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DEPARTMENT OF MECHANICAL ENGINEERING 2022-2027 STRATEGIC PLAN





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OUR PATH FORWARD

In 2021-2022, the ME department as part of the strategic planning process plots its path forward as we pursue new heights of success. This process was all-inclusive with input from department members. The results of our strategic planning process serve to guide our collective efforts, channel our energy, and accelerate our desire to achieve excellence in all we do.

From unprecedented growth in research funding to ever increasing student enrollment, the ME Department is poised to continue its upward trajectory. Buoyed by a collaborative and collegial culture, and the hiring of outstanding new faculty, the ME Department has accelerated its reputation and external standings.

Our educational programs are distinguished from peer institutions due to unique features and the size of the program, which is small enough to support strong student centricity while being large enough to provide a breadth of education, research opportunities, and extracurricular activities. The current state of our educational programs creates a strong foundation for a bold Strategic Plan as presented in this document which further differentiates the Stevens Mechanical Engineering Program from other institutions.

This plan provides reflection upon our recent successes, identifies areas for continued improvement, and prioritizes new areas for opportunities and growth. In this document, we present each of these elements regarding undergraduate and graduate academics as well as research and scholarship. I would like to extend my gratitude to the Strategic Plan Committee and ME faculty for their contribution and support in developing our path forward.

Souran Manoochet

Souran Manoochehri, Professor and Chair Department of Mechanical Engineering

MESSAGE FROM THE CHAIR



2022-2027 STRATEGIC PLAN





To be a top-tier mechanical engineering department focusing on student-centric education and addressing the grand challenges facing society.

Mission

Our mission is to provide a collaborative research and education environment that advances technological research frontiers and scientific discovery. We aim to produce graduates who will become future technological innovators and leaders with a broad-based foundation, problem-solving skills, and an ability to address critical societal challenges and their uncertainties.

Strategic Priorities

The Mechanical Engineering Department features top-tier research and educational programs in product design, advanced manufacturing, thermal/fluid systems, sustainable energy, micro-nanotechnology, robotics, pharmaceutical manufacturing and biomechanical engineering. These programs are guided by the following strategic priorities:

- 1. Create and nurture a student-centric environment that prepares our students to become technological leaders, creative thinkers, and outstanding problem solvers.
- 2. Provide 21st-century educational programs that feature innovative content and relevance.
- 3. Leverage recent initiatives at the department, school, and institute levels for enhanced external communications among all constituencies, including colleagues and peers, alumni, industry partners, potential collaborators, and funding agencies.
- 4. Support, recognize, and celebrate our diverse community of learners and scholars.
- 5. Foster, nurture, and support the growing culture of relevant and impactful research and scholarship within the department.

GOALS, STRATEGIES, INITIATIVES AND METRICS

GOAL 1: Student Centricity - Nurture Stevens' student-centric environment to further facilitate student success

The Mechanical Engineering department is committed to promoting and nurturing a student-centric environment throughout its program offerings. We will further establish our academic culture in which our students feel valued and driven to grow and succeed.

Strategy 1: Improve the advising system for undergraduate and graduate programs.

- A. Enhance departmental advising to facilitate the creation of academic plans according to students' career goals and interests.
- B. For undergraduate advising, select a sub-group of faculty advisors, develop the ME Faculty Advising Handbook (best practices for academic and career advising), and conduct training workshops for faculty advisors.
- C. Establish a new model for graduate student advising that increases interactions between faculty advisor and graduate advisee including holding regular meetings and small group discussions within the same technical track.

Strategy 2: Enhance student-faculty interactions both inside and outside of the classroom.

- A. Establish and promote best practices for enhancing student-faculty interactions in the classroom.
- B. Organize events (social and professional) for enhanced student-faculty interactions outside the classroom.
- C. Recruit highly motivated faculty advisors and student representatives to lead professional student organizations (ASME, SAE, AIAA, ASHRAE, ...) and groups.
- D. Further utilize the ME student Advisory Council (MESAC) as a key source for collecting student feedback.

Strategy 3: Facilitate professional development of our students.

- A. Organize skills-based training and workshops to complement the in-class educational experience of the students.
- B. Collaborate with the Office of Career Services to offer career development seminars to facilitate graduates' job placement.

Strategy 4: Develop initiatives that broaden and enhance the undergraduate and graduate student research experience.

- A. Provide the support necessary for students to engage and excel in research activities.
- B. Facilitate student participation in ME research activities (e.g. summer programs and REUs) and strengthen URM student involvement.
- C. Organize workshops on research methodology, ethics, and scientific writing and strongly encourage student attendance in our departmental seminar series.

Strategy 5: Facilitate professional development of our students.

- A. Establish the ME Graduate Student Association and assign a faculty advisor to provide support to its activities.
- B. Facilitate feedback from graduate students.
- C. Promote student-driven innovation and entrepreneurship.
- D. Expand efforts for internship experiences with industry and national laboratory partners.
- E. Implement a special "ME Lecture Fellowship" for our best Teaching Assistants to receive mentoring in pedagogy and develop practical experience for a future academic career.

- A. Student survey data on advising effectiveness, studentfaculty interactions, and graduate student ecosystem.
- B. Student/faculty ratio.
- C. Average class size: 90% of all UG course sections will have enrollment < 50 and 45% of all UG course sections will have enrollment < 20.</p>
- D. At least 25% of UG students will have research experience.
- E. Number of Master's students doing research and/or internships.
- F. Number of PhD students graduated per faculty per year.
- G. Number of undergraduate and graduate enrollments.



GOAL 2: Program Quality and Delivery - Enhance program quality and delivery to best prepare ME graduates to meet 21st-Century challenges

Stevens' legacy of innovation drives us to improve our curriculum, instructional methods, and classroom technology and equipment to help our students succeed. The Mechanical Engineering department will continue to innovate and to employ best-practices and approaches to deliver a world-class education for our students.

Strategy 1: Foster curriculum innovation and flexibility to advance personalized learning.

- A. Review and modernize the undergraduate and graduate curriculum to better prepare students with the skills and knowledge required for success in the digital economy of the 21st century.
- B. Offer a selection of degrees to satisfy distinct career goals of graduate students, including course-based Master of Engineering degrees, project-based Master of Engineering degrees, and research-based Master of Science degrees.
- C. Promote online graduate programs in the Mechanical Engineering Department.
- D. Promote the integration of communication and scientific writing, teamwork, research methods, and ethics in graduate education.
- E. Establish bridging courses to prepare students with non-engineering undergraduate backgrounds to pursue graduate study in Mechanical Engineering.
- F. Promote and grow the Stevens Accelerated Master's Program.

Strategy 2: Continue to improve the educational experiences of our students through enhanced pedagogy and innovations in program delivery.

- A. Promote inclusive, evidence-based teaching methods and strategies that meet the goals of a student-centric environment.
- B. Strengthen our educational programs through the implementation of evidence-based teaching practices proven to improve the experiences and outcomes of students.
- C. Innovate and update our curriculum to better address the modern, diverse, and interdisciplinary nature of the workplace.

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Strategy 3: Develop and implement creative strategies to recruit the highest quality PhD students.

- A. Work in tandem with Graduate Admissions to enhance adaptability to changes in PhD student recruitment channels.
- B. Increase availability of internal fellowships to fund the first year of study for PhD students, including the highly effective Provost Fellowship and Research Assistantships when available.
- C. Proactively nominate current and prospective PhD students to prepare competitive applications for federal fellowships.
- D. Implement strategies to recruit and retain doctoral students who are underrepresented in STEM.
- E. Strengthen relationships/pipelines with partner institutions known to graduate talented undergraduates.

- A. Annual undergraduate and graduate student survey data.
- B. Senior exit survey data.
- C. Number of ME Alumni pursuing advanced degrees.
- D. ME Alumni starting salaries.
- E. ME Alumni career placements percentage.
- F. Quality of graduate students admitted (GRE).
- G. Undergraduate student retention and graduation rate (e.g. 6-yr graduation rate).
- H. Number of applications received from underrepresented groups (women and URM).



GOAL 3: External Relations - Leverage and improve relations with entities external to the

Institute

Stevens is uniquely poised to leverage a diverse network of alumni and professional contacts to enhance the student experience inside and outside of the classroom. In addition, the Department values its role as a champion for the field of mechanical engineering and to support the pipeline of future students who will pursue mechanical engineering degrees.

Strategy 1: Improve/nurture alumni relations.

- A. Maintain regular communication with department alumni for networking opportunities.
- B. Solicit alumni participation in important Department events.
- C. Engage alumni in promoting Department programs and initiatives.

Strategy 2: Enhance current industry networks and develop new relationships.

- A. Solicit sponsorship from industry for projects including those for capstone senior design.
- B. Solicit industry sponsorship for internship and co-op offerings and Curricular Practical Training (CPT) for international Master's students.

Strategy 3: Leverage our network with academic institutions.

- A. Pursue and develop multi-institutional funding opportunities and improve collaborations.
- B. Market our graduate programs to undergraduate engineering students at top-tier universities to encourage them to join our department, particularly focusing on those programs that don't have doctoral programs.

Strategy 4: Enhance program promotion and marketing.

- A. Promote our graduate programs through various outreach channels.
- B. Increase the visibility of our research work and accomplishments.
- C. Promote and advertise student and faculty success stories.

- A. Number of industry-sponsored projects.
- B. Number of internships and co-op placements.
- C. Number of industry-sponsored CPT positions.
- D. Number of multi-institutional proposal initiatives.



GOAL 4: Diversity, Equity & Inclusion (DEI) - Commit to DEI as a fundamental value of the department

Strategy 1: The ME Department is strengthened and enriched by our diversity in the broadest sense of the word. We are committed to fostering an environment that enables all students, faculty, and staff to thrive. By creating a more diverse, equitable, and inclusive culture and valuing our differences, the department will enhance its impact and influence on the university. Integrate diversity, equity, and inclusion principles throughout all elements of our programs, operations, and decision-making. Seek opportunities to support Institute-wide initiatives to enhance diversity, equity, equity, and inclusion on campus.

- A. Commit to the full participation of faculty and staff in DEI training provided by the Institute.
- B. Follow DEI best practices during faculty and staff hiring to ensure the broadest possible candidate pool and fairest selection process.
- C. Utilize DEI best practices when evaluating candidates for promotion and advancement.
- D. Communicate and reiterate DEI goals and values to students, faculty, and staff in the department.
- E. Build community among faculty within the department to encourage research collaborations, sharing best practices in and out of the classroom.
- F. Commit to support faculty and student groups who are pursuing K12 outreach activities seeking to broaden the pool of underrepresented minority students seeking STEM degrees.
- G. Promote and share the success stories of our students from underrepresented populations in STEM as an inspiration for the next generation of STEM students.

- A. Percentage of women and URM in ME student populations.
- B. Percentage of women and URM in ME faculty ranks and staff positions.
- C. Number of women and URM students doing research.
- D. Retention of women and URM students, faculty, and staff.
- E. Number of awards and grants received by women and URM faculty.
- F. Student satisfaction/course evaluation survey results.
- G. Increase in Outreach activities by ME faculty.
- H. Level of participation in DEI training by students, faculty, and staff.



GOAL 5: Research Impact - Build a growing, high-impact research enterprise

The Mechanical Engineering department has been at the forefront of innovation in engineering the tools of scientific discovery while supporting interdisciplinary research and development with a focus on robotics and autonomous systems, wearable rehabilitation devices, micro/nanotechnology, product design and manufacturing, additive manufacturing, biomechanical engineering, hypersonic flows, computational fluid mechanics, and energy and sustainability. As part of this strategic plan we seek to further enhance the impact and national and international reputation of the research contributions of our department.

Strategy 1: Establish high impact ME research clusters and interface with existing research groups.

- A. Focus clusters along the lines of grand challenges and high-impact research areas.
- B. Pursue large-scale funding opportunities for these clusters.
- C. Facilitate junior faculty engagement within a cluster to pursue large-scale opportunities.
- D. Promote high-impact publications.
- E. Support these clusters through new faculty hiring along with their strategic goals.
- F. Conduct a periodic assessment of these clusters and their impact.

Strategy 2: Promote these clusters to internal and external constituencies.

- A. Promote cluster interactions within the department, across the Institute, and with industry and government to pursue high-return opportunities.
- B. Review and update cluster activities on the department website.
- C. Develop marketing materials for each cluster.
- D. Publicize cluster accomplishments periodically (newsletter, social media, etc.)

- A. Number of proposals submitted annually.
- B. Annual amount for external grants and research expenditures.
- C. Number of PhD students graduated annually.
- D. Total number of annual, peer-reviewed publications.
- E. Number of high-impact publications.



GOAL 6: Research Impact - Build a growing, high-impact research enterprise

Faculty mentoring is critical for promoting faculty development, success, and retention. Mentors assume responsibility for facilitating and advising the professional development of their mentees by providing information, advice, guidance, encouragement, and connections to other colleagues and professional networks.

Strategy 1: Facilitate mentoring and development of ME junior faculty.

- A. Formalize a department-wide faculty mentoring scheme to facilitate junior faculty career advancement.
- B. Implement a support structure and provide resources for junior faculty mentoring and development.
- C. Provide mentoring for junior faculty in pursuing early-stage research opportunities (e.g. Career, ERI, PYI, ...).
- D. Promote faculty participation in Institute level professional development opportunities.
- E. Support faculty to develop teaching innovations and improve their classroom effectiveness.

Strategy 2: Promote faculty collaboration, interactions, and collegiality.

- A. Facilitate junior-senior faculty collaborations and exchange.
- B. Enable resource sharing among faculty within the department.
- C. Organize internal seminars and promote informal interactions among faculty members sharing common interests, activities, and accomplishments.

- A. Number of faculty receiving early-career research awards (CAREER, YIP, etc.).
- B. Percentage of faculty obtaining tenure and promotion.
- C. Faculty teaching evaluation and effectiveness data.
- D. Number of faculty receiving teaching, research, and service awards.
- E. Number of faculty with Fellow standing in professional societies.
- F. Number of junior-senior faculty collaborative proposals.





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