UNDERGRADUATE NEWS 2015

THE OHIO STATE UNIVERSITY

Department of Mechanical & Aerospace Engineering

IN MEMORIAM

On December 12, 2014, a tragic accident occurred in downtown Columbus taking the life of Stephanie Fibelkorn, 21, a third year student in MAE majoring in mechanical engineering. At the time of her death, she had completed her second semester in the major. An inspired and dedicated student, Stephanie was nearing completion of an internship with Columbus City Engineers, was a graduate of the Disney College Program and well on her way to achieving her dream of becoming a "Disney Imagineer."

On January 23, 2015, MAE faculty voted to award the degree of BSME posthumously to Stephanie. She will be greatly missed by all who had the good fortune to interact with her.

On February 25, 2015, The City of Columbus dedicated a street sign at 18th and High Streets, "Stephanie's Imagineer Way," in her honor.

The Stephanie Fibelkorn Memorial Scholarship Fund was established in Stephanie's memory to give financial assistance to female students at Ohio State majoring in engineering or mathematics. Donations can be made through GoFundMe.com or at any JP Morgan Chase banking office.

MESSAGE FROM THE ASSOCIATE CHAIR

Dan Mendelsohn
Associate Professor and Associate Chair

Department of Mechanical and Aerospace Engineering

Chair, Mechanical Engineering Undergraduate Studies Committee

The philosophy at the Department of Mechanical and Aerospace Engineering (MAE) is a belief in learning by doing – a mix of practical theory plus applied experience in engineering practice. The priority we place on team-building, creativity and critical thinking skills gives our students an advantage in today's marketplace.

There is no question students have to work hard to succeed – but our collaborative environment helps our graduates touch countless lives every day through the production of everything from green technologies of the future, to creating a high-powered, efficient race car engine, to designing space vehicles that may one day take people to Mars.

This year, we will introduce the new Technical Elective (TE) Program incorporating innovative changes to the curriculum to better prepare our students for success in their careers – and in life. A re-focus on engineering practice is the outcome of grouping senior level elective courses based on the technical core to reinforce the disciplines of engineering practice, while demonstrating the benefits of applying knowledge in a real-world setting. Design, computational/simulation- based and applications courses, taught by hands-on faculty experts, give students the foundation needed to excel in the classroom and beyond.

A unique aspect of the TE program is the addition of a fourth category of courses, professional development or "soft" skills, a significant step in training engineers of the future. The National Academy of Engineering (NAE) has reinforced the premise that next-generation engineers need to possess the skills to address challenges such as clean water, making solar energy economical and bringing new technologies to underserved populations. In addition to the required curriculum, students may choose from courses such as entrepreneurship and innovation, leadership and communication, and sustainable design and manufacturing, among many others.

Our multi-faceted capstone programs are exemplary models of experiential learning – extremely popular due to their impact on the student experience. Industry sponsored track projects are a direct result of needs expressed by the sponsoring company. Our design competition capstone projects emulate the rigorous competition in industry today. Our simulation-based design for high performance capstone gives students a skill set extremely sought after by employers. The rehabilitation engineering capstone program gives students the opportunity to work in a medical setting, developing life-changing assistive devices while learning the nuances of design.

A common thread underlying our curriculum advancements is teaching excellence. Our faculty are experts in the classroom and in their fields. They are broadly recognized, widely published and are consultants to government and industry across the globe. In class, they draw on a variety of teaching methods and professional experience to challenge our students and prepare them to lead engineering practice into the future. This is evidenced by our focus on using the clinical faculty model to provide unconventional teaching expertise.

Ultimately, we have a commitment and a responsibility to educate our students at the highest level in advanced automotive and aerospace systems, bioengineering, energy and environmental quality, materials and manufacturing, micro and nanotechnology, and nuclear science and engineering – transforming the ways in which the world comprehends many of our societal and environmental challenges. Wherever engineering challenges exist, our graduates will be equipped with the knowledge and skills to address them and make a difference.

CURRICULUM INNOVATION – *Technical Elective Program*

The Mechanical Engineering Undergraduate Program (ME) of the Ohio State University Department of Mechanical and Aerospace Engineering (MAE) is setting the standard for making program educational objectives relevant for our students. As evidenced in past issues of this publication, students are seeing more value in their coursework through experiential learning in their sophomore year, in the expansion of the senior capstone experience and the redesign of laboratory courses; all instituted during the transition from quarters to semesters in 2012. Today, we are well-positioned to introduce the new Technical Elective (TE) Program to our first cohort of students who have experienced the redesigned curriculum as they complete their senior year.

"Engineers are problem-solvers," said Dan Mendelsohn, associate professor, associate chair and chair of the ME Undergraduate Studies Committee. "Our goal is to educate graduates to be ethical, productive and contributing members of society, but also to give them the technical and professional skills and knowledge to excel in the engineering profession."

It is also important that ME program graduates be prepared for success in engineering practice in industry, academia or government, or in a variety of other non-engineering careers such as law or public policy. "We want to ensure that our students are equipped to use their engineering background to help society, improve quality of life, and develop new products and knowledge to promote a sustainable economic environment," Mendelsohn said.

Perhaps most important, students will have unique opportunities to function at a high level in modern engineering by acquiring lifelong professional skills not technically related to engineering, but critical for them to be competitive in today's marketplace and successful in their careers. The new TE program will play an integral role in achieving these educational objectives.

Ground-Breaking Curriculum Changes

The first feature of the new program is the grouping of senior level elective courses based on the technical core of the curriculum in fluid/thermal systems, dynamic systems and control, mechanical and machine design, and nuclear engineering into three categories: design, computational/simulation and applications. This re-focus on engineering practice, versus a singular disciplinary approach, is designed to reinforce disciplinary aspects while showing students the benefits of applying their knowledge in a real-world and practice setting.

Design courses focus on processes used to design products, devices or systems to meet desired performance criteria. Key elements are the generation, evaluation, modeling and testing of multiple design options against multiple design outcomes. Computational/simulation-based courses involve the modeling and simulation of engineering problems using commercial or student-written software, and the assessment of the validity of computation results and simulations through comparison with analytical solutions, estimates, experimental results or common sense checks.

An applications course applies basic engineering principles to the design and assessment of various devices which have broader societal impacts, such as energy and transportation systems, sustainable design and manufacturing, biomedical systems and clean water.

Honing Professional Development Skills – A Tough Sell

The truly innovative aspect of the TE program is the addition of the fourth category of courses on professional skills, which sets ME's program apart from its peers. Topics include public policy, society and technology, entrepreneurship and innovation, leadership and communications, project and systems management, new product design and introduction, Lean Six Sigma Manufacturing, humanitarian engineering, engineering law and economics.

"Adding professional skills to a traditional, purely technical curriculum was hard to justify to faculty at first," said Mendelsohn, "I admit, I had to be convinced." But after significant input from alumni and advisory board members who are practicing engineers in a variety of settings, and in joining the national discussion of preparing engineers for the 21st century, faculty were convinced that offering professional skills courses is an important step in training future engineers.

Making an Impact in Engineering Practice – and on our World

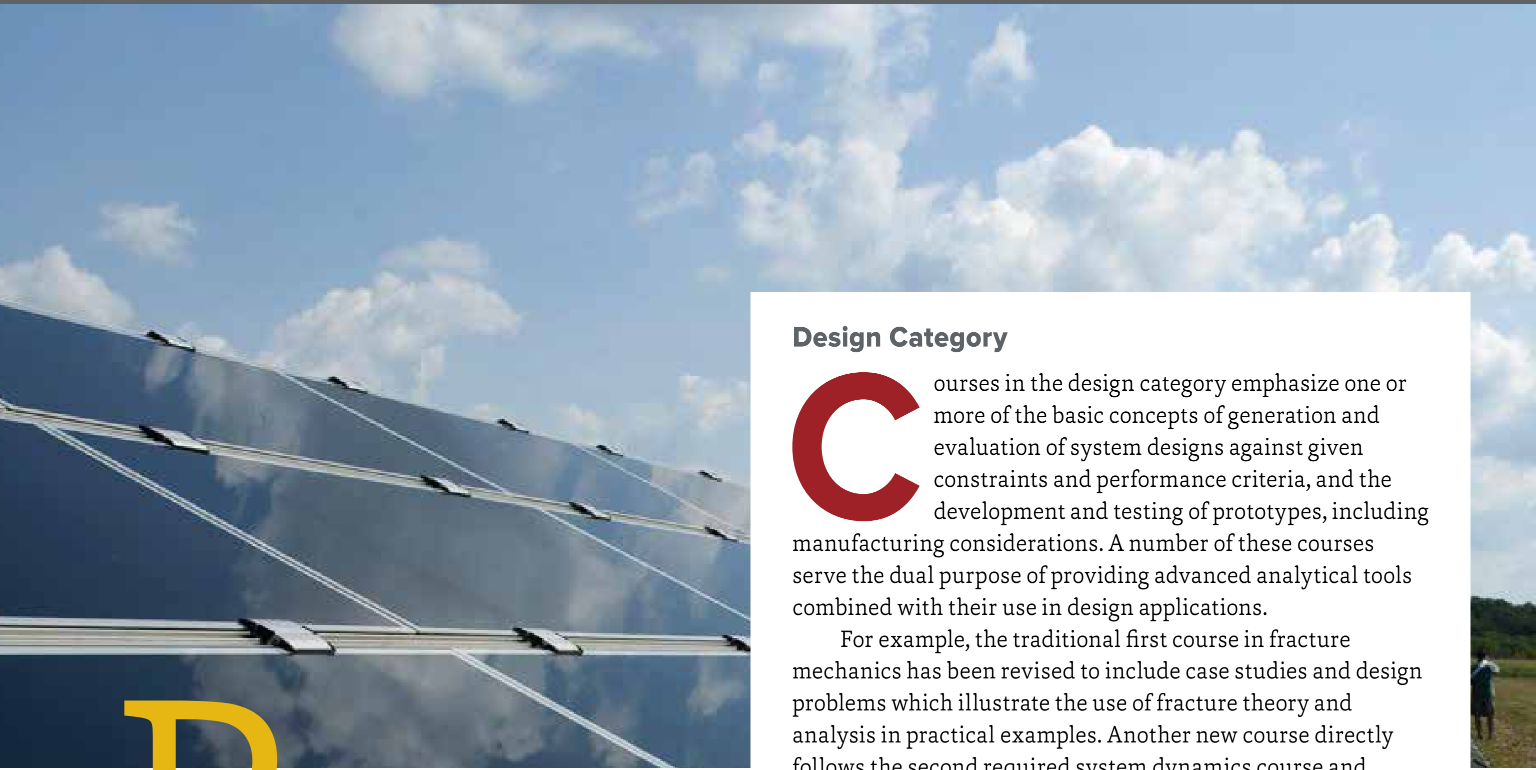
According to the National Academy of Engineering (NAE), the century ahead poses formidable challenges for the engineering profession, from providing access to clean water, to securing cyberspace and making solar energy economical. Mendelsohn believes engineering students of this generation need the skills to address these issues, enumerated in the "NAE Grand Challenges," many of which are inherently global and form the motivation for both the applications and professional skills categories.

The program requires 12 credit hours total; two courses from two of the three categories (design, computational, applications) for a minimum of six credit hours. The remaining credit hours may be chosen from pre-approved independent study courses, any course in the professional skills category, or select engineering and science courses outside the department.

"We're taking small steps," Mendelsohn says, "and if as anticipated the response to professional skills courses is positive, we will expand on the credit given in this important area."

A cross-disciplinary team of faculty leadership from academia, industry, government and private consulting are committed to changing the perception that technical expertise in traditional engineering is synonymous with the engineering profession when, in fact, the strength of engineering in great part is how engineers address real-world societal, environmental and other problems that affect quality of life.

"Engineers are certainly motivated by problem-solving," Mendelsohn says, smiling. "But we want to equip our graduates with a broader vision – and the lifelong skills to change the world."



REFOCUS OF TRADITIONAL ME TECHNICAL ELECTIVES

Design Category

Courses in the design category emphasize one or more of the basic concepts of generation and evaluation of system designs against given constraints and performance criteria, and the development and testing of prototypes, including manufacturing considerations. A number of these courses serve the dual purpose of providing advanced analytical tools combined with their use in design applications.

For example, the traditional first course in fracture mechanics has been revised to include case studies and design problems which illustrate the use of fracture theory and analysis in practical examples. Another new course directly follows the second required system dynamics course and applies control theory to practical design of control systems.

The category also features courses on design applications in vibrations, acoustics, mechatronic and smart material systems and heat exchangers, all with a focus on the end result of applying the theory and knowledge to systems, using state-of-the-art design techniques that are employed by practicing engineers in industry.

"We feel strongly that the design aspects of these courses, which lean heavily on and extend the engineering science in the core courses of the junior year, provide relevance and meaning to the curriculum that cannot be achieved otherwise," said Associate Chair Dan Mendelsohn.

The category is rounded out by two courses devoted entirely to design; one on product design engineering and the other on Computer-Aided Design with a manufacturing laboratory which utilizes 3D printing and CNC Machining. Ultimately, the category allows for a strong concentration in the practice of engineering design.

Applications Category

The applications category is dedicated to courses that are relevant to the big challenges facing society today. A majority of courses in this category deal primarily with energy usage and related engineering systems.

A group of very popular courses deals with transportation and powertrain systems and includes several automotive engineering courses. The first course on Internal Combustion Engines (ICE) applies the fundamental engineering principles to contemporary engines primarily for the mobility industry, evaluates competing advanced powertrains and "variable" technologies, and examines alternative fuels. The assessments are performed by balancing a number of pertinent aspects of these energy conversion devices, including (a) performance including fuel efficiency; (b) impact of pollutant and noise emissions on environment; (c) energy security and sustainability; (d) federal mandates; (e) economic feasibility and customer influence, and (f) national versus global powertrain/fuel choices and government policies. The second course is a powertrain laboratory, which provides an excellent experiential learning opportunity while effectively complementing the first course on the fundamentals of ICE. The third course focuses on vehicle dynamics, which is of considerable importance in the design of lightweight vehicles. A turbomachinery course completes the group.

Also featured is a newly revised course on Heating, Ventilation and Air Conditioning (HVAC) which has a strong emphasis on sustainable and innovative designs of HVAC systems, while providing the thermodynamics, heat transfer and fluid dynamics tools to analyze them. The course makes use of case studies, industry white papers and a final design project to illustrate these concepts. Guest speakers and trips to nearby campus buildings all bring direct relevance to the course.

Another major area of emerging technology and societal challenges is biological applications in engineering systems, and the understanding and combatting of disease. We have recently introduced courses taught by two young faculty; one covering physical properties of biomolecules and the physical interactions that mediate their functions, and one covering the application of mass and energy transport to the understanding of cancer tumor growth, angiogenesis and its inhibition and related issues.

Nuclear science and engineering courses cover nuclear fuel cycle and waste management; nuclear power plant engineering; radiation sensors; reactor core design, instrumentation and control; risk and reliability; and thermoelectric applications for power generation and structural damage detection. These applications are changing the way the world comprehends many of today's societal and environmental challenges.

"Nuclear power is important to many nations seeking sustainable energy sources to ease the global environmental impact from greenhouse gases – and to offset difficulties in obtaining petroleum," said Tunc Aldemir, associate chair of the Nuclear Engineering Program in MAE.

Computations Category

Associate Professor Sandip Mazumder's Applied Computational Fluid Dynamics (CFD) and Heat Transfer class helps students connect theory to practice. According to Mazumder, today's employers are looking for graduates who are well-versed in CFD software. "The more they tinker with it, the more familiar they become and the more they discover."

The course uses both aerospace and mechanical engineering applications to help students conduct CFD analysis, including pipes, furnaces and mixing devices, among others. The course is one of a "suite" of senior level computational offerings in solids, fluids or systems simulation to satisfy senior year elective requirements.

Rebecca Dupaix, associate professor, teaches a well-established course, Applied Finite Element Method, previously the only computational technical elective. "As computational software has become more widespread in industry, we felt it important for our students to gain this experience," Dupaix said.

The course applies finite element analysis to the design process with structural stress analysis as the foundation; identifying a problem, making modeling decisions to simplify the problem, applying loads and boundary conditions, running simulations and assessing the results. In the process, students acquire practical software skills in ANSYS and Abaqus, a helpful addition to their resumes.

"An essential skill as an engineer is the ability to troubleshoot a computational modeling problem," Dupaix said. "My favorite part of teaching this class is seeing students develop and practice these skills."

The Simulation Techniques for Dynamic System Analysis and Design course, created by Assistant Professor Marcello Canova, completes the suite of computational courses and introduces students to the methodologies and software tools used for dynamic system modeling, analysis and design. "The use of system models in mechanical engineering saves critical development time and costs, which is a key priority in industry,"

"This course balances theory, personal experience and hands-on learning, the formula works well and students are becoming proficient with modeling and software tools at a very fast pace."

Canova says. "Developing the knowledge and ability to use such models is a major asset for our students as they move into professional careers."

Model-based design creates high-fidelity models of systems and simulations using tools such as Simscape, MapleSim and AMESim to help students identify problems and develop and optimize solutions before building and testing prototypes. "This course balances theory, personal experience and hands-on learning," says Canova. "The formula works well and students are becoming proficient with modeling and software tools at a very fast pace," he said. "Students are having fun in this class."

The computational category also includes courses in the analysis of vibrations of continuous systems and intermediate dynamics that rely heavily on numerical simulations, and animations of every example and homework problem in the course. Students have commented that seeing and learning how to use modern simulation tools makes the concepts and results come alive in a way not otherwise possible.

Teaching Excellence in Undergraduate Education

MAE is committed to enhancing the teaching of our undergraduate students and is using the clinical faculty model to provide more practical industry-based instruction for our students. Recent appointees as assistant professors of practice include:

Dr. Sandra Metzler worked in the automotive industry for General Motors in the medical device and pharmaceutical industries for 10 years, and in the consulting arena for 10 years. She joined MAE in 2011 and currently teaches in the Capstone Design Program.

Dr. Carl Hartsfield came to Ohio State after 20 years in the United States Air Force working on assignments such as the Minuteman III Intercontinental Ballistic Missile system for the Air Force, sensor payloads for national security satellites and projects for some of the major aircraft companies.

Dr. Shawn Midlam-Mohler has worked on more than $5 million of industry sponsored research with Honda, General Motors, Ford and Chrysler, related to state-of-the-art automotive powertrain technology. He has 13 patents assigned to industry in collaboration with students and colleagues. Midlam-Mohler is the director of the Ohio State University Motorsports Program and advisor of the OSU EcoCAR3 team.

Four additional searches are underway for engineers with extensive practical experience in nuclear engineering and thermal science applications, mechanical and thermal systems design, product design and experimental design, measurement systems, instrumentation and dynamic systems. These ongoing enhancements to our faculty underscore the department's commitment to providing more relevance to engineering science core courses and giving students experience in practical engineering applications closely aligned with engineering practice in industry.

"Our emphasis is on hiring expertise from industry to enhance the classroom experience," Mendelsohn said. "We're dedicated to giving students the hands-on learning experience and critical thinking skills needed to have an edge in the marketplace."

business • design • engineering

COMING IN SPRING 2015:
New Entrepreneurship & Innovation Minor

From ideation to commercialization

The new, university-wide undergraduate minor in entrepreneurship and innovation, set to launch in spring 2015, will play an integral role in enhancing the undergraduate student experience.

Today's competitive environment requires students to develop a thorough understanding of entrepreneurship, innovation and idea generation. The new minor will give undergraduate students from multiple disciplines and majors, including engineering, a core understanding of theories, tools, practice and application of entrepreneurship and innovation.

The framework forms the basis for a revised curriculum that begins with three required courses – one each in business, design and engineering – beginning in the sophomore year. The course can be completed in four semesters. Courses must be taken sequentially; three required core courses, one required elective course, and one required practicum course.

The launch of the minor follows the January 2015 announcement of a new Center for Innovation and Entrepreneurship at Ohio State's Fisher College of Business as a university-wide initiative providing opportunities for discovery, research and student learning.

Learn more at go.osu.edu/eminor.

COMPETITIVE EDGE –
Integrated Teaching

Experiential or applied learning is defined as the process of learning through experience, more specifically defined as "learning through reflection on doing."

Applied learning in the classroom is indeed a by-product of the integrative teaching methods of MAE's Associate Professor Blaine Lilly and Assistant Clinical Professor Sandra Metzler. Their courses on computer-aided design and manufacturing, and fundamentals of product design dovetail and are immensely popular. More than 130 students are enrolled in product design and another 76 in computer-aided design for the spring 2015 semester.

Following an introduction to mechanical engineering course requiring an understanding of the full scope of mechanical engineering in their sophomore year, students have the building blocks to learn the tools of design from concept creation to final implementation, including product manufacture and assembly. "The course covers all aspects of what it means to be a good product designer," Lilly explained. And that's just the beginning.

Creativity plays an important role. "The class is in high demand because we're not only asking students to solve problems, we're engaging them in finding multiple solutions, including developing a prototype as part of a multi-disciplinary project team," Lilly said.

Sandra Metzler's computer-aided design and manufacturing class (CAD/CAM) uses computer software to integrate the product design and manufacturing process, taking students through design of machine components, surfaces and assemblies using parametric and feature-based design principles and design tools, such as 3-D modeling in Solid Works, to facilitate rapid prototyping of design. "The two courses are completely interrelated," said Metzler.

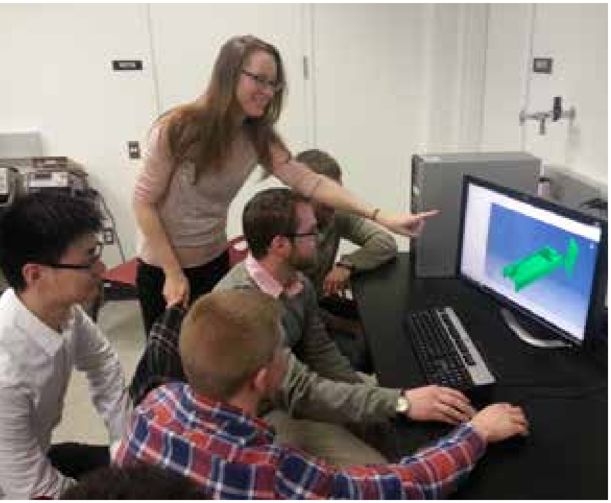
Metzler's background in forensic engineering, manufacturing, and biomechanical engineering, and her experience in the medical device and pharmaceutical industries uniquely position her as a resource and role model for aspiring engineers, especially young women. "We have a cohort of young women excelling in engineering, doing really interesting, imaginative work," Metzler says. "We're trying to break the stereotype."

Lilly, recently elected as an American Society of Mechanical Engineers (ASME) Fellow, has been a driving force in engineering education over the past two decades at Ohio State, developing interdisciplinary curricula and hands-on learning experiences for students. He is passionate about teaching and inspiring students to make an impact. "Only a few schools in the Midwest are doing what we are doing," he says.

A recent survey analysis by the National Association of Colleges and Employers (NACE) confirms that engineering is one of the most profitable college majors. On average, engineering majors earn $3.5 million over the course of their lifetime, more than any other college major. Not surprising, 80 percent of MAE's seniors are hired by manufacturing firms in the Midwest, a statistic Lilly and Metzler want to improve upon.

CAPSTONE PROGRAMS –
Turning theory into practice

Capstone programs by definition are "experiential" projects where students take what they have learned and apply it to a specific idea. Capstone projects give students the ability to utilize engineering knowledge and theory in a real-world setting. The rich diversity of capstone design projects is a major part of our revitalized curriculum, providing a unique opportunity for students completing their engineering education.



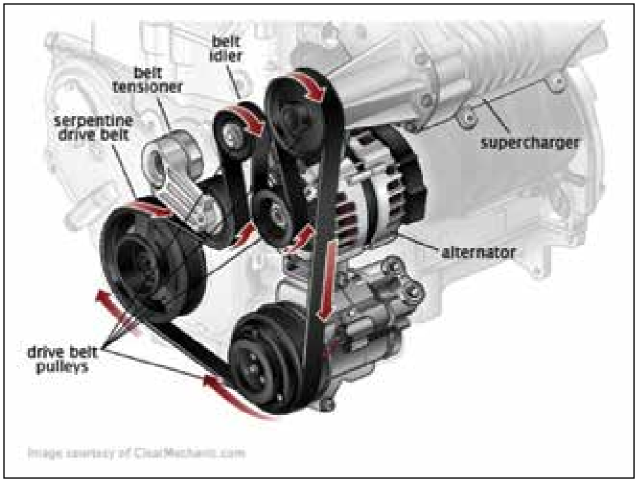
GM Mentor Rene Kreis meets with ME Capstone Design students to review their computational models of a designed test stand to characterize the dynamic properties of a ball bearing, motivated by a steering wheel "shake" phenomenon.

The various senior capstone project options for ME students teach the same engineering design fundamentals but differ in goals, technologies and types of projects. All projects have emphasis on design-prototype-test-report so students actually see how their ideas perform and how "ideation" and engineering analysis work to support design.

Students select one capstone project from five tracks following the first seven weeks in an introduction to design course. Tracks include student design competitions, industry sponsored projects, simulation-based design for high performance, humanitarian engineering projects, assistive devices, and a general projects version. "It's a great way to learn to do design, not just talk about it," says Associate Professor Anthony Luscher who teaches the general design capstone track. Students work on projects that apply mechanical engineering principles, "We want students to be engaged – and have fun," Luscher said.

The industry-sponsored track projects come from actual needs of the sponsoring company and are scoped such that the goals can be met within the academic year time frame. The simulation-based design track grew out of such a sponsorship. The humanitarian project track is set aside for products or systems designed to meet the needs of particular populations in underdeveloped countries such as clean water, affordable stoves and fuels, and local, renewable energy.

Shawn Midlam-Mohler, assistant clinical professor, teaches the design competition capstone track. "These projects are high stakes, real-world, team-based and getting to the deliverables is intense," he said. One such project comes from the Venturi Buckeye Bullet team, pushing the envelope of electric vehicle technology to change public perception of electronic vehicles and support green



Development of an *In-Situ* Accessory Belt Drive Tension Monitoring Method.

Goal:

Develop a non-contact methodology to measure the operational dynamic (alternating) belt tension

Design:

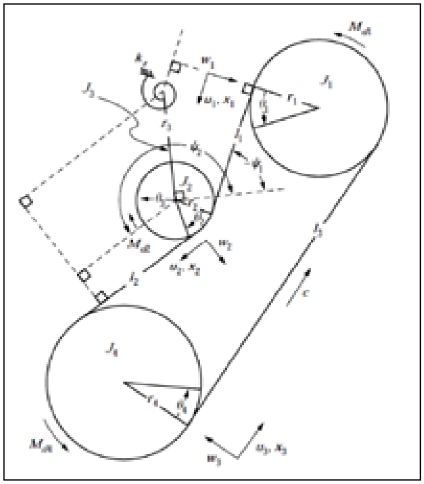
Simplified Belt Drive

V

Model

V

Build

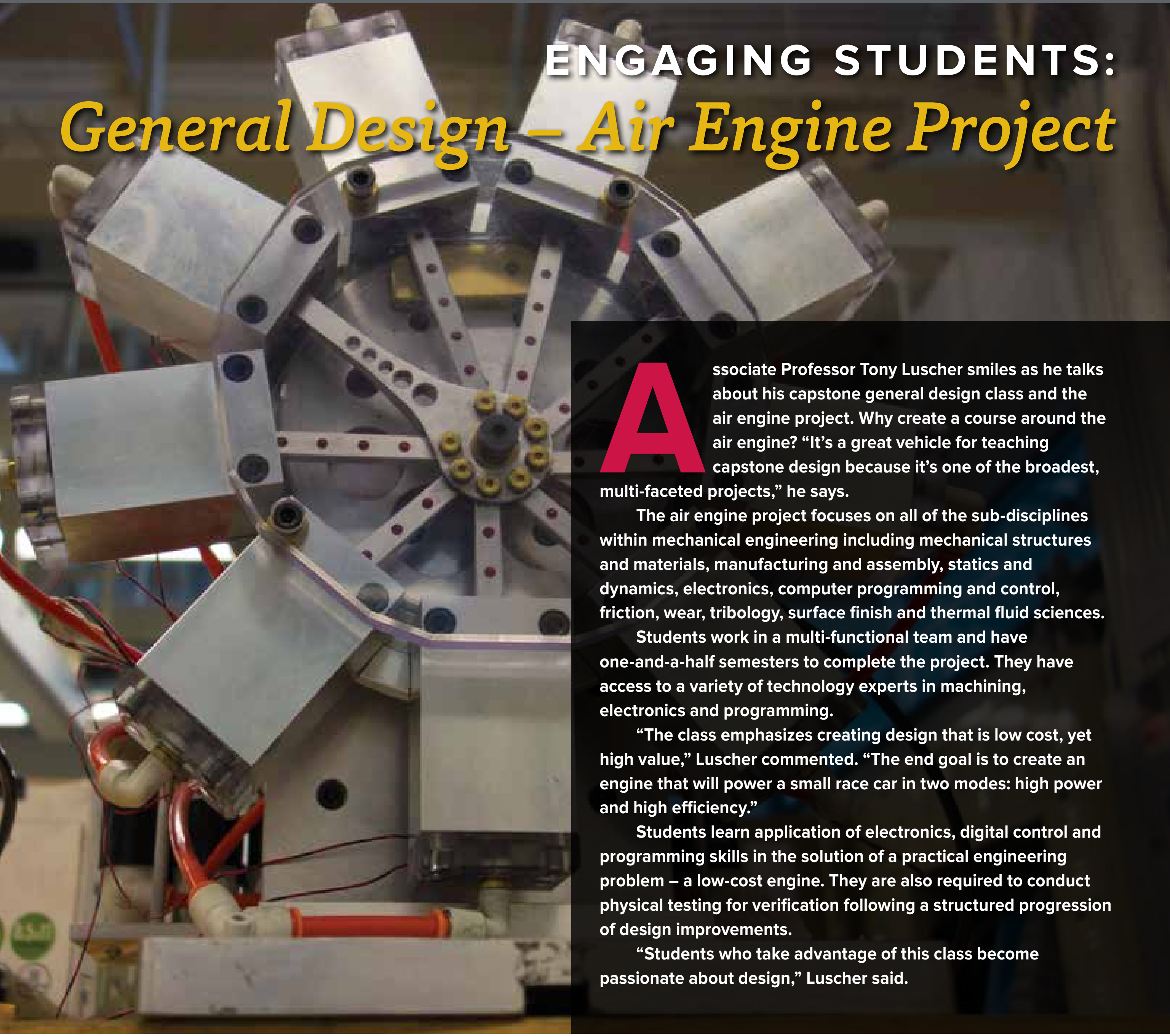


technologies of the future. “We’re giving students hands-on experience that mirrors what happens in industry,” says Midlam-Mohler.

The simulation-based design for high performance capstone gives students experience in the experimental and computational aspects of noise, vibration and harshness (NVH) and structural dynamics while studying an industry-driven problem. Initially funded by the General Motors (GM) Foundation, the project was conceived by Professor Rajendra Singh and Karen Morely of GM. The pilot included 18 students under the supervision of Dr. Jason Dreyer and Dr. Scott Noll and two GM industry “mentors.” The project presented a real-world problem studied during automotive design allowing students to identify where NVH issues would arise in the steering wheel column. Students successfully presented their final reports to the GM team. “Employers have a need for people with this skill set,” said Dreyer. Rich Eckenrode, a graduating senior in the course last year noted, “The project was a major talking point during my interview with Ford and ultimately led to a job offer.” The project was so successful that a separate track has been added and will continue with or without specific industry-sponsored projects.

Sandra Metzler, assistant clinical professor, teaches the rehabilitation engineering senior capstone in assistive devices — integrated with biomedical and mechanical engineering. “Projects vary widely,” Metzler said. “There’s a synergy between the teams.” Each project team has an engineering and clinical/medical advisor and students have the opportunity to work in a medical environment on current real-world problems. Projects are unique, proposed by a variety of sponsors including Ohio State’s Wexner Medical Center, NASA and manufacturers of assistive devices. One project, a patient lift sling device, incorporates design of a more secure, comfortable and supportive sling for patient transfer. “Students literally go into the clinical setting and get feedback on their device,” Metzler said. “They have an opportunity to make a difference, learning design in the process.”

Two additional full year capstone program options are also available to our students. One is aimed at product design as opposed to engineering design and has a strong emphasis on customer needs and potential markets. According to Associate Professor Blaine Lilly, product ideas are taken from the initial conceptualization stage to a patent-ready prototype at the end of spring semester. “Students are expected to do extensive fieldwork and design research up front, and build several prototypes over the course of the two-semester sequence.” The other option is a multidisciplinary and industry-sponsored capstone design course taught by the College of Engineering, with project teams comprised of several engineering majors and business students.



ENGAGING STUDENTS: *General Design – Air Engine Project*

Associate Professor Tony Luscher smiles as he talks about his capstone general design class and the air engine project. Why create a course around the air engine? "It's a great vehicle for teaching capstone design because it's one of the broadest, multi-faceted projects," he says.

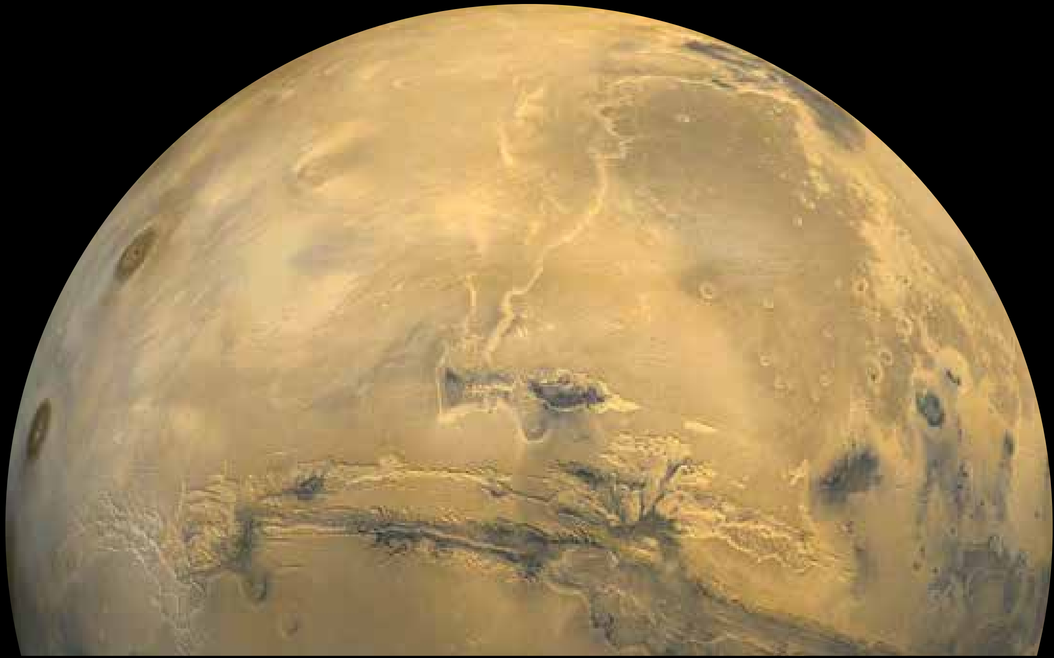
The air engine project focuses on all of the sub-disciplines within mechanical engineering including mechanical structures and materials, manufacturing and assembly, statics and dynamics, electronics, computer programming and control, friction, wear, tribology, surface finish and thermal fluid sciences.

Students work in a multi-functional team and have one-and-a-half semesters to complete the project. They have access to a variety of technology experts in machining, electronics and programming.

"The class emphasizes creating design that is low cost, yet high value," Luscher commented. "The end goal is to create an engine that will power a small race car in two modes: high power and high efficiency."

Students learn application of electronics, digital control and programming skills in the solution of a practical engineering problem – a low-cost engine. They are also required to conduct physical testing for verification following a structured progression of design improvements.

"Students who take advantage of this class become passionate about design," Luscher said.



AEROSPACE ENGINEERING

DISCOVERY, LEARNING, ENGAGEMENT

Aeronautical and Astronautical Engineering (AAE) focuses on the challenges of flight. The proper aerodynamic shape, the correct engine for clean propulsion, the best materials for lightweight structures and the safest control systems must be fully integrated to produce an efficient and economical flying machine.

MAE's faculty bring their expertise to the various disciplines of aerospace engineering – in the classroom, laboratory and in cutting-edge senior capstone design projects. Beyond a technical interest in aero-dynamics, structures, propulsion controls, systems or design, students are taking exploration of aerospace engineering to the next level.

AEROSPACE ENGINEERING

DISCOVERY, LEARNING, ENGAGEMENT

INSPIRATION MARS DESIGN CONTEST

In spring 2014, when Assistant Clinical Professor Carl Hartsfield heard about the Inspiration Mars Design Contest created by the Mars Society, he jumped at the chance to offer it as a potential project for his Space Systems Design class. The Mars Society is a space advocacy non-profit organization dedicated to promoting the human exploration and settlement of the planet Mars.

"I knew this was a significant opportunity for the team," Hartsfield said. Teams from undergraduate and graduate institutions worldwide submitted their designs for an 18 month Mars Flyby mission for two astronauts, with a launch window in 2018.

"I did limit it to one team, but somewhat larger than other design teams at six people," Hartsfield said. Working on a relatively short timeline, the competition entry was due in mid-March, just before spring break.

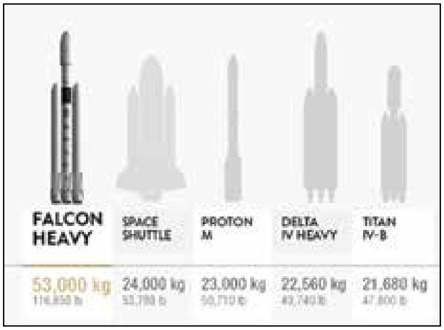
The January 5, 2018, launch date provided a short mission duration of 500 days, so only well developed technology was considered. The team kept their design to 14,434kg total mass, allowing them to launch their mission using the SpaceX Falcon 9 Heavy launch vehicle.

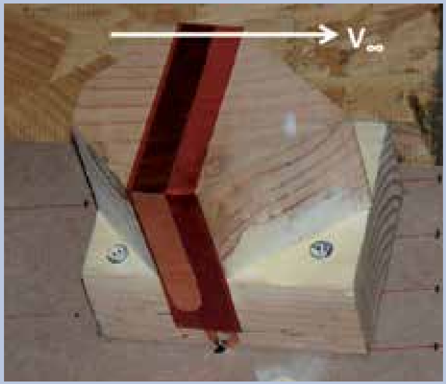
The team's ARES-M design (Astronautical Reconnaissance Expedition Spacecraft to Mars) provided an aeroponic garden to grow food for the mission, also contributing to fresh air recovery. The design included oxygen and water regeneration systems, exercise equipment and entertainment for the crew, including laptop-type computers for communication and conducting experiments to gauge the physiological and psychological effects of prolonged space travel on humans.

This mission would be months longer than the previous record for continuous time in space (Valery Polyakov on the Mir station) and the first experience with human exploration outside the Earth's immediate vicinity.

The project team was selected as a semi-finalist in the contest, placing in the top 21 out of 38 teams representing 56 universities in 15 countries. "Many of the competing teams were much larger, comprised of graduate students from multiple institutions," Hartsfield said. "Making the semifinals with a team of six undergraduate students is an outstanding accomplishment."

"Making the semifinals with a team of six undergraduate students is an outstanding accomplishment."





SCITECH 2015 – MAKING AIRCRAFT CARRIER LANDINGS SAFER

A team of four aerospace engineering students presented their senior experimental design project at SciTech 2015, held in January in Kissimmee, Florida. The American Institute of Aeronautics and Astronautics (AIAA) SciTech 2015 is the largest conference in the world for aerospace research, development and technology.

The project focused on aircraft carrier "burble" mitigation. Burble refers to the sudden randomly occurring downwash encountered by pilots attempting to land on aircraft carriers. These aircraft are at near stall speed so the effect can be catastrophic. The aircraft typically has to abort landing and position itself for another landing, delaying the carrier.

Burble is thought to occur because of vortices shedding off the edges of aircraft carriers to produce highly turbulent airflow near the back of the carrier. Mitigating burble would make aircraft carrier landings safer for naval aviators.

The team performed a systematic computational and experimental study choosing a state-of-the-art plasma-based device after an extensive survey of active and passive control techniques. Transient simulations were first performed using ANSYS Fluent for both controlled and uncontrolled cases to determine where actuators could be placed. Based on the results, a scaled model was constructed and tested.

Analysis of the experimental and computational data showed that the plasma actuators reduced the force of the downwash, mimicking the findings predicted by the team's computations.

"The team did an excellent job of tackling the problem from different perspectives. They were relentless in overcoming the many obstacles that arose in computation and testing phases," said Professor Datta Gaitonde, the team's advisor. "We are proud of their efforts."

Q&A

HONORS AND UNDERGRADUATE PROGRAM RESEARCH

The Undergraduate Honors Research Program is the largest program in the department, giving undergraduate students the opportunity to tackle an open-ended problem under the guidance of Rob Siston, associate professor and program director. We sat down with Professor Siston to learn more.

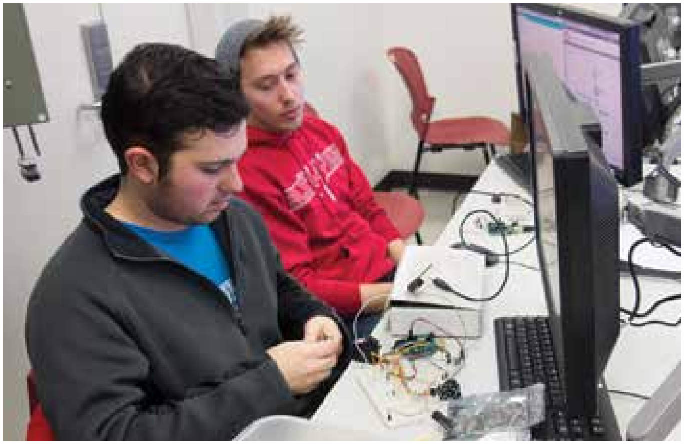
Can you elaborate on the student experience, what makes it valuable and what if anything sets the program apart?

The thing that makes the MAE program unique is that students meet once a week. In other departments there is no formal class meeting. Most weeks, students practice giving technical presentations to each other but I also lecture on some professional development topics.

The Honors Research Program has great benefits for students, allowing them to pursue topics from the core curriculum in greater depth such as controls, vibrations or mechanics of materials, or courses outside the core curriculum such as biomechanics. Most students do this as a tryout for graduate school. If students don't like research at the undergraduate level, they probably won't like it as a graduate student.

They can also try out a specific topic. I've known students to discover they like research but not a specific field, so they go into graduate school but change fields. Some students find they don't like research and go into industry, all of which are good examples of the program serving its purpose.

We are fortunate to have a classroom in Scott Lab that is capable of videoconferencing so each student presentation is videotaped, allowing students to watch themselves "on tape," much like professional athletes do. Throughout the year, we address numerous other topics including networking, effective email and how to give an "elevator pitch."



What is the level of participation/interest from students? How difficult is it to be selected?

We average about 25-30 students per year which is roughly 10 percent of our undergraduate population. The process involves writing a proposal to the College of Engineering which is then reviewed by the College Honors Committee. As long as the student has the appropriate GPA (above 3.0 for research distinction or above 3.4 for honors research distinction) and submits a well-written proposal that focuses on a scientifically valuable problem, nearly everyone gets accepted. It is far easier than most students think.

Can you describe your role as program director and how you interact with students along the way?

I help in two primary ways. Outside of class, I spend most of my time talking with students prior to entering the program. I give information sessions and meet with students to answer their questions. I also play a bit of a "matchmaker." Students come to me with a topic of interest and I can suggest faculty members that do that sort of work. Less frequently, I play the role of an impartial mediator between an advisor and a student.

I read an article where you were quoted about interdisciplinary education as being critical for students. Doesn't this also apply in the honors research program at the undergraduate level?

Yes it does. One of the neat aspects of the class is that we have students in all different disciplines in the same room. This semester I have students majoring in mechanical engineering, aerospace engineering, and materials science. Students conduct research on airplane safety, DNA origami, biomechanics of older adults, shock vibration control, cancer detection and engine control... and they are all in the same room at the same time. They learn to speak to other specializations and make their research accessible to students in other disciplines while avoiding heavy jargon. I've seen several students collaborate with faculty in other departments within engineering, and other colleges across the university. The program is much more interdisciplinary than when I participated as a student 15 years ago.

The Ohio State University

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