



Engineers' Forum



- ▶ VT on Fire
- ▶ Ethics in Engineering
- ▶ The Tubes of Life
- ▶ Gargoyles
- ▶ CEED
- ▶ MacGyver's Corner
- ▶ The Race to Mars

Engineers' Forum November '11



Boston
Scientific

*Discover a career with
Impact*

*Build your career while
making a real difference
at Boston Scientific.*

For more than 30 years, we've been dedicated to improving the lives of patients as well as the lives of the people who work here. We've created a culture based on collaboration, diversity, and innovation, and we encourage learning and growth.

We're innovators: entrepreneurial, passionate, and dedicated to quality—both in our products and in our people—and we're looking forward to a bright future.

www.bostonscientific.com/careers

Defining tomorrow, today.™

Boston Scientific is proud to be an Equal Opportunity Employer.

TABLE OF CONTENTS

Letter from the Editor



Gargoyles



Galipatia



The Tubes of Life



Ethics in Engineering



VT on Fire



Campus Spotlight: CEED



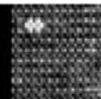
CEED First Year Mentoring Programs



MacGyver's Corner: Leaving Mobile Minutes Behind



The Rundown: Recent Events at VT and Abroad



The Race to Mars: A Tortoise and Snail Story



From the Editor

Editor-in-Chief

Sumedha Mohan

Managing Editor

Valeriy Vislobokov

Layout and Design

Katherine Eckenfels, Mary Dassira

Webmaster

Pranav Angara

Chief Photographer

Andrew Mussey

Copy Editor

Alex Gomez

Writers

Aneela Mousam, Kristin Sorenson, Avery Nelson, Matthew Dowdle, Clarke Richardson Austin, Valeriy Vislobokov, and Joseph Pucci

Editorial Adviser

Lynn Nystrom

Director of News and External Relations
for the College of Engineering

Engineers' Forum is Virginia Tech's student-run engineering magazine. Engineers' Forum is published four times during the academic year. The editorial and business office is located at:

223 Femoyer Hall Virginia Tech
Blacksburg, VA 24061
Phone: 540-231-7738
Email: forum@vt.edu

URL: <http://www.ef.org.vt.edu/>

Member of Engineering College Magazine Associated. The opinions expressed in the Engineers' Forum do not necessarily reflect those of the administration, faculty or student body of Virginia Tech. Copyright 2009 Engineers' Forum. All rights reserved. Reproduction in whole or in part without permission is prohibited.

Printed in the USA.

Dear students,

A big thank you to all for making Engineers' Forum the best engineering magazine on Virginia Tech's campus!

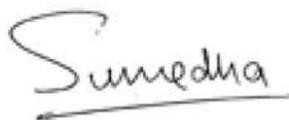
It is your support that has allowed us to continue this effort for the past 30 years. The September issue was a resounding success with both students and advertisers and we hope to repeat the same success with our November issue which will be coming out in the 2nd week of November. In the upcoming issue we talk about varied topics once again. While one article follows up with the race to mars, another focuses on the benefits of joining the CEED mentoring groups. Another article talks about the new foundry on campus and another talks about the fun stuff associated with being a galipatian.

We are introducing a new feature for this issue titled 'Recent Events at VT and abroad.' This feature will describe in a paragraph the interesting scientific and technological developments taking place both locally and internationally. It will be a new kind of a newsfeed.

Good news for the readers- we will soon be having a rack in the Lee Hall. To be precise it will be in the 6th floor lounge. This is part of our ongoing efforts to attract more freshmen to our group.

Please visit our brand new website and leave your comments. Also don't forget to like us on Facebook or tweet us. If you have some interesting information or event to share with your fellow engineers do not hesitate to contact us.

Enjoy the fall and stay warm!!



Sumedha Mohan



Gargoyles

Photos and Article By Clarke Austin

► List of Things to do Before Graduating:

Touch the Hokie stone. Check. Pull an all-nighter at the Math Emporium. Check. Hike the Cascades. Check. Find all of the gargoyles. . .

wait, Gargoyles?

Students both new and old may be unaware of the gargoyles perched on buildings all over Virginia Tech's beautiful campus. These gargoyles hover above the unknowing hordes of students walking to class, preoccupied with classes, food, and other random thoughts. There are about fifteen of these statues total scattered from Hillcrest Hall all the way to the other side of campus. Among the plethora of other activities that have become tradition throughout the ages at Virginia Tech, finding all of these hidden beasts is a popular one. While this task may be a bit stranger than the other items on the list, it might just be worth it. There is a long-held rumor that students who do not find all of them before graduating will leave Virginia Tech with bad luck!

Most of the gargoyles were originally intended to direct rainwater away from the walls of the buildings to prevent erosion, but after a number of years, they primarily served an aesthetic purpose. There are various models of gargoyles around campus that include not only ordinary gargoyles, but also "Cowgoyles" on one of the old agricultural buildings, as well as human gargoyles in commemoration of distinguished people at the University.

Hopefully some of these photos will help get everyone up and started on their journey. Just a little hint, the gargoyles are almost entirely on the campuses oldest facilities.

Good luck!

Clarke Austin is a freshman in General Engineering.



Galipatia

By Matthew Dowdle

I have been a freshman here at Virginia Tech for a little over a month, and I have to say that I am enjoying it so far. The people here are great, the food is delicious, the extracurricular activities are awesome, and the classes are a lot of hard work, but they're not impossible. A big part of why I am surviving my first semester is thanks to where I'm living: Galileo. Galileo is a "Living-Learning Community" here at Virginia Tech for first-year male engineers. It is located on the sixth and seventh floors of Lee Hall, and its female equivalent, Hypatia, is located in Slusher Wing on both the fourth floor and a small pod on the third floor.

Started ten years ago by Dr. Bevelee Watford, Hypatia was created to help freshman girls adjust to the life of an engineer, and to support their fellow women in the field. Two years later, Watford created Hypatia's brother community, Galileo. Both groups were immediately popular, with Hypatia totaling 91 students in its first year, and Galileo totaling 122 students two years later.

These groups began solely as a way for freshmen to adjust to college life and provided a good atmosphere for homework and studying. After several years, the students expressed desire to stay in the program as sophomores in leadership roles. This past year was the first in which the two groups were organized with a team of leaders and mentors.

Often known as Galipatia, the collected conscience of Galileo and Hypatia often work together on many different events that are social, communal, academic, and everything in between. When the big Engineering Exploration test came around, Galipatia hosted a study session for all engineers in which the engineering mentors quickly reviewed all the major studying points and answered questions the freshmen had about the test. Whenever a Galilean or Hypatian needs help on homework, they need only to go to the study lounge to find four or five people doing similar work. Because we are all freshmen engineers and therefore working on the same general assignments, it's easy to get help from a fellow Galipatian.

Galipatia does have a downside though, and that is the extra class mandatory for all members. While the course is interesting and the people are enjoyable, it demands quite a bit of work. So far the assignments have included writing and rewriting a resume, researching companies at the engineering expo, and practicing writing papers to professors. While these are considerably large projects, they also are very important in the real world. This work is long, difficult, and time-consuming (especially on top of the rest of engineering work we have to do), but I believe it will definitely pay off. When we leave to go looking for our first internship or co-op, we will already have the prepared resume and necessary skills to be a much more competitive candidate.

As I progress through college, I'm certain that I'll be thankful for my time spent in Galileo. This community has a track record of retaining 93% of its students, compared to the average retention rate of 89% for freshmen



engineers, and the average GPA is 3.24 compared to the general freshman's 2.22. Similarly, Hypatia retains 96% of its students instead of the usual 88%, with an average GPA of 3.13 instead of the usual 2.99. Considering these statistics, the work ethic I will learn from this community, and the professional skills I'm already beginning to develop, I'm confident that choosing to join Galileo will remain one of the greatest decisions of my college career.

Matthew Dowdle is a freshman in General Engineering.



**The future is growth.
The future is yours.**

Our breadth and diversity provides us with the flexibility to manage our growth in line with global demand and the agility to respond to market conditions.

Farmington, New Mexico
Mining Engineers and Interns

BHP Billiton New Mexico Coal operates surface and underground mines. We are looking for summer interns and full-time mining engineers of all levels.

Why BHP Billiton in New Mexico?

- Career growth opportunities
- Real engineering responsibilities and competitive salary
- Outstanding quality of life in the Four Corners area of NM

Meet our recruiters October 13-14, 2011
Sign up at www.hokies-for-hire.com

Learn more at jobs.bhpbilliton.com



bhpbilliton
resourcing the future

The Tubes of Life

By Matthew Dowdle

Have you ever wanted to visit Europe? If so, you've probably made plans to visit all of its famous landmarks, such as Big Ben, the Eiffel Tower, the Leaning Tower of Pisa, the Coliseum, and of course, the Strandbeests of Holland. For over the last 20 years, Holland's beaches have been home to a huge new form of life, Strandbeests. Also known as "wind beasts" or "beach beasts", Strandbeests are made up of miles of plastic PVC pipe that have been folded, cut and connected to create large mechanical animals. The architect, artist, and engineer behind these animals is a native of Holland named Theo Jansen.

Theo Jansen is an artist and kinetic sculptor. He was born in 1948 in Scheveningen, Netherland and studied physics at the University of Delft, but he eventually dropped out and became a painter for the next seven years. In 1980, he was asked by some friends to help in a fun little project/prank that involved creating a gigantic floating flying saucer and letting it loose. The balloon they had made reminded Jansen of his love for physics, and inspired him to go out and create much more than just paintings. This rekindled love of physics soon helped him create the first Strandbeest.

In 1990, the first beach beast was born, and it was originally created with an environmental motive. The beaches of Holland, just like most beaches around the world, are subject to erosion, and Jansen hoped to create a creature that could use the considerable wind power of Holland's beaches to take care of and maintain the shore without human interaction. Jansen wrote a short newspaper column about this idea and decided to do a quick proof of concept by creating a wind beast that would survive on the beach using only wind power. But as he was working with these creatures originally created to move sand from the beaches to the dunes, he became fascinated with the evolution of walking and running. Jansen describes himself as "An engineer who wants to map the progress of mobility." This yearlong project turned into a lifelong obsession that Jansen hopes will last for many years after him.

His first beasts were very difficult to maintain, required repairs every couple of seconds, and could only walk in one direction down the beach. But now, over 20 years later, Jansen boasts that they can last up to five minutes without needing repairs, and that the wings that he has developed

for his beasts enable them to walk either way with the wind. The beasts were initially powered by the wind so that they would walk with in the same direction, but it soon became apparent that such a simple method would not work. When the beasts walked only one way, they had to be manually "reset" by being pulled back up the beach. To combat this problem, Jansen developed propellers that would catch the wind no matter what direction it came from. After that, Jansen took inspiration from nature through the addition of wings. By placing multiple wings on top of the beasts, he could efficiently transfer power to from the wind to the legs. Yet after this problem was solved, another came up: what would happen on days without wind? As purely wind-powered machines, the beasts were useless on calm days. In response, Jansen developed a "stomach" for the beasts made out of empty soda bottles that could be pumped full of air to power the beasts when the wind could not. Then, he ran into another problem, the sea itself.

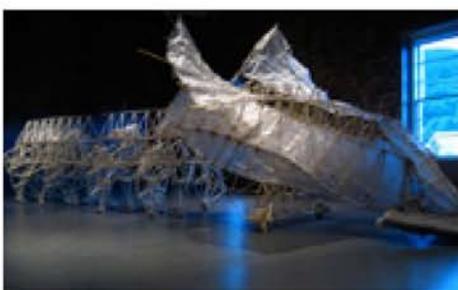
Because these beasts are quite light and live along the beach, they have two mortal enemies: the sea, and the storms. The sea problem was solved with a surprisingly simple method. As the beasts walked down the shore, small, thin tubes would trail along the ground sucking in little bits of air. If the beast would get too close to water the small tubes would start to suck up some water, and the resulting pressure from the water on the tube would send a signal to the rest of the beast causing it to back away. A similar sensor exists to detect the hilly dunes and reverse the beast's direction. After solving these problems, Jansen developed a simple brain for the beast that counts its steps, and uses those steps to keep track of where the sea and dunes are.

Unfortunately, storms are a much bigger problem for the beasts. The strong winds tend to knock them about and tear them to shreds. The answer to this problem is currently very rudimentary - an anchor. Attached to the "tail" of the beast is a stake and hammer mechanism.

When the winds get too strong, the hammer is swung back and forth, driving the stake on the tail into the ground.

Jansen calls these different designs "evolutions" in order to relate his creations as closely as possible to actual animals. Each beast, even if it is short-lived or faulty, is given a Latin taxonomic name. Every time a beast fails to work, Jansen declares it an extinct species, and every time it does work, he has it and the others "evolve" using similar design concepts. Jansen once said that he does not know how many beasts he has created, because he uses pieces of the unsuccessful projects to create new ones. "The walls between art and engineering exist only in our minds," says Jensen. When asked whether he intentionally makes these beasts for their almost poetic appearance, he replied, "When I work, I always work on function and it turns out when it's finished, it usually doesn't function that well but I surprise myself how beautiful it appears." The work done by Mr. Jansen is a beautiful display of what happens when art and science comes together.

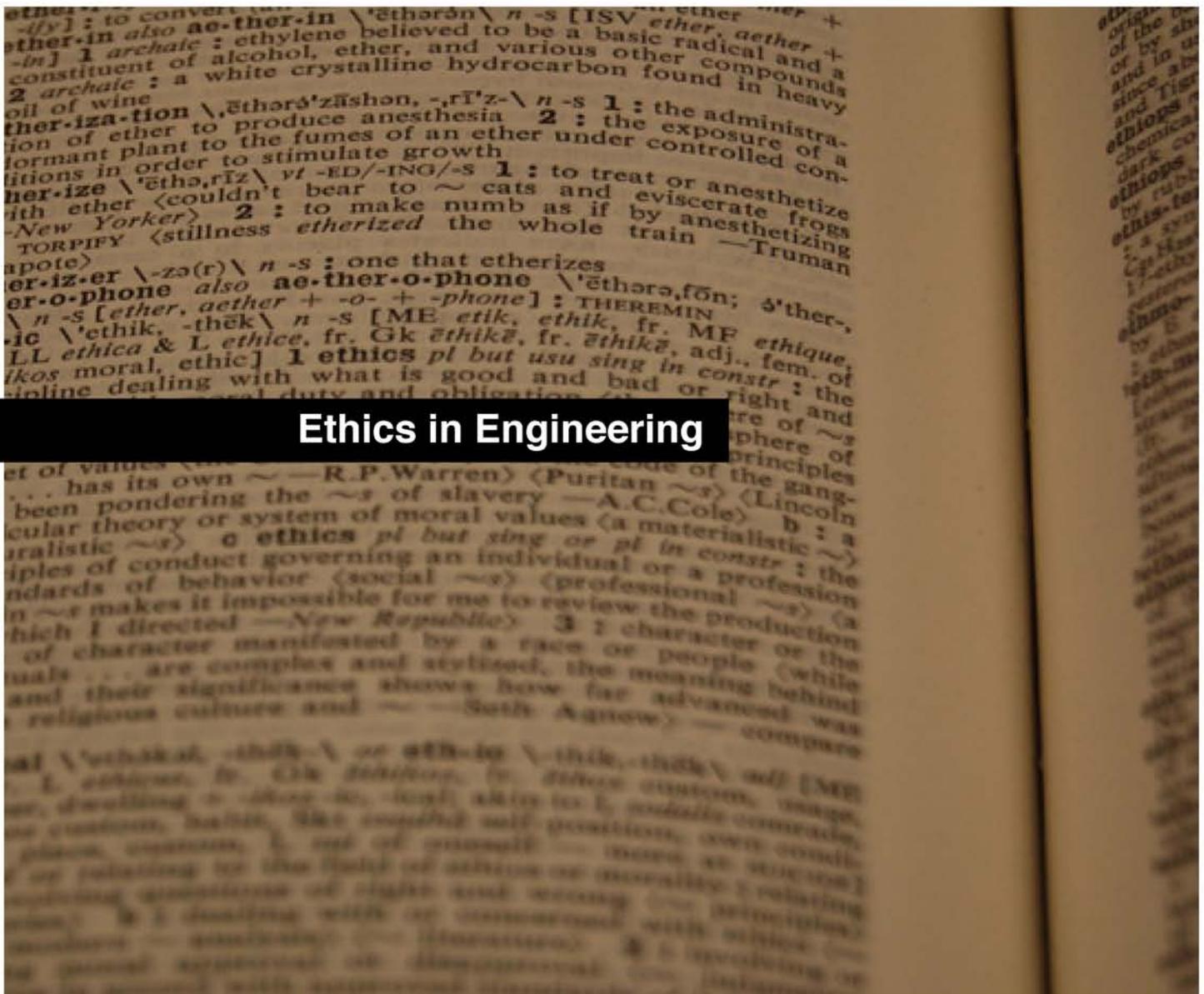
Matthew Dowdle is a freshman in General Engineering.



Photos by:

Luc Van Braekeel, <http://www.flickr.com/photos/lucvanbraekeel/3046346089/>

Fabio Bruna, http://www.flickr.com/photos/_fabio/2576638097/ and http://www.flickr.com/photos/_fabio/2577470062/in/photostream/
megananne, <http://www.flickr.com/photos/megananne/1429386293/> and <http://www.flickr.com/photos/megananne/1430263198/in/photostream/>



Ethics in Engineering

By Joseph Pucci

One might think that ethics only applies to the medical professions, philosophical questions, or ironically, politicians. However, all professions, even engineers, have to deal with ethical dilemmas. Let's start with the definition of ethics, according to the Oxford Dictionary: "moral principles that govern a person's or group's behavior." From this definition, one can assume that moral principles can be applied wherever a person or group is, and whatever that person or group does. However, as we all know, moral principles are not always applied.

The story of Frankenstein is an example, albeit fictional, of how morality was thrown to the wind. Dr. Frankenstein's worst problem was not necessarily that he had created a new life from recycled human parts (even though the ethics of that act are hotly debated even today), but it was the fact that he had no idea of what to do with this new life, how it would react to its surroundings, or how the creature was to be treated. He had created this being for the sole purpose of proving to the world that new life could be generated in a laboratory. Nevertheless, this experiment eventually caused a whole mess of problems, both for Dr. Frankenstein, and for many who came into contact with the monster.

So how does this apply to engineers? The example of Frankenstein is one that highlights the ethical dilemmas faced by those who deal with life. But a number of human and non-human related issues alike also involve these dilemmas. In terms of engineers, these issues involve genetically engineering anything from grains to humans, pharmaceutical companies and their drugs, and even chemical and biological weapons used by some militaries. However, these are just a few of the many examples of ethical dilemmas. It is important to put ethics into terms that all engineers can identify with.

There are many different things that engineers can do with their degrees, but in general, they manipulate materials, living and non-living, using complex scientific understanding to create what we call technology. There are many reasons why an engineer would develop a process or unit of technology, but most of the time this technology is used to benefit a customer. We sometimes hear that the role of an engineer is to develop technology that will benefit all of humanity. One might ask how this could possibly be. In a larger sense, humanity is almost always affected by a new unit of technology or process. If and when that happens depends on the need and/or the response to the use of that technology.

Let's start with the definition of ethics, according to the Oxford Dictionary: "moral principles that govern a person's or group's behavior." From this definition, one can assume that moral principles can be applied wherever a person or group is, and whatever that person or group does. However, as we all know, moral principles are not always applied.

For example, the microwave is an essential kitchen electronic instrument in use today. The microwave's origins date back to a research engineer working for Raytheon Corporation in 1946. Dr. Percy Spencer was working on an experimental radar project that involved the use of a high-voltage magnetron, a device that emits radio frequencies. In one of his experiments, he was carrying a candy bar, which subsequently melted during the operational phase of the experiment. He noticed this, and later went back to test other food items. Later, after more experimentation and development, Raytheon Corporation filed for a patent for the device.

Another example of how one use of technology led to wider use is the development of nuclear technology. Nuclear technology developed out of the need for a powerful weapon that the United States could use as a sure way to win World War II. Of course, what first came out was a tremendously devastating device that has only been enhanced and made more reliable over the years. After the atom bomb, research into possible technology using nuclear energy grew exponentially, partly due to the ensuing Cold War. Today, nuclear power provides for a sizable portion of the Western world's energy needs, as well as Japan's, South Korea's, and Israel's.

While the ethics of nuclear power is, again, hotly debated, the examples above prove that much of technology eventually affects humanity as a whole. There are literally hundreds of other examples of technological research or inventions that have affected humanity today. Technology shapes the world. Because all of this is at the hands of engineers, we must recognize that there exists the need for an ethical decision-making process.

Because engineers often find themselves dealing with business issues, if not running their own business, it is germane to include an overview of business ethics. Thus, the question of "what is the right thing to do" appears at a few different levels. These levels are interpersonal, such as a coworker dealing with his peers; person-corporate, such as hiring and public relations; corporate-corporate/client, in which a business deals with a client, which could be an individual or another business.

There are a few named systems of deciding what is right and what is wrong, as outlined by Mark Holtzapple and W. Reece in *Concepts in Engineering*. The utilitarian approach to ethics involves the greatest good for the greatest number of people. This method attempts to quantify the benefits of a possible course of action. However, this method is best used in cost-analysis. When used to determine the ethicality of a course of action, it can lead to injustice against the individual, even while the community at large benefits. When this injustice is of a major and grotesque nature, the decision must be revised to account for the possible effects on the individual.

The second approach to ethical dilemmas is the ethical egoism theory. This theory states that if one acts in his own "enlightened self-interest", then an act is moral. Enlightened self-interest is defined as the belief that acting in the interest of others will benefit oneself. This idea is an important concept in dealing with interpersonal issues. If two or more people at odds over an issue act in enlightened self-interest, then all sides benefit and no harm is done. In the context of engineering, if the engineer puts himself "into the shoes" of the individual subject to a course of action, that engineer will better understand the effects, negative and positive, that the course of action will have on the individual. The same can be said about a company's or corporation's relationship with a client or the public at large.

The final approach is called "rights analysis," and is largely based on the Judeo-Christian concept of "do unto others as you would have done unto you." However, the concept is revised to give more emphasis on the party being affected, much like the idea of "the customer's always right." This idea sets up a hierarchy of rights; the higher up the hierarchy, the more serious the infringement.

Having known someone who works in the field of engineering and business reinforces these concepts. Mr. Patrick Fergione, a current business owner with a degree in electrical engineering and past work experience as an engineer, has had to deal with these concepts. As a business owner, he has faced the issue of making a greater amount of profit, while maybe cutting the corner on ethical decisions. However, after one of his worst career mistakes, he stated that he will never forego his conscience again in the same way. Fergione feels that when making more money becomes your guiding force, you lose integrity and will not find, in the long run, what you seek. This is true at the personal and corporate levels, he remarks.

Mr. Fergione uses a combination of the rights-analysis and ethical egoism methods in his business, founded on the "Golden Rule." He believes that this guiding principle founds the basis to all ethical dilemmas, and the best solution to the problem will be determined along these lines. He also says that in his experience, these laws of ethics, while they seem restrictive, do not deter wealth or greater success, but instead enhance the standing of an individual and a corporation that has a strong moral backbone, unwilling to dance into moral ambiguity.

The author of this article used notes from an interview and e-mail correspondence with Mr. Patrick Fergione. Mr. Fergione is the owner of Staccato Consulting Group, an Information Technologies consulting firm, physically located in East Norriton, Pennsylvania.

Joseph Pucci is a freshman in General Engineering.

Photo By Katherine Eckenfels



VT on Fire

By Avery Nelson

► On a gravel road off of Plantation Road, where all the Virginia Tech farm animals are, is the Kroehling Advanced Materials Foundry, home of Virginia Tech's Foundry Institute for Research and Education, aka, VT FIRE, a new laboratory where students can cast metal and learn about metallurgy.

VT FIRE is run by its Director of eight months, Dr. Alan Druschitz. He was not part of the initial fund-raising efforts, nor the the construction and collection of equipment (both of which he credits to Professor Robert Hendrix, who still works as an instructor at VT FIRE). However, Dr. Druschitz has been a major part of VT FIRE's success since its first class in the Spring Semester of 2011. With a PhD in Metallurgical Engineering from the Illinois Institute of Technology, 25 years of practical experience in industry, and a previous job at the University of Alabama directing its foundry, he was an excellent candidate for his current position.

Dr. Druschitz recently gave me and the head photographer of the Engineers' Forum a tour of the foundry during a three-hour aluminum lab. We quickly realized that the foundry is an amazing place with great potential to become much, much more.

When we first entered the foundry building, we were standing in a reception area. To the right is a classroom; to the left is an office and a desk. On a shelf behind the reception desk is a life-size Halo helmet. In front of us, down a short hallway, were bathrooms (to the left), a small lab room (to the right), and a pair of double doors at the very end proclaiming "Authorized Personnel Only." The sign is misleading, however, as the foundry is a friendly, welcoming place.

VT FIRE offers opportunities to students from a wide variety of majors. Art students greatly enjoy the detail of metal sculptures afforded by investment casting and bonded sand molds. Students have created roses, dragons, elaborate bookends, Spongebob Squarepants, medallions, and many more quirky or beautiful works of art.

Engineering students are especially prominent students at the foundry. Almost each major has its own purpose there. Aerospace majors can work with aluminum and create plane parts. Mechanical engineers have a rapid prototyping

class that involves a lab at the foundry. Materials Science engineers, of course, can learn about metallurgy. Any student, no matter their major, who is interested is welcome to sign up for basic classes.

The first place we see (after the reception area) is the classroom. There we meet the students of the two classes. One class is Elementary Metal Casting, with four or five students from several majors, and the other is MSE 4305 (Physical Metallurgy and Modeling of Metal Casting), with three Materials Science Engineering upperclassmen. When Dr. Druschitz's lecture ends, the tour of the foundry begins, and we begin to see how state-of-the-art and amazing the foundry is.

The most impressive aspect of VT FIRE is the foundry's environmentally friendly and high-quality working environment. The air within and around the workshop is kept clean and clear by an enormous dust and fume collection system. The dust collector, an enormous contraption which resides next to the building, actually has tubing that goes through the floor and connects to floor vents near much of the equipment, which is preferable to overhead ventilation. All airborne debris and odors are quickly eradicated, for which the students are extremely grateful, having smelled the molten metal while making castings. Student Matt McCarley said, "It's what you think sniffing metal would be like... just terrible."

In fact, the only smell throughout the foundry is the phenolic resin used as the binder in the sand molds. (The binder, by the way, is what makes the sand go from being soft to extremely hard in about twenty minutes. Then the mold can be used to cast metal.) The binder VT FIRE uses is not particularly smelly, as binders go, and it's environmentally friendly.

The water cooling system is also efficient and has minimal impact on the environment because it is a closed-loop system. No water goes down the drain; it all gets recycled back into the cooling system. Also, the lighting system is experimental. Half of the foundry uses short LED lights instead of long fluorescent bulbs. The lights are more expensive than other options, but they use one-tenth the energy that fluorescent lights use, leading to long-term savings. Additionally, the lights are on sensors, so they automatically dim when no one is moving. Even for something so small and energy-efficient, the lights are surpris-

ingly bright.

Safety is strictly enforced at the foundry. Every student and faculty member must have a thorough knowledge of safety equipment and safety rules before working in the foundry. Anyone on the foundry floor must wear safety glasses. Students are required to wear natural-fiber clothing and steel-toed boots. Anyone handling liquid metal must wear the body-length, shiny, fire-retardant suits (which molten metal will roll right off, leaving the wearer unscathed), fire-retardant gloves, and a hardhat with a splatter shield, among other trimmings.

VT FIRE aims to improve the environmental impact and the working conditions of metal-working industries by setting an example for visiting foundries and raising the students' standards for their future employers. Dr. Druschitz explains, "If you don't know it exists, you won't use it. If these students are trained in that environment, when they get to a foundry [where] it's dirty and dusty, you don't have the fume collection, and the binders are smelly, they're going to ask why."

The equipment in the foundry is some of the more advance technology in metallurgy and metal casting. Dr. Druschitz first takes us into the "X-Ray Lab", which houses a spectrometer, a machine that can detect trace elements in iron, steel, aluminum, and copper alloys. The machine can detect more elements than most of the local industrial foundries' spectrometers; occasionally they even ask to use the machine when they have troubles with their metal. In the same room is a Rapid Prototyping Machine, essentially a 3-D printer.

We are finally lead through the intimidating double doors and through the foundry to the investment casting lab. It holds two slurry tanks, potentially large enough to create single-crystal turbine blades, and a rainfall sander, for sanding the surfaces of castings.

Next, we are taken into the foundry room itself, a 2 000 square-foot room with large open doors leading to the outside, a concrete floor, and tons of equipment and materials.

Both of the main furnaces are induction furnaces, meaning they are connected to a special power source that can generate electromagnetic fields in the melting metal, stirring it by convection. The advanced class was melting liquid

aluminum in the lift swing induction furnace, so called because the metallurgist can literally lift the outer wall of the furnace and swing it over to a second base, making the liquid metal in a crucible on the other side easily accessible. A convex meniscus forms while the power supply is turned on, making the liquid aluminum look like a quivering silver bubble. Looking into the furnace (while wearing the proper safety gear, of course), I was mesmerized. Eventually, we watched the students pour the liquid metal, which flows like water, into various molds and metallurgical equipment.

One of the largest pieces of equipment in the foundry is the continuous sand mixer, which is used to create the bonded sand molds and can hold four thousand pounds of sand in its hopper. The students in the basic class spend much of their time making sand molds and casting in those. The largest bonded sand mold the foundry ever created weighed 650 lbs. To move such heavy items, VT FIRE uses a crane installed overhead, which all the students learn how to operate.

This is nowhere near a complete list of the impressive equipment at the foundry. They have so much equipment, Dr. Druschitz and his colleagues struggle to fit everything in while still adhering to all the equipment safety codes.

VT FIRE came into being at a highly opportune time. Dr. Druschitz claims that in recent years, most schools with foundries have shut them down due to lack of interest, retiring professors, and the need for the space and money. However, the metal industries' demand for engineers with hands-on, practical experience in metal casting and metallurgy is on the rise, and there aren't enough engineers and metallurgists out there to fill all the jobs. The military has closed down many of its metal-working places, and it is now working with universities to do detail work and to create specialty materials. The colleges and universities with foundries don't usually have the same practical capabilities as Virginia Tech and are often too theory-oriented for these tasks. VT FIRE is invaluable to industry and the military.

Dr. Druschitz and the other faculty of VT FIRE emphasize the practical and real-world applications of their teachings. You might expect a metallurgy class to require an extensive lab report, but during his lecture, Dr. Druschitz explicitly said that the reports for the aluminum lab should be no more than four pages long. In industry, he explained, no one has time to read a lengthy report. He also explained that upper management rarely look at more than the title, the statement of purpose, and the summary or conclusion. Additionally, the hands-on experience that students get in metal casting at VT FIRE makes all the difference in their search for jobs, internships, and their major focuses, because, Dr. Druschitz says, "If you don't know castings, you don't do castings."

Because it is so advanced and unique, the foundry receives significant attention and support from metal-working industries and people who need specific metal parts. For example, Virginia Castings donates 500 pound super-sacks filled with sand for bonded sand molds. The foundry has also created parts for cars and planes.

The foundry is already an amazing place, but there is still a lot to finish and accomplish before

it reaches full maturity. Currently, Dr. Druschitz is writing the descriptions for all the classes at the foundry and going through all the paperwork necessary to make metallurgy a minor and a focus for materials science engineers. The minor checklist should be available by 2014. In the next five to six years, VT FIRE is also meant to become self-supporting, meaning it will no longer be dependent on loans. The Virginia Tech Foundation is helping VT FIRE to find a few investors for that.

VT FIRE is currently affiliated with the Foundry Education Foundation (FEF). Once the metallurgy minor and focus are available, the foundry can finally apply for certification from the FEF. With certification, VT FIRE qualifies to receive money for research and scholarships from the foundation.

The foundry is also prepared to expand its capabilities. In the near future, the foundry will begin working with copper, which is why the spectrometer is calibrated for copper alloy as well as iron, steel, and aluminum. There are also hopes to expand into computational modeling,

which is basically creating imaginary materials on the computer by putting virtual atoms together and then testing the product in real life to see if it works. Perhaps, one day, when the foundry has more buildings, they will add more fancy equipment for metallurgy beyond casting, like friction stir welding and surface alloying.

Dr. Druschitz says that VT FIRE is "already getting a reputation as a benchmark." And yet, as incredible as the foundry is, it is filled to the brim with possibility. More students at Tech should get to know the foundry and see it in person, in order to truly appreciate it.

For more information about VT FIRE, please visit www.msc.vt.edu/vtfire.

Many thanks to Dr. Alan Druschitz and the faculty of VT FIRE for your enthusiastic cooperation and contributions.

Avery Nelson is a freshman General Engineering. Photographs by Andrew Mussey



Campus Spotlight: CEED

By Kristin Sorenson

Virginia Tech and engineering go hand in hand. Nationally ranked, the university accommodates over 8,000 students in its prestigious engineering programs. Thanks to Tech's rigorous academics and supportive student organizations, its engineers are properly equipped to achieve success in all their endeavors. CEED, the Center for the Enhancement of Engineering Diversity, is an organization at Virginia Tech that focuses on under-represented groups in engineering. In 1992, The Dean of the College of Engineering came up with the idea of implementing this program, and commissioned Dr. Beville Watford, now Director of CEED, to jumpstart it. A generous grant from the National Science Foundation provided funding that has supported many of the programs that are now a part of this organization. Since then, CEED has been working to fulfill its goals of promoting diversity in engineering, and providing support for all students in the field. The center regularly hosts special learning programs and camps for future engineers whether they're currently in middle school, or are preparing to become college freshmen. Sponsored by CEED are student-run organizations at Virginia Tech including the Society of Hispanic Professional Engineers, the National Society of Black Engineers, and the Society of Women Engineers. Each of these groups on campus also has a national presence, as they participate in nationwide conferences and events.

Learning and discovery starts early. CEED recognizes this and has implemented programs targeted specifically for budding engineers - specifically children in middle and high school. The Imagination summer program is designed for 7th and 8th graders interested in math and science. It is a week-long day camp attended mostly by children from the local area. C-Tech² is another summer program intended for prospective students. C-Tech², an abbreviated form of "Computers and Technology at Virginia Tech", concentrates on rising junior and senior girls in high school. The focus of this camp is to raise interest among women in the fields of science, math, and engineering. Many participants come with a general scientific interest, and after taking part in the camp's activities, decide that they would like to pursue a career in science.

For incoming freshmen engineers, CEED holds an annual pre-semester summer program. STEP, the Student Transition Engineering Program, is held for 5 weeks in the summer before the start of the school year. Since 2005, participants have been able to take classes to help prepare them for the work they will be doing in college, and have also had a little taste of Hokie college life before the semester officially starts. Ms. Sandra Griffith, Assistant to the Director of CEED, is involved in many of the programs the Center has to offer. But she says that her favorite program is STEP, "because it's so fun to see them [the students] come here. It's people who have been accepted into engineering here at Tech, and they come up here for 5 weeks out of the summer, take classes, and just get their foot in the door. They meet people, get a sense of what college is like, so once they get here, they've got this big edge. I get to know some of them in the summer, and it's just kind of fun to watch them as they mature over the years. You see some of them - they come in and they're shy, and scared, which plenty of people are when they come to the university - and you see them mature and get confident and go out and do really great things, so it's like you get to meet them when they're just starting out." Ms. Griffith still keeps in touch with some of the students.

On campus at Tech, there are two themed-housing learning communities for freshmen engineers- Galileo and Hypatia. These two groups are comprised of first-year engineering students who live together in a residence hall on campus. Living in these halls, the students have their own home-base support system, and ready-made homework and study groups. Hypatia



Students participate in CEED-sponsored programs.

consists of freshmen girls in engineering, and Galileo is made up of male freshmen engineering students. The students take a special seminar class, learn course success strategies, and socially interact with each other as well. According to Ms. Griffith, many students who participate in either Hypatia or Galileo who benefit greatly from the programs decide to come back as second-year students to be mentors to the incoming freshmen. "This second-year participation is fairly new," said Griffith. She also says that most students who take advantage of such opportunities really find them beneficial to their college careers.

For students already at Virginia Tech, CEED supports a number of organizations focused on diversity. Each of these, including the Society for Hispanic Professional Engineers, is student-run and operated. They are part of their respective nationwide chapters. CEED also sponsors engineering mentoring programs, such as the Academic Hispanic Outreach Alliance (AHORA), Black Engineering Support Teams (BEST), General Undergraduate Engineering Support Teams (GUEST), and Women in Engineering Support Teams (WEST). These programs are targeted towards first-year students to make sure they are comfortable here in their major at Tech, and that they are able to succeed.

The Center for the Enrichment of Engineering Diversity is located on campus at Virginia Tech in Hancock Hall. CEED's ongoing mission is to promote and support diversity in engineering.

Kristin Sorenson is a sophomore in Spanish & Professional Writing.

CEED First Year Mentoring Program



By Anecla Mousam

As you enter your first engineering class, you look into a mass of people overwhelmed with anxiety about what to expect from college. You have likely moved hundreds of miles away from your family, friends, and home to begin the next four years of your life. The transition from high school to college can be difficult as you try to make new friends, learn your way around campus, and adjust to your newly acquired freedom, especially for engineering students. Engineering at Virginia Tech has a reputation for being one of the school's most demanding programs, especially during freshman year.

In order to help freshman adjust to engineering, The Center for Enhancement of Engineering Diversity (CEED), offers a unique peer-mentoring program. The four mentoring programs include Academic Hispanic Outreach Alliance (AHORA), Black Engineering Support Teams (BEST), Women in Engineering Support Teams (WEST), and General Undergraduate Engineering Support Teams (GUEST).

The program pairs 5-10 incoming freshmen with an upper classman serving as their mentor. The students are paired up in the summer and begin communicating several weeks before classes begin. The mentees are introduced to their mentor through phone and email, and are encouraged to ask any questions they may have so that they can learn more about what the program entails. The mentoring program officially kicks off with a welcome back picnic, but before the picnic begins, the mentoring teams compete in a photo scavenger hunt in order to get familiar with the campus. The picnic also includes information booths about engineering organizations that students can participate in.

Once the school year begins, mentoring groups meet once a week to discuss academic and social progress. The meetings give students a chance to express their concerns about classes, professors, and general issues. In the 10 weeks



of the mentoring program, CEED pays for each group to have outings at the local restaurants in Blacksburg, concluding with a large social at BreakZONE after the students' much-dreaded first engineering exam.

I have been involved in the mentoring program for the last three years, and I firmly believe that this program is imperative in helping high school students transition into their first year of engineering. By focusing the program on peer mentoring, students are given an opportunity to receive advice from upperclassmen who have already successfully completed their first year. Who better to learn from than an older student who was in your shoes only a few years ago? I found it very easy to share my problems and concern with someone who would understand what I was going through in a non-classroom setting. I was also provided with information about the various resources that are available on campus, as well as activities and clubs I could join. Because Virginia Tech is a large university, there are tons of things to get involved in, but all those clubs can be tough to navigate when you first begin your semester.

Since the mentoring program had had such a huge impact on my freshman year, I continued to be involved with CEED and came back as a mentor. The program helps not just the freshmen but also the mentors, who learn how to communicate necessary information to the first-year students. Because the program is so rewarding, many students who started as freshman end up staying with CEED and returning for the next three years as mentors.

Quantitative studies have shown that participating in the first-year mentoring program has an impact on overall GPA at the end of the semester. For example, in 2005, the average GPA of the 290 first-year students participating in the mentoring program was 3.02 compared to the 2.83 average of all first year engineering students. It is clear that participating in the mentoring program has a positive impact on both mentors



and mentees; therefore, it is important that the CEED continues to provide these resources for incoming engineering students in the future.

The following testimonies come from students who are involved or have been involved in CEED mentoring, and the impact it has had on their success as a first year engineering student.

"The mentoring program here at Virginia Tech really helped me along my freshman year. Not only did my mentor give me great advice which I still stick to, but my fellow mentees gave me the reassurance that I was not alone." ~Erina Gately

"The program is helping me with outside of class prep, such as good study groups and advice for the test, advice for outside engineering activities, and an amazing opportunity to meet people I wouldn't have otherwise in my major" ~Alycia Rouffa

"We have a chance to know a lot more about the entire engineering program other opportunities such as Expo and extracurricular activities. A lot of my friends don't know about those opportunities, so they missed them already. I feel so grateful that I know about them and it is preparing me for the future." ~Linh Mai

"I became a mentor because I wanted to be able to share my freshman experience with other incoming students. I wanted to have the chance to describe the difficulties I had and how students can overcome obstacles similar to mine. I believe by sharing a different perspective to beginner students, they will feel more at ease and will know how to succeed in their given field since they will realize, like I did, that failing is a part of life and is temporary." ~Nadiyah Younes

To learn further information about the mentoring programs or to get involved with CEED, visit <http://www.eng.vt.edu/ceed>.

Anecla Mousam is a junior in Biological Systems Engineering.



Google Voice Logo: Image belongs to Google Corporation.

“Google Voice gives every one of us the ability to use our data plan for voice, texting, and internet.”

MacGyver's Corner: Leaving Mobile Minutes Behind

By Valeriy Vislobokov

MacGyver's Corner: Leaving Mobile Minutes Behind

► In this feature, we will take a look at how we as engineers can take the cheap way out simply by using things we have lying around. This issue's topic: how to pay as little for your wireless smartphone service as possible using just your Android, Blackberry, or Apple smartphone and an internet connection.

When's the last time any of you have taken a look at your phone bill? Many of us are riding on family plans still tied to that of our parents'. Others typically ignore the cost of having access to everyone and everything at light speed and consider the convenience well worth the price. But regardless of the reason, as engineers and other masters of the technical sciences, we should take a closer look at the efficiency of paying for the different aspects of our cell phone services.

Let's take a look at texting. When it boils down, texting, otherwise known as SMS, is a protocol from the 1990s no different from any other Instant Messaging (IM) protocol. The single discrepancy is that SMS was universally adopted by all the world's wireless carriers. So why is the unlimited transmission of text, the simplest kind of data, costing us upwards of \$20 a month?

The truth is that it shouldn't. Simply transferring the use of your SMS plan to your data plan would eliminate that monthly fee, saving you hundreds of dollars a year. As many of you know, free texting services are widely available on the Internet, although many of them are riddled with advertising. Thankfully, Google has come to the rescue.

In a few easy steps, you can configure a Google Voice account to handle all of your unlimited texting needs. Please keep in mind that for this to work, you will need a smartphone that supports the Google Voice app, such as an iPhone, an Android phone, or a Blackberry. Additionally, to use texting from your phone, you will have to have access to either a wireless network (Wi-Fi) or a mobile 3G or 4G data plan. Even if you do not meet these criteria, you can still use all of your Google Voice features by using any computer with internet access.

To begin, you will need to set up a Google Account by accessing either <http://accounts.google.com/> or directly through Google Voice at <http://voice.google.com/>. After that, you will need to return to voice.google.com to set up your information in detail. The steps are fairly straightforward and easy to follow, so let's go over what you get by signing up instead.

One of the first things the app asks you is if you'd like to replace your voicemail service with Google Voice. While your wireless service provider

is also your voicemail provider by default, it rarely offers any advantages or special features, such as free access to your voicemail; most carriers use a phone number for this system that doesn't count as "free" minutes, meaning every minute you spend checking your voicemail is a minute you can't spend talking to somebody. Google Voice gives you all of what your carrier offers, plus transcripts of voicemails that are viewable using the app or the web interface, an easy-to-use email-like management system for viewing messages available on any computer or smartphone with internet access, and plenty of storage space for archiving all of them for later.

In order to move on to higher functions of the service like texting, you will need to associate a phone number with your Google Voice account. This means that you will either need to pay a one time fee of \$20 to link your phone number with Google's texting and voice service, or you can go the free route and reserve a separate number from Google. Yes, you read that right: Google's ubiquitous generosity has extended to giving out phone numbers for free. Most area codes are available, so you can even choose one that's similar to your existing number. What this entails is now using two numbers, your original number that should no longer receive texts, and a new number that can receive both calls and texts. For the small pain of transferring to two numbers, you now have completely free voice calling and texting wherever you have the Internet. And if you're willing to dish out the \$20, you even get to use one number!

Voice service is a bit trickier. This isn't because it is difficult to set up (although it can be confusing), but because you'll have access to calling via both your service provider and Google Voice. On Android phones specifically, it will ask you every time you make a call (unless you specify a default) whether to make the call using Google Voice or your provider. If you got the free number, the caller ID of the person you're calling will appear as a different number than your provider's phone number. If you paid the \$20, then the only difference would be in whether you use your minutes or your data plan megabytes. Just as with most voice plans, you get unlimited service to the US and Canada (and fairly cheap international calling to boot) for no charge; Google doesn't even put ads in their smartphone app.

This is where it comes to a head: Google Voice essentially gives every one of us with an eligible smartphone the ability to only use our data plan for all three wireless services (voice, texting, and internet). Theoretically, you could save a bundle by only subscribing to a data plan, no minutes or texts bought. Unfortunately, some providers are aware of this loophole, and require you to buy minutes in order to get a data plan. For the time being though, that means we can get away with selecting the minimum amount of minutes with the maximum sized data plan.

While the process of measuring exactly how much Google's free service eats up from your (most likely) 2GB data plan would require real world testing the Engineers' Forum isn't equipped to conduct, we can safely assume that if we planned to completely switch to internet-only use, an unlimited



This is where it comes to a head: Google Voice essentially gives every one of us with an eligible smartphone the ability to only use our data plan for all three wireless services (voice, texting, and internet). Theoretically, you could save a bundle by only subscribing to a data plan, no minutes or texts bought. Unfortunately, some providers are aware of this loophole, and require you to buy minutes in order to get a data plan.

Android Google Voice App: Making the call over data. - Image by TecheSpot

plan would surely suffice. Unfortunately, we know thanks to Sprint's recent advertising campaign that it is the only service that offers a truly unlimited data plan anymore without overage costs. However, you'll plunk down a pretty \$80 bill (with Stephen Hawking's face on the front) every month to get that kind of luxury, mainly because you're also paying for unlimited voice and texting as well. But not all is lost. As of this writing, Virgin Mobile USA is still offering a cheap \$35/month unlimited data plan (with 300 minutes, but we won't need those, will we?) running over Sprint's world renowned 3G network if you purchase one of Virgin Mobile's phones.

The real penny pinchers out there will have spotted the inevitable already: "why pay anything at all if I can just use my phone's Wi-Fi connection to access the free and unlimited Google Voice service whenever I like for no cost?" There are plenty of reasons this won't work though, the most obvious one being that Wi-Fi networks aren't as ubiquitous as 3G/4G networks. Given that you'd need a Wi-Fi connection to even receive calls, it would not be a good idea to rely on such connections for calls, especially since Wi-Fi tends to be weak on cell phones. Maybe one day, in the era of city-wide Wi-Fi, it would be reliable. But for now, the MacGyver thing to do would be to find a balance between your puny minutes, limited data plan, and our fantastic Wi-Fi service at Virginia Tech and the nearby stores with Wi-Fi access.

If you are able to, you should transfer to Google's Voice service, if only on principle. If it's true that we can make unlimited status updates on Facebook every day for the virtually zero cost of finding/having an internet connection, why should we dish out \$20 every month for the same service with 160 character limitations?

Engineering doesn't have to be complex or expensive; just use the tools around you. If you have any suggestions for topics to be featured in MacGyver's Corner, please email managing.editor@vt.edu with the subject "EF MacGyver".

Valeriy Vislobokov is a senior in Aerospace Engineering.



Untitled: Google lets you easily manage your texts and voicemails through your internet browser. - Image created by the author.

Do you want your work to have real meaning and a lasting impact?

Do you have a curious and creative intellect?

We are currently recruiting for Research Analysts. Our analysts have advanced degrees in engineering, mathematics, economics, chemistry, international relations, national security, history, or other scientific and professional fields of study. We're proud of a diverse staff that is objective, imaginative, and committed to serious research.

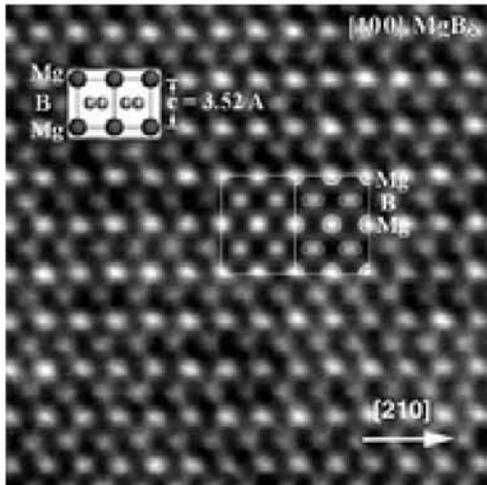
Join us and find unique career opportunities, competitive salaries, and a generous benefits package.

CNA—a pioneer in the field of operations research—is a non-profit organization that brings creative solutions to a vast array of complex problems faced in critical policy areas, such as national security, homeland security, health care, and education. Our analysts work within:

- CNA's Center for Naval Analyses—a federally funded research and development center (FFRDC) for the Navy and Marine Corps that provides research and analysis services to the military and other government agencies to help improve the efficiency and effectiveness of our national defense efforts.
- CNA's Institute for Public Research provides research and analysis to a diverse array of federal, state, and local government agencies. Our overriding goal is to use the best science available to bring the most effective ideas and approaches to enhancing everyday life.

CNA
ANALYSIS & SOLUTIONS

U.S. Citizenship is required. All applicants are subject to a security investigation and must meet eligibility requirements for access to classified information. For more information, please visit www.cna.org. • CNA is an Equal Opportunity Employer



The Rundown: Recent Events at VT and Abroad

► Researchers Find a New Way to “Smell” Your Breath

Dr. Masoud Agah and Dr. Andrea Dietrich at Virginia Tech’s Institute for Critical Technology and Applied Sciences (ICTAS) claim that microelectronics are now small and efficient enough to be able to analyze your breath for toxicity. By analyzing your breath and finding minute traces of toxic substances contained within,

Solar Tech Takes a Leap Forward in Mobile

Recent developments completed by R&D firm New Energy Technologies has resulted in a cross between a solar panel and transparent glass. By utilizing clear, organic solar cells, the new hybrid technology called SolarWindow will not serve in solar power’s usual role of energy harvesting for general electrical consumption and will instead be targeted towards mobile devices where a screen can double as a charger for the battery. Unlike regular solar panels, SolarWindow technology will be able to utilize both natural sunlight’s particular light frequency and also the frequencies of artificial lighting. Visit <http://newenergytechnologiesinc.com/> for more details.

Photonic Molecules Aid in Optical Computing

Many people know that computers today run on electricity. The computers of tomorrow run instead on light, or optical, signals. If you’ve ever heard the term “fiber optic”, it’s probably because your local Comcast cable guy was advertising the highest speed internet subscription available. Currently, the fastest signals travel as optic signals over fiber optic cables; then the signal is converted back to electricity once it reaches your computer. To eliminate this slowdown in speed, researchers at Georgia Tech have developed a class of molecules, called Photonic Molecules, that are optimized for optical signal processing. Once fully developed, these molecules could be used in materials that will replace the well known silicon used in current computers and link our high speed internet to the also recently developed optical processors. Optical computing has the advantage of running faster and also not as hot as legacy electricity based computers.

VT Partners to Develop Cheaper Offshore Wind Farms

Electric utility company Dominion Resources has partnered with Virginia Tech’s Advanced Research Institute in Arlington, VA among other institutions to develop more cost efficient ways of harnessing wind energy just over the

ocean. While wind generation is typically done on land, this is only because installing wind generators in water, like drilling for underwater oil, is very difficult to do safely and quickly. Wind is more reliably available over bodies of water and therefore make it a more consistent source of energy.

First Pictures of Atoms

With the help of aberration-corrected electron microscopy (very fancy electron microscope technology most commonly used in looking at cells), government scientists at the Oak Ridge National Lab have taken the first few pictures of matter where separate

Boron, Carbon, Oxygen, and Nitrogen atoms are distinct from each other. The verdict: atoms look exactly like we predicted. This new ability will allow scientists to analyze new types of materials for structural defects.

Carbon Nanotubes

The latest rage in Materials Science, carbon nanotubes are revolutionizing the field of artificial light weight materials. Although manufacturing processes are still being developed to make mass producing carbon nanotube based materials easier, it's pretty much set in stone that they be the next great thing. Similar to carbon fiber based materials, where carbon-based cloth is cured in resin to harden into a very tough but light material, carbon nanotubes are tiny hexagon shaped molecules of carbon atoms that repeat both horizontally and vertically in a pattern similar to the hexagon shapes on a soccer ball. However, even when this material, called Graphene, is only one layer thick (the thickness of one carbon atom) it will still take a dump truck sized object balancing on a pin needle to puncture the material. All fields of engineering will be able to use it in applications varying from road design to aircraft construction. Stay tuned for a more in-depth article on carbon nanotubes in a future issue!

NanoSonic Develops Self-Assembling Molecules

Local Blacksburg company NanoSonic has developed a better manufacturing process for circuit boards using nanotechnology. Nanotechnology, or the engineering of microscopic, molecule sized machines, is a very new science and still in development. A recent breakthrough by NanoSonic has resulted in, unbelievably, molecules that put themselves together into a circuit board, relying less on machine processes to do the job for them. The process, called Electrostatic Self Assembly, utilizes a 3D solids printer, where certain materials will fall into certain places without guiding from the printer itself.

Valeriy Vislobokov is a senior in Aerospace Engineering



Rights Reserved by PEBondestad on Flickr.com

GENERAL DYNAMICS Electric Boat

Get your career underway

The Nuclear Submarine Has Long been the silent backbone of United States Naval Supremacy. **ELECTRIC BOAT** designs and builds these incredible machines.

We are looking for energetic and innovative individuals to continue the tradition of excellence that has become synonymous with **ELECTRIC BOAT**. We will show you how to apply your skills to the art of nuclear submarine design, engineering and construction.

ELECTRIC BOAT has immediate openings in Groton, Connecticut, for entry level engineers with zero to three years experience.

ELECTRIC BOAT is looking for engineering candidates with a minimum of a Bachelors degree in:

- Aerospace • Chemical • Civil • Computer
- Computer Science • Electrical • Mechanical
- Marine/Ocean • Naval Architecture

ELECTRIC BOAT offers an excellent salary and benefits package, including Tuition Reimbursement, Relocation assistance, and an excellent 401K Plan.

**GENERAL DYNAMICS
Electric Boat**

75 Eastern Point Road
Groton, CT 06340-4999

Please visit www.gdeb.com/employment
for more information, or contact
Electric Boat Employment office at 1-888-231-9662

ES Citizenship Required Equal Opportunity / Affirmative Action Employer

The Race to Mars: a Tortoise and Snail Story

By Valeriy G. Vislobokov

This is the second part in a four part series on the current efforts for a human presence on Mars. You can read part one of the article by downloading the September issue: <http://ow.ly/6VMIR>

The Space Shuttle was supposed to be a step forward from Apollo. In the technical specifications, the Shuttle, otherwise known as STS (Space Transportation System), had demanding requirements. The design called for more than 1 flight per week and over 50% of the craft to be reusable. While this was a tall order, success of the model would have meant a revolution in access to space. Predictably, this is not what happened.

The STS was revolutionary in the way it looked, which is why it amazed so many people. After all, what they saw was an aircraft attached to a rocket: a space plane! But while it definitely looked like the future, engineers both inside and outside NASA were skeptical.

The Space Shuttle averaged only five flights per year over its lifetime, peaking at nine in 1985 just before the Challenger disaster, and it cost much more per flight than the ~\$10 million promised. It spent 30 years delivering cargo into space on a mostly regular basis, demonstrating to both politicians and taxpayers that NASA was being paid a lot of money for accomplishing very little.

However, this common opinion is not at all true. To this day, NASA has spent less money since its founding in 1958 than the United States Department of Defense spent in 2010 alone; more was spent that year on temporary air conditioning in Iraq than on NASA. While its performance record could be disputed, many people agree that NASA does amazing things. Despite the occasional catastrophe, public opinion of NASA is at a stellar 85% (rating the organization's work as at least 'fair').

So why did the Shuttle fall so far short of its goals? While the average taxpayer approves of the job NASA does, including its manned space exploration program, there exists a misconception that NASA does not deserve more money to expand its horizons. This misconception exists for many reasons. For instance, when asked how much of the annual federal budget NASA receives, most people averaged a guess of 24%, more than is spent on any of the leaders in American federal spending: defense, social security, and healthcare entitlements. In reality NASA's percentage of the federal budget is 0.5%, and it has never exceeded 5% in its history. From another perspective, when the government is looking to make trims, NASA is one of

the first agencies on the chopping block, even though it is not in the top 100 spender's list. Finally, while most American taxpayers approve of NASA and even go so far as to say that they like the agency, a sizable number of people either feel that NASA is an agency the country could live without, or that America should solve its problems here on Earth before going out into space.

This misconception is the major reason for many of NASA's faults and, in turn, the faults of the Shuttle. The STS program came as a result of Richard Nixon's next generation plan for space following America's moon program, Apollo. Out of the choices between a permanent base on the moon, a mission to Mars, ceasing the manned space program completely, or developing Low Earth Orbit (LEO) infrastructure (a.k.a. frequent, cheap, and reusable access to space), he chose the latter, which led to the creation of the STS. Developing such infrastructure is by no means easy, and it becomes much harder when there is no established goal for it to accomplish. While the Space Shuttle has helped provide many science missions, satellite services, and easy access to the International Space Station (ISS), these snack-sized missions completely missed the point of a "shuttle" system.

Wernher Von Braun, the Nazi rocket scientist turned NASA mastermind, was the original proponent of making a shuttle system as part of his "Von Braun Paradigm." After all, a shuttle system between the Earth and a space station would allow easier access to both the moon via International Space Station to moon shuttles and Mars via moon to Mars shuttles. The Space Shuttle would then have been the first leg of that paradigm. However, a major bullet in Von Braun's plan was that the moon and Mars are the ultimate goal, or else there is no point in the Shuttle's use.

Mars is largely considered a goal for humanity for no other reason than that it feels like the obvious next step. However, no one seems to have the political capital to declare it a national priority in the same way President John F. Kennedy did with his goal of putting a man on the moon. With the Shuttle, it's not so certain what that goal is; there are no landing strips on Mars, after all. Due to all these shortcomings, the scope of the STS program was cut from all directions, reducing both its versatility and strength. Even when the US Air Force tried to step in and save the program by establishing military uses of the STS program in exchange for Department of Defense funding, it ultimately limited the Space Shuttle's ability to excel in other areas.

Because of these developments, the Shuttle fell short in both cost and safety, the two areas most noticed by the public and the government. When just the first leg of a very long journey costs

billions per flight, few seem to want to invest in a moon base, second space station around the moon, or a footprint on Mars. So to make our next step forward, we first need to take two steps back, which means scrapping the Shuttle. This year marks the last flight of the Shuttle program, but it took 30 years for us to finally take that step back so we could get on track once again.

NASA receives much of its support from Congress, but congressmen are unlikely to finance a NASA project unless their home state happens to manufacture the necessary parts. Unfortunately, nobody's home state takes the initiative to develop new rockets, and only the old rockets receive support. In all likelihood, had the 2003 Columbia accident not occurred, President Bush would not have taken the initiative to end the STS program. It is therefore obvious that the next generation US space vehicle, the Space Launch System (SLS), is a rocket built almost completely out of old Shuttle parts, the only type of rocket those old Shuttle fans in Congress would support.

In this story, the snail is America's government leadership, and the very capable NASA is the shell on its back; the tortoise is every other attempt to explore space available and it's dead in the water. Meanwhile, the snail is slowly crawling in the wrong direction...

Stay tuned for the February issue where The Race to Mars continues! We'll cover in detail the case for NASA being free to take mankind to the stars and receive more support from our government and our people.

Valeriy Vislobokov is a senior in Aerospace Engineering.

To this day, NASA has spent less money since its founding in 1958 than the United States Department of Defense spent in 2010 alone; more was spent that year on temporary air conditioning in Iraq than on NASA.



SLS2: Artist's concept of SLS, the rocket that may take us to Mars. - Image courtesy of NASA.

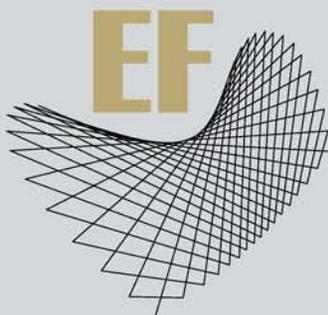
EF Staff



Top Row From Left: Alex Gomes (Chief Copy Editor), Sumedha Mohan (Editor-in-Chief), Aneela Mousam (Writer), Mary Dassira (Layout Designer), Elena Nadolinski (Webmaster)

Bottom Row From Left: Chirag Kapadia (Photographer), Avery Nelson (Writer), Taylor Evan Pfeifer (Business Director), Matthew Dowdle (Writer), Coleman Merenda (Advertising Liaison)

Not Pictured: Valeriy Vislobokov (Managing Editor), Katherine Eckenfels (Layout Editor), Mia Simms (Public Relations Manager), Andrew Mussey (Lead Photographer), Julia Freeman (Webmaster), Kristin Sorenson (Writer), Clarke Richardson Austin (Writer), Joseph Pucci (Writer)



Check out our new website!
<http://www.ef.org.vt.edu/>