Howard A. Stone, Chair

MECHANICAL AND AEROSPACE ENGINEERING

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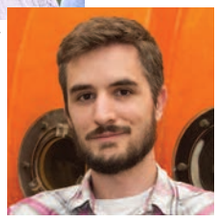

MAE BY THE NUMBERS

Distinctive Characteristics of the Department of Mechanical & Aerospace Engineering (MAE):

66 Visiting & Professional Researchers

The department concentrates its research activities in five broadly defined areas with many faculty involved with two or more areas. The five areas are:
- Applied Physics
- Dynamics & Controls
- Fluid Mechanics
- Propulsion & Energy Sciences
- Materials Science

392 INDIVIDUALS

15 Administrative & Technical Staff

2 Visiting Faculty/ Lecturers

101 Graduate Students

179 Undergraduate & Exchange Students

23+1 Full-time Faculty & Dean

5 Research & Active Emeritus Faculty

About the Department of Mechanical and Aerospace Engineering at Princeton University

Princeton's Department of Mechanical and Aerospace Engineering (MAE) has played a leading role in propulsion, combustion, aerospace dynamics, and fluid dynamics over the past half century, with expansion in recent decades into dynamics and control, applied physics, and materials science.

Our multi-disciplinary focus and attention to both engineering fundamentals and groundbreaking research helps us train graduate and undergraduate students for future leadership in areas of rapidly evolving technologies.

As a result, the people of MAE are providing engineering solutions to address the world's challenges in the areas of food production, biotechnology, energy production, efficiency and management, sustainability, transportation, communication, and health, safety and security.

Together, we take on future challenges, today.

MAE is:
Applied Physics • Dynamics and Controls • Fluid Mechanics • Materials Science Propulsion & Energy Sciences

Challenges:
Space Exploration • Satellite Technology • Pollution and Alternative Fuels • Energy Usage • Battery Technology • Novel Optical Systems • Propulsion Systems • Mechanics of Fluids and Solids • Stability and Control of Vehicles • Aircraft Performance Instrumentation

Cross-disciplinary Collaboration:
Astronautics • Bio-Inspired Design • Bioengineering • Medical Applications Combustion and Energy Conversion • Computational Engineering • Environmental and Energy Technologies • Laser-Matter Interactions • Security • Vehicle Sciences and Applications

PRINCETON MAE 2017-18 YEAR IN REVIEW:

A Flying Start Toward 2020

By Howard A. Stone, MAE Chair and Donald R. Dixon '69 and Elizabeth W. Dixon Professor

Welcome to the newest edition of MAE's annual report. While we celebrate the accomplishments of the people in the Department of Mechanical and Aerospace Engineering (MAE) each year, this edition goes a step further. We hope that by perusing these pages, you will see how we are meeting the challenges faced in our field to develop a better, safer, and more productive world. The following is a quick overview of who we are, what we do, and what is new in our corner of the world.

WHO WE ARE

As a department under the auspices of Princeton University's School of Engineering and Applied Science (SEAS), we had 24 faculty members and one lecturer, 101 graduate students, and 179 undergraduates in the 2017-18 academic year. Together, we build on a long history of academic success and societal impact. For example, five regular or emeriti faculty (Carter, Law, Miles, Smits, and myself) are members of the NAE and/or the NAS. Our graduate students go on to teach and/or conduct impactful research at Princeton and other exemplary institutions. Our undergraduates pursue advanced degrees or enter the working world to contribute new ideas and energy. In the following pages, you can read more details about what the people of MAE have achieved over the last year.

WHAT WE DO

MAE is unique in that it represents a variety of disciplines recognized at most universities in separate departments. We support two of Princeton's five ABET-accredited undergraduate degree programs in SEAS.

Our active, world-leading research programs range from uncovering basic principles to testing innovative theories in and beyond the traditional MAE realm of topics. For example, our faculty are active in:

- Robotics and dynamical systems
- Materials sciences, including problems from engineering materials to biomechanics
- Propulsion and combustion
- Fluid mechanics, including studies of turbulence, environmental flows, and complex fluids
- Several areas of applied physics, including fundamental studies of laser-material interactions, electric propulsion, and fusion energy

MAE faculty collaborate broadly with colleagues across campus and around the world and maintain a vibrant seminar series and intellectual community including postdocs, graduate students, and undergraduates. Read more about these highlights in the Year in Review section.

Photo by Frank Wojciechowski

Researchers led by Professor Howard Stone analyzed the use of water-based foam in hydraulic fracturing. The team, from left, included Stone and post-doctoral researchers Bhargav Rallabandi, Ching-Yao Lai, and Antonio Perazzo.

WHAT'S NEW

In addition to the MAE news, events, and published research papers this year, we also got a flying start, so to speak, on two expanded areas of focus in robotics and propulsion.

Our new Assistant Professor Ani Majumdar is commanding the new IRoM Lab (Intelligent Robot Motion Lab) that will loop into the SEAS robotics initiative. The lab's mission is to develop ways to control highly agile robotic systems such as unmanned aerial vehicles (UAVs), legged robots, and robotic manipulators so that safety and performance are guaranteed in very complex real-world operating environments. (More details here: https://irom-lab.princeton.edu/)

On the propulsion front, recently tenured Associate Professors Marcus Hultmark and Michael Mueller are delving deeper into high speed flows, reacting flows and other topics important in an MAE setting. Marcus's Fundamental and Applied Studies in Turbulence (FAST) lab focuses on the many aspects of fluid mechanics and how they affect the world we live in. Subjects range from drag reduction to boundary layers to wind turbines. (Learn more here: http://fluids.princeton.edu/)

Michael's Computational Turbulent Reacting Flow Laboratory (CTRFL) is developing and using high-fidelity computational tools to gain a fundamental understanding of turbulence and develop first-principles-based models for turbulent (and laminar) reacting (and non-reacting) flows. Engineering applications of interest to the research group include gas turbines and reciprocating engines. (Expanded info here: https://ctrfl.princeton.edu/)

We hope you will read on to learn more about what MAE faculty, students and researchers accomplished in 2017-18 and how we are gearing up for a flying start as we head toward 2020! ♦

YEAR IN REVIEW

Each year, many stories about student and faculty achievements grace the pages of our website. Here is a quick summary of the biggest highlights in one easy-to-read place. To read more details about the stories below, please visit the MAE news pages at https://mae.princeton.edu/about-mae/news.

July 2017

Team to use VR to help with real-world arms control

Alexander Glaser, Associate Professor of Mechanical and Aerospace Engineering and International Affairs and Co-Director, Program in Science and Global Security (SGS), is on a team awarded a $414,000 grant from the Carnegie Corporation of New York and the MacArthur Foundation. Glaser is collaborating with New York City-based Games for Change to develop a full-motion virtual reality (VR) to design and simulate new, cohesive arms-control treaty verification approaches to reduce and secure nuclear weapons and materials.

September 2017

MAE Research Day Winners

Clay Byers took first place at MAE Research Day for his talk, entitled, "Multi-Component Velocity Measurements in a Wall Bounded Turbulent Flow Utilizing a Novel Sensor." Ting-Hsuan Chen was named runner up for her talk called "Ultrafast z-scanning for High-efficiency Laser Material Processing."

October 2017

Ju: Distinguished lecture at Penn State

Yiguang Ju, Robert Porter Patterson Professor of Mechanical and Aerospace Engineering, presented a 2017 Air Products Distinguished Lecture at Penn State's University Park Campus on the topic of "Dynamics of Cool Flames and its Impact on Turbulent Combustion and Modeling."

October 2017

Choueiri: "Fooled by Audio" keynote address

Professor Edgar Choueiri's keynote address at the Audio Engineering Society New York 2017 Convention delved into multiple dimensions of Virtual and Augmented Reality, Spatial Audio, and sound synthesis. He examined the major questions regarding the future of spatial audio and perception, including recent breakthroughs that make reproducing or synthesizing sound even closer to being indistinguishable from reality. Choueiri is Director of Princeton University's Program in Engineering Physics and Director of Princeton's Electric Propulsion and Plasma Dynamics Laboratory (EPPDyL).

October 2017

Stone: Indira Foundation Distinguished Lecture at the India Institute of Technology Bombay

Howard A. Stone, MAE Chair and Donald R. Dixon '69 and Elizabeth W. Dixon Professor, presented, "Beauty and Surprises in Fluid Mechanics: Nature, Research," at the India Institute of Technology Bombay. He talked about the ways that mechanics and fluid dynamics yield insights into a wide variety of "multiphase" problems. Examples included fluid motions generated by living organisms, flows influenced by surface micro textures, various examples involving bacteria, biofilms and flows, bubbly flows that yield insights into unappreciated single-phase flow complexity in simple geometries, and finally the use of a physicochemical phenomenon, "diffusio-phoresis," that suggest new approaches to membraneless filtration of particulate solutions.

November 2017

Smits: MIT lecture on bio-propulsors

MAE Eugene Higgis Professor Alexander Smits gave the Massachusetts Institute of Technology Robert Bruce Wallace Lecture on "Fast and efficient underwater propulsion inspired by biology." He discussed the underlying physics, superior performance, and natural limits of fluid-structure interaction of bio-propulsors, as well as how further performance improvements will require adaptive flexibility and optimized planforms.

November 2017

Researchers win 2017 Edison Patent Awards

MAE researchers Craig Arnold, Alexandre Mermillod-Blondin, Euan McLeod, and MAE alumnus Christian Theriault of TAG Optics, received the Research & Development Council of New Jersey's Edison Patent Award for their "Tunable Acoustic Gradient Index of Refraction Lens and System." The patent represents the first time that sound has been used to make a controllable lens for imaging and materials processing applications; the system also scans over a complete range of focal lengths in only microseconds, much faster than the other variable focal devices on the market.

December 2017

Kosmrlj receives NSF CAREER Award

Assistant Professor Andrej Kosmrlj received a National Science Foundation (NSF) Faculty Early CAREER Development Program Award to research statistical mechanics of slender structures, which stand at the intersection of continuum mechanics, statistical mechanics, and biology.

December 2017

Time capsules for climate change: Socolow's freshman class thinks about the future

Students in Professor Emeritus Robert Socolow's freshman seminar prepared essays and personal reflections about using emerging science to think quantitatively about the impacts of climate change and possible strategies for mitigation. The time capsules containing their work will be stored at Mudd Library until they are opened at the students' 10th, 25th and 50th reunions. Socolow, a leading researcher in technological and policy responses to climate change, says he thinks of the capsules as destiny studies: "The 50-year time frame," he notes, "is the length of these students' careers. There are a huge range of possible outcomes."

December 2017

Revealing latte layering secrets

Double-diffusive convection is the key to pouring a nicely layered café latte, says Nan Xue, lead author of a paper in *Nature Communications* and a graduate student in Professor Howard Stone's lab. Xue boosted the camera's tracking power with tracer particles that scattered light from a green laser beam to help track a faux-latte's internal dynamics. Double-diffusive convection occurs when denser, cooler liquids sink, and lighter, hotter liquids rise until the region reaches equilibrium and the fluids flow into horizontal layers instead. Understanding the process holds commercial promise for improving how to flow liquids into different strata and potentially reduce costs and complexity in a range of applications, such as in food science and improving personal care products.

December 2017

Teaching kids science through chocolate

Chocolate was the sweet subject of the ninth-annual science workshop for kids taught by Howard Stone, MAE Chair, and Bonnie Bassler, chair of the Department of Molecular Biology. Students learned where chocolate comes from, what makes a chocolate bar smooth and creamy, and about how hydrophobic (water repelling) and amphiphilic (in parts water repelling and attracting) materials combine to make a tasty treat.

January 2018

Deike's aerosol research highlighted

Assistant Professor Luc Deike, who studies interactions between the air and seawater and the dynamics of breaking waves, published new research detailing the intense velocity of aerosols cast upward as bubbles on a liquid's surface burst. Knowing the speed and height of aerosols applies to numerous areas of scientific and economic interest, including more accurate climate modeling or creating a perfect glass of champagne. The paper, entitled, "Dynamics of jets produced by bursting bubbles," was published online in *Physical Review Fluids* at https://journals.aps.org/prfluids/abstract/10.1103/PhysRevFluids.3.013603.

February 2018

Law and Ju elected fellows of The Combustion Institute

Chung K. Law was named a fellow for his "brilliant research achievements in all the fundamentals of combustion for applications in propulsion, energy and environmental issues." Yiguang Ju was named a fellow for "innovative fundamental research in laminar flame dynamics, flame chemistry, and plasma assisted combustion."

February 2018

Former NASA administrator and astronaut highlights space achievements

Major General and former NASA administrator Charles Frank Bolden Jr. (USMC-ret.) gave the annual G. S. Beckwith Gilbert '63 Lecture on "Humanity's Exploration" about NASA's achievements. These included the unprecedented landing on Mars with the rover Curiosity, launch of a spacecraft to Jupiter, and continued progress toward the launch of the James Webb Space Telescope. He traveled into orbit four times aboard the Space Shuttle between 1986 and 1994, commanding two of the missions and piloting two others.

March 2018

Doctoral student awarded Porter Ogden Jacobus Fellowship

Doctoral student Matthew Edwards, one of four Jacobus Fellows named, holds a B.S.E. from Princeton and certificates in engineering physics and in robotics and intelligent systems. His dissertation focuses on the development and application of high-power sources of coherent ultrafast radiation. One example is high-intensity X-ray bursts bright enough to capture the structure of an isolated protein and infrared pulses that "for a few millionths of a billionth of a second deliver the power of a million nuclear plants onto an area smaller than the cross section of a human hair."

September 2017

Law presents Shanghai school lecture, wins Beijing Great Wall Friendship Award

Chung (Ed) Law, Robert H. Goddard Professor, spoke on "In Pursuit of Intellectual Excellence" at the Soong Ching Ling School forum in Shanghai. Law, Director of the Center for Combustion Research at Tsinghua University, traced the impact combustion has had on human beings from the dawn of civilization and explained, with simplified illustrations, how the phenomenon works, so that the students could easily sense the "intellectual beauty and excitement of combustion," the school reported.

The Beijing Great Wall Friendship Award was presented by Acting Mayor Chen Jining on behalf of the People's Government of Beijing Municipality during a special ceremony in Beijing.

March 2018

Feliciano '94 receives Jerry I. Porras Latino Leadership Award

José E. Feliciano, who earned his B.S. in MAE, was honored with the Stanford University Hispanic Business Student Association's Jerry I. Porras Latino Leadership Award. Feliciano, who received an MBA from Stanford in 1999, is cofounder and managing partner of Clearlake Capital Group. Efforts that earned his nomination included his help with creating the Stanford Latino Alumni Association and his community service efforts, particularly in marshaling action for hurricane relief in his native Puerto Rico. Read more here: https://www.gsb.stanford.edu/alumni/featured-events/award-events/latino-leadership

May 2018

Princeton Racing Electric on a Roll at Formula Hybrid

The Princeton Racing Electric team took second place in the electric-only category at the Formula Hybrid competition in late spring. The 250 kg vehicle has two Parker GVM142 36 kW drive motors that operate at 6,000 RPM, and features independent rear wheel drive motors. The accumulator high-voltage tractive battery uses Energus cells. See more at https://www.facebook.com/watch/?v=1720312461370545&t=1

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PROFILES

STUDENT

Bec Gray:

Curiosity, Honeybees, and Mathematical Models

DEGREE: PHD

SPECIALTY: DYNAMICS AND CONTROLS

For Bec Gray, house-hunting honeybees hold a key to understanding how multi-agent systems can assess a situation, communicate findings throughout the group, and generate collective decision-making power without a central leader.

"One of the great things about the form of collective decision- making we study is that while some level of intelligence is required, the individual agents can be fairly simple. It is through a sophisticated combination of simple interactions that we see the rich complexity in behavior," explains Gray. "This is advantageous because it means the robots we may someday create for these systems can be low cost and easily replaced."

One example is search and rescue robots sent out to find survivors or collect information after a natural disaster. They have to make decisions about where to search based on the information they observe directly, such as changes in weather conditions or survivors who may be injured, or information they learn from other robots in the group. Robotic vehicles that perform environmental monitoring in the ocean, on land, or in the air have to decide how best to distribute themselves to take measurements and collect samples.

Similarly, a hive's survival relies on the honeybees' ability to use decentralized strategies to communicate, compute, and evaluate multiple pieces of information to make successful decisions as a group. When a hive becomes too small for the swarm, they send out scouts to look for a new site. An ideal home has several key features: it is high off the ground, has a small entrance hole, and has enough room to store food. A scout returns to the home hive and uses various movements (called the "waggle" dance) to communicate to the other bees what she has found. Those bees that are recruited will visit and make their own assessment. When the number of scouts accumulates over time at one of the potential sites, that site is chosen as the new hive.

Taking cues from the honeybees' approach, Gray studies a nonlinear mathematical model of the decision-making dynamics that depends on a small number of parameters, representative of the environment and the network structure. Many natural systems, like the honeybees, can be studied by considering the evolution of equilibria in the system with respect to the various system parameters. Gray looks at the effect of these different parameters—such as the value of the options the bees are choosing between or the number of bees involved—and how they affect the decision-making process and ultimately the group's performance.

"My role is to think about this natural process from a control engineering perspective—what is coming into the system, what is going out of the system, and what happens in the middle to make the process work," Gray says. "The end goal is to both leverage key features from the natural decision-making processes that can be applied to robotic decision-making, and also to develop hypotheses that consider factors that previous population-level models have not been able to."

> **"Bec is inspired by the remarkable collective behavior of animal groups, and she is driven by the opportunity to use mathematical models to explore the mechanisms that help explain observations of behavior. She is doing so well at combining her creativity with her technical expertise to translate the mechanisms into design, all the while keeping her focus on solving problems that benefit society."**
>
> *—Naomi Leonard, PhD, Edwin S. Wisley Professor, Mechanical and Aerospace Engineering*

Gray expanded her engineering focus as an undergraduate at the University of Canterbury in Christchurch, New Zealand, where she worked on a control and dynamics project to develop a glycemic model for people with diabetes.

"I had never thought about approaching biological problems from an engineering perspective before. But, suddenly my eyes were opened to many applications of mechanical engineering that I had never considered. I found it fascinating that engineering methods could be used to develop a greater understanding of non-engineering subjects," she explains.

Gray was one of the graduate students who presented real-life engineering challenges to a fourth-grade class from Harlem Prep Elementary School. She tapped into her life-long curiosity about engineering to inspire young students to pursue careers in science.

"I want them to think about what interests them, and then how engineering is involved or can be involved," she says. "Engineering gives us the opportunity to use our skills and creativity to help people in many vastly different ways."

Clay Byers:

Creating and Seizing Opportunity

DEGREE: PHD SPECIALTY: FLUID MECHANICS

They say luck is what happens when preparation meets opportunity. For Clay Byers, it takes one additional factor to achieve a dream.

"How many people do we come across throughout our lives that have an opportunity, but no one ever gave them a real chance? Those stories always stood out to me," says Byers, who has been a math tutor, remedial algebra teacher, and an undergraduate engineering instructor.

"Anyone can grow up with challenging circumstances and still thrive. It is easy to sit there and judge them, but if they are asking for help, why not reach out a hand and give what you can. I will never forget the look on my neighbor's face when she passed the GED exam after months of studying together, or the excitement of a high school student I tutored when his grades improved enough to earn an athletic scholarship," he says.

In high school, Byers knew he had a knack for science and math and a talent for figuring out how things work. What he didn't have was a way to pay for an engineering degree. No one in his family had gone to college and his parents couldn't afford to send him. Inspired by his grandfather's adventures as a bush pilot in 1940s Alaska, Byers decided that joining the U.S. Air Force was his best opportunity to earn a college degree, pursue engineering, and serve his country along the way.

After graduating from Washington State University, he and his wife moved to California, where he served for four years at Vandenberg Air Force Base. There he oversaw the western range launch facilities, making sure that the radar, safety, and communications equipment was updated and maintained for launches. As his service came to an end, he decided grad school at Princeton was the right path, particularly working in Professor Marcus Hultmark's Fluids Laboratory.

In fall 2017, Byers was awarded first place at the MAE Research Day for his project on "Multi-Component Velocity Measurements in a Wall Bounded Turbulent Flow Utilizing a Novel Sensor." In the experiment, Byers and his colleagues wanted to measure the temperature in a wall-bound turbulent flow using a sensor called a Nano-Scale Thermal Anemometry Probe (NSTAP). They expected to measure a higher temperature at the wall that would decrease as you moved further away. But, it was exactly the opposite. "We turned the heat off and did the same measurement," he explains. "What we found was that our temperature sensor was really sensing velocity. As the water passed over the sensor, it bent the wire and changed the signal."

After a literature search, he and his colleagues discovered it was the first time a probe of that shape and geometry had been used for measuring velocity. They applied for a patent and developed a start-up company called Tendo Technologies. The sensor can be used to accurately measure very slow flow rates for medical supplies, such as an infusion or injection.

"My job is to take complex equations and make them simpler," adds Byers, who is developing mathematical methodologies

> **"Clay is self-motivated, driven, and organized, which allows him to effectively conduct interesting research. He always has a plan for his research, which allows him to focus on the tasks ahead. Yet, Clay can still adapt if that plan fails or if he finds unexpected opportunities along the way. Most students tend to either enjoy mathematical or experimental research, but Clay enjoys both and it adds a unique flavor to his research."**
>
> *— Marcus Hultmark, Associate Professor, Fluids Mechanics and Biomechanics and Biomaterials*

to better understand turbulent equations of motion. "The idea isn't that we are going to solve all of the problems, but rather how can we understand the problems from those governing ideas and parameters."

In addition to his research, Byers is part of the W.E.B. DuBois Scholars Institute, where he developed and taught an intro to engineering course for high school students who came from families or communities with historical barriers to opportunity and achievement. He also helps at Princeton's McGraw Tutoring Program.

Of all his accomplishments, Byers is most proud of being honored with a teaching award from the Engineering Student Council.

"I felt so gratified that the students thought my efforts helped them in a course that is not always so understandable," he says, adding that he plans to continue with both research and teaching after graduation. "I'll jump at any opportunity to inspire young students. It has always been what keeps me motivated."

Aric Rousso:
Prepare for Takeoff

DEGREE: PHD SPECIALTY: THERMODYNAMICS

Aric Rousso's favorite airplane seat is by the window overlooking the wing, but it's not for the bird's eye view. It's to watch the intricate interplay between the engines and the flaps — the physics of thrust and drag — that makes mechanical flight possible.

"The more you learn about planes, the more you realize it is incredible they ever leave the ground for the sheer number of things that have to go right every flight," says Rousso. "I am fascinated by the concept of taking heavier-than-air components and putting them together to generate efficient and safe transport."

He's loved planes from his earliest years: his parents discovered early that their young son would settle down quickly if they rode 10 minutes to the beach and watched planes taking off and landing at nearby Los Angeles International Airport (LAX).

By high school, he decided he wanted to pursue some form of engineering or be a skier. Then, he chose to do both. During a gap year between high school and college he became a licensed ski instructor in New Zealand before entering Johns Hopkins University to major in mechanical engineering. Guiding whitewater kayaking for freshman pre-orientation trips sparked his love for teaching, which led to assisting students with Computer Aided Design at Johns Hopkins and later with fluids experiments at Princeton laboratories.

An undergraduate jet propulsion class sparked his interest in thermodynamics. "You have to mix chemistry and physics into these complicated designs," he says. "I love learning about combustion and propulsion as it explores the application of some very basic principles of heat transfer and mass flow and uses it to power some of the largest man-made objects ever built."

For Rousso, applying knowledge to practical design experiences has been the most rewarding. He was on a Johns Hopkins team that designed and built an off-road vehicle from scratch to compete at the annual Baja SAE Intercollegiate Design competition.

But it was the desire to pursue his interest in design and flight a step further into space travel that led to where he is today. As part of the Advanced Combustion and Propulsion Lab, Rousso is trying to push the envelope in terms of what is possible in energy management, propulsion, and combustion systems to improve the ways people travel on Earth and explore beyond, starting with basic science research.

"You have to understand the fundamental chemistry and physics behind how something works before you can even think about applying that knowledge in an engine," he says. "My hope is that what we learn will be used in the future to design an engine that reduces carbon and other pollutant emissions, as well as improves efficiency and power-to-weight ratios."

As with any technology, he says, engineers first develop it the quick and dirty way.

Now that we have been burning fuel with combustion for half a century, he says the challenge is to innovate and create new technology to make it safe, efficient, and environmentally friendly for everyone.

In the lab, Rousso studies plasma-assisted combustion, a relatively new technology that he believes will someday improve engine efficiency, enhance fuel lean combustion, and reduce emissions. In particular, he is exploring the chemical kinetics and reaction pathways in plasma-assisted combustion experiments of liquid fuel surrogates such as n-heptane. This will help develop models that can accurately predict these plasma-fuel interactions.

Non-equilibrium plasma, he notes, is difficult to generate under real engine conditions: "An alternative may be to study the long lifetime active species these plasmas generate, such as ozone. Ozone addition is another promising method to enhance low temperature combustion."

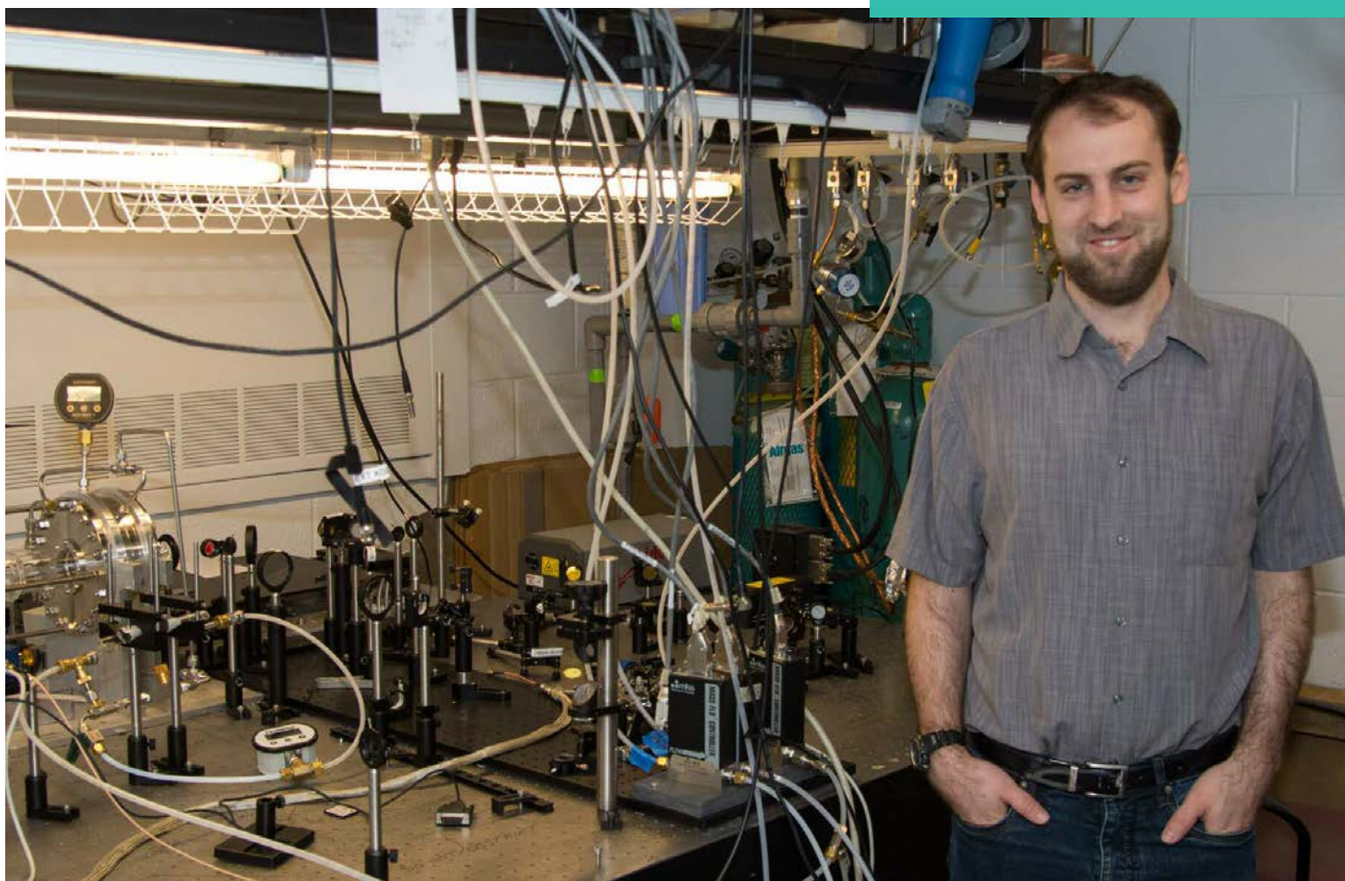
Outside of Princeton, he has researched ozone-assisted, low-temperature oxidation at the Sandia National Laboratory and conducted experiments at the Advanced Light Source synchrotron at Lawrence Berkeley National Laboratory.

After his PhD, Rousso hopes to work in the space or defense sectors to develop technologies for safer air and space travel. His dream is to design part of an engine that helps astronauts go to Mars or beyond.

Until then, he will keep enjoying air travel, taking a seat over the wing as often as he can. ♦

"Aric has a strong passion in research. He is always highly motivated and willing to tackle challenging projects. Moreover, he is a wonderful team member and an exceptional mentor to junior students."

— Yiguang Ju, PhD, Robert Porter Patterson Professor and Director of the Program in Sustainable Energy



Adelle Ingrid Dimitui:

The Art of Code and Engineering

DEGREE: B.S.E MECHANICAL AND AEROSPACE ENGINEERING

SPECIALTY: DEVELOPING ENGINEERING ANALYSIS SOFTWARE

For Adelle Dimitui, combining creativity with engineering while pursuing a positive social impact is an art.

Growing up in the Philippines and Myanmar in Southeast Asia, Dimitui was strongly influenced by her father, who worked for a pharmaceutical company, and her stay-at-home mother. Both inspired her to pursue a Mechanical and Aerospace Engineering degree from Princeton.

"While I learned the value of hard work, graciousness, and education from my father, I credit my mother for helping me learn the value of good conversation and self-esteem," she says.

In high school, Dimitui attended a lecture by a Filipina social entrepreneur who led an organization that built and distributed solar flashlights to low income communities. That sparked Dimitui's passion to take her creative writing, drawing, and graphic design interests and dive headlong into technology programming with a purpose.

"This fulfills everything I want to do: having a positive social impact while fulfilling my insatiable need to learn. I would not be abandoning art, because really technology is art," she says. "There is art everywhere you look — it is an idea that grows from something that is intangible and made into something that is tangible."

Following her freshman year at Princeton, she was accepted into the summertime iXperience coding program in Cape Town, South Africa. There, she learned front-end web development, Javascript and HTML/CSS languages, and the AngularJS and jQuery frameworks for Javascript.

Her coding skills have played an important role in her MAE summer research with Professor Yiguang Ju's Advanced Combustion and Propulsion Lab, where Dimitui wrote and edited MATLAB code that automates some of the graduate students' research processes, thereby reducing their time spent on data processing. Dimitui has helped improve code that quantifies consumption and production during various chemical reactions, as well as code that performs image analysis on pictures of flames to produce turbulent combustion statistical data, such as flame perimeters and local radii of curvature.

> **"Adelle has helped write some new analyzing software to help our team better understand turbulent flames and has also worked on some coding to help us more easily analyze the details of combustion chemistry. We can give her an idea and she takes it and runs with it, which is very helpful to us; she is a good worker, friendly, and independent."**
>
> *— Chris Reuter, graduate student in Professor Yiguang Ju's Advanced Combustion and Propulsion Lab*

She also helped Chris Reuter, one of Professor Ju's graduate students, by developing new analyzing software to study cool flames. These have a maximum temperature around 600 degrees Celsius and are produced by the chemical reactions of certain fuel-air mixtures. His study seeks to understand how transportation fuels can operate over a larger range of conditions, which is important for designing more efficient and cleaner engines and fuel.

Dimitui says she loves experiments as much as coding: "I'm a very hands-on type of person, and I love feeling the tangibility of mechanical equipment while collaborating with peers."

As far as her life's canvas is concerned, Dimitui's work is a mixed media piece: she continues to dabble in traditional art by providing graphic design services to various organizations on campus; she is using her coding and development skills working on an app as a side project; and she has been involved with Engineers Without Borders both as a participant on the technical team of the Peru International Project and on the student board helping with the overarching administration of the organization.

"Engineers Without Borders, to me, acts as an intersection between community service and engineering, which I feel really aligns with my personal values," she says.

Upon graduation, Dimitui hopes to find a job that builds on her experience in hardware and programming. Ultimately, she would like to return to the Philippines.

But as long as she is involved with a sustainable project in technology that has a social impact, Dimitui will consider her work a masterpiece. ♦

FACULTY

Meet the People of MAE

Every day, the people of MAE harness their vast expertise and insatiable curiosity to improve how human beings interact with the world through the creative science of engineering. Our faculty cultivate the unique matrix of lessons and research through which both discoveries and student potential can thrive.

Professor
Craig Arnold
Emily Carter
Edgar Choueiri
Mikko Haataja
Yiguang Ju
N. Jeremy Kasdin
Chung (Ed) Law
Naomi Leonard
Michael Littman
Clarence Rowley
Alexander Smits
Robert Stengel
Howard Stone, *Chair*
Associate Professor
Alexander Glaser
Luigi Martinelli
Daniel Nosenchuck
Daniel Steingart
Assistant Professor
Luc Deike
Marcus Hultmark
Egemen Kolemen
Andrej Kosmrlj
Anirudha Majumdar
Julia Mikhailova
Michael Mueller
Visiting Assistant Professor for Distinguished Teaching
Luiz Gonzalez
Lecturer
Biswadip Dey
Jens Eggers
Lamyaa El-Gabry
Glenn Northey
Associated Faculty
Ilhan Aksay, *Chemical & Biological Engineering*
Amir Ali Ahmadi, *Operations Research & Financial Engineering*
Elie Bou-Zeid, *Civil & Environmental Engineering*
Nathaniel Fisch, *Astrophysical Sciences*
Bruce Koel, *Chemical & Biological Engineering*
David Spergel, *Astrophysical Sciences*
Salvatore Torquato, *Chemistry*
Robert Vanderbei, *Operations Research & Financial Engineering*
Claire White, *Civil & Environmental Engineering*

DEPARTMENTAL COMMITTEES

Graduate Committee
Alex Glaser, *Chair*
Marcus Hultmark
Jeremy Kasdin
Michael Mueller
Dan Steingart
Director of Graduate Studies
Alex Glaser
Undergraduate Committee
Michael Littman, *Chair*
Craig Arnold
Marcus Hultmark
Yiguang Ju (Spring 2018)
Luigi Martinelli
Julia Mikhailova
Alex Glaser, *ex-officio*
Research Committee
Yiguang Ju, *Chair*
Committee constituted on an ad hoc basis
Seminar Committee
Yiguang Ju, *Chair*
Mikko Haataja
Marcus Hultmark
Egemen Kolemen
Diversity Committee
Mikko Haataja, *Chair*
Marcus Hultmark
Dan Steingart
Howard Stone
Honors and Awards Committee
Howard Stone, *Chair*
Alexander Smits
C.K. Law
Naomi Leonard
SEAS EPAC Committee
Luigi Martinelli
Robotics & Intelligent Systems Program
Robert Stengel, *Chair*
Sustainable Energy Program
Yiguang Ju, *Chair*
Committee on Appointments:
None in AY18
Committee on Research Appointments
C. K. Law, *Chair*
Luigi Martinelli
Clancy Rowley
Teaching Schedule Coordinators
Michael Littman
Alex Glaser
Jill Ray, *ex-officio*
Jo Ann Love, *ex-officio*
Climate & Inclusion Committee
Marcus Hultmark, *co-chair*
Julia Mikhailova, *co-chair*
Deanna Spoth
Lou Riehl
Tyler Van Buren
Suin Shim
Chuck Witt
Daniel Floryan
Katherine Kokmanian
Howard Stone, *ex-officio*
Jenn Widdis, *ex-officio*
Jill Ray, *ex-officio*
Freshman Advisors
Marcus Hultmark
Andrej Kosmrlj
Gigi Martinelli
Michael Mueller
Dan Nosenchuck
EEO Officer
Daniel Steingart

FACULTY AWARDS, HONORS AND RECOGNITION

Amir Ali Ahmadi (Associated Faculty, Assistant Professor of Operations Research & Financial Engr.)
- 2018 Innovation Award of the Princeton School of Engineering and Applied Science
- 2018 Multidisciplinary University Research Initiative Award of the AFOSR
- 2018 National Academy of Engineering U.S. Frontiers of Engineering Symposium

Craig Arnold (Professor)
- 2017 Thomas Edison Patent Award

Emily Carter (Professor & Dean)
- 2017 Julian C. Smith Lecturer in Chemical and Biomolecular Engineering, Cornell University
- 2017 Fritz London Memorial Lecturer, Duke University
- 2017 Emerson Center Lectureship Award, Emory University
- 2017 College of Engineering Fall Distinguished Lecturer, University of California, Davis
- 2018 ACS Award in Theoretical Chemistry, American Chemical Society
- 2018 Donald L. Katz Lectureship in Chemical Engineering, University of Michigan

Philip Holmes (Professor, Emeritus)
- 2017 Inaugural Brain and Behavior Initiative-Kavli Lecture, University of Maryland

Yiguang Ju (Professor & Director of the Program in Sustainable Energy)
- 2017 Distinguished Visiting Fellow, The Royal Academy of Engineering, UK
- 2017 Honorary Professorship, Xi'an Jiaotong University, China
- 2017 Air Products Distinguished Lecture, Pennsylvania State University
- 2018 Fellow of the Combustion Institute, The Combustion Institute (International)

Andrej Kosmrlj (Assistant Professor)
- 2018 School of Engineering and Applied Science Excellence in Teaching Award
- 2018 NSF Career Award

C.K. (Ed) Law (Professor)
- 2018 Elected Fellow, The Combustion Institute

Naomi Leonard (Professor & Director of the Council on Science & Technology)
- 2017 Plenary Lecture, SIAM Annual Meeting

Anirudha Majumdar (Assistant Professor)
- 2018 Paper of the Year Award, International Journal of Robotics Research
- 2018 Google Faculty Research Award

Alexander Smits (Professor, Emeritus)
- 2017 Plenary Lecture, University of Michigan/NASA Symposium on Advances in Turbulence Modeling
- 2017 25th Robert T. Wallace Lecture, MIT
- 2018 11th Gerald M. Faeth Memorial Lecture, University of Michigan

Howard Stone (Professor & Chair)
- 2017 4th Annual Indira Foundation Distinguished Lecture, IIT Bombay, India
- 2017 International Mechanical Engineering Congress and Exposition (IMECE), Invited Speaker, Florida
- 2018 Keynote Lecture, Ontario on a Chip, Toronto, Canada
- 2018 G. I. Taylor Medal of the Society of Engineering Science

Szymon Suckewer (Professor, Emeritus)
- 2018 Alfred Nelson Marquis Lifetime Achievement Award

Robert Vanderbei (Associated Faculty, Professor of Operations Research & Financial Engineering)
- 2017 Optimization Society Kachiyan Prize

Class of 2018
Craig Arnold
Marcus Hultmark
Yiguang Ju
Andrej Kosmrlj
Michael Littman
Julia Mikhailova
Dan Nosenchuck
Robert Stengel

Class of 2019
Craig Arnold
Luc Deike
Yiguang Ju
Michael Littman
Dan Nosenchuck
Clancy Rowley
Daniel Steingart

Class of 2020
Craig Arnold
Michael Littman
Luigi Martinelli

Chemical Hygiene Officer
Michael Vocaturo

Safety Manager
Jonathan Prevost

SEAS Lab Safety Committee Reps
Michael Littman
Jonathan Prevost
Michael Vocaturo

Student Organization Representatives
AIAA: Michael Mueller
SAE: Yiguang Ju
MRS: Craig Arnold

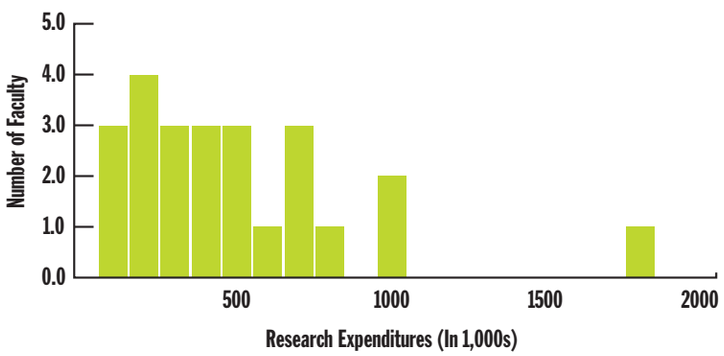
Tau Beta Pi (SEAS-wide):
Michael Mueller, Howard Stone

Faculty Leaves
Fall 2017: Yiguang Ju
Spring 2018: Lex Smits

Department Personnel (as of September 1)

	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Faculty						
Professor	17	15	16	15	13	12
Associate	4	3	2	2	3	4
Assistant	4	6	7	7	6	7
Other	1	2				1
Subtotal	**26**	**26**	**25**	**24**	**22**	**24**
Professional Researchers	43	44	45	50	52	43
Visiting Researchers	10	13	13	12	13	19
Technical Research	5.5	6.5	6.5	5.5	5.5	4
Technical Teaching	4	4	4	4	4	4
Administrative	12	12	12.5	11.5	12	11
TOTAL	**100.5**	**105.5**	**106**	**107**	**108.5**	**105**

Faculty Research Expenditures Distribution FY18

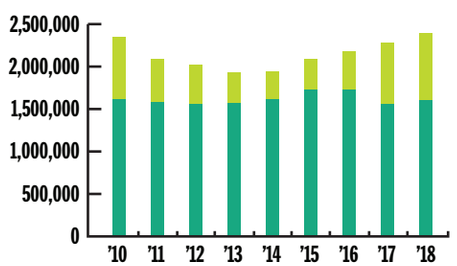


The Baetjer Seminar Series and Crocco Colloquium

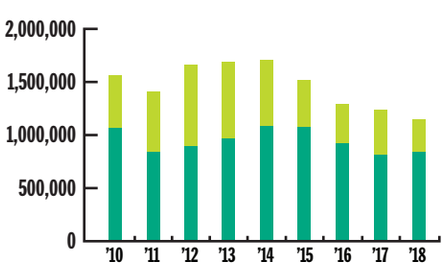
Beyond the classroom, student learning is enhanced through an expanding program of lectures, seminars, colloquia and conferences brought to the University. Leading scholars from outside the Princeton community give lectures about exciting, leading-edge research in fields related to mechanical and aerospace engineering.

Sarah Bergbreiter, University of Maryland
Microsystems-inspired Robotics
Campbell Carter, Air Force Research Lab
KHz Imaging Diagnostics for Tough, Practical Problems
Dennice Gayme, Johns Hopkins University
Wind Farm Modeling & Control for Power Grid Support
Simone Hochgreb, University of Cambridge
Picking the Right Tools for the Job Experimental Diagnostics for Reacting Flows & Thermoacoustics
Peko Hosoi, MIT
Hairy Hydrodynamics
Ken Kamrin, MIT
Continuum Modeling of Flowing Grains
Chris Kliewer, Sandia National Lab
Ultrafast Laser Diagnostics Development for Combustion
Hadass Kress-Gazit, Cornell University
Synthesis for Robotics: Guarantees & Feedback for Complex Behaviors
Miroslav Krstic, UC San Diego
Traffic Flow Control Calming "Stop-and-Go" in Congested Traffic
Ellen Kuhl, Stanford University
Neuromechanics – Perspectives, Challenges & Opportunities
David Lentink, Stanford University
Avian Inspired Design
Jennifer Lukes, University of Pennsylvania
Atomistic Transport Processes at Liquid-Vapor Interfaces
Stephane Popinet, Institut Jean Le Rond d'Alembert, Université Paris-Sorbonne
Numerical Models of Surface Tension
Manu Prakash, Stanford University
Emergent Mechanics & Origins of Behavior in Simple Non-Neuronal Systems
Padmini Rangamani, UC San Diego
Decoding Information in Cell Shape the Role of Membrane Curvature
Andy Ruina, Cornell University
Passive Dynamics is a Good Basis for Robot Design and Control
Angela Schoellig, University of Toronto
Safe Learning-Based Control for Mobile Robots
Julie Shah, MIT
Enhancing Human Capability with Intelligent Machine Teammates
Anna Stefanopoulou, University of Michigan
Stretching Battery Utilization using Novel Stress/Strain Models and Measurements
Sunney Xie, Harvard University
Stimulated Raman Scattering Microscopy: Seeing the Invisible in Biology and Medicine

MAE Operating Expenditures



MAE Sponsored Research Volume



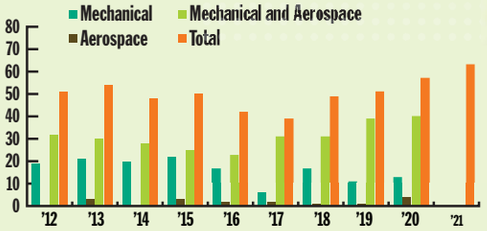
UNDERGRADUATE

Senior Independent Work Projects

Senior independent work is the culminating experience for the undergraduate mechanical and aerospace engineering programs. They participate, in teams, groups or individually, in a research or engineering project that includes elements of engineering design. The Class of 2018 completed the following interesting and exciting year-long projects.

Madelyn Baron, *Mistifying the Fourth State of Matter: Characterizing a Plasma Jet and Water Interface for Applications in Medical Treatment*
Jordon Brown, *Design and Implementation of an Actuated Probe Suite for an Orificed Hollow Cathode*
Daniel Carbonatto-Bowkett, *Aquaticopter: An Underwater and Aerial Vehicle*
Isabel Cleff, *Design, Construction, and Supersonic Wind Tunnel Testing of an Aerospike Rocket Nozzle*
Jeffrey Diament, *Developing a Wind-Sensing Drone: Integration of Nano-Scale Flow Sensors Onboard a Quadrotor UAV*
Tarik Dzanic, *Implicit Large Eddy Simulations of a Large-Radius Leading Edge VFE-2 Delta Wing*
Thomas Fair, *The Effects of Cycling and Storage Conditions on Li-Ion Battery Health, Rate Capability, and Recyclability*
Ankita Ghoshal, *Solid-State Microengines for Efficient and High-Endurance Performance*
Devon Hartsough, *Precision-Actuated Kinematic Mount Design for a Balloon-borne Three Mirror Anastigmat*
Gokul Iyer, *Analysis of Dendrite Growth in Secondary Zinc Cells via EIS Analysis*
Jacqueline Jones, *Pool School: Color-based Object Tracking and Shot Prediction as a Learning Tool in Billiards*
Mobasher Khan, *Applications of Data Science to Electrochemistry*
La Lee Lo, *A Large Eddy Simulation Study of the Flame Structures of Piloted Turbulent Dimethyl Ether Flames*
Delaney Miller, *Assessment of a Wireless Accelerometer System for Tracking Asymmetries in Gait*
Jason Muldering, *A Solid Mechanics-Informed Continuum Model Approach to Phase Engineering Bendable Group VI Transition Metal Dichalcogenide Monolayers*
Bernardo Pacini, *Design, Development, and Construction of a Biologically Inspired Sensor System for Real Time Flow Visualization*
Brian Poirier, *Regrounding Contemporary Rammed-Earth Systems*
Amir Raja, *Imaging Basic Structures Using Ultrasonic Methods Coupled with Inversion Techniques*
Matthew Romer, *Distributed Control of Rigid Body Attitude Kinematics*
Mark Scerbo, *Tiger Power: An Electrical Power System for Princeton's First CubeSat*
Omkar Shende, *On the Efficacy and Accuracy of Models for Large Eddy Simulations of Turbulent 9 Premixed Combustion*
Louis Tambellini, *Z-Beam Composite Stiffened Panel Manufacturing Methods*
Santiago Aguirre-Garnica, *Joshua Freeman, Colin Reilly, Benjamin Shi, Maxwell Schwegman, HORUS: An Origami-Unfolding Solar Array for Autonomous Deployment on Mars*
Jan Bernhard, *Trevor Henningson, Viveque Ramji, Intelligent Quadruped: Simplified RGBD-Based Autonomous Navigation for a Quadruped Robot*
Susannah Crowell, *Bertha Wang, Autonomous One-Inch Robot Arm Prototype (Littlefinger)*
Lena Dubitsky, *Leif Fredericks, Investigating the Characteristics of Helmholtz Resonator Energy Harvesting*
Michael Fuerst, *John VanOrden, Enhancing Consumer ROV Platforms for the Observation of Juvenile White Sharks (Carcharodon carcharias)*
Aliya Greenberg, *Bar Kadosh, Tenley Shield, Lithium-ion Batteries: An Analysis of Commercial Viability and an Application in an Off-Grid Solar-Battery System*
Henry Ha, *Juan Sepulveda-Varon, Ozone-Assisted Deflagration to Detonation Transition of Lean C2H2/Ox Mixtures in Microchannels*
Jonathan Lord, *Augustin Wambersie, Julian Castellon, A. Ju, Tarik Dzanic, Modular Jet Engine Design: an Alternative Power Generation Solution*
Grace Lynch, *Soumya Sudakar, Control of Propeller Hang on a Fixed-Wing UAV*
Fitsum Petros, *Jesus Serrano-Cendejas, Madeline Travnik, Let's Get In Formation: Autonomous Robots for Solar Energy Concentration*
Abhimanyu Shah, *Josh Rogers, CARP: An Economical Underwater Robot for Algorithm Testing*

Mechanical & Aerospace Engineering
Undergraduate Actual Enrollment by Concentration by Class Year



MAE supports the education of 179 undergraduate students from the U.S. and around the world, preparing them for a career or further study. In addition to getting exposure to vast learning resources through our faculty and research staff, students also have the chance to apply their discipline to their own projects and/or collaborate with MAE classmates and students in other disciplines.

GRADUATE

Graduate Programs in MAE

The majority of outstanding technical problems in today's science and engineering fields require a multi-disciplinary research approach at the intersection of engineering, physics, chemistry, biological science, and applied mathematics. Our 101 graduate students, who can earn a PhD or MSE, stand at the center of these challenges. Through their research and study, they contribute new knowledge in mechanical and aerospace engineering to answer the challenges to important societal, scientific, and industrial problems.

2017-18 Graduate Students

Clayton Byers, PhD
Advisor: Marcus Hultmark
Thesis: Theoretical and Experimental Investigations of Similarity Solutions in Turbulent Flows
Position: Assistant Professor, Trinity College, Hartford, CT

Ting-Hsuan Chen, PhD MAEMS
Advisor: Craig Arnold
Thesis: Ultrafast Varifocal Lenses in Laser Material Processing and Particle Tracking Velocimetry
Position: PTD Module and Integration Device Yield Engineer, Intel Corporation, Hillsboro, OR

Tat Loon Chng, PhD
Advisor: Richard Miles
Thesis: Remote Detection of Trace Species for Combustion and Atmospheric Magnetometry
Position: Postdoctoral Fellow, Ecole Polytechnique, Palaiseau, France

Greg Davies, PhD
Advisor: Dan Steingart
Thesis: Characterization of Batteries Using Ultrasound: Applications for Battery Management and Structural Determination

Ryan Davis, PhD
Advisor: Mikko Haataja
Thesis: Multi-phase Field Models and Microstructural Evolution with Applications in Fuel Cell Technology

Yuyang Fan, PhD
Advisor: Marcus Hultmark
Thesis: High Resolution Instrumentation for Flow Measurements
Position: Postdoctoral Research Associate, Mechanical and Aerospace Engineering, Princeton University

Alta Fang, PhD
Advisor: Mikko Haataja
Thesis: Modeling microstructural evolution during crystallization: from organic thin films to electrodeposited metals
Position: Postdoctoral Fellow, NIST (National Institute of Standards and Technology), Boulder, CO

Xiang Gao, MSE
Advisor: Elie Bou-Zeid
Thesis: Velocity Variance In The Atmospheric Surface Layer
Position: Data Scientist, Self-employed

Jingjie Hu, PhD
Advisor: Wole Soboyejo
Thesis: Breast Cancer Detection: From Tumor-Specific Nanoparticles to Cell Mechanics
Position: Postdoctoral Research Fellow, Mayo Clinic, Scottsdale, AZ

Jeffry Lew, MSE
Advisor: Michael Mueller
Thesis: Large Eddy Simulation Subfilter Modeling of Soot-Chemistry-Turbulence Interactions
Position: Assistant Engineer, SciTec, Inc., Princeton, NJ

Wenkai Liang, PhD
Advisor: Chung K. Law
Thesis: Theoretical Studies on Combustion Chemistry and Waves
Position: Postdoctoral Research Associate, Mechanical and Aerospace Engineering, Princeton University

Jonathan MacArt, PhD
Advisor: Michael Mueller
Thesis: Computational Simulation and Modeling of Heat Release Effects on Turbulence in Turbulent Reacting Flow
Position: Postdoctoral Research Staff, Coordinated Science Lab, University of Illinois at Urbana-Champaign; Jonathan will join the University of Notre Dame as an Assistant Professor in January 2020.

Tara Nealon, MSE
Advisor: Marcus Hultmark
Thesis: Simulating and Modeling A Dynamically Scaled Wind Turbine
Position: Upper School Science Teacher, Ranney School, Tinton Falls, NJ

Sebastien Philippe, PhD
Advisor: Alex Glaser
Thesis: A Physical Zero-Knowledge Proof and Unclonable Sensors for Nuclear Warhead Verification
Position: Stanton Nuclear Security Postdoctoral Fellowship, Harvard University, Kennedy School of Government, Belfer Center for Science and International Affairs

Benjamin Reimold, MSE
Advisor: Alex Glaser
Thesis: Minimally-Invasive Treaty Verification: A Proposal of the Buddy Tag
Position: Mechanical Design Engineer, Crane Aerospace & Electronics, Lynnwood, WA

Hari Subedi, PhD
Advisor: N. Jeremy Kasdin
Thesis: Low-Order Wavefront Sensing for Future Space-Based Coronagraphic Missions with a Sparse Aperture Mask
Position: Optical Engineer, NASA Goddard Space Flight Center, Greenbelt, MD

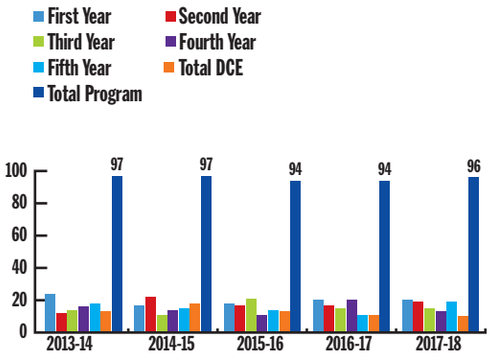
Xiaoyu Tang, PhD
Advisor: Chung K. Law
Thesis: Dynamics of Drop Impact on Liquid Film
Position: Postdoctoral Research Fellow, Chemical Engineering, University of California at Santa Barbara

Sheng Yang, PhD
Advisor: Chung K. Law
Thesis: Chemical Kinetics and Propagation Dynamics of Laminar and Turbulent Flames
Position: Quantitative Researcher, Two Sigma, New York, NY

Deying Yu, PhD
Advisor: Wole Soboyejo
Thesis: Adhesion and the Lamination/Failure of Stretchable Organic and Composite Organic/Inorganic Electronic Structures

Yibin Zhang, PhD
Advisor: Julia Mikhailova
Thesis: The Development and Characterization of Femtosecond Laser Velocimetry Methods
Position: Postdoctoral Appointee, Sandia National Laboratories, Albuquerque, NM

Mechanical & Aerospace Engineering
Graduate Actual Enrollment by Year (PhD)



Graduate Student Fellowships and Awards

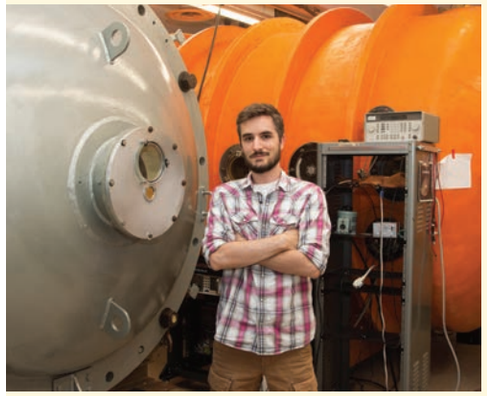
Departmental and Awards:
Nikita Dutta, *MAE Department Second Year Fellowship*
Daniel Floryan, *Harari Post Generals Fellowship*
Ying Liu, *Larisse Rosentweig Klein Award*
Zirui Liu, *MAE Department Second Year Fellowship*
Mark Miller, *Crocco Award for Teaching Excellence*
Samuel Otto, *Athena-Feron Award, Guggenheim Second Year Fellowship, Sayre Award for Academic Excellence*
Sijie Tong, *Summerfield Second Year Fellowship*
Joseph Tylka, *Crocco Award for Teaching Excellence*
Nan Xue, *Phillips Second Year Fellowship*
Omar Yehia, *Guggenheim Second Year Fellowship*
Estella Yu, *Harari Post Generals Fellowship*
University:
Matthew Edwards, Porter Ogden Jacobus Graduate Honorific Fellowship
Yao Lai, Maeder Graduate Fellowship in Energy and the Environment
Sebastien Philippe, Harold W. Dodds Graduate Honorific Fellowship
External:
Ting-Hsuan Chen, *Ministry of Education Study Abroad Fellowship*
Elizabeth Davison, *National Science Foundation*
David Feng, *National Defense Science and Engineering Graduate*
Matthew Fu, *National Defense Science and Engineering Graduate*
Sarah Gady, *DOE Computational Science Graduate Fellowship*
Kelly Huang, *National Defense Science and Engineering Graduate*
Peter Landgren, *National Defense Science and Engineering Graduate*
Justice Mason, *GEM Fellowship*
Bruce Perry, *National Science Foundation*
Christopher Reuter, *National Defense Science and Engineering Graduate*
Aric Rousso, *National Defense Science and Engineering Graduate*
Anthony Savas, *National Defense Science and Engineering Graduate*
Vivian Steyert, *National Science Foundation*
Hari Subedi, *National Science Foundation*
Yibin Zhang, *National Defense Science and Engineering Graduate*

Graduate Program Professional Development

To complement academic offerings, MAE provides programming to promote student success in research, teaching, career development, and professionalism. Students can participate in a number of workshops to develop skills in areas such as public speaking, writing, research, and exploration of post-graduation possibilities.

Alumni Career Panel, **Mac Haas '16**, *Assistant Professor, Rowan University*; **Grunde Jomaas '08**, *Professor and BRE Chair of Fire Safety Engineering, University of Edinburgh, Scotland*; **Brendan McAndrew '04**, *Electronics Engineer, NASA Goddard Space Flight Center, Maryland*; **Emanuel Stockman '09**, *Senior Associate, Osage University Partners, Princeton, NJ*; **Mohamed Bahri**, *Graduate Student, Calculating Effective Elastic Moduli of 2-d Materials*; **Timothy Chen,** *Graduate Student, Plasma-Assisted Fuel Reforming of Methane Using Non-Equilibrium Excitation*; **Luc Deike**, *Assistant Professor, Waves, Drops and Bubbles in Ocean Atmosphere Interactions*; **Nikita Dutta**, *Graduate Student, Structural Characterization of Chalcogenide Glasses during Solution Processing*; **Christopher Galea**, *Graduate Student, Towards Xenon Neutral Density Measurements Using Radar REMPI*; **Aaron Goodman**, *Graduate Student, Ion Heating in Multiple X-Line Reconnection Geometries*; **Matthew Heinrich**, *Graduate Student, Generalizing Mechanical Models of Epithelial Sheets to Study Collective Behavior of Cells*; **Kelly Huang**, *Graduate Student, Mimicking Atmospheric Flow Conditions to Examine Mosquito Orientation Behavior*; **Susanne Killian, PhD**, *Associate Director of Graduate Student Career Advising, Career Services, Interview Skills for Post-Doc and Industry Positions*; **Susanne Killian, PhD**, *Associate Director of Graduate Student Career Advising, Career Services, Networking and Job Search Tools for Engineering PhDs;* **Andrej Kosmrlj**, *Assistant Professor, Guidelines for Giving Good Talks*; **Andrej Kosmrlj**, *Assistant Professor, Mechanics of Slender Structures*; **Matthew New-Tolley**, *Graduate Student, Characterization of Flow Perturbations Generated by a Femtosecond Laser Pulse*; **Louis Riehl**, *Assistant Grants Manager, MAE Business Center: Traveling and Getting Reimbursed*; **Jacob Simmonds**, *Graduate Student, Miniaturization of Low Power Hall Thrusters*; **Judith A. Swan, PhD**, *Associate Director for Writing in Science and Engineering, Princeton Writing Program, Informative Abstracts: Scientific Writing from the Readers' Perspective*; **Sijie Tong**, *Graduate Student, Mechanics of Wrinkled Structures*

Year in Review *continued from page 7*



May 2018

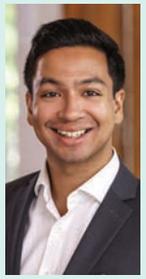
Taunay wins annual Princeton Graduate School teaching award

Pierre-Yves Taunay, a fourth-year MAE graduate student, served as AI for "Microprocessors for Measurement and Control," "Aircraft Flight Dynamics" and "Automatic Control Systems." He expects to finish his degree in 2020. One student said: "I've had Pierre-Yves as a TA for two classes now, and each time, his kindness, enthusiasm and hard work have made him stand out as an exceptional TA." Another student said: "The duration and difficulties of [the Microprocessors course] final project was making everyone involved frustrated — except for Pierre-Yves. We wouldn't have been able to complete our project without him."

May 2018

SpaceShot Team's rocket soars high

Princeton Rocketry Club's SpaceShot team launched its 11-foot-tall student-built rocket toward space from SpacePort America in New Mexico. While the rocket launched successfully and its second stage reached an altitude of 50,000 feet, it did not reach outer space, which is defined as about 328,084 feet (100 km) altitude. The team made plans for future tries.



May/June 2018

Majumdar receives three awards

In May, Assistant Professor Anirudha Majumdar was awarded a National Science Foundation (NSF) CRII Grant for robotics, entitled, "Memory-efficient Representations for Robot Tasks: Lower Bounds and Scalable Algorithms." He also received a Google Faculty Research Award.

In June, he won the inaugural *International Journal of Robotics* Research Paper of the Year Award for his paper, "Funnel libraries for real-time robust feedback motion planning," published in the June 2017 edition of the journal. The research considered the challenges of generating motion plans for a robot that are guaranteed to succeed despite uncertainty in the environment, parametric model uncertainty, and disturbances.

June 2018

Reuter named recipient of a 2018 Bernard Lewis Fellowship

The Combustion Institute awarded graduate student Chris Reuter a fellowship for the 37th International Symposium on Combustion.

PRINCETON
UNIVERSITY

MECHANICAL AND
AEROSPACE ENGINEERING
PRINCETON, NJ 08544