

The logo for ECE (Electrical and Computer Engineering) is displayed in a large, white, lowercase sans-serif font. The background of the entire poster features abstract, overlapping geometric shapes in shades of maroon, orange, and teal, with a fine dot pattern.

4805/4806

Major Design Experience Expo

Wednesday, December 11, 2019
The Inn at Virginia Tech





The Major Design Experience (MDE) provides the culminating experience for each of our participating undergraduate and graduate students. Each student draws from the totality of their learned technical, communications, and teamwork knowledge and skills to solve meaningful challenges for one exciting, real-world project.

The ECE MDE Expo showcases the results of 23 students, each working and learning together as part of a design team for two full semesters. Each of these exciting projects provided a student team with its own set of unique, open-ended, technical challenges defined by our industry partners; and each team has engineered its own solution with facilitation from our faculty subject matter experts. Whether a student's career interests take them to work in industry, to continue towards an advanced degree, or to pursue roles in our national labs, their MDE capstone will influence much of their approach to making contributions to their technical communities and, more broadly, throughout society.

Today's ECE MDE Expo offers us a new format intended to enhance our focus on each project team's outcomes and results. We hope you will also enjoy the new format. Once you've seen today's demonstrations, posters, and technical presentations, I think you will agree that our students have learned much and have delivered some very inspiring and useful projects.

Six of seven projects have external corporate partners providing support, with five of those also defining the project needs and serving the role of the customer. This is complemented with continued support from Virginia Tech internal sponsors and their own project needs. This September, as part of our periodic ABET accreditation review, the Major Design Experience was specifically cited as a strength within our undergraduate EE curriculum. This would not have been possible without the support of our industry partners, our subject matter experts, and a host of other professionals committed to providing our students with these exceptional educational engineering experiences. Thanks to all.

Congratulations to each of the students; their dedication and diligence are evidenced in these seven projects. On behalf of these students, and from me personally, thanks again to our industry sponsors, our subject matter experts, and our MDE faculty for their tremendous support in developing our next generation of engineers.

Luke Lester

Professor and Department Head
Bradley Department of Electrical and Computer Engineering

Welcome to the Fall 2019 Bradley Department of Electrical and Computer Engineering's Major Design Experience Expo. Thank you for attending today and sharing this important milestone in the development of these fine young engineers. Today is a celebration of the achievements of 23 students diligently working on seven diverse industry challenges.

The goal of the MDE program is to provide our ECE students a "real-world" challenge problem at scale and in context, requiring them to draw from their previous learning and life experiences. The problems are open-ended and ambiguous, drawn from our sponsors, who interact as the customer with a student design team. Just like a new hire in a company, the students are assigned to an engineering team, which is expected to generate a project plan and then execute that plan to deliver quality results. Throughout two semesters, the team is guided in technical matters by the subject matter experts, and mentored by the instructors in a host of professional and business skills, including communications, teamwork, metrics, professionalism, company values, and ethics. By working in teams, the students improve their leadership and group interpersonal skills while dealing with unanticipated scheduling conflicts and still meeting their product deliverables. Students are responsible for managing the customer relationship and for solving each of the real-life issues that undoubtedly will arise.

Those who have participated in the past may notice our name change, but that's not all that has changed. Program changes provide the students a better opportunity to showcase the details of their project results. The students are encouraged to demonstrate their actual project on site or with video of the system in action. Their scheduled presentations will be broken out in parallel tracks to allow time for a technical overview of their results and will include questions from a review panel and, time permitting, from the general audience.

MDE is made possible with the dedicated support of our sponsors and subject matter experts, whom we offer our most sincere appreciation. Thank you for your commitment to shaping and enhancing Virginia Tech ECE students as they prepare to embark on the next stage of their journey to make the world a better place by engineering and delivering meaningful solutions.

The MDE program would like to thank Luke Lester for his vision in creating and continuing to support the MDE program. Our gratitude goes to Gino Manzo for stepping forward and building a solid foundation with the initial offerings that shape the MDE program. Thanks to Gino, Toby Meadows, and Ken Schulz for your continued support of the program and for sharing your wealth of industry experience and expertise with each of the students in the MDE program. Because of each of you, we are better indeed!

Finally, to our 23 outstanding students, thank you for embarking upon and embracing the uncertainty of your MDE experience. The future depends upon you, the next generation of engineers, envisioning, engineering, and creating those new technologies that represent your contributions to the world of our collective tomorrow.



J. Scot Ransbottom
Director of Design Projects



PROGRAM

Registration 11:00 - 11:30

Welcome 11:30 - 11:45

Presentations 12:00 - 1:00

	Track 1	Track 2
12:00 - 12:15	General Motors/Virginia Tech Transportation Institute (VTI) - Virginia Connected Corridor Cybersecurity	Collins Aerospace - Wireless Aircraft Refueling Transmitter & Display Application
12:15 - 12:30	Virginia Tech Facilities & Virginia Tech Division of Information Technology - Lane Stadium Customer Experience: Concession Counting Sensors	Virginia Tech ECE - Long-Range Radio Transmitter for a Sub-Orbital Sounding Rocket
12:30 - 12:45	Steelcase - LoRa-Enabled GPS Tracking Device for Trailers	Zeta Associates - Personal Locator Beacon System
12:45 - 1:00		SAIC - Subsea Live Feed Stereo Camera System

Lunch, Review Posters 1:00 - 2:00

Awards 2:00 - 2:15

All guests are requested to vote for Best Poster. **Every vote counts.**

Sponsors

We greatly appreciate their support.



Project Leadership

This class is only possible because of the commitment, dedication, and spirit of the following customers and subject matter experts. Thank you!

Sponsor	Customers	Project	Subject Matter Expert (SME)	Page
Collins Aerospace, Rockford, IL	Mark Bellinger, Tom Wiegele	Wireless Aircraft Refueling Transmitter & Display Application	Peter Han	7
General Motors, Detroit, MI (Virginia Tech Transportation Institute (VTI) facilitated)	Clark Gaylord	Virginia Connected Corridor Cybersecurity	Clark Gaylord	8
SAIC, San Diego, CA	Sean Herndon	Subsea Live Feed Stereo Camera System	Dan Stilwell	9
Steelcase, Grand Rapids, MI	Edward Vander Bilt	LoRa-Enabled GPS Tracking Device for Trailers	Mike Buehrer	10
Virginia Tech ECE, Blacksburg, VA	Glenn Rosenthal	Long-Range Radio Transmitter for a Sub-Orbital Sounding Rocket	Scott Bailey	11
Virginia Tech Facilities & Virginia Tech Division of Information Technology, Blacksburg, VA	Scott Fritz, Thomas Weeks	Lane Stadium Customer Experience: Concession Counting Sensors	Scot Ransbottom	12
Zeta Associates, Fairfax, VA	Benjamin Beasley, Michael Drescher, Stephen Kralick	Personal Locator Beacon System	Louis Beex	13

In addition to our project sponsors and subject matter experts, there were many others who contributed to the success of this cohort in the classroom. We want to take this opportunity to express our deep-felt appreciation and thanks for their contributions.

Guest speakers in order of appearance:

William Baumann **Virginia Tech - ECE**
Director of Instructional Labs

Grant Brewer **Virginia Tech - LINK**
Associate Director for Technology Commercialization

Andrian Jordan **NAVAIR**
NAVAIR Information Processing Display Branch Head for Aircraft and UAVs

Jason Piche **Virginia Tech - LINK**
Director of Technology Commercialization

PROJECT TEAMS

Wireless Aircraft Refueling Transmitter & Display Application



CHALLENGE

Our team was challenged with digitizing old analog refueling systems by developing a guided user interface that reads data wirelessly from a pressure transmitter and is powered by a solar panel and a super capacitor.

LEFT TO RIGHT: Michael Dill, Kristen Seals, and Jiahuan Yang | SME: Peter Han

Michael Dill Lynchburg, VA

Bachelor of Science in Electrical Engineering

Aspirations: I hope to contribute to electrical engineering through research and work in the controls field.

Class comment: I was happy to apply real-world process-engineering principles to the knowledge and tactics that I have learned during my time at Virginia Tech.

Kristen Seals Chesapeake, VA

Bachelor of Science in Electrical Engineering

Aspirations: I am looking to pursue a career in PCB design, and I have an interest in working with power systems. The perfect career for me would be one where my work helps people since that is one of the main reasons I want to be an engineer.

Class comment: I appreciate how this class gave my team the opportunity to work with a real customer to utilize what we have learned, including the engineering approach.

Jiahuan Yang Zhuhai, China

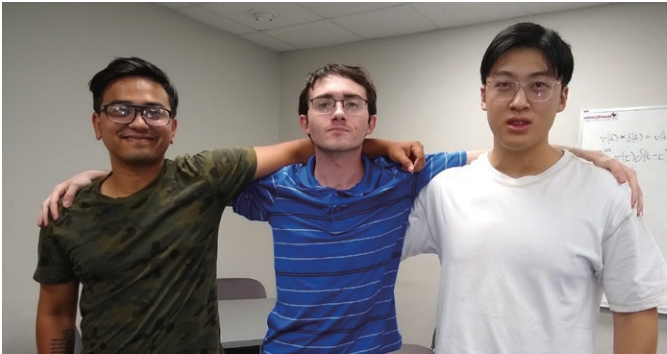
Bachelor of Science in Electrical Engineering

Aspirations: I want to enter into the semiconductor and integrated circuit domain in the future, but at this very moment, I need to have more theoretical understanding of the domain I am interested in.

Class comment: This class gave me the precious experience of cooperating with other people to identify, think through, and solve engineering problems. This class also allowed me to see the types of difficulties I may encounter during my career.

PROJECT SPONSORS: MARK BELLINGER, TOM WIEGELE

Virginia Connected Corridor Cybersecurity



CHALLENGE

Develop a HackRF radio-based device (Raspberry Pi) for transmitting and receiving DSRC packets. Provide a datasheet for HackRF and Raspberry Pi. Analyze message patterns in VT-TI's BSM database.

LEFT TO RIGHT: Riasat Zaman, Eamon Heaney, Hangming He | SME: Clark Gaylord

Riasat Zaman Sterling, VA

Bachelor of Science in Electrical Engineering

Aspirations: I plan on pursuing a career in the semiconductor industry to build shorter (<4nm) silicon semiconductors.

Class comment: This class gave me an opportunity to work on a real-world engineering project. I learned some valuable lessons like problem solving, project management, communicating with employer/customer, and working with professional engineers.

Hangming He Hangzhou, Zhejiang, China

Bachelor of Science in Computer Engineering

Aspirations: I desire to be a well-rounded software engineer.

Class comment: I appreciated the real-world professional experience of working as a team and communicating with customers. The technical knowledge of DSRC and SAE J2735 gained was also valuable.

Eamon Heaney Fairfax, VA

Bachelor of Science in Computer Engineering

Aspirations: I will be attending law school next fall hoping to become a criminal defense attorney.

Class comment: I'm grateful for the opportunity to experience the engineering design process in a real, comprehensive way before I go into the workforce.

PROJECT SPONSOR: CLARK GAYLORD



VIRGINIA TECH
TRANSPORTATION INSTITUTE

Subsea Live Feed Stereo Camera System



CHALLENGE

Our project requirements are to build a sub-sea stereo camera system with a 180-degree field of view and the ability to use VR goggles to see through the stereo camera.

LEFT TO RIGHT: Sifei Ji, Yuan Mao, Christian Ciraco | SME: Daniel Stilwell

Sifei Ji Shanghai, China

Bachelor of Science in Electrical Engineering

Aspirations: I plan to learn and work with signal and communication systems.

Class comment: This class provides us a precious opportunity to deal with a real-world problem. I could apply what I learned from the previous class into the project and understand the lesson more deeply.

Christian Ciraco Mississauga, Ontario, Canada

Bachelor of Science in Electrical Engineering

Aspirations: I am an aspiring power engineer interested in power distribution and renewable energy sources.

Class comment: I appreciated working with outside customers and consulting with them on their desired specifications to reach a desired solution.

Yuan Mao Xi'an, Shaanxi, China

Bachelor of Science in Electrical Engineering

Aspirations: I want to be an Electrical Engineering who has a specialty in semiconductor and power systems.

Class comment: I really appreciate that Virginia Tech provides this two-semester long group design project for us. It's very helpful for us to familiarize ourselves with what will be facing in our future careers. Our mentor helped us a lot during the whole design and build process. We also learned how to solve the problem as a team, how to support each other, and how to help each other.

PROJECT SPONSOR: SEAN HERNDON

LoRa-Enabled GPS Tracking Device for Trailers



CHALLENGE

Steelcase Inc. wants to reduce the time it takes to locate trailers in their parking lot to ensure they uphold the Perfect Order. Our solution was to attach a LoRa-enabled GPS device to the trailer and send/display its coordinates on any internet-enabled device.

LEFT TO RIGHT: Joshua Paragas, Andrew Parker, Navid Nassiri, Tanner Paschal | **SME:** Mike Buehrer

Joshua Paragas Forest, VA

Bachelor of Science in Electrical Engineering

Aspirations: I am currently interested in working with the maintenance and improvements of the power grid.

Class comment: I acknowledge the usefulness in working with a professional and experiencing the trials that come with developing our own product.

Andrew Parker Westminster, MD

Bachelor of Science in Electrical Engineering

Aspirations: I plan to get a master's degree in electrical engineering with a focus on power engineering and work in the power generation industry.

Class comment: I learned that it is better to find a new solution than to keep trying a solution that is not working as it should.

Navid Nassiri Alexandria, VA

Bachelor of Science in Electrical Engineering

Aspirations: My career aspiration is to become an expert in power system protection. After graduation, I will join an engineering company that provides services to electric utility and industrial customers.

Class comment: I appreciate the professional experience that is provided by this class and the opportunity to work on a real-world problem, applying what I learned in my classes at Virginia Tech.

Tanner Paschal Chilhowie, VA

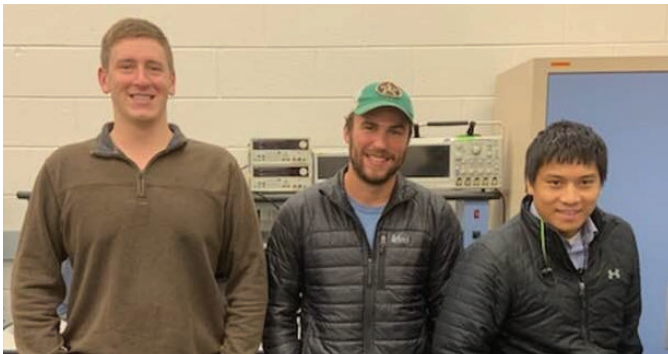
Bachelor of Science in Electrical Engineering

Aspirations: I aspire to become the best engineer I can be, all while learning as much as I can throughout my career.

Class comment: I value the engineering experience that allowed me to work on a real-world problem. The course was able to give me experience that some other courses cannot give.

PROJECT SPONSOR: EDWARD VANDER BILT

Long-Range Radio Transmitter for a Sub-Orbital Sounding Rocket



CHALLENGE

Design, build, and test a telemetry radio for long-range transmission from a sounding rocket.

LEFT TO RIGHT: Paul Mourges, Isaiah Bernard, Monty Noblezada | SME: Scott Bailey

Paul Mourges Stanwood, WA

Bachelor of Science in Electrical Engineering

Aspirations: I am looking to develop power electronic/avionic systems for space and military systems.

Class comment: I appreciated the opportunity to work on a project I was passionate about and, with the support of Virginia Tech, design it and bring it to life.

Isaiah Bernard Callaway, VA

Bachelor of Science in Electrical Engineering

Aspirations: I plan on working in the construction field with an MEP design firm.

Class comment: I enjoyed learning and having an experience in the field of electrical engineering, which I do not plan on having a career in.

Monty Noblezada Ashburn, VA

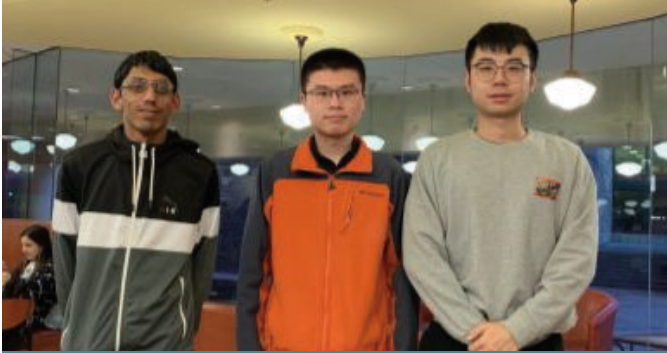
Bachelor of Science in Electrical Engineering

Aspirations: I would like to engineer a better future for humanity while having fun.

Class comment: I enjoyed the freedom to design a solution to an interesting real-world problem from scratch without having to worry about funding. I learned about teamwork and designing software-defined radios.

PROJECT SPONSOR: GLENN ROSENTHAL

Lane Stadium Customer Experience: Concession Counting Sensors



CHALLENGE

Develop sensor system to monitor concession line size. The proof of concept will provide fans and stadium management real-time data for line length at two or more concession stands. The data will be presented on a webpage and saved in the cloud service for stadium operations and fan experience improvement.

LEFT TO RIGHT: Luke Francis, Yijie Bai, Yifei Wang | SME: Scot Ransbottom

Luke Francis Alexandria, VA

Bachelor of Science in Computer Engineering

Aspirations: In the future, I would like to pursue a career in software design.

Class comment: This class gave me experience applying my skills to a real-world application and developing myself in a professional setting. It made me appreciate the value of doing the small things right.

Yijie Bai Beijing, China

Bachelor of Science in Electrical Engineering

Aspirations: As a student of both electrical and computer engineering, I would like to apply my skills from both areas to graduate research in power electronics.

Class comment: I appreciate that this course allowed me to experience a real-world project—from writing a proposal to final delivery. Among all the skills I have learned from this course, communication skills and project management skills were the most valuable.

Yifei Wang Shanghai, China

Bachelor of Science in Electrical Engineering

Aspirations: I aspire to be a professional electrical engineer and help improve people's lives.

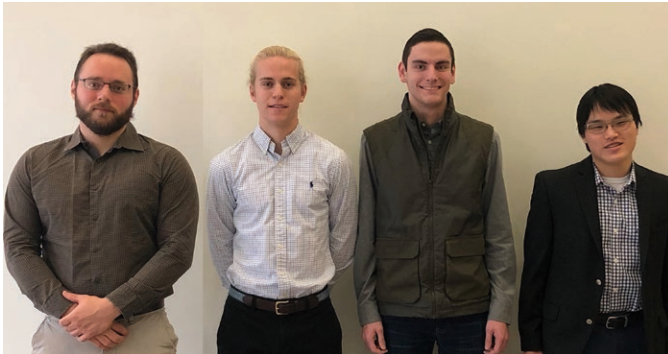
Class comment: The real-world experience provided by this class has taught me a lot. Currently, we are delivering our Phase II to our customers. This experience has taught me that you have to be prepared for every situation because every event in the real world has a risk of failing. It is never too late to have a backup plan for every critical path.

PROJECT SPONSORS: SCOTT FRITZ, THOMAS WEEKS



THE DIVISION OF
INFORMATION TECHNOLOGY
VIRGINIA TECH.

Personal Locator Beacon System



CHALLENGE

Personal Locator Beacons (PLBs) are used around the world to summon emergency search and rescue assistance. This project aims to design, build, and test a PLB system comprised of both GPS tracked beacons and a receiver.

LEFT TO RIGHT: Aaron Giuffré, Paul O'Horo, Aaron Olinger, Jonathan Marshall | SME: Louis Beex

Aaron Giuffré Wyckoff, NJ

Bachelor of Science in Electrical Engineering

Aspirations: I plan to attain competence in many areas of the bio-medical engineering and biotechnology fields including the interface between computers and the human brain.

Class comment: This class is one of the few opportunities where students are released from rote education to follow their own creativity and technical curiosity, building further upon the foundation of years of organizational and technical refinement.

Paul O'Horo Colts Neck, NJ

Bachelor of Science in Electrical Engineering

Aspirations: I want to work in the power and energy industry after graduating in May. I hope to improve our society through renewable energy and smart grid technologies.

Class comment: I enjoyed the freedom of the design experience and the aspect of working for and reporting back to our customer.

Aaron Olinger Roanoke, VA

Bachelor of Science in Electrical Engineering

Aspirations: I am pursuing a degree in electrical engineering with a focus on controls, robotics, and autonomous systems. I would like to work in industry on drive trains and advanced automation systems.

Class comment: It was great having a team mentor who had a wide range of experiences from working in industry for decades and was able to give suggestions and pointers on everything from project proposals to the final poster.

Jonathan Marshall Richmond, VA

Bachelor of Science in Electrical Engineering

Aspirations: I plan to attend law school to become a patent attorney.

Class comment: I am glad I got the chance to apply what I've learned at Virginia Tech to solve a real-world problem.

PROJECT SPONSORS: BENJAMIN BEASLEY, MICHAEL DRESCHER, STEPHEN KRALICK

Many others significantly contributed to the success of the MDE program. We want to take this opportunity to express our deep-felt appreciation and thanks for their contributions. Special thanks to:

Luke Lester

for his vision and continued unyielding support to make this class available for students.

Scot Ransbottom, Gino Manzo, Toby Meadows, and Ken Schulz

for being our assistant instructors, mentoring teams, and making the class better.

Greg Atkins

for maintaining our outstanding class website.

Mary Brewer, Nicole Gholston, Kimberly Johnston, JoAnna Lewis, Susan Broniak, Minerva Sanabria, Jamie De La Ree, Paul Plassmann, and Laura Villada

for setting up information sessions and guiding students into the class.

William Baumann

for allowing us complete access to the design studio, conference room, and assistance to students in need.

Karin Clark, Lisa Young

for being our partners and diligently working to secure us industry sponsorships.

Arthur Ball

for integrating the masters students into our class and providing them ongoing guidance.

Kim Medley

for ordering our materials and helping us solve supplier issues.

Kathy Atkins, Melanie Gilmore

for providing financial guidance and support.

Roderick DeHart, John Ghra, and Brandon Russell

for solving our many IT issues and printing the poster papers in a short time.


Bianca Norton and the staff of the Inn at Virginia Tech

for helping plan, cater, and secure all arrangements for the ECE MDE Expo.

Special thanks

Amrita Chakraborty

for providing unwavering support to the class, the students, and the instructors and keeping this massive machine working.



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