NC STATE Engineering

Fall **2021**

# MAETRIX

# MAE **AT A GLANCE**

## 2020-21 QUICK FACTS

### RESEARCH EXPENDITURES

**$13 MILLION PER YEAR**

More than $7 million in external funding
(Federal, State and Industry)

**49** TENURED AND TENURE-TRACK FACULTY MEMBERS
**23** Full; **13** Associate; **13** Assistant

**6** FULL-TIME NTT TEACHING FACULTY MEMBERS

**6** PART-TIME TEACHERS AND RESEARCHERS

### RESEARCH CONCENTRATIONS AND FACULTY MEMBERS

**Aerodynamics, Fluid Mechanics, Propulsion and Space Explorations Systems**

Bryant, Echekki, Edwards, Ewere, Ferguson, Gopalarathnam, Gould, Granlund, Hall, Kleinstreuer, Luo, Lyons, Mazzoleni, Narayanaswamy, Narsipur, Reyhanoglu, Saveliev, Silverberg, Subbareddy, Vermillion

**Dynamics, Vibrations, Controls and System Design**

Bryant, Buckner, Ewere, Ferguson, Granlund, Hall, Jing, Keltie, Mazzoleni, Peters, Reyhanoglu, Saul, Silverberg, Strenkowski, Tran, Tu, Vermillion, Wu, Xu, Yuan

**Structural Mechanics, Materials and Manufacturing**

Dow, Eischen, Ewere, Huang, Jiang, Keltie, Mazzoleni, Muller, Ngaile, O'Connor, Pankow, Peters, Rabiei, Ryu, Silverberg, Strenkowski, Tu, Wu, Xu, Zhu, Zikry

**Thermal Sciences and Energy Systems**

Echekki, Ewere, Fang, Gould, Kribs, Kuznetsov, Liu, Lyons, Mazzoleni, Moore, Narayanaswamy, O'Connor, Saveliev, Silverberg, Terry, Tu, Vermillion

**Biomedical and Biological Systems**

Buckner, Huang, Jiang, Kleinstreuer, Kuznetsov, Mazzoleni, Muller, Saul

**Nanoscale Science and Engineering**

Chang, Jiang, Jing, Liu, Ryu, Zhu

### UNDERGRADUATE

**1,208** Total number of undergraduate students

**3.49** Average undergraduate GPA

**367** Degrees conferred

**912 ME / 296 AE** Undergraduate students

**351** MAE intended engineering first-year undergraduates

### GRADUATE

**496** Total number of graduate students

**3.5** Average graduate GPA

**119** Degrees conferred

**169** Ph.D. students

**117** Aerospace graduate students

**352** Mechanical graduate students

**159** Master's degree students on campus

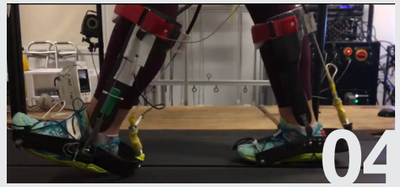
**140** Online master's graduate students

**5.6** Average GPA for graduate admission

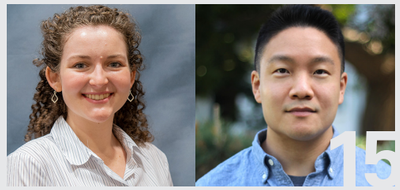
### RANKINGS

- ***U.S. News and World Report:***
  ME ranked 37th of 184 graduate programs;
  AE ranked 29th of 66 graduate programs
- **College Choice:**
  - ME graduate program ranked 22nd of 35 for Best Master's in ME
  - ME ranked 5th of 15 for Most Affordable Online Master's
- **SR Education Group's Top 25 Best Online Master's:** ME master's program ranked 14th

# IN THIS ISSUE





# 02

# UPDATE FROM THE **DEPARTMENT HEAD**

Dr. Srinath V. Ekkad

DEAR FRIENDS, STUDENTS, AND ALUMNI OF MAE AT NC STATE UNIVERSITY,

There is nothing I can say more than that it has been a strange year for all of us. Last Fall, we started the university in a cautious but normal mode and quickly had to revert back to online activities. We have maintained our online teaching and work for the entire academic year since then. Our faculty has worked hard to ensure that our students continue to be trained as well as they could be, given the situation. In the Spring semester, we brought back in-person activity in our undergraduate laboratories and also ensured an in-person experience for our senior design students. Our senior students received the capstone experience of building their senior design projects, a process that we are immensely proud of. We had a very successful Spring semester with the students demonstrating their senior projects to their sponsors and winning kudos for their work. We are continuing to transform the department and the student experience in an effort to produce the best ME and AE engineers in the country who are ready to face any engineering challenge that is out there. Our student design teams have performed excellent this past year. All of them are now housed in either EBIII or in the High Bay building behind EBIII. A few weeks back, the NC State Pack Motorsports Formula SAE team attended the Formula SAE Nevada competition at the Las Vegas Motor Speedway in Nevada, earning them an overall finish of 2nd place for the competition. The Pack Motorsports Baja team recently attended competition in Louisville, Kentucky. Their successes began well before any Dynamic Events occurred, with their vehicle passing Tech Inspection on the first day and the team finished 14th overall. I wanted to also make you aware of recent successes by the NC State High Powered Rocketry Club, out of the Aero Program in the MAE Department. They had a 5th place Overall finish. Our AIAA Design, Build, Fly (DBF) team also did very well this past year and placed at 16th overall. Our student successes are celebrated in this newsletter with more details and also stories of individual accomplishments.

In the past year, we have been able to recruit five new faculty members to the department. Their details are in the newsletter. In the process, we have also focused on increasing diversity among the faculty ranks. We now have 10 female faculty members, two African American faculty members and two Native American faculty members in the department. To my knowledge, we may be the only engineering department in the nation to have two Native American faculty members. More details on our diversity, equity and inclusion initiatives are shared in the newsletter. Dr. Chuck Hall retired this year after 30 years of service. We wish him well in his retirement.

The infrastructure growth has continued with the MAE West research labs active since early Spring. The Supersonic Tunnel, a new NASA subsonic tunnel, the water tunnel and combustion test rigs have all moved to MAE West and are fully functional. The department will be investing in a new hypersonic test facility and a Hot Press that will provide our faculty members additional tools to build on their existing research programs. More details on our research expansion is provided in detail. We have also invested in a new student design and innovation center, the senior design labs and student team areas in Engineering Building III.

MAE@NCSU is on the move and we hope to lay claim to being one of the largest and the best Mechanical & Aerospace Engineering programs in the nation. As we look forward, we want you to be a partner in the success of the department. Please come and join us and help us accomplish more.

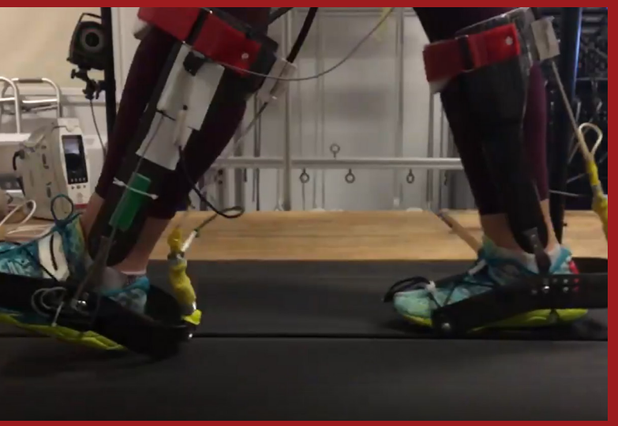
As we plan to come back to normal after COVID-based restrictions for the past 18 months, we are prepared to welcome back our students to campus and classrooms. NC State has made detailed arrangements to ensure the safety of our students, faculty and staff and be ready for Fall semester to start. Our students are excited to come back to face-to-face classes and interact with their classmates and faculty members as they continue their education. I personally am excited to see the campus bustling again with activity and interacting with the students. However, we are still not out of the woods on this pandemic. We will continue to watch the situation and be ready for anything that requires us to recalibrate and continue to provide the best possible education to our students.

We hope you continue to keep yourself updated with our MAE news. We are constantly updating our website and through this newsletter, tell a few in-depth stories. If you ever want to stop by and visit, please email me at **sekkad@ncsu.edu**.

Best Regards,
Srinath V. Ekkad
**Department Head and R.J. Reynolds Professor**

# 04

# RESEARCH **HIGHLIGHTS**



Exoskeleton to provide assistive ankle power.

# Research Highlights

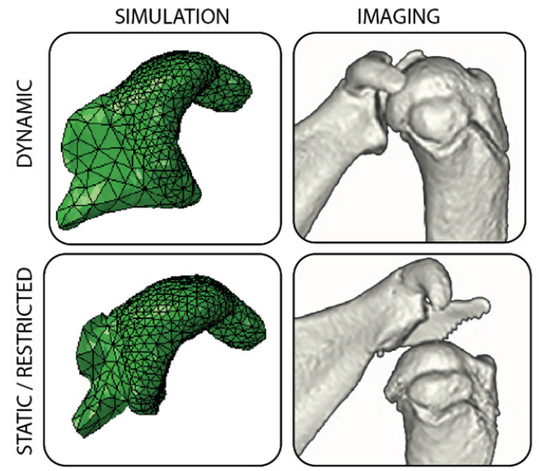
## Movement Biomechanics Laboratory

**DISEASES AND INJURIES TO BONES, JOINTS,** nerves, and muscles, are extremely prevalent. Neuromuscular and musculoskeletal conditions significantly limit movement — including mobility and dexterity — leading to pain, disability, loss of quality of life and reduced ability to participate in society. The complexity of the mechanics of the musculoskeletal system, the striking ability of these tissues to adapt their properties at scales ranging from nanometers to meters and the wide variability across patients in their anatomy and injury profile make defining appropriate treatment for these conditions challenging. Research in the Movement Biomechanics Lab (MoBL), directed by Dr. Katherine Saul, is designed to improve treatment for neuromusculoskeletal disorders across the lifespan, using computational simulation and experimental methods (including magnetic resonance imaging, motion capture, and functional assessments of upper and lower limb performance). The lab seeks to address the grand challenge of integrating cell and tissue level behaviors in the context of whole muscles, bones and joints and overall movement through clinically-relevant simulations and experiments that link human mobility to underlying changes to tissue structure and function.

One of the group's primary interests is the development of novel computational musculoskeletal models and dynamic simulation methods to explore effects of injury and treatment on limb function. These high-fidelity models are mathematic representations of anatomical, physiological, and functional data (including detailed in vivo experimental measures of upper limb muscle anatomy and function MoBL acquires) integrated with engineering computations of intersegmental dynamics and neuromuscular control. They serve as a platform for studying effects of neuromuscular and orthopaedic injury, predicting outcomes of surgical interventions and understanding healthy and impaired motor control. The lab releases these models for use by other researchers, with over 10,000 model downloads to date. The MoBL research team uses these models to perform computational simulations of injury and therapies to understand biomechanical consequences of fracture, spinal cord injury, rotator cuff injury, stroke, and peripheral nerve injury, lending clinical impact to their engineering work.

One research application — funded by the National Institutes of Health — focuses on traumatic neurological injury to the brachial plexus at birth, which causes paralysis of upper limb muscles and alters growth of both muscle and bone. Simulations of shoulder mechanics after brachial plexus injury provide biomechanical insight to clinicians regarding the most appropriate surgical choices given their patient's presentation, available nerve targets and surgical considerations. The team, in collaboration with Dr. Jacque Cole in UNC / NC State Joint Department of Biomedical Engineering, has also established mechanical explanations for the severe permanent postural (e.g. internal rotation contracture) and bone deformities (e.g. shoulder joint malformation) of the developing shoulder when injury to the brachial plexus occurs at birth, demonstrating that impaired longitudinal growth of paralyzed muscles and static loading of the shoulder are key drivers of deformity. Saul's team has identified these mechanical drivers, in part, by developing a unique iterative and integrated simulation approach to predict tissue growth over time, incorporating finite element simulations of tissue mechanics that models growth of tissue in response to loads determined from rigid body dynamic simulations of shoulder motion. This applied simulation work appears not only in engineering journals but also in orthopaedic surgery journals to directly reach the target audience of clinicians working on these important clinical questions.

A second recent application is the use of simulation to explore human-device interactions. In particular, the team (in collaboration with faculty members at NC State, UNC and Georgia Tech including Drs. Greg Sawicki, Michael Lewek, Xiaogang Hu and Derek Kamper) has been studying the neuromechanical response of users moving while wearing exoskeleton devices that provide powered assistance for rehabilitation or augmentation of human performance. For example, MoBL researchers have explored the use of a novel powered adaptive lower limb exoskeleton with patients post-stroke that delivered power at the paretic (weak) ankle according to the patient's measured calf muscle activation and walking speed. This study revealed that although




Simulated growth of the scapular glenoid (shoulder joint) captures critical features of scapular growth and joint formation seen in images of the shoulder following brachial plexus nerve injury.

an exoskeleton may successfully deliver increased power at a single impaired joint to match the healthy side, this did not translate to reduced energy cost of walking due to compensations made by the patients; individuals changed their leg posture to be more vertical when using the exoskeleton. This suboptimal limb configuration limited conversion of exoskeleton assistance to forward propulsion and limited energetic benefits of applied assistance. This work makes clear that better understanding of how rehabilitative interventions that focus on a single joint might impact limb and whole-body walking outcomes is crucial for informed rehabilitative designs. In an ongoing study funded by the National Science Foundation, MoBL is also exploring upper limb exoskeletons designed to enable dexterous finger movements in stroke survivors using real-time neural signals from forearm muscles to drive exoskeleton movement. Personalized musculoskeletal models, calibrated to the unique musculoskeletal structure and activation parameters of stroke survivor, will compensate for limb posture, movement dynamics and subject-specific impairments that could otherwise disturb the mapping between user input and desired output. The assistive forces will reinforce beneficial muscle activation while compensating for abnormal activation patterns. Collectively, the outcomes will restore hand dexterity in stroke survivors, thereby enabling them to perform daily activities and live independently. ■

## INTRAVASCULAR ULTRASOUND IMAGING AND THERAPY

Cardiovascular disease (CVD) is a collection of diseases and conditions that affect the heart and blood vessels in other vital organs, including coronary artery disease (CAD), deep vein thrombosis (DVT), pulmonary embolism (PE), stroke and hypertension. According to the data provided by the World Health Organization (WHO), CVDs are the number one cause of death globally. In 2016, 17.9 million people died from CVDs, which accounts for 31 percent of all global deaths. Detection of the plaques and treatment of clots are among the most active areas of research in biomedical imaging and therapy. Dr. Xiaoning Jiang's group demonstrated a series of intravascular ultrasound transducers and arrays in recent years for intravascular ultrasound imaging and therapeutic applications.

For intravascular ultrasound (IVUS) imaging, unconventional dual frequency IVUS transducers were successfully demonstrated for contrast (microbubbles) enhanced superharmonic imaging, enabling vasa-vasorum imaging for vulnerable plaque identification. In superharmonic IVUS imaging, low frequency transmission waves excite microbubbles so that nonlinear echoes from microbubbles can be received at high frequency (> 3x transmission frequency), leading to IVUS imaging with high resolution and high contrast to tissue ratio. Figure 1 shows a dual-frequency transducer with a 6.5 MHz low frequency element for transmitting and a 30 MHz high frequency element for receiving, and a circular dual-frequency array (2.25 MHz / 30 MHz) was prototyped, for the first time, with 8 low frequency transmission elements and 32 high frequency receiving elements. Notably, all these devices can be integrated into 3F-10F catheters, which indicates a great potential for real clinical endoscopic ultrasonic applications.

For blood clot treatment, ultrasound thrombolysis or sono-thrombolysis, has shown promising treatment outcomes over the past decade or so. Jiang's lab reported the first sub-MHz forward viewing intravascular transducer for microbubble / nanodroplet-mediated sonothrombolysis with improved thrombolytic rate and minimized dose of thrombolytic drugs. Figure 2 shows the mechanism of the stacked transducer on sonothrombolysis with microbubbles. The technology demonstrated a thrombolysis rate of 0.7 ± 0.15 percent mass loss / min in vitro without any use of thrombolytic drugs.

The above intravascular ultrasound imaging and sonothrombolysis research has been supported by two projects from the National Institutes of Health. With on-going in-vivo tests, intravascular ultrasound suggests the promising potential in clinical translations. ■

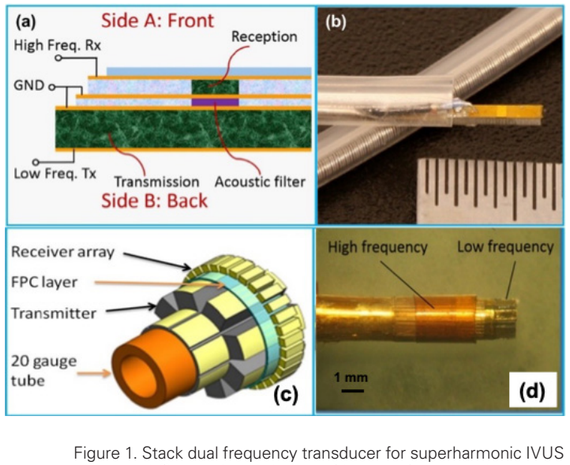



Figure 1. Stack dual frequency transducer for superharmonic IVUS imaging. (a) Schematic illustration of the dual frequency transducer structure; (b) A photograph image to show the fabricated transducer mounted inside a commercial catheter sheath; (c) illustration of the dual frequency cylindrical array structure; (d) photograph images of the fabricated dual frequency cylindrical array.

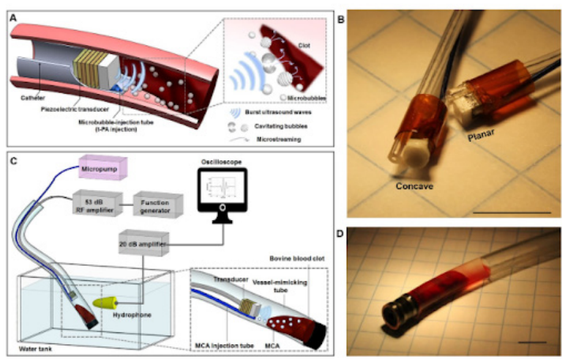
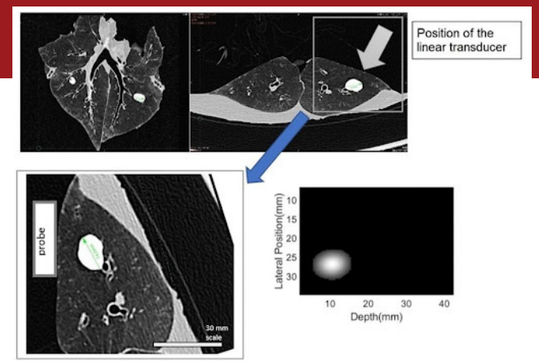



Figure 2. Forward-viewing intravascular transducers for sonothrombolysis. (a) Principle of microbubble-mediated intravascular sonothrombolysis; (b) Customized 620 kHz stacked piezoelectric transducers integrated with a microbubble-injection tube and polyimide housing; (c) In vitro experiment setup; (d) Bovine blood clot sample in a tygon tube.



Research Highlights




CT scans of an artificial lung nodule implanted in a pig lung. On the bottom right, the ultrasound based map shows the nodule, and its distance to the lung surface can be accurately measured.

## USING ULTRASOUND IMAGING TO DETECT LUNG DISEASE

Dr. Marie Muller and her students Roshan Roshankhah and Azadeh Dashti are changing the way ultrasound is used to develop new markers of lung diseases. Lung tissue is composed of millions of air sacs: the alveoli, which scatter sound in all directions. As a result, ultrasound waves do not propagate straight in lungs. Ultrasound imaging is based on the idea that ultrasound waves propagate straight in tissue, at a known speed. In conventional ultrasound, a pulse is transmitted by an ultrasound probe into the tissue, and reflected by the object to be imaged. The time of flight is recorded, and with a known speed of sound, it is straightforward to determine the distance of this object to the surface of the probe. Things are very different in lungs. Because of the air-filled alveoli, the wave has a random trajectory into the medium, and is subjected to many scattering events. It becomes impossible to know where the echoes come from; there is no longer a definable speed of sound. This makes conventional ultrasound imaging of lungs impossible. Muller and her students decided to exploit this feature. The ultrasound waves visit many alveoli and return to the probe charged with information on the lung structure. By utilizing the theory of wave propagation in strongly heterogeneous media, it becomes possible to extract parameters that reflect the microstructure. For example, one parameter of interest is the scattering mean free path, which is defined as the mean distance between scattering events and is bound to be related to alveolar density. This is relevant because alveolar density will change with lung diseases such as pulmonary fibrosis and pulmonary edema. In pulmonary edema, the accumulation of fluid inside and around the alveoli leads to an alveolar distribution of a lesser density. Similarly, pulmonary fibrosis leads to tissue scarring within the lung, which will decrease the size and density of alveoli.

Both diseases are serious chronic lung conditions that lead to serious difficulties in breathing. They need to be managed by treatments and monitored closely. Currently, the only way to do this is in a hospital, using high resolution CT scanning, invasive intracardiac devices or pulmonary function tests. Muller and her students have demonstrated that quantitative ultrasound scattering parameters could detect pulmonary edema and were significantly correlated with the severity of fibrosis, in rodent model studies.

With conventional imaging, a highly skilled, highly trained technician is required to interpret the images. On the contrary, a significant advantage of extracting quantitative markers from ultrasound signals is that it enables them to follow patients from one week to the next, or from one month to the next, with numbers that can be read more easily. This is even more relevant with the current development of ultraportable ultrasound probes by multiple industry players.

Muller and her students are also developing new imaging methods to guide surgery in real time. Lung cancer is routinely detected by CT scanning. Once a nodule is detected, it is resected surgically. But CT imaging is not available in the operating room Surgeons have a hard time finding nodules and ensuring that they are safely and fully resected. Muller's novel idea is to use scattering as a new source of contrast for lung imaging. The lung is filled with scattering alveoli, but pulmonary nodules aren't. Together with her students, they have developed algorithms for mapping the intensity of multiple scattering events, which they use to identify regions of the lung containing nodules. As an example, the figure above shows CT images of a pig lung in which an artificial nodule was implanted. The nodule is visible on the CT. The bottom right image is a rendered map created using multiple scattering as a source of contrast. The nodule is clearly visible; its diameter and distance from the lung surface can be measured. That map is obtained using ultrasound, which has the significant advantage of being real-time and available in the OR. Their next step is to implement these methods on laparoscopic ultrasound probes that can be controlled robotically and used during surgery. To that end, she will work with Dr. Gregory Buckner.

Ultrasound is a mature field of research and technology. Innovation will come from a change of paradigm. By leveraging scattering, Muller is unlocking new uses of ultrasound, in which tissue features can be quantitatively characterized. ■

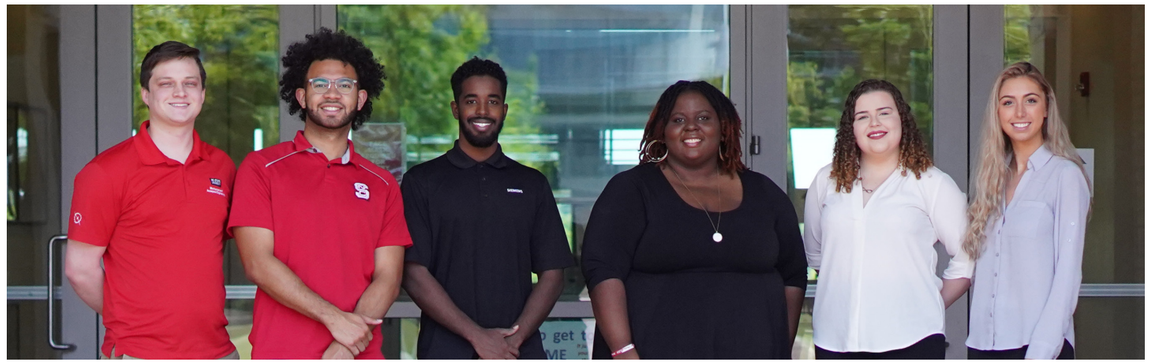
# 08

FEATURE
**STORY**

# Feature

## Diversity in MAE: DEI Initiative Overview

**THE NEW MAE DIVERSITY, EQUITY AND INCLUSION INITIATIVE** kicked off this past year, beginning with the formation of the DEI Committee. The committee includes faculty, staff, and student representatives (Chair: Katherine Saul, Kara Peters, Nancy Moore, Marie Muller, Tarek Echekki, Srinath Ekkad, Jessica Sudduth, Emma Jaynes, Michael Jenkins) to capture perspectives throughout the department and ensure communication with all constituents. In identifying our priorities for the coming year, we are motivated by the recognition that although we have had some great successes in the department, there is still much more to do; in 2020, only 16 percent of undergraduate ME students and 19 percent of undergraduate AE students were women, and approximately 10 percent of both undergraduate and graduate students in MAE were Black, Hispanic or Native American. As a department, we see that it is critical that we foster a diverse and inclusive environment that respects the individual, promotes innovation and offers opportunities for all students, faculty members and staff members so that we can attract, retain and support talented students, staff members and faculty members. To do so, we need to design curriculum, research and administrative processes that support all MAE members equitably. We also want to recognize and celebrate the existing and growing diversity of the department and the engineering and professional successes of students and faculty members.



Our strategy for defining the focus of the committee and mission for the department has largely been based on best practices for new DEI initiatives and benchmarking to peer MAE and other engineering departments. We have drawn from many great examples of best practices to be inclusive and competitive with our practices, procedures, and departmental culture. Our primary initiatives for the next year focus on identifying our current department climate and status, improving recruitment and retention of students into the department and hosting DEI events. We are currently undergoing a climate survey of MAE faculty members, staff members and students that will allow us to benchmark against peer departments in terms of demographics, achievements, culture and areas for improvement. We plan to define future goals based on the climate survey insights. We are revamping parts of the MAE website to better highlight humanistic aspects of our research endeavors, reflect the DEI mission and activities and connect to our department and NC State professional engineering groups, such as Women in Mechanical and Aerospace Engineering (WIMA) and Society of Black Engineers. We are also planning events to more directly recruit engineering first-year students, connect with student professional societies, provide professional development opportunities and increase conversations around inclusion. For example, we are hosting a DEI speaker series, and we plan for a student society fair to raise the visibility of these organizations for incoming students. In addition, this fall WIMA and the department will host a professional development workshop for women engineers, sponsored by John Deere. We look forward to an exciting and productive year, and our continuing activities and progress will be featured on the website and newsletter so everyone can keep abreast of our plans and growth. ■

### THE MISSION STATEMENT

The faculty, staff and students of the Department of Mechanical and Aerospace Engineering value diversity and believe it is essential to achieving our scientific and academic mission. We define diversity as encompassing differences in age, cultural identity, language background, ethnicity, gender, gender identity, faith, neurological make up (neurodiversity), geographic background, political and ideological perspectives, disability status, race, sexual orientation, social and economic status and veteran status. We believe that an inclusive curriculum, diverse department community and welcoming climate are critical to academic excellence, innovation and the well-being of our community. In support of this mission, we seek to:

1. **Actively** promote recruitment, retention and success of a diverse community of faculty, staff and students;
2. **Promote** inclusive curriculum, accessible education, and equitable mentorship;
3. **Enhance** engagement and community for groups underrepresented in STEM; and
4. **Foster** respect for diversity and inclusion in our community among our members and leadership.

# 10

# STUDENT SPOTLIGHT

## Andrew Mistele

Mistele, an undergraduate student in the Department of Mechanical and Aerospace Engineering, has received the prestigious Barry Goldwater Scholarship, placing him among the nation's most promising young scientists and engineers. Mistele is currently a junior in aerospace engineering with future plans of attending graduate school to pursue a M.S. and Ph.D. in aerospace engineering. He would like to conduct research in applied aerodynamics and flight vehicle design in an industry research and development setting.

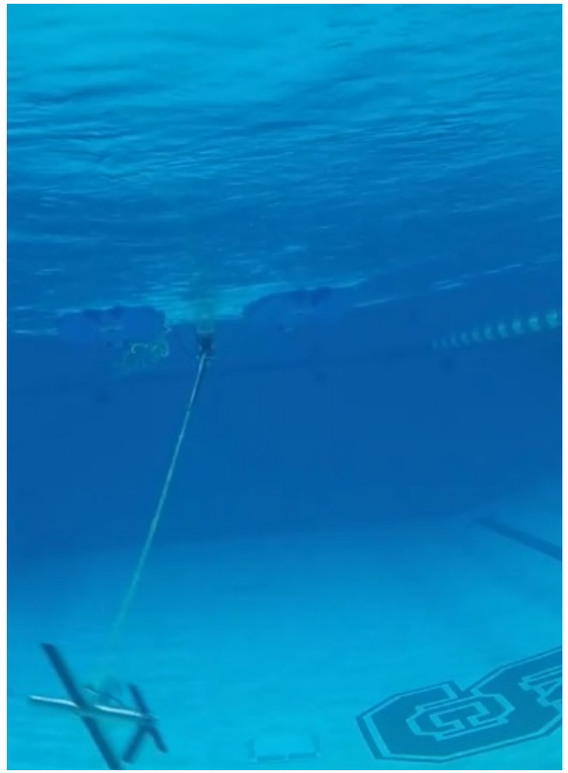
"Outside of my research work, I'm currently working at Northrop Grumman Aeronautics Systems for the third summer in a row. My first summer I supported quality engineering for the F-35 program, while this summer and last summer I've worked as an aerodynamics intern on the MQ-4 Triton program."

**-ANDREW MISTELE**

bit.ly/3nrczXB

Andrew Mistele





Kite executing cross-current flight in the NC State dive well.

From left to right: Zak Leonard, Ashwin Vadlamannati, Sam Bryant, Andrew Abney, Kartik Naik, Dillon Herbert, Dr. Chris Vermillion, James Reed, Mariah Mook, and Sumedh Beknalkar.

Andrew Abney holding the experimental prototype during testing at the NC State dive well.

## Andrew Abney

Abney is a Ph.D. student majoring in Mechanical Engineering. He is a member of the Control and Optimization for Renewables and Energy Efficiency (CORE) Lab under Dr. Chris Vermillion and is the student experimental lead for the Marine Hydrokinetic Energy Harvesting Kite project. Abney comes to NC State after several years in industry supporting development of Automated Fiber Placement technology at Electroimpact and Engines Test Manufacturing at Blue Origin.

Abney leads a diverse team of graduate students across several labs within the MAE department (CORE, ISSRL, EMSSL and Dr. Kenneth Granlund's Lab) in executing tests designed to characterize the flight dynamics of a prototype tethered kite system. At full scale, the kite harnesses the prevailing flow to fly figure-8 paths at many times the prevailing flow velocity. The resultant lift can be used to generate electricity through generators located in onboard turbines or on a ground station which spools out additional tether under load.

The experimental work at NC State is the first open-source work validating this design with traditional aircraft control actuation and fully automated control algorithms. The work in the NC State dive well will prepare the team for execution of open water testing at Lake Norman later in the fall and spring semesters

The underwater kite design and control research taking place within the MAE department has been supported by ongoing federal awards from the U.S. Department of Energy

## Other Notable Student Successes

The annual IEEE International Ultrasonics Symposiums (IUS 2020) was recently held online on September 7-11, 2020 with more than 1,900 attendees from around the world. **Bohua Zhang**, an MAE Ph.D. student from Prof. Xiaoning Jiang's group, won the student paper competition award. The paper titled "Laser Sensor Guided Intravascular Catheter with Ring Type Stack Transducer for Sonothrombolysis" was authored by Bohua Zhang (NC State), **Huaiyu Wu** (NC State), **Leela Goel** (UNC and NC State), and **Xiaoning Jiang** (NC State). ■

# **Student** Awards

Hannah Fletcher

Evan Waldron

Nathaniel Browning

Pippin Payne

Victor Jiminez

## Engineering Students Awards

Each year the College of Engineering recognizes the accomplishments of graduating senior students with engineering senior awards. Receiving these awards is one of the highest forms of recognition for a senior in the college.

The 2020-21 COE senior awards were presented by Dr. Jerome Lavelle (associate dean, Academic Affairs for COE) and Dr. David Parish (assistant dean, Academic Affairs for COE) at the Virtual Engineering Awards Ceremony on Thursday, April 15. The MAE nominees for the college-wide competition were: Victor Jimenez — Citizenship and Service, Evan Waldron — Scholarly Achievement, Hannah Fletcher — Humanities, and Pippin Payne — Leadership.

Pippin Payne was selected as the COE Senior Award winner for Leadership. Payne is a graduating senior in the Mechanical Engineering program. During his time at NC State, he co-founded and served as CEO for Peak Coffee Processing, inventors of a filtration system to create fertilizer from toxic coffee wastewater. His company was recognized as the number one Undergraduate Engineering Startup in the U.S. by the National Academy of Engineering. Pippin serves on the President's Council of Advisors on Science and Technology and is the youngest member ever invited to serve on that committee. Payne also co-founded the National Academy of Engineering: Grand Challenge Scholars at NC State. During the two years of his leadership, the number of scholars increased by over 300 percent.

Additionally, Aerospace Engineering graduating senior Nate Browning was recognized as a recipient of the Shining Star award from Women and Minorities in Engineering Program (WMEP).

The Shining Star Award is presented to the student(s) who consistently supports programs hosted by the WMEP office. These students willingly and sincerely give their time and energy to support the mission and goals of WMEP.

We are extremely proud of our students' achievements and wish them all the best in their future endeavors! ■



# **Team** and **Club** Accomplishments

## Pack Motorsports Formula SAE

FSAE Nevada and FSAE Michigan. The formula student events are a competition where college students design and build a formula-style racing car every year.

In FSAE Nevada they placed:

- Acceleration: 2nd
- Skidpad: 2nd
- Autocross: 4th
- Endurance: 2nd
- Overall: 2nd
- Won Cummins Innovation Award 1st Place
- Won Siemens Electrical Systems Award 2nd Place

In FSAE Michigan they placed:

- Acceleration: 6th
- Skidpad: 18th
- Autocross: 4th
- Endurance: 5th
- Overall: 4th
- Won Cummins Innovation Award 2nd Place

## High Powered Rocketry

The High-Powered Rocketry Club competed in NASA Student Launch this year. Student Launch is a competition against over 40 other universities and high schools/middle schools that involves designing, building and testing a high-powered rocket and payload. This year's payload was a planetary lander that could leave the rocket while it was descending, land separately, upright itself, take a panoramic image of its landing site and transmit it back to the team.

The team placed 5th overall, and earned the following awards:

- 1st place AIAA Reusable Launch Vehicle Award
- 2nd place Safety Award
- 3rd place Social Media Award

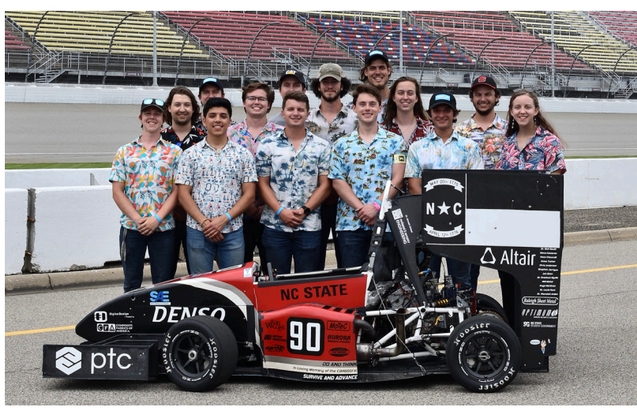
## Pack Motorsports Baja SAE

May 20-23 was a successful competition weekend for the Baja Team in Louisville, Kentucky. From team captain, Alex Amend, "Our successes began well before any dynamic events occurred on Saturday, with our vehicle passing tech inspection on the first day, something that only 15 other teams were able to do that day. That took place on Thursday, and by noon on Friday, our vehicle passed Brake Check. At this time, we were able to drive our vehicle around the paddocks as well as the Practice Track. Because of this opportunity, we were adequately prepared for every event. Acceleration, Hill Climb, Maneuverability and Suspension and Traction took place on Saturday, while Endurance took place on Sunday, the 23rd."

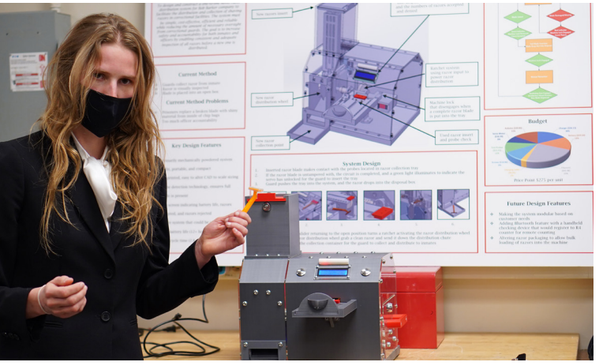
- Overall: 14th
- Endurance: 10th
- Acceleration: 28th
- Hill Climb: 45th
- Maneuverability: 11th
- Suspension and Traction: 13th (tied by distance for 7th)

To his knowledge, the last time the team has done this well was 8th overall at Tennessee in 2016. ■

www.nasa.gov/centers/marshall/news/releases/2021/21-007.html



# **Senior** Design



## MAE Capstone Senior Design

In 2020-21 academic year, we had 186 students in Capstone Senior Design spanning over two courses, MAE 415 in the fall and MAE 416 in the spring. Students were divided evenly to work on six industry-sponsored projects. In the fall, they worked on conceptual design through presentations, reports and computer simulations. This class was conducted on Zoom after the university decided to send students home. In the spring, with the limited number allowed for gathering, the students were strategically spaced out in the Senior Design lab and built prototypes. The prototypes were tested twice, with the second test providing statistical data showing robustness. To accommodate the limitation of number allowed, we have three Senior Design days. Each Senior Design Day was composed of the formal presentation sessions in the morning and prototype demonstration sessions in the lab in the afternoon. It was overall a success because over 90 percent of the prototypes worked. The others, though not completely, worked partially. Below is the list of sponsors with project names and the field required to work on the design.

1. **Bob Barker Company, Inc.**
   Razor Distribution System (Dynamics, Sensing /Detecting System, Manufacturing Operation)
2. **Caterpillar, Inc.**
   Small Track-Type Tractor Idler Height Adjustment
   (Solid Mechanics, Component Design, Assembly Operation)
3. **Cypress Creek Renewables**
   Solar Mowing Solution
   (Dynamics, Robotics, Mechanisms, Solid Mechanics)
4. **Denso**
   Wire Removal Machine
   (Dynamics, Solid Mechanics, Control)
5. **Pentair Aquatic Systems**
   Sanitizer Erosion Feeder (Sensing/Detecting System, Manufacturing Operation, Component Design)
6. **Zurn**
   Sink Basin Clog Detection System
   (Sensing/Detecting System, Modeling, Fluid Mechanics) ■

For more information on how your company can participate in and sponsor a Senior Design Project, contact **Mike Walsh** at **mpwalsh2@ncsu.edu.**



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# NEW FACULTY AND **STAFF**

**Hao Su**
Associate Professor

**Mingtai Chen**
Assistant Teaching Professor

**Chi-An Yeh**
Assistant Professor

**Jingjie Hu**
Assistant Professor

**Henry Ware**
Assistant Professor

**Andrew Lee**
Assistant Professor

**Madalene Adams**
Administrative Support Specialist

**Clay Gosnell**
Contracts and Grants Manager

**Savanah Alberts**
Contract and Grants Manager

**Susan Uy**
Graduate Program Coordinator

# **Awards** and **Honors**

## PROMOTIONS

**Drs. Arun Kumar Kota, Jie Yin**, and **Chris Vermillion** have been promoted to associate professor with tenure.

**Dr. Stephen Terry** has been promoted to research associate professor.

**Drs. Andre Mazzoleni** and **Brendan O'Connor** have been promoted to professor.

**Dr**. **Yong Zhu** has been named the Andrew A. Adams Distinguished Professor.

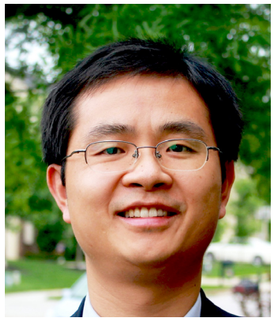
**Dr. Xiaoning Jiang** has been named a Dean F. Duncan Distinguished Professor.

## PERKINS WINS YOUNG INVESTIGATOR AWARD

**Dr. Edmon Perkins**, assistant professor, received a Young Faculty Award from the Defense Advanced Research Projects Agency for 2020. His proposal was titled "Flexible Reservoir Computing Tensegrity Robots."

## EDWARDS NAMED FELLOW

**Dr. Jack R. Edwards**, Angel Family Professor and director of aerospace research, has been elected as a Fellow of the American Institute of Aeronautics and Astronautics (AIAA), the world's largest aerospace professional society. Fellows may be nominated from the ranks of the Associate Fellows by any member in good standing and shall be elected by the organization's board of directors. One Fellow for every 125 Associate Fellows may be elected annually.



## ZHU RECEIVES RESEARCH PRIZE

The Alexander von Humboldt Foundation awarded Yong Zhu, professor and an expert in micro- and nano-mechanics, the Friedrich Wilhelm Bessel Research Prize in recognition of his outstanding academic contributions.

The foundation presents approximately 20 awards annually to internationally renowned academics from abroad in recognition of their outstanding accomplishments in research. The award is named for German astronomer and mathematician Friedrich Wilhelm Bessel (1784-1846) and funded by the Federal Ministry of Education and Research.



## XU ELECTED AS FELLOW

**Dr. Cheryl Xu**, associate professor, has been elected as a Fellow to the American Society of Mechanical Engineers, an honor bestowed to only 3 percent of its 100,000+ members. Founded in 1880 as The American Society of Mechanical Engineers, ASME is a nonprofit professional organization that enables collaboration, knowledge sharing and skill development across all engineering disciplines, while promoting the vital role of the engineer in society. ASME codes and standards, publications, conferences, continuing education and professional development programs provide a foundation for advancing technical knowledge and a safer world.

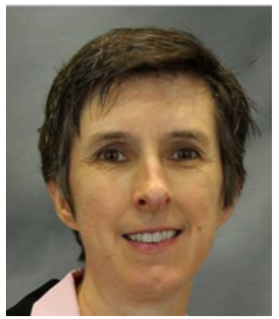
## NARAYANASWAMY PARTICIPATES IN SYMPOSIUM

**Dr. Venkat Narayanaswamy**, associate professor, was one of the 85 of the nation's brightest early-career engineers to be selected to take part in the National Academy of Engineering's (NAE) 26th annual US Frontiers of Engineering (USFOE) symposium.

Engineers who are performing exceptional research and technical work in a variety of disciplines will come together for the two-and-a-half day event. The participants — from industry, academia, and government — were nominated by fellow engineers or organizations.



Awards and Honors



## PETERS RECEIVES GRADUATE PROFESSORSHIP

**Dr. Kara Peters**, Distinguished Professor, was awarded the 2021 Alumni Distinguished Graduate Professorship by NC State Alumni Association. Peters is also the associate department head in MAE and the director of graduate programs.

The Alumni Association Distinguished Graduate Professorship recognizes outstanding graduate-level teaching at NC State University. The award is $4,000.

All members of the graduate faculty are eligible for nomination. Up to two nominations may be submitted through each college's dean's office, and interdisciplinary nominations are submitted through Peter Harries, dean of the Graduate School.

## SAVELIEV RECEIVES TEACHING AWARD

**Dr. Alexei Saveliev**, associate professor, received an NC State University Outstanding Teacher Award for 2021.

The award recognizes excellence in teaching at all levels and is a prerequisite for being considered for the Board of Governors Award for Excellence in Teaching and the Alumni Distinguished Professor Award. Recipients become members of the Academy of Outstanding Teachers for as long as they are NC State faculty members. Recognition is given at commencement, the Celebration of Academic Excellence and the Teaching and Learning Symposium.

# STAFF SPOTLIGHT

### Vincent Chicarelli
***Speciality Trades Technician***

Chicarelli is originally from Newport News, Virginia. One of his favorite hobbies is hiking the local and state parks throughout North Carolina. Currently he works as a machinist and welder in the Research Machine Shop for Mechanical and Aerospace Engineering.

"What I enjoy most about MAE is creating parts and assisting students in manufacturing their projects. Everyday challenges my skill level. I am hoping to finish my career with MAE."

### Jessica Sudduth
***Executive Assistant***

Sudduth joined MAE in 2019 as the executive assistant after being with NC State since 2014. Prior to that, she received her master's degree in anthropology at Kent State University. In her spare time she enjoys camping, gardening, board games and spending time with friends, family and her two dogs, Addie and Elena.

"It's such a pleasure working in a department like MAE. The faculty and staff really care about the department and the students. We work as a team to ensure that we are all successful. I'm so grateful to be a part of such a wonderful group. I believe we have some of the best students around and I'm so glad I get to be a part of their success. I expect great things out of all of them and I believe they are all capable of achieving it. I'm rooting for each and every one of them." ■

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# PROGRAM **UPDATE**

Kara Peters

### Graduate news from Dr. Kara Peters, Professor, Director of Graduate Programs, Associate Department Head

The MAE graduate program offers master's and doctoral degrees in both aerospace engineering and mechanical engineering with 391 current students. Of these students, 137 are in our distance education master's program offered through Engineering Online. We have 49 tenure-track faculty members conducting active and cutting-edge research projects and offering more than 50 graduate courses that span all topics of aerospace and mechanical engineering. This year, we hired a new graduate program coordinator, Susan Uy, and graduate services assistant, Summer Fulcher, who work hard to support all of our graduate students.

This academic year has certainly been a challenging one for all of our graduate students. I am extremely proud of the way that our students have dealt with the many obstacles over the past year including moving to online learning, laboratory closures, online thesis and dissertation defenses and the many additional stresses due to the pandemic. Graduate education can be a challenging enterprise at any time and I think our students deserve special recognition of their resilience over the past 18 months.

We welcomed our fall 2021 graduate entering class in person in August, including six recipients of the NC State Provost Doctoral Fellowship. In addition, we will have the opportunity to finally meet face-to-face many of our graduate students who started in Fall 2020. ■



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# ALUMNI **CORNER**

## CAREER OVERVIEW

Dr. Keith Hollingsworth is professor and chair of the Department of Mechanical and Aerospace Engineering at the University of Alabama in Huntsville. He joined UAH in 2011 as chair of the department. He has over 30 years of experience teaching thermodynamics, fluid mechanics, heat transfer and experimental methods in both classroom and laboratory settings.

Hollingsworth was born in Clinton, North Carolina. He received his B.S. and M.S. degrees in mechanical engineering from North Carolina State University. He received his Ph.D. in mechanical engineering with a specialty in thermal science from Stanford University in 1989. Hollingsworth's research interests span several areas of thermal science, including boiling and two-phase flows, turbulent convection, liquid crystal thermography and biomedical heat transfer. He has graduated over 40 research students at the Ph.D., master's and honors thesis levels. His research accomplishments have been recognized by election to Fellow of the American Society of Mechanical Engineers in 2009 and election to Associate Fellow of the American Institute of Aeronautics and Astronautics in 2016.

Prior to joining UAH, Hollingsworth was on the faculty of the Mechanical Engineering Department at the University of Houston, where his teaching was recognized with the University teaching award, the University research mentoring award, four College teaching awards and two ASME student chapter teaching awards. In 2010, he was elected Fellow of the University of Houston Honors College. He has been a registered Professional Engineer in Texas since 1993.

In 2016, Hollingsworth was inducted into the Mechanical and Aerospace Engineering Hall of Fame at NC State.

**Name:** Dr. Keith Hollingsworth
**Graduating Class:** BSME 1980, MSME 1982, PhDAE 1993

# Q&A with Dr. Keith Hollingsworth

Interview conducted by Dr. Srinath Ekkad

***When did you first start to show an interest in engineering?***

**Dr. Keith Hollingsworth:** When I was five years old, I was enamored with what was then the Mercury program. Like all five, six year old kids, I wanted to be an astronaut, but I was a sickly child. Later a tonsil operation fixed that, but at the time, my father told me, he says, "You know, it's not clear you're going to be healthy enough to be an astronaut, but there are these guys called engineers, who build the rockets, and the space capsules, and are involved in that sort of thing. You should think about that." So, honestly, that was the earliest time I ever heard the word "engineering."

I also give a lot of credit to my grandfather, because he introduced me to the world of science by just sitting with me and reading articles in newspapers. In the 60s, you know, there were a lot of advances going on. He was also the first person who read to me about Einstein, the first person who read to me about Marie Curie. I remember those two in particular, and he really got me started to sort of kindle my love for science.

I am a good example of somebody who didn't see life in academics early. That is to say, I was a farm boy and sort of the first person who went through a four year college in my family. That was a big deal. At that age, you can't see being a professor and getting a doctorate. So I think I am a good example of how programs like the NC State Honors College and undergraduate research and things like that gradually enlighten a person, and get them ready to take the next step, and to see, well, that's desirable, too —"I think I'll do that." So it was gradual.

***Since the beginning of your career, how would you describe the changes in engineering education?***

**K:** The two biggest changes, I think, that I've seen. One is the incorporation of technology. And that happens in two places. Certainly, if you look at the curriculum today versus 40 years ago, when I was an undergrad, 90 percent of it is exactly the same in terms of the way it appears on a curriculum page. The difference is the incorporation of more computer stuff. So that's where technology has impinged on how we build what we teach. Then there's how we teach. We have these systems like Canvas or Blackboard and we've become very dependent on those. I've moved my department to these online homework systems, and others couldn't operate now without them. So that's been a big thing. I think all of that allows a kind of disconnect between the students and the faculty that isn't necessarily a good thing.

***What skills and abilities would you say are essential for someone who is interested in engineering?***

**K:** I believe something like 90 percent of the curriculum has not changed. So I think that the skills and abilities that were required 40-50 years ago are basically the same ones that are still required. Now, you know, you have to be good at math. I think it helps to enjoy learning and genuinely enjoy math. You have to be good at physics and genuinely enjoy that. And it doesn't hurt to be good at chemistry. I think that focus is tremendously important. You have to have the ability to focus on your desire to focus on your education.

I think there's no substitute for putting the time in and working hard. If you're going to do that over a lifetime as opposed to eight semesters, you can do practically anything. Eight semesters is a short amount of time, and you can force yourself to do these things, if you put your mind to it. If you're going to do this over the course of your career, you have to love it. So I think having a genuine love of engineering as a profession is extremely important and actually relatively rare.

***Q. What advice would you give to current students?***

**K:** You have to expect things to change, and you have to change with it. You have to be willing to discover the thing that excites you. Next, you have to be willing to realize that, when you're 40, you're going to find elements that get you up in the morning and get you excited about your day that didn't appeal to you when you're 25 — and again and again. So you have to be willing to grow with the opportunities and see engineering in a very broad way. A 20-year-old doesn't have the breadth to see it how a 40- or 50-year-old does. You just have to be able to grow with it. ■



# WOMEN IN ENGINEERING

## CAREER OVERVIEW

Dr. Antonia Arnold-McFarland is a multi-faceted community advocate who enjoys inspiring hope and positive change in others via her involvement in the community. She works full-time as a technical professional who manages and leads quality engineering projects, programs and process improvements. She also enjoys coaching others on career development, project management and problem-solving methods. In her spare time "Toni" or "Dr. Toni" as she is known, applies these same skills as she serves the community in various capacities. Her Christian faith is the foundation that enables her to have hope and vision to help and lead others.

Arnold-McFarland is a recent author, lecturer and scholar in music and arts of the African American Worship Experience. She leverages this research along with her academic studies, cultural undergirding in African American history and lived experiences to bring diverse and inclusive perspectives to her corporate and community involvement. Her belief is that diversity should matter to everyone.

"Society cannot afford to exclude any human potential that might bring life-changing solutions to the complex problems of today's world."

**Name:** Dr. Antonia Arnold-McFarland
**Graduating Class:** BSME 1996

# Q&A with Dr. Antonia Arnold-McFarland

Interview conducted by Riley Harrison, lead ambassador and ME student



***1. How would you say engineering has changed or advanced over the course of your career?***

**Dr. Antonia Arnold-McFarland:** Work has become a lot more digitized over my 25-year career. The need to stay digitally relevant has become more crucial. Technology is changing at a faster rate. Many companies are going through what's called a digital transformation. Speed to market is important to stay competitive. Teams must produce quicker, work smarter and not harder. Digitizing enables productivity, efficiency, innovation and competitiveness. Professionals should develop digital literacy ongoing.

***2. What are you most proud of in your career thus far? Is there anything else that you are currently striving to accomplish or change?***

**A:** In 2020 and 2021, I participated in two teams recognized for community volunteerism in STEM. We each received the John Deere Inspire Teamwork Award via an Enterprise virtual banquet. The criteria looks at effectiveness in driving collaboration, teamwork, diversity, inspiration and overall impact. I regularly participate in National Society of Black Engineers, FIRST Robotics, Introduce a Kid to Engineering, college campus mentoring and Employee Resource Groups. I am honored to be recognized for inspiring development and STEM interest in others. I am striving to change the outlook of those underrepresented in STEM. There is a global shortage of STEM professionals. We cannot afford to overlook any capable human potential that could help solve the world's complex problems.

***3. Can you describe what it's like to be a woman in the engineering field? Do you feel that being a woman has offered you a different perspective or experience?***

**A:** As a female engineer we have to be ready to handle biases and stereotypes tactfully. We have to accept the likelihood of being the only female in a male-dominated field. We may be second guessed more often, what we say may not be heard. What we contribute may go unnoticed. We're often managing home, family and work responsibilities simultaneously. We naturally offer our multitasking abilities, creativity, inquisitiveness, planning and perseverance. This allows us to bring a unique perspective. We have to put forth more effort to maintain credibility and to earn respect. Navigate the workplace with discernment. Beware of situations where you are set up to fail or forced to prove yourself more than your work peers. It helps to be thick-skinned, yet willing to speak up to address issues. I've experienced double bias as an African American female. I am glad to finally see more employers emphasizing diversity, equity and inclusion in the workplace. Everyone needs to reflect on their own unconscious biases. It is refreshing to finally see this type of change take shape during my career.

> "I would say that there are some challenges because most of the time you're the only female, but NC State prepared me for it."

***4. Is there any advice that you would like to offer to young women considering engineering as a career choice?***

**A:** I met NASA hero Dr. Ronald McNair in high school. This is what he told me before his tragic Challenger launch; don't be afraid to explore the unknown. Let me also add, your unique perspective and capabilities are needed. Find an engineer to consult and advise you on your options. One of my personal mantras is "each one must reach one and teach one." STEM fields are an ever-evolving landscape. As engineers, we are always learning hard skills and soft skills. Never feel like you know it all. As my mom used to say, "homework is never done. There is always something to learn." My mother, the late Mary F. Arnold, was an educator. That advice made more sense to me as I got older. For example, in college we solve problems and are tested on our knowledge to see if we grasped the concepts. The real world presents problems that might require us to learn how to solve them, as we complete the project, while also challenged with urgency and other uncertainties. Practical knowledge extends beyond textbooks. We must know how to discern when we are outside of our expertise, when to seek additional guidance and know how to accurately assess the risks of our decisions. The world depends on our capabilities, so we must keep them relevant.

***5. Was there a moment during your time in the MAE department that stuck out as a pivotal experience for you?***

**A:** I was in an ASME car design contest with two other classmates at the University of South Carolina. We were challenged to design a self-propelled vehicle that could drive in a figure eight path and stop in the middle. We spent long hours working on it and stayed up all night just before our trip there. We could only get it go halfway in the shape of an "S" and not a complete "8." When we got there and we saw other students practicing, we became discouraged and decided to not present. To this day, I regret that we did not present.

In hindsight, we should have presented anyway, regardless of performance. When it was time to present, some of the sleeker looking vehicles that had discouraged us didn't make a complete eight either. They had reliability problems. We realized we would have been just as competitive. We gave up on ourselves too quickly, I wish we had not done that. I called my dad and told him what happened. He advised that we should always seek to finish the race. There is something to be learned from how you finish, even if you don't win. He was right. From that moment on, I've realized that we often learn more from facing obstacles and shortcomings than we do when we have a guaranteed finish. As engineers, we cannot be discouraged when things don't go well. We have to have perseverance. Presenting our best effort, even if we are not "winning" or meeting a set goal, teaches us resilience and paves the way for others to continue where we left off. My father, Raymond Arnold, Jr., was an automotive technology and industrial arts teacher. He also worked in the 1960s and early 1970s as a part of the first African American NASCAR Team (#34). In the late 1970s, he also launched one of the first high school drag racing teams. He often spoke of the challenges faced in NASCAR during a racially tense era, while working as a pitman for Wendell Scott Racing. They always sought to stay in the race, even if winning was a long shot met with inequities, death threats and unfairness. As a result, they paved the way for more diversity in NASCAR. My dad passed in July 2020 and was honored in my hometown Spartanburg, SC, as well as nationally in the media. We were surprised to see him honored on ESPN by stock car driver Darrell "Bubba" Wallace, Jr. Today Wallace is continuing their trailblazing efforts in motorsports diversity, as the only full-time African American driver at NASCAR's top level. Similarly, as female engineers and women in tech, we must set the stage for others to follow. I am inspired by the path paved by the "Hidden Figures" women (Dorothy Vaughan, Katherine Goble Johnson, Mary Jackson, Dr. Christine Darden) that enabled the way for other females at NASA such as Dr. Mae Jemison, and, last but not least, our very own Christina Koch. I'll end with these additional inspiring quotes that continue to motivate me: "Be the change you want to see" (Mahatma Gandhi), "Never, ever give up" (Jim Valvano, Go Pack!) and "To whom much is given, much is required" (Luke 12:48). ■

# 2020 **Alumni Hall of Fame**

From left to right: Top row: Keith Hoffler (B.S. AE ‘83 and M.S. ‘85); Jeff Cope (B.S. ME ‘90); Missy Moore (B.S. ME ‘86)
Middle row: Greg Schott (B.S. ME ‘86); Mary Hudson (Ph.D. AE ‘96); Mark Kniskern (B.S. AE ‘88 and M.S. ‘90)
Bottom row: Jennifer Rhatigan (M.S. ME ‘87); John Hsu (Ph.D. ME ‘77); Scott Bledsoe (B.S. AE ‘94)

The Department of Mechanical and Aerospace Engineering named nine distinguished alumni to be inducted into the MAE Alumni Hall of Fame in the spring of 2021.

In years past, our department has invited alumni from all corners of the world to be recognized for their notable achievements. However, due to COVID-19 and travel restrictions, our alumni, friends, and family will be invited to attend a special induction ceremony at a later date this year.

Built upon their common educational foundation at NC State University, the MAE Alumni Hall of Fame was established in 2012 to inspire our current students and to celebrate the accomplishments of our extraordinary graduates who have used their education to excel in a profession, career or service. This nomination is based on professional and service achievement, entrepreneurship and contributions to professional societies, making this a truly noteworthy distinction.

With over 12,000 MAE alumni, only 150, including this year’s class, have been inducted into the MAE Hall of Fame. The MAE Department is honored to celebrate this prestigious ceremony with the 2020 class. ■

## Alumni Successes

- Alumnus **Eric Warren** (MAE HOF) was featured in **Forbes Magazine (bit.ly/3jwlYum)**.
- **Dr. Tyler Blake Hudson**, MAE Alumnus, has received the Early Career Achievement Medal (ECAM) from the National Aeronautics and Space Administration (NASA). This prestigious NASA medal is awarded to a government employee for unusual and significant performance during the first 10 years of an individual’s early career.
- MAE alumna **Dr. Antonia Arnold-McFarland** was the commencement speaker for Fall 2020 graduation and MAE Alumnus Jeff Mobley was the commencement speaker for Spring 2020 graduation.



## UNDERGRADUATE BOARD

- Basil Hassan
- (Dung) Chi Nguyen
- Antonia Arnold-McFarland
- William Horton
- Chris Holder
- Jeff Sagraves
- Doug Utley
- Josh Longworth
- Andrew Crocker
- Brandi Smith
- Lane Miller
- Robbie Isaac
- Steven Clark

## GRADUATE BOARD

- Rich Wahls
- Eric Warren
- Lisa Teague
- Keith Hollingsworth
- Whitney Lohmeyer
- Michelle Miller
- John Olds
- Shaik Jeelani
- Paul Mobley
- Paul Orkwis
- Worth Longest
- Michele Decroix

## YOUNG ALUMNI BOARD

- Joshua Gingles
- Julia Rao
- Andrew Cox
- Brian Carcaterra
- Tyler Ellington
- Michael Suguitan
- David Tseng
- James Turner
- Alex Chen
- Raven Lauer
- Jess Errico
- John Alexander
- Victoria Thomas
- Josh Dvorak

## FRIENDS OF MAE

- Lane Miller
- Phil Vercaemert
- Brett Stanifer
- Carol Vercaemert
- Kevin McCraw
- Frank Schrier
- Keith Hoffler
- Greg Riffe
- Jim Chastain
- Chuck Randall
- Bob Womack
- Jim Hackney
- Paul Browning
- Gil West

## MAE TOP EMPLOYERS

- Advanced Energy
- Albemarle Corporation
- Altec Industries, Inc.
- Auria Solutions
- Aurora Flight Science
- BMW
- Bell Flight by Textron
- Brock Solutions
- Camco Manufacturing
- Caterpillar
- Collier Research Corporation
- Coty
- Cree/Wolfspeed
- Cummins
- Curtis Power Solutions
- Custom Performance Engineering
- Dewberry
- Eaton Corporation
- Eton Solutions
- Firefly Aerospace
- Fleet Readiness Center East
- General Electric
- General Motors
- Hahn-Mason Air Systems
- Huron Consulting
- ITAC
- Industrial TurnAround Corporation
- Johnson Controls
- Lockheed Martin Corporation
- MCA Services & Engineering
- Martin Marietta
- Michelin North America
- Micro-Epsilon
- NASA
- Naval Air Systems Command
- Naval Sea Systems Command
- Northrop Grumman
- Precor
- R.E. Mason
- Rivian
- RoviSys
- Siemens Government Technologies
- Sierra Space
- Summit College
- Tecnatom
- Telamon Corporation
- Tesla
- Tosca
- United States Air Force
- United States Army
- United States Department of Defense
- United States Navy
- United States Patent and Trademark Office
- United States Space Force
- Vega Construction Company
- WestRock
- Wind Solutions

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## HOW TO GIVE BACK TO MAE

There are many ways to give back to the MAE Department that help our students and faculty:

1. **By making a gift to the MAE Enhancement Fund**, you are helping to fund some of the greatest needs within the department that directly support student programs and faculty research.
2. **Establish an endowed scholarship**, graduate fellowship or professorship that will generate support in perpetuity for our students and faculty.
3. **Give a gift to name a space in Engineering Building III** to help support critical research and learning experiences for our faculty and students.
4. **Your company can give back by becoming a member of the MAE Corporate Partners** program through sponsorship of a senior design project or by making a corporate contribution to the department.

**MIKE WALSH**
*Senior Director of Development*

MAE engages with alumni, friends and companies because we know that strong partnerships are imperative and help fuel success. In addition to financial support, you can give back to MAE by mentoring a student, volunteering for one of our advisory boards, recruiting students to your company or partnering with faculty to support their research. By partnering with MAE, you will gain access to top students and faculty at one of the premier MAE departments in the country.

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## MAE ADVANCEMENT OVERVIEW

The purpose of the MAE Advancement Office is to help support key funding needs in the department by partnering with alumni, friends and companies through philanthropic giving. Our office is focused on creating and maintaining a group of key stakeholders who are interested in supporting the MAE Department. And the contributions that they make give our students and faculty the best learning and research environment on campus.

### TOP EMPLOYERS OF MAE GRADUATES

■ Duke Energy ■ Denso
■ Caterpillar ■ John Deere
■ GE ■ BMW ■ NAVAIR