

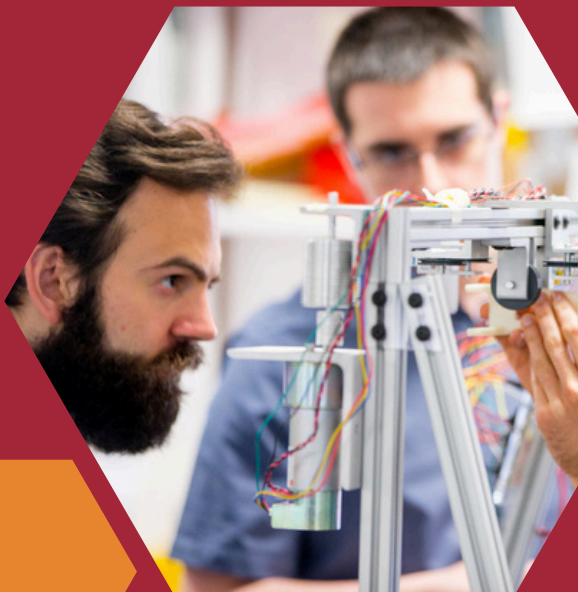
# ANNUAL REPORT

## 2024-2025



Schaefer School of  
Engineering and Science

Department of Mechanical  
Engineering





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# MESSAGE FROM THE CHAIR

It is with great enthusiasm that I present the 2024-2025 annual report for the Mechanical Engineering Department. This year has been marked by significant growth and accomplishment, fueled by the dedication and hard work of our outstanding faculty, students, and staff. From record-breaking student enrollments to new heights in research, education, and community engagement, we continue to uphold our commitment to excellence as we move forward.

In 2024-2025, our department saw major advancements in key areas of mechanical engineering research and a remarkable increase in undergraduate enrollment, one of the highest in our history. A standout achievement this year was the record number of new research awards, a clear indication of the innovative work being done by our faculty and their ongoing commitment to advancing the boundaries of knowledge in our field.

We have also focused on fostering deeper connections between faculty and students. Initiatives such as the ME Summer Research Programs, Freshmen Events, Annual Research Day, ME Town Hall Meetings, Wellbeing Activities Events, and continued support for student organizations have all played an integral role in enhancing the sense of community within our department.

Our academic programs continue to thrive and evolve, driven by a strong spirit of collaboration among faculty. Key highlights include an enhanced advising system, a senior design program with robust industry partnerships, expanded undergraduate laboratories, and an enriched graduate curriculum, particularly in emerging fields like Robotics, AI in Mechanical Engineering, and Aerospace. We are excited to introduce a new graduate program, our Ph.D. in Robotics, and new Graduate Certificates in Aerospace Engineering and the Application of Machine Learning to Mechanical Engineering, further expanding opportunities for advanced study and research.

This report is a reflection of the collective achievements of everyone in our department. Looking ahead, I am excited by the possibilities that lie ahead and confident that the Mechanical Engineering Department will continue to lead in innovation, research, and education. My deepest gratitude goes to everyone who has contributed to our success and supported us on this journey.

Sincerely,



Souran Manoochehri  
Professor and Chair of the Department of Mechanical Engineering







# DEPARTMENT DASHBOARD

**\$3.8M**

in Research  
Expenditures

**Enrollment:**

**725 UG**

**167 Master's**

**65 Ph.D.**

**\$23M**

in Active Awards

**35**

Full Time Faculty

**\$77,600**

average starting  
salary for  
undergrads

**\$7.1M**

in New Research  
Awards

**98%**

of undergraduates  
secured jobs or  
continuing  
education





# STUDENT-FACULTY INTERACTIONS

## ME STUDENT ADVISORY COUNCIL

The Mechanical Engineering Student Advisory Council (MESAC) works with faculty and administration to provide feedback and suggestions aimed at improving the academic experience and program quality.

The Council is split into two groups: the Undergraduate Council and the Graduate Council, each focusing on the needs of their respective students. Both councils work to improve communication, represent student interests, and help enhance the department's educational offerings and resources.

## ME 322 DESIGN SHOWCASE

The ME 322 Design Showcase was a new and exciting event where undergraduate students in the design course could present their final projects. It allows students to demonstrate their creativity and problem-solving skills while receiving feedback from faculty and peers.



## WOMEN IN ME

A group for women faculty, students, and staff to connect and discuss topics specific to their experiences in the field. The Women in Mechanical Engineering Group organizes events like co-op and internship panels, networking lunches, alumni panels, ME-related workshops, fostering community and professional development.

## FRESHMEN ORIENTATION SOCIAL

Held at the start of the Fall semester, this casual event helps freshmen, faculty, and staff connect early on in an informal, welcoming setting.

## 3-MINUTE THESIS EVENT

The 3MT (Three Minute Thesis) competition provides master's and doctoral students in the ME Department with the opportunity to present their research in a concise and engaging format. Using just one static slide and three minutes to speak, participants practice conveying complex ideas clearly to a broad audience. This event helps students strengthen their communication skills, showcase their work, and contribute to a culture of academic excellence.

# STUDENT-FACULTY INTERACTIONS (CONT.)

## UNDERGRADUATE ENGINEERING DESIGN COMPETITION

Hosted by the Mechanical Engineering Department and MESAC, the Undergraduate Engineering Design Competition invites students to put their creativity and engineering skills to the test. Participants design and build a solution to a surprise challenge revealed the day before the event.

This hands-on competition fosters teamwork, innovation, and friendly competition — complete with refreshments and an energizing atmosphere.

## ME TOWN HALL MEETING

Each semester, the ME Town Hall Meeting provides an open forum for undergraduate students to meet with faculty and department leadership. This event encourages candid conversations about curriculum, department updates, resources, and student concerns, helping to shape the future of the program.



## WELLBEING ACTIVITIES EVENT

The department supports students' mental and physical health through wellbeing activities, including mindfulness sessions, snacks, quiet study spaces during finals, fitness challenges, and games to help students recharge and relax.



## GRADUATE BOWLING EVENT

The Graduate Bowling Event provides an opportunity for students and faculty to unwind and socialize in a relaxed setting. This fun, team-oriented activity helps build camaraderie and strengthen connections within the ME Department outside of the classroom.





# STUDENT-FACULTY INTERACTIONS (CONT.)

## ME RESEARCH SYMPOSIUM

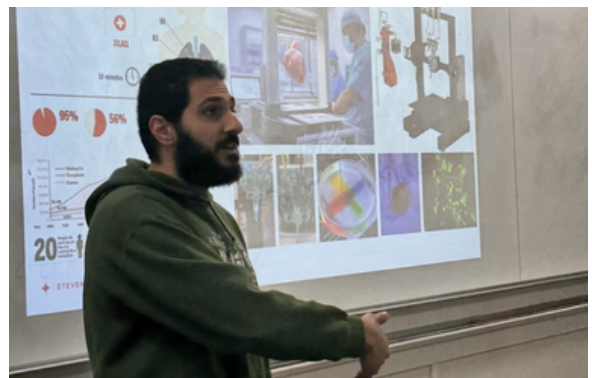
The ME Research Symposium is a day of innovation and collaboration within the Department of Mechanical Engineering. Featuring research presentations, poster sessions, and networking opportunities, it showcases the latest work from both undergraduate and graduate students. This event allows students to share their research with peers and faculty, fostering academic growth and a strong sense of community.



## ME GRADUATE STUDENT ASSOCIATION

The Mechanical Engineering Graduate Association (MEGA) is a student-led organization composed of graduate students pursuing advanced degrees in mechanical engineering. MEGA provides opportunities for networking, professional development, academic collaboration, and social events.

Notable events include 'Get to Know Your Faculty Trivia,' fostering informal connections between students and faculty, and industry/academic career panels, designed to provide valuable insights and guidance for students pursuing careers in both academia and industry.



# STUDENT-FACULTY INTERACTIONS (CONT.)

## ME SEMINAR SERIES

The ME Seminar Series, offered in both the Fall and Spring semesters, features expert speakers from across academia and industry, giving students and faculty the opportunity to discuss advanced topics in Mechanical Engineering and interact directly.



## FUTURE OF MECHANICAL ENGINEERING IN EMERGING TECHNOLOGIES

The Industry Torchbearers and the Department of Mechanical Engineering, in partnership with ASME, hosted an event at ASME Headquarters in New York City featuring Stevens alumni, students and professionals.

The program included remarks from Stephanie Viola (representing ASME leadership), Lori E. Feiler Dean of the Schaefer School of Engineering and Science, Dr. Jean Zu, and Dr. Souran Manoochehri, followed by a panel discussion on emerging technologies shaping the future of mechanical engineering.





# UNDERGRADUATE

Mechanical engineers create the systems and components behind technologies from medical devices and vehicles to power systems and robotics. The Bachelor of Engineering in Mechanical Engineering at Stevens Institute of Technology combines a strong foundation in engineering and the liberal arts with hands-on projects, including senior design, to develop technical expertise, communication skills and professional values. Graduates are prepared for careers in industries such as automotive, aerospace and energy, as well as for advanced study.



## SENIOR DESIGN EXPERIENCE

The Senior Design Program in Mechanical Engineering continues to serve as the capstone experience for our undergraduates, integrating technical knowledge, creativity, and teamwork into innovative projects across three thematic areas: Thermal-Fluids, Manufacturing and Product Design, and Robotics. This year, the program achieved remarkable milestones, with 39 projects involving 196 students (170 Mechanical Engineering and 26 interdisciplinary collaborators). Projects originated from a broad spectrum of sources: 24 faculty proposals, 10 industry partners, 3 student-driven ideas, and 2 competitions.

Students worked under the mentorship of our ME faculty advisors and benefited from strong partnerships with industry sponsors, reinforcing Stevens' commitment to experiential, real-world engineering education. The enhanced project selection and team formation processes allow students to indicate advisor preferences and expected deliverables, ensuring stronger alignment between team objectives and available resources.

We are deeply grateful to our industry partners for their continued support. The 2024–2025 cycle was sponsored by General Dynamics, IEEE, Siemens, RTX, EA Technology, Kearfott, Seebeckcell Technologies, S-Wind, L3Harris, NASA (competitions), Sigma Design, Gow-Mac, Digital Ocean, and LinkGear.





# SENIOR DESIGN PROJECTS

The Best Mechanical Engineering Senior Design Project at the SES Undergraduate Awards was presented to Neil Deshpande, Konnor Getz, Celia Mauri, Ava Steneck, and Ryan Ward, advised by Prof. Nicholas Parziale, for their project Hypersonic Boundary Layer Pitot Rake. The team designed and manufactured the first successfully tested pitot rake in the Stevens Shock Tunnel, enabling critical data collection on turbulent boundary layers at speeds above Mach 5. Their work advances Stevens' hypersonics research and contributes to fields of national importance, from re-entry vehicles to future aerospace systems. These selected projects from 2024–2025 reflect Stevens' mission to prepare engineers who are technically excellent and socially conscious.



## HYPE RAKE

**Advisor: Nicholas Parziale**

The team developed a novel pitot rake to measure boundary layer properties in hypersonic flight, critical for vehicles traveling at speeds over Mach 5. Their device is the first successfully tested in the Stevens Shock Tunnel, advancing the Fluids Laboratory's research in hypersonics. Sponsored by L3 Harris Technologies and advised by Prof. Nicholas Parziale, the project positions Stevens at the forefront of experimental hypersonic studies.



## AUTO GROOVE

**Advisor: Prof. Mishah Salman**

AutoGroove merged STEM and the arts (STEAM) through an autonomous percussive guitar-playing robot. The modular system strummed chords, struck rhythms, and allowed user interaction via a UI, inspiring K–12 students to explore creativity alongside engineering.



## SARIS

**Advisors: Profs. Souran Manoochchhri, Chaitanya Krishna Vallabh, Chan Yu**

Designed for automated piston cylinder inspection, SARIS integrated a robotic arm with 3D scanning and image-processing algorithms. The system reduced inspection time, improved quality, and delivered a scalable solution for the automotive industry.



## SOLAREV

**Advisor: Dr. Zahra Pournorouz**

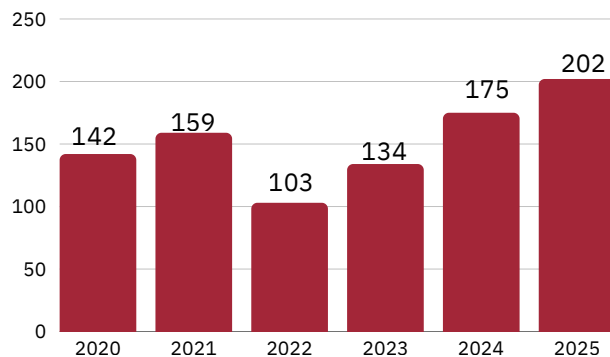
The SolarEV team developed a solar-powered charging station tailored for small electric vehicles, addressing gaps in charging infrastructure. Their solution integrated photovoltaic panels, safety features, and theft protection, promoting sustainable transportation while reducing carbon emissions.

# UNDERGRADUATE ENROLLMENT

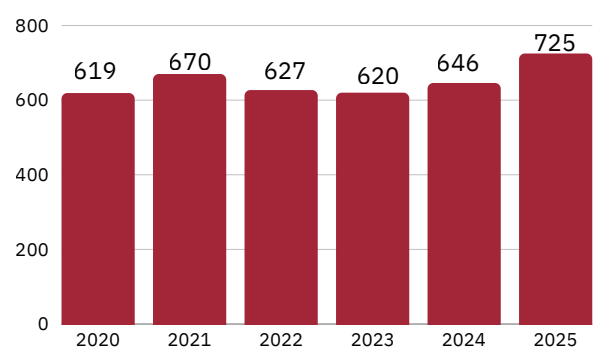
Mechanical Engineering department continues to experience significant growth in undergraduate enrollment. In the Fall 2025, we welcomed 202 new undergraduate students, a 15% increase from the previous year. Additionally, total undergraduate enrollment increased by 79, demonstrating the enduring appeal of the program and the growing demand for skilled mechanical engineers. In addition to the incoming class, we regularly receive transfer and change of major students that reflects in the total enrollment number.

Through a rigorous curriculum, immersive hands-on learning, and access to cutting-edge research, our students gain the skills and knowledge needed to thrive across diverse engineering fields. We take pride in delivering a high-quality education that equips graduates for meaningful and successful careers.

**NEW UNDERGRADUATE ENROLLMENT**



**TOTAL UNDERGRADUATE ENROLLMENT**





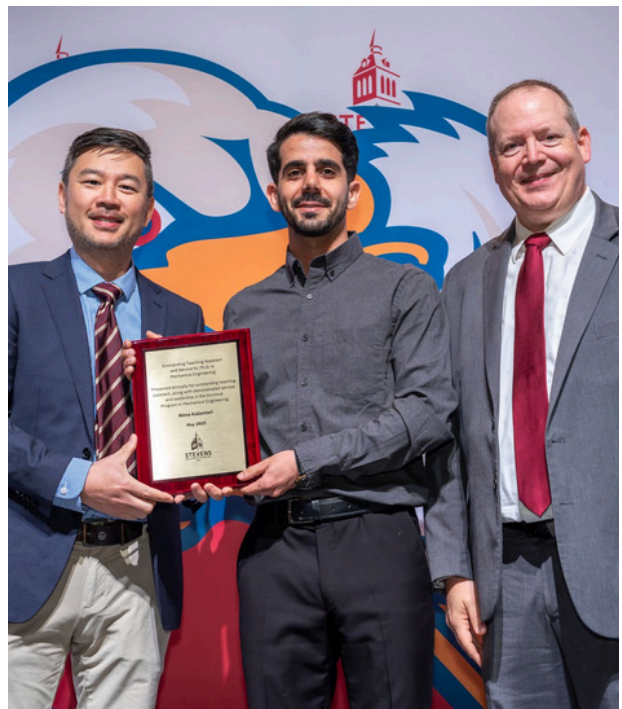
# GRADUATE

The Master's programs in Mechanical Engineering and the Doctorate in Mechanical Engineering program represent the pinnacle of advanced education and research in the field. Guided by expert faculty, students learn to leverage innovative technologies, lead high-quality product development, and manage projects to rigorous professional standards. With a flexible curriculum that includes a fast-track option to complete the degree in one year, graduates are well-prepared for careers across industries such as automotive, medical devices, additive manufacturing, renewable energy, robotics and automation, power generation, and aerospace.

The Department of Mechanical Engineering offers four master's programs and four joint master's programs designed to strengthen students' technical expertise, leadership skills, and career opportunities. These programs provide specialized study, hands-on experience, and the ability to address complex challenges, lead engineering teams, and drive innovation.

At the doctoral level, the department offers a Ph.D. in Mechanical Engineering as well as a newly developed Ph.D. in Robotics. These programs represent the highest level of academic pursuit, with a focus on advanced research, interdisciplinary collaboration, and close mentorship from faculty experts. Doctoral candidates conduct original research that advances knowledge and contributes to both industry and society.

Across both master's and doctoral programs, students are challenged to think critically, explore new ideas, and develop transformative solutions. Graduates emerge as leaders and innovators, shaping the future of mechanical engineering through research, technological advancement, and professional impact.



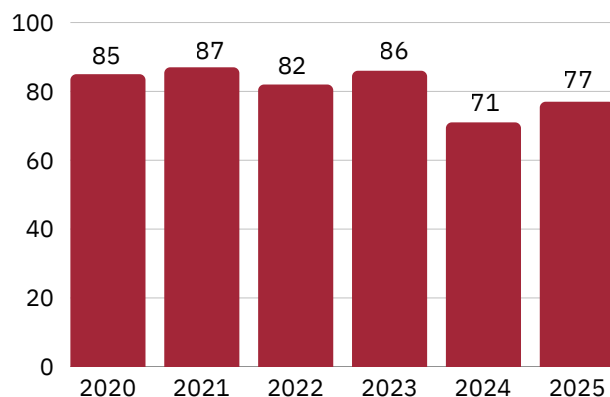


# GRADUATE ENROLLMENT

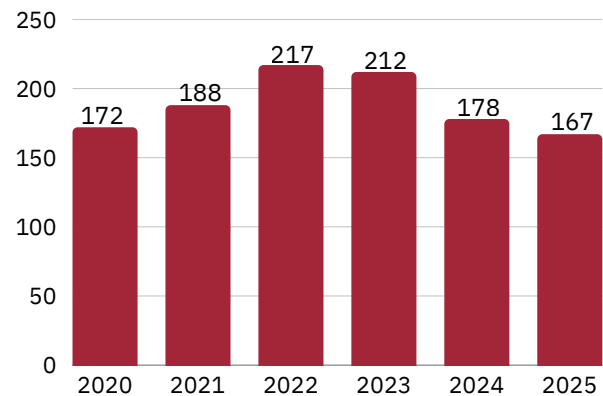
The Mechanical Engineering Department continues to demonstrate sustained graduate student enrollment at the Master's and Ph.D. levels. In Fall 2025, the department welcomed 77 incoming master's students and 10 incoming doctoral students. This level of enrollment underscores the program's strong reputation and continued ability to attract highly qualified candidates.

The department's focus on cutting-edge research areas like Micro/Nano/Quantum Technology, Dynamics, Controls, and Robotic Systems, Aerospace Engineering, Biomechanical Engineering, Energy, Thermal-Fluids, and Sustainability, and Design Computations and Advanced Manufacturing contributes to its growing popularity. Additionally, the department's commitment to providing hands-on experience, state-of-the-art facilities, and a supportive learning environment has influenced these positive trends.

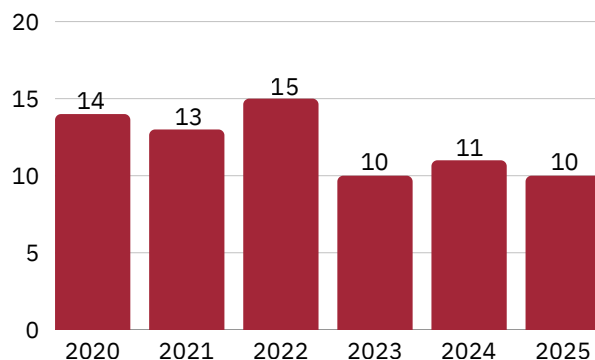
## NEW MASTER'S ENROLLMENT



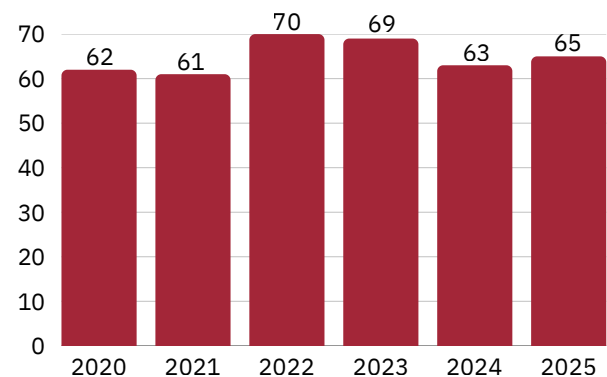
## TOTAL MASTER'S ENROLLMENT



## NEW PH.D. ENROLLMENT



## TOTAL PH.D. ENROLLMENT



# NEW GRADUATE PROGRAMS LAUNCHING IN FALL 2025

The Mechanical Engineering Department is excited to announce three new graduate offerings beginning in Fall 2025: a Robotics Doctoral Program, a Graduate Certificate in Aerospace Engineering, and a Graduate Certificate in the Application of Machine Learning to Mechanical Engineering. These programs expand our pathways for advanced study and research while aligning with industry demand and emerging technologies.

## **Robotics Doctoral Program (Ph.D.)**

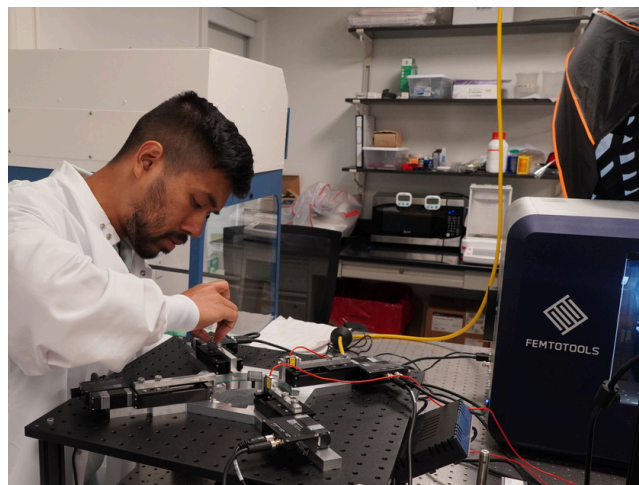
This interdisciplinary program blends rigorous mathematical foundations with hands-on methods in robotics and mechatronics, preparing students for research leadership and advanced technical roles across sectors from manufacturing to healthcare. The degree requires 84 credits beyond the bachelor's, including advanced coursework, the Doctoral Signature Course, and substantial dissertation research. The program is jointly managed by Mechanical Engineering, Electrical & Computer Engineering, and Computer Science, with contributions from Mathematical Sciences and Biomedical Engineering.

## **Graduate Certificate in Aerospace Engineering (12 credits)**

Designed for engineers seeking targeted aerospace credentials, this certificate provides an overview of the field spanning fluid mechanics, solid/structural mechanics, and control theory. Required courses include Introduction to Aerospace Engineering (ME 545) and Introduction to Modern Control Engineering (ME 621), with electives in compressible/advanced fluids and structural mechanics. The program prepares students for careers in aerospace, space exploration, and national security..

## **Graduate Certificate in the Application of Machine Learning to Mechanical Engineering (12 credits)**

This certificate equips students to apply AI/ML across mechanical engineering domains, covering optimization, modeling and simulation, and core programming in MATLAB and Python, with exposure to modern deep-learning methods (e.g., CNNs, RL, Transformers). The curriculum requires Machine Learning in Mechanical Engineering (ME 596) plus selections from courses with applied AI/ML examples in mechanical engineering, along with existing catalog offerings from Applied AI (AAI) and computer science. Graduates will be prepared for careers at the intersection of machine learning and mechanical engineering, reflecting the program's objective to equip students for ML-driven roles in ME.



# STUDENT ACHIEVEMENTS

## SELECTED HIGHLIGHTS



### **Ralf Zgeib Takes Top Honors in 3MT® Competitions**

Mechanical Engineering doctoral student Ralf Zgeib won first place in the Department's Three Minute Thesis (3MT®) Competition and the People's Choice Award at the Schaefer School of Engineering & Science 3MT® Final. His clear, compelling presentation showcased both research excellence and strong communication skills.

### **Stevens Electric Boat Team Wins Planing Hull Championship**

The Stevens Electric Boat Team took first place in the Planing Hull category at the ASNE PEP competition in Virginia Beach, VA. Composed largely of first- and second-year students, the team impressed with quick problem-solving, resilience in 30-knot winds and standout teamwork.



### **Rai Singh Bindra Receives Prestigious AOC Scholarship**

Mechanical Engineering student Rai Singh Bindra received the competitive Association of Old Crows (AOC) Scholarship, honoring academic achievement, innovation, and leadership in STEM and national defense applications.

### **Introduce a Girl to Engineering Day**

This annual event at Stevens engaged young students through hands-on activities and mentorship with women engineers, inspiring interest in STEM and highlighting the importance of representation and early exposure.





# STUDENT ACHIEVEMENTS (CONTINUED)



## **ME Ph.D. Students Present at NEBEC 2025**

Ph.D. students from Dr. Long Wang's Advanced Robot Manipulators Lab presented cutting-edge healthcare and human rescue robotics research at the 51st Northeast Bioengineering Conference, hosted by NYU Tandon.

## **Ava Wang '25: Leadership Through Mentorship and Service**

Ava Wang '25 contributed as a teaching assistant, first-year mentor, and Women in Mechanical Engineering leader. Her commitment to mentorship and inclusion shaped the department and campus community. She now begins her career with Messer Americas.

## **ME Students Win ASME Trebuchet Competition**

For the second year, Stevens Mechanical Engineering students defeated Fairleigh Dickinson in the ASME Trebuchet Competition, achieving a 170-foot launch. Led by Noah Golan and advised by Dr. Zahra Pournorouz, the team showcased exceptional collaboration, problem-solving and engineering skill from concept to completion.



## **First-Year Student Wins with Poker Networking App**

First-year student Sean Marvuglio co-created All In, a poker networking app with 250+ users. The project earned first place and \$8,000 at Seton Hall's "Pirate's Pitch," marking the first freshman-led team to win the competition.

## **SAE Baja Team Prepares for National Competition**

The Stevens SAE Baja team tested their vehicles at Rowan University, earning 5th and 6th place finishes. The event offered key design insights and strengthened their problem-solving skills as they prepare to compete nationally against more than 100 schools.





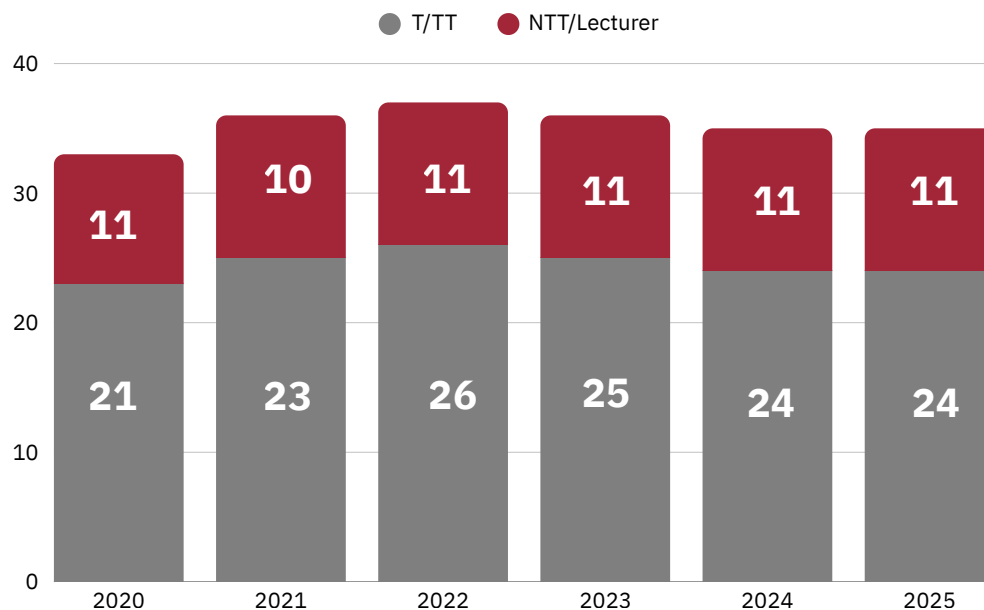
# FACULTY

## BY THE NUMBERS



Our world-class faculty, comprising 35 members, practice diverse activities across engineering. They prioritize hands-on learning and research, providing students with experiential knowledge and abundant resources. Globally recognized for their contributions to research, teaching, and professional practice, our faculty's expertise spans various disciplines, fostering intellectual curiosity and academic excellence.

Our faculty's commitment to both theory and application drives groundbreaking research addressing pressing global challenges. Their insights advance the field of Mechanical Engineering and hold far-reaching implications for industries, societies and communities. Out of our 35 faculty members, 24 are Tenure or Tenure Track, and 11 are Teaching Track. The faculty size trend over the past five years is illustrated below.



# FACULTY ACHIEVEMENTS

## SELECTED HIGHLIGHTS



### Professor Nicholas Parziale

- Received the **Presidential Early Career Award for Scientists and Engineers (PECASE)**, the nation's highest honor for early-career researchers, recognizing his work in high-speed aerothermodynamics
- Recipient of **2025 Stevens Alumni Association Outstanding Teacher Award** for connecting theory to real-world applications and inspiring student learning
- Appointed **George Meade Bond Chair** for a five-year term



### Professor Brendan Englot

- Named a **2025 Innovate100 Leader** for pioneering work in AI-driven robotics and autonomous systems
- Appointed **Anson Wood Burchard Chair** for a five-year term



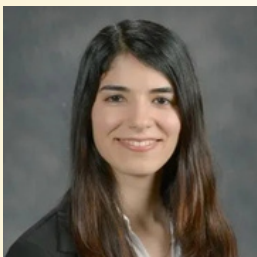
### Professor E.H Yang

- Selected as an **IEEE Sensors Council Distinguished Lecturer** for advancing global sensor research
- Serves as **Chair of the IEEE Nanotechnology Council (NTC) North Jersey Chapter**, organizing seminars and strengthening collaborations between Stevens and external institutions



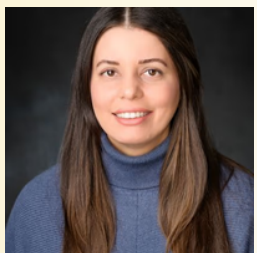
### Professor Chang-Hwan Choi

- Invited to speak at the **National Academies of Sciences, Engineering, and Medicine Workshop** on Transformative Science & Technology for Defense, joining experts from top institutions to discuss innovation in materials and manufacturing for extreme environments



### Associate Professor Shima Hajimirza

- Elected to the **Board of Directors of the American Society of Thermal and Fluid Engineers (ASTFE)** for a three-year term beginning July 1, 2025



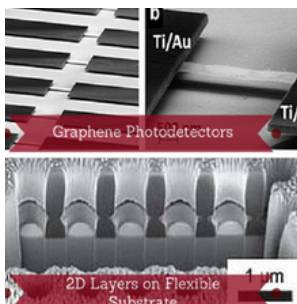
### Teaching Assistant Professor Zahra Pournorouz

- Established **LINK-ME Initiative** to strengthen collaboration between Stevens' Mechanical Engineering Department and partners across industry, government and academia through design projects, internships, panels and research



# TENURE AND TENURE TRACK FACULTY BY RESEARCH AREA

## MICRO/NANO/QUANTUM TECHNOLOGY



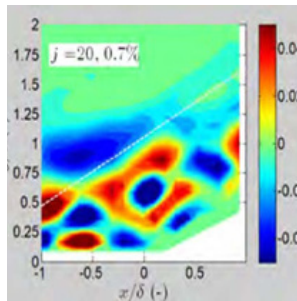
Chang-Hwan Choi  
Frank Fisher  
Shima Hajimirza  
Yong Shi  
Eui-Hyeok Yang  
Annie Zhang

## DYNAMICS, CONTROLS, AND ROBOTIC SYSTEMS



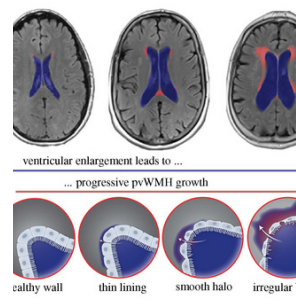
Gizem Acar  
Brendan Englot  
Christophe Pierre  
Kishore Pochiraju  
Hamid Jafarnejad Sani  
Christopher Sugino  
Long Wang  
Damiano Zanotto  
Jacqueline Libby

## AEROSPACE ENGINEERING



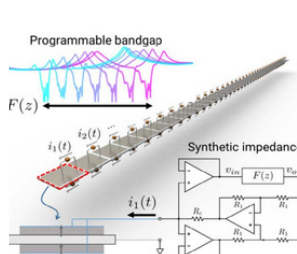
Nick Parziale  
Christophe Pierre  
Jason Rabinovitch  
Siva Thangam

## BIOMECHANICAL ENGINEERING



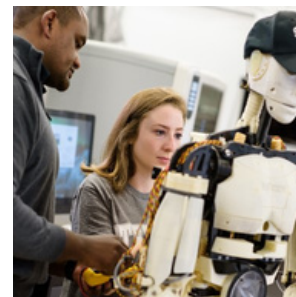
Robert Chang  
Long Wang  
Johannes Weickenmeier  
Damiano Zanotto  
Jacqueline Libby

## ENERGY, THERMAL-FLUIDS AND SUSTAINABILITY



Chang-Hwan Choi  
Hamid Hadim  
Shima Hajimirza  
Nick Parziale  
Jason Rabinovitch

## DESIGN COMPUTATIONS AND ADVANCED MANUFACTURING



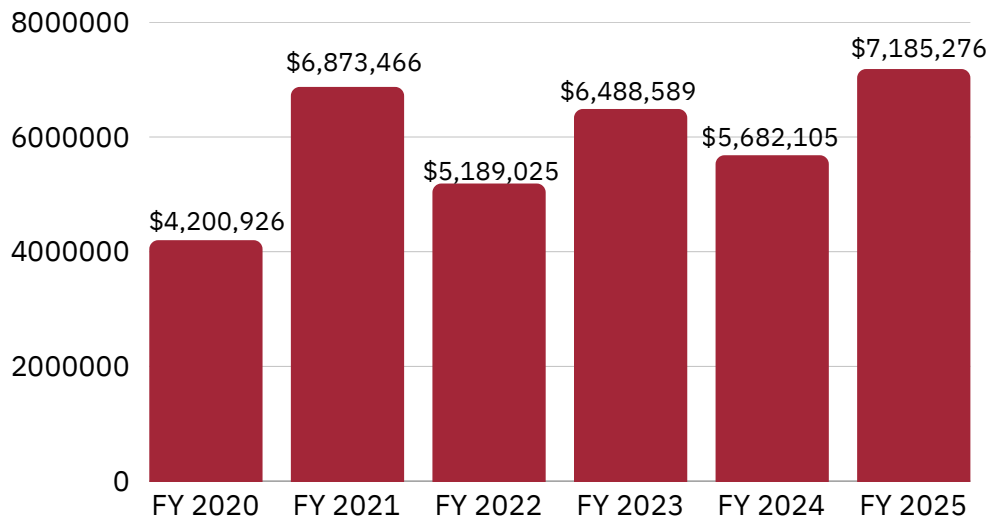
Robert Chang  
Chang-Hwan Choi  
Sven Esche  
Souran Manoochchri  
Kishore Pochiraju



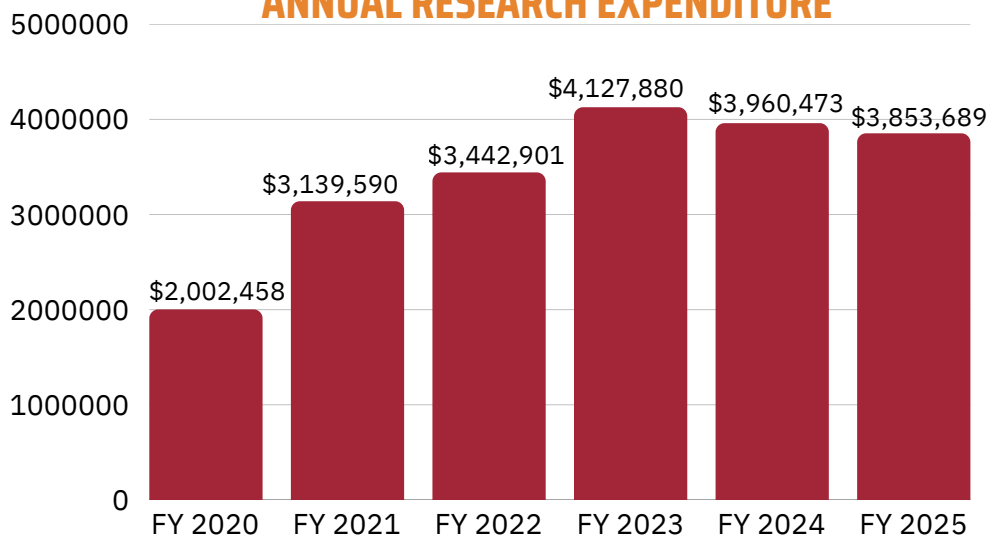
# SPONSORED RESEARCH

The Department of Mechanical Engineering is dedicated to innovative, interdisciplinary research, fostering collaboration among esteemed faculty members. Research areas include hypersonic reactive flows, mobile robotics navigation, biomechanics of soft materials, and 2D material development. The department has experienced significant research growth, with over \$22.9 million in active awards from various government and industry sources in 2024-2025. Our institution's substantial research expenditure underscores our commitment to advancing knowledge and driving innovation, acknowledging research's pivotal role in shaping industries, economies, and societies.

## ANNUAL RESEARCH AWARD



## ANNUAL RESEARCH EXPENDITURE



# ACTIVE RESEARCH AWARDS

Our department boasts a vibrant research community, spanning from theoretical to applied fields. Recent growth in multi-PI grants has fueled larger research labs and innovative projects. This collaborative spirit, combined with \$22.9 million in active awards, drives our scholarly impact. Below is a chart outlining the distribution of the external research sponsors in the department.

| Main Sponsor Name                                              | Award               | Percent |
|----------------------------------------------------------------|---------------------|---------|
| National Science Foundation                                    | \$6,903,490         | 30.09%  |
| Office of Naval Research                                       | \$4,048,625         | 17.65%  |
| Perspecta Labs Inc.                                            | \$1,439,276         | 6.27%   |
| Regents of the University of Minnesota                         | \$1,206,499         | 5.26%   |
| U.S. Army Medical Research Acquisition Activity                | \$1,191,127         | 5.19%   |
| ASME Foundation, Inc.                                          | \$1,105,392         | 4.82%   |
| Columbia University                                            | \$1,033,307         | 4.50%   |
| Leidos, Inc.                                                   | \$960,000           | 4.18%   |
| U.S. Army - Picatinny                                          | \$731,852           | 3.19%   |
| National Aeronautics and Space Administration                  | \$495,334           | 2.16%   |
| DOD - Combat Capabilities Development Command Armaments Center | \$459,524           | 2.00%   |
| CORVID Technologies LLC                                        | \$444,192           | 1.94%   |
| Kaswin                                                         | \$379,904           | 1.66%   |
| Case Western Reserve University                                | \$378,124           | 1.65%   |
| U.S. Department of Agriculture                                 | \$375,000           | 1.63%   |
| University of Washington                                       | \$364,498           | 1.59%   |
| Rutgers University                                             | \$328,325           | 1.43%   |
| HySonic Technologies, LLC                                      | \$249,864           | 1.09%   |
| The Regents of the University of California                    | \$240,049           | 1.05%   |
| Georgia Institute of Technology                                | \$232,000           | 1.01%   |
| Sandia National Laboratories                                   | \$219,973           | 0.96%   |
| Duke University                                                | \$100,000           | 0.44%   |
| New Jersey Health Foundation                                   | \$35,000            | 0.15%   |
| Raytheon Company                                               | \$18,400            | 0.08%   |
| Analytical Mechanics Associates                                | \$2,940             | 0.01%   |
| <b>Total</b>                                                   | <b>\$22,942,695</b> |         |



# FACULTY RESEARCH

## SELECTED PROJECTS

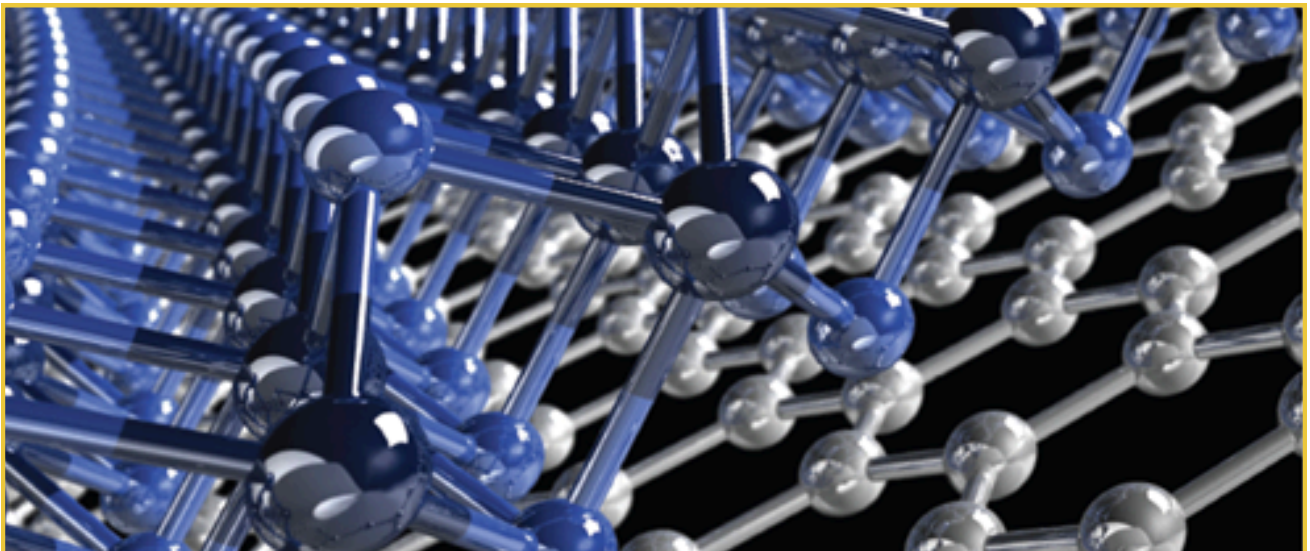
### PIONEERING 2D QUANTUM MATERIALS FOR SPINTRONIC INNOVATIONS AND BIOSENSING

E.H. YANG

Professor E.H. Yang's research focuses on two-dimensional (2D) magnetic semiconductors and their applications in next-generation nanoelectronics and biosensing. A highlight is the Nature Communications paper on iron-doped molybdenum disulfide (Fe:MoS<sub>2</sub>), which demonstrated stable room-temperature ferromagnetism in a true 2D semiconductor. By introducing Fe atoms substitutionally into the MoS<sub>2</sub> lattice, the work created a scalable, air-stable 2D dilute magnetic semiconductor that retains ferromagnetism at the monolayer limit. This breakthrough established a new platform for spintronics, showing that practical magnetic functionality can be engineered at the atomic scale. Building on this, field-free, low-power magnetic switching was achieved using orbital and spin angular momentum in Fe:MoS<sub>2</sub> devices, reducing energy consumption by nearly two orders of magnitude compared to conventional systems.



In collaboration with colleagues at Harvard Medical School, 2D materials are also applied in biosensing. The project develops peptide-functionalized MoS<sub>2</sub> sensors capable of detecting viruses with high sensitivity and specificity, paving the way for next-generation clinical diagnostics and point-of-care testing platforms. These projects bridge nanoelectronics and biosensing, positioning 2D materials as enabling technologies for energy-efficient information systems and advanced healthcare diagnostics.



# FACULTY RESEARCH (CONT.)

## ADVANCING PHYSICAL REHABILITATION AND DIGITAL MOBILITY MONITORING THROUGH MACHINE LEARNING AND WEARABLE TECHNOLOGY

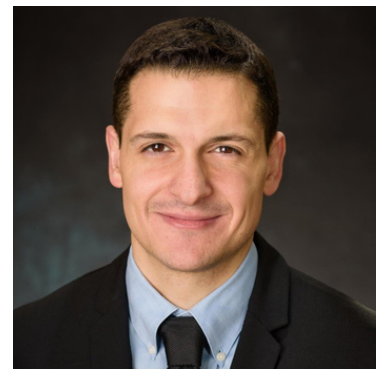
DAMIANO ZANOTTO

Dr. Damiano Zanotto and his team in the Wearable Robotic Systems Laboratory are integrating machine learning with wearable robotics and sensors to develop personalized robot-assisted rehabilitation paradigms and sensitive digital biomarkers of real-world mobility.

The group has pioneered reinforcement-learning-based “assist-as-needed” control strategies for custom-engineered ankle exoskeletons and end-effector arm-rehabilitation robots. These devices dynamically adapt the level of physical assistance based on user performance, promoting targeted motor adaptations while encouraging volitional control. Such strategies hold promise for improving rehabilitation outcomes in future plans of care for individuals with neurological or musculoskeletal gait impairments.

In parallel, the team is advancing in-shoe sensing technologies for remote monitoring of mobility in individuals with progressive neurological conditions. By pairing these sensors with machine learning-based abstraction models, the system can accurately estimate stride-level spatiotemporal and kinetic gait metrics in every day environments, continuously, over weeks or months. This capability enables the development of highly sensitive digital biomarkers to track disease progression, detect early mobility decline, and evaluate intervention efficacy—ultimately helping bring new treatments to patients faster and more effectively.

Zanotto’s group collaborates closely with leading clinical institutions—including Columbia University Irving Medical Center, Stanford Medicine, Harvard Medical School, Penn Medicine, and the Kessler Institute for Rehabilitation—to validate these technologies and accelerate their translation into real-world use.



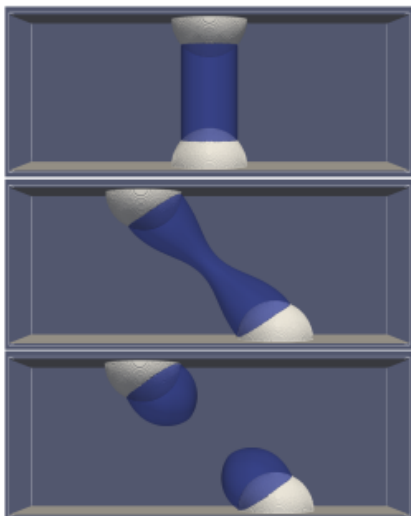
# FACULTY RESEARCH (CONT.)

## MODELING MULTIPHASE FLOWS FOR SOFT MATTER APPLICATIONS

KEVIN CONNINGTON

Kevin Connington's research involves computational fluid dynamics (CFD) modeling of multiphase flows using the Lattice Boltzmann Method (LBM). The LBM is a novel approach to CFD that solves the discretized Boltzmann equation, rather than the Navier-Stokes (NS) equation of traditional flow solvers. The LBM has many advantages, such as the ease of implementing boundary conditions and its ability to scale well on high performance computing (HPC) platforms.

Prof. Connington develops his in-house LBM code to run on Stevens' powerful HPC system, Jarvis, for applications in "soft matter" flows. Soft matter encompasses a range of complex fluid flows where coherent macro-structures, coupled to fluid flow, are easily deformable, such as suspensions of red blood cells.



*Figure: The sequence of images shows the rupture of a liquid bridge between two spherical particles undergoing a shearing motion. The sequence proceeds top to bottom.*

Prof. Connington was recently awarded a National Science Foundation (NSF) grant to study the dynamics and rupture of stretching liquid bridges between particles. In some oil and gas transport applications, liquid bridges can form between solid hydrate particles. If the particles separate, the liquid bridge between them will rupture (see image sequence). However, the liquid bridge can also draw the particles together through surface tension effects, and it is believed that these bridges may be involved in forming agglomerations of particles that can grow to a size that catastrophically clogs the pipeline.

This project will characterize liquid bridge rupture/agglomeration modes for extensional, shearing, and vibrational particle motions via numerical simulation.



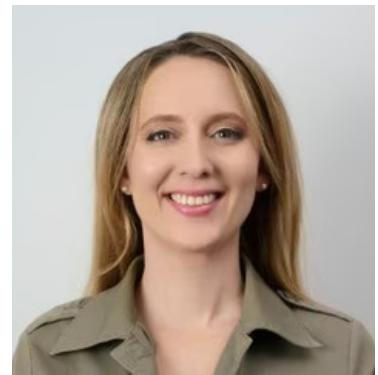
# FACULTY RESEARCH (CONT.)

## SOFT ROBOTICS FOR PHYSICAL THERAPY AND PAIN REDUCTION

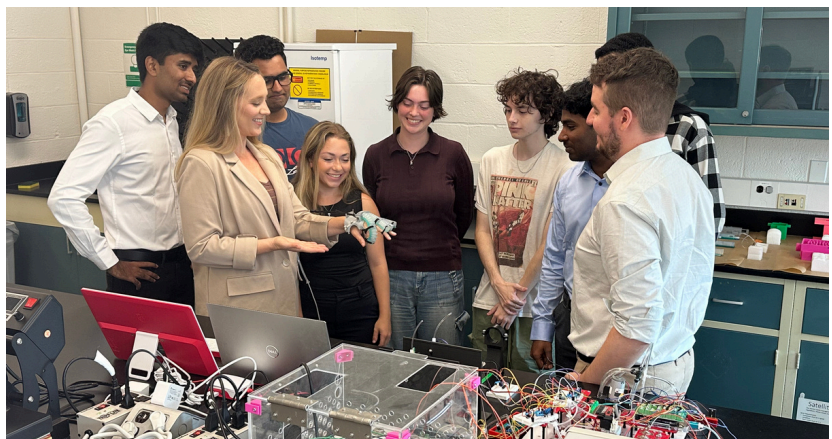
JACQUELINE LIBBY

Assistant Professor of Mechanical Engineering Jacqueline Libby was awarded a grant by the National Science Foundation (NSF) for her project titled "ERI: Soft Robotic Musculoskeletal Manipulation for Pain Reduction." The project focuses on the innovation of soft robotic devices to help individuals suffering from debilitating pain. These devices will enable future robotic physical therapy assistants to perform automated, targeted musculoskeletal manipulation.

The project will focus on foundational research in personalized soft robotic therapy, through the tight integration of activities in soft robotic design, modeling, fabrication, force sensing, control, and physical human-robot interaction. All of these activities are concurrently being explored by Dr. Libby and her students in her lab.



Dr. Libby and her research group also published two journal articles. She published one in IEEE Robotics and Automation Letters (RA-L), which is ranked by Google Scholar metrics as the top journal in Robotics. The second article was published in IEEE Access. Both articles focus on novel pneumatic control algorithms and mechatronic architectures for adaptive and auto-tuned control of soft robotic actuators.



# FACULTY RESEARCH (CONT.)

## BIOMECHANICS-INFORMED ROBOT-ASSISTED CASUALTY CARE

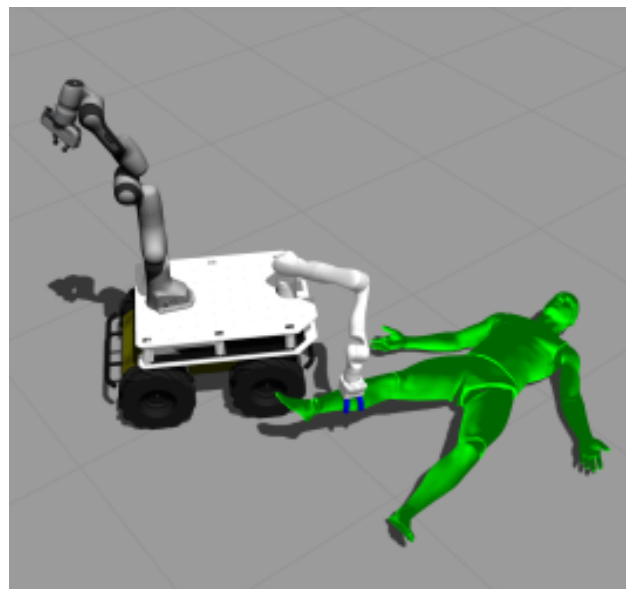
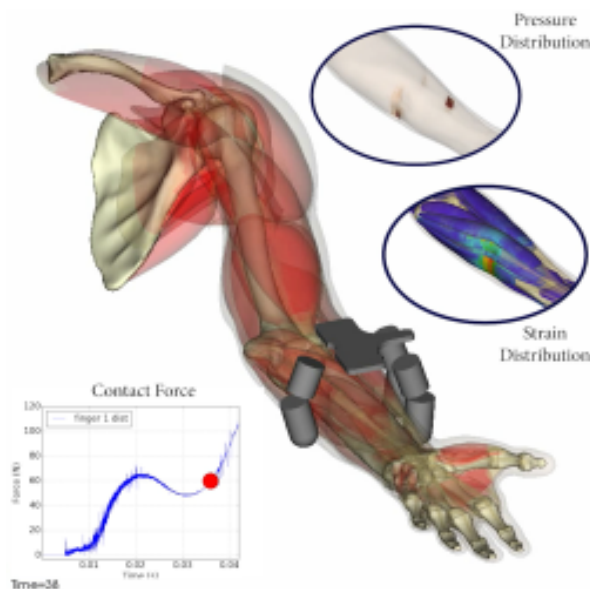
LONG WANG

Assistant Professor Long Wang and his team in the Advanced Robot Manipulators (ARM) group study robotic manipulation—how robots sense, plan, and act on the physical world.

Our focus is safe, reliable manipulation in unstructured and extreme environments. We combine model-based control with high-fidelity simulations to support design and controls of manipulators and end-effectors that work with people and tools. We build hardware, validate in digital twins and bench tests, and transition results to fieldable systems.

One active project targets robotic assistance for casualty care. A mobile manipulator gently repositions limbs, stabilizes posture, and prepares a casualty for extraction and transport, with a path toward more complex emergency tasks.

In partnership with Corvid Technologies, we are creating a biomechanically accurate, multi-fidelity digital human model that predicts contact forces, pressure, and tissue strain during interventions. These simulations set safety limits, inform controller design, and drive the development of durable hardware and robust autonomy for real-world operations.

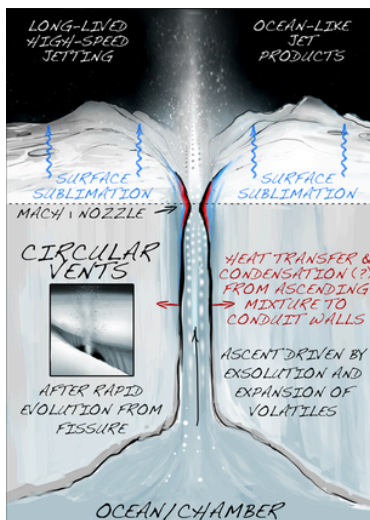


# FACULTY RESEARCH (CONT.)

## COMPRESSIBLE FLOWS FOR SPACE EXPLORATION AND VEHICLE DESIGN

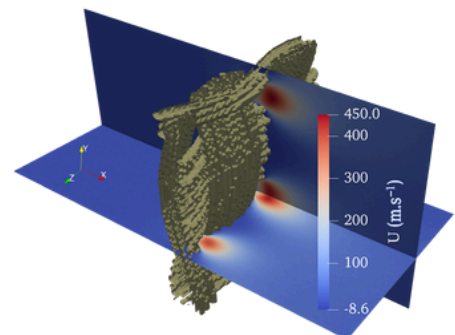
JASON RABINOVITCH

The Rabinovitch Research Group (RRG) combines an interest in space exploration with fundamental computational fluid dynamics research. Areas of interest include investigating plume-surface interactions during powered descent of spacecraft, modeling supersonic parachute inflations, investigating high-speed multiphase flow phenomena for future high-speed vehicles, and modeling geophysical phenomena, such as the plumes on Enceladus or Yardangs on Earth and Mars. Work in the RRG supports the design of future spacecraft and missions, along with the design of terrestrial high-speed vehicles. This work not only contributes to the engineering design of future spacecraft and vehicles, but also to better understanding our solar system in general.



The RRG has been working on several projects over the past year. On the planetary science side, there is a NASA funded effort to understand and model why and how the Enceladus plume (an ice volcano erupting into space from the southern pole of a moon of Saturn) erupts, and how the make-up of the plume may help us understand the composition of Enceladus' subsurface ocean. Switching to high-speed terrestrial vehicles, there is an ONR funded project in collaboration with Cornell University on modeling high-speed droplet aerobreakup and impingement – i.e. how much damage might occur if a high-speed vehicle flies through a rain cloud and hits small water droplets? With even faster vehicles (12 km/s) traveling through the upper atmosphere of Venus, Prof. Rabinovitch also investigated how sampling the Venus atmosphere at such high speeds may affect the composition of the gas that you are able to bring back to Earth – this knowledge would be necessary if the VATMOS-SR mission concept were to ever be selected for flight.

Finally, the RRG has contributed to understanding how the permeability of parachute materials is affected by the rarefied environment experienced when a supersonic parachute is deployed in the upper atmosphere of Mars to help a spacecraft land safely on the surface.





# FACULTY RESEARCH (CONT.)

## OCEAN-POWERED ROBOTS FOR AUTONOMOUS OFFSHORE AQUACULTURE

BRENDAN ENGLOT

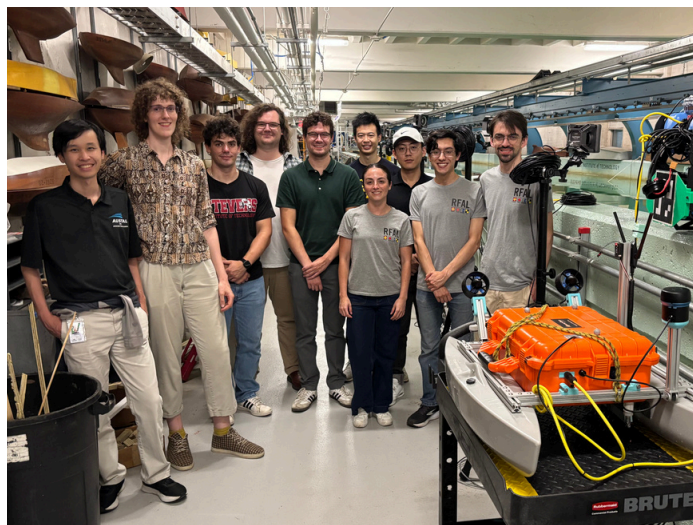
Mechanical Engineering Professors Brendan Englot, Long Wang and their students recently concluded their work on a four-year, multi-university, National Robotics Initiative (NRI) project that was funded by the U.S. Department of Agriculture's National Institute of Food and Agriculture (USDA-NIFA).



The goal of the project, "Ocean-Powered Robots for Autonomous Offshore Aquaculture", which included Stevens, University of Virginia, University of Michigan, and Virginia Tech as partners, was to develop a robotic system capable of inspecting, cleaning, and maintaining an offshore fish farm.

The system is comprised of an unmanned surface vehicle (USV) that harvests energy from ocean waves and wirelessly transmits data at the surface, and an autonomous underwater vehicle tethered to the USV, operating below the surface to clean and inspect the fish pens. The underwater robot was the focus of Englot and Wang's research efforts, as they worked together to develop the perception (Englot) and manipulation (Wang) capabilities needed to autonomously maintain an aquaculture site. Prof. Englot's work focused on high-resolution mapping and reconstruction of underwater structures using fused optical and acoustic perceptual sensing. Prof. Wang's work focused on the design and control needed to reliably grasp and manipulate underwater structures.

Their efforts culminated with a major demonstration of the two-robot system which took place at Stevens in July. All of the participating faculty and students spent a week operating the system in the Davidson Laboratory testing tank. Project stakeholders, collaborators, and potential future sponsors attended the demonstration, and the team is discussing the next steps for maturing the system to a higher technology readiness level.



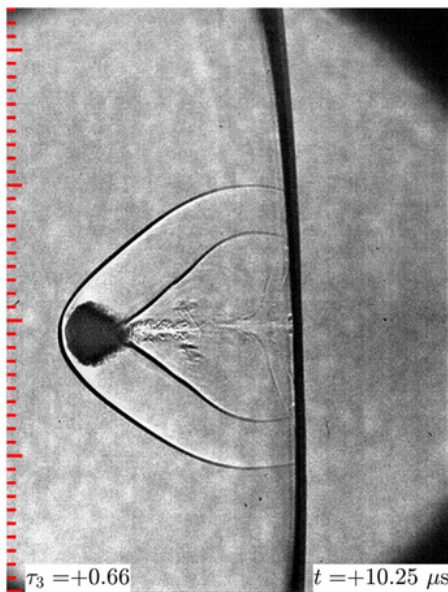
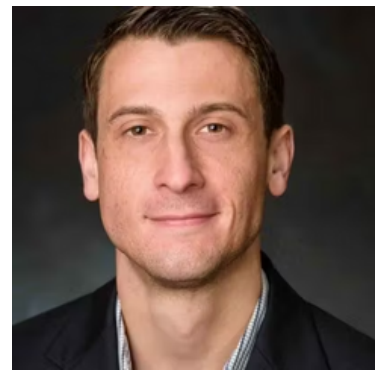
# FACULTY RESEARCH (CONT.)

## HYPersonic AEROTHERMODYNAMICS

NICHOLAUS PARZIALE

Nick Parziale's research with measurement techniques in supersonic/hypersonic flows has given insights to flow physics that have been sought after by NASA, the DoD, and the fluid-mechanics community for decades.

Parziale works with optics, lasers, and atomic physics that has resulted in: a) Focused Laser Differential Interferometry (FLDI), which measures density; and, b) Krypton Tagging Velocimetry (KTV), which measures velocity. He has also investigated high-speed vehicle weather encounter, where his group studies how rain impacts high-speed vehicles.



These measurement techniques are so-called 'non-intrusive, optical diagnostics,' which means they do not disturb the gas flow. This enables Parziale's group to study new fluid mechanical phenomena in the thin (1 millimeter) gas layer near a high-speed vehicle called the boundary layer. The transition of a boundary layer from a laminar (well-ordered) state to a turbulent (chaotic) state dictates a vehicle's capability because a vehicle with a turbulent boundary layer has higher drag and heat transfer, requiring more thrust and thermal protection.

Parziale's group was recognized with the 2024 Presidential Early Career Award for Scientists and Engineers (PECASE) by the White House.

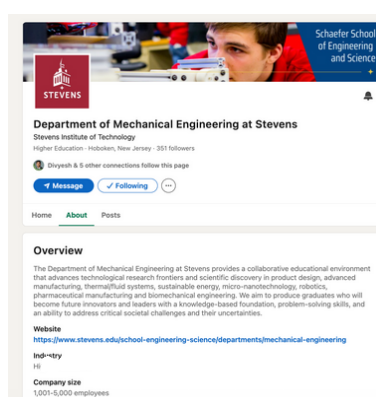
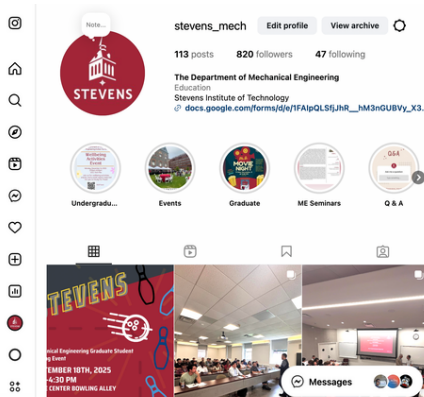
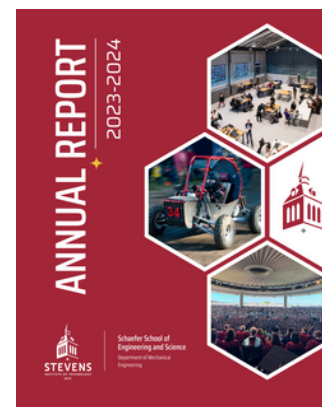
Additionally, Parziale was recognized with the 2025 Outstanding Teacher Award from the Stevens Alumni Association.



# COMMUNICATIONS

The Department of Mechanical Engineering engages its audience through a variety of communication channels. Annual reports showcase key achievements and groundbreaking research, while newsletters provide regular updates on faculty, students, and departmental initiatives. The department leverages LinkedIn to connect with alumni and industry partners and uses Instagram to highlight its culture, student life and research through dynamic visuals.

Additionally, event flyers promote conferences and other departmental activities. Together, these efforts effectively share information and foster connections within the academic and professional community.





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