MOMENTUM

Department of Mechanical and Aerospace Engineering Newsletter Fall 2024

Cullen College of Engineering
UNIVERSITY OF **HOUSTON**

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UHCullenCollege University of Houston Cullen College of Engineering

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Letter from the Chair

Dear Colleagues,

Greetings from Houston! I am pleased to announce that our department has officially adopted a new name: **The Department of Mechanical and Aerospace Engineering**. This change reflects our growing focus on aerospace and highlights our commitment to advancing mechanical and aerospace engineering research and education. A new NASA Center **Inflatable Deployable Environments and Adaptive Space Systems (IDEAS²)** has been established within our department to drive innovation in aerospace technologies. IDEAS² will serve as a hub for research and education in advanced materials, structures, and systems for space exploration. At the same time, the department is growing with the addition of new faculty and the expansion of its research enterprise with newly funded research projects on energy, manufacturing, mechanics, and autonomous systems. National recognitions, such as the **Cozzarelli Prize** awarded to Dr. Pradeep Sharma for his groundbreaking paper on musical perception and the **ASME Materials Division Centennial Mid-Career Award** awarded to Dr. Yashashree Kulkarni for her pioneering work at the interface of materials and mechanics, demonstrate the outstanding caliber of our faculty.

Karolos Grigoriadis, Ph.D.
Hugh Roy and Lillie Cranz Cullen Endowed Professor & Department Chair
Director, Aerospace Engineering Graduate Program
Cullen College of Engineering
University of Houston

UH MECHANICAL & AEROSPACE ENGINEERING

BY THE NUMBERS

FACULTY

4 National Academy of Engineering Members

4 National Academy of Inventor Fellows

4 National Academy of Inventor Senior Members

Enrollment

1060 Undergraduate Students

268 Graduate Students

DEGREES AWARDED

184 B.S.

53 M.S.

31 PH.D

THE MAE DEPARTMENT WELCOMES 3 NEW FACULTY FOR THE 2024-25 ACADEMIC YEAR

Maksud Rahman comes to UH from Rice University as an assistant professor. He earned his doctorate in Fiber Science from Cornell University. Rahman's academic interests lie in interdisciplinary materials science research, using an engineering and biology perspective to design and fabricate 'Nature-inspired-Structures'.

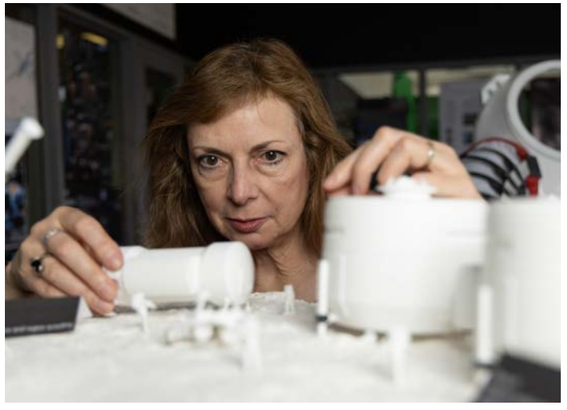
Jingyi Luan comes to UH from Harvard University. She becomes a member of the Cullen College of Engineering as an assistant professor in the mechanical and aerospace engineering department. Her expertise lies in biomaterials and nanomaterials for bio-sensing and bio-imaging, next-generation molecular diagnostics, point-of-care and wearable sensors.

Kelly Yi-Chun Huang joined the Cullen College of Engineering on January 1, 2024, as an assistant professor in the mechanical and aerospace engineering department. Huang's research focuses on investigations of the turbulent processes that drive the atmospheric surface layer and the development of novel and high-resolution sensing techniques.

THE NEW MECHANICAL AND AEROSPACE ENGINEERING DEPARTMENT:

A YEAR IN THE LIFE OF CHAIR KAROLOS GRIGORIADIS

By Alex Keimig



Hugh Roy and Lillie Cranz Cullen endowed Professor of Mechanical Engineering and Mechanical and Aerospace Engineering Department Chair **Karolos Grigoriadis** has had quite the year.

After nearly three decades as a faculty member of Cullen College's Mechanical Engineering department, he was named as the new Department Chair earlier this year, succeeding Hugh Roy and Lillie Cranz Cullen Distinguished University Professor **Pradeep Sharma** upon Sharma's own naming as the new dean of the Cullen College.

"I am honored to be named chair and appreciate the support of the department and my colleagues," said Grigoriadis. "It's certainly a significant change in responsibilities for me. I've been in this department for close to 30 years now, focusing on research and teaching; this new position has a significantly different and expanded role in terms of promoting the department, ensuring that the day-to-day operations are progressing well, and putting in place a vision for expanding the department in terms of its mission."

According to Grigoriadis, the transition of the Mechanical Engineering Department to the Mechanical and Aerospace Engineering Department – another recent and significant change – is "long overdue."

"As 'Space City', Houston is entitled to an aerospace engineering program at its university," he continued. "The new program will respond to the rapidly growing local, regional, and national need for a highly skilled aerospace workforce and advances in aerospace technologies. Currently, our department offers graduate degrees in aerospace engineering and space architecture. We plan to proceed with the introduction of an undergraduate degree in aerospace engineering and a graduate degree in space engineering. This expansion of our educational and research programs is a necessary step to ensure we stay in tune ››

THE FUTURE OF AEROSPACE IN SPACE CITY: IDEAS2 ABOUND

These initiatives aren't just commercial. In 2017, NASA officially launched the Artemis program, the goals of which include returning humans to the Moon for the first time since 1972 and establishing a permanent base there to facilitate later human missions to Mars. These goals make the industry's needs clear: in order to get to and exist in outer space, we need confident experts at getting to and existing in outer space. Grigoriadis calls this "the workforce that space technology needs for the future": educated and experienced professionals who can produce, operate, repair, and continually improve upon the technology that allows humans to occupy the hostile conditions beyond our atmosphere.

This is just one role of a new NASA-funded research center that opened at UH this fall: The NASA Center for Inflatable Deployable Environmental Adaptive Space Systems, or IDEAS2. With NASA's $5 million grant funding, researchers at the center will conduct cutting-edge research on expandable, modular, and reconfigurable structures needed to develop space infrastructure in lunar orbit and on the surface of the Moon.

In addition to Texas A&M University, Stanford University, Houston Community College and San Jacinto College, the UH-based center will collaborate with industrial partners Boeing, Axiom Space, Bastion Technologies and Lockheed Martin. A total of fourteen faculty members representing each of the constituent academic institutions will be participating in IDEAS2, with nine of them from the University of Houston.

"I expect that this will be a great collaborative effort, and that working on these technologies will progress the infrastructure needed for these space missions," said Grigoriadis. "The Center's main focus is to innovate the development of infrastructure and technologies that are necessary to support space exploration goals for long-term human presence on the Moon and subsequent missions to Mars. Our vision is to become a premier national innovation hub that propels NASA-centric, state-of-the-art research and promotes 21st-century aerospace education."

"This research will support NASA's space exploration goals and simultaneously provide expanded opportunities to educate students to meet the growing needs of our aerospace engineering workforce," he added.

"The state-of-the-art research and technology that will be developed at this center will build the infrastructure that is needed for our sustainable presence on the moon, and eventually Mars. This will involve deployable, expandable, modular adaptive structures for habitats, communication arrays, solar panels, antennas, large telescopes, heat shields... There is a whole array of infrastructure needs for this purpose. Our objective is to produce innovative architectural design, deployment, assembly adaptation, structural integrity analysis, health monitoring, and other technologies that are needed for these assets."

ON THE HORIZON

In addition to investigating and testing invaluable technological work, the IDEAS2 Center will be developing something even more crucial: human capital.

Grigoriadis is confident not only that the undergraduate and graduate students assisting with research at the center will be equipped with the necessary skills to lead Houston and the world into the new space economy, but that their outreach for K-12 students will inspire an entire generation of aerospace engineers and lifelong STEM enthusiasts.

"The educational component of this center will span a broad range of activities, starting with STEM engagement programs for K-12 students. We want to inspire their interest in science, technology and especially space. This is how we will build the workforce that aerospace technology needs for the future," Grigoriadis affirms.

"Innovation is boosting the boundaries – building upon prior knowledge, but pushing that knowledge and progressing technology and research to expand into areas wherein there is a real need to provide new tools, methods, algorithms, and technology. These efforts are consistent not only with our goals in aerospace overall, but for the college's Mechanical and Aerospace Engineering department as well: to respond to this need from the perspectives of technology, research, workforce, education, and innovation.

MAE'S CESCON EARNS CAREER AWARD FOR AUTOMATIC CONTROL WORK

By Stephen Greenwell

For **Marzia Cescon**, the David C. Zimmerman Assistant Professor of Mechanical and Aerospace Engineering, the news in January that she had earned funding for her National Science Foundation (NSF) CAREER proposal came as a welcome surprise.

“I had forgotten about it,” she said, laughing, attributing this to a combination of the weather and the time of the year.

“I was informed of the award on a Thursday morning in January. The semester had just started that week and we were coming off a few days of below freezing temperatures, which are always challenging to handle in Houston. Safe to say, at that time, the NSF career was a remote thought. Receiving the notice of award, then, came really as a surprise, and a good wish for the New Year! I felt grateful for my mentors, past and current collaborators and, most importantly, my students.”

Cescon's proposal is “Data-Enabled Neural Multi-Step Predictive Control (DeMuSPc): a Learning-Based Predictive and Adaptive Control Approach for Complex Nonlinear Systems.” The award amount is $655,248. She described her field of expertise as automatic control – technology that controls processes in order to achieve desired behaviors.

“We observe, and with the tools that we develop, we mathematically describe various phenomena occurring in nature and in our environment, and we use this knowledge to act upon and control these phenomena,” she said. “Automatic control is ubiquitous in our homes, cars and infrastructure. It is the quintessential multidisciplinary field, addressing seemingly unrelated problems with a unified theory.”

As examples of practical applications of this knowledge, Cescon pointed to the autopilot function of a Boeing 747, which follows a predetermined trajectory while adjusting to wind and currents. A biological form of automatic control is in the human body, such as temperature control based on workload or light control by a retina.

“My research is then concerned with the design of methods and tools to make a system behave in a desired way, while adapting to changing conditions and context, and ensuring safety at the same time,” she said. “We achieve that by harnessing data collected with available sensors from the system and its environment to enhance the traditional feedback control loop rooted in model-based design with learning enabled components. We apply the tools that we develop to the automated glucose regulation in people with type 1 diabetes and to the safe and assured autonomous operation of vehicles such as satellites and quadrotors drones.”

Cescon's interest in automatic control started while earning her B.Sc. in Information Engineering from the University of Padova in Italy.

“It was the third year of college and I remember noticing a poster in the hallway advertising the master’s program in Control Engineering,” she said. “At that time, I knew nothing about the field, however from the poster it looked enough intriguing and esoteric. I decided to send my application in for the program to explore this field and got hooked.”

Cescon earned her M.Sc. in Control Engineering from Padova, followed by her doctorate in Automatic Control from Lund University in Sweden. She credited her advisors there, along with support from her peers at UH and the hard work of her students, as direct reasons for her current success.

“There’s quite a long list of people who have had significant and positive influence on my academic path, over the years. In this regard, a statement of Isaac Newton comes to mind: 'If I have seen further it is by standing on the shoulders of Giants,'” she said. “In particular, at UH, I appreciate the unwavering support and enthusiasm of Dr. Karolos Grigoriadis, chairman of the Department of Mechanical & Aerospace Engineering, and the encouragement of the faculty members of the Intelligent and Autonomous Systems group.”

A MINIMAL PHYSICS-BASED MODEL FOR MUSICAL PERCEPTION

Pradeep Sharma Wins Cozzarelli Prize

By Laurie Fickman

When **Pradeep Sharma**, Hugh Roy and Lillie Cranz Cullen Distinguished University Professor of Mechanical Engineering and dean of the Cullen College of Engineering, won the Proceedings of the National Academy of Sciences (PNAS) 2023 Cozzarelli Prize, it was music to his ears on different octaves. First, his paper is the only winner in the Engineering and Applied Sciences category chosen from more than 3000 research articles that appeared last year in PNAS. Another key for Sharma's concerto of cheer is because the paper examines the complex phenomenon of musical perception and begins to answer the incredibly complex question, 'Why do some people hear music better than others?'

There is no treble in seeing the full expression of originality in Sharma's article, "A minimal physics-based model for musical perception," in which he examines why some people, entirely untrained in music, can listen to a song and replicate it on a piano with unnerving accuracy. What enables some to "hear" music so much better than others?

"Variation in the physical properties of the auditory system, such as the hair cells of the internal ear, may partially account for differences in people's ability to perceive musical tones," reports Sharma in the article.

Sharma and team developed a physics-based model of the mechanics of the hair cells of the inner ear to understand how it perceives multiple tones and its ability to clearly distinguish between two pitches.

"The physics-based model explains how the geometry and electromechanical properties of hair cells may influence musical perception. The model also explores the impact of factors external to the auditory system, including medications such as ibuprofen," Sharma notes.

> "VARIATION IN THE PHYSICAL PROPERTIES OF THE AUDITORY SYSTEM, SUCH AS THE HAIR CELLS OF THE INTERNAL EAR, MAY PARTIALLY ACCOUNT FOR DIFFERENCES IN PEOPLE'S ABILITY TO PERCEIVE MUSICAL TONES,"
>
> - DEAN OF THE CULLEN COLLEGE OF ENGINEERING PRADEEP SHARMA

'SUPER COOL CONDUCTOR' PROJECT WINS $2 MILLION IN DOE FUNDING

University of Houston Transitioning Energy Innovations Into the Real World

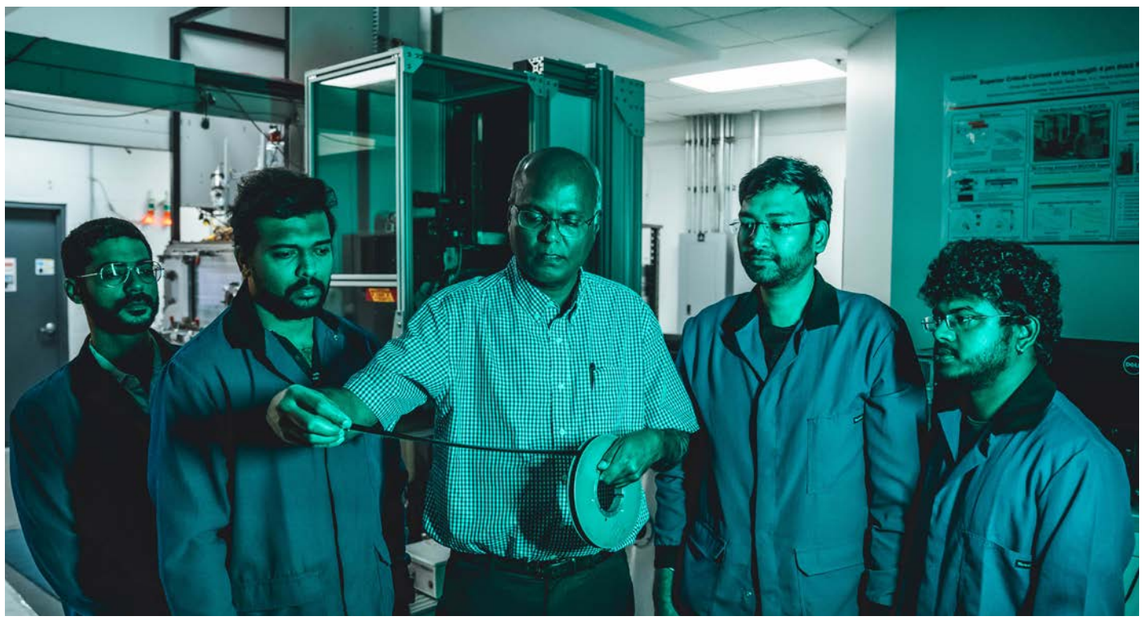
By Rashda Khan

The U.S. Department of Energy recently announced a $10 million investment in three projects to develop novel technologies to manufacture high-performance superconducting tapes in the United States. Two of the projects are built on the foundations of cutting-edge research from the University of Houston.

The DOE values superconductivity because it means zero wasted electricity. Superconductivity, found only in certain materials, allows direct electric current to be conducted with zero resistance and without energy loss. Widely available low cost, high-temperature superconducting (HTS) tapes are used for a broad range of clean energy applications that move the country closer to a net-zero future, including in transmission cables, the grid, electric-based motors and generators, nuclear fusion reactors, electric aviation and more. However, demand for HTS tapes is outstripping supply, the cost is high, and the bulk of the manufacturing is occurring outside the U.S.

The funding, through the DOE's Advanced Research Projects Agency-Energy's (ARPA-E) Novel Superconducting Technologies for Conductors Exploratory Topic, will help boost different types of superconductive technologies.

UH's **Selva Research Group** received $2 million for a three-year project, titled "Low-Cost, High-Rate Fabrication of High-Performance, Uniform, Long REBCO Conductors." Their work focuses on scaling up the manufacture of the team's high-temperature superconductor tape to implement the technology for clean energy applications. The project will scale up the advanced metal organic chemical vapor deposition (MOCVD) process developed by the team and address key metrics such as speed and cost of production, and uniformity of tape performance.



Venkat Selvamanickam, head of the Selva Research Group at the University of Houston, is globally renowned for his work with superconductor tapes.

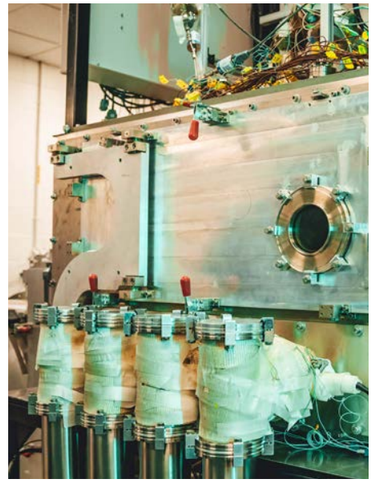
Venkat Selvamanickam, M.D. Anderson Chair Professor of Mechanical and Aerospace Engineering and director of the Advanced Manufacturing Institute, is recognized globally for his research to develop better manufacturing technologies for thin film superconductor tape. His team was the first to manufacture the thin film superconductor tape, which was used in 2008 to power 25,000 households in Albany, N.Y., and now is used by more than 200 institutions worldwide.

The Selva Group has demonstrated its HTS tape's electric current-carrying-performance is three times better than the tapes available on the market. His research group works with many partners to use its HTS tape to make small-scale prototypes of magnets, coils and cables to incorporate in several applications. Now, the team is focusing its attention to make the manufacturing process for its tape more efficient and consistent.

"Even though our superconducting tape is three times better than today's industry products, for us to be able to take it to full-scale commercialization, we need to produce it faster and at a lower cost while maintaining its high quality," Selvamanickam said. "This funding is to address this challenge and it's an important step forward towards commercialization of our technology."

UH Vice President for Energy and Innovation **Ramanan Krishnamoorti** is proud of the work happening at UH, a Carnegie-designated Tier One Research University.

"These awards recognize the relevance and quality of the research at UH and our commitment to making a meaningful impact by addressing society's needs and challenges by transitioning innovations out of research labs and into the real world," Krishnamoorti said.



Conductivity-enhanced wires can lower costs and improve grid performance — including resilience against extreme weather events.

> "THESE AWARDS RECOGNIZE THE RELEVANCE AND QUALITY OF THE RESEARCH AT UH AND OUR COMMITMENT TO MAKING A MEANINGFUL IMPACT BY ADDRESSING SOCIETY'S NEEDS AND CHALLENGES BY TRANSITIONING INNOVATINS OUT OF RESEARCH LABS AND INTO THE REAL WORLD."
>
> - RAMANAN KRISHNAMOORTI

High-performance superconductor tapes can maximize next-generation energy storage technologies and support electrification for energy-intensive sectors leading to a clean energy economy.

AUTONOMOUS ROBOT FOR SUBSEA OIL AND GAS PIPELINE INSPECTION

By Chris Stipes

With an increasing number of severe accidents in the global oil and gas industry caused by damaged pipelines, University of Houston researchers are developing an autonomous robot to identify potential pipeline leaks and structural failures during subsea inspections. The transformative technology will make the inspection process far safer and more cost effective, while also protecting subsea environments from disaster.

Thousands of oil spills occur in U.S. waters each year for a variety of reasons. While most are small, spilled crude oil can still cause damage to sensitive areas such as beaches, mangroves and wetlands. When larger spills happen, pipelines are often the culprit. From 1964 through 2015, a total of 514 offshore pipeline–related oil spills were recorded, 20 of which incurred spill volumes of more than 1,000 barrels, according to the Bureau of Ocean Energy Management.

The timely inspection of subsea infrastructure, especially pipelines and offshore wells, is the key to preventing such disasters. However, current inspection techniques often require a well-trained human diver and substantial time and money. The challenges are exacerbated if the inspection target is deep underwater.

The SmartTouch technology now in development at UH consists of Remote Operated Vehicles (ROVs) equipped with multiple stress wave-based smart touch sensors, video cameras and scanning sonars that can swim along a subsea pipeline to inspect flange bolts – bolted connections have accelerated the rate of pipeline accidents that result in leakage, according to the Bureau of Safety and Environmental Enforcement (BSEE).

The BSEE is funding the project with a $960,493 grant to UH researchers **Zheng Chen,** Bill D. Cook Assistant Professor of Mechanical and Aerospace Engineering and **Gangbing Song,** John and Rebecca Moores Professor of Mechanical and Aerospace Engineering, who are working in collaboration with Oceaneering International and Chevron.

"By automating the inspection process with this state-of-the art robotic technology, we can dramatically reduce the cost and risk of these important subsea inspections which will lead to safer operations of offshore oil and gas pipelines as less intervention from human divers will be needed," said Chen, noting that a prototype of the ROV has been tested in his lab and in Galveston Bay. The experiments demonstrated the feasibility of the proposed approach for inspecting the looseness of subsea bolted connections. Preliminary studies were funded by UH's Subsea Systems Institute.

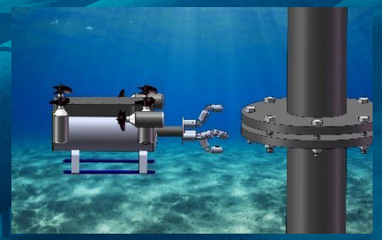
Oil and gas pipelines fail for a variety of reasons including equipment malfunctions, corrosion, weather and other natural causes, or vessel-related accidents which account for most large leaks. Toxic and corrosive fluids leaked from a damaged pipe can lead to devastating environmental pollution.

"Corrosion is responsible for most small leaks, but the impacts can still be devastating to the environment. Therefore, our technology will be highly accurate in monitoring corrosion and will also help mitigate the chances of pipeline failure from other factors," said co-principal investigator Gangbing Song, who has conducted significant research in piezoelectric-based structural health monwitoring. His prior research efforts include numerous damage detection applications, such as crack detection, hydration monitoring, debonding and other structural anomalies.

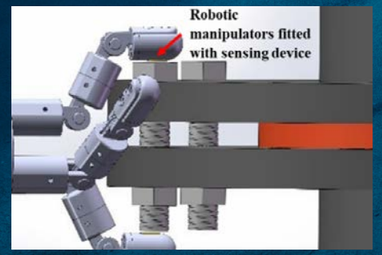
The UH researchers are collaborating with Oceaneering International, an industrial leader in ROV development, non-destructive testing and inspections, engineering and project management, and surveying and mapping services. Additionally, Chevron, a major oil and gas operator, will evaluate the technology's future commercialization.

The SmartTouch sensing solution will open the doors for inspection of other kinds of subsea structures, according to the researchers, by forming a design template for future robotic technologies.

"Ultimately, the project will push the boundaries of what can be accomplished by integrating robotics and structural health monitoring technologies. With proper implementation, the rate of subsea pipeline failure and related accidents will decrease, and subsea operations will be free to expand at faster rate than before," added Chen.



Rendering of the SmartTouch technology now in development.



Robotic manipulators fitted with sensing device.

Gangbing Song

Zheng Chen

NEW RESEARCH

XU PART OF $2M RESEARCH INTO IRON, STEEL PRODUCTION DECARBONIZATION

By Stephen Greenwell

A professor at the Cullen College of Engineering is part of a multi-million dollar research effort led by the University of Nevada that aims to decarbonize domestic iron and steel production. **Ben Xu**, an assistant professor in the Mechanical and Aerospace Engineering Department, is co-PI on the research project "Fast Electrowinning via Rotors for Responsible Iron Creation (FERRIC)." The total project value is $2.1 million from Department of Energy (DOE) Advanced Research Projects Agency–Energy (ARPA-E), with $300,000 earmarked for Xu's work.

The overall goal of the research is to innovate "a unique, clean energy solution to replace blast furnace technology, a centuries-old steel production method that has long powered one of the world's dirtiest industries," according to a press release from UNLV. Over the next three years, the team aims to "scale up and compete" with the industry-standard blast furnace method by using a room-temperature approach in an aqueous system for iron production — a huge departure from the high-temperature environment of the blast furnace method.

Xu noted that his team would be providing two areas of research for the project.

"My team at UH will perform computational fluid dynamics (CFD) study and integrated multiphysics simulations to design the proposed impeller-accelerated reactor, a key component of the low temperature electrowinning system that will be crucial for scale-up," he said. "Once the design is finalized, my team will assist the 3D printing of optimized impeller and the assembly of the lab-scale testing system."

Xu and his team will be employing computer algorithms to help find near-optimal hydrofoil impeller design.

"The multiphysics (hydro-thermo-mechanical) simulation will be performed in the interstitial domain to find hydrofoil designs that maximize a figure of merit involving boundary layer thickness, bubble growth rate and size, and drag reduction," he said. "Using this hydrofoil cross-section, our UH team will then apply a new surrogate model for the top-down impeller blade geometry (e.g., number of blades, blade length, blade thickness, blade curvature, etc.). An optimal top-down geometry will be found, marking the first design iteration of a full impeller blade."

Jeremy Cho is the lead researcher for the proejct and a mechanical engineering professor at UNLV. The collaboration with researchers at UNLV came about thanks to networking and sharing academic research between universities and departments.
Xu identified several students from his research team as being involved in this research.

"My postdoctoral fellow Dr. Santosh Rauniyar and Ph.D. student Shuqi Zhou will be in the team to perform the research," he said. "In particular, Dr. Rauniyar will be in charge of the optimization and 3D printing, and Shuqi will conduct the multiphysics CFD simulations."

INNOVATION TO OVERCOME DEFICIENCIES IN 3D PRINTING

By Laurie Fickman

The metal 3D printing machine in the UH lab of Professor Venkat Selvamanickam

The University of Houston is collaborating with Texas A&M University to tackle the challenge hindering the use of Additive Manufacturing (AM), commonly known as 3D printing, for a variety of commercial applications – the need for real-time monitoring and analysis to ensure consistent quality and reproducibility throughout the production process.

At present, quality control and qualification of metal AM parts is mostly carried out through offline inspection and characterization, but ideally, a broad range of sub-surface and bulk microstructural features should be evaluated in real-time, at the speed of fabrication in an AM tool.

"The objective of our project is to accomplish this goal by the development of real-time, comprehensive, in-situ sub-surface and bulk structural analysis of AM parts during fabrication, and integration with multi-modal data from various in-situ sensors, that can bridge the critical knowledge gap between process conditions and properties," said **Venkat Selvamanickam**, M.D. Anderson Professor of Mechanical and Aerospace Engineering at UH, who is leading the project through the UH Advanced Manufacturing Institute (AMI), which he created. The project is supported by a $957,849 grant from NIST The National Institute of Standards and Technology.

Preliminary study has confirmed that sample-to-sample differences due to varying AM process conditions are identifiable via two-dimensional X-ray diffraction (2D-XRD).

"We will design, construct and install a custom in-line 2D-XRD in the hybrid Directed Energy Deposition tool in AMI facilities at University of Houston. This tool offers a robust platform that includes features such as multi-material deposition (for spot-alloying and functional grading) and several in-situ sensors for process monitoring," Selvamanickam said.

Since its formation in 2018, AMI, a University-wide center, serves as a pivotal hub for advancing the scale-up and commercialization of technologies developed by UH faculty, facilitating the transition from idea to manufacturing and eventual market deployment. The project on additive manufacturing follows a successful track record of AMI in scaling up superconductor manufacturing technologies for industrial applications.

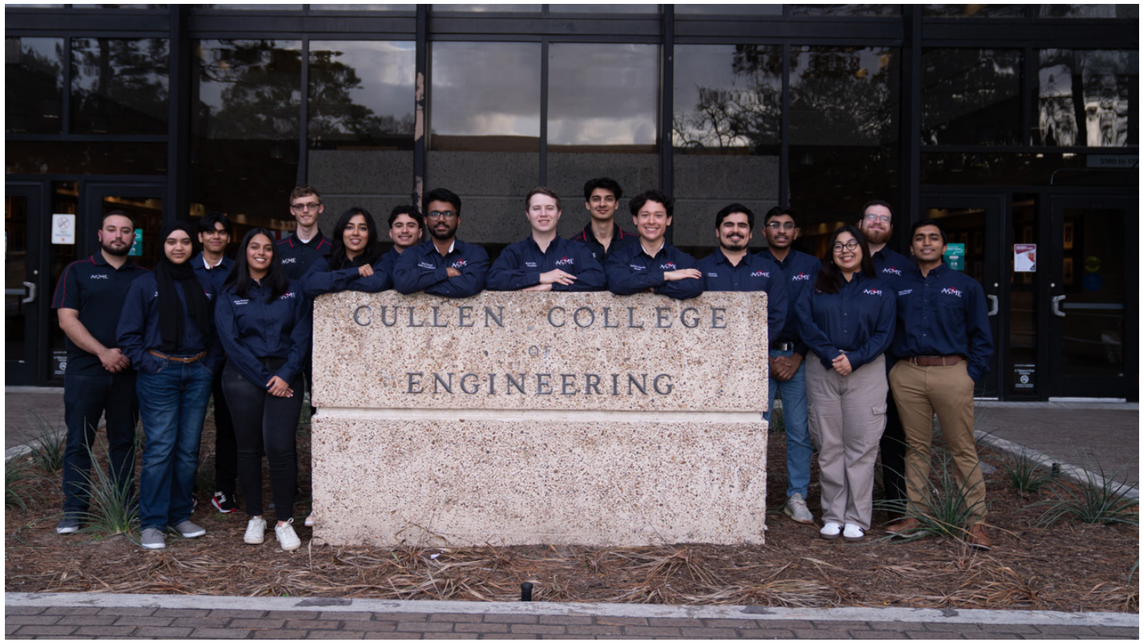
Ying Lin, associate professor of industrial engineering and Goran Majkic, research professor of mechanical and aerospace engineering at UH join Selvamanickam on the research team. At Texas A&M University, Ali Erdemir, professor of mechanical and aerospace engineering and Halliburton Chair, will coordinate the program and the Texas A&M team includes Mathew Kuttolamadom, associate professor of engineering technology and industrial distribution.

To be sure, AM is revolutionizing the way metal structures are fabricated for many applications in aerospace, automotive, energy, medical and other industries. But widespread use of is contingent on meeting the stringent requirements of quality and repeatability of parts made by this process.

"Such an achievement will tremendously expand the use of metal additive manufacturing in many applications," Selvamanickam said.

ASME STUDENT CHAPTER AWARD

By Alex Keimig



The American Society of Mechanical Engineers (ASME) at the University of Houston has been awarded the ASME Student Section Achievement Award for 2023-2024.

ASME-UH is "a professional student organization that aims to lead engineering students to success in all aspects of the engineering disciplines," with "conscious intention to promote diversity, equity, and inclusion in all... programs, events, member outreach, learning and development opportunities, scholarships, and communications."

Most ASME-UH members are mechanical engineering students, but the organization is not major-or college-specific, and it welcomes students from any field of study who may be interested in learning more about mechanical engineering or the related tools and resources available.

"We continue to be impressed by your commitment, new ideas, and collaboration with other student leaders," said ASME Student Section Engagement Coordinator **Janice Parker**.

According to former president Kevin Jandal, who began his freshman year as a mechanical engineering student at the Cullen College of Engineering in 2020, the award represents not only the organization's success in the 2023-24 academic year, but their growth and re-development post-COVID.

"I really wanted to focus on [reconnecting] ASME-UH to the larger national ASME. We weren't interacting to take full advantage of all of the resources available to us, so one of my first initiatives was to make sure that student ASME-UH members got all of the full benefits of becoming national members," Jandal said.

His goal of reinvigorating academic and professional development resources for students helped jumpstart multiple new initiatives, including study nights for specific courses as well as MATLAB and technical writing refresher tutorials, connections to national scholarships, mentorship programs, new networking opportunities, and the ASME Lab.

Located in the ASME lounge, this lab features six 3D printers, hand tools, and materials intended "to provide students all the resources they need, whether for classes or for personal projects."

"Our lab committee operates [the facility] nearly 24/7, providing students with rapid prototyping and 3D printing for any project they have," said Jandal. "The way ASME-UH has built and operates this lab is something that hasn't been done before by any student organization and supplements all departments of engineering."

"As an aspiring leader, I'm looking forward to seeing what more I may be able to do for our organization given how Kevin has left it," said 2024-25 ASME-UH president and mechanical engineering student **Bryan Haro**. "We won this one award this time, but we want to see if we can continue to level up and set a new foundation. Mechanical engineering is one of the largest majors in the college, and I think we have a vast number of ways to continue to grow and provide our fellow students with professional and academic skills."

The continued cooperation between Haro and Jandal is no accident.

"Kevin's leadership actually inspired me to run for president," Haro said.

Jandal, having seen the difficulty that disconnected officer cohorts can cause for student organizations that are looking to grow and thrive rather than just continue existing, was determined to ensure that a proper hand-off took place for ASME-UH.

"Here in my last semester, I really want to make sure I'm present for the new leadership and able to server as an advisor," he said.

This year Haro looks forward to continuing to support ASME-UH's academic and professional development initiatives, their K-12 STEM interest and education outreach program, and the organization's student mentorship program, which matches student mentors and mentees according to their individual strengths and goals for the academic year.

FOUR UH MEA STUDENTS EARN SUMMER INTERNSHIPS AT AFRL

By Alex Keimig

Left to right] Nicholas Tijerina, Arturo de la Barcena, Britney Rogers and Paul Novoa.

Four students from the Mechanical and Aerospace Engineering Department at the University of Houston's Cullen College of Engineering have earned prestigious internships from the Air Force Research Laboratory.

With a staff of roughly 4,200 civilian and 1,200 military employees, the AFRL is the scientific research and development lab for the U.S. Air Force, with a multi-billion dollar yearly budget. The four students are **Britney Rogers**, **Paul Novoa**, **Arturo de la Barcena** and **Nicholas Tijerina**.

We asked all four students to provide us with a short statement about earning this honor, which can be read below. >>

"For the AFRL internship, it has been a very crucial stepping-stone in my career that pushed me to think beyond just academic applications. It has given me a tangible relationship and a sense of purpose to know my work contributes to the advancement and understanding of control systems in the aerospace industry. It has fueled my passion even more and would like to thank Dr. Karolos Grigoriadis, my graduate mentor, and Dr. Edwin Forster, my AFRL mentor, for this amazing opportunity to work as an ARCTOS employee in Dayton OH via the Air Force Research Laboratory (AFRL) Minority Leaders – Research Collaboration Program (ML-RCP)." — Nicholas Tijerina.

"I feel honored to have been recognized by so many talented people, both my professors and my colleagues at the AFRL, and grateful for all of the opportunities that the Minority Leaders - Research Collaboration Program (ML-RCP) has offered me. Before I took this same internship last summer, I didn't really consider going to graduate school. But now that I have been exposed to so much awesome research work, I couldn't imagine myself anywhere else." — Arturo de la Barcena.

"I really appreciate the opportunity to come all the way to WPAFB to work with the AFRL. Last summer's research I worked on opened the door to my thesis topic of the comparison of different modern controllers with safety assurance techniques for comparison for spacecraft maneuvers, which I am in the final stages of currently. This year's topic has proven to be just as interesting to me and I am happy for the ability to do research once again with the same section. It's a real blessing." — Britney Rogers.

"I am very happy to have been sent up to Wright-Patterson Air Force Base to work at AFRL for the summer. I have been learning a ton and have developed a strong interest in aerospace engineering while living in the city where it all started with the Wright brothers. We have formed a good group of interns here and, so far, it has been really fun. In addition, AFRL is taking me to Las Vegas for the AIAA AVIATION Conference, which I am very excited about." — Paul Novoa.

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>
> -BRITNEY ROGERS

UH MAE ALUM

PARLAYS DOCTORATE INTO WORK AT BOEING

By Stephen Greenwell

For **Theophilus Kaaya**, a proud University of Houston alumnus, his connection to his family was an important consideration when it came to initially picking a college, especially since he would be acclimating to the United States from Uganda.

“I came as an international student, and my first two siblings came before me. They went to Texas Southern University,” he said. “I was interested in mechanical engineering or something else involving engineering. It had to be engineering, which TSU didn't have at that point.”

It was a combination of the programs offered and the proximity to his family that combined to make UH an attractive school for his undergraduate degree.

“UH had my major, mechanical engineering, and it was close to TSU, where my siblings had gone before,” he said. “Compared to other universities in the Houston area, it was also more affordable.”

Kaaya earned his doctorate from UH in 2023, and he is now a propulsion engineer at Boeing. Throughout his educational journey, Kaaya said he has relied on his family, community, and God for support.

“Family bond is important. We're raised to grow together as a family and to work things out together as family, so that has helped a lot in my journey,” he said. “They have been there in my down moments when I'm feeling low, and they've been there in my high moments. That has helped temper and handle any challenges that I've faced throughout my academic wjourney. It's important, and I treasure it very much.”

Once he was enrolled at UH, Kaaya said that the staff at Learning Support Services (LSS) — now known as LAUNCH — were vital to his success. He later worked as a tutor for LSS for majority of his undergraduate as well.

“Down there we had **Dr. Laura Heidel**, and Mr. **Kenneth Williams**, they were my supervisors,” he said. “They equipped us with all the resources we needed to be successful, not only as tutors, but also as students. They made the learning process and stay at school memorable and enjoyable. Every time I finished my work, I had to go down to the tutoring center and help students. I love teaching and tutoring, and that helped me build my social, negotiation and teaching skills.”

As part of his studies, Kaaya had to take history courses, which he noted with a laugh that he initially wasn’t looking forward to. But now, he recognizes their importance.

“I didn’t like history that much at first. The fact that I had come to college, and they told me I had to do history, again, I was thinking of going back,” he said, laughing. “My sister told me to think of the big picture. What do you actually want? And that helped me put things in perspective. History was just two semesters, and that would be it, but eventually, when I attended the classes, I started enjoying history. And to this day, I can see how history does actually affect and informs engineering. We may not think of it that much, but it actually plays a vital role, even when you’re solving problems.”

Kaaya earned his mechanical engineering degree from Cullen, but elected to continue at the college, earning his master's degree and doctorate as well. The financial aid offered by the school and the strides in improving the research environment were key in his decision. The university achieved Tier One status in 2011, which was reconfirmed in 2016.

“They did offer some scholarships that I took opportunity of for my Bachelor's level, and they also offered me a scholarship for my master's degree. That allowed me to come back and do the first year of my master's before I switched to the Ph.D.,” he said. “The Ph.D. offered the Graduate Tuition Fund and departmental scholarships that helped cover most of the tuition, and it also allowed me to get a monthly stipend that covered my expenses for my day-to-day living.”

When asked if he had advice for current students, Kaaya stressed the importance of reaching out to others for support.

“There is no need to fear faculty and staff. They are there to help us succeed,” he said. “Make friends and make the memories count. This is one of the best times you will have in your academic journey. Be resilient, determined, and focused on your goals. It is easy to get distracted, but having accountability buddies and remembering the reason you are going to school will keep you on track. Use as many opportunities available as possible. You never know what might come of them.”

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>
> -THEOPHILU KAAYA

Chris Slaton [right], a Mechanical Engineering student at the Cullen College of Engineering, completed the Mickey Leland Energy Program fellowship this summer with the U.S. Department of Energy and Office of Fossil Energy and Carbon Management.

SLATON COMPLETES MICKEY LELAND FELLOWSHIP

By Stephen Greenwell

In 2021, the United States and 18 other global nations made the pledge to pursue a goal of net-zero carbon emissions by 2050 via launching the Net Zero Government Initiative. It's a lofty goal and that will require dedicated minds from countless areas of special study to become a reality.

Mechanical Engineering senior **Chris Slaton's** work with superalloys over the summer as a Mickey Leland Energy Program fellow with the U.S. Department of Energy (DOE) and Office of Fossil Energy and Carbon Management (FECM) was one piece of a larger puzzle that seeks to bring us one step closer to reducing our net carbon emissions to zero by the year 2050.

"I really want to get into the energy sector, so I thought this was a perfect opportunity to jump in and do some research with the DOE for the FECM," Slaton said.

Superalloys are complex, high-strength alloys – materials made by combining two or more metallic elements – with an impressive ability to resist both intense stress and extremely high temperatures.

One greener energy option currently under investigation in the United States is the use of hydrogen to generate electricity. Though it burns cleaner than traditional fossil fuels, it also burns much hotter. Existing systems would need to be upgraded with new nickel superalloy components to meet the challenge, and meeting this need is what makes identifying the ideal chemical composition of the right alloy so important.

"In terms of the specific alloy I was investigating, we're really looking for a replacement for turbine rotors. With our current technology, systems often use steam, wind, water or gas to move rotors and thereby generate power," Slaton said. "These alloys we're investigating are specifically intended for hydrogen turbines. To successfully handle burning hydrogen, they need to be able operate at much higher temperatures, so you need a stronger material to be able to reach and withstand those high temperatures for sustained operations."

Grain structure – the physical microstructure that gives a superalloy its high-performance characteristics – is something of tiny scale but huge importance. Slaton spent the duration of the summer program using electron microscopy and electron backscatter diffraction to investigate three variations (each containing a slightly different amount of carbon) of Nimonic 105, which is an alloy of particular interest. These tools can provide important clues and additional context that help guide the process of material selection for specific industrial tasks.

Slaton's investigation, however, was only the tip of the iceberg.

"My roommate – the other participant that I stayed with in Oregon – was working on a related project, but more for the pipelines themselves," Slaton said. "He was investigating coating technologies to help reduce the effects of hydrogen corrosion on the current pipelines, which would allow us to use the pipeline that's already in the ground to move hydrogen."
Retrofitting existing structures and systems to the fullest extent possible not only further reduces waste and emissions but reduces additional labor and delays that could impede the United States' ability to meet the proposed 2050 deadline.

"I realized that we have all of these projects over at the DOE all focused on achieving one goal, and that is being able to provide clean energy," he said.

"I think the scale at which there's cohesion across the DOE and how they and the FECM bring together all of these projects to focus on their goal of net zero carbon emissions by 2050 is just awe-inspiring."

In August, the program concluded with a forum that allowed participants to present their research work and project findings.

"The Technical Forum at the end of the summer went really well. We got to meet the Secretary of Energy, and we got to speak with a lot of people, and we got to see everybody's projects. Some of them were incredibly technical – that was really impressive. You could really tell how much they focus on bringing in new scientists to the DOE. They put a lot of energy into making sure they get the people they need to move the mission forward," Slaton said.

Having now returned to Texas, Slaton hopes that his knowledge and experience will help him find further research opportunities with a material science lab at the University of Houston.

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