

Headlines

College of Engineering Headlines is produced annually to present highlights of the past year as well as late-breaking December 2013 news, as they appeared in the general media.

Due to limited space, many of the articles appear in excerpted form and are designated by ellipses. These 28 pages represent only a small sampling of news concerning the College of Engineering alumni, faculty, student, and events during 2014.



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THE NEW YORK TIMES • December 31, 2013

F.A.A. Picks Diverse Sites to Carry Out Drone Tests

by Matthew Wald

WASHINGTON — The Federal Aviation Administration will authorize test sites for drone aircraft in upstate New York, New Jersey and at least eight other states, the agency said on Monday, preparing for a time when unmanned aircraft of various shapes and sizes cruise over the landscape.

The agency picked six institutions to operate test locations, which will explore how to set safety standards, train and certify ground-based pilots, ensure that the aircraft will operate safely even if radio links

are lost and, most important, how to replace the traditional method for avoiding collisions. Integrating the aircraft into the nation's airspace, set by Congress for 2015, will be phased in gradually. . . .

The six winners, chosen from a field of 25, included Griffiss International Airport, a former Air Force base near Rome, N.Y., which will fly some tests from Cape Cod in Massachusetts, and **Virginia Tech**, which will fly in Virginia and has an agreement with Rutgers University in New Jersey for test-

See DRONE TESTS, page 2

BBC • April 2, 2014

U.S. Navy tests robotic fire-fighters

The Shipboard Autonomous Fire-fighting Robot (SAFFiR) has been built by **engineers at Virginia Tech** and other U.S. universities.

The robots are expected to perform a variety of tasks - balancing, turning valves, picking up and dragging a fire hose and jetting water on the fire.

They also have a vision system to search for survivors.

"The human-sized autonomous robot is capable of finding and suppressing shipboard fires and working seamlessly with human fire-fighters," says the Office of Naval Research's website.

Such a machine should be "able to withstand
See ROBOTIC, page 11

FOX NEWS • January 31, 2014

Football helmet design can lower concussion risk, study finds

by Loren Grush

As the Super Bowl approaches on Sunday, more and more attention is being paid to the concussion epidemic surrounding the game of football. During the 2013 regular season, NFL players suffered a total of 121 concussions, equating to more than seven concussions per week.

Many experts claim that

proper helmet design can ultimately lower the incidence of concussions in the game - an argument that has now been confirmed by new research conducted on the football field.

After embedding sensors into two different types of football helmets, researchers from **Virginia Tech University** have revealed that

one helmet was much more effective at preventing concussions than the other. According to the researchers, their findings confirm that helmets can actually be designed to reduce the risk of concussions during gameplay.

Study author **Stefan Duma, professor and head of the Virginia Tech - Wake Forest**

See DESIGN, page 5

**THE WASHINGTON POST
March 9, 2014**

Researchers closing in on solving mystery of how some snakes fly

by Meeri Kim

An ornate, lime-green snake hangs from a branch. Upon spotting a predator, it suddenly propels itself into the air, flattening and wiggling its body until safely landing in a faraway tree.

Flying snakes sound like creatures from a bad B-movie, but these serpents are elegant gliders that have evolved a special skill that sets them apart. In two new studies, engineers have used simulations to try to decipher how the wingless reptile manages to remain airborne despite its lack of flight appendages. . . .

In a tornado, the low-pressure region is in the center, or eye. Similarly, researchers found areas of low pressure that form on top of the snake's body, creating a small amount of suction and helping to generate lift.

In collaboration with flying-snake expert **Jake Socha of Virginia Tech**, Barba was able to visualize these swirls of air in a complex computer air-flow simulation.

See SNAKES, page 20

THE WALL STREET JOURNAL • September 5, 2014

U.S. Intelligence Community Explores More Rigorous Ways to Forecast Events

by Jo Craven McGinty

Analysts for the Central Intelligence Agency, the National Security Agency and more than a dozen other government organizations depend on their ability to forecast national and global events to help ward off various threats to the country, but old-style approaches can produce flawed results.

To improve quality, the government has taken the unusual step of running tournaments that invite people outside the intelligence community to develop better ways to forecast world events, and several have produced notable results.

"Traditional forecasting in the intelligence community relied on human judgment, and the way in which humans make those judgments has tended to be unstructured deliberation," said Jason G. Matheny, a project manager for IARPA, the Intelligence Advanced Research Projects Activity, the research and development arm of the Office of the Director of National Intelligence. . . .

EMBERS, the winning OSI project, beat out two competitors and is led by **Naren Ramakrishnan at Virginia Tech**. To identify brewing events, the team vacuums up large

See EVENTS page 15

USA TODAY • December 30, 2013

FAA names six sites for testing drones

by Bart Jansen

The Federal Aviation Administration named six teams across the nation that will host the development and testing of drones to fly safely in the same skies as commercial airliners.

The announcement represents a major milestone toward the goal of sharing the skies by the end of 2015, in what is projected to become an industry worth billions of dollars. But technical

hurdles and privacy concerns remain in a regulatory program that's already a year behind schedule....

The FAA will work with the chosen groups to get at least one drone site operating within the next six months. Out of 25 applicants, the winners are:...

• **Virginia Polytechnic Institute and State University**, which has test locations in Virginia

and New Jersey, plans to test failure modes and technical risks for drones, to ensure they land safely if they lose their connection with a pilot....

The sites chosen are expected to attract economic development. The Association for Unmanned Vehicle Systems International, projected the industry will create 100,000 jobs and generate \$82 billion in economic activity in the decade after the aircraft are allowed in general airspace....

(This article also appeared in: *Reuters, The Chronicle for Higher Education, Chicago Tribune.*)

WVTF-FM • March 5, 2014

Drones & Jobs

by Robbie Harris

There's been a lot of attention on Drones recently. But alongside concerns about privacy and military applications, is potential job creation in Virginia as a new industry rises.

Virginia is one of

seven sites selected for Drone testing research projects. That got **Virginia Tech's** office of economic development thinking about what that might mean for the state if this new industry takes off. Estimates are as many

as 100,000 jobs could be created, nationwide over the next ten years.

"Virginia is well positioned in terms of technology development especially and potentially attracting other industries in this larger vehicle

cluster because of our current strength. So there's room to grow even beyond what we already do and a good basis in terms of technology development already," says Jennifer Shand, Senior Economic Development specialist....

CIO • February 6, 2014

9 Windows Azure HDInsight Big Data Success Stories

Virginia Tech Transforms Life Sciences Research

by Thor Olavsrud

Virginia Polytechnic Institute and State University has been using the HDInsight Service to aid its life sciences research in DNA sequencing. Leveraging a grant from the National Science Foundation, **Virginia Tech computer scientists** developed an

on-demand, cloud computing model using Windows Azure HDInsight Service that helps locate undetected genes in a massive genome database.

"Of the estimated 2,000 DNA sequences worldwide, they are generating 15 petabytes of genome

data every year," says **Wu Feng, professor of Computer Science at Virginia Tech**. "Many life sciences institutions simply do not have access to the computational and storage resources required to work with data sets of this size. We're generating data faster than we can analyze it."

DRONE TESTS - The New York Times

(Continued from page 1)

ing there as well. Virginia Tech plans to conduct "failure mode" testing — finding out what happens if the aircraft's control link is lost. ...

Mr. Huerta said the choice of the six institutions marked a milestone for the aircraft, whose proponents prefer to call them "unmanned aerial sys-

tems." But he said that while a 2012 law sets 2015 as the year by which they should be integrated into an airspace shared with conventional airplanes, "we would envision that that would be a staged process, as we learn more about what these aircraft are, and how they interact with other aircraft" ...

WLS-TV10 (local NBC)
March 10, 2014

Study shows Virginia ready for drone growth

by Dawn Jeffries

A new **Virginia Tech** study shows the Commonwealth is in a good position to take flight when it comes to unmanned aircraft systems, also known as drones.

Researchers say the state asked them to look into what the Commonwealth's strengths might be following the university's designation as one of six federally certified drone test sites back in December. "Virginia has the opportunity and the capability to be a national leader in the development, manufacture, and creative use of autonomous vehicles," researchers said. ...

VIRGINIA TECH COLLEGE OF ENGINEERING

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ABC • April 7, 2014

Virginia Tech conducts FAA-driven experimental drone flight

by *George Jackson*

In December, the Federal Aviation Administration chose six research and test sites for unmanned aerial vehicles – commonly known as drones. Virginia captured one

of those highly coveted spots. It's a designation that could pay financial dividends for years to come.

Last week, **Virginia Tech** hosted its first FAA-driven experimental drone flight....

WLSL-TV10 (local NBC) • April 2, 2014

VT students testing, flying drones

by *Jenna Zibton*

BLACKSBURG, VA – Virginia Tech students are testing drones at the Kentland Experimental Air Station in Blacksburg.

The University is one of six testing sites across the country selected by the Federal Aviation Administration.

"It's exciting work and we

all thrive on adrenaline in this world and the payoff is great because we do things that nobody else is doing," said **Kevin Kochersberger, an engineering research associate professor.**

The students and faculty projects include: detecting radiation, plant disease, physics of flight, and aerial imagery.

AVIONICS TODAY • April 22, 2014

The Future of Unmanned Flight

by *Chelsea Bryan*

Just five years ago, the idea of the futuristic aircraft known as Unmanned Aircraft Systems (UAS) dotting our skies seemed more like talk of UFO sightings than future tech, but now, "I think you've got to be pretty deluded to think that we're not going to have unmanned aircraft in the National Airspace," says **Craig Woolsey, director of the Virginia Center for Autonomous Systems and a Virginia Tech research professor....**

Researchers like Woolsey, also **associate professor and assistant department head of**

the Virginia Tech Aerospace and Ocean Engineering Department, employ UAV sensors that can comb the air for pathogen spores and even detect concentrations for substances like anthrax via in-flight micro-chemical lab processes.

That sampling of research underway at Virginia Tech and Kansas State programs represent only a fraction of international applications.

The military has been working to develop sense and avoid since as early as 2009, according to the Air Force's Unmanned Aircraft Systems Flight Plan, ... Woolsey thinks viable solutions should

surface within two to five years, but tech developments can't help UAVs go commercial without FAA approval. ...

Once a sense and avoid solution does gain FAA and other civil aviation authorities' approval, UAV commercial applications not only become viable in different altitudes and locations, but the controversial autonomous system also becomes possible.

"The FAA is not excited about autonomous aircraft," says Woolsey, but Callahan says the Air Force is interested in technologies that will make them more autonomous. ...

But even bigger than the sense and avoid question, says Woolsey, is regulation, which will remain a roadblock long after the technology has advanced. He thinks both science and regulation questions could be answered, however, within 20 years. Sense and avoid and autonomy together in turn create a need for more robust, aggressive systems, which Woolsey has already seen under development....

IN THE CAPITAL • November 11, 2014

SAIC Donates \$750K to Support the Future of National Security at Virginia Tech

by *Molly Greenberg*

Science Applications International Corp. announced a gift of \$750,000 to **Virginia Tech's Ted and Karyn Hume Center for National Security**

and Technology, a commitment that will be donated to the university over the next five years.

The Hume Center is known on campus for

leading Virginia Tech's research, education and outreach programs "focused on the communication and computation challenges of the See FUTURE, page 4

BIO-MEDICINE • January 6, 2014

Virginia Tech's De Vita receives government's highest of engineering honors to study pelvic disorder

In 2012, Raffaella De Vita received a National Science Foundation Faculty Early Development (CAREER) Award to lead a national study on pelvic floor disorders, affecting some one third of adult American women.

Today, De Vita, associate professor of engineering science and

mechanics at Virginia Tech, is one of 102 researchers named a recipient of the Presidential Early Career Award for Scientists and Engineers (PECASE), the highest honor bestowed by the United States

government on science and engineering professionals in the early stages of their independent research careers.

The PECASE award will enhance her ongoing efforts of the five-year CAREER award....

WVTF-FM (local NPR) April 8, 2014

Jet Engines of the Future

by *Robbie Harris*

The jet engine company, Rolls Royce, is making good on its promise to open two, new, state of the art, aerodynamics research centers at Universities in the commonwealth.

Virginia Tech and the University of Virginia will be home to the new research and development facilities designing the next generation of aircraft engines for Rolls Royce.

It's the culmination of an ongoing research relationship with the British company, which has its North American headquarters in Reston, Virginia.

Rolls Royce has dozens of research centers like this around the world but just one in the U.S. until now.

"So it's quite an honor to be able to have an op to work closely with Rolls Royce to do comprehensive research and technology development for them," said **Jack Lesko, Associate Dean in the College of Engineering at Virginia Tech.** "And for our students to get an op to engage in projects they'll actually be able to see flying..."

THE WASHINGTON TIMES • August 13, 2014

Virginia Tech to showcase drone research

BLACKSBURG, Va. (AP) – State and federal leaders are visiting **Virginia Tech** to discuss research being done on unmanned aircraft systems.

Officials say Federal Aviation

Administration Administrator Michael Huerta and Virginia Gov. Terry McAuliffe are scheduled to visit the Blacksburg campus Wednesday.

The visit will include a demon-

stration of a six-rotor, unmanned aircraft gathering information at a mock auto accident scene.

Last year, Virginia Tech was selected by the FAA as a research site for unmanned aircraft sys-

tems.

Led by Virginia Tech, the mid-Atlantic-based component of the national effort will also involve the University of Maryland and Rutgers University in New Jersey....

VIRGINIA BUSINESS
April 8, 2014

U. Va., Virginia Tech join Rolls-Royce University Technology Centers network

Two Virginia colleges have joined Rolls-Royce's University Technology Centers (UTC) network. U. Va.'s UTC will focus on the study of advanced material systems, flow modelling and other fields. **Virginia Tech's** UTC will specialize in the study of advanced systems diagnostics, flow modelling, power electronics and other subjects.

"Rolls-Royce is one of the world's most successful and innovative companies, and we are very excited that it has selected the campuses of Virginia Tech and University of Virginia to award its second and third University Technology Centers in the U.S.," **Richard Benson, dean of Virginia Tech's College of Engineering** said in a statement.

Together with Rolls-Royce, the universities form the Commonwealth Center for Aerospace Propulsion Systems (CCAPS) and are founding members of the Commonwealth Center for Advanced Manufacturing (CCAM)....

USA TODAY • September 4, 2014

Universities pave the way for drone testing

by Priscilla Alvarez

Drones, a technology once unknown to many, are making headlines again as companies such as Google and Amazon attempt to sharpen their competitive edge.

Universities, however, are also playing a critical role in their introduction to modern society for civilian use.

In December, the Federal Aviation Administration announced six test sites aimed to conduct research vital to integrating unmanned aircraft systems (UAS) into the nation's airspace, according to a FAA press release. Of the six, three were universities – the Univer-

sity of Alaska, Texas A&M University-Corpus Christi and **Virginia Tech**.

This August, the FAA announced that Virginia Tech's program was ready to conduct research – beginning the incorporation of academia into the industry as the FAA develops UAS regulations.

Craig Woolsey, associate professor in aerospace and ocean engineering at Virginia Tech, has been working with UAS for the past seven years.

"I think that the role that we've [academia] already been playing is to help develop the technology that will ensure

that these systems can address important commercial needs and do it safely," Woolsey says....

For students at Virginia Tech, the test site has also opened the opportunity to expand on research involving the capabilities of UAS, according to Coggin.

Chris Kevorkian, 24, a Virginia Tech graduate student in aerospace engineering, is focusing his thesis on FAA regulations. The test site allows him to see the process first hand as those regulations develop.

"I can't and won't say that I'm writing FAA regulations, but I'm writing what I think should be in them," Kevorkian says. "It puts

See TESTING, page 5

WSET-TV 13 (ABC) • February 20, 2014

Local Educators Honored by Gov. McAuliffe

Governor Terry McAuliffe honored 12 Virginia educators as recipients of the 28th annual Outstanding Faculty Award (OFA) for excellence in teaching, research, and public service.

Dr. Wu-chun Feng, Professor of Computer

Science at Virginia Tech, is an internationally recognized researcher in efficient parallel and distributed computing. He created a computing resource for science and engineering that debuted as the greenest commodity supercomputer in the U.S. in 2011....

ABC NEWS (GOOD MORNING AMERICA) • October 23, 2014

Exclusive Look at Football Helmet Safety Testing

by Jim Avila and Felicia Patinkin

Preventing concussions has become a top priority for elite players and anyone with a child sporting a football jersey, and new technology and research is racing to try to make the game safer for all.

Virginia Tech University, which has tracked more than 300,000 impacts on its football team, is the epicenter for research into safer helmets. Their method uses a simple but critical test: lifting a football

helmet rimmed with sensors six feet into the air, then dropping it onto a rubber-coated concrete and steel block.

The test mimics what players can face on the field. Then a one- to five-star safety rating is assigned for each helmet tested.

Helmets with more stars provide a reduction in risk compared to helmets with fewer stars.

"If you don't make a five-star helmet, a lot of times you can't

even bid on the sale of helmets. If a school puts out a call for proposals, it'll say we are only taking bids for 5-star Virginia Tech rated helmets," **Stefan Duma, the director of the School of Biomedical Engineering and Sciences at Virginia Tech** told ABC News. "I think if you are a manufacturer, you can't be in the business unless you are making 5-star helmets."

ABC News got an exclusive look

See SAFETY, page 12

FUTURE

In The Capital

(Continued from page 3)

national security community."...

Hume Center Director

Charles Clancy also spoke about the advantages of having SAIC as the university's anchor educational partner has been and will be for Virginia Tech.

"Their support enables us to educate the next generation of national security leaders and technologists, and we look forward to an ongoing partnership...." Clancy said....

THE NEW YORK TIMES • January 31, 2014

Study Suggests That Some Football Helmets Are More Protective

by Ken Belson

As the scrutiny on head hits has increased in recent years, football helmet manufacturers, no doubt mindful of the potential for product liability suits, have made it clear that their products are designed mainly to prevent skull fractures, not concussions.

Some helmets include warning labels that read: "No helmet system can protect you from serious brain and/or neck injuries, including paralysis or death. To avoid these risks, do not en-

gage in the sport of football."

A study published in the *Journal of Neurosurgery* on Friday did not change the prevailing logic that no helmet will ever prevent all concussions.

But the findings, which were based on more than 1.2 million head impacts by more than 1,800 players on eight college football teams over six seasons, suggest that certain helmets can reduce the risk of a concussion by more than 50 percent.

According to **Steve Rowson, the lead author of the study and an assistant professor at Virginia Tech**, which has created a helmet rating system, the study was the first to compare players based on the number of times they were hit and the helmets they wore.

"Controlling for head impacts allows you to compare apples to apples," he said. "For example, you're not comparing a player in one helmet who rarely gets hit to a player in another helmet type who frequently gets hit..."

MSNBC • January 31, 2014

Newer football helmets could cut concussion risk in half, new study suggests

Researchers found a 54 percent difference in concussion risk between two different helmets made by the same company in a large study that included data from 1,833 college football players.

The players in the study wore

one of two helmet models made by the Riddell company: the older VSR4 and the newer Revolution.

All the helmets had been equipped with sensors that recorded forces, or accelerations, experienced by the players' heads

each time there was a hit.

"No helmet can completely prevent concussions," said study co-author **Stefan Duma, a professor and head of biomedical engineering at Virginia Tech-Wake Forest University**. "There's always

a risk. All we are saying is that by effectively adding more padding, it reduces the accelerations, and that reduces concussions."

Duma and his colleagues scrutinized concussion and accelerometer data collected from 2005 to 2010 from eight college football teams. All the players wore either the Riddell VSR4 or the Riddell Revolution.

During the years of the study there were a total of 322,725 head impacts in players wearing the VSR4 helmets and 27 concussions, which amounted to 8.37 concussions per 100,000 jolts to the head.

Among those wearing the Revolution, there were 958,719 head impacts and 37 concussions, which amounted to 3.86 concussions per 100,000 head impacts.

Concussion experts called the study an important first step, but one that needed to be duplicated...

(This article also appeared in: *DailyRx.com*, *Innovations Report*, *Medical News Today*, *MedicalDaily.com*, *MedicalXpress.com*, *Medindia.com*, *MSN Autos Canada*.)

THE SEATTLE TIMES • February 1, 2014

Football-helmet design can cut concussion rate by half, study finds

by Geoffrey Mohan

LOS ANGELES – Super Bowl viewers might want to keep an eye on the helmets crashing together in Sunday's game between the Seattle Seahawks and Denver Broncos. A new study says the lids worn by opposing quarterbacks Peyton Manning and Russell Wilson, not to mention the dreadlock-filled helmet of Seattle cornerback Richard Sherman, can reduce concussion risk by more than half, compared with an older model.

The study adds to a growing consensus that helmet design can impact impacts. This one, published Friday in the *Journal*

of *Neurosurgery*, was the first to control for the number of impacts different players receive. It measured head-motion changes during more than 1.2 million impacts over five years of Division I NCAA football games played by eight college teams.

Sixty-four of those hits resulted in diagnosed concussions, and the relative risk of being among those dizzy denizens of the gridiron was cut by roughly 54 percent if players wore a more-advanced model helmet. Both helmets in the comparison were made by the same manufacturer, Riddell, which is the official helmet of the NFL (at least

until Sunday's game is over and its contract ends).

"If players had matched impacts throughout their whole career, you'd see about half the number of concussions" in the newer helmet, said the study's lead author, **Steven Rowson, a biomedical engineer at the Virginia Tech-Wake Forest University School of Biomedical Engineering and Sciences**...

Quarterbacks had the highest recorded head accelerations, followed by running backs and wide receivers

DESIGN - Fox News - (Continued from page 1)

School of Biomedical Engineering and Sciences, has been researching helmet design in relation to concussion risk for years, but this is the first study to compare helmet differences on the field, rather than in the lab.

"I think some of the original motivation was in 2008, we were getting a lot of questions from our equipment group about what type

of helmet to buy," Duma said. "But there's really nothing out there [for guidance]. There are a lot of individual manufacturers, but no independent system to figure out what is better. So that's when we started reporting on biomechanical parameters..."

The research was published Friday, Jan. 31, in the *Journal of Neurosurgery*.

TESTING

USA Today - (Continued from page 4)

me in close proximity to know more about what's going on."

While not directly involved with the site, **Virginia Tech graduate student Mark Palframan, 26**, who has been actively involved in UAS research, sees the test site playing a

critical role in the future.

"It's going to revolutionize the industry as we know it. I think an essential step is to have these test sites in place to make sure everything is certified and providing service to the community," Palframan says....

CBS NEWS • February 18, 2014

Football helmets don't provide much protection from concussions, study suggests

by Michelle Castillo

Football helmets are supposed to be a source of protection, but they may do little to ward off the effects of a hit to the side of the head that can cause traumatic brain injuries such as concussions.

A new study shows that blows that cause rotational force aren't warded off much by the sports equipment. Rotational injury occurs when the head rotates on the neck because of the impact, causing the brain to rotate....

Experts and athletes have grown increasingly concerned that re-

peated head trauma may lead to chronic traumatic encephalopathy (CTE), a degenerative brain disease. CTE causes symptoms similar to Alzheimer's, including memory loss, mood swings, cognitive issues, depression, confusion, aggression and motor skill issues. The patient's brains sustain physical damage, including a buildup of proteins called tau and tangled nerve cells. It can only be definitively diagnosed after death. Traumatic brain injuries have also been shown to triple the risk of early death.

Researchers tested football hel-

metts with a version of the standard drop test system, which is the method the National Operating Committee on Standards for Athletic Equipment uses to test helmet safety and impact effect. The helmets were worn by a crash test dummy with a neck....

This year, **Virginia Tech-Wake Forest researchers** rated the Adams A200 ProElite helmet as "not recommended." The helmet scored the lowest out of 18 helmets tested due to poor protection against linear and rotational acceleration. The Schutt Air Advantage got an "ade-

quate" rating, while the Riddell 360 did much better.

"Some helmets are much better than others," **Stefan M. Duma, who heads the Virginia Tech-Wake Forest School of Biomedical Engineering and Sciences**, told the *Los Angeles Times*.

The new study will be presented at the 2014 American Academy of Neurology's meeting in Philadelphia, which will be held from April 26 through May 3. This meant that the results are preliminary and have yet to be published in a peer-reviewed journal.

LA TIMES • February 17, 2014

Football helmets and concussion: A new study opens new questions

by Melissa Healy

Here's a novel idea, given that American parents send almost 4 million of their children out to play tackle football every year, despite mounting concerns about youth concussions: Maybe the helmets their kids wear should be tested and ranked on how well they prevent concussion.

A study to be presented at a meeting of the American Academy of Neurology attempts to do exactly that, comparing 10 of the most widely used football helmets in drop tests designed to measure the kinds of forces that are most likely to result in concussion....

This is not the first time that commercially available football helmets have been tested for how well they protect against "rotational acceleration" forces -- the twisting, torquing, sheering forces that result when the brain is knocked side-to-side as well as front-to-back inside the skull. A project at the **Virginia Tech-Wake For-**

est University School of Biomedical Engineering and Sciences has also sought to gauge the effectiveness of football helmets in blunting the forces that cause concussion.

In ratings released early this year, the Virginia Tech-Wake Forest researchers rated the Adams A2000 ProElite "not recommended," giving the helmet the lowest score of 18 helmets it tested for protection against a combination of "linear acceleration," the straight front-to-back forces that can cause bruises and bleeding in the brain; and "rotational acceleration," the twisting of the brain within the skull that causes concussions.

For the record, the Virginia Tech-Wake Forest team awarded the Schutt Air Advantage two stars in protecting against brain injury, labeling the helmet "adequate" but well below the five stars it awarded to the Riddell Revolution Speed, the post-2013 Xenith X2, the Rawlings Quantum Plus and the Riddell 360.

All these helmets have passed muster with the National Operating Committee on Standards for Athletic Equipment, the nonprofit organization that sets standards for headgear.

In an interview, **Stefan M. Duma**, who heads the **Virginia Tech-Wake Forest School of Biomedical Engineering and Sciences**, cautioned that the research being presented at the American Academy of Neurology's meeting must be considered preliminary until it's been peer-reviewed and published. But he also took exception to the suggestion that there is little difference among football helmets when it comes to concussion prevention.

"Some helmets are much better than others," said Duma, whose team has compared helmets' performance not only in acceleration laboratories but on football fields, by analyzing college teams' helmet-brand use and their concussion rates....

POPULAR SCIENCE • January 29, 2014

Q&A: The Engineer Who Wants To Power The World With Carbs

by Francie Diep

You might like carbs, but probably not in the way **Percival Zhang** does. **Zhang, a chemical engineer at Virginia Tech** (sic), runs a lab that's dedicated to converting carbohydrates into electricity. The lab's inventions include proofs of concepts showing

that carbohydrates are able to power everything from cellphones to cars.

"In my personal view, I think carbohydrates are some of the best chemical compounds for energy storage," he says. "Nature chose this one already."

He means that living things,

including humans, break down molecules of carbohydrates when they need energy to breathe, eat and generally do all the things organisms do. On the other hand, most of humanity's inventions run on the energy that comes from breaking down molecules called hydrocarbons, which

are found in coal, natural gas, and crude oil.

Just last week, Zhang and his colleagues debuted a prototype battery that uses maltodextrin, a carbohydrate that often goes into processed foods, as its source of electrons for producing electricity....

CONSUMER AFFAIRS • May 14, 2014

Five new football helmets get five-star ratings from Virginia Tech

by Truman Lewis

Virginia Tech has updated results of its adult football helmet ratings, which are designed to identify key differences between the abilities of individual helmets to reduce the risk of concussion.

All five of the new adult football helmets introduced this spring earned the five-star mark, which is the highest rating awarded by the Virginia Tech Helmet Ratings. The complete ratings of the helmets manufactured by Schutt Sports and Xenith LLC, each with two new products, and Rawlings Sporting Goods Co., with one helmet, are publicly available at the helmet ratings website.

The new helmets are Schutt's Vengeance VTD and AiR XP Pro VTD, Rawlings' Tachyon; and Xenith's EPIC and X2E.

"The Institute of Medicine released a recent report on concussion in sports that found our helmet rating system to be a theoretically grounded approach on how the injury mitigation properties of helmets could be assessed," said **Stefan Duma, the Virginia Tech Harry C. Wyatt Professor and department head of biomedical engineering, and project leader.**

"Consumers care about safety, and as a result, helmets that are rated poorly are not selling," he added. "This is going to continue to drive helmet design."

"Remarkable progress"

"This is remarkable progress for helmet safety in football. Not only are consumers using the ratings to purchase helmets, but manufacturers are using our rating system to design new helmets to achieve five stars," added **Steven Rowson, an assistant professor of biomedical engineering at Virginia Tech....**

THE CHRONICLE OF HIGHER EDUCATION • October 13, 2014

Can We Predict the Next War?

by Beth McMurtrie

Every minute of every day, computers overseen by **Virginia Tech** process billions of bits of data in an attempt to predict the future.

Tweets from politicians, satellite images of hospital parking lots, news stories about rising bus fares: All are mined, categorized, and fed into algorithms designed to anticipate the next flu outbreak or which candidate will win a city election. As many as 50 computer-generated alerts flash daily on computer monitors and are evaluated for accuracy at the end of each month....

The feedback loop is far quicker in the **Virginia Tech**-led project, known as Embers ("early model-based event recognition using surrogates"). It uses current data to make short-term, highly specific predictions regarding a group of countries in Latin America. One forecast, for example, might say there is a 75-percent chance that public-transit riders will protest rising fares in Rio de Janeiro next Saturday.

"The forecasts are very fine-grained, very different from previous forecasting programs," says **Naren Ramakrishnan, an engineering professor at Virginia Tech**, who leads the project. "They want us to predict when, who, what, where, and why."

Embers encompasses 10 institutions and about 70 academics, including political scientists, Latin American specialists, epidemiologists, and computer scientists. Their work is supported by the Intelligence Advanced Research Projects Activity, or Iarpa, a research agency within the Office of the Director of National Intelligence, which has spent about \$34-million on this and other forecasting projects....

WXIA-TV11 (NBC Atlanta) • February 24, 2014

Football helmet safety

Check your school's helmet rating

America's favorite sport is also one of the most dangerous ones you can play.... A helmet is the player's defense against a concussion or even worse – a traumatic brain injury.

11 Alive's Catie Beck has spent the past month investigating the types of helmets used in area high schools.

The results mean a lot when it comes to risking concussions. That's what **researchers at Virginia Tech** found in their study.

They say depending on what helmet you use, you may be able to reduce your

concussion risk by as much as 50 percent.

That's what they've used to compile a five-star rating of the most commonly used football helmets.

The Virginia Tech rating system goes from a "Not Recommended" rating, and proceeds from one to five stars. Researchers said they are most concerned with those helmets that are listed as "Not Recommended," along with one-and-two star rated helmets. They say the difference between those helmets at the bottom of the scale and the top-rated four-and-five

star ranked helmets is very significant....

Dr. Stefan Duma says the findings show a dramatic difference in how much different models cushion the impact.

"There was no way for consumers to get any idea which helmet was better," Dumas said. "It was purely what it looks like, what it costs, what the sales rep tells me - so we were the first group to actually present independent biomechanical data, and I would absolutely encourage people to use it." ...

WATER & WASTES DIGEST ONLINE • October 14, 2014

WERF Recognizes Virginia Tech Professor for Research

Amy J. Pruden, Ph.D., honored with WERF's Paul L. Busch Award

On Tuesday, Sept. 30, the Water Environment Research Foundation (WERF) awarded **Virginia Tech civil and environmental engineering professor Amy J. Pruden, Ph.D.**, with the Paul L. Busch Award. The award was presented at WEFTEC.14 in New Orleans during the celebration of WERF's 25th anniversary.

The WERF Endowment for Innovation

in Applied Water Quality Research awarded \$100,000 to Pruden for a research project that will inform best management practices for advancing water reuse and to address antibiotic resistance concerns. Pruden seeks to improve our understanding of antibiotic-resistant genes (ARGs) in recycled water distribution systems....

ESPN NFL • February 4, 2014

Seattle's win could transform NFL

by Gregg Easterbrook

...In football safety news, for years this column has rolled the drums for the idea that although no football helmet can prevent concussions, newer designs reduce the risk. Three years ago at Super Bowl time, I wanted to know why the NFL would not disclose which helmet models its players wear; and why the NFL does not mandate that only improved models be worn: "This is a short-sighted policy TMQ has been objecting to since the Riddell Revolution, the first-generation helmet engineered to reduce concussion risk, went on sale."

In July 2011, I detailed **Virginia Tech research** showing that the Riddell VSR4, the most common helmet, was dangerous compared to newer models. My new book "The King of Sports" details how James Collins, football coach of the public high school nearest my home, junked the school's VSR4s and replaced them with the modern Riddell Revo, owing to safety concerns. Collins did this in 2003, a full decade ago! Yet VSR4s are still on players' heads, including in the NFL.

Helmet manufacturers and the National Op-

erating Committee on Standards for Athletic Equipment – to which the NFL defers, though NOCSAE seems to function mainly as a rubber-stamp – criticized the **Virginia Tech research** as based on lab tests, not real-world data.

Fair enough. Last week, **Virginia Tech released the results of six years of real-world data** comparing total head hits to concussions, by helmet types, at eight Division I college football teams. The finding: Correcting for incidence and severity of hits, a player wearing the Riddell Revo had a 54 percent lower risk of concussion than a player wearing a VSR4.

This study is a bombshell. For many years the NFL and NOCSAE have contended it is impossible to determine whether any particular helmet reduces concussion risk. Virginia Tech has now put hard data on the table. The study is another feather in the cap for **Virginia Tech, which has become the national leader in seeking football safety.**

It also raises disturbing questions regarding whether the NFL has always been more concerned with avoiding legal liability – the league believes that mandating a helmet type makes it liable for any concussion sustained in that headgear – than with the health of players....

PHYSICIANS NEWS DIGEST • January 31, 2014

NFL concussions are down; new helmet design curbs brain injuries

by Brad Broker

On Sunday, we celebrate the current national pastime – the Super Bowl. In addition to dissecting the game, the pools, the fantasy projections and the commercials, the NFL wants everyone to know about the progress made in efforts to curb concussions.

The NFL announced this week that concussions for the 2013 season were reduced by 13 percent from last season and concussions caused by helmet-to-helmet hits had decreased by 23 percent....

Perhaps one reason for the decline in concussions is an advancement in player equipment, particularly the helmets. A new study published today in the *Journal of Neurosurgery* found that proper helmet design can reduce the incidence of concussions in football.

Researchers studied eight college football teams – **Virginia Tech**, University of North Carolina, University of Oklahoma, Dartmouth College, Brown University, University of Minnesota, Indiana University, and University of Illinois — over a six year period and compared players wearing an older model Riddell VSR4 vs. the newer Riddell Revolution

helmets.

All of the helmets were equipped with sensors that measured head acceleration for each impact players experienced. Players wearing the newer Revolution helmets experienced a 54 percent reduction in concussion risk compared to players wearing the VSR4, which showed higher head accelerations resulting from impact.

Researchers said that the newer helmet design was a significant factor. "It all depends on the way you build the shell, the type of padding you use and other factors," study co-author **Stefan Duma, a professor and head of biomedical engineering at Virginia Tech-Wake Forest University** told *the New York Times*. "While some helmets will reduce risk more than others, no helmet can eliminate risk" entirely.

According to the Centers for Disease Control, football is the number one sport for concussions resulting in emergency room visits and traumatic brain injury. Almost 30% of such sports related injuries come from football. Soccer is second with 16%; basketball had 15%.

Duma said that even with improvements in equipment, head injuries will continue to occur. But the "most effective strategies are altering league rules and teaching players better techniques."...

U.S. NEWS & WORLD REPORT • March 20, 2014

Latest Equipment a Must for Engineering Grad Students

by Ron Cowen

A couple of years ago, Matthew Woodward, an engineering grad student at Carnegie Mellon University in Pittsburgh, began building a palm-size robot that could crouch, jump and fly like a vampire bat. The device also had to be agile enough to slip through narrow passageways and navigate such hazardous environments as the inside of a nuclear reactor....

To assure that the robot would be lightweight but durable, Woodward needed to use a state-of-the-art 3D printer to fabricate precision components. Churning out tiny parts in a few hours would have been impossible by conventional computer-controlled techniques; the 3D printer enabled Woodward to build much of the biologically inspired robot as a single block of material rather than having to

bolt on additional pieces....

Many engineering schools now incorporate formal experiential learning into the graduate school experience. Internships and co-op programs, which typically alternate a term of work with a term of academic instruction, also give future engineers a chance to impress companies....

How can a would-be grad student assess whether an engineering school has what he or she will need? ...

You can also talk to graduate students and professors engaged in active research at your undergraduate institution about the kind of equipment they use, says **Doug Bowman, director of the Center for Human-Computer Interaction at Virginia Tech** in Blacksburg. "It helps you establish a baseline: How does this school compare to the school I'm attending now?"...

TIME MAGAZINE • September 18, 2014

The Tragic Risks of American Football

by Sean Gregory

Sixteen-year-old Chad Stover died playing a game after suffering a traumatic brain injury. Is the game worth it?

...The Tipton Cardinals needed a tackle. With the team trailing Sacred Heart 27-18 in the opening round of the Missouri high school playoffs, a stop here – on first down and 10 with less than seven minutes to play – would help keep its fading season alive.

As the running back took the handoff and sprinted right, Tipton's Chad Stover, a 16-year-old defensive back, dived at the player's legs with his arms outstretched. Chad's

head collided with the runner's right thigh as the ballcarrier dodged the tackle to gain another few yards. Chad went down, and his helmet smacked into the ground.

"Was it a crazy-hard hit?" asks Ben Smeltzer, a Sacred Heart wide receiver who was blocking Stover on the play. "No."

Chad wobbled to his feet, and after a time-out, he jogged to the sideline. Twice, a Tipton assistant coach asked if he felt well enough to return to the game. Twice, Chad said he was good. He went back in, and Tipton huddled up. "Something's wrong," Chad told a teammate before lining up for the

play. Suddenly his legs turned soft; teammate David Richardson, one of Chad's best friends since grade school, caught him as he collapsed....

The Brutal Reality

Even football's youngest, smallest players are susceptible to brain injuries. **Virginia Tech's biomedical-engineering department** tracked 19 boys ages 7 and 8 during the 2011 and 2012 seasons. The researchers counted 3,061 blows to the heads of the boys, 60% of which occurred in practice. None of the kids suffered a concussion, but some of the shots they took were brutal: 11 of the hits registered a g-force of 80 or greater.

"That's the level you might see in car crashes," says **Stefan Duma, a Virginia Tech professor**....

Changing the Game

Other attempts to make football safer have focused on the equipment... But many high schools can't afford the latest gear, and no helmet on the market can prevent a concussion. "We are very careful to say that helmets are the third level of protection for football players," says Virginia Tech's Duma, an expert in helmet safety. "The first is the rules, the second is coaching. Kids shouldn't be doing silly drills in practice where they're hitting each other in the head."...

BLOOMBERG BUSINESS WEEK • May 19, 2014

Rawlings' New NRG Tachyon Football Helmet Earns 5-Star Rating

PRNewswire – The Rawlings NRG Tachyon™ football helmet, the newest adult-size football helmet from Rawlings Sporting Goods Company, Inc., a subsidiary of Jarden Corporation (NYSE: JAH), was rated as 5 Stars, the "Best Available" rating in the 2014 Virginia Tech Helmet Ratings™. This news was announced Wednesday by **Dr. Stefan Duma, professor of biomedical engineering and head of the Virginia Tech-Wake Forest School of Biomedical Engineering and Sciences**.

The NRG Tachyon football

helmet's 5-Star rating follows its Bronze Edison Award™ win this April in the applied technology-protective systems category. The NRG Tachyon is the only 5 Star-rated football helmet to have won the prestigious honor....

The NRG Tachyon joins its predecessor the Rawlings NRG Quantum Plus™ as Rawlings' premier 5 Star-rated football helmets. In addition, Rawlings' NRG Quantum™ and NRG Impulse™ football helmets maintained their 4-Star ratings, classified as

"Very Good" in this year's study. The complete ratings are publicly available online at <http://www.sbes.vt.edu/helmet>.

"With the new NRG Tachyon helmet 5-Star rating, we see this as a validation of our product performance strategy to manufacture the protective products football helmet consumers demand," said David Hill, senior vice president and general manager of Rawlings' field and court division. "The football helmet consumer is telling us that the Virginia Tech Helmet Ratings is an important component in their product-buying decisions...."

Only adult-size football helmets available at retail were assessed using the STAR (Summation of Tests for the Analysis of Risk) evaluation system, which was developed by Dr. Duma and **Dr. Steven Rowson, assistant professor of biomedical engineering at Virginia Tech**. To date, a total of 23 adult football helmet models have been evaluated, using more than 2,700 laboratory tests. ...

**THE NEW YORK TIMES
August 23, 2014**

In Race to Develop Safer Football Helmets, Many Questions Remain

ASSOCIATED PRESS – Arkansas Coach Bret Bielema proudly posted a message on Twitter last spring that featured the Razorbacks' new helmets – a futuristic design by Riddell called the SpeedFlex that is supposed to be the latest in head protection.

A vocal proponent of player safety, Bielema is happy to be a part of the cutting edge. But it is a bit of a leap of faith. He has no proof that the SpeedFlex, or any other helmet, can reduce the risk of a devastating head injury....

Dr. Stefan Duma, the department leader of the Virginia Tech-Wake Forest School of Biomedical Engineering and Sciences, has been a pioneer in releasing independent ratings for the safety that football helmets provide.

His team tests helmets by buying three, then performing 40 tests on each helmet that measure front, top, side and back impacts.

The researchers aggregate the scores from all impacts and assign each helmet a rating of one to five stars, with five the highest....

(This article also appeared in: Fox 5 Morning News, *The Advocate*, *Atlanta Journal-Constitution*, *Augusta Chronicle*, *CSNS News*, *Bucks County Courier Times*, *Bennington Banner*, *Columbus Ledger-Enquirer*, *Connecticut Post*, CTV News Channel, CTV Toronto, *Daily Hampshire Gazette*, *Davis Clipper*, *Enquirer-Herald*, *Farmington Daily Times*.)

THE ROANOKE TIMES • October 25, 2014

Students test new ways of teaching and learning at Virginia Tech

by Tonia Moxley

BLACKSBURG — After nearly four decades teaching computer science, **Virginia Tech professor Dennis Kafura** is not one to jump on every passing bandwagon touting change.

"I'm not much for educational fads because I've seen them

come and go," Kafura said.

But last year when he was teaching a junior level computer science class in the traditional way — lecture with slides and homework assignments — Kafura noticed the occasional student surfing Facebook. And attendance

See TEACHING, page 28

POPULAR MECHANICS • August 25, 2014

These helmets will save the NFL from itself

For the past couple of years it's been hard to ignore: Football hurts football players. And not in the sore-knee, it'll-take-a-little-longer-to-get-out-of-the-lounger-when-I'm-retired kind of way.

More in the way of Jeremiahae Finley, who had one hit end his 2013 season – and almost his ability to walk. Or worse, in the way of Junior Seau, whose chronic brain

damage is widely suspected to have led to his suicide in 2012.

But there is hope. Last year was already big for the NFL in terms of safety. The league put independent neurologists on sidelines, banned high-risk tackles, and pledged more than \$765 million to help retired players and fund medical exams and research. Helmet manufacturers are making improvements too, thanks

in large part to **Dr. Stefan Duma, head of Biomedical Engineering at Virginia Tech.** Duma and his team developed a five-star rating system that subjects helmets to 120 various impacts, simulating the types of hits a player might take during a game. In 2011, when the first ratings were released, only one helmet received five stars. This year nine did....

CHIEF LEARNING OFFICER • January 8, 2014

USN&WR announces 2014 Best Online Programs

U.S. News & World Report released its 2014 Best Online Programs rankings. The rankings, now in their third year, are a resource for students who are seeking online education programs for degree completion and career advancement.

The 2014 U.S. News Best Online Programs include online bachelor's and master's degrees in engineering, business, education, nursing

and computer information technology, as well as information on the costs of an online degree and tips for being a successful distance learner....

Best Online Graduate Computer Information Technology Programs

1. University of Southern California
2. Boston University (MA)
2. **Virginia Tech...**

THE NEW YORK TIMES
July 22, 2014

Spartan Hockey Helmets Going Under Microscope

by Jeff Z. Klein

BLACKSBURG, Va. –

Hockey helmets may be on the verge of a radical makeover, as scientists and engineers at Virginia Tech prepare a rating system that measures each brand's and model's ability to reduce the risk of concussion.

"After football, hockey is the sport that produces the highest rate of concussion," said **Dr. Stefan M. Duma, a Virginia Tech professor and**

See HOCKEY, page 11

WDBJ-TV7 (local CBS) • May 7, 2014

Past Virginia Tech president says teaching remains his first love

BLACKSBURG, Va. - Doing any job for more than 50 years is an incredible feat. In 56 years one man at Virginia Tech has been a dean and the school's president.

But **Dr. Paul Torgersen** said teaching has always been his first love.

Wednesday morning, mostly engineering students watched one last time as Paul Torgersen shuffled into his "Theory of Organization" class in the basement of Pamplin School of Business at Virginia Tech.

Fifty-six straight years and never missing a single semester and Torgersen wasn't about to start. Watching and waiting until his students had found their assigned seats, then he was very clear.

"Ok, it's time to get started."

Tall and trim, this engineer -over five decades- has been around the block. As department head, Dean and president of Virginia Tech. He was asked to lead the Hokie nation. Torgersen agreed, but only if he could keep teaching too

"The people in charge said 'We need you'. I said 'are you sure?' They said 'we need you.' Well I made a condition, I'll become an administrator, but I'm not going to leave the classroom."

Torgersen and Tech both kept their word. Each year students have packed his classes. Word spread on campus about Dr. Torgersen and the life lessons he included.

Lorrie Sanders is a Human Nutrition Food and Exercise Major, not an engineer. She'd heard that Torgerson taught with kindness, concern and a lot of common sense....

Engineering Dean Dr. Richard Benson shook Dr. Torgerson's hand, smiled and had his picture taken.

"[Dr. Torgerson] is our best teacher, you may have heard me say that but it's actually true. We know that repeatedly from comments from students."

Students don't treat Torgersen like a dean or professor or even a university president, they treat him like a rock star....

AL JAZEERA AMERICA • Sept. 8, 2014

Stefan Duma, head of Virginia Tech's biomedical engineering department has spent the last decade studying the Hokies ... and trying to make the game safer by creating an independent rating system for helmets based on how they reduce the

risk of concussion.

Look at this 100 g hit. Professor Duma says a five star helmet can cut the concussion just as five star cars reduce the risk in a collision.

It's going to take a mean helmet to prevent these concussions with these players....

THE DENVER POST • March 14, 2014

It's dialing the phone, not talking, that distracts drivers

by Vincent Carroll

The most common anecdotes for why cellphone use while driving is dangerous are deeply misleading. ...

"We've got five different data sets," on cellphone use while driving, **Greg Fitch of the Virginia Tech Transportation Institute (VTTI)** told me, and none found extra risk for talking on the phone.

Fitch is no apologist for hand-held cellphone use in cars. In fact, he thinks

banning such use ... is "appropriate." But as he and colleagues wrote in a study for the U.S. Department of Transportation, "Talking on a cellphone, regardless of the type of interface, was not associated with an increased SCE," or safety critical event, meaning a crash, a near-crash, or less serious incident.

A study published January in *The New England Journal of Medicine*, also involving the institute's work ...

HOCKEY

New York Times

(Continued from page 10)

the head of the university's **biomedical engineering department**. "We want to produce a mechanism to try and reduce that risk of concussion."

That mechanism is a five-point rating scale called the STAR system, which the Virginia Tech football team began applying to its helmets in 2011. While there is still disagreement on whether concussions can be reduced by improving helmets, the football rating system quickly became influential, leading manufacturers to substantially increase internal padding. Sales for five-star football helmets have soared, and those for low-rated helmets plunged.

Duma and Dr. **Steven Rowson, who also teaches biomedical engineering at Virginia Tech** and is a co-investigator in the project, have been conducting preliminary tests to perfect their methodology for hockey helmets for more than a year. They hoped to start testing hockey helmets in about a month and to release ratings for about 30 models this fall or winter.

"This is going to hit hockey like a ton of bricks," said Dale Pfriem, president of ICS Laboratories, an Ohio-based company that tests and assesses personal protective equipment. Pfriem was part of a group of hockey helmet manufacturers and testers invited to Virginia Tech to review the center's methodology before formal testing begins. ...

ROBOTICS

BBC

(Continued from page 1)

higher heat for longer periods than human fire-fighters," it adds.

Two versions of the robot, made by researchers at Virginia Tech and the universities of California, Los Angeles and Pennsylvania, will be tested on board the decommissioned USS Shadwell.

The ship is regularly set on fire to test new equipment....

THE WASHINGTON POST • April 22, 2014

Chuck Hagel met a life-sized robot today. *And no one seems that concerned.*

by Chris Cillizza

Defense Secretary

Chuck Hagel spent Tuesday at the Pentagon, checking out the five new innovations from the Defense Advanced Research Projects Agency (DARPA). Among the exhibits were the latest in prosthetic

limb technology – demonstrated by a longtime friend of Hagel's who lost an arm in Vietnam – and a hand-and-arm apparatus that responds to brain impulses.

Then there was the life-sized robot, developed as part of a chal-

lenge to DARPA to create a robot that could go into places too dangerous for humans. Here's how *Stars and Stripes* described the robot.

Virginia Tech's entrant in the contest, the hulking 6-foot-2-inch Atlas robot developed by

Boston Dynamics, loomed menacingly in the background as Hagel was shown a video of robots walking over uneven ground and carrying things.

Except for LED lighting, however, the 330-pound humanoid appeared to be switched off....

CNBC • March 25, 2014

NRL Autonomy Lab Hosts Shipboard Fire Robotics Consortium

The U.S. Naval Research Laboratory (NRL) Laboratory for Autonomous Systems Research (LASR), partner in the Navy's Damage Control for the 21st Century project (DC-21), recently hosted robotics research teams from the **Virginia Polytechnic Institute and State University (Virginia Tech)** and the University of Pennsylvania (Penn) to demonstrate the most current developments of advanced autonomous systems to assist in discovery, control, and damage control of incipient fires.

Fighting fires, inherent by its extreme unpredictability, high

temperatures and rapid decline of environmental and structural integrities, can at times prove challenging to even the most seasoned firefighting veteran. ...

To mitigate these risks, NRL researchers at LASR and NRL's Navy Center for Applied Research in Artificial Intelligence (NCARAI), under direction and funding from the Office of Naval Research (ONR), are working with university researchers to develop advanced firefighting technologies for shipboard fires using humanoid robots ...

This highly specialized research, to promote advanced firefighting

techniques, includes development of the novel robotic platform and fire-hardened materials (Virginia Tech), algorithms for perception and navigation autonomy (Penn), human-robot interaction technology, and computational cognitive models that will allow the robotic firefighter to work shoulder-to-shoulder and interact naturally with naval firefighters (NCARAI). ...

"SAFFiR is being designed to move autonomously throughout a ship to learn ship layout, interact with people, patrol for structural anomalies, and handle many of the dangerous firefighting tasks that are normally performed by humans," McKenna said. The robot is designed with enhanced multi-modal sensor technology for advanced navigation and a sensor suite that includes a camera, gas sensor, and stereo infrared (IR) and ultraviolet (UV) cameras to enable it to see through smoke and detect sources of excess heat. ...

Dr. Brian Lattimer, associate professor at Virginia Tech's Department of Mechanical Engineering, additionally commented that what we are now seeing is the result of a multidisciplinary project combined to perform all the critical tasks necessary for fire suppression by a humanoid robot.

(This article also appeared in: *4-traders, Fort Mill Times, The Herald, Marinelink.com SYS-CON Media, Ulitzer.*)

THE FISCAL TIMES • April 10, 2014

We're One Step Closer to Robots on the Battlefield

by David Francis

Last week, the robotics industry made a huge leap forward, with the Navy announcing that it planned to test a humanoid robot built to fight fires at sea this August.

The robot, called the Shipboard Autonomous Firefighting Robot (SAFFiR) and developed by a team of scientists from the Naval Research Laboratory, **Virginia Tech**, the University of California, Los Angeles and the University of Pennsylvania, is one of the most advanced robotic

machines ever developed. There are two versions of the robot - one that stands five feet tall was a simple legs and control mechanisms. Its six-foot tall brother is more advanced, capable of complicated locomotion. ...

SAFFiR is just one of many robots currently being developed, and many of the projects are funded by DARPA, the secretive defense research branch of the U.S. military. DARPA is also offering a \$2 million prize for companies and universities to develop robot technology....

SCIENCE DAILY • September 2, 2014

So ... do you know what's in your water?

Would you like your glass of water with a little iron in it? Or do you prefer a copper taste? Possibly manganese? Did you realize that there are more than two dozen flavors to water, not all of which are as yummy as say, rocky road ice cream?

For several decades **Andrea Dietrich**, who trains utility staff and managers around the U.S. and across the globe on how to use sensory analysis to detect changes in water quality, has worked in the area of assessing taste, odor, and visual perception of chemical elements in water.

Dietrich, a professor of civil and environmental engineering at Virginia Tech, has received numerous grants in this area, including one from the National Science Foundation.

This \$1.6 million contract asked her to investigate connections between corrosion of home plumbing materials, tastes-and-odors in drinking water, economics, and consumer health concerns.

For her research efforts, Dietrich has registered a number of firsts with journal papers reflecting her work on such diverse

topics as: improving cancer therapy through odor and taste intervention; prevention and treatment of obesity by drinking more water; health effects of iron and copper in drinking water; and risks to people over 50 for unhealthy over-exposure to iron in water.

So when Amanda Sain of Concord, North Carolina, arrived as an environmental

engineering graduate student at Virginia Tech, and she started reaching out to faculty, she found the public health element of Dietrich's work fascinating.

In turn, Dietrich was able to secure funding for Sain's studies, using resources from the **Institute for Critical Technology and Applied Science (ICTAS) and the Water INTERface**

Laboratory at the Blacksburg, Virginia, university.

Sain's main project with Dietrich has focused primarily on a specific aspect of human health – what is the impact of exposure to manganese in water and air...

(Editor's Note: This article also appeared: Innovations Report, and Sciencecodex.com.)

ENVIRONMENT HEALTH SAFETY (EHS) TODAY • April 7, 2014

Effects of West Virginia Chemical Spill Still Linger in the Air

by Josh Cable

On Jan. 9, a leak in a Freedom Industries chemical-storage facility contaminated the Elk River with 4-methylcyclohexane methanol, leaving 300,000 West Virginia residents without tap water for several days. Nearly three months after the spill, researchers have found that the accident continues to affect the water and air quality in the Mountain State.

"Based on our increasing understanding of the chemicals involved in the water crisis, the complexities and implications of the spill keep growing," said **Andrea Dietrich**,

professor of civil and environmental engineering at Virginia Polytechnic Institute and State University. "People are still afraid to drink the water. Odors persist in schools, residences and businesses. Data are still lacking for the properties of the mixture of chemicals in the crude MCHM that spilled."

Dietrich and her research team received a National Science Foundation grant to analyze the properties of crude 4-methylcyclohexane methanol, or MCHM, the major component in the chemicals that spilled into the Elk River...

FOX NEWS • June 10, 2014

Robot rescue: First-responders of the future

by Molly Line

From nuclear disasters, to natural catastrophes and blazing hot fires, robots that can stand-in for humans in dangerous places are under development....

What happens when the challenge is burning hot? At **Virginia Tech, mechanical engineers** are leading a team, including researchers at UCLA and the University of Pennsylvania, to create a firefighting robot for the U.S. Navy, one that

will be protected with a resin shield to prevent heat and water damage.

The humanoid creation at Virginia Tech is part of the Shipboard Autonomous Firefighting Robot – or (SAFFiR) program.

It can balance on unstable surfaces – like a ship at sea – navigate tight quarters and using clues, like smoke, locate a fire.

"We've seen robots go from walking very slowly and not being able to balance well to being able to balance like on a ship and being able to navigate on a ship," said **Prof. Brian Lattimer, the director of the Extreme Environments, Robotics & Materials Laboratory (ExtReMe Lab) at Virginia Tech.**

The robot will be tested later this year on the Navy's fire test ship, the ex-U.S.S. Shadwell which is moored in Alabama.

The ultimate goal- to keep people out of harm's way.

"We're not only looking to use the technology for ships but for fires in buildings," said Lattimer. "Our big push is to not be sending people into burning buildings and structures but to send robots into these harsh conditions..."

WVTF-FM (local public radio) March 26, 2014

West Virginia Water Doesn't Pass the Smell Test

by Robbie Harris

Scientists at Virginia Tech say a chemical that contaminated the Elk River in West Virginia early this year, is more complex than previously known. A new study may explain why a telltale smell persists, after officials declared the water safe to drink, more than two months ago.

Before the chemical spill January 9th, little was known about something called crude methylcyclohexane methanol or MCHM. Long used as a cleaning agent in the coal industry, 10,000 gallons spilled into the Elk River, contaminating much of the state's water and leaving it with what many describe as the scent of licorice.

"The smell is present at much lower concentrations than what the CDC says people could drink," says **Andrea**

See SMELL, page 13

SAFETY - ABC News

(Continued from page 4)

inside the Virginia Tech lab, where engineers are doing something not unlike crash testing for automobiles. ...

(Editor's Note: This article also appeared in the Morning Report - Newschannel 8, ABC News Radio Online, KARX-FM Online, KBKR-AM, KBOI-AM, KCFX-FM, KPUR-FM, KRMD-FM, KSFO-A, KZRK-FM, MyCentralOregon.com, SoMdNews.com, WEAN-FM, WIVK-FM, WJBD-AM/FM, WJJK-FM, WJR-AM, and WOSH-AM.)

THE WALL STREET JOURNAL
November 8, 2014

See a quick way through traffic? Not so fast

by Jo Craven McGinty

The next time you speed an hour in stop and go traffic, go ahead – blame the drivers. Chances are, it's their fault. And may be yours, too.

When traffic thickens on freeways, drivers often make decisions that worsen conditions. They speed up when they should slow down. They change lanes when they should stay put....

In effect, they leave no room to react....

"Everyone is selfish and wants maximal time versus optimal time for everyone," said **Hesham Rakha, a professor of civil and environmental engineering at Virginia Tech.** "By being selfish you make the system worse."

See TRAFFIC, page 14

SMELL – WVTF-FM

(Continued from page 12)

Dietrich, a professor of civil and environmental engineering at Virginia Tech. She led a study that found the human nose can detect MCHM at more than one-hundred times lower than the guideline recommended by the Centers for Disease Control. "The people in West Virginia have been smelling this methylcyclohexane compound for almost two months now. And any type of odor that persists for a long time, is annoying to people."

Her team began studying the chemical soon after the January ninth spill, with a Rapid Response grant from the National Science Foundation. But Dietrich, an expert in water testing, went beyond its scope to find out what was causing the persistent odor. They found the chemical is easily vaporized and that's what causes what they call the 'odor threshold' to be lower than previously thought. They also found that MCHM is actually a two-part molecule and only one of them is responsible for the strong smell. ...

NSF SCIENCE 360 • March 27, 2014

Tests elucidate the odor properties of the contaminants affecting West Virginia residents

The complexities and implications of the chemical spill into West Virginia's Elk River keep growing, according to a study.

In the more than two months since the Jan. 9 chemical spill into West Virginia's Elk River, new findings reveal the nature of the chemicals that were released into the water and then into the air in residents' houses.

"Based on our increasing understanding of the chemicals involved in the water crisis, the complexities and implications of the spill keep growing," said **Andrea Dietrich, professor of civil and environmental engineering at Virginia Tech.** "People are still afraid to drink the

water; odors persist in schools, residences, and businesses; data are still lacking for the properties of the mixture of chemicals in the crude MCHM that spilled."

The lack of data motivated Dietrich and her research team to take on essential odor-related research that went beyond their National Science Foundation Rapid Response Research grant to better understand the properties of the chemical mixture called crude 4-methylcyclohexane methanol, the major component in the crude mix of the spilled chemicals into the Elk River. It is used in the separation and cleaning of coal products. ...

CHARLESTON DAILY MAIL • March 27, 2014

New report differs in MCHM data

by Dave Boucher

A new report from Virginia Tech could shed light on what, exactly, makes crude MCHM smell like licorice, and how much needs to be in the air and water for people to smell it.

Some of the findings differ significantly from those released by the team of scientists hired by Gov. Earl Ray Tomblin to conduct the state Testing Assessment Project, or WVTAP.

The Virginia Tech team, led by civil and environmental engineering professor Andrea Dietrich, determined people can smell MCHM in water at any concentration greater than 7 parts per billion, according to a press release from the university.

It's a considerably higher threshold than the 0.15 parts per billion level determined and released in the WVTAP team study.

"Experts and consumers can detect the licorice odor caused by Crude MCHM far lower than 7 ppb," said Mike McGuire, a California-based scientist and WVTAP team member, in a statement released late Wednesday.

He argues the Virginia Tech team studied pure MCHM, not crude MCHM, which he says contains compounds with a sharper licorice odor.

The state says they believe a combination of MCHM and another chemical called PPH were the only substances involved in the spill discovered Jan. 9. They are relying on data provided by Freedom Industries, the company that owned the faulty storage tank.

Dietrich says no research team is using exactly what leaked into the Elk River.

"No odor researcher is

using the exact crude MCHM plus PPH that leaked into the Elk River, then was processed through the water treatment plant and distributed through pipes to consumer tap water," she said in an email to the Daily Mail. "At this point, no one has data on how the chemical composition of crude MCHM changed from the tank to the tap."

Dietrich's team reached its conclusion by using equipment that can determine different characteristics of the components of MCHM. ...

Staff Writer Whitney Burdette contributed to this report.

(*Editor's Note:* This article also appeared in: *Iowa Ag Connection, Lab Manager Magazine, Michigan Ag Connection, Minnesota Ag Connection, Missouri Ag Connection, Ohio Ag, South Dakota Ag, Pennsylvania Ag, Wisconsin Ag Net, usagnet.*)

THE EXPONENT TELEGRAM • March 10, 2014

Virginia Tech researchers assess chemical that contaminated water

Virginia Tech faculty engineers and students are unravelling fundamental chemical and health properties of the chemical that contaminated the drinking water for the

residents of West Virginia.

Fueled by a \$50,000 National Science Foundation Rapid Response Research grant, the team seeks to understand the properties of a chemical mixture called

crude 4-methylcyclohexane methanol (MCHM), according to study leader **Andrea Dietrich, a professor of civil and environmental engineering.**

The research team, which

includes **associate professor Daniel Gallagher, assistant professor Robert Scardina, and senior analytical chemist Jody Smiley of the**

See CHEMICAL, page 14

THE CHARLESTON GAZETTE • March 26, 2014

Virginia Tech experts pinpoint MCHM odors

by Ken Ward, Jr.

CHARLESTON, W.Va. — **Researchers at Virginia Tech** believe they have pinpointed a form of the chemical MCHM that could be causing licorice-like odors to linger in the region's drinking water long after the January chemical spill that contaminated drinking water supplies for 300,000 residents in a nine-county region of West Virginia.

Using specialized equipment, **experts at Virginia Tech's College of Engineering** traced the odors to one of MCHM's two chemical structures, or isomers, and analyzed at what levels that form of MCHM could be smelled in the air and estimated what concentrations could be smelled in water.

A team led by **Virginia Tech environmental engineer Andrea Dietrich** estimated the odor threshold for that form of MCHM at 7 parts per billion. That's 100 times less than the levels the U.S. Centers for Disease Control advised were acceptable for people to drink. But the CDC's 1-part-per-million number remains controversial, and Dietrich said that the continuing odor problems have their own important impacts on residents.

"The toxicity aside, annoying odors have a psychological burden," Dietrich said. "Let's hope this chemical doesn't have any toxicity and the CDC is right. But if people are living with it for two or three months, it imparts a fear and a reminder, and it's a psychological

burden. If you can smell it, it's still around."

Dietrich is an expert on water quality and treatment, as well as on taste and odor assessments of water. After the Freedom Industries chemical spill, she received an emergency grant from the National Science Foundation to study MCHM and its potential impacts, and one focus of the Virginia Tech team is the coal-cleaning chemical's odor....

(Editor's Note: This article also appeared in: Bio-Medicine, DailyNewsEn.com, Data Center Journal, HealthCanal.com, Homeland Security Newswire, Industrial Safety and Security Source, Kentucky Ag Connection, Phys.org, and Science-Daily.)

CHEMICAL — The Exponent Telegram — (Continued from page 13)

Department of Civil and Environmental Engineering (<http://www.cee.vt.edu/>), is determining the long-term fate of the chemicals in the drinking water distribution system and the environment....

"Residents were alerted by a strong licorice odor that led many people to think at first that the air was polluted," Dietrich said. "In that respect, consumers are important sentinels for exposure to low levels of

MCHM. As is typical of chemicals that were grandfathered under the Toxic Substances Control Act, not a lot of data exists about the product."

Dietrich said many knowledge gaps exist about the short- and

long-term fate of the chemical in water systems. The research will provide fundamental chemical properties that can be used to estimate human exposure through drinking water and indoor air pollution....

FOX NEWS • March 13, 2014

Professor cooks up recipe for turning wood chips into food

by Linda Zeldovich

Would you like wood chips with that?

Someday, restaurants will serve wood chips the same way they now serve mashed potatoes and grits. Also on the menu will be corn stems, husks and other unappetizing plant parts. And what's more, diners will love the stuff.

That's what **Virginia Tech professor Y.H. Percival Zhang** is promising the world.

Zhang, who studies **biological systems engineering** at the university's College of Agriculture and Life Sciences, has developed a process that can transform wood chips, corn stems and other agricultural refuse into edible starches. And he hopes to do

it someday in a facility that will look like a giant brewery....

TRAFFIC Wall Street Journal

(Continued from page 13)

The Federal Highway Administration estimates that 40 % of all congestion nationwide can be attributed to recurring bottlenecks. The problem cost the country \$78 billion last year in wasted time and fuel....

Mr. Rakha compares it to pouring sand through a funnel. "If you pour sand suddenly, not so much goes through as if you pour exactly the amount the funnel needs," he said. "There is more throughput by pouring less into the funnel."...

FOX SPORTS • October 25, 2014

Danica Patrick on new crew chief: 'I'm not scared of change'

by Jared Turner

Stewart-Haas Racing announced earlier this week that beginning with next weekend's Sprint Cup Series race at Texas Motor Speedway, Danica Patrick and Kurt Busch will swap crew chiefs and road crews although the drivers' respective over-the-wall crews will remain in place.

This means that Patrick ... will soon have someone else atop her pit box for the first time in

nearly two years. That person, rookie crew chief **Daniel Knost**, has worked with Busch since the 2004 Sprint Cup Series champion joined Stewart-Haas ahead of this season....

Knost, a first-year crew chief with a doctorate degree in **mechanical engineering from Virginia Tech**, brings skills to the table that differ starkly from those of Gibson -- an old-school crew chief..

U.S. NEWS & WORLD REPORT • November 12, 2014

NASCAR driver Patrick gives STEM a boost

by Lauren Boyer

Danica Patrick thrives as a woman in a man's world.

The 32-year-old -- the first female driver to lead at the Indy 500 -- is one of the most successful and well-known women in the history of racing.

She didn't get there by stooping to gender stereotypes.

See BOOST, page 18

EVENTS**The Wall Street Journal**

(Continued from page 1)

volumes of publicly available data, including online news, blogs, social media such as Twitter posts, Wikipedia pages, weather data, crime rates and images of, for example, parking lots outside hospitals – to name a few of the myriad sources.

The group looks for classes of events, such as political unrest or disease outbreaks. However, instead of attempting to build a single computer model to accommodate all types of forecasts, the team created many separate models with different strengths and weaknesses. Each event class has about eight models, and the conclusions produced by each are weighted and combined to produce a single forecast.

“You can think of it as a little marketplace of algorithms all competing with each other, trying to outdo other predictions,” Mr. Ramakrishnan said.

To help gauge the success of OSI, IARPA catalogues world events as they happen and compares the list to events previously forecast by OSI. On average, the program has detected 90% of all eventual events of interest....

MEDICAL NEWS TODAY
April 25, 2014**Following a protein's travel inside cells is a key to improving patient monitoring and drug development**

Virginia Tech chemical engineer Chang Lu and his colleagues have used a National Science Foundation grant to develop a technique to detect subcellular location of a protein.

In science, “simple and accessible detection methods that can rapidly screen a large cell population with the resolution of a single cell inside that population has been seriously lacking,” said Virginia Tech chemical engineer Chang Lu.

In the Royal Society of Chemistry journal *Chemical Science*, Lu has announced that he and his coworkers have developed a novel technique that detects the subcellular location of a protein. The significance of this method is that the technique will allow the scientific and technological communities a simple and improved method for studying effectiveness of therapies for disease, including cancer

NOVA NEXT • March 26, 2014**The Inevitability of Predicting the Future***by Tim De Chant*

In February, while the world was watching citizens of the Ukraine topple their government from behind barricades of flaming tires, computer scientist **Naren Ramakrishnan and his research team** were intently watching a similar situation unfold in Venezuela.

The South American nation has been a tinderbox since early February when Leopoldo Lopez, mayor of Chacao and an opposition leader, tweeted a call for #LaSalida on Friday, January 31. We will meet this Sunday, his tweet read, for #TheExit.

The hashtag was a thinly coded call for the ouster of President Nicolas Maduro, Hugo Chavez's successor. The protests, which decry high inflation, shortages of staple goods, and the country's soar-

ing homicide rate, started in Chacao and quickly spread to the capital, Caracas.

For a while, demonstrations took place nearly every day. Since the unrest began, at least 32 people have died.

For years, **Ramakrishnan, a professor at Virginia Tech, and his team** have been sitting through tweets, blog posts, and news articles about Latin America, keeping a close eye on events in ten countries, including Venezuela. These past couple of months have been no different.

But Ramakrishnan and his colleagues haven't been bent over newspapers or straining their eyes scanning streams of tweets. Rather, they were monitoring the dashboard of EMBERS, their computer program that draws on tweets, news articles, and more to

predict the future....

EMBERS is the result of years' worth of work by Ramakrishnan and his team, which includes computer scientists, statisticians, political scientists, social scientists, and an epidemiologist.

It is the winning entrant in the Open Source Initiative at the Intelligence Advanced Research Projects Activity, a part of the Office of the Director of National Intelligence. IARPA, according to its website, “invests in high-risk, high-payoff research programs that have the potential to provide the United States with an overwhelming intelligence advantage over future adversaries.”

The ability to accurately forecast civil unrest, epidemics, and elections around the world could do exactly that....

FUTURE TENSE • April 1, 2014**Symptoms of violence***by Patrick Tucker*

The date is June 30, 2012. **Computer scientist Naren Ramakrishnan is in his Virginia Tech lab** watching a map of the Americas on his computer screen.

A band of hundreds of red dots hovers over Mexico City; another band is over the Brazil-Paraguay border. The dot cluster is ringed by concentric circles of yellow, green, and blue. It looks almost like a radiant heat map, as though the capital of Mexico and the Brazilian border town of Foz do Iguaçu are on fire, but they aren't – at least, not yet.

These dots represent geotagged tweets containing the terms “pais,” “trabajador,” “trabaj,” “president,” and “protest.” The controversial Enrique Peña Nieto is about to be officially elected the president of Mexico, and the geotagged tweets represent a march taking form to protest his election.

In 2012 Nieto represented the return to power of the Partido Revolucionario Institucional (PRI). Despite the insurgent sounding moniker, the PRI is very much the old power party in Mexico, having governed the country for 71 years until 2000. It has long been associated with chronic corruption and even collusion with drug cartels.

Nieto, a young, handsome, not conspicuously bright former governor of the state of México, is seen by many as something of a figurehead for a murky, wellfunded machine.

Having met him, I can attest that he can be very charming, smiles easily, and has a firm handshake. As a governor, he is best known for allowing a particularly brutal army assault on protesters in the city of San Salvador Atenco.

The June 30 red dot cluster over Mexico indicates a lit fuse around the topic of Nieto on Twitter.

At 11:15 p.m. on July 1, as soon as the election is called for the PRI, the student movement group Yo Soy 132 (I Am 132) will spring into action, challenging the results and accusing the PRI of fraud and voter suppression.

The next month will be marked by massive protests, marches, clashes with police, and arrests. This is the future that these red dots on Ramakrishnan's monitor foretell.

The cluster in Brazil relates to a sudden rise in the use of “pais” (“country”), “protest,” “empres” (businesspeople), “ciudad” (“city”), and “gobierno” (“government”). In a few days 2,500 people will close

See SYMPTOMS, page 16

THE WASHINGTON POST • May 25, 2014

An inventor takes the helm at Virginia Tech

by Nick Anderson

BLACKSBURG, Va. – The incoming president of Virginia Tech, a public university that seeks to be known as an engine of innovation, holds 17 patents and was co-inventor of a laser process crucial for making white-light-emitting diodes.

When **Timothy D. Sands** takes office June 1 as the 16th president of what is formally known as Virginia Polytechnic Institute and State University, he will bring an inventor's eye for unexpected breakthroughs to his job at a moment when higher education itself is being

reinvented.

As a professor of materials science and engineering, first at the University of California at Berkeley and then at Purdue University in Indiana, Sands exhorted his students to keep careful notes and exploit "things that happen by the wayside" in a laboratory.

"The trick is not to leave it on the wayside, but to pick it up and do something with it," Sands said in an interview here this month. "You don't know which ones are going to be valuable."

The same might well be true of experimentation in research and teaching at universities....

VIRGINIA BUSINESS • October 30, 2014

Look, Mom: no hands

TORC Robotics in Blacksburg was a pioneer in the technology behind driverless cars

by Joan Tupponce

Autonomous or driverless vehicles may be a new buzzword within the auto industry, but the technology behind those vehicles isn't new to Michael Fleming, CEO of TORC Robotics LLC in Blacksburg. The company has been working with the technology since it opened its doors in 2007.

"The autonomous technology is not yet being used by consumers, but it is coming," says Fleming. "... It's the same technology we are

working on and have deployed."

The year TORC opened, it partnered with **Virginia Tech** to compete in a challenge sponsored by the Department of Defense Advanced Research Projects Agency (DARPA). Teams were tasked with developing a fully autonomous vehicle that had to travel 60 miles of urban and off-road environments in less than six hours.

"We were competing with 89 teams from around the world," Fleming recalls. "We were

one of three teams [Carnegie Mellon and Stanford were the other two] that finished the challenge. That was our claim to fame..."

Fleming was a graduate student in engineering when he started his company. He began with four partners, all **Virginia Tech engineering professors and graduate students**.

The five had been working on a robotic project at Virginia Tech when they discovered that industries were interested in their technology....

ONLINE COLLEGES • February 19, 2014

Tech Thoughts: Jeff Reed – Virginia Tech

by Eric C. Lipsky

Technology is one of the biggest drivers of change in industry and lifestyle.

Think about it: In the last six years we've gone from cell phones that were merely capable of text messaging, making phone calls, and some Internet functionality, to smartphones that are more powerful than the computers first used to help land a man on the moon. We're able to interact, capture, and transmit information

on a mass-scale today that would have required your own personal TV network a few decades ago....

We asked **Dr. Jeff Reed, the Director for Wireless@Virginia Tech** – one of the largest and most comprehensive university wireless research groups in the U.S. – for his thoughts on technology and how it is impacting education, and here's what he had to say.

Technology is a fast changing industry, how have you seen

the way you teach in your field change over the last five years?

A big change in teaching has come about due to untethering the professor to walk around with his wireless tablet with students who also have tablets and can interact wirelessly and in real time with the professor and each other.

Complexity of technology has required us to take more of a systems engineering approach to teaching.

Students can't know everything about everything. However, they need to be able to assemble complex operations together to grasp how things work.

For instance, simulation is often used as a teaching tool and instead of building up a simulation from scratch at the lowest level, more software modules are now available that encapsulate much of the complexity of an individual component in order to grasp concepts of more complex systems....

SYMPTOMS - Future Tense - (Continued from page15)

the Friendship Bridge connecting the Brazilian city of Foz de Iguaçu to the Paraguayan Ciudad del Este, another episode in the impeachment drama of Paraguayan President Fernando Lugo.

As soon as clusters appear on Ramakrishnan's computer, the system automatically sends an alert to government analysis with the Intelligence Advanced

Research Projects Activity (IARPA), which is funding Ramakrishnan through a program called Open Source Indicators (OSI). The program seeks to use available public data to model potential future events before they happen. Ramakrishnan and his team are one of several candidates competing for IARPA funds for further development. The different teams

are evaluated monthly on the basis of what their predictions were, how much lead time the prediction provided, confidence in the prediction, and other factors.

Correctly forecasting a military invasion in Africa used to be the sort of thing only a superpower could do; now it's a semester project

POPULAR SCIENCE • September 17, 2014

The Brilliant Ten: Abaid Studies Bats To Make Drones Smarter

Learning how bats avoid radar jamming could help scientists control huge swarms of robots.

by *Veronique Greenwood
and Cassandra Willyard*

As the sun set over the mountains near Jinan, China, **Nicole Abaid** sat by the narrow mouth of a cave and watched a colony of bats emerge. Unlike the radar that humans use, the bats' echolocation didn't seem to jam as the animals converged into a thin stream. Abaid, a mechanical engineer and mathematician at Virginia Tech, was there to discover why – an insight that could lead to more intelligent robots.

After getting her start by studying how schooling fish come to consensus, Abaid has broken new ground with bat colonies. Bats can adjust their signals so they don't overlap with their neighbors' frequencies. Abaid suspected they may be able to share information too, so she modeled how they might listen in on each other to better avoid obstacles. She went to

China to line the bat cave with infrared cameras and an ultra-sonic mic that could gather data to verify her model. "The big idea is to tell if and how they use each others' signals," she says. At the same time, she's designing bat-inspired ultrasonic sensors to improve communications among robots....

(Editor's Note: This article also appeared in: MSNBC's Morning Joe, BioSpace, BroadwayWorld, CBS Detroit, Indianapolis Business Journal, IT Business Net, IT News, ITbriefing, KAIT-TV, KATV-TV, KAUZ-TV, KBMT-TV & K-JAC, KCBD-TV, KCEN-TV, KCTV-TV, KFJX-TV, KFMB-TV, KFVS-TV, KHGI-TV, KHQ-TV, KIII-TV, KLKN-TV, KLTV-TV, KMEG-TV, KMPH-TV, KNDU-TV, KNOE-TV, KOLD-TV, KOTV-TV, KPHO-TV, KPLC-TV, KPTM-TV, KPTV-TV, KRHD-TV, KSFY-TV, KSLA-TV, KSTC-TV, KSWO-TV, KSWT-TV,

KTEN-TV, KTRE-TV, KTUL-TV, KTVN-TV, KUAM-TV, KUSI-TV, KWES-TV, KWQC-TV, KWTU-TV, KYTX-TV, MinyanVille, MLive.com, MoneyShow.com, Oceania, On Top of Politics, Review Seeker, Roanoke Star-Sentinel, Sparta Independent, Staten Island Advance, Sun News, Sys-Con Italy, TickerTech.com, Townhall, Virtual Strategy Magazine, Vision Monday, WAFB-TV, WAFF-TV, WAVE-TV, WBOC-TV, WCIV-TV, WCSC-TV, WDRB-TV, WFIE-TV, WFMJ-TV, WFSB-TV, WGCL-TV, WGFL-TV, WICU/WSEE, WIS-TV, WJRT-TV, WJSU-TV, WKRN-TV, WLBT-TV, WLNS-TV, WLOX-TV, WLTZ-TV, WMDT-TV, WNEM-TV, WOIO-TV, WOWK-TV, WRCB-TV, WRIC-TV, WSET-TV, WAFX-TV, WSHM-TV, WSMV-TV, WTOG-TV, WTOL-TV, WTVM-TV, WUPV-TV, WVNS-TV, WWBT-TV, WWTU-TV, WXIX-TV, WXTX-TV, WZDX-TV.)

WVTF-FM (local NPR radio) • January 31, 2014

Charging Up Innovation

by *Robbie Harris*

Virginia Tech is one of seven partners selected for a nationwide push to create manufacturing hubs, which President Barack Obama mentioned in his State Of The Union Address this week.

Tech just found out it was selected for the government/

private sector partnership for the President's Clean Energy Manufacturing Innovation Institute, headquartered at North Carolina State University.

How many devices do you plug in every day?

Every smart phone, laptop and many other portables

use power electronics to convert electricity from the outlet into the proper mode for the device to operate.

Professor of Electrical Engineering at Virginia Tech, Dushan Boroyevich is part of a team that will head up the effort to improve those little black boxes....

THE ROANOKE TIMES • February 5, 2014

Virginia Tech named partner in semiconductor innovation institute

Virginia Tech has been named one of seven partners in the Clean Energy Manufacturing Innovation Institute.

The institute is charged with inventing technology and manufacturing processes that will make power electronics devices more efficient. Tech will receive \$3 million over five years for its work with the institute.

BLACKSBURG, Va. – Virginia Tech is one of seven university or laboratory partners in the Clean Energy Manufacturing Innovation Institute announced recently by President Barack Obama.

The \$140 million institute, headquartered at North Carolina State University, is charged with inventing the technology and manufacturing

processes for power electronics devices based on wide bandgap semiconductors.

Power electronics devices are used by almost all modern electrical devices -- from cell phones to electric cars -- and by the equipment controlling the power grid. Using inverters and converters, power electronics converts electricity into the voltage and current needed by the device.

Today's power electronics devices are not 100 percent efficient and some energy is lost as heat during the conversion process. Improving power electronics efficiency could cut U.S. electrical energy consumption significantly, according to **Fred Lee, professor of electrical and computer engineering and director of Virginia Tech's Center for Power Electronics Systems....**

Virginia Tech will lead the power electronics research and applications thrust of the Clean Energy Manufacturing Innovation Institute.

Lee, center co-director Dushan Boroyevich, associate professor Rolando Burgos, and assistant professor Qiang Li, also of electrical and computer engineering, will tackle wide bandgap applications in power electronics systems involving silicon carbide (SiC) and Gallium nitride (GaN).

Virginia Tech will receive \$3 million across a five-year period....

Alex Huang, professor of electrical and computer engineering at North Carolina State University, led the successful proposal effort. Huang currently serves as director of the National Science Foundation Engineering Research Center, the FREEDM Systems Center.

From 1994 to 2004, Huang was on the **electrical and computer engineering faculty at Virginia Tech** and served as a technical lead at the **Center for Power Electronics Systems....**

THE NEW YORK TIMES • June 10, 2014

If Robots Drove, How Much Safer Would Roads Be?

Human error is the culprit in 93 percent of automobile crashes – including the pileup last weekend that left Tracy Morgan in critical condition, caused, prosecutors say, by a truck driver who had been awake for 24 hours.

Robots, on the other hand, don't need to sleep. Nor do they get drunk or distracted by cellphones. That is why Marc Andreessen, the venture capitalist, wrote on Twitter about the accident, with his usual bravado, "Self-driving cars and trucks are a moral imperative."

How much safer would driving be if robots replaced humans on the roads?...

But two studies by **researchers at Virginia Tech – H. Clay Gabler, a professor of biomedical engineering, and Kristofer D. Kusano, a research associate** – suggest how much safer robot cars might be. They found that even cars that are not fully autonomous but that automate some of the most dangerous aspects of driving could have as big an effect as seatbelts have had.

The studies, which were sponsored in part by Toyota Motor, analyzed the crashes, injuries and fatalities that could have been prevented by cars that alert drivers when they drift out of their lane or correct the car's course, and those

that sense an impending collision and automatically brake. They used a representative sample of real-world crashes nationwide and simulated what would have happened had the automation been in place.

Fully automated cars would definitely be far safer overall than human-driven ones. Humans are prone to error, making phone calls, being...

Another drawback is price, which will affect acceptance of the cars. Even Mr. Gabler, who studies this for a living, owns a car without any automation at all. "I'm an academic, so I don't drive brand-new expensive things," he said.

FOX NEWS • July 28, 2014

U.S. Marines testing autonomous GUSS off-roader

by Gary Gastelu

The U.S. Marine Corps motto "Semper Fidelis" is Latin for "always faithful," and it could soon have a vehicle that lives up to it.

The Marines have just

completed the first live tests of a new autonomous off-roader called the Ground Unmanned Support Surrogate – GUSS – that is designed to follow troops into the field, literally.

The small, Jeep-like vehicle was developed by **TORC Robotics, Virginia Tech University** and the Naval Surface Warfare Center Dahlgren Division....

THE ROANOKE TIMES • March 6, 2014

Inca builders inspire a modern engineer

by Tonia Moxley

BLACKSBURG – Four years' worth of research on the ancient Inca Road of the Andes led by a **Virginia Tech engineering professor** will be part of a major Smithsonian Institution exhibit scheduled to open next year.

Christine Fiori, associate director of Tech's Myers-Lawson School of Construction and a professor of engineering practice, secured a \$90,000 grant from the National Science Foundation to lead multidisciplinary

teams of students and experts to Cusco, Peru to study the ancient road building methods of the Qhapaq Ñan, or Main Andean Road.

Some of the project's findings were surprising, like the lack of a stone foundation for the road, Fiori said. And others, like sophisticated hydraulic features show how ancient technologies could inform modern construction.

But mostly, Fiori said the road could serve as a way to interest young people in engineering careers – a goal she is committed to realizing in the future....

INNOVATIONS REPORT • January 29, 2014

Virginia Tech biomedical engineer pursues development of 5-D imaging technology

Currently, the medical community has limited ability in clinically assessing blockages called atherosclerotic plaques in the human body.

These dangerous blockages that can lead to heart attacks and strokes are not easily diagnosed due to "the lack of

noninvasive imaging techniques to accurately model atherosclerotic plaques in vivo," said **Guohua Cao, assistant professor of biomedical engineering at Virginia Tech**.

With the award of a National Science Foundation CAREER grant valued at \$400,000, Cao is currently working on developing

an unprecedented, 5-D micro-computer tomography scanner for the in vivo imaging of atherosclerotic plaques in transgenic mouse models....

"Our innovative approach is to combine three separately developed technologies into one synergistic imaging system," Cao explained....

BOOST

U.S. News & World Report

(Continued from page 14)

"If it's something you're really interested in, then you're going to have the confidence and commitment and drive to make yourself successful," she tells *U.S. News*...

These days, the NASCAR driver pays that attitude forward by empowering a younger generation of women to forge their own paths in the male-dominated arenas of science, technology, engineering, and math.

Since the end of October, the rear green panel of her No. 10 Chevy race car has sported the hashtag #STEM, a feature chosen by tech company sponsor GoDaddy....

It doesn't hurt that the sport of racing relies on mastering the principles inherent in STEM. "If an engineer doesn't know what they're doing, it makes your life a living hell. The car won't handle well. It's not comfortable. It's not consistent. It makes a huge difference," Patrick says.

Take, for example, the relationship between downforce and drag.

Downforce is the force of air onto the car, an element that helps the wheels hug the ground when a driver rounds a corner. Drag is the amount of wind and air resistance a car might experience as it goes around the track.

"You're trying to improve the amount of downforce and reduce the amount of drag," says Daniel Knost, Patrick's crew chief. "We do a lot of computer simulation so we can predict what the car is going to do and how we're going to set it up."

Knost, 35, who holds a doctorate in mechanical engineering from Virginia Tech, says his job includes everything from thermodynamics – extracting maximum power from the gas an engine burns – to utilizing wind tunnels to build a more aerodynamic vehicle...

THE WEATHER CHANNEL • February 3, 2014

Flying Snakes Surprisingly Aerodynamic, New Study Shows

by Michele Berger

That a snake can fly isn't a surprise – it's part of group nicknamed "the flying snakes," after all.

What's fascinating is how it accomplishes the feat: As the snake leaps into the air, it flattens out its body. Then, as it begins to fall, it makes an undulating S motion,

eventually shallowing its path, so as not to hit the ground with a "thud."

Jake Socha, Ph.D., wanted to know how this reptile produces enough aerodynamic force to travel nearly 100 feet by air. "We know that the animal glides," the **Virginia Tech assistant professor** told

weather.com. But "how it is that they glide?" In other words, how do they stay in the air?

Socha and his colleagues broadly answer this question in a paper published today in *The Journal of Experimental Biology*. ...

The paper, "Aerodynamics of the flying snake *Chrysopelea para-*

disi: How a bluff body cross-sectional shape contributes to gliding performance," can be found online at *The Journal of Experimental Biology*.

(Editor's Note: This article also appeared in: *Korean Herald*, *Christian Science Monitor*, CBS News.)

BBC NEWS • January 29, 2014

Secrets of flying snakes revealed

by Rebecca Morelle

The mystery of how flying snakes stay aloft may have been solved by scientists.

These unusual reptiles, which are found in rainforests in Southeast Asia, are able to fling themselves from trees and elegantly glide through the air.

Scientists say that the serpents radically alter their body shape to generate the

aerodynamic forces needed to perform this feat.

The findings are published in the *Journal of Experimental Biology*.

Professor Jake Socha, from Virginia Tech in the U.S., who carried out the study, said: "The snake is definitely not an intuitive glider. When you look at it, you say: 'that thing should

not be able to glide.' And in its normal body configuration that is probably true.

"But when it enters the air, when it takes off and jumps and leaps from a branch, it massively transforms its body..."

(Editor's Note: An article on this work also appeared in: *Science World Report*, *French Tribune*, *East African Standard*.)

**DISCOVERY NEWS
January 29, 2014**

Snakes Take on UFO Shape to Fly

by Jennifer Viegas

"Flying UFO-shaped snakes" sounds like fodder for a late-night horror flick, but some snakes really do sail through the air and look like UFOs in the process...

The study, published in the latest *Journal of Experimental Biology*, helps to explain how such snakes (in the genus *Chrysopelea*) can remain airborne for up to 100 feet...

The snakes launch from seemingly any position on a tree, flexing their ribs as they initiate a glide. They then stretch and flatten their bodies from a circle into an arched semi-circle.

"It looks like someone's version of a UFO," co-author **Jake Socha of Virginia Tech's College of Engineering** said in a press release. The snakes launch themselves into air to move around their treetop home and to escape predators. They are mildly venomous, and prefer to take flight rather than fight. ...

"They look like they are swimming," he said. "They turn their whole body into one aerodynamic surface."

Once they fully unravel the snake's technique, they plan to use it to design tiny aerial robots for search and rescue missions, reaching places that larger devices and humans could not otherwise go.

THE NEW YORK TIMES • February 19, 2014

Slithering through the air with the greatest of ease

by James Gorman

Some people might view a snake that can launch itself from trees and glide through the air as their worst nightmare, something to be avoided, proof positive that human beings were not meant to venture out of doors.

They probably don't study aerodynamics.

For **John J. Socha**, how a snake's body, when flattened with ribs spread, achieves aerodynamic lift is an irresistible question.

Dr. Socha has been studying the paradise

tree snake, one of a group of five gliding snakes from Southeast Asia, for more than a decade. And he and others have spent a good amount of time launching the snakes from platforms and videotaping their flight.

They have documented how the snakes leap and how they move when they fly. And in a paper in the Feb. 1 issue of *The Journal of Experimental Biology*, **Daniel Holden, Dr. Socha and colleagues at Virginia Tech** and Purdue University analyzed what kind of wing a snake's body becomes....

R&D MAGAZINE • November 3, 2014

New technology shows promise for delivery of therapeutics to the brain

A new technology that may assist in the treatment of brain cancer and other neurological diseases is the subject of an article in *Technology*.

According to the authors, the current medical use of chemotherapy to treat brain cancer can be inefficient because of the blood-brain-barrier that impedes

the delivery of drugs out of blood vessels and into the tumor.

The **researchers from the Virginia Tech - Wake Forest Univ. School of Biomedical**

Engineering and Sciences described in their article that they have created "a tool for blood-barrier-brain disruption that

See PROMISE, page 26

DISCOVERY NEWS • May 20, 2014

Biotech Factories to Farm Fake Meat

by Eric Nüler

The movement to sell locally sourced, artisanal food and drink has picked up steam in recent years as many consumers demand better quality products with a smaller environmental footprint and traceable pedigree. But some

Dutch researchers are taking this idea a step further, proposing the creation of village-level “meat factories” that would produce unique flavors of artificial beef, pork or chicken, all from a biotech reactor....

Warren Ruder, assistant professor of biological systems engi-

neering at Virginia Tech, agreed that the technology is already there to build bio-beef, it just cost a lot. “The type of culture they are describing is relatively simple,” Ruder said. “We’ve been making artificial muscle in the laboratory for a decade.”...

VIRGINIA BUSINESS online • September 18, 2014

Virginia Tech names new engineering building Goodwin Hall in recognition of record donation

Virginia Tech has renamed its **Signature Engineering Building** in recognition of the philanthropy of Alice and Bill Goodwin.

Goodwin Hall, located near the corner of Prices Fork Road and Stanger Street, will be formally dedicated on Oct. 24 at 10:30 a.m.

The Goodwins of Richmond committed the largest single donation in Virginia Tech history to help fund construction of the 155,000-square-foot, \$95.2 million facility. It opened in June to faculty, and students started attending classes there in August, when the fall semester began.

“The mechanical engineering degree I earned from Virginia Tech helped me, and I believe in giving back,” Bill Goodwin said in a statement. He graduated with a bachelor’s degree in 1962 and later earned an MBA from the University of Virginia.

The Goodwins initially made their gift anonymously. They have a long history of supporting Virginia Tech. The Goodwins are charter members of the President’s Circle of the *Ut Prosim Society*, the university’s most prestigious donor recognition group. In 2005, Bill Goodwin received Virginia Tech’s University Distinguished Achievement Award, one of the university’s highest honors.

Bill Goodwin is retired chairman and president of CCA Industries, a holding company with assets that include golf resorts and hotels.

“The importance of Goodwin

Hall to the continued growth and excellence of our college cannot be overstated,” said **Richard Benson, dean of the Virginia Tech College of Engineering.** “Speaking not only for myself, but for all our students, faculty, and staff, I want to thank the Goodwins for their leadership gift on this project, and to also thank each and every one of the more than 150 donors whose generosity helped us make this spectacular building a re-

ality?”...

The Virginia Tech Board of Visitors approved the building naming on Sept. 15. It also approved the naming of dozens of prominent, interior spaces within the building in recognition of major gifts by other donors.

Among those spaces were the Quillen Family Auditorium named in recognition of a \$3 million gift led by alumnus Michael Quillen and given by his family....

BIOSPACE.COM • June 11, 2014

UMD, GW, and VT add Johns Hopkins to NSF’s DC I-Corps Node and NSF’s National Innovation Network

The University of Maryland, along with the George Washington University and **Virginia Tech**, have added the Johns Hopkins University to the National Science Foundation’s Innovation Corps (I-Corps™) regional collaboration called DC I-Corps.

JHU becomes the newest member university of the National Science Foundation’s National Innovation Network.

The NSF has approved a request from the three original universities to officially include Johns Hopkins in the I-Corps program’s “node” in the Mid-Atlantic called DC I-Corps, which was formed last year with \$3.75 million in NSF funding. It is one of five regional

nodes established nationwide by the NSF, and the first to expand its membership.

Together, these five nodes currently form the basis of the National Innovation Network, which links together select universities with established entrepreneurs and venture capitalists to train faculty and student researchers from throughout the U.S. to transform ideas into products and get them on the market....

Along with the lead principal investigator Dean Chang, the co-principal investigators for the DC I-Corps regional node are Jim Chung, executive director of the Office of Entrepreneurship, the George Washington University, and **Jack**

SNAKES

The Washington Post

(Continued from page 1)

An earlier study by Socha, published in *the Journal of Experimental Biology* in January, also investigated the flattened shape by using a 3-D printed snake model submerged in a tank of flowing water.

Both experiments found that, surprisingly, the reptile has an excellent capacity to generate propelling flight forces, or lift.

They are called “flying snakes,” but to be more precise, they are masters of the glide.

As a biomechanist, Socha works at the intersection of biology and physics, studying flying snakes for almost 20 years. ... Socha has found that serpents tend to maintain angles of attack of about 20 to 40 degrees.

Also, some portions of the snake’s body are perpendicular to the trajectory they are moving in, so they become like little sections of a wing. They hit the wind sideways, allowing for more lift. “If the cross-section was round, there’s no way it would glide at all would be our guess,” he said....

Lesko, associate dean for research & graduate studies, College of Engineering, Virginia Tech. ...

UMD, GW, and VT have all woven elements of the I-Corps methodology into courses for both undergraduate and graduate students. Together, UMD, GW, VT and JHU have sent 18 teams to the national I-Corps program and many more to the regional DC I-Corps program. ...

(Editor’s Note: This article also appeared in: *4-Traders, The Herald, The Indianapolis Business Journal, KEYC-TV, KHGI-TV, KLNK-TV, KMAX-TV*, 16 other TV outlets, MLive.com, Moneyshow.com, MSN Money, TickerTech.com, and WND.com.)

CHEMISTRY WORLD • September 8, 2014

Higher levels of some metals in e-cigarette smoke

by *Harriet Brewerton*

A study comparing secondhand emissions from e-cigarettes and conventional tobacco ones reveals that although e-cigarettes release much lower levels of most harmful compounds, they actually discharge more nickel and silver than tobacco cigarettes.

E-cigarettes are electronic devices that aerosolise nicotine-containing liquids, called e-liquids, for users to inhale.... little research exists on what effects e-cigarettes have on users or those in the vicinity....

This has left regulators behind and led to confusion for users. E-cigarette use is starting to be restricted in some public areas such as the London Underground, some airports and most schools, and the World Health Organization has recently called for vaping to be banned in all indoor areas....

Air quality expert **Linsey Marr, of Virginia Tech, U.S.**, says although the work shows that e-cigarettes seem to produce much lower exposures to many of the worrisome compounds in secondhand smoke, she would be wary of sitting near someone using one indoors. "E-Cigarettes still release com-

pounds that have adverse health effects, and some of the metals are of particular concern."

According to this study, the source of the metals appears to be the e-cigarette cartridge rather than the e-liquid, highlighting the need for manufacturing processes to be closely regulated.

Ruprecht says the team hope this research will help to verify the health hazards for smokers and for persons exposed to secondhand aerosols from e-cigarettes in indoor environments. "The results could be valuable in setting policies for the use of e-cigarettes in public spaces," adds Marr.

**ASEE PRISM
September 2014**

20 under 40

by *Sarah Khan, Mary Lord, and Mark Matthews*

They hail from across the United States and beyond, migrating to engineering education via pathways as far flung as an entrepreneurial start-up, competitive gymnastics, medicine, and the Navy. Their research topics are equally varied, from cancer to energy storage and a field so rarefied – nanogeochemistry – that its Facebook page has just four "Likes."

What these accomplished under-40 academics all share, however, is a demonstrated talent for teaching, real-world research, or – as is often the case – both. They were picked to highlight the role of engineering and engineering technology institutions in shaping a globally competitive workforce, based on recommendations by schools and colleagues and research by *Prism* staff....

The common denominator is imagination.

Raffaella De Vita**Mother of Invention**

Eureka moments can strike in odd places.

Raffaella De Vita, a soft-tissue expert and associate professor of engineering science and mechanics at Virginia Tech, discovered her niche at the forefront of repro-

See UNDER, page 22

CHEMISTRY WORLD • January 24, 2014

Nanomaterials: Bin and burn?

by *Megan Tyler*

Scientists in the U.S. have begun addressing the question of whether the disposal of nanomaterials could damage the environment, by investigating the fate of nanomaterials in incinerators.

Over the past few decades, nanomaterials have proven to be extremely useful, and as our understanding of their unique properties has increased, so has the variety of applications for which they have been used. For example, nanomaterials make excellent catalysts due to their very large surface area to volume ratios, and they are very popular in the medical industry as vehicles for the delivery of drugs into the body. But it's not only in industry that nanomaterials have been making their mark, they are slowly but surely making their way into a myriad of consumer products as well. Nanomaterials are already being used as UV filters in sun cream and in cosmetics as colourants, and nanosilver is becoming popular as an antibacterial agent in fabrics and cleaning products....

The presence of metal and metal oxide nanoparticles in incinerated products may actively reduce emissions of other potentially harmful chemicals....

A study by **Linsey Marr and co-workers from Virginia Tech in Blacksburg** suggests that the scientific community is starting to look into the potential impacts of nanomaterial disposal. In their

study, the team tried to elucidate the fate of nanomaterials that end up in incinerators. There are concerns that some nanomaterials may be toxic to certain organisms and as the use of nanotechnology increases it is inevitable that some nanomaterials will enter the waste stream and be incinerated. As such, it is important to fully understand what happens to nanomaterials during the incineration process.

Although the group's research is still in its early stages, it did throw up some pretty interesting results. The principal finding was that the

majority of the nanomaterials partition into the ash at the bottom of the incinerator, but a particularly interesting discovery was that nanoparticles in the waste could influence the efficiency of combustion in the incinerator as well as the composition of the emissions released. For example, metal oxide nanomaterials were found to increase the efficiency of combustion and decrease the emission of toxic polycyclic aromatic hydrocarbons (PAHs). Meanwhile silver nanoparticles decreased combustion efficiency and increased PAH emissions....

MONITOR GLOBAL OUTLOOK • May 19, 2014

Behind mine disaster, Turkey's push for growth

The push for cheap energy to fuel rapid economic growth lies behind last week's mining disaster in Turkey.

Booming growth is driving demand for access to cheap, easy coal throughout much of the developing world.

But when efforts to boost production bypass the modern techniques that have dramatically improved safety records in many nations, mines become accidents waiting to happen....

"Transferring some of the technology in the developed

countries with mature safety cultures [to those without] is key to accelerating change," says **Kray Luxbacher, associate professor of mining and minerals engineering at Virginia Polytechnic Institute and State University in Blacksburg, Va.** "These systems have already been developed, so we don't have to start from ground zero..."

"In mature safety cultures, no one believes that losing your life is the cost of having a job in a mine," Ms. Luxbacher said in a telephone interview....

CIRCUIT CELLULAR • July 16, 2014

Embedded Security (*EE Tip #139*)

by C.J. Abate

Embedded security is one of the most important topics in our industry. You could build an amazing microcontroller-based design, but if it is vulnerable to attack, it could become useless or even a liability.

Virginia Tech professor Patrick Schaumont explains, “perfect embedded security cannot exist. Attackers have a wide variety of techniques at their disposal, ranging from analysis to reverse

engineering. When attackers get their hands on your embedded system, it is only a matter of time and sufficient eyeballs before someone finds a flaw and exploits it.”

So, what can you do? In CC25, Patrick Schaumont provided some tips:

As design engineers, we should understand what can and what cannot be done. If we understand the risks, we can create designs that give the best possible protec-

tion at a given level of complexity. Think about the following four observations before you start designing an embedded security implementation.

First, you have to understand the threats that you are facing. If you don't have a threat model, it makes no sense to design a protection—there's no threat! ...

Second, make a distinction between what you trust and what you cannot trust. ...

Third, security has a cost. ...

RICHMOND TIMES DISPATCH • June 7, 2014

Carbon dioxide technology's future may be tied to natural gas

by Peter Bacqué

Unwanted carbon dioxide from power plants may be the key to unlocking valuable natural gas sealed deep underground in coal seams, Virginia Tech researchers say.

And, better yet, injecting CO₂ into coal and shale-gas formations locks the waste product up, they said, where it can't contribute to the greenhouse effect.

By itself, carbon capture and storage is un-economically expensive.

“Storing the CO₂ is not going to pay,” said Michael E. Karmis, professor of mining and minerals engineering, and director of Tech's coal research center, but it could if the carbon dioxide could be used to produce more high-value natural gas.

“If you can do that, you can offset the cost of capturing and transporting CO₂,” said Karmis' Virginia Tech engineering colleague Nino Ripepi. “It could have a big benefit for economic development.”

With funding from the U.S. Department of Energy, and support from Dominion Virginia Power, Virginia Tech's

Virginia Center for Coal and Energy Research is testing the potential of unmineable coal seams in Southwest Virginia's Buchanan County to store carbon dioxide and, at the same time, produce natural gas — methane — otherwise trapped 1,500 to 2,000 feet underground

in coal beds....

“If we could capture and sell CO₂ at a reasonable price, then there's the potential for this industry to thrive,” Ripepi said.

But to do that, “you'd need a pipeline network,” he said. “Right now we're buying food-grade CO₂ and trucking it in.”

UNDER - ASEE Prism - (Continued from page 21)

ductive health while seven month's pregnant with her second child. She was crossing campus, pondering how to craft a ligament-research proposal “novel” enough to pass NSF muster, when she felt pain on both sides of her abdomen.

“That's interesting,” she thought, and hit Google for possible causes. Nothing turned up. Even the names and anatomical descriptions of ligaments supporting the uterus and vagina varied widely.

“It was really a mess!” recalls De Vita. That seemed surprising given that incontinence, pelvic-organ prolapses, and other disorders affect

a third of female U.S. adults. Startling, too, was the lack of scientific research guiding surgery – costing Americans \$1 billion annually – to treat such conditions.

De Vita suddenly saw where her work could make a difference. Weeks after giving birth, she refined and submitted a winning NSF CAREER proposal to study the elastic and viscoelastic properties of two major ligaments supporting the uterus and the vagina.

The following year, 2013, she won a Presidential Early Career Award for Scientists and Engineers (PECASE).

“Having a baby really inspired this research,” says De Vita, who never imagined as the

CBS-DC
June 15, 2014

Researchers: Nicotine 'Can Initiate A Cancer State'

Researchers have discovered that products like the nicotine patch, may actually do more harm than good.

Virginia Bioinformatics Institute researchers found that using nicotine-infused smoking cessation products may not be the safest way to help people addicted to smoking quit the habit. They found that the carcinogenic qualities of nicotine used excessively mutates a cell's DNA.

Harold “Skip” Garner, a professor of biological science, computer science, and basic science affiliated with the College of Science, the College of Engineering, and the Virginia Tech Carilion School of Medicine, and geneticist Jasmin Bavarva discovered that nicotine causes thousands of mutations called single nucleotide polymorphisms (SNPs) in exposed cells, compared with control cells that were not exposed, a press release detailed....

daughter of an Olivetti worker in Italy that her career trajectory would include a Ph.D. in mechanical engineering from the University of Pittsburgh and meeting a U.S. President.

Since struggling to find her initial collaborator, an Army gynecologist and researcher, De Vita has seen growing interest in her field, with the world conference of biomechanics holding sessions on female reproductive mechanics. Meanwhile, her email is flooded with requests for guidance on disorders that many women were, until recently, too embarrassed to discuss. Not so her kids, 3 and 8, by now accustomed to clinical talk laced with words like “vagina.”...

ELECTRONIC COMPONENT NEWS • September 29, 2014**Can cartoons be used to teach machines to understand the visual world?**

An enormous gap exists between human abilities and machine performance when it comes to understanding the visual world from images and videos. Humans are still way out in front.

“People are the best vision systems we have,”

**RICHMOND TIMES-DISPATCH
November 2, 2014*****Dominion's David Christian:*
'The most interested
man in the company'***by Peter Bacqué*

For **Dave Christian**, life's either an all-out adventure or it's nothing at all.

A **Virginia Tech graduate and mechanical engineer** by education, he's the head of Dominion Resources Inc.'s multi-state, multi-megawatt power-generating arm, responsible for \$8.7 billion in operational and capital budgets.

And he's a commercial pilot, a mountain climber, a rock climber, a musician, a philanthropist and community volunteer, a voracious reader and a thoughtful leader.

“Dave always makes me think he's the most interesting man in the company,” said his boss at Dominion Resources, Thomas Farrell II. “He's certainly the most interested man in the company.”

Behind the switch

As CEO of Dominion Resources' generation unit, Christian is responsible for overseeing the more than 23,600 megawatts of electricity generated by the power stations of the company's merchant and regulated electric utility businesses....

Speaking up for Virginia Tech

Virginia Tech, Christian's alma mater, terminated its graduate program in nuclear engineering in 1986. But when **Richard Benson became dean of Tech's College of Engineering** in 2005, he wanted the university to bring it back.

When state education officials questioned whether the proposed program was important to Virginia Tech, the state and the nation, Christian spoke up. “He didn't oversell, he didn't use a heavy hand,” Benson recalled, but “he has a lot of authority.”

“When he spoke it was really influential,” the Virginia Tech dean said.

Tech's graduate nuclear engineering program became official Jan. 1....

said **Devi Parikh, assistant professor in the Bradley Department of Electrical and Computer Engineering at Virginia Tech**. “If we can figure out a way for people to effectively teach machines, machines will be much more intelligent than they are today.”

In her research, Parikh is proposing to use visual abstractions or cartoons to teach machines. She works from the idea that concepts that are difficult to describe textually may be easier to illustrate. By having thousands of on-line crowd workers manipulate clipart images to mimic photographs, she seeks to teach a

computer to understand the visual world like humans do.

Parikh has expertise in computing areas such as computer vision and pattern recognition. Based on her earlier successful creative work on how to learn from visual abstractions, Google has selected Parikh to receive one of its Faculty Research Awards.

Google's innovative award provides Parikh with \$92,000 of unrestricted funds and allows her to work directly with Google researchers and engineers as they explore how to best learn from visual information....

SPECIALTY FABRICS REVIEW • March 5, 2014**The energy around us**

Energy harvesting researcher **Dr. Shashank Priya, Virginia Tech**, responds to questions about the status of kinetic energy harvesting technology.

What is your assessment of the commercial viability of kinetic energy harvesting?

Kinetic energy harvesting prototypes have been demonstrated by several research laboratories and large companies, such as Exelis Inc. There are a variety of platforms where this technology is being targeted, such as trains, aircrafts and buildings for powering the

wireless sensor nodes, surveillance components and health monitoring systems. A lot of progress has also been made on water flow energy harvesting systems, and they should find deployment for remote monitoring applications.

What markets and applications are most likely to be (or will continue to be) early adopters?

Wireless sensor nodes, surveillance components, and health monitoring systems are the prime applications for platforms, such as buildings, automobiles, trains, aircraft and ships.

What could happen in the research (what would be “breakthrough”) that could change the picture?

There are two main metrics that need to be improved: power density and bandwidth. In order to do so, more research needs to be conducted on improving the material performance and implementation of these material architectures on the desired substrates. In addition, research is required to further the design of low-frequency structures, non-linear concepts and efficient circuits....

PHYS.ORG • April 21, 2014**New material coating technology mimics nature's lotus effect**

Ever stop to consider why lotus plant leaves always look clean? The hydrophobic – water repelling – characteristic of the leaf, termed the “Lotus effect,” helps the plant survive in muddy swamps, repelling dirt and producing beautiful flowers.

Of late, engineers have been paying more and more attention to nature's efficiencies, such as the Lotus effect, and studying its behavior in order to make advances in technology. As one example, learning more about swarming schools of fish is aiding in

the development of unmanned underwater vehicles. Other researchers are observing the extraordinary navigational abilities of bats that might lead to new ways to reconfigure aviation highways in the skies.

Ranga Pitchumani, professor of mechanical engineering at Virginia Tech and currently on an invitational assignment as the chief scientist and director of the Concentrating Solar Power and Systems Integration programs of the U.S. Department of Energy's

See COATING, page 24

COATING

Phys.Org

(Continued from page 23)

SunShot Initiative, would like to see more efficiencies and clever designs in technology. His work reflects this philosophy.

His recent development of a type of coating for materials that has little to no affinity for water emulates the Lotus effect. Commonplace material coatings are as simple as paints and varnishes. More sophisticated coatings might be used for resistance to corrosion, fire, or explosives.

The American Chemical Society recognized the impact of the work of Pitchumani and Atieh Haghdoost, a recent doctoral graduate from Pitchumani's Advanced Materials and Technologies Laboratory, featuring their research on the cover of its April 15 issue of the publication *Langmuir*, a highly-cited, peer reviewed journal. The article can be found at: <http://pubs.acs.org/doi/abs/10.1021/la403509d>, which includes a video demonstration of the coating....

(Editor's Note: This article also appeared in: Science Daily, AZoM, Bio-Medicine, BioPortfolio, DailyNewsEn.com, Data Center Journal, Electronic Component News (ECN) – Online, Phys.org, Product Design & Development, ScienceDaily, ScienceNewsline, Laboratory Equipment, ORNL Review, and R&D magazine.)

BALTIMORE SUN • January 4, 2014

Maryland teen gets worldwide stage after winning Intel award

by Jean Marbella

The whiteboard that keeps track of Jack Andraka's schedule would be an exhausting blur for anyone, let alone a 16-year-old high school student: Last-minute requests are squeezed into already full days, scientific conferences bump up against speaking engagements, successive trips to India, Ireland and Harvard seem one missed connection away from a cascading disaster.

It's no wonder the extraordinarily in-demand Andraka is sleepy-eyed on this recent day, but as it turns out, the reason is entirely ordinary – he was up late studying for a test at North County High School in Glen Burnie....

Andraka has had anything but a normal time since winning the top \$75,000 prize at the 2012 Intel Science and Engineering Fair for his promising invention of an early-stage test for pancreatic cancer. With his voluble personality, he has become something of an ambassador-at-large for the cause of research and education, turning up everywhere from "The Colbert Report" to the kind of international summits where, as he wryly puts it, "you could Wikipedia everyone at your table."

But Andraka always comes home, eventually, as he did for the holidays. It's tempting to say that back home in Crownsville, with his parents Jane and Steve and his brother, Luke, home from

his freshman year in college, he can just be Jack, regular boy, as opposed to whiz-kid scientist on the public stage. But in the Andraka household, the norm hovers on a more elevated plane.

Luke, 18, similarly bloomed early. Now at Virginia Tech, his gift is engineering – like his father, a civil engineer who works for a development company, and others in his extended family. "Strange TVs, old kitchen equipment would follow him home and become something different," his mother Jane said.

At 13, Luke's science fair project, remediating mining damage in a stream, placed fourth in a national science competition for middle-school students. In 2010, he won \$96,000 in the Intel competitions, including the "Genius Scholarship," and the following year, the THINK award given by the Massachusetts Institute of Technology to students whose projects benefit their communities.

All of which read like a challenge to his younger brother. "So, of course I had to beat him," Jack said.

The national middle-school science competition was discontinued by the time Jack was eligible, but Jack says he "got back" by winning the top Intel prize, in addition to victories in other categories that pushed his total take to \$100,500....

THE COLLEGIATE TIMES • January 30, 2014

Tech alumnus' commercial contends for Super Bowl spot

by Aastha Batra

For some, the most exciting part of watching the Su-

per Bowl is the variety of commercials that air during the game. But few think about the process of selecting the commercials, or even the process of producing them.

Raj Suri, a computer science graduate of Virginia Tech, came to understand the process firsthand this past year when he produced a Doritos commercial.

... The pair competed against 5,500 other commercials from all around the world.

What sets the pair's commercial apart among this year's submissions is the amount of money that was used to produce it. Unlike other competitors who spend millions of dollars in making their commercials, Suri and his coworker were able to do it for about \$300 by having it shot in their neighborhood, with the main roles played by Anderson's six-year-old son and dog.

Doritos will select two winners from the applicant pool. The first is selected by popular vote and will receive \$1 million....

(Editor's Note: Suri won the competition.)

RICHMOND TIMES DISPATCH • June 3, 2014

Regulations' impact on electric rates is unclear

by Peter Bacqué

What effect the EPA's proposed rules on carbon emissions will have on electric rates in Virginia is up in the air, officials said Monday.

And learning what that impact will be will take years, they said, as the state develops its plan to implement the federal regulations covering existing power plants....

The American Electric Power system, of which Appalachian Power is a part, is one of the most carbon-intensive power companies in the nation, while Dominion Resources and

its Dominion Virginia Power unit is one of the least, officials said.

"There's not an easy option (to reduce carbon emissions) other than to close coal and open natural gas plants," said **Nino Ripepi, an assistant professor in Virginia Tech's Department of Mining and Minerals Engineering**. "That's very troublesome."

"What this reduction would do on a global scale is not significant," Ripepi said. "There are too many emissions from too many sources. I think it's clear and everyone knows that."...

ENVIRONMENT HEALTH SAFETY TODAY • July 23, 2014

Study: Obese Workers Are More Prone to Fatigue

by Josh Cable

Obese workers have less endurance and are more prone to fatigue than their non-obese co-workers, a new study suggests.

Published in the *Journal of Occupational and Environmental Hygiene*, the study examined the endurance of 32 individuals in four categories (non-obese young, obese young, non-obese older and obese older) who completed three distinct tasks that involved a range of upper-extremity demands. The tasks – hand grip, intermittent shoulder elevation and a simulated as-

sembly operation – involved periods of work and rest, and included pacing demands similar to those experienced by workers in manufacturing settings. ...

“Previous studies have indicated that both age and obesity lead to decreased mobility, particularly when it comes to walking and performing lower-extremity tasks,” said **Maury Nussbaum, Ph.D., a professor in the Department of Industrial and Systems Engineering at Virginia Tech**, who also worked on the study. “However, we found no evidence of an interactive effect of obesity and

age on endurance times, which is contrary to previous findings.” ...

According to Cavuoto and Nussbaum, the results from this and related studies will contribute to a better understanding of the ergonomic impacts of obesity and age, which is important for describing the link between personal factors and the risk of workplace injury. ...

*(Editor’s Note: This article also appeared in *Insurance Journal*, *healthcanal.com*, *Science World Report*, and *ScienceNewsline*.)*

INNOVATIONS REPORT • June 6, 2014

New proactive approach unveiled to malware in networked computers and data

Cybercrime comes in all forms these days. One recent headline told of the creepware or silent computer snooping that resulted in the arrest of some 90 people in 19 countries. Miss Teen USA was among the victims. Her computer had been turned into a camera and used to spy on her in her own bedroom.

On the commercial front, Target suffered the largest retail hack in U.S. history during the Christmas shopping season of 2013, and now the Fortune 500 company’s outlook is bleak with steep drops in profits.

New research to be announced at the June 2014 ACM Symposium on Information, Computer and Communications Security <http://asiaccs2014.nict.go.jp/> in Kyoto, Japan has unveiled the causal relations among computer network events. The work effectively

isolates infected computer hosts and detects in advance stealthy malware also known as malicious software.

The work was conducted under the auspices of a 2010 National Science Foundation CAREER Award grant to develop software

that differentiates human-user computer interaction from malware http://www.nsf.gov/award-search/showAward?AWD_ID=0953638&HistoricalAwards=false.

That \$530,000 award was presented to **Danfeng (Daphne) Yao, associate professor of**

computer science at Virginia Tech. She worked with **Naren Ramakrishnan** <http://www.cs.vt.edu/user/ramakrishnan>, the

Thomas L. Phillips Professor of Engineering, and her graduate student Hao Zhang of Beijing,

See PROACTIVE, page 26

**FCW: THE BUSINESS OF FEDERAL TECHNOLOGY
June 16, 2014**

Malware methodology, drone launchers and a health IT departure *NSF grantee finds new malware approach*

by FCW staff

Research funded by a National Science Foundation grant resulted in the uncovering of a new proactive methodology for detecting malicious software in networked

computers and data.

Findings from the 2010 NSF CAREER Award grant to develop software that differentiates human-user computer interaction from

See MALWARE, page 26

**ELECTRONIC
COMPONENT NEWS
November 3, 2014**

Ant behavior might shed insight on problems facing electronics design

by EurekaAlert

Michael Hsiao plans to harness swarm intelligence based on the efficient behavior of ants.

Why would this matter? Ant colonies are known for their efficiency in finding the best route to food sources. So **Hsiao, professor of electrical and computer engineering at Virginia Tech**, and an expert in design verification has tackled one of the major problems facing electronics design in a novel way.

He has developed mathematical formulas that simulate the methods used by the ants when they are seeking nourishment.

Hsiao plans to use these algorithms to improve the accuracy in electronics design when one needs to validate and verify that the design meets the spec.

The National Science Foundation has awarded him a grant of \$418,345 to continue exploring his ideas. ...

IN THE CAPITAL • November 14, 2014

Virginia Tech Professors Help Create VR Bat Display For the Smithsonian

by Molly Greenberg

A bat display at the Smithsonian has been brought to life thanks to professors at **Virginia Tech**.

Rolf Mueller, an associate professor of mechanical engineering at the Blacksburg school, scanned a National Museum of Natural History vampire bat specimen that was then animated by Dane Webster, faculty at the Institute for Creativity, Arts, and Technology at Virginia Tech, and a group of students. Mueller and Webster are collaborators on efforts to update the Hall of Bones; a project led by Robert Costello of the Smithsonian’s National Museum of Natural History.

The National Museum of Natural History designed a

mobile app called “Skin & Bones” to allow Smithsonian visitors the chance to see a 3-D digital vampire bat skeleton “descend from the actual skeleton and run away as only vampire bats can,” reads a university article about the project. ...

Mueller developed layers of high-resolution images of vampire bat specimen from the Smithsonian that allow viewers at museum touch-screen displays the ability to superimpose the skin surface over the bone structure. ...

Mueller added that “Bat biosonar is one of the most sophisticated sonar systems in existence. And, yes, that includes manmade sonar systems.” ...

POPULAR SCIENCE • February 19, 2014

Modeling Bat-Mobility to Build Better Robobats

by Rebecca Boyle

Seagull drones, RoboBees, and human-powered aircraft – all these flying machines borrow heavily from nature's designs. But building animal-inspired robots requires understanding how the animals work, at least on a basic level. Humans may never build something as complex as a bat, but we can build a simplified version that borrows a bat's key tricks. **Danesh Tafti and colleagues at Virginia Tech** are doing the hard work of making this job a little easier.

Bat wings are actually arms and hands covered with a stretchy, sensitive membrane. By literally lifting a finger, bats can make minute course corrections in mid-air.

But it's difficult to tease out how they do this. You have to stick a lot of sensors on a bat and let it fly, measuring aerodynamic forces. Then computer simulations must crunch these readings to model the fluid dynamics of flight.

Tafti's team recently did the latter, using recorded measurements completed by a Brown University group. They modeled the flow field that a bat's wing produces, something that is very difficult to measure in experiments – imagine watching a bat flap around in a wind tunnel, and trying to make sense of the physics.

"This thing is moving all over the place, so to get a quantitative assessment of what the flow field looks like is extremely difficult," Tafti

says.

The end goal: A simplified bat-flight model, which engineers could use to make a robobat that flies like a real one....

(Editor's Note: This article also appeared in: *Mother Nature Network*, *International Business Times*, and *Christian Science Monitor*.)

THE WHY FILES • February 27, 2014

Bats on the wing

by David J. Tenenbaum

With a small body mounting giant wings built on the highly articulated bone structure of the mammalian arm, the bat's herky-jerky motion is almost inevitable. But how does their flapping affect the airflow around the wings?

In an extremely complex manner, is the gist of a new study that, based on data about the actual flight of a fruit bat, built a detailed picture of the variations in air pressure that keep the bat aloft and moving forward.

The thousand-odd species of bats are the only true flying mammal, and their wings have the structure of a mammal's arm and hand, which makes their flight – and the movement of the surrounding air – rather complicated.

The data on flight tracked the position of 50 points on a fruit bat wing during a climbing flight, says senior author **Danesh Tafti, a professor of mechanical engineering at Virginia Tech**. "The experimenters put markers on the wings, and used two or three cameras to capture the motion. We got the spatial coordinates of these points that tell us where they are in space."

But the fluid dynamics equations Tafti was using were thirsty for detail. "You have to know the spatial location of each point on the wing at each time point in the simulation," he says. Since each wingbeat requires tens of thousands of simulation steps, "we have to interpolate a lot of points."

Because it's nearly impossible to actually measure air flow and pressure near the wing, computer simulation is the only way to explore the fluid dynamics of bat flight....

Ultimately, the study is part of "bio-inspired design," that aims to understand and replicate flapping flight, says Tafti, who notes that nature's designs are usually more efficient than human ones. "We'd like to take the essentials and use them to design a vehicle that would fly like a bat."

PROMISE - R&D Magazine - (Continued from page 19)

uses bursts of sub-microsecond bipolar pulses to enhance the transfer of large molecules to the brain."

The members of the biomedical school are: Rafael V. Davalos, associate professor of biomedical engineering; John H. Rossmel Jr. and Thomas Rogers-Cotrone of the Virginia-Maryland College of Veterinary Medicine; Christopher Arena, Paulo A. Garcia and Michael B. Sano of the Bioelectromechanical Systems Laboratory and John D. Olson of the Center for

Biomolecular Imaging.

The new tool is called Vascular Enabled Nanosecond pulse or VEIN pulse. It will "reversibly open the blood-brain-barrier to facilitate the treatment of brain cancer," Davalos explained.

"The sub-lethal nature of these electrical bursts indicates that the VEIN pulse may be useful for treating other neurological disorders such as Parkinson's disease, epilepsy and Alzheimer's disease," Davalos added.

In their testing, the VEIN pulse treatments were administered

using minimally invasive electrodes inserted into the skull of each of the 18 anesthetized male rats. They varied the pulse duration within a burst, the total number of bursts (90 to 900), and the applied field. A key element of their success was that the pulses alternated in polarity to help eliminate muscle contractions and the need for a neuromuscular blockade.

The next step in this research would be to move to large animal, pre-clinical trials.

PROACTIVE – Innovations Report – (Continued from page 25)

China, a doctoral candidate in computer science.

The **Virginia Tech computer scientists** used causal relations to determine whether or not network activities have justifiable and legitimate causes to occur.

"This type of semantic reasoning is new and very powerful," Yao said....

(This article also appeared in *HPC Wire* on June 4, 2014.)

MALWARE – FCW – (Continued from page 25)

malware were revealed at the ACM Symposium on Information, Computer and Communications Security in Kyoto, Japan, earlier this month.

Danfeng Yao, associate professor of computer science at Virginia Tech, worked with a fellow professor and a graduate student on detecting malware and infected

computer hosts in advance.

"The true significance of this security approach is its potential [as a] proactive defense capability," Yao said. "Conventional security systems scan for known attack patterns, which is reactive. Our anomaly detection based on enforcing benign properties in network traffic is a clear

departure from that."

Yao had previously garnered a three-year grant from the Office of Naval Research on cybersecurity to quantitatively detect anomalies in Defense Department computers, mobile devices, command and control servers, and embedded systems deployed on U.S. Navy ships. ...

THE WASHINGTON TIMES
July 21, 2014

Va. Tech institute receives 2 federal contracts

The federal government has awarded two contracts potentially worth \$55 million to **Virginia Tech's Transportation Institute**.

Virginia Tech said Monday that the Federal Motor Carrier Safety Administration awarded a contract to further study commercial truck driver safety. The contract is for up to five years and up to \$30 million.

The institute also received a contract from the National Highway Safety Administration to research automated-vehicle technology. The contract is for up to five years and a maximum \$25 million.

NBC NEWS • November 11, 2014

Physicists Study Why Dogs Are Sloppier Drinkers Than Cats

Popular web videos showing that "cats rule and dogs drool" have new scientific evidence to support that felinophilic sentiment, at least when it comes to drinking. While cats expertly manipulate water to quench their thirst neatly, dogs smash, slosh, spill and splash their way through a drink, according to research presented Monday at a meeting of the American Physical Society.

Neither cats nor dogs can close their cheeks tightly enough to create suction, as humans do, so exactly how they manage had been a puzzle. In 2010, engineers at Princeton University and the

Massachusetts Institute of Technology, among other schools, discovered how cats lap water. Basically, felines touch their tongue to the water's surface without penetrating it and pull up a column of liquid. In contrast, high-speed cameras revealed that a dog's tongue smashes forcefully through the water's surface to scoop up a drink. Dogs "make lots of splashing, but a cat never does," said **Virginia Tech biomechanical engineer Sunny Jung**, one of the study's authors. ...

The cat-lapping study was published today on the journal *Science's* website....

THE ROANOKE TIMES • September 28, 2014

The Signature Engineering Building expands possibilities at Virginia Tech

by Tonia Moxley

BLACKSBURG — You can tiptoe through the second floor of **Virginia Tech's newly opened Signature Engineering Building**, but no matter how light your footsteps, the echoes will register as data in what officials say will be the most instrumented public building in the country.

Ground zero of the effort to make the 155,000-square-foot research and classroom building a test bed for everything from energy efficiency systems to building health and safety monitoring is Tech's

Smart Infrastructure Laboratory, overseen by mechanical engineering professors Pablo Tarazaga and Mary Kasarda.

Their students work on making "smart materials" by embedding sensors into architectural media, such as steel used in construction. These processes may eventually allow building components to monitor their own structural health and signal problems as they occur — a much cheaper and more accurate process than using human inspectors for the job, the

researchers say.

So far the team, which includes several graduate students, has installed about a dozen sophisticated sensors, known as accelerometers, around the building, with plans to increase that number to more than 240. The sensors will be hard-wired to the data collection system with 10 miles of cable, or enough to circle the Drillfield 14 times, Tarazaga said....

Eventually, Tarazaga said, students will be able to jump in the hallway and see the vibration translated onto monitors outside the lab....

COMPUTERWORLD UK
September 17, 2014

Virginia Tech researchers devise traffic app to rival weather apps

by Sharon Gaudin

Before many travelers head to the beach or up to the mountains to go apple picking or skiing, they check a weather app.

One day, they also may check a traffic app that will help them get to the beach or the mountains without getting stuck in a traffic jam or waylaid by an accident.

Researchers at the Virginia Tech Transportation Institute are working on a cloud-based application that will use real-time information and historical data to predict when and

See TRAFFIC APP, page 28

BUSINESS STANDARD • August 12, 2014

New tech could display traffic signs inside vehicles

A new technology may allow a dashboard screen inside the car to display traffic signs and alert the driver of what actions to take.

Researchers at the **Virginia Tech Transportation Institute** are in the early stages of a novel idea to move stop and yield signs, among other posted traffic, from the side of the road into the car itself.

A dashboard screen will automatically alert the driver of what actions to take, if any. If no other car is present at the inter-

section, the driver would be allowed to pass through and go on, researchers said.

"The idea is there would be no physical stop or yield signs on the side of the road, but they would be inside the vehicle," said **Alexandria Noble** of Newark, Delaware, a master's student with the **Virginia Tech Charles E Via Jr Department of Civil and Environmental Engineering**.

Noble, who is also working with the **Virginia Tech Transportation Institute**, is

spearheading the proof of concept adaptive stop-yield study with funding from the US Department of Transportation.

Noble is working under direction of her adviser and project manager, **Thomas A Dingus, the institute's director and an endowed professor of civil and environmental engineering at Virginia Tech...**

(*Editor's Note:* This article also appeared in *Financial Express*, *Government Technology*, and the *Times of India*.)

PULSE OF THE PLANET (National Public Radio)
February 11, 2014

Prevention Through Design

When a new product is produced or a new procedure introduced into the work place, how do we know it's safe?

Ambience: Construction

I'm Jim Metzner and this is the Pulse of the Planet.

Deborah Young-Corbett: I'm working in a field called prevention through design.

Deborah Young-Corbett is an assistant professor at the Institute for Critical Technology and Applied Science at Virginia Tech.

Young-Corbett: This is a relatively new field in engineering where the engineers factor in risk reduction into the design process.

So that ultimately their end products will have little or no risks to the end user, the general public and the environment....

This concept of prevention through design is being advocated by the National Institute for Occupational Safety and Health, a federal agency. So that when engineers go out into the workforce and design various things, they will have this in their minds, that they should be thinking about what risks their designs might pose.

...Pulse of the Planet is made possible in part by the National Science Foundation. I'm Jim Metzner.

TEACHING - Roanoke Times - (Continued from page 9)

was sometimes low.

An idea from 2010 came back to the professor, based on a more experimental course he had taught that used in-class exercises and minimized lectures.

"I was impressed by the change that approach brought into the classroom," Kafura said. "It struck me as being more interesting for me, and more interesting for them."

It's a lesson Kafura and doctor-

al student Cory Bart have brought to a new project: developing a computer science course for everyone, even the liberal arts people.

They have put in months of work developing an online, interactive textbook and working out a new teaching model for the course, which is intended to make students, no matter their major, comfortable using big data to answer important questions in their fields....

THE AUTO CHANNEL • July 17, 2014

EcoCAR 2 Team Wins MathWorks Award

NATICK, MA -- July 17, 2014: MathWorks today announced that University of Victoria has won the MathWorks Modeling Award as part of the EcoCAR 2 collegiate engineering competition. The award recognizes the team's use of MATLAB and Simulink for Model-Based Design during the three-year project-based learning

competition where students were tasked with the real-world challenge of reengineering a 2013 Chevrolet Malibu by improving its fuel efficiency and reducing its emissions while retaining its performance and consumer appeal. Other schools to place included Ohio State University and **Virginia Tech**, winning second and third place respectively...

TRAFFIC APP – ComputerWorld UK

(Continued from page 27)

where traffic is likely to snarl and slow a trip.

To build the travel app, university researchers created an algorithm that combines historical and real-time data to predict traffic patterns and congestion, according to Virginia Tech....

"Most people think traffic prediction has been implemented, used long ago, but it's actually new," said **Hao Chen, a Ph.D. candidate at Virginia Tech** and a researcher on the project....

Mapping applications typically rely on mileage and speed limits to predict travel times, and digital traffic warning signs set up beside highways tend to only announce traffic jams that are already happening.

"They don't have the confidence to tell you what will happen," Chen added in a statement. "We can provide on average 95% prediction accuracy for travel time."

Researchers noted that one of the challenges they faced with creating a smartphone app that can predict traffic patterns and travel times is the sheer volume of information needed.

To overcome that, they used cloud computing.

"All the information resides up in the cloud," said **Wu Feng, a professor in the departments of Computer Science and Electrical and Computer Engineering at Virginia Tech**. "An end user merely queries the cloud. The cloud computes the answer and then ships it back to your phone or laptop. The big data simply remains in the cloud."

(Editor's Note: This article also appears in Computer World Singapore online, Linux World online, MIS Asia online.)