

# MAE NEWS

**DEPARTMENT OF MECHANICAL  
AND AEROSPACE ENGINEERING**

COLLEGE OF ENGINEERING  
NORTH CAROLINA STATE UNIVERSITY  
SPRING 2013



## **THE NEW NEIGHBOR**

*The recently opened James B. Hunt Jr. Library — located just steps from MAE's home in Engineering Building III — is redefining the engineering study experience*

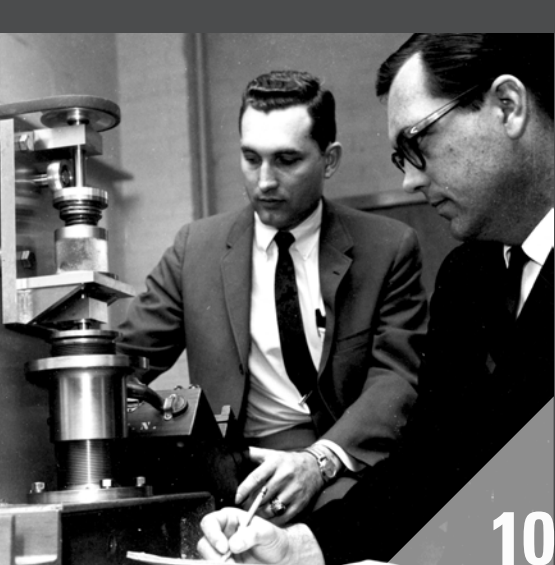
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**NC STATE  
UNIVERSITY**



**COLLEGE OF  
ENGINEERING**

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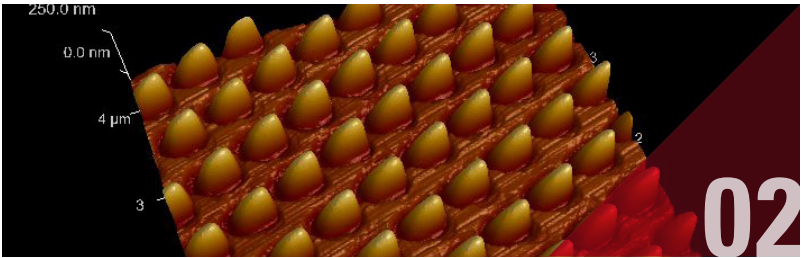
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Remembering a NASA traineeship program that shaped the Department.



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The new James B. Hunt Jr. Library opened on Centennial Campus at the start of the spring 2013 semester. The 220,000-square-foot structure, shown here in February, has received global attention for its state-of-the-art technologies and futuristic feel.



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MAE faculty are working to generate nanostructured surfaces at low cost. They're also translating marketing information into engineering knowledge that can guide product design decisions.



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The recently opened James B. Hunt Jr. Library — located just steps from MAE's home in Engineering Building III — is redefining the engineering study experience.



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FROM THE DEPARTMENT HEAD



Richard D. Gould

Dear Alumni and Friends,

The Department continues to be in high demand and is thriving. As the country moves to become more competitive in advanced manufacturing, our department is participating in what some have called a manufacturing renaissance by adding another faculty member in this area. We are also active in unmanned aerial systems (UAS) research with an emphasis on autonomous flight and are collaborating with the NC Department of Transportation on a UAS test range.

On the undergraduate curricular front, we are exploring how to include hands-on design and computing throughout the curriculum and how to give our students more technical electives. We also just opened a departmental student machine shop that certified undergraduate and graduates students can use to fabricate parts and prototypes for design competitions or research. In June 2013 we plan to dedicate our chassis dynamometer test cell that will be used to conduct research on hybrid electric vehicles. Our distance-delivered master of science (MS) programs now enroll 130 students, a total that surpassed the number of on-campus MS students for the first time.

I am proud to report that in 2011–12 we graduated 403 students – 63 BSAE, 25 MSAE, 4 PhDAE, 207 BSME, 90 MSME, and 14 PhDME. We are proud of our MAE graduates, who helped the College of Engineering at NC State rank 15<sup>th</sup> among the nation's engineering schools in a survey of recruiters published in the *Wall Street Journal*.

On the research side, MAE had record research expenditures in 2012. As part of the ongoing effort to continuously improve NC State engineering research and education, we hired two tenure-track faculty, Drs. Mark Pankow and Venkat Narayanaswamy.

In this newsletter you'll learn about many exciting things happening in the Department – including our groundbreaking research in nanocoining and product design – meet some of our outstanding alumni, and join us as we celebrate honors for students, faculty and staff. You'll also learn more about the new James B. Hunt Jr. Library, which is just a short walk from the Department's home in Engineering Building III on Centennial Campus. Finally, many of you will remember our Center for Acoustical Studies that is featured in this newsletter.

You – our alumni – are extremely important to our future. We sincerely hope that you join our efforts to continuously improve our educational programs and student experiences. Your donations support critical activities that are not supported by state funds, including student scholarships, endowed professorships, student clubs and organizations, student travel to conferences, senior design, and the newly opened student machine shop.

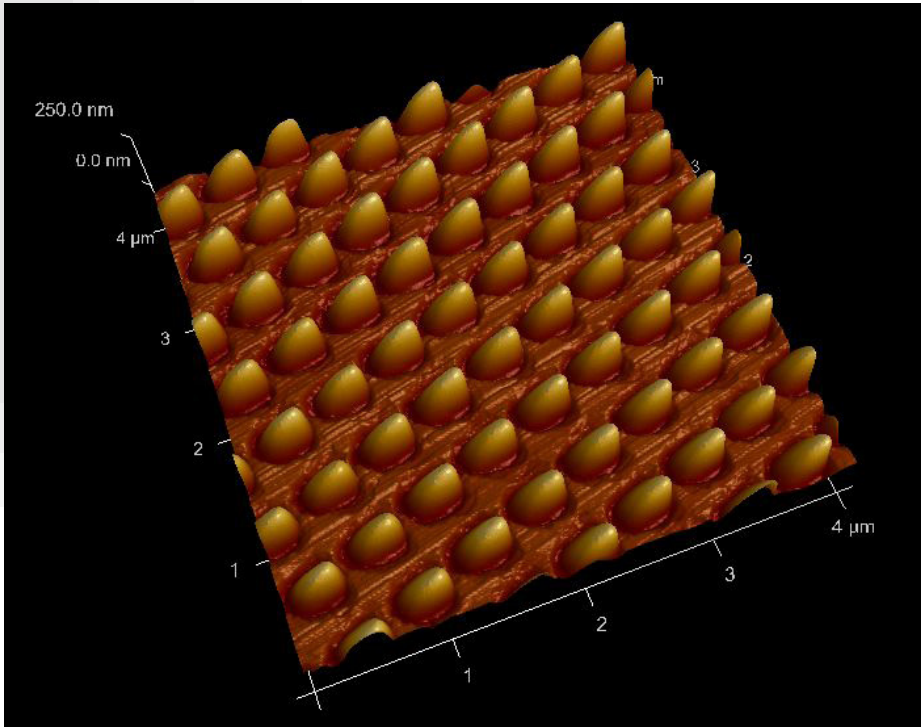
I hope you enjoy this edition of our newsletter. If you have any questions or suggestions, or just want to know how you can help us, please contact me at [gould@ncsu.edu](mailto:gould@ncsu.edu).

Best regards,

Richard D. Gould  
RJ Reynolds Professor and Head



RESEARCH HIGHLIGHTS



Atomic force microscope measurement of UV curable replicate from nanocoined EL nickel

Nanocoining sub-micron features

Faculty: Dr. Thomas Dow | Students: Erik Zdanowicz, John Nowak

Nanostructured surfaces have a wide range of applications including anti-reflective coatings, superhydrophobic/superhydrophilic surfaces, surface enhanced Raman scattering (SERS), and pool boiling enhancement surfaces. Interference lithography has shown the ability to create high fidelity, repeatable features but is not quite economically viable as a means of production.

Nano-imprint lithography is a physical process that is gaining attention primarily because of the ease of feature replication. Current research in a fast nano-imprint technique called nanocoining is underway with the goal of generating nanostructured surfaces at low cost.

Nanocoining is a process developed to produce large arrays of nanostructured surfaces at high rates. This process uses a diamond die that has a nanostructured pattern machined into the contacting face using a focused ion beam.

The diamond die is pressed into a work-piece surface and the nanofeatures on the die are transferred when the material is stressed beyond the yield limit. This replication step is rapidly repeated (1-50 kHz or 1,000-50,000 indents per second) to cover large areas and create either a mold or finished work-piece. The

die has 1,600 nanofeatures spaced 500 nm apart which means at the highest rate (50 kHz) 80 million nanofeatures are created per second.

One of the challenges in developing the nanocoining process was how to indent on a moving surface. Because the production rate must be high, the work-piece must always be moving which will smear the nanofeatures if a normal, orthogonal die path is used.

To overcome this, an elliptical die-path was characterized to match the velocity of the moving work-piece at contact as well as create an indent that was indexed directly after the preceding indent.

The elliptical die-path along with techniques for maintaining indent depth (~150 nm) and aligning the contacting face to be parallel with the work-piece surface were all design challenges overcome to produce areas of nanostructures on materials such as EL nickel, plated copper, 6061 Al, cartridge brass, silicon and germanium.

These surfaces were also used to create replicates in UV-curable material. •

Transforming market information to engineering knowledge in product design

Faculty: Dr. Scott Ferguson | Students: Garrett Foster, Alex Belt, Kalie Porterfield

In today’s global economy, America’s manufacturing sector must compete with companies in developing nations that enjoy inherently favorable cost structures. This has challenged American manufacturers to reduce their manufacturing footprints while maintaining sufficient market coverage. Business strategies centered on excessive product proliferation are no longer effective, as middle-class consumers in the United States and Europe look for products that maximize their “value-for-money.”

Further, it is expected that economic growth in China and India will lead to nearly 3 billion people joining the middle class over the next decade.

When shopping for a product – or even when at the grocery store – consumers are barraged with options that rarely fulfill their diverse set of wants and needs. Since product desirability is measured from the perspective of the customer, the features, options and price associated with a product are inherently important. Product specifications drive customer-perceived value, which along with price, drive a product’s market share. Therefore, designing competitive products requires an understanding of what people want from a product, allowing manufacturers to strategically target products for well-defined customer groups with strong preferences and a favorable willingness to pay.

The System Design Optimization laboratory, led by Dr. Scott Ferguson, is working to advance the state-of-the-art in engineering design theory by creating tools and methods that help engineers identify market opportunities and navigate the tradeoffs associated with selective variety. Toward this goal, Ferguson and his team have been exploring how information from the marketing domain can be translated into engineering knowledge that can guide product architecture decisions.

To explore the question surrounding how many products to offer and what specifications they should have, Ferguson’s team has been collaborating with researchers at General Motors R&D on a project funded by the National Science Foundation.

In this work, mathematical preference models obtained from discrete choice conjoint surveys are used to infer market segmentation strategies and investigate the optimal configuration of a product line. Results from this project have shown that when the number of possible build combinations becomes large (on the order of millions), the likelihood of a non-tailored optimization algorithm reaching the global optimum is small.

This has led to the development of a targeted initial population strategy that uses information from the marketing domain

– a survey respondent’s preferred product configuration – to intelligently create starting points that guide the product search. The results show that this technique is quite effective at improving solution quality and reducing computational expense for single and multiobjective problem formulations.

Beyond product line optimization, Ferguson’s group has begun to explore how marketing information can help address the front-end challenges associated with product customization. Sponsored by the NSF CAREER Award, this work investigates how the interaction between customer preferences and product price can be used to develop a product proliferation strategy that offers customized variety while still considering the challenges this creates for the firm.

Work in this area began by developing a mathematical relationship for sacrifice gap – the difference between what customers want and what they settle for. This allowed for the measure of sacrifice to be used in an optimization problem, where customization opportunities that benefited both the customer and the firm were identified. Building on this conclusion, recent efforts have explored how a company’s market segmentation strategy and the engineering changes needed to enable customization interact when selecting appropriate customization offerings. •



Dr. Scott Ferguson explores how marketing information can be translated into engineering knowledge that can guide product architecture decisions.





# EVERYONE LIKES THE NEW NEIGHBOR

*The recently opened James B. Hunt Jr. Library — located just steps from MAE's home in Engineering Building III — is redefining the engineering study experience.*

The new study space for MAE students just might be the world's most advanced library.

Students in the Department are already carving out their favorite nooks at the new James B. Hunt Jr. Library, which opened in January on NC State's Centennial Campus. The 220,000-square-foot structure has received global attention for its state-of-the-art technologies and futuristic feel, attributes that should boost the Department's profile and its efforts to recruit and retain top faculty and students.

The library contains NC State's engineering collections and is just a short walk from the Department's home in Engineering Building III. Hunt boasts nearly 100 study-group rooms and technology spaces featuring everything from 3D printers to giant high-definition video displays.

Andrew Mullican, a junior in mechanical engineering, said he still sees tour groups walking through the library, an indicator that months after its opening the building remains a subject of public fascination.

It's great to have a study area so close to where most of his classes are held, he said.

"I go there a few times a week to study and do homework on my own," Mullican said, "and a lot of my classmates go there to work every single day."

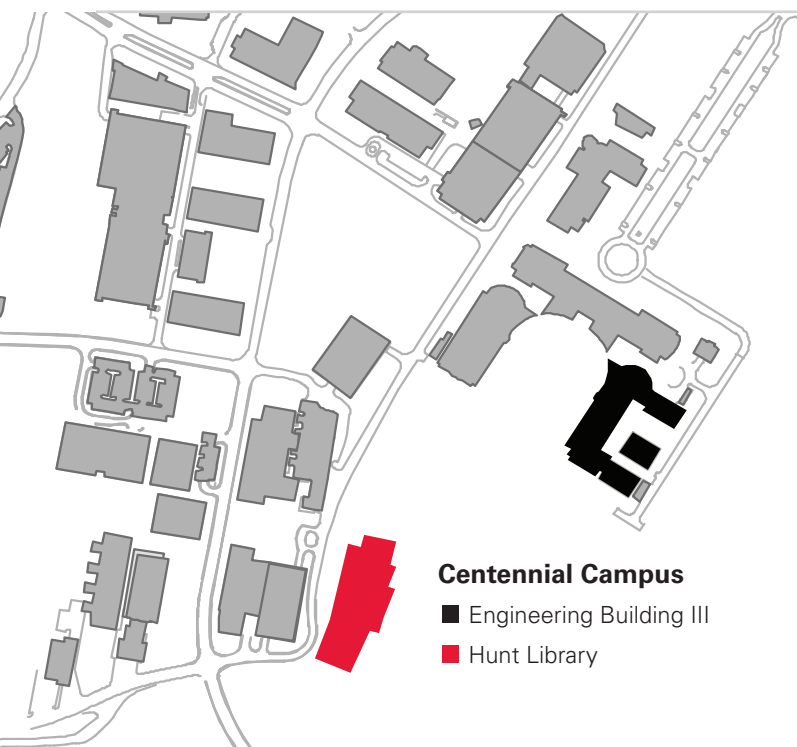




After a student selects a book from the library's online catalog, one of four "bookBots" retrieves the title and delivers it to a pickup area in five minutes or less.



The library's expansive study areas are perfect for group work.



The library's namesake, former North Carolina Gov. James B. Hunt Jr., holds two degrees from NC State and is one of the university's staunchest supporters.

"The Hunt Library says that something important is happening at this university," Hunt said. "It also says that NC State is one of the leading universities in the nation and in the world in providing the best opportunities for students to learn."

There are nearly 2 million books in the Hunt Library – but you won't find too many lining the shelves. More than 95 percent are managed by the bookBot, a robotic, automated book delivery system that retrieves titles from a giant storehouse within the building.

After a student selects a book from the library's online catalog, one of four book-gathering machines travels the bookBot's climate-controlled aisles looking for the title. Students can watch the robots work through an observation window on the library's first floor.

In five minutes or less, a bin emerges at a pickup area with the book inside.

"We're an engineering school, evidenced by the fact that we have a 'robotic librarian,'" said Stephen West, a junior in aerospace engineering. "How does it get cooler than that?"

The book-fetching system is just one of many advanced technologies at the new library. During the library design process, planners spoke with engineering students and faculty to see how they worked and what types of spaces they needed. The conversations helped inform how designers crafted the library's study, research and work areas, which include a high-tech, glass-enclosed "Fishbowl" room created to give students and faculty from different fields a place to meet and trade ideas.

There are high-definition display walls for video-game developers, laser cutters that can shape and engrave wood, acrylic and other materials, and 3D printers that can quickly produce plastic prototypes of everything from medical devices to aircraft parts.

Powering it all is a supercomputer that supports the library's technical infrastructure. Hunt is the only academic library in the US with this technology.

Outside the building, Hunt has lots of environmentally friendly features. They include a rain garden that collects storm water runoff, 12 rooftop solar panels that power the library's hot water system, and an innovative air conditioning system that uses chilled water instead of air to keep the temperature comfortable. The solar "fins" lining the library's exterior are specially sized to keep out the heat while letting in natural light.

For NC State engineers, the library functions as a community center on the growing campus, now home to more than 60 percent of College faculty and students. The library has a café and, like the D.H. Hill Library on Main Campus, is open 24 hours most weekdays.

Travis Burrows, a senior in mechanical engineering, goes to the library every day. He said the expansive study areas are perfect for working in groups.

"The parking is great, especially if you're there after five," he said. "And the open design makes it a really spacious place to work."

### A LIBRARY FOR THE PEOPLE

The Hunt Library holds more than books – it's also home to some of North Carolina's most prominent policy research organizations.

One of those entities is the Kenan Institute for Engineering, Technology and Science, which funds groups and individuals that want to use those fields to improve the economy and public welfare. Another is the Institute for Emerging Issues (IEI), which was founded by Gov. Hunt in 2002.

IEI's first home was inside the Kenan Institute, which helped the fledgling "think and do tank" grow during its early years. Now, IEI works with communities across North Carolina to devise solutions to the state's most pressing challenges in health care, the economy, the environment and education.

IEI's presence in the Hunt Library includes the Emerging Issues Commons, one of the most attention-grabbing spots in the building. Set up as an interactive multimedia exhibit, the space encourages visitors to learn more about the innovative ways in which North Carolina is preparing for the future.

"My dream for this library is that the people of North Carolina will have at their fingertips the kind of information they need to collaborate with the citizens in the state's 100 counties," Hunt said. "I want them to develop ways to build the economy, improve education, and provide greater opportunities for the people." •

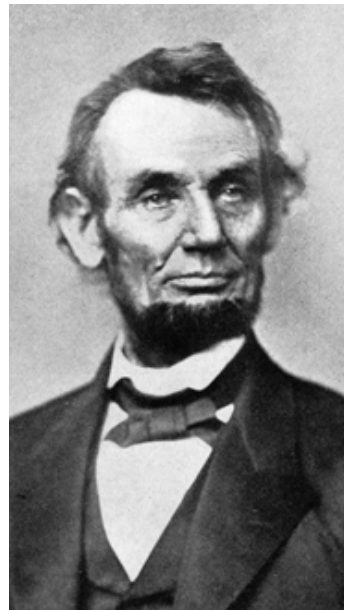




# THE MAE LEGACY

*Mechanical and aerospace engineering is deeply rooted in the history of NC State. Its origins date to the university's founding in 1887.*

*Since then, MAE has grown into one of the university's largest and most well-respected departments. As NC State wraps up its 125th anniversary, its mechanical and aerospace engineering graduates can look back on an exceptional record of accomplishment.*



## 1860s

1862  
President Abraham Lincoln signs the Morrill Act, paving the way for the creation of land-grant colleges focusing on agriculture on the mechanical arts.

## 1880s

1887  
The North Carolina College of Agriculture and Mechanic Arts is established. It includes engineering departments.

1889  
The first freshman class (below) arrives on campus. Walter J. Mathews is the first enrolled student. He studies mechanic arts, or engineering.



## 1920s

1922  
Mechanical engineering, which had been previously housed in Holladay Hall and the Mechanical Building, moves to a new home, Page Hall (above).

1923  
The School of Engineering is formed. Mechanical engineering is among its founding departments.

1929  
The aeronautical engineering option is offered for the first time.

## 1940s

1940  
The Department of Aeronautical Engineering is established.

1941  
Katharine Stinson (below) receives a BS in mechanical engineering with an aeronautical option, becoming the first woman to graduate from NC State with an engineering degree. She goes on to make key contributions to aircraft safety and serves on an advisory committee under President Lyndon Johnson.



## 1950s

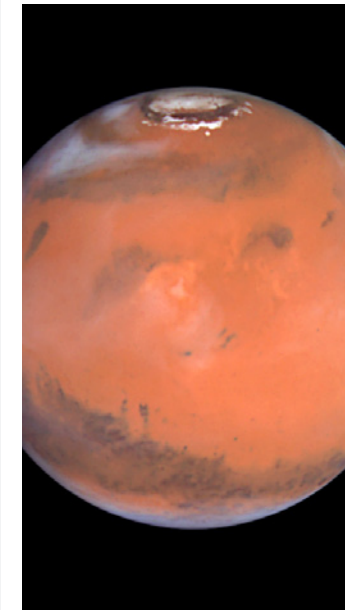
1951  
The departments move into two new buildings, Broughton Hall (above) and Riddick Engineering Laboratories. The buildings include several wind tunnels and a collection of diesel engines furnished by the US Navy.

1953  
The first African-American students enroll at NC State. They include Hardy Liston, who studies mechanical engineering.

## 1960s

1962  
The two departments combine to form the Department of Mechanical and Aerospace Engineering. The merger coincides with more NC State engineering graduates and faculty joining the US space program.

1965  
The Department awards its first PhDs in mechanical engineering.



## 1980s

1988  
The Mars Mission Research Center is established. The giant research effort focused on developing technologies for planetary exploration, with particular emphasis on Mars.



## 2000s

2010  
The Department moves to the new Engineering Building III on Centennial Campus. The facility boasts nearly 250,000 square feet of offices, labs and classrooms. A separate structure behind the building houses wind tunnels and an anechoic chamber.



# CUTTING THROUGH THE NOISE

*Remembering a NASA traineeship program that shaped the Department.*



On a night in late September of 2012, a tight-knit group of North Carolina State University engineers gathered after a 40-year hiatus. The nearly 50 engineers, who were dedicated to solving some of the most difficult noise and vibration problems of their time, gathered to pay homage to their peers, professors and mentors, as well as the university that made their work possible.

At a banquet room at a Triangle Sheraton hotel, the engineers shared stories of illustrious careers in academia, government and industry. The reputation for research and education excellence that the Department and the College of Engineering now enjoys didn't come easy. Getting there took innovation, conviction and sheer determination.

Dr. Carl Zorowski, a former MAE department head, recounted a tougher time for engineering at NC State. He said NC State engineering experienced difficulty in the late 1960s and early 1970s, including low enrollment that translated to limited funds.

"We were struggling as a group, but the struggle also made us hungrier," he said.

That all changed in 1969 when Dr. Franklin D. Hart, then on the Department's faculty, secured a grant of \$251,000 (equivalent to about \$1.5 million today) from NASA for a Graduate Traineeship Program in Aerospace Acoustics.

Zorowski, Hart's PhD chairman, remembered learning of the grant award.

"We knew the program had the capacity to grow — and Frank Hart was instrumental in making it happen," Zorowski said.

Securing the grant meant funds to develop facilities, programs, and research opportunities for graduate students would be available. The grant also allocated funds for recruitment of prominent faculty. The capacity that Zorowski had dreamed of would now be possible.

As a result of the grant, the Center for Acoustical Studies (CAS) was established in the Department in 1969. Hart served as the

principal investigator for the project and ultimately was named the center's first director.

The NASA Traineeship Program was intended to address the national need for PhD-level engineers trained in solving sound and vibration problems over a wide range of areas, including aerospace applications, machine design, and environmental noise problems. It provided funding for sound and vibration measurement and analysis equipment, including laboratory support.

NASA also provided an opportunity for NC State faculty and students to work with NASA scientists and engineers at the space agency's facilities at Langley, Va. NASA personnel also participated in the research conducted at NC State and, in some cases, NASA employees continued their engineering educations at the university.

For some students in the program, NASA also provided opportunities for employment. They included Dr. Thomas Brooks, a senior research scientist at NASA who developed a semi-empirical study on fan noise, results of which are still used today.

From the start, faculty and students of the CAS worked with other departments on campus, including psychology, industrial engineering, biological and agricultural engineering, as well as the School of Textiles, now the College of Textiles.

One of the first CAS interdisciplinary projects was aimed at understanding the effects of noise on human sleep and job performance. This research involved Dr. Richard G. Pearson of the Department of Industrial Engineering and Dr. Thomas E. LeVere of the Department of Psychology.

In addition to Hart, early CAS faculty members included Dr. Larry H. Royster and Dr. J. Ronald Bailey. Royster received his PhD in engineering mechanics from NC State in 1968 and subsequently became a faculty member in the Department. His research in the CAS initially involved underwater transducers. He



also worked in cooperation with the UNC Speech and Hearing Center and became a leading expert in hearing loss and hearing conservation.

Bailey received his PhD from the Institute for Sound and Vibration at the University of Southampton in England and subsequently joined the MAE faculty. He is currently Guerry Professor of Engineering and director of the Center for Energy, Transportation and the Environment at the University of Tennessee at Chattanooga.

At the reunion, Bailey, a student of Hart's, recalled how this professor was different.

"Dr. Hart expected every student to succeed, and that inspired us to do just that," Bailey said.

Hart left the CAS in 1980 to become the associate dean for research for the College of Engineering. He later became vice chancellor for research and provost of NC State.

Dr. Thomas H. Hodgson, an internationally recognized authority on theoretical acoustics, turbulent fluid flow, and aero-acoustics, replaced Hart as the CAS director. During Hodgson's tenure, the CAS was renamed the Center for Sound and Vibration (CSV). Dr. Richard F. Keltie followed Hodgson as director of the CSV, and Dr. Robert T. Nagel followed Keltie.

In addition to reminiscing about the past, the reunion activities also included a look at today's NC State. The attendees took a tour of the new MAE facilities on Centennial Campus conducted by Dr. Richard Gould, head of the Department.

Dr. Wayne Smith, a tour attendee, remarked at the tremendous degree of investment made on students' behalf.

"Obviously they've given some thought to what education is today by incorporating green spaces, beautiful architecture and the very best in technology," he said. "I couldn't be prouder of my alma mater." •

Opposite page: Dr. Frank Hart (right), with graduate student Craig Hartsell, secured the NASA grant that started the Graduate Traineeship Program in Aerospace Acoustics.

Left: Dr. Carl Zorowski (right), with graduate research assistant Stanley Dunn, was head of the Department for many of the program's early years.

## FAR AND WIDE

*NASA trainees at NC State's Center for Acoustical Studies made important advances in a variety of areas.*

### TIRE NOISE GENERATION

Dr. William F. Reiter was a professor at NC State and later worked for IBM. He retired as the Boeing Professor in Design Manufacturing at Oregon State University.

### AERODYNAMIC NOISE GENERATED BY SHROUDED PROPELLERS

Dr. Richard E. Longhouse worked for General Motors Corp. and retired as manager of the Sound and Vibration group at the GM Delphi Automotive Division.

### BASIC MECHANISMS OF HUMAN HEARING, HEARING LOSS AND DEVICES

Dr. Reginald Cook worked at the National Institute of Environmental Health Sciences and later founded Opto Acoustic Sensors, Inc.

### VIBRATION OF SHELLS

Dr. George G. Georgopoulos was in the acoustics and vibration group at Westinghouse. He is currently president of High Energy Corp.

### LOW-FREQUENCY ROOM ACOUSTICS

Dr. Wayne Smith worked for John Deere Co. and later worked on GPS control of Deere equipment. He retired as program manager of Advanced Engineering for John Deere.

### NOISE AND VIBRATION PROBLEMS IN THE WOODWORKING INDUSTRY

Dr. Thomas F. Brooks was employed by NASA and is currently a senior research scientist at the space agency. Dr. David M. O'Brien was employed by John Deere Co. and, later, Honeywell Aerospace Corporation. Dr. John S. Stewart is a sound and vibration consultant and retired as a research professor at NC State.



# AWARDS AND HONORS

## Bio-flight senior design team places third in international competition

› The NC State Bio-Flight Senior Design Teams visited Marietta, Ga., for the SAE Aero Design East Competition held in April 2012. Both teams competed in the Heavy Lift Micro class requiring them to build an RC airplane capable of fitting into a box 18x24x8 inches. The teams were scored on the plane’s ability to carry the greatest payload weight relative to its empty weight.

One team, Above Ground Level, placed third in the presentation part of the competition. Another team, JAC, received high praise from the competition judges for its innovative fiber glass carrying box that was equipped with solar panels to charge its battery from anywhere.

Both teams spent two days at the Georgia Model Aviators Airfield flying their planes in competition with teams from across the world, including Brazil, India, Canada, Poland and China.

## Faculty Honors

› Dr. Tiegang Fang, assistant professor, was the author of one of the 20 most cited articles published in the international journal *Communications in Nonlinear Science and Numerical Simulation* from 2007 to 2012. The article, “Closed-form exact solutions of MHD viscous flow over a shrinking sheet,” appeared in Vol. 14, Issue 7, 2009.

› Dr. Yong Zhu, assistant professor, received the 2012 Sigma Xi Faculty Research Award from NC State’s chapter of Sigma Xi, the scientific research society.

The award honors young scientists and engineers who have excelled in research. Zhu’s research interests are on the boundary between micro and nanotechnology and the mechanics of materials, including the mechanics and electromechanical coupling of low-dimensional nanostructures.

› Dr. Afsaneh Rabiei, associate professor, was named a Senior Fellow of Brain Mapping Foundation in April 2012. She was also selected as a visiting scholar at the Society for Brain Mapping and Therapeutics.

# NEW FACULTY AND STAFF

› Dr. Mark Pankow, assistant professor, received his BS in mechanical engineering from California Polytechnic State University in 2005. He received his MSE and PhD in mechanical engineering from the University of Michigan in 2007 and 2010, respectively. Prior to joining NC State, he was a post-doctoral researcher at the Army Research Laboratory in Aberdeen, Md.

Pankow’s research focuses on 2D and 3D woven composites subjected to ballistic and blast loads. This work has applications in armor systems and structural applications due to its low weight, high strength and damage tolerance.

› Dr. Venkat Narayanaswamy, assistant professor, received his BS in aerospace engineering from the Indian Institute of Technology Madras, India, in 2004 and his PhD in aerospace engineering from the University of Texas at Austin in 2010. Prior to joining NC State, he was a postdoctoral research associate at UT Austin and RWTH Aachen, Germany.

Narayanaswamy’s research focuses on understanding the complex turbulent interactions that occur in supersonic flows and reacting flows, where he develops measurement techniques to probe the flow at extreme conditions. This work has applications in energy from fossil fuels, air-pollution mitigation, military transport and missile launch.

› Whitney Wilson-Botts works in administrative and business support for the Department. She received her BA in history from NC State in 2004. She previously worked for her family’s kitchen and bath company, Artistic Kitchens & Baths, mainly designing kitchen remodels.

# FACULTY UPDATES

› Several existing faculty have new appointments: Dr. Alexiei Saveliev was granted tenure at the associate professor level; Dr. Chau M. Tran was recommended for appointment to teaching associate professor; Dr. Stearns Heinzen was recommended for appointment to teaching assistant professor; and Dr. Fuh-Gwo Yuan was named the National Institute of Aerospace Samuel P. Langley Professor.

› Dr. Bob Nagel stepped down as associate head and director of graduate programs and is beginning phased retirement, and Dr. Paul Ro has replaced Nagel in this capacity. Dr. Thomas A. Ward III left the Department to take a faculty position at Iowa State University, and Dr. M.K. Ramasubramanian left to become department head at Clemson University.

# STUDENTS' CORNER

## Graduate Student Association



AUGUST 2012

### Fall Social Event

To welcome new students into the Department, the MAE Graduate Student Association hosted a cookout (above) at Lake Raleigh on Centennial Campus. The event featured burgers, lawn games and a beautiful lake view.

SEPTEMBER

### Graduate Student Seminar

One of Dr. Ashok Gopalarathnam’s PhD students, Kiran Ramesh, presented a seminar entitled “Aerodynamics of Flapping Flight”.

## American Society of Mechanical Engineers (ASME)

› In November, members and officers of ASME attended the annual **International Mechanical Engineering Congress and Exposition** to learn about current research and technology from across the engineering field. The conference was held in Houston, Texas.

› The ASME design team was hard at work this year. For this year’s **ASME Student Design Competition** at the Regional Student Professional Development Conference, the problem was to construct a robot with an integrated telecommunication system for remote operation and a control system to perform at the competition. It was an exciting time for the builders.

OCTOBER

### Graduate Student Seminar

One of Dr. Larry Silverberg’s PhD students, Chad Bieber, gave a seminar entitled “Scaling Central Command Control Architecture in Multiple UAV systems”.

### Movie Night

With snacks and drinks provided, the 80s masterpiece “Real Genius” was shown on one of the classroom projectors in EB3.

### Intramural Volleyball Team

This year’s intramural team was the most successful team yet. The group advanced to the finals in the grad/faculty/staff league.

NOVEMBER

### International Pot Luck

American students brought Thanksgiving-themed dishes complete with a turkey and all the fixings. International students brought delicious dishes from back home for all to enjoy.

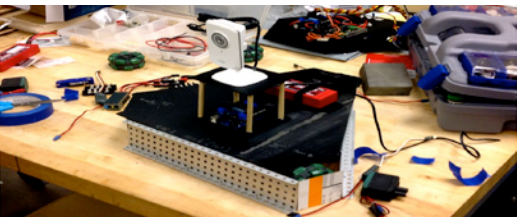
JANUARY 2013

### New Student Orientation

A start-of-the-semester staple is the new graduate student orientation. Current students passed on tips and advice to new students.



ASME officers and members attended the IMECE 2012 event in Houston.



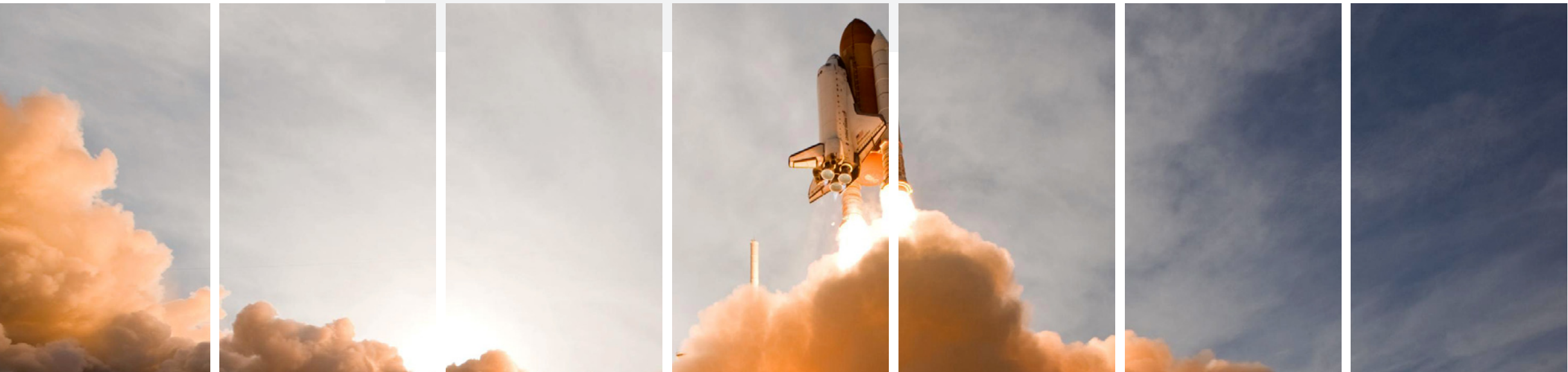
The ASME design team built a robot, shown here at the start of the spring 2013 semester, for the design competition in March.



FEATURED ALUMNUS

INTO ORBIT

Dr. Bill Ailor III has built a four-decade career at the forefront of US orbital and reentry operations.



Ailor's work has included developing flight mechanics simulations for various flying objects, including the Space Shuttle.



I received a BS in aerospace engineering and an MS in mechanical engineering from NC State (an MS was not offered in aerospace engineering at the time) in 1967 and 1969, respectively. I then went to work for the Naval Ordnance Station in Indian Head, Md., for a few years, and following that received a PhD in aerospace engineering from Purdue University.

After graduating from Purdue, I accepted a position at the Aerospace Corporation, a nonprofit corporation that supports the national defense space program. I've been at Aerospace for the last 38 years, and am now the principal engineer with its Center for Orbital and Reentry Debris Studies (CORDS).

My time at NC State truly shaped my life. I met Barbara, now my wife, there — she was in the zoology department studying malaria in pigeons (I was attracted despite the rather peculiar smell she occasionally acquired from handling lots of dirty birds). I also played clarinet in the band, lived in the dorms, suffered through lots of courses, and did master's research on the aerodynamics of paper airplanes, which meant spending many hours late at night running the wind tunnel.

Strange as it seems, those courses that seemed so painful at the time have really paid off during my career. My education left a technical foundation that would be very relevant to my future work. I've been most thankful for the excellent English courses. I was actually able to write coherent reports, a fact that was greatly appreciated by my supervisors.

After graduating from NC State, I won a few contests with my paper airplanes (thanks to those long hours at the wind tunnel), and that research project helped me have the confidence to try new and different things throughout my career. For example, when I arrived at Aerospace, I immediately was involved with predicting where the Cosmos 954 satellite would reenter the atmosphere and where the debris would fall. The satellite contained a nuclear reactor, so the world was concerned about where radioactive debris might land (Cosmos 954 ultimately reentered and debris was recovered in remote areas of Canada). This experience led to a lifelong interest in reentry breakup.

I later developed flight mechanics simulations for various flying objects, including the Space Shuttle, was involved in strategic planning for the company, was in charge of the corporate computer networks, and established an organization to help satellite operators avoid collisions in space.

In 2000, the evolution of satellite telephones and miniature electronic systems enabled a new class of inexpensive, but very capable satellites to be built and flown. Aerospace built and tested PicoSats that were the size of a deck of cards, and I imagined a small device, essentially a PicoSat with a heat shield, designed to ride a reentering spacecraft into the atmosphere, record data during the spacecraft's breakup, break free during breakup, and transmit the recorded data via the Iridium system.

We built such a device, called the Reentry Breakup Recorder (REBR), which had its first successful reentry test in 2011 and two more successes in 2012.

A person never knows where a career will take him or her, but based on my experience, NC State provides the tools and the confidence to excel at meeting the challenges you'll face and to do lots of interesting things. Despite the seeming irrelevance at the time, absorb as much as you can. •

William (Bill) H. and Barbara J. Ailor  
Enhancement Fund for Mechanical and  
Aerospace Engineering

It was a simple decision for Dr. Bill Ailor III and his wife, Barbara: A portion of their estate would go to NC State, a university that produced many good memories and a tremendous education.

Bill Ailor remembers the day he met Barbara, a fellow NC State graduate student who needed help carrying boxes to her apartment at the start of the semester. He credits NC State with giving him the flexibility to find the major, aerospace engineering, that was the best fit for his interests.

He hopes the couple's planned gift, which can be used to buy new equipment and support students and faculty, encourages others to help the department that introduced him to his field.

His advice to NC State alumni: "Make sure that the university that has been so important to you benefits from your work and success."

FINDING THE BEST FIT

The NC State Engineering Foundation can help supporters find a planned giving option that works best for their long-term financial goals.

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For more information, visit [www.engr.ncsu.edu/foundation/ways-to-give](http://www.engr.ncsu.edu/foundation/ways-to-give) or contact Tasha Martin at [tasha\\_martin@ncsu.edu](mailto:tasha_martin@ncsu.edu) or 919.513.7557.



MAE HALL OF FAME

Inductees to the MAE Hall of Fame are distinguished alumni whose professional excellence inspires students. Nominations are based on professional and service achievements, entrepreneurial activities and contributions to professional societies. Members are listed with their most advanced NC State degrees.

**Mr. Charles E. Edwards**  
BS MAE 1950  
*President & CEO*  
Bandag, Inc.

**Mr. Gerald D. Mann**  
BS MAE 1952  
*Owner*  
Mann Properties, LLP

**Col. Gerald B. Hurst**  
BS MAE 1956  
USAF (retired)

**Mr. James Edward Ingram**  
BS MAE 1962  
*President*  
Mediated Solutions, Inc.

**Mr. Jerry N. Hefner**  
MS ME & AE 1968  
*Consultant to the National Institute for Aerospace*

**Dr. Claud Ervin Pugh**  
PhD ME 1968  
*President*  
ORSA, Inc.

**Mr. Fred Ellington**  
MS ME 1969  
*President*  
Ellington Utility Contractors

**Dr. Lee Parker**  
PhD AE 1969  
*President*  
JLP Consultants

**Mr. William W. Rickard**  
BS MAE 1969  
*Vice President - Development and Production*  
Super98, LLC

**Mr. Randy Swartz**  
BS MAE 1971  
*CEO*  
The Swartz Group

**Mr. James C. Chastain III**  
BS MAE 1974  
*President*  
Heyward, Inc.

**Dr. John W. Sheffield**  
PhD ME 1975  
*Principal Consultant*  
DNV KEMA Energy & Sustainability

**Dr. Selcuk Guceri**  
PhD MAE 1976  
*Bernard Gordon Dean of Engineering*  
Worcester Polytechnic Institute

**Mr. Robert C. Cagle**  
BS MAE 1977  
*Vice President*  
Repcon, Inc.

**Dr. Hank G. Hoomani**  
PhD ME 1977  
*President*  
Progressive Design Collaborative, Ltd.

**Mr. Richard Allen Reed**  
BS MAE 1977  
*President*  
Triumph Actuation Systems, LLC

**Mr. Donald I. Lamonds**  
BS MAE 1978  
*CIO and Executive VP of Information Technology*  
Reynolds American, Inc.

**Mr. William C. Hall**  
MS ME 1980  
*President*  
Ramsey Products Corporation

**Mr. Floyd Byron Goodwin**  
BS MAE 1981  
*President*  
Goodwin Technical Services

**Dr. David D. Jones**  
PhD ME 1981  
*President*  
Jones Consulting Services, LLC

**Mr. Gregory A. Riffe**  
BS MAE 1981  
*President*  
GAR Engineering, Inc.

**Mr. Richard G. Wolfe**  
MS ME 1981  
*Vice President*  
Washington Group International

**Mr. D. Scott Stabler II**  
BS MAE 1982  
*Vice President, Corporate Operations*  
Huntington Ingalls Industries

**Dr. Robert W. Walters**  
PhD AE 1984  
*Vice President for Research*  
Virginia Polytechnic Institute and State University

**Ms. Lori Morton**  
BS MAE 1986  
*President*  
Aerie Engineering

**Mr. Alex W. Beltzhoover**  
BS MAE 1987  
*President*  
Southeastern Heat Processing Systems

**Mr. Timothy P. Howard**  
BS MAE 1987  
*Vice President*  
Commissioning Agents, Inc.

**Dr. Lane Ross Miller**  
PhD ME 1988  
*Vice President of Technology*  
Lord Corporation

**Mr. C. John Fitzgerald**  
MS AE 1989  
*President*  
FTS International, LLC

**Mr. Chris Holder**  
BS MAE 1990  
*Research & Engineering Group Head*  
Naval Air Systems Command

**Mr. Gary E. Kilpatrick**  
BS MAE 1990  
*President & CEO*  
Gary E. Kilpatrick & Associates, P.A.

**Dr. Chi Nguyen**  
BS MAE 1992  
*Managing Partner, Principal Scientist*  
Aerospace Innovations, LLC

**Mr. Hans A. Debot**  
BS MAE 1993  
*President & CEO*  
deBotech, Inc.

**Mr. David B. Ledford**  
MS ME 1994  
*President*  
Boneal, Inc.

**Dr. Gregory Washington**  
PhD ME 1994  
*Dean of Engineering*  
The Henry Samueli School of Engineering at UC-Irvine

**Mr. Michael S. Matson**  
BS MAE 1996  
*Senior Equity Research Analyst-Medical Supplies & Devices*  
Mizuho Securities USA

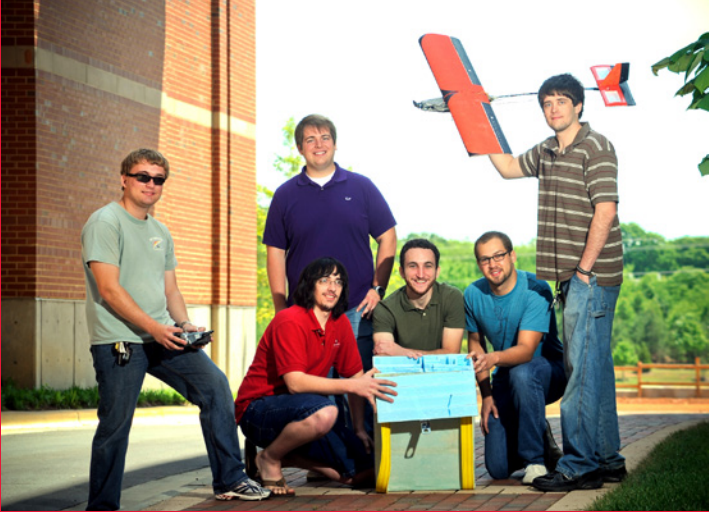
**Dr. Joseph R. Davis**  
PhD IE 1997  
*Energy Engineer and Project Manager*  
Engineering Economics, Inc.

**Mr. Erik Dixon**  
BS MAE 1998  
*General Manager*  
Broadcom Corporation

**Dr. Rolin Barrett, Jr.**  
PhD ME 2005  
*Consulting Engineer*  
Barrett Engineering

DATA POINTS

A look at some of the figures that shape the Department of Mechanical and Aerospace Engineering at NC State.



Place won by Bioflight Team JAC at the 2012 AIAA Southeast Regional Competition. The team built a small, hollow-winged transport and surveillance aircraft that could be assembled by two people in less than three minutes.

248,291

Square footage in Engineering Building III, the Department’s new home on Centennial Campus.

Total living alumni.

10,666

19

Graduates named Distinguished Engineering Alumni by the College of Engineering.

Approximate number of graduate and undergraduate students.

1,575



North Carolina State University  
Department of Mechanical and Aerospace Engineering  
Campus Box 7910  
Raleigh, NC 27695-7910

## SUPPORT MAE AT NC STATE

A gift to the Department of Mechanical and Aerospace Engineering is an investment in the future.

Gifts support scholarships, fellowships, professorships, academic programs, faculty research and other initiatives that are not typically supported through state appropriations. This private philanthropy empowers the Department to achieve excellence in research and education.

To learn more about supporting the Department, contact Tasha Martin at the NC State Engineering Foundation.



Tasha Martin  
919.513.7557  
[tasha\\_martin@ncsu.edu](mailto:tasha_martin@ncsu.edu)

[www.mae.ncsu.edu](http://www.mae.ncsu.edu)

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