



Engineers' Forum

Volume 30 No. 3 September 2010

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SEPTEMBER 2010 **Engineers' Forum**

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The Engineering Expo is a career fair for engineering students seeking internships, co-ops and full time jobs at leading engineering companies.

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The Heidelberg Speedmaster 74 five-color press, which has a tower dedicated to each of the CMYK (cyan, magenta, yellow, and black) colors and an extra tower for a spot color when necessary.



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Pictured to the left are NVIDIA and AMD brand GPU accelerator cards. These cards would normally be installed in each compute node of the small cluster testbed featured on the cover.

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Dear Readers,

I'd like to welcome you back to campus for the fall semester of 2010! I hope you come back to campus re-energized and ready for the wonderful Tech football season!

As the new Editor-in-Chief of the Forum, it gives me a lot of pleasure and pride to give you this issue of the Engineers' Forum. In this issue, you will hear the story behind Hokie stone, the history behind the Engineering Expo, the possible engineering applications of the new iPad, the process behind printing the Engineers' Forum magazine, and much more. Stay with us- there's much to be discovered in this issue!

As always, the Engineers' Forum is a completely student-run organization, and we're always on the lookout for new talent. Writers, photographers, layout members, and business people are all welcome to become members of the Forum. We even pay our members for their contributions, so if you're looking to get involved this semester, the Forum might be for you!

The Engineers' Forum is constantly changing and improving, and we welcome your opinions for those changes. If you have any feedback you'd like to share, improvements you'd like to see, or any topics you'd like covered in the Engineers' Forum, please email us at forum@vt.edu.

I'd like to wish you the best of luck at the Engineering Expo; Andrew Mussey and I hope you have a wonderful semester. Go Hokies!

Christina Kazmer



Editor-in-Chief

Cover photo courtesy of Computer Science Department



EXPO: A WEALTH OF OPPORTUNITY

As the 2010 fall semester begins the hustle and bustle of campus life returns to Blacksburg. Once again engineering students are hitting the books after a well deserved summer vacation. Soon after arriving on campus, even before the trees on the Drillfield turn orange and maroon, engineering students are given an extraordinary opportunity, the Engineering Expo. For those who don't know, the Engineering Expo is a career fair for engineering students seeking internships, co-ops and full time jobs at leading engineering companies. Boeing, Northrop Grumman, the US Navy, and the CIA are regulars among the many companies looking for new hires.

Not only is the Engineering Expo organized for engineering students, but it is also planned and run by

engineering students. The Student Engineers' Council (SEC) began organizing this year's Expo in December 2009. Since the earliest planning began, the SEC has invited, processed, and organized the company representatives that will be present at the Expo. The SEC is also responsible for promoting the event to all engineering students. Over 200 companies regularly attend the Expo, each with several representatives and job offers, making it the single greatest source of job offers for Tech engineers.

The Engineering Expo has grown to be the second largest of its kind nationwide, second only to Purdue University, and the SEC is determined to host the largest engineering career fair in the nation. But the Expo hasn't always been as large as it has become. It has a rich that stretches back three decades.

The past 30 Engineering Expos have attracted increasingly larger crowds of students and company recruiters. As the Expo's success grew, the



Many companies use resumes given at the Expo to immediately inform students if they would be a good fit.

SEC began creating spin-off events similar to the Expo. The Freshman Major Mixer is an event that helps freshman engineering students decide which of the many degrees Tech offers to pursue. The Leadership in Engineering Conference (LEC) is an all day event where speakers ranging from company reps and professors lecture attendees on new ground breaking technologies in the business world.

While most students are enjoying spring break, the SEC takes a plane to the National Association of Engineering Student Councils meeting to plan the Expo fulltime. Along with other student engineering councils, they discuss how to better their programs. The Engineering Expo is the biggest focus at the NAESC conference and Virginia Tech's SEC helps lead the way. The amount of



The Expo brings together job opportunities from around the country for engineering students to take advantage of.



The Expo hosts a wide breadth of companies to support Tech's diverse engineering programs.

planning put into the Expo makes ensures its high quality every year.

Thanks to its intricate planning put into Engineering Expo and the wealth of opportunities it offers, the Expo is a great opportunity for students even if they're not seeking a job. It offers a glimpse into the work world and the company representatives are always willing to answer any questions. The 31st Engineering Exposition at Virginia Tech looks to continue the tradition of past Expos, offering young engineers a stepping stone into the business world.

Allan Kirchhoff is a sophomore in Mechanical Engineering.



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Catherine Chambers shows the staff various samples of materials that Printing Services has produced which are sitting on top of the Heidelberg SM 74 color control booth.

THE ENGINEERS' FORUM TOURS PRINTING SERVICES

Anyone who has ever worked on the staff of a newspaper or magazine (including us here at the Engineers' Forum) knows the dedication and hard work required to write, edit, and design a quality piece of media. But what happens after a completed digital issue is sent to the printers? Last May, members of the EF staff contacted Mrs. Catherine Chambers, manager of Virginia Tech Printing Services, in order to find out more about the professional printing process. Mrs. Chambers arranged a tour for the EF staff of the Printing Services facility on South Main Street.

Did you know that there are two Digital Print Centers on campus? Most students do not, yet Printing Services is a valuable resource for students and faculty alike. The print centers are located at 132 Burruss Hall and 142 Smyth Hall. Competitively priced color and black and white printing is available at both locations. Files can be submitted electronically, so you can place a high quality printing order in the comfort of your dorm or apartment.

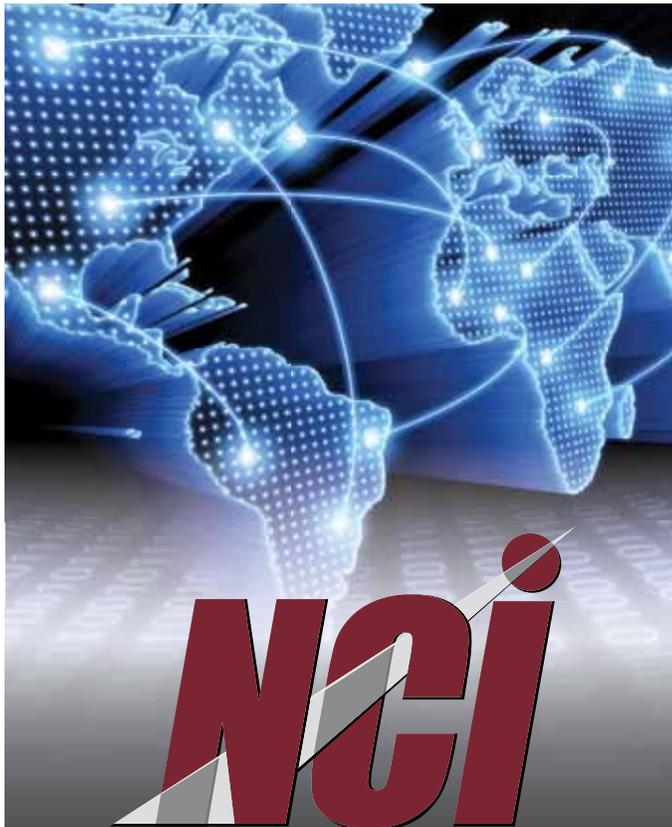
Pricing estimates are available upon request, and the Printing Services staff will work with you to make sure your order is placed exactly the way you want. Copier machines, operated by the Copier

Management Program, are available for departments and students groups, too. Many print jobs are completed on campus, but the off-campus printing facility – the one that the EF staff toured – also picks up orders and will deliver the completed products to most locations on campus free of charge!

A variety of papers, inks, and machines are available to meet your printing needs, including digital reproduction, copying, binding, bulk mailing, and more. Printing Services will even organize a job through an outside printing service if their resources are not sufficient for a specific project. This branch of Transportation and Campus services has revamped itself to fit the needs of Tech students, faculty and staff, so stop by and see what the friendly people at Printing Services can do for you and your projects!

The pictures in this spread are from the EF staff's visit to 1425 South Main Street; the information in this article, as well as printing guidelines and other tips, are available online at <http://www.printing.vt.edu/>. Check out Printing Services on Facebook, too!

Julia Alspaugh, the previous Editor-in-Chief, is an alumna from the mechanical engineering class of 2010



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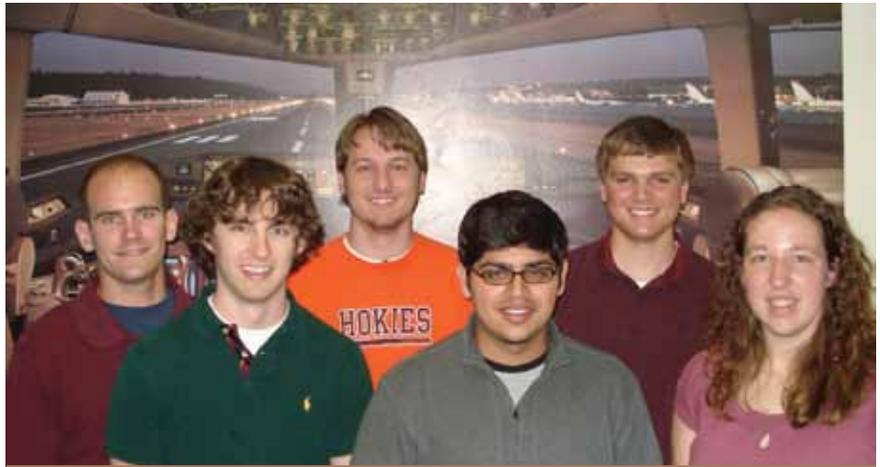
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Pictured is the award winning Virginia Tech aerospace engineering team. From left to right are: Joshua Eggleston, Kristopher Walbert, Eric Buckenmeyer, Umair Surani, Andrew Lyford, and Katie Rybacki.

Blacksburg, Va.,
Aug. 16,
2010 — Virginia Tech's design of a reliable and cost effective system to send a minimum of two astronauts to a Near Earth Asteroid (NEA) and return them safely to earth has won the team first place in the 2010 American Institute of Aerospace and Aeronautics (AIAA) Team Space Transportation Design Competition.

The Virginia Tech engineering students called themselves Team COLBERT, an acronym for Close Object Landing by

Earth Research Team.

They named the mission Athena after the Greek goddess of wisdom, due to the amount of insight into the history of the universe that would be gained from the asteroid samples brought back by the astronauts.

"Our students did an outstanding job in the competition," said Christopher Hall, professor and head of the aerospace and ocean engineering department at Virginia

Tech. "And Kevin Shinpaugh, one of the designers of our System X supercomputer, was a great source of information for our students as they looked at redundancy and aerospace design methods."

The six members of the team, all aerospace engineering majors, were: Josh Eggleston, of Chester, Va.; Kristopher Walbert, of Birdsboro, Pa.; Eric Buckenmeyer, of Lake Ridge, Va.; Umair

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Surani, of Sugar Land, Texas; Andrew Lyford, team leader, of Leesburg, Va.; and Katie Rybacki, of Ashville, N.C. The faculty adviser, Kevin Shinpaugh, of Catawba, Va., is the director of research and cluster computing at Virginia Tech and an adjunct faculty member with the AOE department.

The focus of the effort was to design a Human Asteroid Exploration System (HAES), with a technology that was feasible for a timeline between 2018 and 2030. The HAES had to provide all of the crew accommodations and life support systems for safe travel. The system also had to devise how the astronauts would explore the asteroid's surface, how they would be able to use scientific equipment, and how they would transport at least 100 kilograms of asteroid samples back to Earth.

The students explored various risk mitigation strategies. They focused on multiple thermal and radiation systems to shield the astronauts from the harsh conditions of space, decided on health monitoring systems that could also take preemptive steps in the case of a problem, and proposed a water landing back on Earth to insure no undue stress was placed on the astronauts' bodies after such a long mission in zero gravity.

They also identified redundancy as key to the safety of the mission. Instead of one living environment, they proposed a separate lander and capsule that could serve as a lifeboat in the event of system failure. They also designed each subsystem with multiple computer systems, eliminating a total system failure in the event of one computer malfunctioning.

The engineering students devised a theoretical spike and ice system for the

legs of the lander when it was on the asteroid. The spikes would provide the main grip to the asteroid surface and the ice would allow for an added attachment. The astronauts would be attached to the arms of the lander to make sure they did not escape the asteroid's gravity, and the students also designed for multiple arms in case one failed.

They selected the Variable Specific Impulse Magnetoplasma Rocket (VASIMR) engine that requires the fuel to be launched with the spacecraft, but its low fuel consumption reduces the amount of fuel needed. VASIMR actually reduces the amount of fuel needed from 90 percent of the spacecraft dry mass to about 40 percent, they wrote in their award winning paper.

The students selected hydrogen as the fuel of choice, citing its safety aspects from previous testing in space applications.

They added that it was readily available and less expensive due to its high usage rate.

Other parameters they focused on included a launch vehicle selection, additional scientific instrumentation, spacecraft configuration, power systems, thermal and environmental systems, radiation protection, and more. In all, their submitted technical paper was 89 pages.

AIAA will honor the team at the AIAA Space 2010 Conference & Exposition Aug. 30

–Sept. 2, 2010 at Anaheim, Calif.

Virginia Tech's College of Engineering is internationally recognized for its excellence in 14 engineering disciplines and computer science. As the nation's third largest producer of engineers with baccalaureate degrees, undergraduates benefit from an innovative curriculum that provides a hands-on, minds-on approach to engineering education. It complements classroom instruction with two unique design-and-build facilities and a strong Cooperative Education Program. With more than 50 research centers and numerous laboratories, the college offers its 2,000 graduate students opportunities in advanced fields of study, including biomedical engineering, state-of-the-art microelectronics, and nanotechnology.

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Engineering Student *Soars* in Boeing Competition

Blacksburg, Va. Aug. 23, 2010 — Onur Bilgen of Ankara, Turkey, a recent Ph.D. recipient in the mechanical engineering (ME) department at Virginia Tech, has won third place in the Boeing competition for Engineering Student of the Year 2010.

Bilgen, nominated by his adviser Dan Inman, who holds the George Goodson Professorship of Mechanical Engineering at Virginia Tech, is being recognized for his work to enhance the use of small, unmanned air vehicles (UAVs) and micro air vehicles (MAVs). These vehicles have multiple practical uses, and the Defense Advanced Research Projects Agency (DARPA) first advanced research on this technology in the early 1990s.

The Boeing contest is open to engineering students worldwide, and its key criterion

is the impact, or potential for impact, of the candidate's work or future aeronautical or space technology. The entrant may be from an undergraduate or a graduate student. Bilgen, Inman, and Kevin Kochersberger, also of ME, recently filed for two patent disclosures on their work. One of the patent disclosures deals with a shape-changing airfoil, also referred to as a morphing airfoil. Kochersberger is the director of the Unmanned Systems Laboratory at Virginia Tech. Specifically, the three have designed several novel airfoil concepts that provide aerodynamic control. An airfoil is the shape of a wing or it could be a blade that might be part of another component of the vehicle such as a turbine engine. The airfoil is typically used to generate lift in the aerial vehicles.

Bilgen, who is the lead author on the patent disclosure, says the airfoil's

uniqueness is due to its ability to change its shape or morph, much like a bird in flight. This specific airfoil uses piezoelectric actuators.

Piezoelectricity is the electrical charge that occurs in certain solid materials due to a mechanical

pressure. It also refers to the mechanical pressure generated due to the application of electricity. An everyday example for piezoelectricity might be the flame from a cigarette lighter when one's finger exerts the mechanical pressure to cause the ignition.

Bilgen uses this electrical-to-mechanical conversion property of piezoelectric materials to change the shape of the airfoil.

These actuators are placed at the top and bottom surfaces of the airfoil, and aid in the capability of the wing to change its shape depending on the electric voltage.

Bilgen studies the effects of several structural and aerodynamic parameters to achieve higher efficiency for generating lift while consuming as little power as possible.

"Higher lift and lower drag can be achieved by using novel airfoils that employ piezoelectrics as opposed to conventional actuators such as bulky motors," Bilgen added.

Earlier this year, Boeing announced Virginia Tech was one of its targeted schools for recruitment purposes.

Virginia Tech's College of Engineering is internationally recognized for its



Virginia Tech doctoral candidate Onur Bilgen of Ankara, Turkey, conducts his research with Center for Intelligent Material Systems and Structures (CIMSS) and Dan Inman, the CIMSS director and academic adviser to Bilgen.



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Virginia Tech Lands National Science Foundation Award for

HOKIE SPEED

Blacksburg, Va, Aug. 5, 2010 – Wu Feng, associate professor of computer science as well as electrical and computer engineering and principal investigator on the grant, along with Khidir Hilu, professor of biological sciences, and Scott King, professor of geosciences, all at Virginia Tech, successfully applied for the \$2 million grant through the National Science Foundation's Major Instrumentation Program to invent and build "HokieSpeed."

Feng, who joined Virginia Tech in 2006, is an expert in efficient computing systems. He is the founder of the Green500 List, a ranking of the most energy-efficient supercomputers in the world, and considered to be a complementary listing to the Top500 List of supercomputers. He also serves as the faculty co-director for the NSF Center on High Performance Reconfigurable Computing (CHREC), an NSF Industry/University Cooperative Research Center (I/UCRC).

Virginia Tech became a key player in the field of high-end computing in 2003, when it designed and built System X, when the machine was ranked as the fastest academic supercomputer in the world (November, 2003 TOP500 List). Srindhi Varadarajan, associate professor of computer science, was the chief architect of System X.

Feng described HokieSpeed as a new heterogeneous supercomputing instrument based on a combination of central processing units (CPUs) and graphical processing units (GPUs). In terms of raw performance, he noted that HokieSpeed is

expected to deliver 35 times better peak performance, 70 times better peak power efficiency, and 14 times better peak space efficiency than System X.

"HokieSpeed is expected to catalyze new approaches for conducting research via the synergistic amalgamation of heterogeneous supercomputing and cyber-enabled tools to enhance ease of use. In particular, it will give end users the ability to perform in-situ visualization for rapid visual information synthesis and analysis. It will also control their level of immersion in the discovery process – from being completely immersed, making real-time intuitive decisions via a large-scale gigapixel display, to observing the instrument automatically collect, organize, and analyze data in support of visual analytics. A large set of Virginia Tech researchers from across the University will be actively involved in research using HokieSpeed," Feng said.

The expectations for HokieSpeed come from the researchers' plan to have each compute node of the supercomputer consist of both CPUs and GPUs. Since the 1960s, the CPU has served as the brains in computing instruments. Recent trends, however, have exposed the CPU as a

"jack of all (computing) trades, master of none," Feng said, "thus giving rise to heterogeneous computing instruments with multiple types of brains that include both CPUs and GPUs.

"This transformative instrument will empower faculty, students, and staff across disciplines to tackle problems previously viewed as intractable or that required heroic efforts and significant domain-specific expertise to solve," Feng said.

As an example, Feng cited his leadership of a team of more than 20 interdisciplinary researchers from eight institutions around the world in 2007. They developed software cybertool instruments to integrate a set of distributed supercomputers, totaling 12,000 plus CPUs, to enable the discovery of missing genes in 699 microbial genomes. Originally thought to be computationally infeasible, his team completed the task in ten weeks.

Virginia Tech's Office of the Vice President for Information Technology and the Office of the Vice President for Research provided key enabling cost sharing support for this project.

Staff Reports



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The Cornerstone of the Hokie Nation

Hokie Stone serves as the foundation for Virginia Tech buildings as well as the spirit of Hokie Nation. Adorning every building on central campus, the stone is a unique symbol of Virginia Tech, attracting students from all over the world and bringing back alumni every year.

Hokie Stone is a native variety of limestone quarried at a local mine owned by the university. The stones have been in use since the late 1800's, and have become so popular with visitors, students, and faculty that in 1983 the Board of Visitors decreed all buildings constructed in central campus must feature them as siding.

Hokie Stone is a type of limestone unique to Southwest Virginia, Tennessee, and Alabama. It was formed approximately 300 million years ago when the African and North American tectonic plates collided at the end of the Paleozoic Era. The forces from this collision created faults and folds in the Earth's crust, pushing layers to the surface where the limestone could be formed.

The large range of colors in the stone—including pinks, yellows, maroons, browns, grays, and blacks—are a result of the high levels of calcium and magnesium found in the stones and the environmental conditions in which the stone was formed. The lighter color rocks were

created under arid, desert climates while the dark gray and black stones were formed in swamp or wetland conditions.

Hokie Stone is found in several locations near the Blacksburg area. The Virginia Tech Foundation purchased a local 38 acre quarry in 1975 that has been in operation since the late 1950's. The quarry provides eighty percent of the stone used in university buildings, while the remaining twenty percent is purchased from a farm in Montgomery County to get a larger color variation.

Workers at the quarry use black powder to loosen the rock and break the stones into two by one foot blocks. Each stonemason shapes and smooths the stones by hand, using only hammer and chisel, and can process about one ton of stone per day. A ton of stone will cover more than 30 square feet of a building. The typical building will use approximately 1,500 tons of Hokie Stone, nearly 85,000 individual stones, and takes about 6 months to quarry.

New equipment was recently implemented by the university that would reduce the bulk and cost of building construction by cutting the stone to brick depth. The new Visitor and Undergraduate Admissions Center, scheduled to open in June 2011, will be the first building on campus to incorporate stone cut with the new technology.

The first implementation of Hokie Stone on the Virginia Tech campus was in the YMCA building (now the Performing Arts Building) in 1899. The limestone façade and Romanesque architecture proved to be popular with then president John McBryde and the faculty.

The next president, Joseph Eggleston, extended the usage of Hokie Stone to the neo-Gothic McBryde Building

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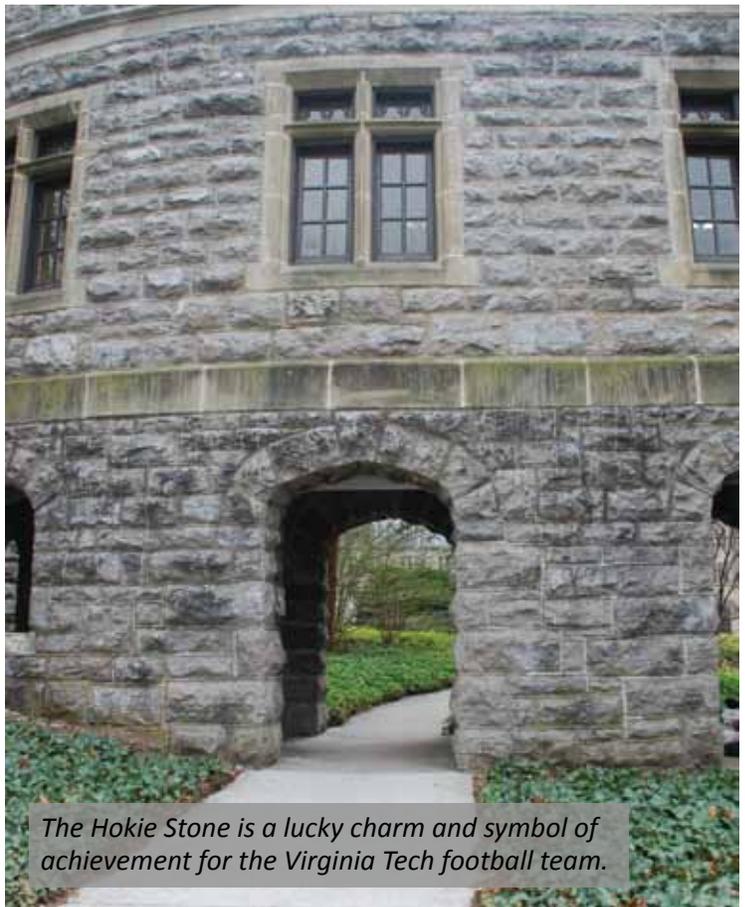
of Mechanical Arts in 1917. Even though this building was destroyed in 1966 it served as the model for all the buildings to come.

These days all buildings in the central campus area, as required by the Virginia Tech Board of Visitors, are clad in Hokie Stone. All of the buildings opening this academic year including ICTAS II, Visitor's and Undergraduate Admission Center, and not excepting the new Parking Structure, will feature our native limestone.

The Hokie Stone is a lucky charm and symbol of achievement for the Virginia Tech football team. Immediately before they enter Worsham Field on game day, each player touches a Hokie Stone above the door in Lane Stadium. Written beside the stone are the words, "For those who have passed, for those to come, reach for excellence."

Hokie Stone was also used for the memorial after April 16th tragedy. The permanent memorial, based on a temporary memorial setup by students, consists of 32 stones each with the name of a student of faculty member who was killed that day.

Hokie Stone is an important symbol for Virginia Tech, its students, faculty, and surrounding community. It acts as a timeless foundation that connects the past, present and future of Virginia Tech, standing for the resilience and strength of Hokie Nation.



The Hokie Stone is a lucky charm and symbol of achievement for the Virginia Tech football team.

Z. Nathan Bales is a senior in Civil Engineering

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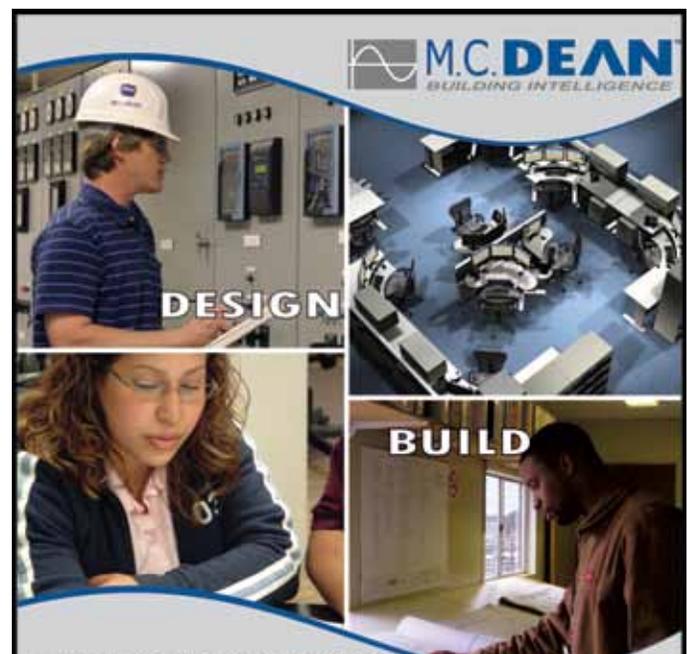
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more than 20 countries, according to the company's website. A judging committee of technical publication editors and NI experts reviewed the papers and selected the contest finalists and winners.



Several other College of Engineering teams attended NIWeek, including the Hybrid Electric Vehicle Team of Virginia Tech (HEVT) and a group highlighting a newly developed digital version of a paper-based pediatrics medical emergency chart, known as the Broselow Tape. The HEVT also gave a keynote demo to NIWeek attendees, highlighting efforts to re-engineer a hybrid car for maximum fuel efficiency and lowest possible emissions.

This is not the Virginia Tech College of Engineering's first major win at NIWeek. In 2007, a team, headed by Hong, won for its miniature autonomous humanoid robot DARwIn project, snagging prizes for Most Outstanding Application of Virtual Instrumentation; Editor's Choice Award for Best Application of Virtual Instrumentation; and Best Application of Virtual Instrumentation, Mechatronics Category.

Staff Reports



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A. A cow B. A hippo coming out of the mist
 C. Hellboy D. Umm... an inkblot?



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Google meets VT

Introduction

If you haven't used Google mail, edited a Google document, done a Google search or have otherwise missed the 21st century explosion of information you're in for a treat.

During the course of this past few years, Virginia Tech has worked to create a partnership with the silicon-valley giant. Visitors to the VT campus over these years have included Eric Schmidt, the CEO of Google, who discussed the need for investment in Virginia, as well as Vint Cerf, the Google Vice President and Chief Internet Evangelist who described the creation

of the TCP/IP protocol and the backbone of the internet, and finally Henry Green who explained how Google's data servers operate.

The Problem

VT webmail was never intended as a long-term repository for your emails, and the VT email terms of service even indicate that:

"WebMail serves only as a Web interface to the VT Mail server. WebMail is not configured to keep permanent copies of your messages. If you wish to keep a permanent copy of your messages, you must use a desktop e-mail client

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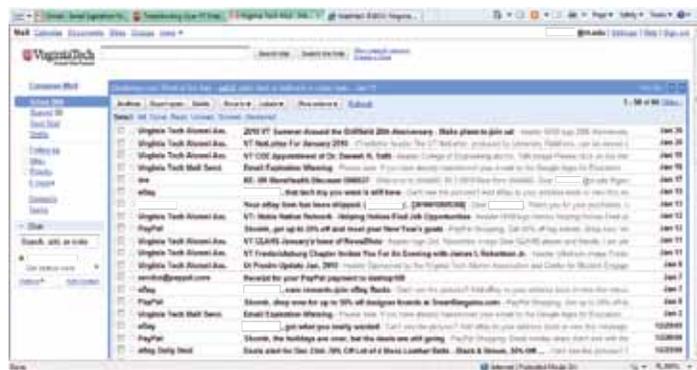
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to periodically download your messages from the VT Mail server. Also, there is no way to set up filters or rules from within WebMail. “



The Google Solution

Features:

- More than 7 GBs of storage
- Calendar Integration
- Real-time collaboration
- Group project sites

Northwestern, Brown, Arizona State, and the Wahoos up north have all “Gone Google,” in the past few years and VT has signed on for a pilot trial. Currently Google Apps are available to alumni who can transition by following



Continued on page 22

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Applications can be completed and submitted online beginning September 1st, 2010. The application process will close on October 8th, 2010. Apply at jobs.bhpbilliton.com.

Apply online at jobs.bhpbilliton.com

Continued from page 21

instructions on VT Knowledge data. Based on the results and feedback from this trial, VT will make the decision about further role outs to the university.

Space

Gmail has an "Infinity+1" storage plan that is currently at 7484 megabytes and constantly increasing.

You are currently using 1 MB (0%) of your 7410 MB.

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Powered by Google

Calendar Integration

When emails arrive with event information included, Gmail has smart lingual recognition systems that can create an event that can instantly fill date, time and location information in for you.

Real-time collaboration

By harnessing the currently existing the infrastructure of online services, Google documents creates word processors and spreadsheet tools that can be accessed by multiple users simultaneously.



Issues

So although we at the EF are already preparing to mourn the loss of VT webmail, we are looking forward to the implementation of Gmail. Currently the migration process will only work if you are alumni. This initial stage represents a pilot that allows VT to examine the reliability and technical robustness of the Gmail solution, as well as for VT network administrators to become familiar with the Google apps interface.



The other major issue with a Gmail solution from a user perspective is the associated loss of privacy. Google apps privacy notice concludes that administrators may 1. View statistics about the account's usage 2. Change your account password, suspend or terminate your account access and your ability to modify your account; 3. Access or retain information stored as part of your account, including your email, contacts and other information.

Darius Emrani is a junior in Electrical Engineering and Biochemistry

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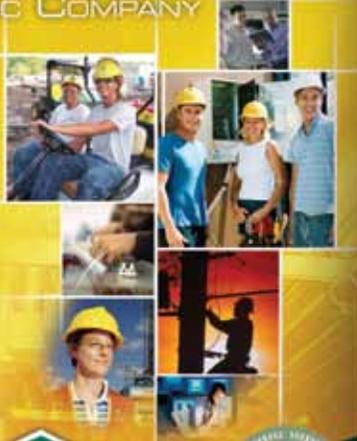
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