College of Engineering

2022 Self-Study

IOWA



CONTENTS

Introduction	3
About the College of Engineering	3
Self-Study Charge	5
Charge 1: Develop and refine value proposition(s) on the undergraduate program	s in
the context of the market and competition to enhance recruitment and increase	
enrollment	6
The Value of an Engineering Education	6
Efforts to Increase Undergraduate Enrollment	8
Collegiate Resources, Facilities, and Initiatives	17
Emerging Opportunities	20
Charge 2: Increase graduate enrollment through targeted student recruitment	22
Current Graduate Enrollment	22
New Recruitment Efforts	23
Graduate Student Support	24
Charge 3: Increase grant submissions and faculty/staff salary recovery from gran	ıts . 28
Current Proposal Award Rates	28
Research Support	29
Faculty Mentoring & Recognition	30
Charge 4: Develop a plan for collegiate resource management	31
Indirect Cost Recovery	31
Enrollment Management	32
Faculty Recruitment	37
Faculty Retention	39
Staff Workforce Planning	40



Introduction

About the College of Engineering

Our Mission

To build an inclusive, diverse, and responsible community recognized for:

- providing an accessible, modern education in engineering and science for future, interdisciplinary leaders;
- advancing knowledge through fundamental and applied research; and
- facilitating life-long learning and economic development.

Our Vision

The College of Engineering at the University of Iowa is driven by talented faculty, staff, and students who are producing knowledge to address grand challenges around advanced technologies, health sciences, sustainability, energy, and the environment. Our graduates are ethical, globally-aware citizens whose work while at the University of Iowa and throughout their careers make the world safer and our use of resources more efficient. As a center of innovation and discovery, the people who make up the College of Engineering are undoubtedly improving quality of life for our Iowa community as well as for people across the United States and around the world.

Defining characteristics/aspirations

- Atmosphere that values diversity and community partnerships
- Global awareness, communication skills, and team building
- Internationally recognized research programs
- Resource management
- Interdisciplinary engineering research
- Leadership and service

Academic Departments & Research Profile

There are six academic departments within COE, including:

- 1. Roy J. Carver Department of Biomedical Engineering (BME)
- 2. Chemical & Biochemical Engineering (CBE)
- 3. Civil & Environmental Engineering (CEE)
- 4. Electrical & Computer Engineering (ECE)
- 5. Industrial & Systems Engineering (ISE)
- 6. Mechanical Engineering (ME)

College of Engineering 2022 Self-Study



The University of Iowa is proud to be categorized as a R1: Research University (Highest research activity) in the Carnegie Classification of Institutions of Higher Education. The College of Engineering (CoE) is a major contributor to the metrics required of institutions in this category, including faculty-led research funded by competitive external sources, competitive and selective undergraduate programs, and an active and well-supported doctoral program based on research training.

The College of Engineering is a vital and major contributor to the research success necessary for the university's long-term membership in national associations of similar institutions, including the Big10 Conference and the Association of American Universities (AAU). In addition to numerous active research laboratories led by individual faculty, College of Engineering faculty also lead many collaborative research centers and endeavors which extend across campus, including:

- IIHR Hydroscience and Engineering
- Iowa Technology Institute (ITI)
- National Advanced Driving Simulator (NADS)
- Iowa Superfund Research Program (ISRP)
- Center for Global and Regional Environmental Research (CGRER)
- Center for Bioinformatics and Computational Biology (CBCB)
- Center for Health Effects of Environmental Contamination (CHEEC)
- Iowa Institute for Biomedical Imaging (IIBI)
- Iowa Initiative for Artificial Intelligence (IIAI)

Research in the College is motivated by the college's commitment to advance engineering innovation <u>in</u> three areas of strategic focus: Engineering for Human Health, Engineering in the Environment, and Engineering for Emerging Technologies. The research productivity of our faculty is outstanding based on measures such as archival journal publications (an average of 6 per faculty member per year) and research expenditures (an average of ~\$450k per faculty member per year). College of Engineering faculty are among the most active researchers on campus as measured by national and international honors and awards, citations of faculty publications in the peer-reviewed literature, the number of proposals submitted and funded by competitive funding sources, and participation in large interdisciplinary research centers.

In Fall 2017, the college opened a \$37 million Annex, adding an additional 65,000 square feet of space to the College of Engineering, yielding a gross square footage of ~334,000 in the Seamans Center, which houses all six academic departments. The Annex includes expanded educational opportunities and state-of-the-art classrooms, research, and study space.

Highlights of the new annex include:

- a 128-seat, state-of-the-art tiered lecture hall, laptop-enabled with three giant screens;
- a 96-seat, state-of-the-art lecture hall, laptop-enabled with four large screens;
- the Student Development Center, home to the professional academic advisors, global experience, instructional support, professional development, and undergraduate diversity programs;
- the Design Studio, a unique, hands-on "maker" classroom;
- 4,000 square feet of student collaboration space, including more than 200 seats for work groups;



- 234 solar roof panels with the capacity to produce 76,000 kWh of energy per year, cutting back on energy costs;
- 2,200 square feet of bioswales, outdoor plantings that reduce stormwater runoff; and
- 5,000 square feet of green roofing, including numerous native plants.

Self-Study Charge

All programs of study in the College of Engineering undergo a thorough accreditation process by the engineering accrediting body, <u>ABET</u>. ABET accreditation is one of only two accrediting agencies in the US to be ISO 9001:2015 certified, and the ABET accreditation review process occurs on a six-year cycle. ABET evaluates each program within the college, and for each program, the process includes an extensive (>500 page per program) Self-Study Report that includes qualitative and quantitative documentation and assessment of each program's strengths, limitations, and efforts towards continuous improvement.

Because of the extensive ABET accreditation review that recently concluded (Feb 2021 – all programs of study were successfully accredited/renewed), the Provost's Office has requested that a limited-scope review take place, with a focus on the following topics:

- 1. Develop and refine value proposition(s) on the undergraduate programs in the context of the market and competition to enhance recruitment and increase enrollment
- 2. Increase graduate enrollment through targeted student recruitment
- 3. Increase grant submissions and faculty/staff salary recovery from grants
- 4. Develop a plan for collegiate resource management (faculty salary, hiring, enrollment management, indirect cost recovery)



Charge 1: Develop and refine value proposition(s) on the undergraduate programs in the context of the market and competition to enhance recruitment and increase enrollment

The Value of an Engineering Education

The value of an engineering degree and the annual return on investment remains high. For students who graduate on time, <u>reports indicate</u> a bachelor's degree in engineering can produce a net return on investment (ROI) of \$1 million or more, while the median bachelor's degree has a net ROI of \$306,000. The median starting salary for graduates from the UI College of Engineering in 2021 was \$63,000, with 95% of graduates finding employment or enrolling in graduate / professional school within 6 months of graduation. On average, our four- and six-year graduation rates are 40% and 63% (cohorts 2008-2016), respectively. These rates are slightly higher than national benchmarks within colleges of engineering (34% four-year graduation rate and 58% six-year graduation rate), as <u>reported by ASEE</u>. These graduation benchmarks represent students who enter the College of Engineering in their first year (or, for schools without direct admission, express interest in pursuing an engineering degree) and graduate with a degree in engineering in four/six years. These rates do not include students who start in engineering but then graduate with a degree in another discipline.

It is important to recognize that pursuing a degree can also come with economic risks to students, as economic benefit is tied to degree attainment. Thus, to make a compelling case for the value of an engineering degree, attention must be focused on both recruitment as well as retention, with resources devoted to each. In the following sections, we summarize recent efforts to strengthen our value proposition. We also describe strategies that have been implemented since the last review, designed to increase undergraduate enrollment within the college of engineering. These strategies focus not only on recruitment efforts, but on the importance of supporting student success and retention.

Why Choose Engineering at the University of Iowa?

As a small college of engineering located on a vibrant liberal arts campus, we are in a position to offer students educational experiences beyond their technical studies. In addition to gaining the technical skills required of an engineer, our students become leaders with the highest ethical standards, capable of working both independently and collaboratively on teams to drive innovation.

As a part of our efforts to refine how we communicate to prospective students, we recently surveyed all first-year engineering students in the *Engineering Success for First-Year Students* seminar course (Fall 2021 and Fall 2022 cohorts). One goal was to understand why students chose to pursue a degree in engineering and why they chose to do so at The University of Iowa. Below are the top 5 responses to each question.



Reasons our students chose to pursue an engineering degree	Reasons students chose to pursue their engineering degree at the University of Iowa
Societal impact - make a difference/change the world	Cost
Technical and scientific curiosity	Location
Financial security	IOWA / Being a Hawkeye
Opportunity for a rewarding career	Small College at a Big Ten institution
Enjoy math and science	Reputation of the College

Our marketing and communications team has now begun to promote the benefits of our size, our Big Ten affiliation, and the fact that we are one of only 12 engineering schools in the country with colleges of medicine, nursing, public health, pharmacy, and dentistry all on the same campus—a clear asset of an engineering college that is a part of a comprehensive R1 university.

Furthermore, we are beginning to emphasize the fact that our students are able to declare their engineering major of choice immediately upon enrollment, and our program enrollments are never capped. This differentiates us from the majority of engineering colleges, and helps eliminate some of the "competitive" mindset that many first-year engineering students face. Our college's common first-year curriculum allows students the flexibility to change (or declare) their engineering major any time within the first year, without delaying time to graduation.

Our college's emphasis on communication has been cited by industry as setting our students apart from most engineering students. Many employers note our students' technical writing ability and their ability to communicate to a variety of audiences as strengths of our graduates. Students make use of the **Hanson Center for Communication** (described on p. 20) for guidance and communication strategies, and many courses within the college emphasize communication in its many forms.

Training Engineers... and Something More

In the College of Engineering, we encourage our students to pursue their interests and passions beyond just the technical competencies – to take advantage of everything a B1G University has to offer. While engineering disciplines are often portrayed as solely technical pursuits, the goal of engineering is to advance technology that can have a positive impact on society, the environment, and the world. We commonly describe our college as training *Engineers and Something More*, to recognize the important connection between societal and technical challenges and impacts. Students have the opportunity – and are encouraged – to pursue additional interests, which may include studying abroad, earning a minor,



certificate, or dual major, or participating in our Grand Challenge Scholars program. That "something more" may also take the form of a student athlete, leadership in a student organization, or participating as a member of the Hawkeye marching band – or a variety of other engagement and enrichment opportunities.

To support students becoming an *Engineer and Something More*, the UI CoE Curriculum offers more flexibility than many colleges of engineering across the country. For example, all degree programs can accommodate the addition of a minor without additional time to degree. Similarly, there are many opportunities for students to study abroad during a semester or summer program, or participate in a summer internship, without additional time to degree.

Another aspect of students' identity as an *Engineer and Something More* is the emphasis on the value of liberal arts and creative pursuits. Students in CoE draw upon the educational strengths of other colleges across our comprehensive campus, to develop their skills and knowledge in entrepreneurship, communication, leadership, teamwork, global awareness, creativity, and cultural appreciation. Engineering students' General Education requirements include courses that emphasize opportunities to "Be Creative" and to appreciate the importance of Diversity, Equity, and Inclusion.

The motto and ethos to *Become an Engineer and Something More* continues to resonate with our students as well as alumni. Its use in marketing and recruiting materials, however, has been intentionally limited because visually, the *Something More* often portrays students' participation in extracurricular activities such as athletics or the marching band, as these activities are readily photographed and recognized. The broader impacts of the opportunities and full meaning of the ethos are often appreciated more once a student has matriculated or following graduation.

Leaders from across the college recently revisited the *Become an Engineer and Something More* tagline, dedicating considerable time at our Fall 2021 EAC retreat to discussing this idea and what it now means. We similarly consulted our collegiate Engineering Advisory Board (comprised of engineers in the industry) to understand whether this message continues to resonate with alumni and industry leaders. The consensus from these discussions was that this is an important identity of the college, but that we should continue to expand the "something more" beyond opportunities to pursue a sport or get a minor, and further emphasize the ways that this materializes within our classrooms and in the way our students' engage in research, student organizations, and volunteer activities.

Efforts to Increase Undergraduate Enrollment

Recruitment

Revisions to Undergraduate Admissions Criteria

Prior to the university moving to test-optional admissions, in Fall 2019 the College of Engineering eliminated the minimum ACT requirement (i.e., 25) and instead used the <u>RAI calculation</u> in an effort to account for the known biases associated with standardized tests against students of color. Since the RAI



calculation also considers the HS GPA and number of courses in the core subject areas, these factors can counterbalance a less-than-optimal ACT score. The minimum RAI and GPA requirements are 265 and 3.33, respectively.

However, the university changed to test-optional admissions the following fall, and as such, we were unable to assess the impact of eliminating the minimum ACT requirement. Moving forward, we will continue to work with the UI Office of Admissions to examine the longer-term impacts of going test-optional and, if necessary, will modify the admissions criteria and /or the application review process.

Beginning in Fall 2019, students not directly admitted to the College of Engineering, but enrolled in another UI college, can elect to be designated as 'Engineering Interest' in MAUI. This has proven helpful by aiding advisors in the university's Academic Advising Center (AAC) and providing the eSST the opportunity to invite these students to collegiate events (i.e., to learn more about the engineering disciplines / departments, etc.).

Transfer Articulation Agreements

In Spring 2021, the University of Iowa and Kirkwood Community College (KCC) entered a new articulation agreement, expressing a shared commitment to increasing opportunities for student access to - and success in - higher education. By clarifying the transfer policies and procedures (which assure articulation between programs) the institutions seek to assist students in making a seamless transfer from the associate to the baccalaureate degree; specifically, the agreement provides students who have earned an Associate Applied Science in Computer Science degree the opportunity to complete a Bachelor of Science in Engineering in Computer Science and Engineering from the UI. This agreement is unique in that collegiate faculty (from ECE) and staff will advise students throughout their study at KCC and at UI when KCC students attend the College of Engineering's Spring Career Fair. Faculty will continue providing support (advising and tutoring) to these transfer students after enrolling at the UI. Two additional agreements are in preparation, one in electrical engineering (also in ECE) and another in construction management (tied with CEE).

The Addition of Two New Undergraduate Programs

Within the Engineering discipline, the creation of a new degree-granting program is an especially significant undertaking as each program that a department offers requires separate ABET accreditation. As such, the college is limited in the ways it can target strategic enrollment initiatives in response to changing student interests or current trends. While changes in marketing and messaging can be made, the process of developing and offering a new ABET-accredited major takes 8 years of planning, and thus departments carefully consider long-term expectations of student interest before developing new programs.

Since the last self-study, in response to growing interest, we've introduced two new programs within the college: Computer Science and Engineering (CSE) in the Department of Electrical and Computer Engineering (ECE) and Environmental Engineering (EnvE) in the Department of Civil and Environmental



Engineering (CEE). Each program was successfully accredited during our recent <u>ABET accreditation</u> review (AY2020-2021).

Computer Science and Engineering (CSE)

The CSE program admitted its first cohort of new first-year students in Fall 2016. To date, a total of 193 CSE degrees have been awarded (including students who transferred into the program or changed their major to CSE as early as 2016). Program enrollment escalated rapidly from 14 students in 2016 to 285 in fall 2019. Today, CSE is the third largest program in the college behind the Mechanical and Biomedical Engineering programs. While the program is administratively housed in ECE, it functions as a collaborative relationship between ECE and the Department of Computer Science (CS) in the College of Liberal Arts and Sciences (CLAS). The ECE and CS faculty collaborate to not only deliver the courses, but also to guide curriculum development, assess outcomes, and ensure continuous improvement.

Environmental Engineering (EnvE)

The EnvE undergraduate program admitted its first cohort of new first-year students in 2017. Program enrollment grew from 3 students to over 50 in the first three years. To date, 31 EnvE degrees have been conferred. The program is the first environmental engineering program in Iowa and was created to build on the success and strong reputation of CEE's graduate program in environmental engineering. In 2015, the CEE Advisory Board encouraged the development of an undergraduate program, aligning with the rapid growth of job opportunities in this field.

Marketing & Communications Efforts

The college has expanded and enhanced its student recruitment marketing across our print, social, and digital media platforms.

Specifically, we have revised our <u>college viewbook</u> – sometimes called a lookbook – to be better aligned with best practices for these publications. The viewbook features large, vibrant-color imagery combined with short text blurbs that offer prospective students and their families key takeaways about the curricular and co-curricular offerings in the college. This print piece is provided to visiting students and families as well as shared online with audiences who cannot come to campus. It is designed to be consumed quickly and easily, knowing that prospective students receive many similar publications. By focusing on images over text, the vibrancy of the experience in the College of Engineering is better communicated.

We have made a more concerted effort to deploy content on social media channels where we know prospective students are engaged. Our efforts have focused primarily on Instagram where we have grown our followers from around 140 to more than 1800. We now feature more *story*-driven content so that our content more frequently appears in prospective students' feeds. Our content highlights the work of current students – undergraduate researchers, those involved in student orgs, individuals who are studying abroad, etc. – further emphasizing the well-rounded and enriching experience of our students. Among all of our social media channels, Instagram is most directly connected to recruitment efforts.



We are also developing new video content that appeals to prospective students, much of which is featured on social media channels and is inventoried on our YouTube channel. We have developed videos highlighting our student ambassadors, our new leadership academy (LEaPP, described below), and some of the innovative work done by our graduate students. The graduate student videos serve as tools to recruit graduate students as well as to set the example of where our undergraduates can take their education after completing their four-year degree.

All of these strategies reflect our recognition that our marketing to prospective students must be more digital, more social, and more shareable. Although it may take some time before we see these efforts pay off, we will continue to create this type of content since this is – and will remain – the best way to reach our prospective student audience.

Discounting

The total % discount applied to the tuition for engineering students is the highest at the university at 30.7-33.5% over the past five years. While cost was the primary factor for reasons that students chose engineering at Iowa (see Table on p. 7) and the college certainly understands the burden that the cost of education puts on families, we also recognize the need to manage aggressive discounting to drive enrollment. This will require ongoing partnership with the Office of Admissions and Office of the Provost.

Student Success and Retention

Retention and graduation are often the hallmarks of student success. While critical to observe, if we were to measure only retention, we would miss the opportunity to examine whether our efforts to support student success are working, or course-correct if necessary. To this end, we are adopting a proactive, datadriven approach. In an effort to determine when - and why - a student may veer off a path leading to degree completion, the engineering student success team (eSST- described in more detail below) monitors (and/or has plans to monitor) the following aspects of student success, and intervene via targeted outreach when necessary:

- Academic standing;
- Mid-term low grade notices;
- Completion / grades in gateway courses;
- Credit accumulation;
- Full time continuous enrollment vs. semesters withdrawn;
- Timely registration;
- Participation in advising appointments; and
- If/why a student drops a foundational course; namely, the foundational math and science courses that serve as pre-requisites for many engineering courses.

We are committed to disaggregating the data so that differences between subgroups can be identified and addressed accordingly. For example, we plan to examine whether differences exist between

IOWA

traditional, transfer, first-generation, and part-time students. We have also begun examining data for racial subgroups, to look for opportunities to better support student persistence.

Engineering Student Success Team (eSST)

The Engineering Student Success Team (eSST) was formed in 2018. It is directed by the Associate Dean for Academic Programs, and comprises professional staff dedicated to supporting all aspects of the student life cycle, from pre-enrollment through graduation and beyond. The team's mission is to inspire, challenge, and empower each of our students to become 'an engineer and something more.' The team serves not only to recruit prospective students, but to establish inclusive partnerships, programs and services, cultivate leadership, and enrich academic and career goals, all toward enhancing student success and advancing the educational experience. Responsibilities of the eSST include, but are not limited to, recruitment and admissions, academic advising and support, study abroad programs, leadership development, and career services.



While the eSST is a newly formed group, it is in part a reorganization of CoE student support staff whose roles included academic advisors, registrar, and professional development staff. Since the last review, there has been considerable turnover in staff, which allowed for some reimagining of the team organization and structure. Following a number of staff departures post-pandemic, we have hired four new staff members into the following roles (Figure 1): Assistant Directors of: Academic Support, Leadership Development, and Outreach & Recruitment, and Assistant Registrar. Each position serves a dual role as a professional academic advisor (see Holistic Advising Approach described below).



Holistic Advising Approach

Collaborative Advising Model

College advising is a critical factor in advancing student success. The College of Engineering recently reimagined its collaborative advising model between professional academic and career advisors, peer advisors, and faculty advisors (Figure 2). This shared model combines the expertise of professional academic and career advisors with the experience of peer students and the knowledge of the faculty to:

- provide informed recommendations for the development of an academic plan that leads to degree completion and toward career goals;
- assist students with course selection and registration;
- facilitate connections to the University community, campus resources, and leadership opportunities;
- identify at risk students and provide early alert retention services;
- and deliver preparatory 'graduation checks' to ensure properly communicated degree expectations.

This is not an exhaustive list. Our goal was to establish an accessible and comprehensive advising process for all College of Engineering students.

Organizational Format

Academic advising has been restructured with shared responsibilities between professional academic advisors and faculty advisors within three stages: (1) prospective students (orientation); (2) first-year students; and (3) students in second year through graduation. All incoming students are advised at orientation and during their first semester by a professional advisor. The professional advisors are each assigned to a specific program (or programs), allowing them to work closely with faculty (and the peer advisor(s)) from the respective department(s). During the second semester, students who have declared an engineering major are matched with a faculty advisor, while those students who remain undeclared continue to be advised by their professional academic advisor. An important change to note, is that even after a student has transitioned to a faculty advisor (who will serve as the principal advisor), their professional advisor remains listed in the system as an 'additional advisor,' available to help answer questions and serve as an additional resource for the student.

This change, introduced in Fall 2021, comes after several years of our previous advising model, where, during their third semester, students transitioned from only a professional advisor their first year, to only a faculty advisor. This model left students in limbo during that third semester; in most cases, students hadn't yet met their faculty advisor until their first advising appointment (one-to-two weeks prior to early registration). This meant that students needing advising assistance earlier in the semester needed to reach out to a faculty member they were not yet familiar with, and many found this a challenging transition after working with the professional advising staff in their first year. Moreover, in this model, the professional advisors were often viewed as "first-year advisors" and not as an additional resource for the students beyond year-one. Consequently, the majority of questions from students in year-two and beyond (i.e., namely, registration procedures and deadlines,

College of Engineering 2022 Self-Study

IOWA

graduation requirements, and other collegiate policies and procedures) that came into the student development center, fell on a single staff member to answer - an unsustainable model.

Additional efforts are underway to provide opportunities for students to learn more about the various

engineering disciplines, in an effort to ensure that students who enter without declaring a major, or transfer in from another college or institution, have ample opportunity to learn more and become engaged with the college early.

With this improved, collaborative model, we have made an intentional effort to shift advising from a traditional. reactive role, where advisors respond as problems arise, to a more proactive role, using data as described above to intervene early when students may be having trouble. Additionally, in Spring 2022, the college developed and shared Advising Best Practices documents with faculty, staff, and students. These documents help ensure that students get the most out of their advising relationships.



New Mentoring Programs

Society of Women Engineers (SWE) Mentors

In Fall 2020, the Society of Women Engineers (SWE) organization expanded their existing mentoring program to include first-year engineering students who identify as female. SWE's mentoring program now pairs interested first-year students with a current (2nd, 3rd, or 4th-year) female engineering student. The first year, 48 incoming students signed up for the mentorship program, with similar numbers the following year.

Engineering Graduates of the Last Decade (eGOLD) Mentors

Our eGOLD Board mentorship program, launched in 2020, has matched 400 engineering students with alums working in industry. Driven by best practices, and to support our students from underrepresented and marginalized groups, our goal for this program is to pair mentors and mentees not based solely on major and/or career interest, but to also include preferences for a pairing based on shared identities (i.e., race, gender, LGBTQ+ identity, etc.). This practice approach emerged from



a recommendation from a listening session with students. We continue to assess the efficacy of this program and make improvements accordingly.

Academic Support Services

Tutoring

The College of Engineering provides free evening tutoring (Sunday – Thursday, 6:00 – 9:00 pm) to supplement the foundational first-year courses (MATH, CHEM, PHYS, & ENGR), as well as some second year ENGR core courses. Engineering Tutoring is staffed by undergraduate students who have demonstrated proficiency in the course(s) they tutor. The tutoring sessions do not require an appointment, rather they are on demand / drop-in. Students are encouraged to use tutoring early and often. Since fall 2018, to ensure all students are aware of the resource, we have made it a requirement for students to visit a tutoring session at least once, as part of the first-year Engineering Success course - ENGR:1000. Students are free to come and go throughout the evening sessions, collaborate with peers, and ask questions of the tutors. Students utilize the service to catch up or get ahead, complete homework, and/or study for a test.

In addition to the in-person tutoring services, the tutors have recorded video reviews for the courses covered by tutoring. Pre-pandemic, we set up an in-house one-button studio for recording problem solutions in an effort to create a video library for each of our introductory courses. Our goal was to provide an additional resource for students, one that could be accessed at any time. Unexpectedly, the pandemic sped up these efforts. Unfortunately, the quality of the videos is not as high as we would have liked. Nevertheless, they provide an added resource as we work to improve upon them. This fall we will be creating a series of new videos for our Introduction to Engineering Problem Solving course (ENGR:1100), taken by nearly all first-semester engineering students.

Supplemental Instruction (SI) - Statics

During the 2021-2022 academic year, we introduced SI to our ENGR:2110 Statics course, with the intention to expand to other courses in the future. While the number of students who have participated to date has been low, we hope that it becomes a valuable tool for our students moving forward.

Study Tables

This fall we plan to add "study tables" to our array of academic services. Our goal is to supplement the tutoring and SI programs by offering peer-led, group study tables for historically challenging first-year courses. Long-term, our goal is to establish study tables for each course in the engineering core curriculum, starting with the first-year courses. Perhaps even more important than the additional form of academic support, study tables hold the potential for first-year students to meet other engineering students who are enrolled in the same (typically large) first-year courses across campus (i.e., first-year courses offered by MATH, CHEM, PHYS, BIOL). With these large courses offered in numerous departments and buildings, the goal with these "study tables" is to build community among engineering students, and to form cohorts of students that will continue to meet as groups and support one another throughout their undergraduate studies.

IOWA

Faculty Engagement in Recruitment and Retention / Persistence

Achieving our student recruitment and retention goals continues to be a team effort. While members of the staff (eSST) lead our collegiate recruitment efforts, they work in collaboration with engineering faculty and staff colleagues and university partners across campus.

Faculty have historically participated in our recruitment efforts by serving on faculty panels during Explore Engineering Days (E-Days) and Hawkeye Visit days. Faculty impact student retention/persistence in many ways - by cultivating inclusive classrooms, offering advice and mentorship to students during advising sessions, and by showing care, concern, and commitment to students in all their interactions.

In Fall 2021, in an effort to broaden faculty involvement, the dean charged two subcommittees / teams with identifying strategies for enhancing faculty engagement in (1) recruitment and (2) retention and persistence. Team leads were tasked with building teams of five to seven members. To ensure that a range of perspectives was represented, volunteers from faculty, staff, students, potential partners from other colleges, communications/marketing and central administration/service units were invited to participate and/or consulted during the work of the committees. Each team was charged with refining goals, understanding current challenges and barriers, and developing no more than 3-5 high-level approaches for their respective areas, consistent with the collegiate strategic plan. The teams identified action items, tactics, and success metrics for each respective focus. Moving ahead, the plan is to strategically prioritize the goals from each team, and select 1-2 goals per year to implement, evaluate, and refine.

Curricular Assessment and Changes

During AY2018-2019, the Engineering Faculty Council (EFC) assembled two ad hoc committees to examine the two first-year core engineering courses – Introduction to Engineering Problem Solving (IEPS - ENGR:1100) and Introduction to Engineering Computing (IEC - ENGR:1300). Both IEPS and IEC are handson by nature, and foundational for future engineering coursework. Moreover, they play an important role in first-year student retention. These two courses, coupled with the Engineering Success for First-Year Students seminar (ENGR:1000), are often the only engineering courses taken during a student's first year; the remaining first-year curriculum consists of courses in mathematics, chemistry, physics, rhetoric, and possibly a general education course, all offered outside of the college. Historically, IEPS has been an important course for first-year engineering students - most notably, the smaller, "project" sections. In addition to providing students with fundamental problem-solving techniques, other goals of the course include, but are not limited to, creating excitement about the profession, boosting confidence, and teaching/encouraging teamwork.

Because these courses serve as most students' first exposure to engineering and the college, we devote considerable resources to them. For example, IEPS is a 3sh course consisting of both a lecture and a faculty-directed project / activity component. The lecture meets twice weekly for 11 weeks. This fall, two faculty members each teach two lecture sections (enrollments: 126, 122, 130, and 89). Additionally, sixteen project sections, also led by faculty, will meet throughout the entire semester. Each of the eight



faculty members assigned to teach the project sections are assigned to two coordinated sections. Scheduling is such that each ~30 student section meets individually for one hour per week as well as for an additional hour jointly with the other section taught by the same instructor on an "as needed" basis. The faculty-directed activities and projects focus on introducing the student to the application of a structured engineering design problem solving process while working in teams on open-ended problems. This course also includes a writing assignment. Students are presented with an ethical dilemma and instructed to write both an objective and persuasive summary, with an emphasis on communicating with different audiences. Prior to submitting their work, students are required to schedule a meeting with the Hanson Center for Communication (described on p. 18) to receive feedback on their writing.

For the first time in twenty years, our undergraduate core curriculum (i.e., the courses that *all* engineering students take, regardless of major) was reviewed and revised, with changes implemented in Fall 2021. The review process included a 6-person task force (appointed by the Associate Dean for Academic Programs and consisting of 4 tenured/TT and 2 instructional track faculty, with representation from each department). Input was collected from faculty at departmental meetings, through surveys of faculty, by speaking with students, collecting input from advisory boards, etc. The committee's recommendations were reviewed, discussed, and approved by the engineering faculty at the Fall 2020 CoE Faculty Meeting. As a result of the committee's recommendations, the number of core engineering courses required for all students (regardless of program/major) was reduced, thus reducing the number of semesters "in common" for all engineering students from 3 to 2 semesters. These changes allowed program-specific courses (often foundational courses) to replace the vacated core requirements. Associated documentation has been revised, students have been advised, and the degree audits and UI general catalog updated accordingly.

Collegiate Resources, Facilities, and Initiatives

Prospective students recognize the importance of access to resources and facilities. Below, we highlight some of the valuable resources our students take advantage of, which we believe impact both recruitment and student success efforts in the COE.

Engineering Machine Shop (EMS)

The EMS redefines the concept of an educational machine shop by providing the Engineering College with state-of-the-art manufacturing equipment, software, and services. These include computer-controlled milling; computer-controlled abrasive water jet cutting; three-dimensional scanning and printing as well as traditional manufacturing equipment. The EMS contains lathes, mills, bandsaws, and many hand tools with which to work many types of materials, including plastics, fiberglass, and metals. The shop acts an instructional classroom for design related projects in courses ranging from the first-year Introduction to Engineering Problem Solving course to the Senior Design Capstone courses. The Machine Shop provides for direct student access to the facility following certification.



Lichtenberger Engineering Library

In 2016, the Engineering Library reimagined itself as a creative space for students. Rather than as simply a storage space for books, the library has been redesigned to be a place for students to imagine, tinker, explore, brainstorm, and create. The space focuses on 3D modeling as well as virtual and augmented reality.

A new addition to the library is a Tool Library. Since 2016, the number of tools available for check out has increased from 35 to 275, and many students, faculty, and staff take advantage of this unique resource for class projects, capstone design classes, research projects, and hobby activities. Example tools include: infrared cameras; basic hand tools; LabQuest measuring equipment; laptops and iPads, and tools/equipment are updated regularly.

During the pandemic, the library assisted in assembling and distributing laboratory kits and laptop computers for engineering courses/students. The librarians are a vital resource and support the college's mission and strategic goals in a variety of ways, including through education and support on Patents and

The staff of the Lichtenberger Engineering " Library have re-imagined the role of the library for engineering students in a digital age. In addition to traditional roles such as maintaining collections and assisting students in finding research sources, the library is providing new resources that support student learning and exploration. Examples include a tool library, workshops taught by the Engineering Electronic Shop, distribution of home lab kits for courses. creative spaces, and a science fiction movie series. These resources provide students with excellent opportunities to deepen their knowledge, gain practical skills, and pursue creative projects."

Standards, offering Creative Kick-Start Funding opportunities, and Learn & Create workshops.

Hanson Center for Communication (HCC)

The HCC is a unique facility first launched in Fall 2001 (called the *Hanson Center for Technical Communication* until 2019) in response to feedback from constituents (industry, alumni, faculty, students, ASEE Roundtable, etc.) about the importance of technical writing and communication within engineering disciplines. Staffing for the HCC includes a director and student staff who are dedicated to providing support for students in engineering classes. Students visit the HCC for technical writing feedback and



guidance on writing assignments and/or to enhance laboratory reports. The center has generous drop-in hours for students seeking assistance with, and critique of, their writing. All first-year students are required to visit the HCC for a writing assignment during the Introduction to Engineering Problem Solving course

(ENGR:1100), which helps make students aware of the HCC's services and emphasizes the importance of technical communication early. As evidence of the HCC's impact, our students continue to be recognized for their communication skills. Employers frequently comment on their ability to communicate with a variety of audiences, both during the interview process and on the job.

Both the HCC and Engineering Library were highlighted during our recent ABET accreditation review, and quotes from the ABET review are included as insets within the descriptions of each resource above.

The Hanson Center for Technical " Communication offers engineering students an unusually comprehensive resource for developing communication skills as an integral part of their engineering education. feedback fellow ...They provide to engineering students on both oral and written assignments, either individually or as part of a group project. The Center enhances the education of the students being coached and that of the peer tutors."

NEXUS (where engineering meets art)

The **NEXUS** space provides a collaborative environment for creativity. The program hosts an art club, workshops such as drawing, printmaking, and hot stamped foiling for engineers. Moreover, the facility has been used for senior design projects for multiple programs. It should be noted that beginning with the fall 2015 semester, all first-year undergraduate students have required to take at least three semester hours in the arts as part of their general education requirement (i.e., 'be creative'). The range of courses available to students include painting, dance, theater and many other activities not usually associated with engineering.

Ethics Initiative

While engineering education relies heavily on a solid technical foundation, engineers solve problems and innovate in order to impact people and the natural and built environment. To ensure that our students are professionally prepared for engineering practice, that training must include a strong appreciation of cultural diversity, sustainability, environmental stewardship, and societal impacts of technological advances as they relate to engineering practice. Consequently, with the help from a generous donor, during the summer of 2019 the College of Engineering launched an engineering ethics initiative. Through this initiative, the goal is to engage students in exercises that put them "in the shoes" of a practicing engineer and experience the challenges of encountering and addressing situations that require ethical decisionmaking. As an outcome, our graduates will be equipped with practical tools for discovering and confronting ethical and societal dilemmas as they naturally arise in their future careers.



In response to the initial call for proposals, four ethics modules were developed by teams of CoE faculty and implemented throughout the college during the Fall 2019 semester. One of these modules, titled "Societal Impacts of Engineering Design" was developed as an interactive 'choose your own adventure' style game using various ethical dilemmas (e.g., a whistle blower scenario where the product you just developed has a deleterious impact on the health of a particular population). Consequently, the students gain an appreciation for the impact of their decisions and how seemingly positive engineering contributions may have unintended negative consequences. This activity was initially introduced in two of the project sections for the first-year Introduction to Engineering Problem Solving course. Its initial success and impact have led to its expansion into the majority (and soon to be all), of the project sections.

Emerging Opportunities

LEaPP Academy

Now more than ever, important societal changes (such as the fast pace of technological advancements and increasing demands for multi-disciplinary collaboration) require new ways of preparing lowa Engineers to become the next generation of innovators and problem solvers. In response, the College of Engineering has created a Leadership, Ethics, and Professional Pathways (LEaPP) Academy, which will expand the experience of engineering students.

Open to all students in the college, LEaPP will supplement engineering coursework with meaningful, experiential opportunities where students can draw on the wisdom of successful alumni, analyze engineering case studies, conduct innovative research with faculty members, and take part in microinternships that will position them for success in industry. LEaPP builds on the successes of other engineering programs including the Hanson Center for Communication (HCC), the Virginia A. Myers NEXUS of Engineering and the Arts, the Grand Challenges Scholars Program, and the college's ethics initiative. Each of these programs offers students opportunities to engage in co-curricular activities that integrate what students learn in classrooms and laboratories with valuable skills and perspectives related to communications, artistic sensibilities, global issues in engineering, and the ethical implications of innovation.

LEaPP was launched with support from a cornerstone gift from UI alumnus James Whiteley (BSME 62, MS 64) who also provided support for the college's Grand Challenges scholars and ethics initiative.

Makerspace

In collaboration with staff from housing and dining, a task force of faculty and staff from CoE developed a proposal for a makerspace to be established in the lower level of Burge Hall (at the bottom of the grand staircase that leads to the lower level off a main entrance). This makerspace holds the potential to support both recruitment and retention efforts in CoE by creating additional opportunities for students to engage with STEM materials, tools, and resources in ways that they choose, and in ways that align with their



passions and interests. The location in Burge Hall has been chosen in part because it is the residence hall that houses the People in Engineering (PIE) Living-Learning Community (LLC).

It is intended that the proposed space will allow engineering students to explore, brainstorm, and create; it will serve as a space for team building and collaboration to develop creative and critical thinking skills, build community, and have fun. When completed, the space also holds the potential for boosting self-confidence and building students' engineering identity. We envision the space to potentially host satellite sites for Engineering Student Organizations (including the 3D Print Club and NEXUS/Artineers) to host activities, for CoE to offer Engineering workshops and design challenges, and for ENGR:1100 office hours and after-hours project work.



Charge 2: Increase graduate enrollment through targeted student recruitment

Across the college, individual faculty members, departments and centers undertake various efforts to recruit, support, and retain graduate students. These efforts include communicating with prospective graduate students, offering research and teaching assistantships, scholarships, and other means of financial support, and organizing orientations, seminars and picnics to enhance graduate student life. In addition, there are Dean's fellowships that are competitive and utilized to attract strong graduate students to the college. Over the past few years, the Associate Dean for Graduate Programs, Research, and Faculty (ADGPRF) has convened regular meetings among Directors of Graduate Programs (DGSs) across the college. This has allowed departments to more effectively share best practices, collaborate, and build on efforts taking place within a single department. It has also helped identify opportunities that would most greatly benefit from college-wide support or infrastructure. In the sections below, we focus on graduate recruitment and retention efforts taking place college-wide.



Current Graduate Enrollment

Since peaking in 2010, graduate student enrollment underwent a steady decline from 2011 to 2018 – a time when undergraduate enrollment rose considerably, and significant resources were required to support the rapid increase in undergraduate class sizes. Since then, the CoE graduate program has been re-prioritized; additional attention has been directed toward re-growing our graduate programs. In the past few years, enrollment has begun to rise, but additional work is needed to strengthen our graduate programs.

IOWA

New Recruitment Efforts

The success of graduate recruitment and enrollment efforts, both in terms of the quantity and quality of recruited students, has varied significantly across departments and from year to year. Often, the programs that have the most resources and staffing have had the flexibility to adjust to industry and funding trends, whereas the departments with fewer resources have lacked the capacity to make cohesive or lasting improvements in their recruitment efforts.

In the summer of 2021, the College created a staff position (Assistant Director of Graduate Programs) charged with leading COE-wide graduate student recruitment efforts, so that each department is served with resources, expertise, and strategic planning for their graduate program needs. This new position has allowed us to pursue a number of strategies to satisfy graduate enrollment goals during the first year of this position.

Efforts can be categorized into three areas:

- Increasing "leads" and prospective students (applications) from undergraduate engineering programs
- Increasing leads and prospective students from students graduating from non-engineering programs (including math, physics, chemistry, etc.)
- Improving acceptance rates through personal and high touch recruitment of admitted PhD students

We initiated recruitment efforts at in-person conferences, such as the <u>GEM</u> Annual Conference and <u>BMES</u>, as well virtual career and graduate school fairs like the I-74, Big10+ Expo, and various school-specific graduate school/career fairs. Many fairs continued to be offered virtually in 2021, however a number of conferences have already indicated they'll return to an in-person format so the college will be represented at more events in 2022.

Additionally, we have implemented several initiatives designed to attract prospective students from nonengineering fields such as math, physics, chemistry, and others. The most significant effort was our "Engineering at Iowa" event held in conjunction with our <u>Research Open House</u>. Students from Liberal Arts & Sciences colleges across Iowa and Illinois were invited to campus to learn about our engineering graduate programs while also attending our ROH poster session. We hosted a couple of virtual info sessions that were attended by non-engineering undergraduate students. In this same vein, we've also begun discussions with faculty at Liberal Arts & Science institutions to investigate the possibility of establishing 4+1 partnerships designed to create pipelines that would attract students pursuing general engineering or non-engineering STEM to our graduate programs.

We have recruited a diverse cohort of undergraduates to participate in or NSF-funded computational bioengineering REU program for the past two years. This has already resulted in successfully recruiting a URM student from the first year of the REU to the BME graduate program (Fall 2022). The REU and other summer research programs on campus have the potential to serve as a reliable tool for steadily developing a more diverse graduate student body.



The pandemic affected our ability to implement a larger scale, college-wide visit for prospective (admitted) PhD students, however we were able to host a smaller group of students on campus and provided some new visit experiences that we plan to continue in future campus visits. We coordinated new social events for the visits, in addition to the usual meetings with faculty & graduate students, tours, and meals. Students enjoyed a meal with current and other prospective students from different departments and then attended a group outing to SpareMe bowling. We also invited students from the Graduate Student Council to attend and represent the college. It's a limited sample size, but of the four prospective students who visited that week, two will be matriculating to our graduate programs. We will continue to improve our campus visit experience for prospective graduate students (for example, holding a poster session) so that we are not only attracting more applicants, but doing everything we can to successfully matriculate them into our programs.

Graduate Student Support

Funding Support for Graduate Students

Increasing the number of graduate students, particularly PhD students in the college is a strategic priority as stated in the CoE strategic plan. External and internal grant funding is the primary source of support for graduate research assistantships in the college. Teaching assistantships are few and, in many cases, it is advantageous to fill those positions with undergraduate TAs. This presents a challenge in meeting our goal of increasing PhD student enrollment. There are several ways in which such increases can be achieved:

- 1. Increase the number and amounts of internal and external grants in the college. With the ongoing strategic faculty hiring plan and its focus on research areas with potential future growth, the research activity and expenditures of the college can be increased, in turn leading to an increase in graduate student numbers.
- 2. Starting in AY2021, a long-standing practice of 10% salary release expected from tenured faculty was suspended. Since such voluntary release primarily came from research-active faculty, it is hoped that these release amount will now be directed to hiring graduate research assistants.
- 3. The college has established cost-share and bridge funding mechanisms so that faculty can make 4-year PhD assistantship support to prospective graduate students. Peer institutions routinely make such offers, which has placed the college in an uncompetitive position in attracting graduate students. Four-year offers can remedy this shortcoming.
- 4. Increasing Masters students can be achieved by offering professional masters programs in the college. This will require resources to manage and operate, and the economic viability and need for such programs needs to be determined prior to developing such a program. In a previous attempt, a program called MSEIT (Master of Science in engineering and information technology)



was attempted but was later suspended due to lack of subscription. Developing and sustaining such programs requires start-up resources and administrative support to become viable.

5. Enhanced efforts at communicating with and recruiting graduate students under the charge of the newly created position of Assistant Director of Graduate Programs. This includes connecting with prospective students online, at in-person fairs at UI and other colleges, and at national and international conferences.

The above efforts are aimed at enhancing the quality and quantity of graduate students in the college. However, the rate limiter for efforts to increase graduate (especially PhD) student enrollment is faculty success in garnering external funding. To further this goal, we are also paying increased attention to training in grantsmanship, mentoring of junior faculty, connecting faculty to research networks and other faculty development opportunities.

Graduate Student Space

Based on feedback from current students and Directors of Graduate Studies (DGS), the college has recently designated a space specifically for graduate students to utilize. The Graduate Hub (3016 SC) has been furnished to serve as a breakroom, study, and social space for all graduate students on weekdays from 7:30 am – 7:00 pm. Students may use the refrigerator, microwave, and coffee machine during those hours. We also maintain a stock of bottled water and ingredients for PB+J sandwiches in the refrigerator as a fallback for students, or more significantly, for students who may be enduring food insecurity.

Sectional seating and a television have also been installed to facilitate community-building events like friendly video game tournaments and World Cup viewing parties. The space will also be open to students to serve as a gathering space for research affinity groups, journal or book clubs, or graduate-student student organizations. Coffee & donuts will be provided to the students once a month during the academic year to serve as both a community-building effort and a student appreciation gesture. Graduate program staff will organize and facilitate many of these events, but we will communicate and empower students to utilize the space for their own community and professional development pursuits. Lastly, this space will be exhibited and utilized during prospective student visits.





Graduate Student Professional Development

The college is seeking to improve professional development opportunities for graduate students, particularly guided by a recent survey of graduate alumni of the college which revealed that nearly 90% of our graduate students find careers in non-academic settings (industry, government labs). To this end, we have begun several initiatives, including:

- 1. Graduate seminars focusing on professional development
- 2. A grad LinkedIn page dedicated to current students and alumni
- 3. Organizing and supporting grad student travel to national conferences, particularly those focused on underserved cohorts.
- 4. Organizing and supporting workshops for grad student personal development, grant writing, public speaking and bootcamps for grad success.

In addition, the Assistant Director of Graduate Studies has worked with graduate students to establish an Engineering Graduate Student Council, which organizes both professional development and social activities to support the graduate student community.

Graduate Staffing Restructure

With planned implementation for Fall 2022, graduate support staffing will transition from traditional singledepartment staff support to a hub-and-spoke model where a small team of staff will support all graduate programs throughout the college. This model will help create efficiencies, develop cross-training



College of Engineering 2022 Self-Study

opportunities, and lay the framework for implementing best practices throughout the graduate student lifecycle in every department. The design of the graduate support framework is aimed at enhancing all aspects of graduate education in the college, starting from recruitment of graduate students, retention of graduate students through community building and professional development, and managing all aspects graduate student life in the college by developing and deploying best practice across all units. Through several iterations of communications with faculty, unit leaders and staff, we are working on a college-wide graduate support team framework to manage graduate programs uniformly across all departments.



Charge 3: Increase grant submissions and faculty/staff salary recovery from grants

The College of Engineering faculty and staff are highly productive in terms of research and innovation, as well as securing funding required to support these efforts. The college has promoted and financially supported faculty research development, in the form of cost-sharing, bridge-funding, seed-funding, identification of research opportunities, supporting travel and workshop attendance (particularly for junior faculty) and is seeking to further enhance research proposal submissions and awards with several efforts from the college's research office led by the Associate Dean for Graduate Programs, Research, and Faculty (ADGPRF).

Current Proposal Award Rates

Faculty grant activity in the college for the past decade has exceeded proposed dollar amounts of \$40M per year and research expenditures of approximately \$20M per year. This represents a robust level of research expenditures per faculty and is competitive with peer engineering R-1 research institutions. In FY21, the college submitted 392 proposals with total proposal dollars exceeding \$74M.



IOWA

Research Support

Cost share and bridge funding

During the 2020-21 academic year, the college developed a process and set of guidelines for committing in-kind and cash cost-share on federal proposals as well as bridge funding support for projects that have lost or may lose extramural funding. These procedures were reviewed with collegiate leadership (i.e., dean's office, DEOs, and center directors) and discussed at Engineering Administrative Council meetings. They are now a part of the finance forms that all faculty and staff can access from the CoE website (<u>link</u>).

Pre- and Post-award support

Over the past two years, we carefully analyzed the college's pre- and post-award research support and developed a college-wide network structure to advance our capabilities in this area. With the planned hiring of an estimated 20 new faculty members in the current Strategic Plan period, the enhanced research support will be a significant part of the effort to support faculty and increase productivity.

Salary release

Starting in 2010, the CoE initiated an administrative resolution that provided that tenured faculty in the college release a minimum of 10% of their GEF academic year salary through contracts and grants where the initial 10% of GEF released salary plus fringe would be made available to the home academic department and any release in excess of 10% would be made available to the PI.

In 2021, a review showed that only 58% of the faculty covered by the guidance actually participated, resulting in an inequitable and undue burden on some research-active faculty. Moreover, the EFC conducted a survey of the faculty and found some recurring themes around how the practice hurts faculty productivity, research, and graduate student numbers. The amounts released to the departments totaled ~\$600,000 over the past three years.

For FY22 and FY23, this administrative resolution was suspended and the college provided a supplement to the academic department budget in lieu of the faculty release. The funding for this supplement came from tuition and ICR now included in the GEF. It is hoped that PI retention of these funds will increase their ability to invest in initiatives to support the research mission, especially PhD students.

CoE is unique among UI colleges in that 100% of salary release from grants goes back to the individual researcher/PI who released the salary; elsewhere on campus, a portion of the salary release is distributed to the PI's college and/or department. While there may be some marginal benefit to a collegiate or departmental budget in keeping a percentage of the salary release, this redistribution does not result in a net increase in funding for the college.

Faculty Mentoring & Recognition

Faculty mentoring and support is critical to retain and foster the professional and personal growth of the core of our college's strength, i.e., people, and in particular, faculty. To this end, we have set up a new mentoring structure in the college. In the past, many departments assigned a mentor to each incoming faculty member (though this was an inconsistent practice across the college). In the new framework, in addition to a departmental mentor, the college has identified both a peer mentor and a senior mentor (each outside of the faculty member's home department). This is based on the best practice of having a team of mentors for each faculty member.

With six new faculty joining the college this fall (4 Assistant Professors – tenure-track; 1 Professor, tenure-track; 1 Associate Professor of Practice), the college developed more formalized and college-wide faculty onboarding. This includes HR-based onboarding processes, a welcome bag with COE-branded items, and a **New Faculty Orientation** (NFO) for college-specific policies and practices. Organized the week prior to the start of the Fall semester, NFO included an overview of the college, the introduction of leaders of various college units, a panel discussion, and lunch with other faculty and mentors. The NFO was well-received and additional check-ins are planned throughout the first year, to continue to support and build community among our new colleagues. Part of the goal of NFO and similar events is to facilitate opportunities for incoming faculty to form networks and build community early in their careers at Iowa. We have also made concerted efforts to secure funds to support faculty startups at nationally competitive levels and to secure lab and office spaces for faculty that are well appointed to enhance their work life.

Of course, support for faculty goes beyond supporting newly hired faculty. To this end, the college has revamped its Faculty Awards framework by forming a committee to focus on identifying and nominating faculty for awards at all levels—from college-specific to nominations for national awards and fellow positions. The 11-person standing committee comprises faculty from all six departments (including both TT and non-TT faculty) and is tasked with increasing the number and level of awards received by CoE faculty by streamlining the nomination and selection process.



Charge 4: Develop a plan for collegiate resource management

Indirect Cost Recovery

In 2020, the CoE was tasked with developing plans to bring the CoE F&A Revenue Model (i.e., revenue resulting from Facilities & Administrative – F&A or Indirect – Costs from sponsored research) into alignment with the policies for the rest of campus. Prior to 2020, F&A was primarily returned – in full – to three CoE centers/institutes: IIHR, ITI, and NADS. This request, while discussed for several years, became increasingly necessary with the adoption of the university's modified Responsibility Center Management budget model. While the previous Indirect Cost Recovery (ICR) model was effective in enhancing research activity within the centers, this model was difficult to sustain – it was inconsistent with budget models for other centers/institutes across campus and had a significant negative impact on the budget of the CoE as a whole. Moreover, this previous ICR distribution model was creating increased tensions between the centers/institutes and the departments. Faculty and other researchers who were affiliated with centers had access to more grant support, marketing, and web administrative staff/resources than was available to non-affiliated faculty (or faculty affiliated with centers other than IIHR, ITI, or NADS).

A key component in the college's strategic plan is to *maintain strong research funding and identify new sources of support for research.* The strategic plan outlines specific strategies to achieve this, by building on collegiate strengths, fostering research collaborations, actively coordinating the development of large, multidisciplinary research proposals, and expanding access to pre-and post-award support college wide. To that end, beginning in Fall 2020, UI central administrators and CoE leadership began working with center directors to align the F&A allocations with the standards used by the other colleges across campus. The goal was to create new processes and financial control systems for the College and ensure that accountability and responsibility was established within the Dean's office. Throughout the semester, the group evaluated and revised fiscal policies across the college and within the centers/institutes, developing a set of policies that supported the financial management of F&A revenue within the College of Engineering.

The new Indirect Cost Recovery (ICR) model became effective January 1, 2021, where ICR is now directed through the college (with a portion retained centrally), consistent with university-wide budget models. To ensure sustained research excellence within IIHR, ITI, and NADS, both current and future year center/institute budgets were developed within the CoE budget model, and a five-year plan was established to gradually transition centers/institutes into this new ICR model.

In 2021, the Dean formed two subcommittees of the Engineering Administrative Council (EAC). The committees were asked to recommend policies and practices related to:

- 1. research center allocations and research incentives (the EAC Budget Subcommittee) and
- 2. center/institute affiliations, research administration and proposal support, and the use of funding allocations (the EAC Policy Subcommittee).



Each committee met several times over the subsequent year, articulated a set of guiding principles, examined ICR approaches at other Big Ten institutions, and developed a set of recommendations that are informing the ongoing transition of the ICR budget model. With the completion of these subcommittees' recommendations in the Spring 2022 semester and the close of FY2022, the college is now considering several approaches to distributing ICR revenue across the college, unit (department/center/institute), and individual PI. Several distribution scenarios will be modeled to look at different percentage distributions amongst college/unit/PI, as well as whether to employ fixed percentages vs. graduated percentages (i.e., X% upto \$Z and (X+y) % if >\$Z). During the Fall 2022 semester, college leadership will engage with EAC to review and refine these different scenarios and gather additional input from various stakeholders. The goal is to have an ICR budget model that is fair, transparent, and predictable to communicate with faculty and staff by Spring 2023, before implementing in FY2024.

Importantly, this transition to an ICR distribution model consistent with other units on campus is enabling the implementation of several important initiatives described in this self-study. This includes the creation of an office/staff to support pre- and post-award administration, the restructuring of graduate student support roles as a college-wide function, and even efforts to synthesize marketing and communication efforts across the college. These resources - which are important for sustaining research excellence, increasing grant funding, and recruiting graduate students - will now be able to serve all faculty/staff, not just those affiliated with the three aforementioned centers.

Enrollment Management

Current Enrollment

This fall, the cohort of new first-year engineering students totals 412, a 13.5% increase over the Fall 2021 cohort size. While this increase is welcome, enrollment remains lower than our target. Since enrollment peaked at 624 new first-year students in 2016, the college has seen a decline in the number of first-year students. Most notably, the Fall 2017 enrollment saw a sharp drop, with only 483 new first-year students (Figure 6).

Even before the pandemic shuttered the campus and courses transitioned online, our undergraduate engineering enrollment essentially flattened in 2017, after a significant increase in enrollment between 2009 and 2016. This trend followed what was reported nationally (ASEE Engineering by the Numbers, 2011–2020). Unfortunately, the pandemic compounded the enrollment declines, both locally and nationwide, so that engineering enrollment has dropped more quickly and with larger-than-expected declines than what has been predicted with the emerging "demographic enrollment cliff."

Since 2018, we have been working closely with the UI Office of Admissions and the Office of Student Financial Aid, with an emphasis on strategic enrollment management to reach prescribed admissions and yield targets in advance of this cliff. As one example of new initiatives that have resulted from this collaboration, in an effort to drive enrollment of students from Illinois, the Illinois Engineering Community of Scholars Award was launched for Fall 2022, as described in the section below.

IOWA

Enrollment growth need not rely entirely on recruitment alone. Student-focused retention initiatives generate increased enrollments by attracting more students to persist. While new undergraduate enrollment decreased from 2016 to 2020, student persistence to the second year increased from 76% in 2016 to ~82% in 2020, partially helping to offset declining enrollment.



The Impact of Enrollment on the CoE Budget

In 2018, the university budget model transitioned to that of a modified Responsibility Center Management (mRCM) model. In this new model, tuition revenue is allocated to colleges based on incremental increases to the number of majors in the college. In this way, in order for CoE to increase its allocation of funds made available from tuition, enrollment (i.e., the number of students in a program) within the college must increase. This is made more challenging because the budget allocation depends on the relative growth or reduction in enrollment as compared to a baseline year (FY2018), during which CoE enrollment was near its peak. The budgetary impacts of an overall decline in enrollment have been compounded by declining non-resident enrollment, including that of international students.

The CoE retains 72% of the incremental net tuition earned from its majors, while the remaining 28% is allocated to support central administrative units on campus. Importantly, beginning FY2023, this 72/28 split applies not only to base tuition, but also to the COE-specific supplemental tuition. Until now, 100% of the supplemental tuiton was brought into the college, and accordingly, the supplemental tuition rates were calculated to cover the additional costs necessary to provide an engineering education.

It is important to note that net tuition is calculated as tuition minus any student financial aid (SFA) and/or instructional transfers (i.e., tuition transferred to other colleges to reflect course enrollment in those other

College of Engineering 2022 Self-Study



colleges – calculated for each student based on # of fee hours enrolled outside of CoE). At the undergraduate level, SFA is distributed centrally by the Office of Admissions, such that CoE is unable to predict or plan for the net tuition revenue it will receive, based on a given year's enrollment. In recent years, SFA awarded to CoE undergraduates has increased, while enrollment has simultaneously decreased, which has had a tremendous negative impact on the college's budget.



Enrollment Goals and Challenges

Each year, CoE works with the office of Strategic Enrollment Management (SEM) to establish annual enrollment goals. Currently, college enrollment is below our target of a total of 2365 enrolled students. We are confident that this target enrollment is achievable, and that we can support a student body of this size, which is in alignment with our peak enrollment in 2016 (2267 enrolled students). Reaching this enrollment target will require the addition of ~700 new, first year (or transfer) students enrolled in CoE.

Recently, SEM performed a competitive analysis of student enrollment to better understand where students who are admitted to UI CoE ultimately choose to enroll. Nearly 25% of students who are admitted to our program (but choose to enroll elsewhere) select either University of Illinois – Urbana Champaign (UIUC - 13% based on available data from past five years) or Iowa State University (ISU - 12% based on available data from past five years).



Tables 1 and 2 show the admissions data from the two largest two markets (residents of Iowa – Table 1 and Illinois – Table 2). Admissions data indicates that large majority of admitted students from Iowa choose between attending UI and ISU. In the past five years, the percentage of *accepted* Iowa resident students who matriculate to UI has remained roughly steady, ranging between 53%-56%. Between 14%-22% of this same group of admitted Iowa residents instead choose to matriculate to ISU. This percentage appears to fluctuate more, and in future years, we will continue to examine whether this continues to average ~18%, or whether it is trending upward.

Table 1. UI College of Engineering Admissions Data for Iowa Residents					
Iowa Residents (UI COE Admissions)	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021
Applied	607	609	448	409	422
Admitted	466	462	417	385	397
Enrolled at UI COE	250	253	223	215	209
UI COE yield from admitted IA Residents	54%	55%	53%	56%	53%
Enrolled at ISU	66	88	91	68	78
% Admitted to UI COE who attend ISU	14%	19%	22%	18%	20%

Table 2. UI College of Engineering Admissions Data for Illinois Residents					
Illinois Residents (UI COE Admissions)	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021
Applied	1427	1295	1259	1142	973
Admitted	1158	979	1129	1033	905
Enrolled at UI COE	169	136	189	143	99
UI COE yield from admitted Illinois residents	15%	14%	17%	14%	11%
Enrolled at UIUC	214	188	194	180	150
% Admitted to UI COE who attend UIUC	18%	19%	17%	17%	17%
Enrolled at ISU	83	83	56	71	65
% Admitted to UI COE who attend ISU	7%	8%	5%	7%	7%

Admissions data shows that the majority of Illinois residents who are admitted to the University of Iowa College of Engineering are ultimately choosing to enroll at UI, ISU, or UIUC, as reflected in Table 2. The percentage of UI CoE admitted Illinois residents who ultimately matriculate to UIUC or ISU has remained steady (ranges of 17%-19% and 5%-8%, respectively). However, the percentage of Illinois residents matriculating to UI CoE has undergone larger variations from year-to-year (11%-17% from Fall 2017-2021).



Recognizing that AY 2020-21 and 2021-22 were greatly impacted by the pandemic, we will continue to monitor this data in upcoming years.

In 2021, the Dean's office examined the admissions data in the context of relative tuition costs for an Iowa resident to enroll in engineering at UI and ISU, and for an Illinois resident to enroll in engineering at UI, ISU, and UIUC. This data is shown in Figures 8A (Iowa resident tuition) and 8B (Illinois resident tuition). As shown in these graphs, for Iowa residents enrolled in engineering, the cost to attend ISU is slightly lower than the cost to attend UI. For Illinois residents enrolled in engineering, cost of attendance at UIUC and ISU are both substantially lower than attendance at UI. These costs do not align with each respective school's USNWR rankings; this underscore the importance of appropriate marketing and messaging about our college's unique value proposition. These observations also motivated the development of the Illinois Engineering Community of Scholars Award, described below.



Illinois Engineering Community of Scholars Award

In an effort to drive enrollment of students from Illinois, the Illinois Engineering Community of Scholars Award was launched for Fall 2022 admissions with the support of the Office of the Provost. The scholars award is \$2,500 a year for up to four years, or until the bachelor's degree in engineering is conferred (whichever comes first). Awardees must maintain continuous full-time enrollment at the University of lowa with a major in Engineering (fall and spring terms), a minimum 2.00 UI GPA, and continue to pay nonresident tuition for renewal. The eligibility criteria for the award include: must be a student in the College of Engineering, must be from Illinois, and GPA \geq 3.9 (and no test score) or GPA \geq 3.5 (and ACT \geq 25) or GPA \geq 3.8 (and ACT \geq 24).

IOWA

In Fall 2022, 105 students from Illinois accepted the inaugural Illinois Engineering Community of Scholars Award. In total, in 2022, 144 Illinois students deposited and declared Engineering as their program of study, compared to 93 at the same time-point in 2021.

Faculty Recruitment

Strategic Hiring Initiative

In Fall 2021, the College of Engineering launched a strategic hiring initiative directed at increasing the size of our tenure track faculty in areas that will improve quality of life in Iowa, across the nation, and around the world. These new hires will reflect our commitment to advancing engineering innovation through collaborations with colleagues across campus, enhancing the educational experience of our students, and instilling ethics, social justice, and global awareness in everything we do. Our areas of strategic excellence focus on:

- Engineering for human health
- Engineering in the environment
- Engineering for emerging technologies

From 2021 to 2026, the goal is to increase the number of tenure/tenure-track faculty in the college by twenty. These twenty positions will align with the goals of our strategic plan to:

- create an environment in which all members of the collegiate community-students, staff, and faculty-are welcomed, supported, and able to thrive
- provide a transformative and personalized educational experience that prepares our graduates to become an engineer and something more
- lead signature areas of research and economic development to drive breakthroughs that have societal impact
- train graduate students to become outstanding technical leaders and innovative researchers
- engage in mutually beneficial partnerships, boldly communicate our achievements, and build influence with state and federal decision makers
- acquire and steward private investments that strengthen the college and amplify our service for the common good.

In its first year (2021-2022) of this initiative, the college has successfully recruited five new tenure-track faculty, in addition to hiring an associate professor of practice. With three faculty retiring (two TT and one IT) and one departing (IT) over the same period, our TT faculty body increased by three, while our teaching-focused faculty (Instructional/Professor of Practice tracks) dropped by one.

Implementation of Path to Distinction

CoE has implemented the Provost's Path to Distinction (PTD) best practices into the faculty search process. PTD describes research-informed strategies to advance diversity, equity, and inclusion in faculty searches. Within the CoE, all searches in 2021-2022 included PTD training (including training to recognize



and reduce the impacts of implicit bias) and committees utilized the best practices recommended by PTD throughout the search process. In addition, in 2021, searches piloted an approach that included an Equity Advocate on each search committee. The Equity Advocate position was a full "voting" member of the search committee and was represented by a faculty member within the CoE but outside the department/discipline that was conducting the search.

Specific responsibilities of the Faculty Equity Advocate role include:

- Serve as voting member on faculty search committee
- Throughout the search, ensure that the search committee adopts best practices to advance DEI, as described in the <u>Path to Distinction</u> program. Some examples:
- Suggest and participate in active recruitment methods to increase the diversity of the applicant pool
- Ensure that contributions to DEI are included in the evaluation criteria
- During each stage of evaluation, advocate for the use of evaluation tools that reduce implicit bias
- Remind the committee about examples of implicit bias and ways that cognitive errors may
 manifest on search committees (i.e. JoAnn Moody's <u>Rising Above Cognitive Errors: Guidelines for
 Search, Tenure Review, and Other Evaluation Committees</u>)
- Serve as a liaison to college's Path-to-Distinction coordinators. At specific checkpoints during the search:
- Check in, discuss progress, and review best practices for upcoming stage of search
- Review relevant demographic data about applicant pool, shortlist, etc.

Since piloting the Equity Advocate in AY2021-2022, the Engineering Faculty Council has revised the College of Engineering's *Criteria and Procedures for Faculty Appointments, Evaluations, and Promotions* document to include the role of Equity Advocate as a permanent position. This revision was supported by a college-wide faculty vote in May-June 2022.

Recruitment Challenges

The current spaces within the college of engineering are heavily utilized to fulfil the teaching and research missions of our college. Offices and laboratory spaces have reached capacity, and with ongoing faculty searches and a five-year strategic hiring plan, the college has taken a close look at space utilization and developed a set of guiding principles so that space planning can be transparent, inclusive, efficient, strategic, and adaptable.

Five new faculty joined the college in August 2022; finding research lab spaces (especially wet labs) as well as graduate student spaces proved challenging. Aside from the need for additional research spaces, many of our existing research spaces are aging and in need of major upgrades, or are not equipped to deal with additional equipment demands (i.e., increase in HPC compute nodes requires HVAC controls, clean air rooms, dark rooms, etc.). The college continues to review space allocations and utilization to ensure that current facilities are fully utilized.

One effort that we hope will relieve some space concerns is a "hoteling" approach we are currently piloting within the Seamans Center. With the now frequent hybrid mode of operation, and in view of space constraints,

College of Engineering 2022 Self-Study



the college has prepared these hoteling spaces and made them available for faculty/adjunct faculty/visiting scholars. These offices are intended for use by faculty who do not have a primary private office in the Seamans Center (SC), but may need to spend significant lengths of time, to hold office hours, work with SC collaborators, prepare for/attend meetings in SC etc. They are hospitable and usable, with good lighting and connectivity. Two rooms that were previously used as conference rooms have been converted to hoteling spaces, with 10 total reservable desks, some of which include desktop computers.

Several of our teaching labs serve more than one course. While this helps ensure that we maximize the use of space, lab courses typically include several lab "sections," and accommodating multiple classes with numerous lab sections can make scheduling a challenge. Beyond the classroom, students also need the ability to get hands-on through maker's spaces and/or student organization involvement. Our student organizations regularly build models that compete in regional/national competitions that are currently sharing spaces with other student organization or with researchers. Additional space is needed for them to be able to adequately build their competition items without hindering our researchers. As described in Charge 1, the College of Engineering is currently collaborating with the Division of Student life to develop an Engineering Maker Space in Burge Hall, where the *People in Engineering* Living-Learning Community resides.

Faculty Retention

The college continues to prioritize both attracting and retaining a diverse faculty body. Faculty retention efforts are multi-faceted and depend upon the college's ability to cultivate a welcoming and inclusive climate, offer competitive salaries, and address faculty's support and mentoring needs. New faculty mentoring efforts are described above, and several ongoing activities across the college are focused on creating an inclusive and welcoming community within the college.

CoE faculty salaries remain at or near the bottom of any peer group comparison. Based on AAU and ASEE peer benchmarking data available, CoE analyzed and evaluated our faculty salaries to determine the dollars needed across departments and ranks to bring our faculty's salaries to an upper quartile of benchmarking averages. In completing that analysis, to bring faculty at all ranks to the peer benchmark upper quartile would require more than an additional \$2 million in salary dollars alone.

Through conversations with the Provost Office and the CoE DEOs, the college has prioritized salary increases first for assistant professors whose salaries are outside the typical range to ensure all assistant professors are at the peer benchmarked average or above. The next prioritized salary increases will focus on bringing assistant professors and early associate professors to the upper quartile of peer benchmark. It is the goal of the College of Engineering to continue to discussions with DEOs and the Provost Office in the upcoming years to bring faculty at all ranks and from all departments to the peer benchmarking upper quartile. Our anticipated timing for these first two priorities described above is FY 2023-2025.

College of Engineering 2022 Self-Study



Beyond salary benchmarks, the college continues to make it a priority to proactively retain its faculty. In the past two years, CoE has leveraged the Provost's High Impact Hiring Initiative funds to support both successful recruitment and retention packages for faculty.

Staff Workforce Planning

Staff are integral members of the College of Engineering and play important roles in all aspects of the COE mission. Among their many, diverse roles, the COE's ~160 dedicated staff members:

- lead several units in the CoE (Finance & Operations, HR, Marketing & Communications, Technology),
- are critical to the research mission (approximately 45 staff serve as research scientists, research engineers, or other research positions in the CoE),
- support both undergraduate and graduate student success (through academic advising, career planning, admissions and outreach, leadership development, department administration, etc.), and
- maintain day-to-day operations across the college and within the centers.

Each department is supported by a departmental administrative staff member, while the position of graduate coordinator is currently being reorganized (see Charge 2). Similarly, CoE provides centralized staff support for undergraduate student services (for example: the eSST, discussed in Charge 1), graduate recruitment and support (the Assistant Director of Graduate Programs), HR, IT, finance, and facilities management.

The College of Engineering has growing concerns about staff recruitment, retention and potential staffing gaps that could adversely impact collegiate operations and our teaching and research missions. To address this, in 2021, a Staff Workforce Planning and Prioritization process was developed and launched to gather information from units so staff hiring and salary actions could be prioritized in accordance with College of Engineering strategies and operational needs.

The Staff Workforce Planning & Prioritization process considers staffing needs for the current and two subsequent fiscal years. The scope of the information gathered focuses on regularly appointed staff across all funding sources. Specific actions to plan and prioritize include the creation of new/replacement positions, career development (promotion/advancement) for current staff, and consideration of any anticipated departures.

With the current labor market, it is important for the college to recruit and retain high quality staff to help fulfil our mission; however, we realize we are extremely lean in our staffing and do not currently have the financial resources to address all of the staff hiring and compensation needs at once. The Staff Workforce Planning & Prioritization process allows us to begin taking a systematic approach to identify and address critical operations for investment.

