SPECIAL EDITION

Spring 2026

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Engineering Innovation at Lehigh

THE Aerospace Issue

A new master's program—grounded in systems thinking and a legacy of leadership—launches Lehigh engineers into the space economy

See page 14

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LEHIGH UNIVERSITY

Features

Departments

Research Briefs

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Engineering Innovation at Lehigh

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THIS PAGE: BETH MURPHY; OPPOSITE PAGE: TOP: CHRISTA NEU

LETTER FROM THE DEAN

Aiming higher in engineering education

Welcome to the Spring 2026 edition of *Resolve*—a magazine dedicated to research and educational innovation in the P.C. Rossin College of Engineering and Applied Science at Lehigh University.

While this issue explores the expanse of aerospace and the heights of our engineers' achievements in the field, we begin with an important step in preparing our students to become Future Makers. I am profoundly grateful to announce a $10 million gift from David Jackson '67, Patricia Jackson, Suzanne Jackson, and the Suzanne and David Jackson Foundation to support, our innovative First Year Rossin Engineering (FYRE) program.

This transformational gift will establish the Jackson Laboratory in the historic Packard Laboratory building, creating a dedicated space where first-year students will engage in focused problem-solving and engineering thinking. Through a series of interdisciplinary modules, students are introduced to engineering practice from the start, and challenged to tackle complex problems while building the technical skills and creative confidence that define the Lehigh engineer.

The Jackson family's generosity builds on remarkable momentum behind FYRE. In recent months, Lewis (Lew) Hay III '77 '08P '11P and Sherry A. Hay '78 '08P '11P established an endowed deanship of the Rossin College, inspired by this vision for engineering education. In total, the enthusiasm FYRE has created across the Lehigh Engineering community has resulted in $18 million in gifts over the past eighteen months.

Finalized just as this issue of *Resolve* is going to press, the Jacksons' gift marks a milestone for FYRE. You can read an update on the program's progress in this issue (page 12), and our Fall 2026 edition will discuss the impact of this philanthropy in greater depth.

At the same time, the Rossin College is making renewed investments in research around specific industries where we are poised to create real impact. One such investment is our focus on engineering for the "New Space" economy. Building on Lehigh's enduring legacy, these efforts include the launch of our new Master of Science in Aerospace and Space Systems Engineering (page 14), expanded support for student clubs and competition teams that give students practical experience designing and building flight systems, and the recruitment of faculty whose research is advancing technologies shaping the future in this exciting field.

The careers of alumni such as Greg Scaven '85, an expert in propulsion subsystems (page 19), and Michelle Parker '92, Vice President and Chief Engineer of Boeing Defense, Space & Security programs (pictured with me, above, and featured in our Q&A on page 8), reflect the academic rigor of the Lehigh experience as a launchpad into industry leadership.

THIS TRANSFORMATIONAL GIFT WILL EXPAND OPPORTUNITIES FOR HIGH-IMPACT LEARNING THE MOMENT STUDENTS ARRIVE ON CAMPUS.

Beyond aerospace, we continue to push boundaries as a Carnegie R1 university focused on interdisciplinary problem-solving. The Center for Community-Driven Assistive Technologies (CDAT), a hub for researchers applying technical expertise to improve the lives of children and adults with disabilities, is a vital example (page 10).

The strength of our research enterprise is also reflected in the February 2026 election of Professor Israel E. Wachs to the National Academy of Engineering (page 2)—among the highest professional distinctions an engineer can receive. The honor recognizes Professor Wachs' lifetime of achievement in catalysis research, driving industrial and environmental innovations that make global chemical processes more efficient and sustainable.

Finally, in this issue's Rising Star article, we highlight Lifang He, an associate professor of computer science and engineering (page 24). As an emerging leader in AI and machine learning for health and biomedicine, she exemplifies the next generation of researchers advancing a tradition of breakthrough innovation with lasting impact.

I hope you enjoy this edition of *Resolve*; thank you, as always, for your interest in Lehigh Engineering!

Stephen P. DeWeerth, *Lew and Sherry Hay Dean*
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Wachs elected to National Academy of Engineering

Elite honor recognizes chemical engineer's decades of research in catalysis, *operando* molecular spectroscopy, and sustainable processes

Israel E. Wachs, the G. Whitney Snyder Distinguished Professor of Chemical and Biomolecular Engineering, has been elected to the National Academy of Engineering (NAE), one of the highest professional honors in the field of engineering.

Wachs was recognized "for establishing fundamental structure–activity/selectivity rules governing molecular engineering of mixed oxide catalysts" that guide the rational design of solid catalysts (materials that accelerate and control chemical reactions) for air pollution remediation, sustainable energy, fuels, chemicals, plastics, and pharmaceuticals.

NAE membership honors individuals who have made outstanding contributions to engineering research, practice, or education, as well as those who have pioneered technological fields. This election also underscores the national visibility of research conducted at Lehigh, which was designated an R1 institution—indicating the highest level of research activity according to the Carnegie Classification of Institutions of Higher Education—in 2025.

"Professor Wachs' election to the National Academy of Engineering recognizes his decades of pioneering fundamental contributions to chemical engineering," says Stephen P. DeWeerth, the Lew and Sherry Hay Dean of Engineering. "His work has reshaped key areas of catalysis science, bridged fundamental understanding with practical applications, and helped define the modern field of *operando* molecular spectroscopy. His research has impacted a global community of scientists and engineers and has provided industry with fundamental tools to design more efficient and sustainable processes."

For almost four decades, Wachs has earned international recognition for his pioneering work in *operando* molecular spectroscopy, a methodology he helped establish that enables catalysts to be characterized under actual reaction conditions while simultaneously monitoring reaction products in real time.

This "working" view of the surface chemistry of solid catalysts has allowed Wachs and his collaborators to identify catalytic active sites and surface reaction pathways, establishing structure-activity/selectivity relationships that guide the rational design of advanced catalysts. This fundamental research has many applications, from the sustainable manufacture of value-added fuels, chemicals, and pharmaceuticals to environmental catalysis.

"I am deeply honored and humbled to be elected to the National Academy of Engineering," says Wachs, who joined the Lehigh faculty in 1987. "This recognition reflects not just my own efforts, but the sustained contributions of my students, postdoctoral researchers, colleagues, and collaborators over the years. My career has been driven by a passion for advancing fundamental understanding in surface chemistry and catalysis and applying that knowledge to real challenges—from cleaner industrial processes to technologies that benefit society."

Early in his career, Wachs achieved what he once described as a "lifetime discovery" by using Raman spectroscopy to resolve the long-debated molecular structures of supported metal oxide catalysts—providing the first clear view of how such catalysts function at the molecular level.

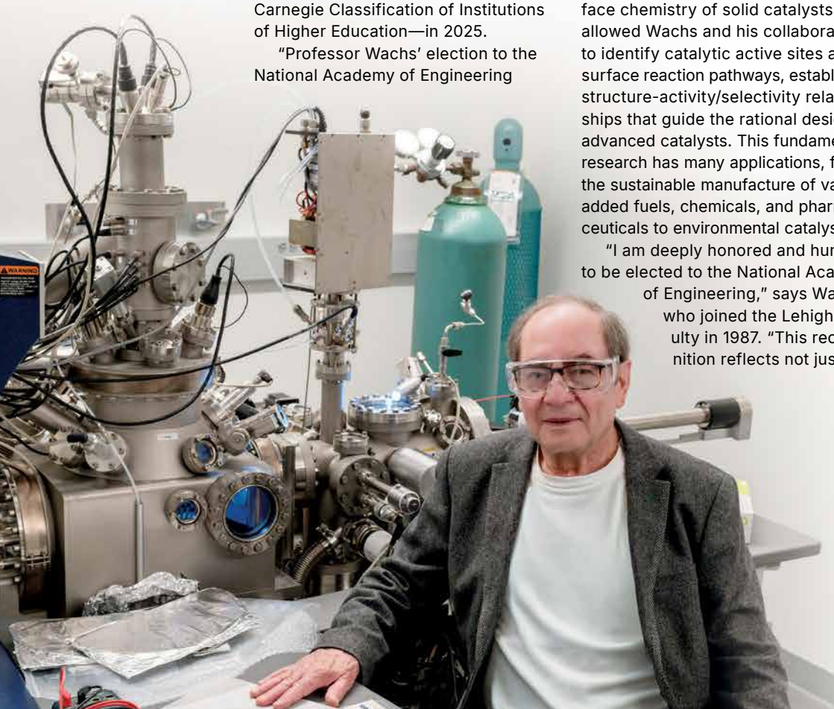
"I'M DRIVEN BY A PASSION FOR ADVANCING KNOWLEDGE AND APPLYING IT TO BENEFIT SOCIETY."

—Israel E. Wachs

Today, he directs Lehigh's *Operando* Molecular Spectroscopy and Catalysis Research Laboratory, where recent projects have included converting toxic gaseous NO_X emissions from power plants to benign N_2 and H_2O, transforming CO_2 and H_2O captured directly from air to fuels and chemicals with renewable energy, and converting sustainable biomass-derived ethanol to green rubber and fuels. His group is also focused on transforming abundant natural gas into value-added aviation fuels and key chemical building blocks to address global shortages.

A prolific inventor and researcher, Wachs holds more than 100 U.S. and international patents and has published over 400 highly cited technical articles with a career publication citation count exceeding 53,000.

As an educator and mentor, he has advised 50 PhD students and 20 postdoctoral researchers. He has guided numerous researchers who now serve as professors in academia, conduct research at national laboratories, and hold leadership positions in global corporations such as Dow, DuPont, Chevron, and Toyota.



Wachs' work in catalysis has made advanced spectroscopy tools a key feature of Lehigh's research ecosystem.

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Predicting how bones heal

Every year, nearly 10 million Americans experience a broken bone. A quarter of patients with lower leg fractures face delayed healing, and one in 10 patients will develop a nonunion, a break that requires additional major surgery to heal. The consequences of nonunions are serious and exact a significant physical, mental, and financial toll on patients' quality of life.

"The challenge with fracture healing is recognizing when somebody is going to have problems and knowing when to intervene," says Hannah Dailey '02 MS'06 PhD'09, an associate professor and associate chair of the Department of Mechanical Engineering and Mechanics.

Dailey and her team recently received funding as part of an international collaboration with Switzerland's AO Research Institute Davos (ARI) that puts them a step closer to identifying that critical point of intervention. The four-year project is supported by the National Science Foundation and the Swiss National Science Foundation and aims to create computational models that can predict how bones will heal over time.

Both mechanical and biological factors influence how a bone heals. Mechanical factors—such as the rigidity of the implant meant to stabilize the fracture, the distance between bone ends, and the loading pattern on the limb—have been studied for decades, says Dailey, and existing models show how these physical and structural conditions set the stage for healing. Less well understood, however, are the biological factors—the cellular, molecular, and systemic processes that rebuild the bone.

"If you and I broke our legs in exactly the same place, in exactly the same way, we would not have identical healing responses because we have different biologies," says Dailey. "And up to this point, those differences aren't something the model could account for. So we're going to change the framework to incorporate these biological differences and make the model more probabilistic."

To do that, the team will use a library of imaging data provided by ARI, one of the world's leading institutes for orthopedic research. The data tracks fracture healing in sheep over time, a process that closely mimics that in humans. The project uses only existing data, so no new animal studies are required.

"Instead of getting just one picture at the end of the healing process, we have images taken over many months, which allows us to measure what's happening as healing progresses," she says. "We can then use that data to feed and tune these predictive models. It will then inform the physician how healing will progress based on both mechanics and biology."

The team plans to add their model to ARI's online training platform OSapp. ARI supports interactive simulations for educating surgeons around the world.

The long-term goal, Dailey says, is to develop a patient-specific simulation that predicts how an individual's bone will heal based on their biology and the implant used.

"That predictive capability will be like having a smart crystal ball," she says. "Surgeons will be able to make better, earlier decisions about whether to operate again or prescribe a bone stimulator."

A HYPERGRAPH LENS ON COMPLEX OPTIMIZATION PROBLEMS

Aida Khajavirad, an associate professor of industrial and systems engineering, is advancing the theoretical foundations of a notoriously difficult class of optimization problems through a new project supported by the Office of Naval Research (ONR).

Working with Alberto Del Pia of the University of Wisconsin–Madison, Khajavirad is rethinking how researchers approach binary polynomial optimization (BPO). This broad family of problems is so complex that solving them exactly becomes impractical at scale. They arise in fields including machine learning, cybersecurity, mission planning, and logistics.

While binary quadratic optimization has been studied extensively, far less is known about higher-degree BPOs. Using a novel hypergraph approach—a way of mapping complex optimization problems so their structure can be analyzed—Khajavirad and Del Pia seek conditions under which these problems can be solved efficiently. Their work builds on a decade-long collaboration linking computational complexity to structural properties of the underlying hypergraph.

Khajavirad's research centers on the theoretical, algorithmic, and computational foundations of optimization, with applications in data science and engineering. Her work has been recognized with honors from the INFORMS Optimization and Computing Societies and has been supported by multiple federal agencies.

The ONR project reflects both the depth of her scholarship and the collaborative nature of today's advances in optimization theory.

"Despite the many applications of binary polynomial optimization across science and engineering, fundamental questions remain," she says. "This project allows us to advance the theory and algorithms behind these problems and broaden their impact."

Modeling risk, building resilience

New consortium advances catastrophe modeling for practical decision-making

Lehigh and Rice universities have launched the Consortium for Enhancing Resilience and Catastrophe Modeling (CERCat), bringing together researchers, industry leaders, and public-sector innovators to advance the science of catastrophe modeling and improve how communities prepare for and respond to disasters.

By uniting academic research with industry and government expertise,

the consortium aims to strengthen catastrophe modeling tools and translate new insights into practical solutions that support disaster resilience.

"Catastrophe modeling is at the heart of ensuring more resilient communities," says Jamie Padgett, CERCat deputy director and professor and chair of civil and environmental engineering at Rice. "CERCat provides a bridge between academia and industry stakeholders in the broader risk, resilience, and catmodeling space. By combining the intellectual capital of our universities with the expertise of industry and government, we can advance the field and deliver insights that benefit industry and society."

CERCat held its inaugural industry advisory board meeting last year, establishing an initial research agenda of high-priority projects. At a subsequent meeting in February 2026, consortium participants shared progress across multiple efforts, underscoring sustained collaboration between academic and industry partners.

Early projects include developing multihazard fragility curves to model how buildings perform under overlapping threats such as hail and wind, capturing compounding effects that better reflect risk than traditional single-hazard approaches.

Researchers are also creating wildfire fragility curves for residential structures using historical event data and linking environmental, structural, and topographic characteristics to predict building vulnerability. Additional priorities include using artificial intelligence and remote sensing to accelerate post-disaster damage assessment and improving modeling of the joint probability of hazards during hurricanes by moving beyond stationary assumptions and accounting for a changing climate.

"This consortium is not just about advancing models—it's about advancing their applications," says Paolo Bocchini, CERCat director and a professor of civil and environmental engineering at Lehigh. "Our work has the potential to improve everything from insurance frameworks to building codes to how communities plan for recovery. Insights we generate will translate into better risk communication, safer infrastructure, more efficient disaster response and more resilient economies."

CERCat brings together 18 interdisciplinary faculty members from civil and environmental engineering, statistics, earth sciences, mathematics, computer science, social sciences, and public policy. The consortium also engages students and postdoctoral researchers to foster the next generation of leaders in risk and resilience.

Collaborating academic institutions include Columbia University, Florida Atlantic University, Missouri University of Science and Technology, and Washington State University.

UNDERSTANDING WATER-SOLUBLE POLYMERS IN WASTEWATER

When we pump shampoo into our hands, we expect just the right consistency—not so runny that it slips through our fingers, yet not so thick that it feels like mayonnaise. The polymers behind this pleasant texture are called viscosifiers. They're used in consumer products like shampoos, detergents, and cosmetics, keeping ingredients suspended and stable in solution. But what happens when those same polymers wash down the drain is less well understood.

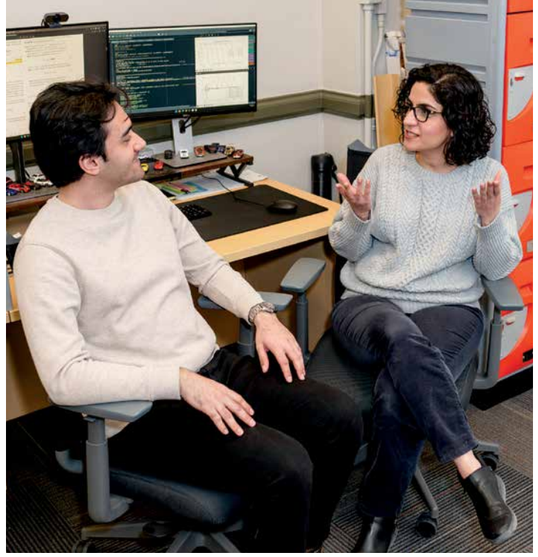
"Wastewater usually goes to a treatment plant, where the solids are filtered out, and the rest is either broken down by microbes, or precipitated as sludge before being tested and then released into streams," says Xuanhong Cheng, a professor of bioengineering and materials science and engineering.

Cheng and her team are collaborating with materials science company Dow Inc. to study how microbes—microscopic organisms that digest sewage—interact with and potentially biodegrade these polymers. Their "academic liaison with industry" proposal was recently awarded a three-year National Science Foundation grant.

Cheng's lab will first map how microbes break down the polymers—mixing them together and tracking microbe growth, as well as the effects of the resulting degradation products. The team will also test whether mixed communities of microbes can break down polymers more effectively than any single strain.

"If a consortium of microbes works better," she says, "we could design strategies to mix them selectively, targeting different parts of the polymer for full degradation."

Their goal is twofold: to better understand the chemistry behind full degradation, which could influence product design; and to pinpoint microbial mixtures that could be deployed in treatment plants, reducing polymers in discharge from those plants.



Khodabakhshi (right) aims to replace trial and error with efficient simulation.

Physics-based machine learning could unlock better 3D-printed materials

Additive manufacturing—also commonly referred to as 3D printing—is a manufacturing technology that builds objects layer by layer using materials such as metals, polymers, or biomaterials.

"This layer-by-layer approach allows for the fabrication of parts with complex geometries that are often difficult, or even impossible, to achieve with conventional manufacturing methods," says Parisa Khodabakhshi, an assistant professor of mechanical engineering and mechanics. "However, the thermomechanical properties of the final additively manufactured parts are influenced by a large number of process parameters, making design optimization particularly challenging."

Establishing the map between variations in process parameters and the final part's properties requires several simulations across a wide range of length scales, making the task a computationally expensive one.

"The computational demands of performing all the necessary simulations make it impractical," says Khodabakhshi. As a result, manufacturers often resort to trial and error methods to achieve desired thermal or mechanical properties in the end product. "However, you cannot fully explore the entire design space that way to find the optimal design, which is why we're currently not able to utilize the full potential of additive manufacturing."

> "AS ENGINEERS, WE DON'T WANT TO JUST TRAIN A BLACK-BOX ALGORITHM. WE WANT TO BE CONFIDENT IN THE OUTPUT."
>
> —Parisa Khodabakhshi

Khodabakhshi recently received a three-year, $350,000 grant from the National Science Foundation to develop a computationally efficient model that accurately predicts how additive manufacturing process parameters influence the solidification microstructure, which in turn determines the properties of the final part. Specifically, Khodabakhshi will develop a physics-based, data-driven reduced-order model for predicting microstructure evolution in binary alloy solidification (or when a mixture of two metals changes from liquid to solid).

"For example, if I want a part that has specific thermal properties," she says, "I don't know what my process parameters should be to achieve them. The simulations that link given process parameters to the resulting solidification microstructure, and consequently the final properties of the built part, are highly nonlinear. We refer to this simulation as the forward map. From there, I can construct the inverse map, which connects desired properties back to the process parameters."

The NSF project focuses on developing a computationally efficient model for the process-structure relationship. Its ultimate goal is to optimize the manufacturing of additively manufactured parts, which are especially useful in the aerospace, automotive, and healthcare industries—fields in which confidence in manufacturing is paramount.

The team's approach uses a scientific machine learning framework that blends data-driven machine learning algorithms with physical laws.

"As engineers, we don't want to just train a black-box algorithm," says Khodabakhshi. "We want to embed physics into the problem to satisfy the governing equations of the physical phenomena so that we're confident about the output that we receive. That's the difference between conventional machine learning and scientific machine learning."

PSE at Lehigh: 50 YEARS OF MATERIALS IMPACT

When Lehigh launched its Polymer Science and Engineering (PSE) program in the early 1970s, few universities treated polymers as a distinct, interdisciplinary field. Fifty years later, PSE remains a model for advanced materials education that integrates chemistry, physics, and engineering with industry-informed research.

From the outset, the program has emphasized translating fundamental polymer science into real-world applications. That approach has shaped generations of engineers and scientists now working across academia, government, and industry, and it continues to define PSE's research strengths today—from polymer synthesis and characterization to sustainable materials and circular materials systems.

Those same priorities now guide how PSE educates today's materials professionals. Alongside its on-campus research enterprise, the program offers a fully online master's degree and graduate certificate, expanding access for working engineers and scientists seeking advanced training without stepping away from their careers.

In October 2025, PSE brought alumni, faculty, students, and industry partners together to reflect on the program's trajectory. A keynote address by Mohamed El-Aasser, emeritus provost and professor of chemical engineering and former director of the program, traced the program's evolution through major research milestones, curriculum shifts, and long-standing industry collaborations that have enabled PSE to adapt to emerging challenges in materials science.

"Fifty years of PSE," says current program director Luciana Arronche, "shows how science and industry can shape the materials that define modern life."

New computational model guides neurostimulation therapy for atrial fibrillation

Atrial fibrillation (AFib) is a cardiac disorder in which the chambers of the heart beat rapidly and irregularly. It's the most common type of arrhythmia and the leading cardiac cause of stroke.

While several treatments—ranging from medication to surgery—exist, the search continues for improved options to address AFib, which the National Institutes of Health (NIH) forecasts will affect up to 12 million people in the United States by 2050.

One emerging strategy includes electrical stimulation, known as neurostimulation, which researchers believe could potentially suppress, treat, or even reverse the disorder.

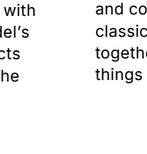
"At the experimental level, neurostimulation has been found to help not only AFib but also heart failure with reduced ejection fraction and hypertension," says Oluwasanmi Adeodu, a postdoctoral researcher in the Department of Chemical and Biomolecular Engineering.

"However, when it was applied in large clinical studies, the results were underwhelming. Part of the problem is dosage. Researchers didn't have a way to know how much stimulation to give. They were flying blind without real-time feedback on how the body was responding."

In a paper published in *PLOS ONE*, Adeodu and his team present a model that features the human cardiovascular system, the processing centers in the brain that control the heart, and the information pathway linking the heart to the brain. The model was designed to predict the hemodynamic response of patients after an onset of AFib and, ultimately, can help answer questions about where and at what levels neurostimulation should be applied, thereby moving the approach closer to becoming an accepted form of personalized treatment for AFib.

"This was a translational exercise," says Adeodu, who was lead researcher on the paper, whose co-authors include Mayuresh Kothare, the R. L. McCann Professor of Chemical and Biomolecular Engineering and the associate dean for research in the Rossin College. "As engineers, we took what clinicians know about AFib—and all the physiological changes that occur in patients—and turned those facts into math. Our goal was to answer the question: Can our model match known effects of AFib on easy-to-measure hemodynamic quantities such as blood pressure and heart rate? If the answer was yes, we could use it to explore new connections."

> "THE MAIN ADVANTAGE OF THIS MODEL IS THAT IT IS COMPUTATIONALLY TRACTABLE."
>
> —Mayuresh Kothare



The answer *was* yes. The team validated their model against clinical data and found that its predictions of heart rate, stroke volume, and blood pressure matched what doctors see in real patients. One especially interesting result: The model flagged a part of the atrioventricular node—a structure in the heart—as a strong candidate for stimulation. That same area is already a target for ablation therapy, suggesting the model is on the right track.

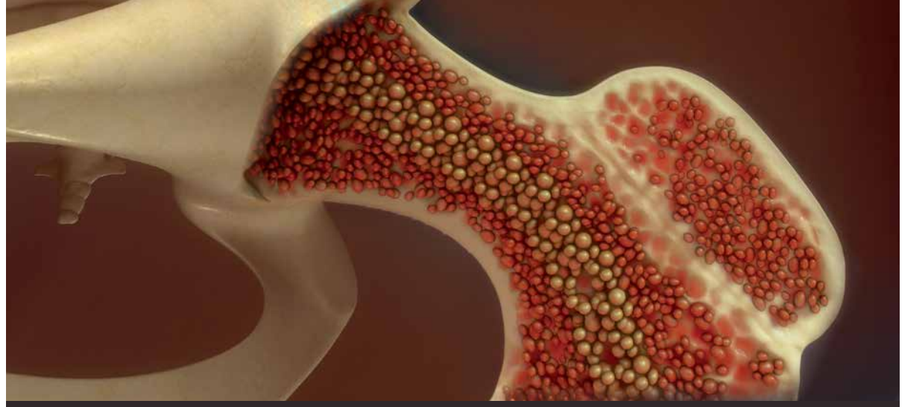
Now, Adeodu says, the stage is set for further study. Researchers can use the Lehigh team's model as a tool to explore where—and how much—neurostimulation can alter the elevated and irregular heart rate, or improve the compromised baroreflex sensitivity associated with AFib. They can leverage the model's predictive power to test the effects of stimulating different parts of the cardiovascular system, without relying on animal or human subjects. Once they optimize their approach using the model, they can test those strategies in patients. As clinicians use the model, their feedback will help further refine it.

Kothare sees this paper as the successful result of a collaborative effort by co-authors Raj Vadigepalli, formerly a professor at Thomas Jefferson University, now at the University of New Mexico; Michelle Gee, a graduate student at the University of Delaware; and Babak Mahmoudi, a professor at Emory University. The project was the outcome of a $2.2 million NIH grant through the Stimulation of Peripheral Activity to Relieve Condition (SPARC) program that was focused on developing software and modeling tools for optimizing the delivery of neurostimulation signals to peripheral nerves to treat conditions such as cardiac arrhythmia, hypertension, and stomach and bladder disorders. Kothare and Mahmoudi co-led the project, which concluded in 2023–2024.

"The main advantage of this model is that it is computationally tractable, unlike more complex three-dimensional cardiac models that require high performance computing infrastructure to solve the resulting equations," says Kothare. "This low computational cost makes it particularly attractive for rapid testing and even real-time use, allowing bidirectional flow of data and information between the patient and the virtual representation of the cardiac system of the patient, in the true framework of a 'digital twin.'"

The long-term goal, says Adeodu, is an automated, wearable device that continuously monitors physiological feedback and delivers the appropriate stimulation to counter atrial fibrillation. For now, translating a serious condition into math and lines of code has brought clinicians closer to truly personalized cardiac care.

"Once you have a good model, it opens up a whole new world of insights and connections," says Adeodu. "It's classic proof that when people come together from different fields, amazing things can happen."



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Hip or shoulder? Location matters in bone marrow for joint repair

Study offers insight that could influence regenerative treatments

Bone marrow aspirate concentrate (BMAC) is a common treatment for joint injuries.

The invasive therapy involves extracting bone marrow—often from the hip—and concentrating it to preserve stem cells and growth factors, which help promote wound healing and tissue regeneration. The concentrated mixture is then injected into the injury site to speed up tissue repair and reduce inflammation. BMAC can be used on its own or in conjunction with surgery to repair ACL, MCL, and meniscus tears and other injuries.

"We know that BMAC has therapeutic properties that seem to be effective," says Colin Herna, a fifth-year doctoral student in bioengineering who is advised by Sabrina Jedlicka, an associate professor of bioengineering and materials science and engineering and Lehigh's deputy provost for graduate education. "But exactly what is being injected is not always understood. We're trying to uncover what's in the black box."

Herna is the lead author of a recent paper published in *ACS Omega* detailing how he and his team identified measurable differences in the composition of bone marrow extracted from the hip versus the shoulder.

Bone marrow is typically harvested from the iliac crest of the hip (the curved upper ridge of the pelvic bone), which provides large volumes of marrow. In theory, says Herna, this means it contains more stem cells and results in anecdotally better outcomes. For certain injuries—such as rotator cuff tears—surgeons can draw marrow from the humeral head of the shoulder (the ball-like end of the upper arm bone forming part of the shoulder joint), avoiding a second invasive procedure. Herna set out to determine if marrow from the shoulder was comparable to hip marrow.

Using samples from both sites, Herna applied two machine learning models to screen 109 unique proteins for relevance. He then compared where the models' results overlapped.

"We identified six proteins that may help distinguish between the two extraction sites," he says. "In other words, the marrow in the hip and in the shoulder share many of the same ingredients, but not in the same ratios."

The difference may stem from the unique microenvironments of individual bones. Such variability matters because proteins and growth factors can significantly influence healing, even in tiny amounts.

Herna believes the process he and his team developed will help guide other researchers.

"Right now, BMAC extraction is not standardized—different kits follow different protocols," says Herna. "That variability leads to differences in stem cell and protein concentrations. With this machine learning approach, we created a framework medical professionals can use to study BMAC or other biological tissues."

Further down the road, this research could deepen understanding of BMAC and allow physicians to tailor treatments, choosing extraction sites based on the proteins most likely to benefit each patient. Combined with future research into demographic factors, such as age, sex, and lifestyle, it could bring regenerative medicine closer to personalized care.

For Herna, the data science aspect of the project was especially motivating.

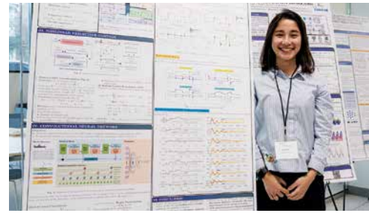
"There is so much information out there," he says. "Having the skills to make informed decisions based on that data is valuable across many fields of research."

MICROGRID RESEARCH FOR AI DATA CENTERS

Hyperscale data centers are behemoths of computing power. Often spanning more than a million square feet, they house thousands of servers that process, store, and analyze massive datasets that drive artificial intelligence. Not surprisingly, such infrastructure demands an enormous amount of power.

"Data centers have distinctive load profiles," says Saskia Putri (pictured), a fourth-year PhD student advised by Farrah Moazeni, an assistant professor of civil and environmental engineering. "When training AI models, their power requirements can jump suddenly and significantly. These rapid fluctuations can create instability in the electrical grid."

To address this, Siemens—a leader in automation and energy systems—has sponsored a one-year research project led by Moazeni and co-led by Javad Khazaei, an assistant professor of electrical and computer engineering. As part of the pact, Putri received a year-long fellowship to work with researchers at Siemens on advancing microgrid technology for more resilient and



reliable energy systems. The effort stems from a collaboration between the company and Lehigh's Center for Advancing Community Electrification Solutions (ACES).

One of Putri's primary tasks is to develop a data center microgrid—a localized power network capable of operating independently of the main grid. Her work focuses on modeling and simulation, along with embedding real-time control systems, to enhance stability and reliability for energy-intensive operations such as AI training.

Reliability by design

Dr. Michelle Parker '92 on engineering for an expanding space economy

At a time of unprecedented transformation in the global space sector, Dr. Michelle Parker '92 is steering the technical direction of one of the industry's most expansive defense and space enterprises. The mechanical engineering alumna and Dean's Advisory Council member was recently named vice president and chief engineer for Boeing Defense, Space & Security programs, where she oversees design and execution across the division's portfolio.

Over more than 25 years at Boeing, Parker has helped guide some of the company's most visible and complex programs—from leading Boeing's Space Mission Systems business, which includes national security space systems and commercial and government satellites, to serving as Chief Engineer of the Space & Launch Division, supporting the system that powered NASA's Artemis I mission. She began her career in thermophysics, designing satellite thermal systems, and rose through the company in leadership roles spanning engineering, strategy, and enterprise technology.

Here, Parker reflects on the Lehigh experience that shaped her career, the evolution of the space industry, and how graduate programs such as MS-AERO—Lehigh's new master's degree in Aerospace and Space Systems Engineering—can prepare the next generation of engineers to design systems that *must* work—the first time, every time.

Q: In what ways did your time at Lehigh shape your path to a career in aerospace engineering?

A: As a mechanical engineering major, I focused on thermodynamics, fluids, and heat transfer. I appreciated the hands-on nature of those classes—you immediately applied what you learned in the classroom. I also gained a deep understanding of how collaborative engineering really is; it's far more team-oriented than people expect. Learning to work across disciplines while attending Lehigh provided a foundation that has been vital throughout my career.

Q: How do you foster cross-disciplinary collaboration?

A: It starts with understanding the overarching objective—what we're delivering and why it matters. If you can communicate the mission, you can get people from different technical backgrounds aligned around a common goal. It also helps them recognize each other's constraints. I often find myself acting as the translator or connector among team members. When you're building complicated systems, that integration is essential.

Q: How would you describe your leadership philosophy?

A: It's always about the team. I do not like finger-pointing. We win or lose together. As a leader, technical integrity is also incredibly important. Once a satellite is in space, you can't bring it back—it has to work. We're building sophisticated systems for high-stakes missions, so operational reliability is huge.

Q: What industry trends excite you most right now?

A: Space has always been exciting, but the industry has really blossomed over the last decade. We're seeing an expansion in exploration—returning to the moon, going to Mars, launching heavy-lift rockets. We've also shifted from handcrafted satellites to "hot" production lines where we're manufacturing dozens of similar satellites. To increase the velocity of that production, we're introducing automation into our processes wherever possible. The satellite industry is at an inflection point where schedules matter more than ever. Delivering at pace is critical.

Q: What skills do engineers need as the industry moves in this direction?

A: Fundamental mechanical and electrical engineering skills are non-negotiable. But we're seeing production engineering, manufacturing engineering, and industrial engineering take on a much more prominent role. At Boeing, we're hiring a lot of production engineers because speed depends on manufacturability. It's not enough to design a product; you have to ensure it can be built efficiently. The systems that build the vehicle become as vital as the satellite itself.

Q: How can engineers better communicate the importance of their work?

A: As engineers, our language tends to be highly technical because specificity matters. But to capture the interest and imagination of the broader public, you have to describe how engineering impacts daily life. Take GPS, for example. Without GPS satellites, we couldn't navigate with our phones. Weather forecasting, real-time banking, global internet connectivity—these are just some of the daily essentials that rely on space-based infrastructure. Most people don't think about what's powering those services, which is actually a testament to how reliable our satellites have become. However, making that connection is crucial if we want to inspire the next generation to join or support the industry.

Q: How do you see Lehigh's MS-AERO program equipping students for future success in the industry?

A: A master's degree allows for specialization that the industry now demands. My undergraduate studies at Lehigh focused on thermofluids. I went on to earn my master's and PhD from the University of Pennsylvania in that area, with research focused on loop heat pipes for spacecraft thermal control. That deeper, specialized knowledge gave me an edge in my career. Lehigh's program will allow students to focus on areas unique to aerospace—such as launch, mission operations, and propulsion.

In this field, systems engineering is critical. Our technology is profoundly interconnected, from the components within the satellite to the links between ground stations and users. A master's program helps students understand how integrated design works, teaching them how subsystems come together to ensure the entire product operates as intended.

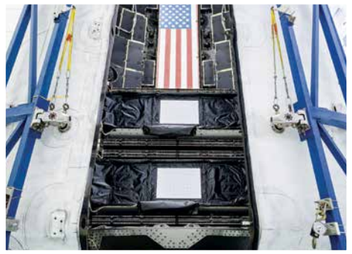
Q: Mentorship is a key component of the program. How has mentorship shaped your own trajectory?

A: At every stage of my career, my mentors have emphasized one thing: Be technically excellent. If you want to solve big, complex problems or lead technically driven businesses, your technical expertise and integrity come first. I also had a mentor whose advice has always stayed with me: Hire people smarter than yourself, and always seek to understand where the other person is coming from. Whether in a negotiation or a design review, every difference of opinion has a root cause. If you take the time to find that root, you'll reach the best solution.

Q: What advice do you have for early-career engineers?

A: Build a strong foundation. It's natural to be eager for the next step, but whether your expertise is in engineering, business, or another field, you need a base to build upon. It's also imperative for future leaders in the space industry to be resilient. This is a challenging business. You will face setbacks because you are constantly pushing the boundaries of what's possible. When failures happen, you have to identify the source of the problem, make the corrections, and get right back to work.

> "As a leader, technical integrity is incredibly important. Once a satellite is in space, you can't bring it back—it has to work."



COURTESY OF BOEING

COURTESY OF SPACEX (2)

Two Boeing 03b mPOWER satellites (above) are encapsulated ahead of their launch aboard SpaceX's Falcon 9 (right) to join a constellation delivering global connectivity.

»Inside CDAT

Lehigh's newest University Research Center takes a human-centered, interdisciplinary approach to assistive technologies supporting mobility, independence, and daily life

Story by Christine Fennessy | Photos by Christa Neu

Engineers are natural problem solvers. At Lehigh, the Center for Community-Driven Assistive Technologies (CDAT) is built on the idea that the most meaningful solutions emerge when engineering expertise is paired directly with lived experience. In other words, people facing accessibility challenges and those who support them help shape and guide the center's work.

"Community members tell us the problems they face so we can design, develop, and translate the tools that will have maximum societal impact," says CDAT director Vinod Namboodiri, a professor of computer science and engineering and the Forlenza Chair in Health Innovation and Technology in Lehigh's College of Health (COH).

Launched in 2025 as one of three new University Research Centers, CDAT brings together faculty, staff, and students to develop technologies that will improve life for people with disabilities.

"Starting with a community problem isn't easy—any single faculty member may lack the skills to solve it," Namboodiri says. "But that's where our ability to work in collaborative, interdisciplinary teams makes a difference."

Prior to the center's launch, Namboodiri and his team held a workshop in 2024 to better understand the scope of local challenges. They invited participants from medical organizations like Good Shepherd Rehabilitation (a clinical and research partner of Lehigh), nonprofits such as the Lehigh Valley Center for Independent Living and the American Foundation for the Blind, senior living centers, and multiple school districts. Working together, they named three focus areas: Mobility and Access, Transitions, and Smart Spaces. Although CDAT is still in its early stages, projects in each area are already being defined—and in some cases, underway.

Moving through the world

Juan Aceros leads the Mobility and Access focus area. The associate professor of bioengineering, who also has a joint appointment at Good Shepherd Rehabilitation, specializes in pediatrics and develops ride-on toys and technologies that help children with disabilities better engage with the world.

"Our objective is to improve quality of life through mobility so that people can participate in the activities they enjoy," he says.

Projects in this area include Mapping for Accessible Built Environments (MABLE), an ongoing initiative headed by Namboodiri (pictured, left) that allows people with a range of impairments to use an app to receive turn-by-turn instructions while navigating indoor environments.

Another proposal involves a harness system for individuals unable to stand independently because of injury or stroke. The concept resembles a canopy that opens and locks into place, says Aceros. The harness could support a person's body and enable them to walk.

"That person could then work, for example, behind a counter at a café," he says. "Having that harness system allows them to be out in the world, engaging with people, and doing physical activity. It has the potential to be life-changing."

That work builds on research Aceros launched earlier in his career, in which he and his team at the University of North Florida demonstrated that ride-on toys can have a measurable psychosocial impact on very young children with disabilities by enabling them to move through and interact with their surroundings. The devices resemble small ATVs and are adapted to each child's needs.

For example, if a child has weak lower-body control due to spina bifida, the device may require standing to strengthen leg and core muscles toward the long-term goal of advancing from a wheelchair to independent walking. For children with more severe disabilities, the ride-ons can be operated by others and paired with helmets that support the head and encourage eye contact—an essential element of human connection.

The next step, Aceros says, is studying how the devices influence biomechanics, including gait and postural control, across populations.

"Some of the children who use these devices show significant improvements in mobility, posture, and communication, while others don't," he says. "So we're embedding high-tech sensors in the toys to identify patterns in how they're used and how that correlates with improvement. That data can help clinicians make informed recommendations—such as how often and how long a child should use the device—to maximize benefit."

His team has already begun building a motion-capture lab at Good Shepherd. The space, which he plans to eventually relocate to Lehigh's campus, will allow researchers to more precisely measure movement patterns and integrate those findings into the design of future ride-ons.

A related project explores the integration of vibration therapy into ride-ons for children with little to no ability to move from the neck down. Vibration is commonly used in clinical settings prior to treatments like physical therapy, says Aceros, because it activates mechanoreceptors that boost muscles' responsiveness and extend the effects of treatment. The toy will incorporate a supportive harness and vibration technology to stimulate core muscles.

"The vibration will strengthen their muscles, and we hope to see improvements in trunk control," says Aceros. "For these children, even small gains in posture control can help prevent ulcers, reduce pain, and minimize pressure sores. We want to understand whether a ride-on like this can independently function as a therapeutic intervention. I believe it can."

Such research depends on collaboration across disciplines, and CDAT will provide access to that expertise, says Aceros. It will also help attract students eager to work on problems grounded in real-world impact.

"Students who gravitate to work like this want to see their energy and intellect translated into the community and into projects that matter," he says.

Preparing for change

Another focus area, Transitions, centers on helping people with disabilities as they move through major life stages, such as from high school to college or from employment into retirement. It's co-led by Lee Kern, a professor of special education in Lehigh's College of Education, and Fathima Wakeel, an associate professor of population health (COH). One project involves developing methods that use augmented reality to simulate life in higher education for individuals on the autism spectrum.

"These students are used to a certain support structure and routine, so how do we prepare them for the changes to come?" says Namboodiri. "Solutions might include virtual reality wearables that immerse them in the sights and sounds of a college campus, or a large language model and chatbot that simulates events like a career fair. The goal is to give individuals—and their caregivers—a way to experience these transitions ahead of time and feel more confident navigating them."

Integrating tech in daily life

The third focus area, Smart Spaces, explores how technology can support people in activities of daily living. It's co-led by Mooi Choo Chuah, a professor of computer science and engineering and an associate director of Lehigh's Institute for Data, Intelligent Systems, and Computation (I-DISC), and Dhruv Seshadri, an assistant professor of bioengineering. Several projects have already received funding, including one focused on individuals with dysphagia (difficulty swallowing) and another on people with multiple sclerosis (MS).

In the dysphagia project, researchers are developing algorithms and placing sensors on the neck to measure the effort and frequency of swallowing.

"Ultimately, we're trying to quantify what therapists currently assess subjectively, using tools like perceived exertion," says Seshadri. "We aim to provide objective data clinicians can use to better understand and tailor treatments to address dysphagia."

Seshadri hopes to eventually pair the software with a device that integrates swallowing metrics alongside other vital signs, such as heart rate and body temperature, to assist with diagnosing related conditions.

Aceros (left) and Seshadri (above) work on technologies that improve care and quality of life.

"Patients with dysphagia can develop aspiration pneumonia," he says. "When food enters the windpipe, it can cause infection and trigger changes in respiratory rate, heart rate, and temperature. Given its life-or-death importance, we're interested in the potential of swallowing as the next digital biomarker of disease."

Seshadri's team is taking a similar approach to quantifying muscle fatigue—which can lead to gait abnormalities and falls in people with multiple sclerosis—as a way to assess and improve therapy. Sensors will measure changes in muscle activity during standard rehabilitation exercises such as walking and sit-to-stand tests. Currently, fatigue is largely assessed through a patient's self-reporting.

"We're trying to provide the first quantifiable means of assessing rehabilitation outcomes in patients with MS," he says, "so we can deliver clinically meaningful information to physical therapists."

Story by Christine Fennessy | Photos by Christa Neu

Learning by doing

With each new cohort and module, FYRE sharpens its vision for a hands-on first year in engineering built around connection and practice

There was a moment in the Fall 2025 semester when Christina Haden (pictured, top left) could almost see the transformation happening in the students around her. They were leaving the classroom after their first day in Design and Making Foundations, the inaugural module of Lehigh's First Year Rossin Engineering (FYRE) program. In their hands, they held placards they had created after learning how to solder electrical components and use a laser printer to engrave and cut their names.

"I could see the excitement and sense of belonging in their eyes," says Haden, a teaching associate professor of mechanical engineering and mechanics and the director of FYRE. "They were recognizing the resources and tools they had at their fingertips already, from day one. They had been high schoolers just moments before that class, and they were now college students with meaningful, hands-on experience in what it means to be an engineer."

FYRE is an innovative approach to guiding incoming students toward a meaningful and fulfilling future in engineering. Last fall, the program, which is still in the pilot phase, consisted of two 7-week, project-based modules that introduced students to a range of engineering disciplines and professional tools. The novelty and promise of such an approach instantly attracted students like Paige De Caro '29 and Jayden Altamura '29 (at right).

"I liked the idea of a pilot program because it meant they were trying something new, and I was looking forward to having a hands-on experience," says De Caro, who plans to major in civil and environmental engineering. "When they said we would be working across disciplines, I was excited about that, too, because even though I already knew my major, I wanted to experience all the aspects of engineering that FYRE offered."

Altamura, who intends to major in mechanical engineering and mechanics, applied for the program as soon as he read the email introducing it. He found the approach intriguing.

"I wouldn't just be learning about engineering," he says, "I'd be learning how to be an engineer."

Both students joined 32 of their peers as part of the inaugural FYRE cohort, and as a group, they were immediately steeped in the language of engineering. The Design and Making Foundations module required them to build a functioning machine using 3D printing, laser cutting, Arduino programming, and basic electronics. Working in teams, the students designed, tested, and refined their creations. For most, it was their first exposure to such sophisticated hardware and software.

"The students had to learn the design language of how you get an idea off a piece of paper, bring it into reality, and then iteratively make it better," says Haden.

De Caro and Altamura worked together on a four-person team to conceive of and build a prototype of a machine that could help people with limited mobility access items they couldn't physically reach. The team envisioned a system that could move vertically and horizontally across a series of shelves, taking objects from one location to another. The idea came out of a series of brainstorming sessions aimed at identifying a problem they could solve within the module's timeframe. It was an engaging challenge, says Altamura, in part because it provided an opportunity to work on something that could truly help other people.

"My mom had spine surgery a few years back, and she has trouble bending down," he says, "so a machine like this could probably help her."

Building it meant acquiring a range of skills. De Caro had some experience soldering and working in a woodshop, but she had never operated a 3D printer or written code. The breadth of what she had to learn in seven weeks could have felt daunting. Instead, tackling the challenges taught her one of engineering's most important lessons.

"The instructors were always telling us, 'If it doesn't work, that's okay,'" she says. "In a way, they want you to fail because they want you to learn. So I didn't feel pressured, because I knew they were looking for us to understand the process."

The group hit their deadline (as did all of the teams) in time for a campus expo in which the students demonstrated their machines for an audience of their peers, faculty, and other visitors, while articulating how the prototypes could potentially be scaled up to solve a real-world problem.

"It made me feel proud to show it off and to know that I actually did this. I made something that works, and works consistently, which is even more important," says Altamura.

For both De Caro and Altamura, the most surprising—and rewarding—takeaway from the module was the value they found in teamwork.

"I kept calling my mom to say how much I loved team projects now because of that class," says De Caro. "What we were able to get done—I never would have thought it was possible. I learned that everyone has something to contribute, and being part of a team isn't just about the product you're producing, it's also about the people you're working with."

Altamura echoes the sentiment. "We worked well together," he says. "We found an efficient way where we could all use our different skills."

Beyond encouraging teamwork, FYRE is designed to support first-year students as they navigate the academic and personal transition to university life.

"FYRE is not just about technical rigor," says Haden. "It's so much more ambitious. It's a holistic approach that allows students to get to know each other, figure out what they are passionate about, and, in the process, learn the importance of belonging. The program embodies an ethos that helps students successfully move between these very distinct spaces, between high school and the start of their sophomore year."

After completing Design and Making Foundations, the students immediately dove into the seven-week Energy Foundations module where they gained practical experience designing and testing electrochemical cells, building a Raspberry Pi–powered potentiostat to measure and control those systems, experimenting with how materials store and release energy, and constructing their own coin cell batteries.

"Some of the most impactful future advances will be driven by innovations in energy storage technologies—an area where our students are developing both technical expertise and systems-level perspective," says Joseph Menicucci, an associate teaching professor of chemical and biomolecular engineering and associate chair of the ChBE department, who led the module.

In the Spring 2026 semester, a new group of first-years are test-driving FYRE through Design and Making Foundations and a new seven-week module called AI Foundations. It's taught jointly by Eric Obeysekare, a teaching assistant professor of computer science and engineering who has a joint appointment with Lehigh's Office of Creative Inquiry and is the associate director of FYRE, and Charalambos Marangos, an associate teaching professor of industrial and systems engineering. (The AI module was also open to, and attended by, members of the inaugural cohort.) Students are learning the programming language Python and applying those skills toward building chatbots, artificial intelligence agents, embedded systems, and other tools.

"AI, and in particular large language models like ChatGPT, are having a huge impact on education," says Obeysekare. "It's easy to think that AI can do anything. But as you build an understanding of how these LLMs actually work, and what they're able to do well—and what they don't do well—then you can think more critically about their application."

The AI Foundations module teaches students how to build chatbots and artificial intelligence agents.

Although still in its nascent stages, FYRE is already setting students up with the confidence, skills, and support they need to become tomorrow's problem solvers. Students like De Caro and Altamura are now proficient in techniques that traditionally weren't taught until upper-level engineering classes. Neither hesitates when asked if they would recommend the program to other students—"a hundred percent," says De Caro. It's the hands-on aspect they appreciate most; the opportunity to make something that does something. Something important.

"It's been extremely encouraging to hear the students' feedback," says Obeysekare. "They've already developed the engineering mindset. They're building real machines that can solve real problems, and at the end of the day, that's what engineering is."

"I wouldn't just be learning about engineering. I'd be learning how to be an engineer."

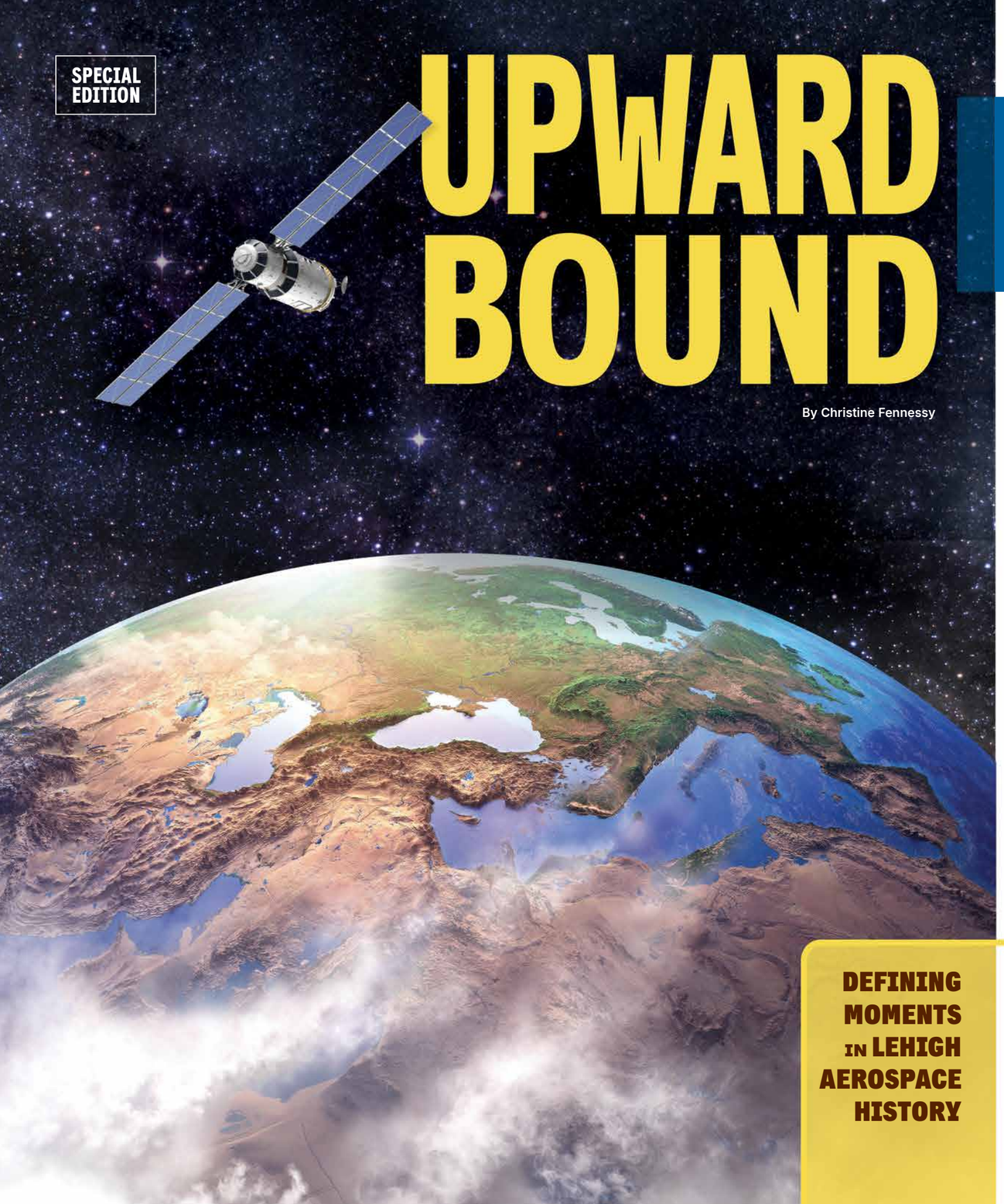
—Jayden Altamura '29

Students worked in teams to build functioning machines they then presented during a campus expo.

SPECIAL EDITION

UPWARD BOUND

By Christine Fennessy



MOZZZ (EARTH). YURIY MAZUR (SKY), PHONLAMAIPHOTO (SATELLITES THROUGHOUT) VIA ADOBE STOCK

In Lehigh's new MS-AERO program, alumni and industry experts teach and mentor future leaders in aerospace and space systems engineering

IT'S BOOM TIMES FOR THE AEROSPACE INDUSTRY.

Once driven primarily by exploration, aerospace now underpins critical economic infrastructure and national security. Private companies like SpaceX and Blue Origin have disrupted the industry with reusable rockets, enormous satellite constellations, and platforms that could one day support a space-based economy. Government agencies are racing to build resilience and deterrence into their tracking and communications satellites, while adopting faster, more agile, and more scalable approaches to developing air and space systems.

"There's just so much happening in both the commercial and government sectors, that the demand for engineers is extremely high," says Terry Hart '68 H'88, a former NASA astronaut (see page 23) and teaching full professor in the Department of Mechanical Engineering and Mechanics (MEM). "With our new MS-AERO program, Lehigh can accelerate the path for students to enter careers where that demand is most acute."

MS-AERO, a 30-credit Master of Science in Aerospace and Space Systems Engineering designed for engineers and others looking to begin or advance their careers, officially launched in the Fall 2025 semester with 12 students. The program is a natural extension of two converging trajectories at the university, says Arindam Banerjee, Paul B. Reinhold Professor and MEM chair: the increasing popularity of the department's minor in aerospace engineering, and decades of faculty research contributions spanning aerospace engineering and space-relevant technologies (see timeline, beginning below).

"Modern aerospace problems are systems problems, not single-discipline ones," says Banerjee. "The MS-AERO program offers a systems-level curriculum that reflects how aerospace is practiced today, with formal pathways connecting coursework, labs, and project work. It equips engineers to meet growing technical complexity, workforce shortages, and the strategic demands of a transforming aerospace and space sector—one that's increasingly central to the nation's scientific, economic, and national security priorities."

In addition to taking eight new graduate courses in aerospace engineering, students can choose from more than 40 technical electives across six departments in the Rossin College and Lehigh's College of Arts and Sciences.

"Because aerospace is so interdisciplinary, we are drawing from our faculty across Lehigh to prepare our students for careers in the aerospace industry," says Hart. "For students who would prefer to focus on a particular area of aerospace engineering, we're also planning to offer 12-credit certificates in one of three technical concentrations, as well as a 12-credit certificate in aerospace project management, jointly with the College of Business. These concentrations will give our students a competitive edge, especially if they're looking to go into research and development."

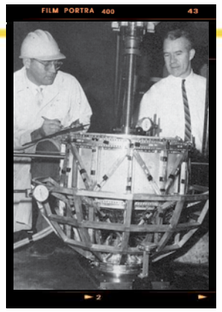
> "STUDENTS WILL HAVE A COMPETITIVE EDGE, ESPECIALLY IF THEY'RE GOING INTO R&D."
>
> —Terry Hart '68 H'88

For example, a mid-career engineer pursuing a master's degree could also earn a certificate in aerospace project management or in one of the three technical areas. For those who don't have time to complete the full master's program, a 12-credit certificate can be pursued independently. Although students can complete MS-AERO in a single full year, the program is intentionally designed for working professionals. All classes are offered remotely and asynchronously, and many are taught by full-time industry professionals—some of whom are Lehigh alumni.

DEFINING MOMENTS IN LEHIGH AEROSPACE HISTORY

1962
THE TELSTAR EXPERIMENT

Fritz Engineering Lab conducts stress tests on the structural frame of AT&T's Telstar, the first U.S. communications satellite.



1964
SPACE SCIENTIST AT HELM

Space engineer W. Deming Lewis is named Lehigh's 10th president after a distinguished career with Bellcomm.

1967
EXPANDING RESEARCH

Lehigh secures a NASA grant to calculate structural stress on Apollo heat shields during atmospheric re-entry.

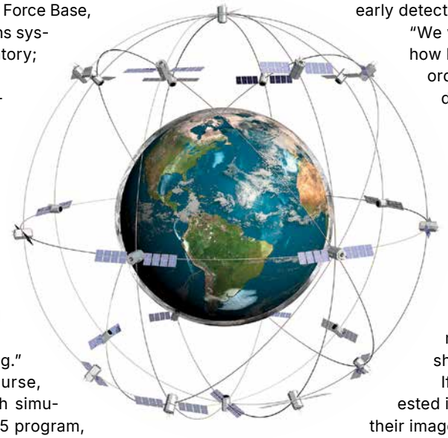
"They're all subject matter experts, which is a major advantage for students," Hart says. "Our visiting lecturers are teaching in an experiential way that's bringing students right up to the state of the art in the industry."

At the heart of the MS-AERO model is a focus on project-based learning coupled with individualized mentoring by industry experts.

"The theme throughout all of my classes is application," says Chris Schulz, a space systems consultant who teaches the Data Fusion and Introduction to Aerospace Engineering courses.

Schulz has an expansive resumé: he has served as director of hypersonic research at the Air Force Flight Test Center at Edwards Air Force Base, California; as a flight and weapons systems architect at Draper Laboratory; and as a senior director at Blue Origin. He says he sees a recurring deficit among new recruits to the aerospace industry.

"We tend to see high-performing young graduates with an incredible depth of theoretical knowledge but little hands-on experience," he says. "I structure my classes to bridge that gap and simulate the experiences they'll have in industry. My students need to actually make something."



For the introductory course, Schulz tasked his students with simulating the 188th flight of the X-15 program, which set the world record in 1967 for the fastest speed ever—Mach 6.7—for a crewed aircraft. But first, they had to work through the math of flight dynamics, or the forces that act on an object to make it move.

"A lot of them reacted with, 'What the heck—another transformation matrix? For real?'" says Schulz. "But then they got to see how those equations went into simulating a flight profile—how the vehicle and engine would perform, and the sequence of events required to meet the mission objectives. These are the same simulations used in industry. The students not only built the model, but also completed every step required for a flight test demonstration. The project directly connects academic theory to a real-world event and mirrors the kind of work they might do in the future."

As a doctoral student working under Hart, Andrew Abraham MS'11 PhD'14 studied how spacecraft can travel efficiently between Earth and the Moon. Now the senior space traffic coordination specialist at The Aerospace Corporation in Virginia taps into his years of industry experience to guide student projects at Lehigh.

Students in his Advanced Astrodynamics class design a mission that provides regular deliverables to a hypothetical client. One student, for example, proposed a constellation of satellites for forest fire detection. Abraham helped him work through the trade-offs between early detection and cost.

"We worked through questions like: how big does the fire have to be in order to reach the threshold of detection, and how many satellites do you need to place in orbit in order to achieve that performance?" says Abraham. "Students have to balance performance against cost, making deliberate trade-offs that shape the final design. Drawing on my experience, I can guide them toward the aspects of the project they're most interested in, while helping shape their path as engineers."

If a student is primarily interested in achieving high fidelity with their images, for example, Abraham helps them with orbit propagation to predict the path of the satellites. If the student instead wants to develop the business case for their project, Abraham leads them through optimization problems that enable them to present a range of solutions to a potential client.

"These are absolutely the types of skills that are used in industry," he says. "And students develop them through these projects."

Thanks to the project-based coursework and small class sizes, MS-AERO students have invaluable access to their instructors, who also serve as mentors. Schulz says that students frequently come to him with questions about how and where their skills and »

CENTER: FOTOFLASH/ADOBESTOCK; OPPOSITE AND NEXT PAGE: LURA PHOTOS BY CHRISTA NEU

1969
TRACKING APOLLO 11
Trajectory analyst Bernie Schneider '63 supplies data that aids TV tracking of the rocket in flight.

1970
ANALYZING MOON SAMPLES
Professors Charles B. Sclar and Joseph I. Goldstein analyze lunar samples from Apollo 11 and 12. A public viewing of lunar rocks draws 5,500 visitors to campus.

1975
PREDICTING MATERIAL FAILURE
Institute of Fracture and Solid Mechanics develops mathematical models for the Space Shuttle Thermal Protection System.

'The challenge is the point'

To the uninitiated, a video of a rocket that never leaves the earth can feel anticlimactic. But for the students behind it, the static fire of Bowie—a liquid bi-propellant rocket—was a turning point. The test confirmed that the Lehigh University Rocketry Association (LURA), a student-founded-and-run club, had moved beyond early experimentation into the kind of systems-level engineering used in industry.

"We were looking for a seven-second burn time, and that's what we got," says LURA's president, Keegan Gagnon '26, a newly graduated mechanical engineer who is now a graduate student in Lehigh's MS-AERO program. "Compared with solid fuel, which can be purchased as a cartridge, there's more plumbing, more electronics, and more moving parts to liquid fuel, since you have to build the entire propellant system yourself. Not a lot of universities are working with it, but liquid fuel is what SpaceX and NASA use for their rockets, and we wanted to build something that reflects the industry. The next step is to launch it."

Bowie is one of several recent advances by a club still in its formative years. Gagnon, who worked with model rockets as a child, started LURA during his sophomore year after realizing how companies such as SpaceX were driving demand for aerospace engineers—and after learning that Lehigh had a distinct advantage in the field.

"I had no idea we had an astronaut as a professor on campus," says Gagnon. "After learning about Terry Hart, and all the amazing classes he taught, I started the club."

It wasn't easy launching a club that works with explosive materials, but today LURA has over 40 members from a range of majors. Its purpose is twofold, says Gagnon: to expose students—from across engineering disciplines and beyond—to rocketry and aerospace, and to push the boundaries of collegiate research and development in those areas.

"We intend to work on systems that mirror industry practice, so when students go to these companies, they're already familiar with the technology," he says. "We want everyone to know that Lehigh University can compete as a serious rocketry program."

To that end, the next test for Bowie will take place mid-semester in Maryland. The goal is to reach 5,000–6,000 feet. At that point, a small parachute, or drogue, will deploy and slow the rocket's descent. Once it reaches approximately 1,500 feet, a larger parachute will deploy and carry it safely to the ground. The flight will mark the club's first-ever launch of a liquid-fueled rocket.

Meanwhile, the team is also preparing Talon, their 14-foot-long, 8-inch-diameter solid fuel rocket, for the 2026 Experimental Sounding Rocket Association's International Rocket Engineering Competition (IREC) in Texas. The annual event is the world's largest collegiate rocketry competition, and teams must apply for selection. This year's IREC will host 186 teams from around the globe.

"Talon has been our main project for the year, and the plan is to compete for the world championship in the 10,000-foot category," says Gagnon.

At IREC, winning can take many forms. For the altitude category, the overall winner is the team that gets as close to 10,000 feet as possible, but teams are also evaluated on the quality of their design reports, the accuracy of their simulations compared with actual flight data, and the complexity of their payload. LURA's payload is a robotic dog named Laika.

"The point of the competition is to be innovative," says Joshua Kraus '27, who is concentrating on aerospace engineering and behavioral psychology in Lehigh's Integrated Degree in Engineering, Arts and Sciences (IDEAS) program and serves as lead engineer on Talon's payload. "We weren't looking to build the safest option, which is usually a CubeSat—a miniature, inexpensive satellite. It's straightforward: a box you send up and bring back down. But that's not our way. We're the first rocket lab at Lehigh, and we wanted to go in with a bang."

The payload team has been developing Laika—named after the dog who flew aboard the Soviet Union's Sputnik 2—since last summer. The goal is for Laika to be released at 2,000 feet, parachute back to Earth, and, upon landing, release itself from its restraints. From there, it will stand up, walk around, and perform its scientific mission: taking photos of the terrain with an optical camera, collecting temperature readings with a thermal camera, and using Time-of-Flight (ToF) LiDAR—which measures distance using laser pulses—to navigate.

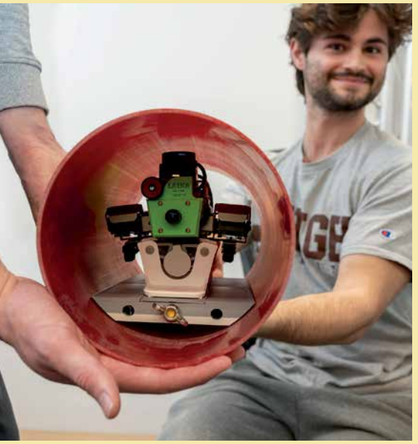
"It's an interesting concept because most robotic exploration is done with wheels," says Kraus. "But that technology is becoming arcane. In the future, the way that robots move and act will look closer to how humans or animals move. With Laika, we wanted to demonstrate that technology. It's harder to do, but the challenge is the point."

Embracing such challenges isn't just about winning competitions. LURA provides

Continued

students with a unique opportunity to encounter many of the situations they will face as working engineers—experiences both Gagnon and Kraus, along with other club members, have successfully leveraged in interviews.

"I was able to walk through the different problems we faced and how we worked through them," says Gagnon, who will be working as an aerospace engineer at Northrop Grumman after completing his master's degree. "Everything from budgetary and regulatory issues to the fact that we initially didn't have lab space and were working out of the back of my car for a while. It was on a much smaller scale, but those experiences made clear how we were able to execute a vision. We went from spending half a semester talking about what the club could become to being one of the biggest engineering clubs on campus and competing at the largest event in collegiate rocketry."



Club members work toward certification in building and flying different rocket types (above). Kraus (at left) demonstrates the Laika payload inside the airframe of the Talon rocket.

For Kraus, who will be interning with SpaceX in California this summer, LURA marked his first experience with engineering being a deeply collaborative effort. Previously, he'd thought of engineering as largely a solo endeavor—studying, working, and building on his own. As a member of LURA, he is constantly surrounded by peers with different skill sets and strengths, and he's struck by how much more inspired and productive he feels as part of a team.

"Learning how to operate in a team environment and trust other engineers was huge, and I became a significantly better team player," he says. "Being able to demonstrate that mindset to these space companies is incredibly valuable. LURA taught me how to be an engineer among engineers." —*CF*

interests might fit within the aerospace industry.

"We often discuss—this is what you've studied, but what do you actually like to do? And then I end up telling them about who does what in industry and where they do it," he says. "That conversation gives them the opportunity to vector toward a meaningful position."

Identifying that alignment early on is key. Without making that connection, Schulz says, students risk landing jobs that ultimately aren't a good match, wasting valuable time and formative experiences.

"It's a disservice to the company, and to the employee," he says. "I've seen recent graduates spend two years going through the paces of a job so they could find out where they really wanted to go, and it puts them way behind. This program can guide students and connect them with industry contacts to apply for positions that align with their interests. It's a win-win for everybody."

For companies, the benefits extend beyond hiring well-trained employees to include opportunities for scientific collaboration.

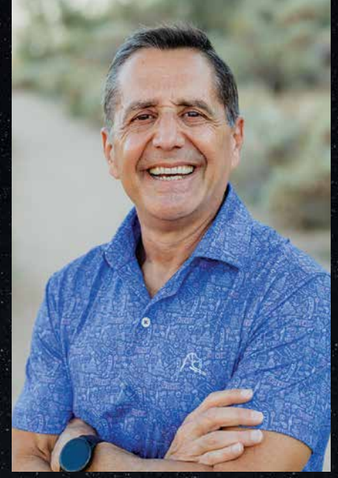
"Our lecturers could bring ideas to the students stemming from their own companies' needs, which could spawn research projects," says Hart. "Or companies may hire our undergraduates, then send the student back for a master's degree to work on a specific topic area. These relationships create the potential to build a strong research portfolio within the program."

While professors can help their students connect with companies and secure interviews, internships, or even jobs (several have already received offers), those who choose to continue in academia also benefit from their instructors' extensive backgrounds.

"This program is an excellent launch point into highly specialized—and highly competitive—graduate programs," says Abraham. "Because of my background and connections, I can help guide students toward the best ones. Our mentorship is not limited to industry work. It can extend deep into academia as well."

For those who do opt for the industry route, however, the program's project-based training will give them

OPPOSITE PAGE: DAVE BENTLEY PHOTOGRAPHY



'We have an obligation to design systems that keep people safe'

The principles that allow an automobile to deploy an airbag and a launch vehicle to fly into space share an unexpected connection. In both cases, these are split-second actions that depend on technology that translates an electrical signal into a carefully controlled and precise actuation event.

"They both rely on pyrotechnics," says Greg Scaven '85.

That shared technology helped shape Scaven's career, which has involved pyrotechnics, explosives, and propellants used in the defense, automotive, and aerospace markets. His work has led to lifesaving innovations.

Scaven's journey to Lehigh and chemical engineering started with the U.S. Army Reserve Officers Training Corps (ROTC) program. After graduating from the university, he was commissioned as a second lieutenant in the Army's Chemical Corps. While on active duty, he earned a master's degree in chemical engineering from the University of Pennsylvania and was later deployed to the demilitarized zone in Korea. After returning to the United States, he began working on next-generation flame weapons. Following deployments overseas during Operation Desert Storm, Scaven left active military service and joined a defense contractor in Arizona.

"In the early days of my civilian career, I worked on rockets," he says. "Think of them as a way to deliver a payload from point A to point B. The propulsion system delivers the payload to its intended destination or target. The business end is the payload, where, in the case of a rocket or missile, a warhead is used against a target. I was a warhead guy, maximizing the terminal effects upon initiation."

In the mid-1990s, that same company, Talley Defense Systems, was improving the propellant systems for the first driver's-side airbags in vehicles. Scaven spent the next decade advancing airbag technology for the automotive industry, eventually working for—and then leading—the company that developed the world's first side-impact head airbag.

"When airbags first appeared, they protected drivers and passengers in frontal crashes, but people still died in side collisions because the crush zone on a vehicle's side is very small," says Scaven. "We knew if we could place an airbag in that area, we could save many lives. And we did it! Those same airbags are now standard in most production vehicles today."

In 2006, Scaven started leading a division of Pacific Scientific Energetic Materials Company (PacSci EMC), which produced thousands of highly specialized pyrotechnic components for military, space, and aerospace uses. "I always tell people that if something flies or launches—and this is still true today—PacSci EMC plays a role in making it happen," he says, "because the company provides the initiation mechanisms that make it all work."

That extensive list of applications includes rockets and satellites launched by organizations such as Blue Origin and NASA; military missile defense systems manufactured by Lockheed Martin and Raytheon; and ejection seats used in high-performance military aircraft.

Scaven remembers grateful pilots coming to speak with his employees. "They'd been flying at over 500 miles per hour and had to punch out at a relatively low altitude due to engine failure. They said, 'Hey, you guys saved our lives. Thanks to your attention to quality, we are celebrating the holidays together with our families this year.'"

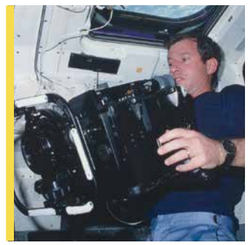
The company also developed the separation nuts used in the Space Shuttle program. Known as "sep nuts," these devices tethered the shuttle to the ground just before liftoff while it was generating around 7 million pounds of thrust. Overall, says Scaven, the space shuttle used more than 100 pyrotechnic mechanisms made by PacSci EMC, each essential to its flight.

Scaven, an incoming member of the Rossin College Dean's Advisory Council, has become the go-to alumni expert whenever rocket-related topics come up on Lehigh's campus. In 2023, he started advising upper-level students involved in

Continued

1982
EXPERIMENTS IN SPACE
Professor Mohamed El-Aasser's team prepares first chemical reaction experiment in space for Columbia shuttle mission.

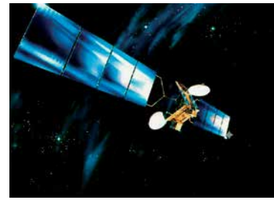
1984
THE DREAM IS ALIVE
Terry Hart '68 H'88 serves as cinematographer for the IMAX documentary and operates Challenger's robotic arm.



1987
LEADERSHIP AT NASA
John-David Bartoe '66, a Challenger STS-51-F payload specialist, is named chief scientist and helps shape Space Station Freedom, precursor to the ISS.

1990
THE SPACE GRANT ERA
Lehigh joins the Pennsylvania Space Grant Consortium, a NASA-funded partnership that provides student fellowships and research support.

1994
'LIVE' FROM LEHIGH
Lehigh begins broadcasting via the Telstar 401 satellite over the Lehigh Educational Satellite Network.



capstone project teams, and the following year, he remotely co-taught a class on the history of explosives. As part of the curriculum, he recommended that students study the Takata airbag scandal, where millions of vehicles were recalled after airbags deployed with too much force, sometimes sending metal shrapnel into drivers and passengers. The defect, linked to an unstable ammonium nitrate-based propellant system, caused multiple deaths and injuries.

"The Takata airbag recall is especially unfortunate because it exposed a lack of corporate ethics," he says. "Production schedule deadlines were prioritized over safety and quality concerns, and that decision ultimately led to the company's downfall." Scaven knew some of the people involved in this case, and at the end of the semester, he visited the class to share more about this now infamous recall.

"You had a lifesaving device that ended up killing people," says Scaven. "That fact cannot be reconciled. Takata is an important case study because it helps students understand that when you're making a device like that, the most important thing you can do is speak up if something doesn't seem right. Yes, there are real-world financial implications, but in the end, people may be harmed or killed if you work in a culture where that communication doesn't happen."

So while he's more than happy to "geek out," as he puts it, on all the technical aspects of engineering with students, what Scaven really wants them to understand is the importance of teamwork. How they will have to work—and communicate—with people across multiple disciplines to achieve a business's overall objectives and goals.

"We win as a team," he says. "It's those relationships between all team members that enable us as engineers to deliver the best products and services to surpass our customers' expectations. I really enjoy discussing that holistic approach with students."

> "RELATIONSHIPS ENABLE US AS ENGINEERS TO DELIVER THE BEST PRODUCTS AND SERVICES."
>
> —Greg Scaven '85

Scaven also stresses that throughout his career, he has rarely been just a chemical engineer. He's had to apply mechanical and electrical engineering, materials science, systems engineering, and management skills. Aerospace engineering, he tells students, is a little bit of everything. That's one reason he's excited about Lehigh's MS-AERO program and its focus on real-world projects guided by industry experts.

"These students are going to learn that the field isn't just about doing calculations involving distillation columns," he says. "They are going to see how everything comes together to deliver a product to a customer that works in the field as it was designed on paper."

He knows that when that occurs, the outcome can be life-changing: people walk away from crashes and pilots go home to their families.

"I care deeply about people in motion not getting hurt," he says. "We have an obligation as engineers to design systems that keep people safe. Looking back over my career, I'm most proud of all the things we've made as a team that have helped save lives." —*CF*

ALUMNI IN AEROSPACE
Join our LinkedIn group to connect and stay informed.

a significant edge, he says. Wherever they land, students will almost immediately be confronted with the company's goals—and its problems.

"Our students are going to be able to speak to those challenges in an informed way," he says. "They'll already be partway up the learning curve, and that's just going to accelerate their ability to progress in their career."

That elevated insight will be evident in the next generation of systems engineers thanks to the program's collaboration with Lehigh's College of Business. It's rare, says Schulz, for new graduates to enter industry with experience in systems-level thinking—designing, integrating, and managing complex systems so all their parts work together to achieve a goal. "But at some point in their careers, these engineers will be responsible for running projects and making sure they're completed on time and on budget," he says. The 12-credit certificate in aerospace project management, offered in partnership with Lehigh Business, is designed to meet that need.

"We need systems engineers because the world is, generally speaking, becoming more complex," says Karl Fetzer '07, staff research scientist at Siemens Research and Development.

Fetzer, who teaches the Guidance, Navigation and Control of Aerospace Vehicles course, says the role of systems engineer is typically learned on the job. Someone might start out as a propulsion analyst or avionics hardware specialist, and as they work with other teams, they develop the cross-disciplinary knowledge that enables them to manage and coordinate the various groups toward a common objective.

"Every product is integrating systems of very different types," he says. "If you had told an engineer who designed refrigerators in the 1980s that they needed to interact with a software team and a computer hardware team, they probably would have said, 'Why is there a computer in my refrigerator?' But now, every industry is integrated, so systems engineering is increasingly important. This curriculum lends itself to helping people along that path."

Fetzer describes his own course as understanding the systems that tell aircraft and spacecraft where they are in space, where they should be, and how to

OPPOSITE: ALONES/ADOBE STOCK; THIS PAGE: TOP: CHRISTA NEU

'The greatest adventure in human history'

Jared Isaacman, a highly successful tech entrepreneur and commander of two commercial space missions—who was recently confirmed as NASA administrator—brought his vision for space exploration to Lehigh in October 2025 to kick off Lehigh's new Future Makers Speaker Series. In conversation with Provost Nathan Urban, Isaacman shared reflections on his journey from his childhood fascination with flight to leading the Inspiration4 and Polaris Dawn missions.

"I decided I wanted [to be an astronaut] when I was in kindergarten," he recalled, noting that becoming a pilot was a more realistic step toward that dream. He emphasized that space exploration is humanity's "greatest adventure" and "our destiny," and reflected on the profound perspective gained from his time in orbit: "I felt…an appreciation for how small we are in the grand scheme of things. Who knows what we might find out there?"

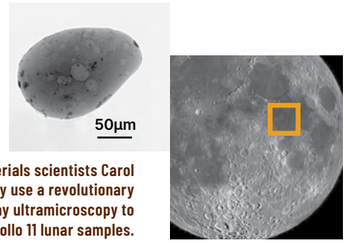
Isaacman also highlighted the importance of private-sector innovation in space. With multiple launch companies emerging, including SpaceX, Blue Origin, and Rocket Lab, he said competition drives progress and lowers costs, while NASA should pursue goals beyond the reach of private enterprise. "There has to be a space economy," he said, so that space exploration will go from "the select few to the many."

Before the event, Isaacman and Professor Terry Hart engaged a group of students in a private Q&A. The discussion explored astronaut training, risk management, and applications of AI in both aerospace and Isaacman's Shift4 payment platform.

2004
AFTER COLUMBIA
Professor Arnold Marder studies debris from the disaster, bringing shuttle failure analysis into the classroom.

2005
NASA GOES NANO
The Center for Advanced Materials and Nanotechnology supports research on nanoscale materials and devices, with ties to the James Webb Space Telescope (JWST).

2009
X-RAYING THE SEA OF TRANQUILITY
Commemorating the 40th anniversary of the Moon landing, materials scientists Carol and Christopher Kiely use a revolutionary technique called X-ray ultramicroscopy to analyze the original Apollo 11 lunar samples.



2021
A LANDMARK LAUNCH
Scott Willoughby '89 leads the Northrop Grumman team that designed and deployed the JWST.

get there. “The vehicle has to answer all three in order to move safely from point to point,” he says.

For their project, Fetzer’s students choose an aerospace vehicle—such as the Hubble Telescope—and from the perspective of guidance, navigation, and control, analyze and design how those systems work to enable its safe travel. “I want students to be able to appreciate that if they’re working with a GN&C engineer, this is what goes into the tasks they’re going to be doing,” he says.

Looking ahead, Fetzer sees abundant opportunities for collaboration across campus, in particular with MEM professor Nader Motee, who directs the Autonomous and Intelligent Robotics (AIR) Lab. Motee’s group conducts research into guidance, navigation, and control systems in aerial robots.

Fetzer’s students could team up with Motee’s to conduct research, and Motee’s research could inform his students’ projects. “It would be great to be able to give and take with labs like his across campus,” says Fetzer. “There are exciting real-world applications coming from those research projects that we could integrate into these courses.”

Schulz believes the research opportunities within the program could also serve as a pathway for students to launch new businesses and startups. “We absolutely have the caliber of students who have the capability, character, and enthusiasm to take on these types of challenges,” he says.

It’s a perspective grounded in experience. Students in the MS-AERO program are now recipients of the expertise and insight that come only from those working in an ever-changing technology landscape with never-ending deadlines. It’s a rare opportunity—for both students and instructors.

“As someone who has been in the industry for a long time, I feel a responsibility to pass on the lessons I’ve learned that helped further my own career,” says Schulz. “Our students want to develop areas within the aerospace industry that will, frankly, help us grow as a human race. It’s not easy working full time and teaching, but helping students achieve their goals makes it all worthwhile.”

RESEARCH UPDATE

ENGINEERING MATERIALS AND STRUCTURES FOR THE FUTURE OF FLIGHT

When propulsion systems fail, it’s often because structural materials reach their breaking point—cracking, deforming, or degrading under heat and stress. Extending those limits is central to the research of Natasha Vermaak, an associate professor of mechanical engineering and mechanics. Vermaak seeks to develop materials and structures capable of powering next-generation engines for satellites, orbital vehicles, and other high-demand space applications.

One of her current projects explores a particularly unforgiving environment: the rotating detonation engine (RDE). Unlike conventional engines, which rely on deflagration-based combustion, these engines sustain a continuous detonation wave traveling at thousands of meters per second. The design promises dramatic gains in efficiency and thrust, but it also exposes components to rapidly fluctuating thermal and mechanical loads. Although the RDE concept has advanced quickly, materials capable of withstanding these extreme conditions have not.

Vermaak leads a multi-institutional team—with researchers at Carnegie Mellon University; the University of California, Irvine; and the Air Force Research Laboratory; and industry partners—investigating structural materials systems engineered for this harsh regime. By combining experiments, high-fidelity simulations, and data-driven tools—including AI and machine learning—the team aims to understand how alloy composition and microstructure influence damage and failure under detonation-driven loading, ultimately guiding the design of materials that can keep pace with propulsion innovation.

“This is an exciting opportunity to identify breakthrough materials capabilities that may spur advancements in propulsion systems of the future,” she says.

> “BREAKTHROUGH MATERIALS MAY SPUR FUTURE PROPULSION ADVANCES.”
>
> —Natasha Vermaak

Another focus of Vermaak’s work is a collaboration supported by the Defense Advanced Research Projects Agency (DARPA), which addresses turbomachinery components in jet and rocket engines. The project challenges the long-standing “one part, one material” paradigm by exploring additively manufactured components in which material properties vary across a single part. Using bladed disks as a test case, the team, led by MIT, is developing AI-enabled design tools to optimize geometry, composition, and performance for each location, while considering material criticality.

Together, these projects illustrate a consistent theme in Vermaak’s research: questioning traditional assumptions about how aerospace materials and structures are designed, and expanding the range of conditions in which advanced propulsion systems can safely operate. By bridging mechanics, design, and materials science with computational and experimental tools, her work is helping to define the limits—and possibilities—for the future of flight.

TOP: VERMAAK LAB/AI GENERATED; RIGHT: NASA; TIMELINE PHOTOS: LEHIGH LIBRARIES SPECIAL COLLECTIONS, NASA; CHRISTA NEU

@iHartAerospace: AN ASTRONAUT’S VIEW

NASA astronaut. Fighter pilot. Engineer. Educator. Terry Hart has done it all. Now, he brings his decades of experience to **@iHartAerospace**, a short-video series on Instagram, TikTok, YouTube, and LinkedIn.

From piloting the Space Shuttle Challenger to leading engineering teams, teaching mechanical engineering, and working in the satellite-communications industry, Hart has navigated the inner workings of aerospace at every level.

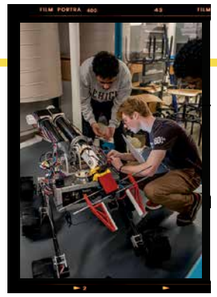
In the videos, he breaks down topics such as orbital mechanics and mission planning from a perspective shaped by both hands-on experience and leadership across technical and organizational challenges.

The series distills a lifetime of expertise into concise, engaging lessons, allowing anyone—from aspiring engineers to curious enthusiasts—to see aerospace through the eyes of someone who has truly lived it.

Scan to watch videos and follow @iHartAerospace on your favorite social media platform.

2023
LUSI MARKS MILESTONE

The Lehigh University Space Initiative enters its first custom-built Mars rover into the University Rover Challenge.



2024
SCIENCE IN MICROGRAVITY

An interdisciplinary team sends an NSF-funded experiment to the ISS to investigate thermophoresis, or particle movement, in the absence of gravity.

2026
FIRST GRADUATES TAKE FLIGHT

Lehigh awards its inaugural MS-AERO degrees.

TIMELINE RESEARCH BY MARY ELLEN ALU

For a deeper look at Lehigh’s aerospace milestones, check out the expanded timeline.

REMEMBERING GEOFFREY ANDREWS ’15

Geoffrey Andrews ’15, a Lehigh mechanical engineering alumnus and visiting lecturer, played a key role in developing the MS-AERO program and was known for his passion for aerospace engineering and teaching. He died in a June 2025 plane crash at age 30, a loss felt deeply across the Lehigh community. To read more about Andrews’ life and work and to support the student award established in his name, visit **engineering.lehigh.edu/ga-award**.

Defining the future of AI in healthcare

Computer scientist Lifang He envisions unified models that bring the reasoning of machine learning to clinical care

Lifang He, an associate professor of computer science and engineering (CSE), didn't set out to build clinical tools when she began working with machine learning models. But during her doctoral research, after applying tensor-based methods to neuroimaging data in collaboration with clinicians at Northwestern University and the University of Illinois Chicago, she saw those models sharpen diagnostic accuracy in ways that proved immediately consequential.

The experience redirected her trajectory, moving her from methodological innovation toward medicine, where computational insight could shape real-world decisions.

Lifang He (standing) leads the Medical AI Research (MAIR) Lab.

"I was very excited about that result, so I started to work in the medical field and try to bridge the gap between machine learning and medicine," He says.

Now at Lehigh, He focuses on developing artificial intelligence systems that can synthesize complex health data and translate patterns into clinically meaningful understanding. Her engagement with the broader AI and health research communities reflects that same translational focus.

She recently co-organized an event in the 2025 Spring Symposium Series sponsored by the Association for the Advancement of Artificial Intelligence with fellow CSE professor Mooi Choo Chuah and collaborators from Massachusetts General Hospital/Harvard Medical School and the Northwestern University Feinberg School of Medicine.

The AI for Health Symposium highlighted emerging directions in multimodal modeling, healthcare-AI partnerships, and federal priorities in AI-enabled medicine. She has also been invited to serve as area chair for this year's ACM SIGKDD Conference on Knowledge Discovery and Data Mining in Jeju, Korea, where she will lead the "AI for Healthcare" section under the new AI for Science track.

"It's the premier data science and AI conference," she says, "and the new track focuses on how AI can better serve science."

Within the regional professional community, He serves as Chair of the IEEE Computer Society for the Lehigh Valley section, working to strengthen connections among academia, industry, and the general public, while advocating for the responsible application of new computing advances.

Across these roles and activities runs a consistent research aim: building AI systems capable of processing varied data streams with the nuance of a medical professional.

"Our goal is to build AI systems that can reason about human health, the way clinicians or doctors do," He says.

Several proposed lines of research suggest how that goal could take shape. He and colleagues at Yale University and the University of Pennsylvania have conducted preliminary work toward multimodal AI systems that integrate neuroimaging, retinal imaging, and clinical data. A proposal building on that work is under review by the National Institutes of Health. The concept is to bridge artificial intelligence, clinical data, and translational medicine to better understand mechanisms underlying complex neurological diseases, with the long-term objective of improving early diagnosis and patient prognosis.

Central to the proposal is an eye-brain foundation model trained on expansive datasets that include retinal and brain images and clinical data—an approach motivated by evidence that the eye can serve as a window into the brain in neurological disease.

"A generalist model can uncover patterns and connections that reveal insights across many diseases," she says. "A key innovation is its ability to handle missing and irregular longitudinal data. In real clinical settings, patients often have only one type of scan available. So it will be able to make predictions from eye images only or from brain images only, or both if they're available."

The framework would combine broad-based AI methods with targeted architectures optimized for particular diseases or imaging modalities. Such systems would offer a flexible foundation for a variety of clinical applications, including early detection and the prediction of disease progression.

"It will be able to support many downstream tasks with minimal additional training," she says.

A separate collaboration with researchers at William & Mary and VCU Health outlines a complementary direction: integrating wearable sensors and mobile technologies to monitor and predict motor symptoms in Parkinson's disease. That proposal envisions translating advanced foundation models into lightweight, real-time systems that could operate directly on smartphones, enabling continuous monitoring and more personalized care in everyday clinical settings.

For He, merging high-level versatility with the precision needed for specific medical diagnoses isn't just a coding challenge—it's the most promising route toward more responsive, patient-centered care.

"I'm excited now about the possibility of unifying the generalist and specialist models so we can meaningfully improve outcomes for patients."

CHRISTA NEU

LEHIGH UNIVERSITY

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A HOME FOR FYRE

A $10 million gift will establish the Jackson Laboratory to support the hands-on projects that define First Year Rossin Engineering.

See page 1