PENNSTATE

College of Engineering

Department of Engineering Science and Mechanics

2014-2019 STRATEGY

PREAMBLE

The Department of Engineering Science and Mechanics (ESM) in the Penn State College of Engineering is a leading department in interdisciplinary and multidisciplinary learning, discovery and engagement. ESM is recognized internationally not only for its excellence in academic programs, research enterprise, and service to the global community, but also for fostering innovations, new technologies and business enterprises. ESM faculty members currently lead/co-lead nine research centers on topics that include: nanotechnology applications, education and career knowledge; neural engineering; composites manufacturing; innovative sintered products; laser-materials interactions; nano-characterization; dielectrics and piezoelectrics; and microwave processing and engineering. Nine business ventures related to these topics have been established by ESM faculty and students.

Honors quality is the hallmark of the engineering science undergraduate degree program, which has been the honors program for the College of Engineering since 1956. Approximately 140 undergraduates and 130 graduate students are supported by faculty whose research expenditures have ranged from ~$10,000,000 to $12,119,147 over the last five years. ESM comprises 29 tenured/tenure-track faculty, two fixed-term graduate faculty, eight affiliated graduate faculty, and 15 staff. The full professors hold one department head chair, five named chairs/professorships, two distinguished professorships, and two faculty held named development assistant professorships. Sixteen faculty members are recognized as 33 Fellows in 19 professional societies. One faculty member is a Jefferson Fellow with the U. S. Department of State.

The strategic initiatives adopted in ESM's 2014-2019 Strategic Plan emphasize honors education; preparation of students who will be World Class Engineers; development of leaders, entrepreneurs, and the workforce-of-the-future; while placing a high priority on education and research that addresses the challenges facing our complex global society. The plan was prepared with input from ESM faculty, students, staff; the ESM Industrial and Professional Advisory Council; and the Penn State Engineering Science and Mechanics Alumni Society. Strategic initiatives are aligned with those of the College and University, and with state, national and global priorities in engineering and science. The plan is an evolving document that will be reviewed and updated annually in accordance with ESM's evaluation and assessment plans for ABET.

VALUES

The Department values and nurtures visionary leaders; futuristic and out-of-the box thinkers; those who develop the theoretical foundations for future technologies; innovative individuals who spin-out businesses, develop translational and bench-to-bedside technologies; and those with the creative inspiration, drive, innovation, and professional acumen to bring theory to practice for the benefit of humankind.

We support accomplishments and foster integrity, ethical behavior, creativity, innovation, intellectual germination, professional development, sterling character, and leadership.

Excellence
We pursue excellence in all endeavors and maintain the highest technical and professional standards. We expect, value, and recognize excellence from all our constituencies - students, faculty, staff, alumni, and professional colleagues.

Innovation
We seek to innovate at the intersection of disciplines to spin out new research fields, educational paradigms, intellectual property, industrial collaborations, and technologies that position ESM as a leader in the global engineering and scientific communities.

Professionalism
We conduct our activities in a professional, safe, and collegial manner. We adopt the professional standards of the multiple disciplines and societies across which we interact.

Ethics
At the core of ESM values is the integration of ethical conduct and sound judgment in all facets of our activities and professional interactions.

Collaboration
We will continue to be an inherently interdisciplinary and multidisciplinary department that pioneers innovation across the disciplines and professions.

Diversity
We seek to provide a welcoming and respectful climate for a diverse community of students, faculty, staff, alumni, professional colleagues, and the public.

Sustainability
We emphasize sustainable practices that will address global challenges and improve human health, environmental quality, and energy, civil, and healthcare infrastructures.

VISION

The Department of Engineering Science and Mechanics will be a nationally and internationally renowned Department that is recognized for its interdisciplinary excellence and scientific variety of accomplishments in research and education. ESM will spearhead developments in the engineering sciences by fostering discoveries, innovations, new technologies, and business enterprises.

MISSION

To develop a holistic approach for forming national and international leaders of engineering, academia, industry, politics, governments, the professions (including business, law, and medicine), and public service; and to apply a solid foundation in scientific and engineering principles in order to impact the well-being of the global society and its environment.

STRATEGIC OBJECTIVES

Education

Enhance honors, graduate, and workforce education through new resident, distance, online and World Campus programs; develop academic programs in emerging interdisciplinary areas to attract a diverse, global, body of students from industry, government, and academe; and provide leadership development, entrepreneurial, and hands-on learning experiences.

Research

Innovate at the intersection of disciplines to spin out new knowledge, research fields, and technologies that benefit our global society. Foster innovation, intellectual property development, industrial collaboration, entrepreneurship, start-up companies, and global business enterprises.

Service

Develop leaders of academia, industry, the professions, and government for our local communities, the Commonwealth, our nation, and the global society. Create futuristic thinkers who can identify, develop, and bring to fruition new pedagogies and technologies that gain the support of our politicians, corporations, philanthropists, think-tanks, and humanitarian agencies for the benefit of humankind.

Institutional Governance

Evaluate existing and create new governance models in collaboration with the Departments, College and University that support leadership growth within the respective units, promote financial stability, enhance revenue generation, facilitate innovation within each unit, engage our respective communities, recognize and advance staff, and support creative endeavors with evenly distributed risk.

STRATEGIC GOALS

In Education

Strategic goals in education include: i) expanding the education, outreach, and workforce development programs of the National Science Foundation Advanced Technology Education (NSF ATE) National Center for Nanotechnology Applications and Career Knowledge (NACK), housed in Penn State's Center for Nanotechnology Education and Utilization (CNEU), into additional states in the U.S., to historically black colleges and universities, to minority-serving institutions, to returning veterans, and to an increasingly diverse community; ii) developing new one-year, resident, non-thesis, M.S. degrees in multiple interdisciplinary topics, in collaboration with other units; iii) Identifying and marketing undergraduate and graduate certificates/minors for resident and World Campus education; iv) increasing professional, leadership and entrepreneurial opportunities for students and the workforce; and v) enhancing the national and international recognition and ranking of the ESM undergraduate honors degree program.

These goals will be achieved by taking the following actions:

1. Submission of an NSF ATE NACK renewal proposal in 2015, creating nano-education hubs in additional States, and developing World Campus versions of the 6 undergraduate capstone courses with an equivalent graduate course sequence.
2. Repackaging existing courses and developing new graduate courses, as appropriate, for the one-year, resident, non-thesis, M.S. degrees.
3. Submitting proposals to create new undergraduate and graduate certificate programs and minors.
4. Marketing and recruiting a cohort of students for the new Joint M.D./Ph.D. in Engineering Science and Mechanics degree; offering a short course in Corrosion and developing workshops/short courses.
5. Communicating and marketing the value of the ESM honors program to enhance its visibility, recognition, ranking, and student recruitment.

In Research

Strategic goals in research include: i) enhancing the safety of the nation's energy, civil, transportation, and medical infrastructures; ii) engineering solutions for human health through innovations at the intersections of materials engineering, mechanics, the life sciences, and medicine. (Special emphases include the brain, neural engineering, imaging, genome of materials, biomedical devices, and bio-inspired materials); iii) developing ESM's multiple manufacturing activities in support of university, state and national initiatives in advanced manufacturing. ESM's manufacturing-related activities include: additive manufacturing, novel powders and sintered components, novel materials, composite manufacturing technology, laser-based manufacturing, nanomanufacturing, smart textile-based manufacturing, micro- and nano-electro-mechanical device production, and biomedical device fabrication; iv) contributing to the National Nanotechnology and Photonics Initiatives (NNI/NPI); and v) participating in a University-wide thrust in engineering systems; and vi) fostering innovation, intellectual property development, and start-up companies.

These goals will be achieved by taking the following actions:

6. Recruiting faculty in strategic research areas to increase ESM's tenured/ tenure-track faculty to 35.
7. Collaborating with the College and University to support ESM's faculty and 8 research centers in their development of major research proposals.
8. Building and developing new research facilities to support ESM's research programs.
9. Developing, in collaboration with the College and University, financial support and endowments to attract the top graduate students to our programs.
10. Disseminating our research accomplishments to enhance recruitment of exceptional students.
11. Development of global research partnerships.
12. Infusing innovation, leadership, entrepreneurship, and intellectual property development into both undergraduate and graduate research to facilitate the emergence of new companies and business enterprises.

In Service

Strategic Goals in Service to the technical community and to society aim to: i) develop faculty, student, staff and alumni leadership, recognition, and service internally and in external organizations that serve the professions and society; ii) grow ESM's service mission by encouraging student participation and leadership in internal and external organizations/programs that serve society (e.g. THON, Engineers without Borders); iii) increase industrial collaborations in research centers and programs to promote rapid diffusion and reduced time to market for new technologies and products; iv) foster growth of spin-out companies to generate employment and create economic prosperity in the community, the Commonwealth of Pennsylvania and beyond; and v) promote global educational and research partnerships to enhance recognition of ESM's contributions to innovation, economic prosperity, and social responsibility across the globe.

The following actions promote the accomplishment of our service strategic goals:

13. Nomination of ESM members for professional recognition, leadership opportunities, and service to the engineering professions at all levels in the Commonwealth, nation and global community.
14. Encourage students to take the Engineer in Training examination and become professional engineers.
15. Promote industrial collaborations to enhance the transitions: research > prototype > products > scale-up/manufacturing. (e.g. novel bench to bedside technologies).
16. Collaborate with University, Commonwealth and alumni partners to guide intellectual property development and the growth of new business enterprises.
17. Develop memoranda of understanding with global University and industry partners (as appropriate) to facilitate knowledge and technology transfer across the globe.

In Governance

Strategic goals in institutional governance aim to: i) review College and Departmental governance structures to enhance shared governance; ii) review a new University/College budget model with faculty incentives for revenue-generation; iii) enhance operational efficiency and agility; iv) provide opportunities for staff advancement, and recruit staff to support new initiatives; and v) invest in community building among the students, staff, faculty, and alumni.

These goals will be achieved by taking the following actions:

18. Establish a department head/associate head model for administrative back-up.
19. Implement a budget projection and forecasting model that supports revenue generation.
20. Increase operational efficiency, agility, and conserve resources through sustainable practices.
21. Create staff advancement opportunities and appoint additional staff for new initiatives.
22. Build our community through social, faculty/staff, alumni, industry, and development events.

The above 22 actions for advancing the Department in education, research, governance, and service form the basis of the implementation plan that will be developed in the next phase of strategic planning.