

ECE News

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Newsletter of the Department of Electrical and Computer Engineering

GEORGE MASON UNIVERSITY | VOLGENAU SCHOOL OF ENGINEERING | SPRING 2019

"Mason students can join the renewed space race."

Pictured in front of the satellite are Sammy Lin, Aaron Martinez (front row), Brian Smiga, Landon DeCoito, Peter Pachowicz, Jay Deorukhkar, and Keerthan Nukavarapu.



RESEARCH CORNER

CubeSat/SatCom/SpaceCom at ECE

BY PETER PACHOWICZ

The great successes of senior design projects in the Electrical and Computer Engineering Department stimulated the establishment of a new platform for projects that can be continued and contribute to a lasting long-term outcome. Two years ago, the idea of getting ECE students engaged in a space program came to our attention. We've set the long-term goal to develop an interesting new platform oriented toward CubeSats and satellite communication for senior designs and other courses. This goal fits perfectly within the electrical and computer engineering domain and fully relies on hands-on engineering education, student interest, and enthusiasm.

In the first step, we jump-started the development of a satellite communication ground station on the roof of the Nguyen Engineering Building. This ground station enables projects on modern antenna design, satellite tracking, software defined radio receivers, and signal processing and communications. Contactor

work has been completed, and we are building and integrating system components into a ground station configuration. Unlike other academic institutions, our system will rely on our own designs and fabrication of individual components and subsystems adopting the most recent research and practices.

The second aspect of our initiative is to design and build a new satellite bus comprising a Mason CubeSat. Students have already experimented with the development of a transceiver and a power system. Recently, we qualified for the ThinSat Program while partnering with Thomas Jefferson High School and Chantilly Academy students. This program, sponsored by Virginia Space and Twiggs Space Labs, is devoted to bringing space engineering to hands-on STEM (science, technology, engineering, and mathematics) and academic education. Three launch slots have been awarded to the team for the fall 2019 mission. The Mason team will design, build, and integrate the ThinSat payload to carry three experiments in

Continued on page 4

LETTER FROM THE CHAIR



Dear Alumni and Friends,

Two of the most interesting and important topics discussed at the South Eastern Electrical and Computer Engineering Department Heads Association (SECEDHA) meeting in October concerned current enrollment trends in ECE graduate programs and discussion of the difference between electrical engineering and computer engineering. While enrollments in electrical engineering are dropping, enrollments in computer engineering are rising, along with those in computer science. The programs are very different, but both have one thing in common: the word “computer.”

We must do a better job recruiting students into ECE and, more specifically, into electrical engineering. Hot topics and high-paying jobs related to problems in big data, machine learning, and data analytics attract students to computer science and computer engineering programs. At the same time, students interested and excited about the field of robotics end up in computer science or mechanical engineering.

Perhaps we need to tell our story better. We need to let potential students know exactly what electrical and computer engineers do. We need to let them know where our graduates work. We need to tell them our engineers make cell phones, computers, and robotic devices more powerful and useful. Electrical engineering has changed considerably over the past few decades, and some people think that the name is no longer right for the field. They think we should come up with a different name. Changing the name from EE to something else, however, is not feasible, even if there was a better name.

These are all very interesting questions to discuss over coffee, and there are no obvious answers to any of them. Regardless, as ECE department chair at Mason, I am pleased to see the healthy growth in computer engineering enrollments, and I am confident that enrollments in EE will increase again soon. More than anecdotally, I have heard from industry people and our advisory board members that companies can train their employees to write computer programs or teach them how a specific piece of hardware works. What they are looking for is graduates who have strong analytical skills, a breadth of understanding on a variety of engineering topics, and the ability to think creatively and design complex systems—skills that they find in ECE graduates.

I would like to close with a personal note on the retirement of Professor Lloyd Griffiths, who served as dean of the Volgenau School of Engineering from 1997 to 2012. Since stepping down as dean, he has been a valuable member of the ECE Department and an inspiration and role model to our students. Although I first met Lloyd many decades ago at Massachusetts Institute of Technology, our paths did not cross again until I came to Mason in 2014, and, for me, personally, he has been a valuable mentor and a good friend. He will be sorely missed by all of us in ECE. I, along with the rest of the department, wish him well in his pursuit of solar eclipses and peaceful travels with his lovely wife, Arlene. Safe journeys, my friend.

We invite you to follow us on Facebook, and I look forward to sharing more news and stories of our department in the future.

Monson H. Hayes

Chair, Department of Electrical and Computer Engineering

INSIDE

CubeSat/SatCom/SpaceCom at ECE	1
Letter from the Chair	2
William Diehl Continues His Service	3
Tracking Removable Devices	4
New Transdisciplinary Center Focuses on Brain-Body Interactions	5
Lloyd Griffiths Retires.	6
Students Team Up in First-ever Major League Hackathon	7
Second Annual Recruitment Mixer Was a Huge Success	7



ALUMNI PROFILE

William Diehl Continues His Service to Community and Nation through His Academic Career

William Diehl, PhD Electrical and Computer Engineering '18, accepted an offer for a tenure-track position at Virginia Tech and joined the electrical and computer engineering faculty as an assistant professor in Blacksburg, Virginia, in August 2018. Diehl is continuing the line of research he began during his studies at Mason, in which he investigates security applications on reconfigurable platforms for resistance to active and passive side channel attacks, analyzes device signatures for malware or Trojan insertions, and designs countermeasures that can be incorporated into novel microarchitectures suitable for the internet of things (IoT). He also teaches hardware-software codesign, in which students learn to optimize the allocation of algorithms into their most efficient hardware and software manifestations.

ECE News interviewed Diehl to learn about his years before, during, and after Mason.

***ECE News:* Tell us something about your time before Mason.**

WD: Prior to my academic career, I completed a 23-year career in the U.S. Navy, retiring as a captain in 2014. During this time, I served in a number of tactical and strategic positions, including many sea tours, flight assignments in Navy aircraft, and command staffs in the Pentagon and abroad. Between my Navy and academic careers, I worked at General Dynamic Mission Systems—first as a business development senior manager, where I focused on business opportunities in electronic warfare and radio frequency convergence, and later as an FPGA (field-programmable gate array) and firmware engineer working on a major missile and air defense radar project.

***ECE News:* Why did you choose to complete a PhD after your career in the U.S. Navy?**

WD: After a successful military career, I felt it was time to pursue other opportunities. For me, a career in academia was the perfect choice, since it would enable me to continue service to the community, nation, and humanity as a whole, while offering the

best path for lifelong learning and personal improvement. Pursuing a PhD at Mason afforded an excellent chance to immerse myself in cutting-edge research while staying close to the bustling hub of government and industry in the Washington, D.C., area.

***ECE News:* What was your most significant experience while you were pursuing your PhD?**

WD: Teaching core curriculum undergraduate courses was my most significant experience during my PhD program. Although we ultimately complete a PhD based on our attainment of excellence in research and academics, there is no equivalent to the immense responsibility of complete management of a course, from precourse preparations to submission of final grades. College is such a fundamental part of so many people's lives that professors should be humbled to have this opportunity to help shape the world.

***ECE News:* How do you like to spend your "nonwork" time?**

WD: Outside of academic life, I am a credentialed sailing instructor and certified flight instructor. I keep myself busy with learning foreign languages, and I enjoy outdoor activities, such as hiking and mountaineering.

"The entire Mason experience, including teaching and research, provided me the confidence and perspective I needed to decide to continue into an actual academic career."

Tracking Removable Devices

BY BOB OSGOOD

Did you ever wonder if it's possible to see if anyone has plugged a thumb drive into your computer? And should you care? The answer to both questions is "yes." Data can be stolen from a computer, or malware can be placed on a machine, and both of these things can be done using a removable device such as a thumb drive or an SD (Secure Digital) card. SD cards can now hold up to one terabyte of data. In modern Microsoft Windows computers, information gets stored and restored and sometimes restored again. For removable storage devices, also known as USB devices, that data is recorded in several places. One of these locations is the registry. The registry is essentially a database that tracks information vital to the operation of the Windows Operating System. The registry includes USBSTOR, a place where you can find records of USB devices (located in the following directory: System/CurrentControlSet/Enum/USBSTOR). This record can provide the name of the device, its serial number, and the first and last time the device was connected to the system.

We've known about USBSTOR for years. But recently, Microsoft, with Windows 10, introduced a new event log called MWPDP (Microsoft-Windows-Partition%4Diagnostic.evtx, located in the \Windows\System32\winevt\Logs folder). This log acts as a one-

stop shop for information on removable devices. Every time a device is connected or disconnected from a system, a record is generated with details on the removable device. This log entry is placed in the MWPDP log. The log is continually updated, but when a major Windows update occurs, any prior records are destroyed.

Using the Windows Event Viewer, you can see the details of a removable drive that I connected to my computer. It provides the manufacturer, model, serial number, and other information. You should also see this device appear in the USBSTOR records of the System Registry file, but it's not there. It actually shows up in the system registry file under the SCSI key. Information isn't always stored where you think it should be stored. Another way to look at this is with Microsoft's Message Analyzer, a free tool from Microsoft (available at www.microsoft.com/en-us/download/details.aspx?id=44226).

The addition of the MWPDP event log gives us the ability to quickly identify when a device was connected and disconnected from a computer and what the identifying details for that device are.

Sam Blackburn contributed to this report.

CubeSat/SatCom/SpaceCom at ECE, continued from page 1

low earth orbit: a thermal battery shielding against freezing temperatures, a radio frequency spectrum survey for future spectrum allocation, and an efficiency comparison of two satellite power architectures.

As we pursued these initiatives, we learned about another opportunity late last year. A 35-year-old 9.1-meter satellite dish, located on the Fairfax Campus and owned by a private company, was scheduled for demolition unless someone stepped in, developed a utilization plan, and obtained funds in order to secure the dish transfer. The generous donation of this dish and financial support by a subsidiary of the George Mason University Instructional Foundation, as well as a very significant financial contribution provided by the school's corporate partner CACI, made the acquisition a reality. Instead of going to a scrap yard, the dish will serve as a platform for student projects in the areas of satellite communications, space communications, and the

very challenging technical area of Earth-Moon-Earth communications. With renewed interest in space travel and exploration, the dish will allow students to receive, process, and analyze signals from missions to the moon.

In parallel, new courses have been developed and taught, including ECE 580 Small Spacecraft Engineering, ECE 699 Small Satellite Development, and ECE 639 Satellite Communications. These courses serve as a core for a specialization area and a newly proposed graduate certificate. The opening of a hands-on space engineering program was also enthusiastically received by other students who established a Mason Satellite Communications Student Club. The club is engaged in more advanced projects, such as satellite surveillance and a Space Glider using a ThinSat bus. We believe that this recently established program will grow and benefit not only Mason, but also the many local companies with an interest in space engineering.

RESEARCH CORNER

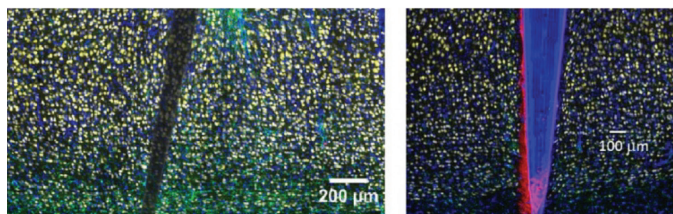
New Transdisciplinary Center Focuses on Brain-Body Interactions

BY STEPHANIE CARMACK

The Center for Adaptive Systems of Brain-Body Interactions (CASBBI) was recently chartered by the provost as one of Mason's Transdisciplinary Centers for Advanced Study. CASBBI's vision is to improve the function and quality of life for individuals with chronic disability. CASBBI focuses on developing multidomain assessments and interventions necessary to address the interrelated biological, physical, and psychosocial systems involved in many disabling conditions. CASBBI combines training initiatives with its research mission to develop the next generation of scientists, engineers, and clinicians.

CASBBI was formed with faculty and students from four academic units: the Volgenau School of Engineering, the College of Humanities and Social Sciences, the College of Health and Human Services, and the College of Science. It includes experts in engineering, neuroscience, physics, computer science, psychology, and rehabilitation. Engineering is represented by Nathalia Peixoto, associate professor in the Department of Electrical and Computer Engineering; Parag Chitnis, assistant professor in the Department of Bioengineering; Siddhartha Sikdar, CASBBI's director and professor in the Department of Bioengineering; Michelle Harris-Love, associate professor in the Department of Bioengineering; Zoran Duric, associate professor in the Department of Computer Science; and approximately 20 undergraduate, graduate, and postdoctoral fellows.

The center's members integrate their knowledge to inform novel interventions and translate solutions into practice. CASBBI's core methodological capabilities are in multiscale neuromodulation and neuroimaging, human machine interactions, sensorimotor integration, and human movement. CASBBI researchers explore



Nathalia Peixoto's group is investigating the biocompatibility and functional properties of novel-coated implantable neural electrodes.



Siddhartha Sikdar's group has developed novel wearable ultrasound systems that enable fine proportional positional control, a significant advancement in dexterity for prosthetic devices. Photo by Evan Cantwell

adaptive changes in the brain, body (sensorimotor and neuroimmune systems), behavior, and physical and social environments, and the interactions between these areas in chronic disability, such as mobility impairments, substance use disorder, and chronic pain.

Several team-based projects within the framework established for CASBBI are already under way. CASBBI researchers are identifying mechanisms of motor recovery following stroke, spinal cord injury, and amputation. Several lines of research are exploring ultrasound imaging applications in rehabilitation. For example, researchers are developing wearable ultrasound sensors for lightweight exoskeletons and prosthetic devices with new paradigms for assistive control. Ultrasound imaging has also been used by CASBBI researchers to objectively characterize physical dysfunction and clinical interventions in chronic pain.

Another active research area is the development and characterization of novel materials for neural interface technologies. Recently, CASBBI researchers have begun investigating the use of technology such as novel wearable sensors, smartphone applications, and advanced data analytics to empower communities of recovery around individuals with substance use disorder.

CASBBI welcomes new student and faculty members and external partners as we build a community of convergence research on chronic disability. For more information, please visit our website at casbbi.gmu.edu or contact Stephanie Carmack at scarmac@gmu.edu.



FACULTY CORNER

Lloyd Griffiths Retires

Lloyd Griffiths was the dean of the Volgenau School of Engineering at George Mason University from 1997 to 2012. Since then, Griffiths has been a faculty member in the ECE Department, where he has taught courses in digital signal processing, adaptive systems, and cyber-physical systems security. This spring he will retire.

ECE News spoke with Griffiths (pictured with his wife, Arlene) about his years at the Volgenau School as dean and faculty member.

***ECE News:* In what year did you become a faculty member at George Mason?**

LG: I became a faculty member at Mason when I became dean of the school in 1997. My previous position was at the University of Colorado in Boulder, where I had served as chair of [their] ECE department.

***ECE News:* What do you view as your most significant accomplishment(s) during your time at Mason?**

LG: I think the most significant accomplishment was developing strong ties between our school and local industry. We did this by identifying key business leaders and encouraging them to become involved to help our school grow and strengthen. Many of these people did not graduate from Mason, but they wanted to help us by becoming involved. We invited the best of them to accept a position on our advisory board with the understanding that we needed not only their advice and their counsel, but—equally important—we needed their financial support. Philanthropic investments by Ernst Volgenau, the Nguyens, Sid Dewberry, and numerous others have enabled us to build a very strong engineering school in spite of minimal state support.

One very significant event for me, personally, was being honored with an endowed scholarship in my name. This scholarship continues to grow. It became fully endowed in 2012 and has been used to support a number of outstanding students over the years. I am very proud to have my name associated with this scholarship.

***ECE News:* What have you found to be the most rewarding part of being a faculty member in the ECE Department?**

LG: I have enjoyed working with our faculty, our students, and our alums. I particularly enjoy the interaction with students in my classes. We are now attracting top-level students to our school. It has been a distinct pleasure to work with them.

***ECE News:* What is your funniest memory of your time at Mason?**

LG: During my tenure as dean, we made a few videos to help interest outsiders in our school. One of these was of a motorcycle drag race on a street next to our building. I was on my Harley and [former Mason] President Merten was in an electric golf cart. The race started out predictably, with me pulling out well ahead of the president. But then, there was a loud roar, and the golf cart literally flew past me to win the race—the cart had some type of supercharger. One obvious conclusion for me was that I should definitely not pursue a career in movies. There is a video of the race online at bit.ly/2RFFbwE.

***ECE News:* Where do you think George Mason and the ECE Department will be in the year 2035?**

LG: I expect by then the school will have grown to a position of national recognition as one of the leading engineering programs in the country. This is no easy feat, and it will require a major effort from all of us. However, given the advances that we have already made and continue to make, it is an achievable goal.

***ECE News:* What are your plans for retirement?**

LG: I'd like to do the usual kinds of things—some travelling, learning to hit a golf ball in the direction I intend it to go, visiting our five grandkids, and reconnecting with friends I haven't seen for a while.

***ECE News:* Did we miss anything that you'd like to share?**

LG: I expected a question on the “rap” convocation speech that I gave in 2012. I can no longer recall exactly why I did this, but once is thankfully enough—some would rightfully say “too much.” It was scary, to say the least, but I did have fun doing it. I would like to thank Michael Nickens for all of his help and support. He was my musical accompaniment. Doc Nix is a world-class tuba player. He is also a very kind and patient man. You can view the video at bit.ly/2RCXuHA.

ECE NEWS

Students Team Up in First-ever Major League Hacking-sponsored Hackathon

BY MARTHA BUSHONG

Students, faculty, and alumni attended George Mason University's first-ever hackathon—PatriotHacks—in the fall of 2018.

The event, a programming marathon, allowed aspiring developers to choose, design, and implement a unique software or hardware application. Specific themes and challenges were presented to competitors. While working on their projects, students enjoyed snacks, networked, attended workshops, and won awards.

PatriotHacks was the vision of computer engineering student Afnan Ali and information systems and operations management student Jonathon Vega. The two students wanted to organize Mason's first-ever hackathon that would be endorsed by Major League Hacking (MLH).

When Vega and Ali pitched their idea to Vice President of Entrepreneurship and Innovation Sean Mallon and Mason Engineering's Executive Director of STEM

Outreach Kammy Sanghera, the engineering students described a first-of-its-kind hackathon open to students of all disciplines from colleges and universities in Northern Virginia, Maryland, and Washington, D.C., as well as Northern Virginia Community College.

"The best ideas often come from people who think differently from each other and who have a different perspective to share," Mallon says. "We hope PatriotHacks can bring people from around Mason and the D.C.-metro area together."

The weekend-long competition culminated with an impressive 33 projects entered for judging. An internet-of-things smart trash can that automatically sorts different types of waste into specific categories won the prize for Best Sustainability Hack. An immersive lecture won the prize for Best Hardware and Best Virtual Reality. This project allows students to interact with objects in virtual space, making abstract objects more concrete.



Students Afnan Ali and Jonathon Vega served as catalysts for PatriotHacks.

Local sponsors, including Accenture, CACI, Verizon, Balsamiq, GitHub, Nova Systemic, and Booz Allen Hamilton, helped fund and send representatives to the event. In addition to support from MLH, university sponsors included Mason's Office of Entrepreneurship and Innovation, the Volgenau School of Engineering, the College of Science, and the Mason Game and Technology Academy.

Students, sponsors, volunteers, and organizers look forward to hosting another hackathon next year and possibly adding tracks for medicine and healthcare, and arts and entertainment.

When asked if he would do this again, Ali said, "300 percent yes. I'm excited to do this again next year and have even heard requests from students asking we do it again next semester."

MORE ABOUT LLOYD GRIFFITHS

Griffiths received his undergraduate degree in electrical engineering from the University of Alberta in Edmonton, Canada. He received his MS and PhD in electrical engineering from Stanford University. He is a fellow of the IEEE and has been recognized with the IEEE Browder J. Thompson Memorial Prize Paper Award. He currently sits on the board of directors of a few privately held, early-stage companies, which have been established in areas that he has a strong personal interest in.

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Second Annual Recruitment Mixer Was a Huge Success

Senior ECE students, company representatives, alumni, advisory board members, administrators, and faculty and staff attended the department's second annual mixer on the evening of September 19, 2018, in the Johnson Center's Dewberry Hall on the Fairfax Campus. Representatives from 28 companies set up their display materials and joined a reception before the students arrived. The representatives recruited students for internships and permanent positions for a variety of jobs ranging from hardware design and testing, telecommunications services, power systems, cloud services, and software engineering.

Prior to the mixer, faculty members and advisors encouraged students to prepare and fine-tune their resumes, and many students received feedback from their engineering seminar instructors, career services staff, and employers-in-residence. This preparation allowed the students to use their time productively and engage with alumni, company representatives, and other attendees.

The ECE Department would like to acknowledge the companies who attended the event. We look forward to seeing them again next year.

Accenture

Amplus Energy Solutions

BAE Systems

Booz Allen Hamilton Inc.

Caron Technology

Deloitte

Dominion Energy

Expedition Technology Inc.

General Dynamics

GeneSiC Semiconductor Inc.

Hughes

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