

College of Engineering

Strategic Plan for Diversity and Inclusion

Diversity Working Group
College of Engineering, University of Delaware

September 2017

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Faculty diversity and inclusion strategic plan
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Undergraduate diversity and inclusion strategic plan
Staff diversity and inclusion strategic plan

1. Introduction

Consistent with the University’s Inclusive Excellence Diversity Action Plan, the College of Engineering (COE) is committed to improving the diversity of its faculty, students, and staff and explicitly recognizes the importance of diversity in achieving academic excellence. As stated in the University’s Diversity Action Plan, “diversity at UD means both the recognition and appreciation of all human differences, based upon, but not limited to, age, race, ethnicity, national origin, sex, class, gender identity, disability, sexual orientation, culture, ideology, politics, religion, citizenship, marital status, job classification, veteran status, and income and socioeconomic status.” The College has been working towards this goal for many years, and yet there is more to be done. In this document, we present the strategic plan for broadening participation and fostering inclusion within the College. The attached plans for faculty, graduate student, undergraduate, and staff diversity provide more details for each of those groups. The College’s plans and activities are being closely coordinated with the Office of the Vice Provost for Diversity (www.udel.edu/diversity) and UD ADVANCE (www.udel.edu/advance).

2. Organizational structure and strategic plan development

2.1. Organizational structure

During the Spring of 2016, a new organizational structure for COE diversity efforts was developed and adopted to improve the vision and coordination, and thus the impact, of diversity-related efforts. While the College had undertaken many valuable diversity-related initiatives in the past, there was no overarching structure or plan to bring them together and assess their effectiveness. With the foundation built by those efforts and with the growing interest in inclusive excellence from the University administration, the time was right to take those efforts to the next level, to reorganize and reinvigorate them so as to maximize positive impact. The new structure, shown in Figure 1, went through multiple iterations, with the final version reflecting input from many involved—the Dean’s leadership team, Department Chairs, the previously established COE Committee on Diversity, and interested individual faculty and staff.

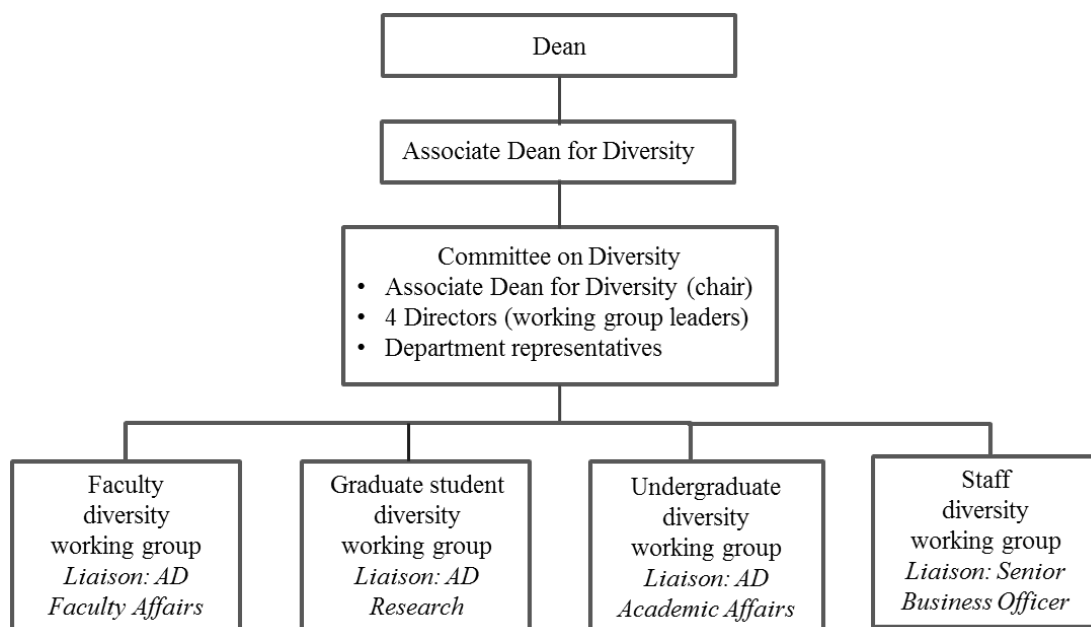


Figure 1. Organizational structure of College of Engineering diversity efforts

An Associate Dean of Diversity oversees all efforts, serves as the College Chief Diversity Advocate, and reports to the Dean. There are four working group Chairs, one each to oversee all efforts related to faculty, graduate students, undergraduate students, and staff, respectively. Each leads an active, working group focused on efforts related to the associated constituency. Each working group has an Associate Dean or other senior college administrative leader who acts as a liaison between the working group and related general college functions. The Committee on Diversity—comprised of the Associate Dean for Diversity (Chair), the four working group Chairs, and representatives from each department—serves to support the efforts of the working groups and ensure they are coordinated and guided by a common vision. The roles and responsibilities of each position, committee, and working group are described in Appendix A. The specific people serving in each role as of July 2017 are included in Appendix B. As of that time, more than 40 faculty, staff, and students are meaningfully engaged as part of the diversity team, including the College ADVANCE Fellow, Michael Chajes, who is serving as Chair of the Faculty Diversity Working Group.

2.2. Approach

The new team, which formed in Fall 2016, has defined the following guiding principles:

- **Engage.** The challenges we face require ideas, energy, and buy-in from as many members of the College community as possible. We seek to engage everyone at the level of commitment they can offer.
- **Divide and coordinate.** By partitioning responsibility among the four groups and empowering each to define the challenges and propose solutions, we establish accountability and allow each group to focus on a more manageable task. Coordinating among the four groups, with everyday College operations, and with the Vice Provost for Diversity, UD-ADVANCE, and others at the university level, we ensure the groups' efforts are aligned and efficient.
- **Be strategic.** Our approach is data and research-driven, systematic and analytical, setting goals, targeting interventions, and assessing progress to be as effective and efficient as possible.
- **Integrate.** Rather than operating as a separate stream of activities, diversity and inclusion must be an integral part of normal College operations—recruiting, advising, and teaching students; recruiting and supporting faculty and staff. Although this approach can be difficult, requiring close collaboration with many groups, it is the only way to get to the source, rather than symptom, of some issues, and to ensure that changes are institutionalized and sustainable.
- **Communicate.** We seek transparency and openness for diversity and inclusion efforts so that we can uncover and include as many good ideas as possible, engage as many community members as possible, and ultimately take advantage of momentum from early successes to facilitate later ones. Building a reputation for positive work in the diversity could make it easier to recruit students, faculty, and staff that further improve diversity and inclusion within the College.

Each of the four working groups—Faculty, graduate student, undergraduate, and staff—developed their own strategic plan (see Attachments). Each strategic plan includes the following for the group: Goals, summary of the current status of diversity, background on previous diversity and inclusion efforts, specific aims and tasks planned to achieve the goals, a budget, and a schedule. For convenience, in Sections 3 and 4, we summarize the goals and planned tasks, respectively, from the four plans.

3. Diversity and inclusion goals

Based on analyses of the current status of diversity and inclusion in each group, and review of the literature and best practices, we defined our ultimate goals, and each working group defined five-year goals as well (see Attachments for details). They are assembled here for convenience. Although the College seeks diversity and inclusion in all forms (Section 1), our efforts initially focus on diversity with respect to women and underrepresented groups (URGs, defined as non-White, non-Asian), for which the College has particularly obvious deficiencies. We fully expect that many other groups (e.g., those based on gender identity, religion, physical capability) will benefit from these initial efforts. In fact, since many of the tasks involve simply implementing best practices, they should be beneficial to College operations in general.

Many issues were considered in defining these goals. We considered goals related to demographics, possible disparities among groups in retention rates or ranks, and inclusiveness of the climate. These three types of goals are related but not the same. It is possible to have diversity in numbers and still lack a fully inclusive environment, for example. For the demographics, we considered goals both in absolute terms and relative to other universities. The former is what determines if critical mass exists and is most relevant for the benefits diversity and inclusion are meant to achieve. The latter is relevant to help benchmark progress since we recognize the College is influenced by the context and social dynamics of the country. We also considered the timing of achieving goals. We wanted to specify a timeline for goals as much as possible to ensure the urgency exists to make progress given the College's other pressing issues. However, we also recognize that changes in demographics are limited by the turnover rates of each group. Every four years, the undergraduate student body is entirely renewed. Graduate students typically remain in the College for two to five years. Changes in graduating classes then, must be reflected to a large extent in the incoming class approximately four years prior. For faculty and staff, only a small portion leave and are hired each year, so changes in overall demographics are necessarily slow. For these reasons, we are interested both in incoming and overall demographic numbers. We considered goals at the College level, but recognizing the heterogeneity of departments, at the department level as well. We also need to be cognizant of the natural variability that results from the relatively small numbers in some groups. Thus, we realize that we must be careful not to interpret normal variability as either positive or negative trends. Finally, there are multiple ways to partition each group that may be of interest. For example, by type (tenured/tenure-track vs. continuing track) and rank for faculty; by domestic vs. international for graduate students. In defining goals, we sought to be careful and specific to capture the issues necessary to achieve the benefits of inclusive excellence while remaining as simple and focused as possible to facilitate communication and assessment of progress. With all these ideas in mind, the ultimate and five-year goals, described more fully in the attachments, are as follows (Figure 2 and 3).

ULTIMATE GOALS	
To fully achieve inclusive excellence, our ultimate goals are for the College to have:	
• Demographics similar to the national population • No disparities between racial, gender, or other groups in retention rates or across ranks, and • An inclusive, supportive climate in which all members of the community can thrive	

Figure 2. Ultimate goals for College diversity and inclusion

FIVE-YEAR GOALS			
	Demographics for each department and for the College as a whole	Disparities (racial, gender) for the College as a whole	Climate
Faculty	25% women 10% URGs	• No disparities in retention rates • Continuous improvement towards no disparities in T/TT vs. CT, and in distribution across ranks	Inclusive, supportive
Graduate students	Among incoming students: 33% women 25% URGs (among domestic)	No disparities in retention rates	Inclusive, supportive
Undergraduate students	Among incoming students: 30% women 15% URGs	No disparities in 6-year graduation rates (70% for all)	Inclusive, supportive
Staff	30% women on technical staff 20% URGs on all staff 20% men on administrative staff	Continuous improvement towards no disparities in managerial vs. non-managerial	Inclusive, supportive

Figure 3. Five-year goals for College diversity and inclusion

Note that we have not made relative ranking compared to other universities an official goal because absolute demographic goals are more relevant for realizing the benefits of diversity and inclusiveness, and because data availability in measuring progress towards relative ranking goals requires using rates for graduating students, which have a time delay and thus are more difficult to achieve as five-year goals (unlike incoming students). Nevertheless, we intend to track demographics relative to other universities, with an aim to have every department and the College as a whole be in the 75th percentile in terms of percentage of women and percentage of people from URGs at all levels.

4. Aims and planned tasks

Each of the four working groups defined a few specific aims, and for each, multiple tasks or actions items required to achieve them. The details, again, including proposed budgets and timelines, are in the Attachments. The main aims and tasks are summarized in Section 4.1 for convenience. Since some efforts have already begun, the status of each—[C] complete or established as on-going effort now, [I] in progress, or [P] planned—is indicated. Additional tasks required at the College-level, to be led by the Associate Dean for Diversity, are presented in Section 4.2.

4.1. Summary tasks from four plans

Status: [C] = complete or established as on-going effort now; [I] = in progress; [P] = planned

Faculty

1. Improve recruitment of excellent, diverse faculty
 - [I] Hold annual recruiting workshops for all faculty search committee members.
 - [P] Utilize networks of diverse scholars. The college has numerous faculty tied into networks that should be leveraged in searches.
 - [I] Learn from search committee chairs via surveys and interviews what worked well and what did not. The lessons learned will be used to update the workshops.

- [P] Hold “Faculty of the future” workshops on campus every other year.
 - [P] Develop new programs that can be used to recruit diverse faculty such as fellowship programs for postdocs with an explicit pathway to a faculty position (assuming good performance as a postdoc).
 - [P] Create new named junior and senior professorships used to recruit diverse faculty.
2. Improve faculty mentoring
 - [P] Hold annual mentoring workshops for mentors and mentees.
 - [P] Develop improved mentoring practices by exploring new approaches, such as, hybrid one-on-one/cohort-based mentoring.
 - [P] Work with the dean and department chairs to ensure that mentoring is evaluated during the annual evaluation process. This will ensure mentoring accountability.
 3. Improve climate as it relates to diversity and inclusion
 - [I] Include diversity and inclusion topics in department faculty meetings, deans/chairs meetings, and college faculty meetings.
 - [P] Message from the deans and chairs of the importance of diversity and inclusion. Inclusion of diversity and inclusion topics in college and department PR materials including being sensitive to materials and displays that do not represent our diversity goals.
 - [P] Hold a college-sponsored distinguished seminar series in which we bring in diverse speakers to give scientific talks, perhaps one per semester. This could be organized either by having departments nominate speakers, having the faculty diversity working group solicit nominations and select speakers, or having the talk rotate among departments. This would have a direct impact on climate in allowing students and other faculty to interact with more diverse faculty than just those at UD.
 - [I] Hold 1-2 social gatherings to build community. These can be a combination of gatherings for specific groups, like a women faculty lunch, to gatherings of the College faculty as a whole.
 4. Educate chairs on issues on faculty diversity
 - [P] Develop and hold a chairs workshop to engage, educate and support chairs on issues influencing diversity and inclusion.
 - [P] Make diversity and inclusion actions and accomplishments a portion of the annual evaluation of chairs by the dean.

Graduate students

1. Improve recruiting of an excellent, diverse group of graduate students at both Master’s and PhD level.
 - [P] Leverage current outreach programs for graduate student recruiting.
 - [P] Expand existing successful department programs and encourage adoption of best practices across departments.
 - [P] Develop new recruiting initiatives.
2. Improve formal and informal advising and mentoring for graduate students.
 - [P] Assess retention rates for departments in the College of Engineering.
 - [P] Leverage/extend existing peer mentoring programs.
 - [P] Provide support for better faculty and staff advising and mentoring.
 - [P] Clarify policies related to graduate student progress and grievances.

3. Improve the climate for diverse groups in the College of Engineering.
 - [P] Conduct graduate student focus groups study to assess climate.
 - [P] Improve support for graduate student mental health.
 - [P] Assessment of diversity initiatives through annual climate survey.

Undergraduates

1. Strengthen recruitment practices to improve yield, especially of qualified women and URGs.
 - [I] Revise student-facing marketing materials
 - [C] Customize marketing by departments through admissions portal
 - [C] Train faculty and students for University-sponsored recruiting events
 - [I] Have faculty conduct direct outreach to student recruits
 - [C] Recruit engineering undecided (EGU) students into departments through freshmen year
 - [C] Recruit and co-advise university studies (UST) students with interest in engineering
 - [P] Develop best practices for facilitating external student transfers, particularly from diverse feeder institutions
2. Strengthen existing student support services and extracurricular programming around student recruitment, retention, and achievement, particularly for women and URGs.
 - [C] Hire properly credentialed staff academic advisors in each department
 - [I] Provide college-level oversight and coordination of staff and faculty advisors
 - [P] Incorporate undergraduate student advisement into faculty evaluation system
 - [I] Select appropriate faculty advisors for critical student organizations
 - [I] Underwrite base operating budgets for diversity-focused student organizations
 - [I] Incentivize student organizations to join diversity effort through merit-based supplemental funding
 - [I] Re-envision the RISE program, starting with development of a strategic plan for it
3. Educate and empower the faculty to implement cultural and curricular changes proven effective with diverse learners.
 - [C] Routinely present diversity issues at departmental faculty meetings
 - [C] Sponsor a college-wide diversity journal club
 - [P] Sponsor a one-time, externally funded faculty workshop on diversity in the classroom
 - [P] Run a semester-long diversity seminar series
 - [I] Assign faculty most effective at teaching to first and second year courses
 - [C] Conduct a comprehensive student-focused climate study
 - [P] Fund faculty seed grants for diversity research
 - [I] Establish “alternative routes” through first and second year courses
 - [I] Conduct market research into admissions policies, specifically EGU designation

Staff

1. Improve recruitment of excellent, diverse administrative and technical staff
 - [I] Broaden staff job applicant pools
 - [P] Develop best practices for job searches
2. Improve retention of excellent, diverse administrative and technical staff
 - [P] Conduct a staff focus group study
 - [P] Host facilitated brown bag lunches for staff on diversity and inclusion

- [C] Have the Associate Dean present semi-annually on diversity and inclusion at the all-college staff meetings
- [P] Sponsor half-day workshops for staff on diversity and inclusion with an invited facilitator

4.2. College-wide tasks

Status: [C] = complete or established as on-going effort now; [I] = in progress; [P] = planned

Task 1. Develop organizational structure and strategic plans for diversity and inclusion.

- [C] Organizational structure. The first major undertaking is to define an organizational structure that supports effective and efficient work in improving diversity and inclusion in the college, and then to recruit energetic, engaged faculty, staff, and students to assume the defined roles. Timeline: Complete in Fall 2016.
- [C] Planning. The second part of this task is development of thoughtful, research-based, data-driven strategic plans to guide the initiative, including clear goals, timelines, and budgets. They should reflect broad based input from all interested parties. Timeline: Complete in Summer 2017.

Task 2. Raise funds to support diversity and inclusion efforts.

[I] With the budgets in place, a plan must be developed to collect the required funds from various sources—College and University budgets, alumni giving, corporate giving, internal grants, and external grants (e.g., from the National Science Foundation). By creating a comprehensive plan, spending can be prioritized and each potential source can be targeted for support of the endeavors most appropriate to it. Timeline: Discussions with staff in charge of alumni and corporate giving have begun. Fundraising will be a focus in Fall 2017 and Spring 2018.

Task 3. Develop and implement College-wide diversity and inclusion communications plan.

[I] A communications plan for College diversity and inclusion efforts should be developed and implemented to maintain awareness of, create buy-in for, and develop widespread engagement in the efforts, and to ensure the best ideas are solicited and included. The communication strategy should be tailored to each particular target audience, including current and potential future faculty, graduate students, undergraduates, staff; alumni; potential donors; and the general public. We expect that it will include description of on-going efforts and development and distribution of an annually-updated Diversity Scorecard that reports the results of progress toward our goals based on the evaluation (Section 5). Timeline: In AY16-17, a strategy was begun in which each semester the Associate Dean for Diversity visits one faculty meeting per department as well as one all-College staff meeting to provide updates on a particular topic (Fall 2016 topic: New organizational structure; Spring 2017 topic: Undergraduate strategic plan). Those efforts have been effective and will be continued. In AY17-18, communications for other audiences, including an improved website will be the focus.

Task 4. Individual engagement of Department Chairs.

[P] Recognizing that Department Chairs are key players in implementing many of the diversity and inclusion efforts and in setting the tone for the College, we will provide Chairs with the support they need to be effective partners and advocates. For each department, we plan to have individual meetings 1-2 times per year with the Department Chair and the core diversity team (Associate Dean for Diversity and Chairs of the four working groups). In the meetings, the core diversity team will provide department-specific updates on the progress, challenges, recommended solutions, and on-going activities, and will answer questions and hear concerns and ideas from the Chair. Timeline: Begin AY17-18.

Task 5. Support faculty, graduate student, undergraduate, and staff diversity working groups in developing and implementing their plans.

[I] The Associate Dean for Diversity must make substantial efforts to support the working groups in their tasks, ensuring they are coordinated with each other and with other College and University operations.

Timeline: Began in Fall 2016, on-going.

5. Evaluation

We will monitor progress towards our goal of increasing diversity among the College's undergraduate student, graduate student, faculty, and staff. There will be two primary mechanisms for evaluation, each of which will be conducted annually for student, faculty, and staff subpopulations. First, we will use institutional data to determine the change in demographics, focusing on gender and racial diversity, over the course of the year. We will report the demographic composition of (1) the incoming and outgoing cohorts for students, and the groups hired and leaving for faculty and staff, and (2) the aggregate demographics for subpopulations across the College. Data will be compared to diversity targets established in each working group's strategic plan.

Second, to monitor shifts in student, faculty, and staff climate that may not be immediately reflected in demographic changes, we will conduct voluntary annual surveys specific to each subpopulation, each year for all five years of this strategic plan. First year survey results will be considered baseline. Survey instruments will be designed and validated by the Delaware Education Research and Development Center (DEDRC), in consultation with the College Diversity Team, using common themes identified by the focus groups with each subpopulation.

We will make the results of both evaluations publically available (while ensuring confidentiality) as part of the Diversity Scorecard (Task 3).

6. Conclusions

This strategic plan, together with the four attached strategic plans related to faculty, graduate student, undergraduate, and staff diversity, will serve as a guide for the reorganized and reinvigorated College efforts to broaden participation and make the College an inclusive place to learn, work, and grow. These plans represent months of discussion and debate by many faculty, staff, and students involved in diversity and inclusion in the College. Nevertheless, while the plans will provide important blueprints for the actions we undertake in the next five years, we expect that they will continue to evolve as we proceed and learn, and as conditions change.

APPENDIX A. Diversity structure memo

July 2016

Administration of diversity in the College of Engineering

Goals in developing this structure for diversity in the College

- Provide an overarching structure to diversity efforts in the College that offers vision and coordination
- Establish accountability by ensuring clarity of who is ultimately responsible for what
- Empower working groups. Support them with the necessary authority and resources so that they can be effective.
- Engage more faculty, staff, and students to actively participate in the efforts to improve diversity, and institutionalize their involvement through the working groups
- Treat all populations equally, encouraging cooperation and coordination among them, while recognizing the unique issues for each
- Focus on action-oriented efforts that move beyond documentation and planning
- Make working groups small enough to be effective and efficient while ensuring they are inclusive and incorporate input from diverse viewpoints
- Maintain and build on success of existing activities and programs (e.g., WIE, RISE)

Overview

With these goals, we propose the following structure for diversity-related efforts in the College of Engineering. An Associate Dean of Diversity oversees all efforts and reports to the Dean. There are four Working Group Chairs, one each to oversee all efforts related to faculty, graduate students, undergraduate students, and staff, respectively. Each leads an active, working group focused on efforts related to the associated constituency. Each working group has an Associate Dean or other senior college administrative leader who acts as a liaison between the working group and related general college functions. The Committee on Diversity—comprised of the Associate Dean for Diversity (Chair), the four Working Group Chairs, and representatives from each department—serves to support the efforts of the working groups and ensure they are coordinated and guided by a common vision. Each position, committee, and working group is described further below.

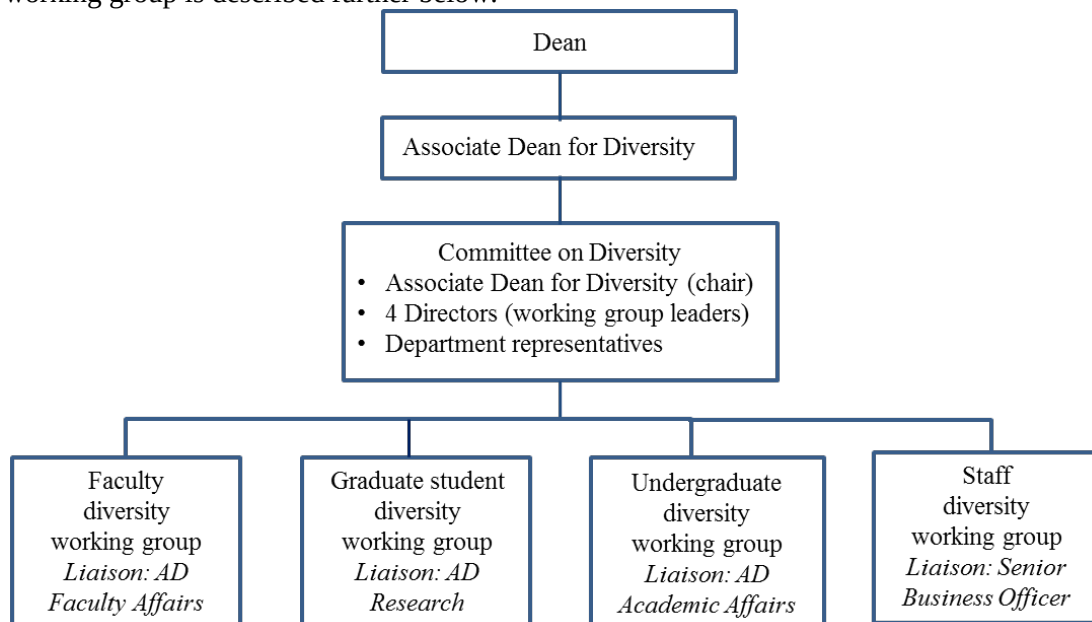


Figure 1. Proposed structure

Associate Dean for Diversity

- Oversees all activities related to improving the recruitment and retention of a diverse, inclusive community of faculty, staff, graduate students, and undergraduates
- Represents the College diversity efforts externally by serving as:
 - * College of Engineering Diversity Advocate under the Associate Provost for Diversity's Executive Council on Diversity
 - * In other capacities as needed
- Oversees the Committee on Diversity and four working groups shown in Figure 1 and described below by:
 - * Chairing the Committee on Diversity
 - * Ensuring each working group is fully populated and actively engaged in its mission
 - * Ensuring each working group has the support it needs—authority and resources—to be effective
 - * Ensuring the working groups are coordinating effectively
 - * Serving as an ex-officio member on the faculty, graduate student, undergraduate, and staff working groups
- Ensures adequate resources are available for College diversity efforts by working with the Dean and the College Development Office, and writing grant proposals
- Oversees College diversity budget
- Manages all staff working on diversity within the College Dean's Office and coordinates with other staff with ancillary diversity functions via job function and/or external grant activity. (If there are no additional resources at the start for additional FTEs for diversity functions, a transition plan and implementation timeline will be developed. Many of the current diversity staff are dual-purposed, where their primary function is not directly related to diversity.)
- Coordinates with the ADVANCE Fellow, who may or may not be involved on one of the four working groups
- Oversees coordination with externally-funded efforts that include Engineering but are larger than the College, such as, ADVANCE, LSAMP, and BTB
- Coordinates with the Dean and his team as needed
- Reports to the Dean

Working Group Chairs

- There are four Diversity Working Group Chairs, one to lead diversity efforts related to each constituency—faculty, staff, graduate students, and undergraduates. The Staff Diversity Working Group Chair will be a staff member; all others will be faculty members.
- Responsible for diversity efforts related to the associated constituency
- Lead the associated working group and ensure it undertakes its charge effectively
- Choose members of associated working group, at least initially
- Serve on the Committee on Diversity
- Report to the Associate Dean for Diversity
- Considered a major service assignment

Committee on Diversity

- Comprised of the Associate Dean for Diversity (Chair), the four Diversity Working Group Chairs, and representatives from each department. A Working Group Chair may be considered the representative of his/her department if desired. Members are encouraged, but not required to also serve on a working group. The membership should be determined with an aim to ensure inclusion of diverse viewpoints based on gender, race, and other relevant characteristics.

- Functions as an active, working committee that meets regularly and is supported with necessary resources
- Ensures that the faculty, graduate student, undergraduate, and staff diversity working group goals and plans are coordinated and in line with the College and University goals
- Supports the faculty, graduate student, undergraduate, and staff diversity working groups in their efforts by providing input and feedback, and by advocating on their behalf
- Evaluates and documents effectiveness and efficiency of College diversity efforts overall, with help from the working groups
- Promotes diversity efforts within and outside of the College. Department representatives promote diversity efforts within their departments.

Faculty, Graduate Student, Undergraduate, and Staff Diversity Working Groups

This description holds for all four working groups, with “associated group” referring to faculty, graduate students, undergraduates, and staff, respectively.

- Led by a Chair who, at least initially, can choose its members.
- Formed so that it is small enough to be effective and efficient while ensuring inclusion of diverse viewpoints based on role (faculty, staff, student), department, gender, race, and other relevant characteristics. For the Graduate Student Working Group, membership may include Chairs of the subcommittees, such as, WIE. For the Undergraduate Committee, membership may include undergraduate student leaders from the student organizations, such as, SWE, NSBE, and SHPE.
- An Associate Dean or other senior college administrator with responsibility for the related area acts as a liaison to link diversity working group activities to more general college activities on the topic (e.g., linking faculty diversity efforts to more general faculty affairs). This will likely be the Associate Dean for Faculty Affairs for the Faculty Working Group, the Associate Dean for Research for the Graduate Student Working Group, the Associate Dean for Academic Affairs for the Undergraduate Working Group, and the Senior Business Officer for the Staff Working Group.
- Functions as an active working group that meets regularly and is supported with necessary resources
- Defines diversity goals and plans for the associated group, in consultation with the Committee on Diversity
- Responsible for all activities related to diversity for the associated group, including efforts to promote diversity in hiring/recruitment, retention, promotion, and improving the climate
- Oversees existing diversity efforts for the associated group and initiates new ones as deemed necessary. For the Faculty Working Group, at least initially, this will include running the search committee and mentoring workshops begun under ADVANCE PAID. For the Graduate Student Working Group, this includes overseeing more focused graduate student diversity committees, organizations, and programs, including the existing Graduate Student Women in Engineering (WIE) Steering Committee. For the Undergraduate Working Group, this includes overseeing more focused undergraduate student diversity committees and organizations, including for example, SWE, NSBE, and SHPE.
- Evaluates and documents effectiveness and efficiency of diversity efforts for the associated group
- Promotes diversity efforts related to the associated group within and outside the College
- Coordinates with the other three diversity working groups
- Reports to Committee on Diversity

APPENDIX B. Diversity Team (as of 7/1/17)

Committee on Diversity

Chair: Rachel Davidson (Associate Dean for Diversity, Faculty, CIEG; College Chief Diversity Advocate)

- Michael Chajes (TT Faculty, CIEG)
- Robert Opila (TT Faculty, MSEG)
- Jenni Buckley (CT Faculty, MEEG)
- Christine Shinn (Staff, HR Manager, College)
- John Slater (TT Faculty, BMEG)
- Raul Lobo (TT Faculty, CHEG)
- Kathy McCoy (Chair, CISC)
- Heather Doty (CT Faculty, MEEG)
- Josh Zide (TT Faculty, MSEG)
- Tingyi Gu (TT Faculty, ELEG)

Faculty Diversity Working Group

Chair: Michael Chajes (Faculty, CIEG; College Advance Fellow)

Liaison: Pam Cook (Associate Dean for Faculty, College)

- Heather Doty (CT Faculty, MEEG)
- Thomas Epps (TT Faculty, CHEG)
- Rebecca Gegan (Staff, HR Asst., College)
- Dawn Elliott (Chair, BMEG)
- Hui Fang (TT Faculty, ELEG)
- Stephanie Law (TT Faculty, MSEG)
- Dustyn Roberts (CT Faculty, MEEG)
- Hagit Shatkay (TT Faculty, CISC)

Graduate Student Diversity Working Group

Chair: Robert Opila (TT Faculty, MSEG)

Liaison: Yushan Yan (Associate Dean for Research and Entrepreneurship, College)

- Benjamin Carterette (TT Faculty, CISC)
- Pierre Desir (Graduate student)
- Camil Diaz (Graduate student)
- Heather Doty (CT Faculty, MEEG)
- Arthi Jayaraman (TT Faculty, CHEG)
- Gwendolyn Looby (Staff, Academic Advisor, ELEG)
- Nii Attoh-Okine (TT Faculty, CIEG)
- Nicholas Valdes (Graduate student)
- Josh Zide (TT Faculty, MSEG)

Undergraduate Diversity Working Group

Chair: Jenni Buckley (CT Faculty, MEEG)

Liaison: Michael Vaughn (Associate Dean for Academic Affairs, College)

- Josh Enszer (CT Faculty, CHEG)
- Terry Harvey (CT Faculty, CISC)
- Marianne Johnson (Staff, RISE Program, College)
- Terri Kalesse (Staff, Academic Advisor, College)
- Andy Novocin (CT Faculty, ELEG)

- Sarah Palmer (Staff, Undergrad coordinator, CIEG)
- Lori Pollock (TT Faculty, CISC)
- Sarah Rooney (CT Faculty, BMEG)
- Ismat Shah (TT Faculty, MSEG)

Staff Diversity Working Group

Chair: Christine Shinn (Staff, HR Manager, College)

Liaison: Michael Matthews (Senior Business Officer, College)

- Michael Davidson (Staff, Master Elect/Inst Spec, College)
- Mark Dobbins (Staff, Business Office Manager, College)
- Megan Hancock (Staff, Sponsored Programs Coordinator, Center for Composite Materials)
- Al Lance (Staff, Machinist, College)
- Michele Schwander (Staff, Academic Advisor, BMEG)
- Maria Tarry (Staff, HR Assistant, College)
- John Yoo (Staff, Data Analyst, College)

APPENDIX C
University of Delaware Comparator Institutions
as of September 2016 as determined by the UD President's office
(<http://ire.udel.edu/comparators-dashboard/>)

Boston University
Case Western Reserve University
Georgia Institute of Technology – Main Campus
Indiana University – Bloomington
Iowa State University
Michigan State University
North Carolina State University at Raleigh
Ohio State University – Main Campus
Pennsylvania State University – Main Campus
Purdue University – Main Campus
Rutgers University – New Brunswick
Stony Brook University
Texas A&M University – College Station
University of Arizona
University of Connecticut
University of Illinois at Urbana-Champaign
University of Maryland – College Park
University of Massachusetts – Amherst
University of Michigan – Ann Arbor
University of Minnesota – Twin Cities
University of North Carolina at Chapel Hill
University of Pittsburgh
University of Utah
University of Virginia – Main Campus
Virginia Polytechnic Institute and State University

Strategic Plan for Faculty Diversity and Inclusion

Faculty Diversity Working Group
College of Engineering, University of Delaware

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1. Introduction

The College of Engineering, through efforts supported by two NSF ADVANCE grants (the first being awarded in 2008), has worked over the past decade to improve the level of faculty diversity, in particular, the number of female faculty (FF). The College has implemented workshops to train members of search committees on best practices in conducting faculty searches, and also has put in place a required mentoring program for all assistant professors (tenure-track, TT, and continuing track, CT) that has been supplemented by workshops for mentors. While the data presented herein shows that the efforts to date have led to some improvement in the percentage of FF, additional progress related to faculty diversity and inclusion is still needed. With the University President's stated desire to increase the size of the College faculty substantially over the next several years, we have an unusual opportunity to improve diversity and inclusion as part of that process. We have and will continue to coordinate closely with UD-ADVANCE in developing and implementing this plan.

2. Goals

To have the best faculty and teach a diverse student body, we need a diverse faculty and a supportive and inclusive environment. We will attain these goals by implementing best practices for recruiting and mentoring faculty, as well as building a supportive and inclusive culture across the College. Note that although the College seeks diversity and inclusion in all forms, our efforts initially focus on diversity with respect to women and underrepresented groups (URGs, defined as non-White, non-Asian), for which the College has particularly obvious deficiencies. We fully expect that many other groups (e.g., those based on gender identity, religion, physical capability) will benefit from these initial efforts. In fact, since many of the tasks involve simply implementing best practices, they should be beneficial to College operations in general.

To be among the most diverse engineering colleges, and most fully benefit from all the ways in which diversity can enable the College to achieve and maintain excellence, the five-year goals for the College of Engineering in terms of faculty diversity are:

- To have to have no less than 25% female faculty and 10% faculty from URGs, within each department and for the College as a whole. Research suggests that "critical mass" for a minority population to self-perpetuate and affect cultural change within the broader community is usually taken to be 15%-30% (Etzkowitz et al. 1994, Childs and Krook 2008). These percentages have often been used to set goals for participation of women or URGs in historically male-dominated fields. Recognizing that the turnover of faculty is slow, however, reaching critical mass will take time. Projections of faculty demographics suggest the College can achieve 25% FF and 10% faculty from URGs in 5 years (see Appendix A).
- To eliminate racial and gender disparities in retention rates in the College.
- To demonstrate continuous improvement towards the ultimate aim of eliminating racial and gender disparities in the distribution between T/TT and CT faculty and in the distribution across ranks (Assistant, Associate, Full professors).

- To create an inclusive culture that is supportive of diversity in all its forms. The College will improve the climate as it relates to diversity and inclusion, especially with respect to URGs.

3. Current Status

This section presents a current measure of faculty diversity in the College of Engineering, as well as a 10-year historical view. It includes two analyses: (1) comparison to other universities by department and over a 10-year period, considering only tenured/tenure-track (T/TT) faculty due to data limitations, and (2) a more detailed analysis of the UD College of Engineering faculty as of June 2017. The first analysis is based on data from the American Society for Engineering Education (ASEE) (Section 3.1); the second on internal UD data (Section 3.2). In both cases, the data are evaluated in terms of percentage of FF and percentage of faculty from URGs. Although we recognize that there are both similarities and important distinctions between faculty of color who are from the U.S. vs. from another country (e.g., African-American vs. African), except where noted in Section 3.2, URG is defined simply as non-white and non-Asian because the ASEE data does not include information regarding foreign nationals.

Additional data that is of interest, and has just been tabulated, is the demographic data from recent searches both in terms of short lists and hires, as well as a better understanding of the demographics of faculty who have left UD, and the reasons for which they left. Plans to continue to gather this information are included in Section 5 and the existing data is currently being studied by the College's faculty diversity working group.

3.1. Comparison to other universities

Because an important use of the data is to compare to national norms (as provided by ASEE), and since demographic data for non-tenure-track faculty is not available for universities across the country in the ASEE database, the data presented in this section is for tenure/tenure track (T/TT) faculty only. CT Faculty are not included. The data for UD are compared both to all institutions in the ASEE database, and to UD's comparator group of 25 schools established by UD's president (Appendix B). The data are compared both at the college level, and by department. It should be noted that UD's comparator group was selected considering institutions as a whole. As such, at both a college and department level, the comparator group may not be the group of top engineering programs that would be selected if only the College of Engineering, or if only specific departments in the College of Engineering departments, was concerned. For college-level comparisons, for each school, we sum only the faculty in the 7 departments that we have in the UD COE.

Table 1 and Figure 1 summarize the T/TT ASEE faculty data on percentage of FF over time, both for UD and the comparison groups. They indicate that in terms of percentage of FF, the College is above the national and comparator group averages (18% at UD vs. 16% for all schools and for the comparator group), and as a college, is at the 73rd percentile nationally. Figure 1 shows that over the last 10 years, the percentage of FF has been increasing at all universities, and especially at UD. This is likely due in great part to the College's explicit efforts under the ADVANCE PAID grant (2008-2013) and the ADVANCE-IT grant (2014-present). Table 1 and Figure 1 also show that the distribution across universities is, and has been, relatively tight, with a difference of only about 6 to 8 percentage points between the 25th and 75th percentile.

Table 1. % Female for the COE as a whole, for T/TT only, over 10 years (2007-2016)

	Year									
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Percentage female, all ranks									
University of Delaware	14%	14%	12%	15%	18%	17%	16%	17%	20%	18%
Average of all schools	12%	13%	13%	14%	14%	14%	14%	15%	15%	16%
Average of comparators	13%	13%	13%	14%	14%	15%	16%	15%	17%	16%
75th percentile among all schools	15%	15%	16%	17%	17%	17%	18%	19%	19%	19%
25th percentile among all schools	9%	9%	9%	9%	10%	9%	10%	10%	11%	12%
UD's percentile among all schools, in terms of %FF	73th	65th	48th	68th	76th	78th	67th	67th	81th	73th

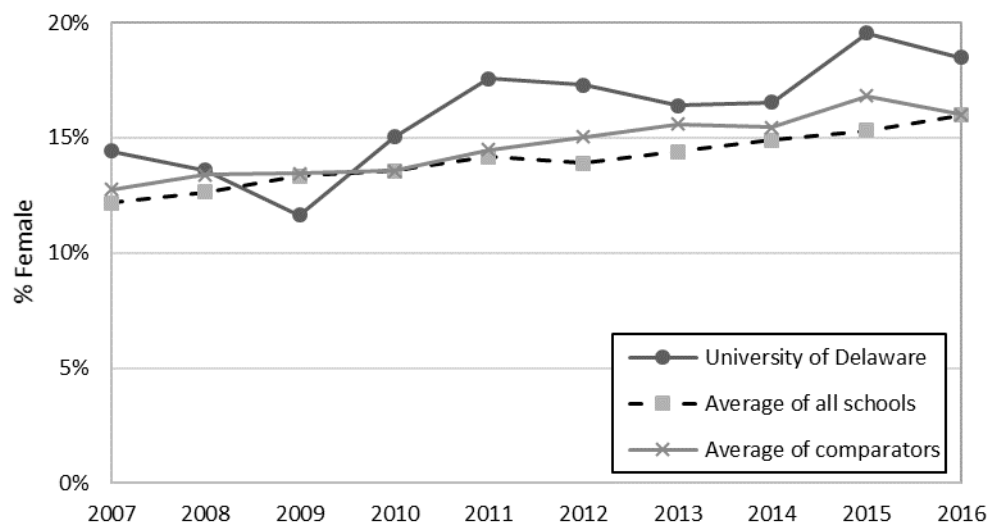


Figure 1. Percentage of female faculty in the College, 2007-2016

Table 2 and Figure 2 show the 2016 data by department, including in Table 2, the approximate number of faculty required to reach the 75th percentile, one possible target, assuming all else remains constant. BMEG and CISC have notably high percentages of FF (43% and 26%, respectively). In total, four departments are above the national average (BMEG, CIEG, CISC, and ELEG), while three are below the national average (CHEG, MEEG, MSEG) (Table 2). The differences are relatively small, however; in only one case is a department more than 2 percentage points below the average (CHEG is 5 percentage points below).

Another useful way of interpreting the data is to see how much of a change is required in each to reach the 75th percentile. Because the numbers of faculty in a department are relatively small (approximately 20, Table 2) and thus percentages are variable, and because the distribution across universities is relatively tight, it turns out that even departments in a relatively low percentile now, with only 1 to 2 additional FF, all departments would reach the 75th percentile (all else remaining constant) (Table 2). Of course, the flip side is that the loss of a just a few FF can cause a substantial drop, and thus retention is exceedingly important. It is also worth noting again that the President has proposed a plan to grow the College faculty substantially in the coming years. Once more details are available on that plan, the analysis can

be repeated to determine how much of that growth would have to include FF to reach the targets from Section 2.

Table 2. % Female by department and for COE as a whole, for T/TT only, for 2016

	Department							
	BMEG	CHEG	CIEG	CISC	ELEG	MEEG	MSEG	COE
	Percentage female, all ranks							
University of Delaware	43%	14%	20%	26%	16%	10%	15%	18%
Average of all schools	24%	19%	18%	19%	13%	12%	17%	16%
Average of comparators	19%	17%	21%	17%	12%	14%	17%	16%
75th percentile among all schools	30%	25%	25%	24%	18%	17%	23%	19%
25th percentile among all schools	15%	11%	13%	12%	6%	5%	11%	12%
UD's percentile among all schools, in terms of %FF	91st	38th	51th	81th	69th	41th	49th	73th
Num. comparators	22	20	23	12	24	23	19	25
Total num. T/TT faculty at UD	7	21	20	19	19	20	13	119
Num. needed to get UD to 75th percentile	---	2.3	1.0	---	0.4	1.4	1.0	0.6

* BMEG=Biomedical; CHEG=Chemical & Biomolecular; CIEG=Civil & Environmental; CISC=Computer & Information Sciences; ELEG=Electrical & Computer; MEEG=Mechanical; MSEG=Materials Science

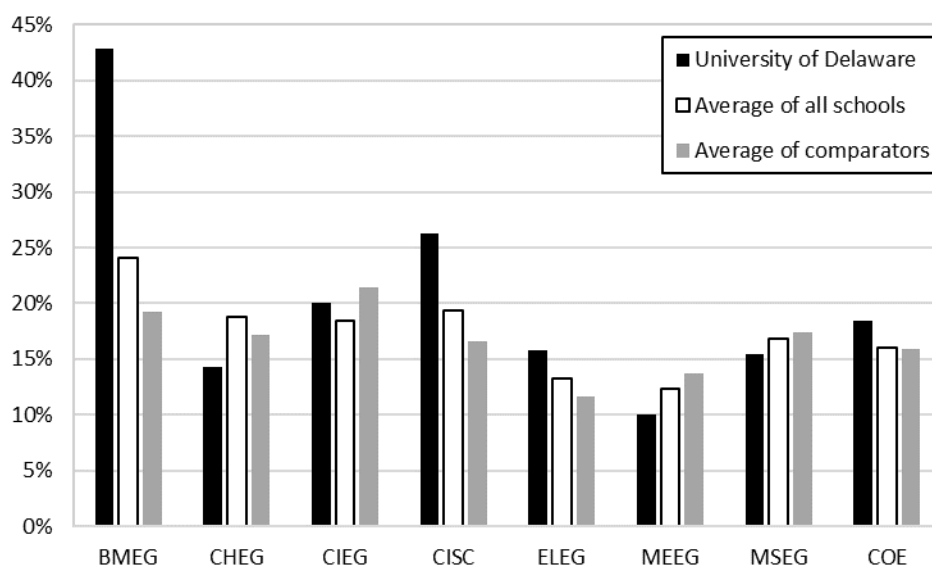


Figure 2. Percentage of female faculty by department and for the College as a whole (2016)

Tables 3 and 4 and Figures 3 and 4 provide analogous data for percentage of faculty from URGs. Table 3 and Figure 3 indicate that unlike for FF, the percentage of faculty from URGs has remained relatively constant over the last decade both for UD and for the comparator groups. The College has remained approximately at the national average. As of 2016, the College has 7% faculty from URGs and is at the 66th percentile nationally. The data show the distribution of percentage URG faculty across universities is also tight, with the difference between the 25th

and 75th percentile only being 5 to 10 percentage points. Since the numbers of URG faculty are even smaller than FF (8 vs. 21 out of 119 in UD's college), the percentages are even more variable than that for FF.

Table 4 and Figure 4, which present the URG faculty data by department, show that although two of the seven departments have zero faculty from URGs (BMEG and MEEG), the other departments are in the 64th to 84th percentile nationally. Examining the number of additional faculty from URGs required to meet the targets, Table 4 suggests that 0 to 2 are required in each department to reach the 75th percentile (all else remaining equal). As discussed in Section 3.2, the relative goal is much easier to meet in this case because most universities have very low percentages of URG faculty. Thus, we feel that it may be desirable to try to achieve a minimum critical mass as opposed to a percentile ranking. Again, while the plus side is that small changes can have a big effect, the downside is that the loss of only one faculty member from either group (female or URG) leads to a substantial drop in the percentage.

Table 3. % URG for the COE as a whole, for T/TT only, over 10 years (2007-2016)

	Year									
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Percentage URG, all ranks									
University of Delaware	7%	7%	8%	6%	5%	5%	6%	6%	9%	7%
Average of all schools	12%	13%	14%	7%	8%	8%	8%	7%	8%	7%
Average of comparators	7%	7%	7%	5%	6%	5%	5%	5%	5%	5%
75th percentile among all schools	12%	13%	13%	8%	8%	8%	8%	8%	8%	8%
25th percentile among all schools	3%	3%	3%	2%	2%	2%	2%	2%	2%	3%
UD's percentile among all schools, in terms of %URG	56th	55th	57th	64th	56th	56th	63th	57th	78th	66th

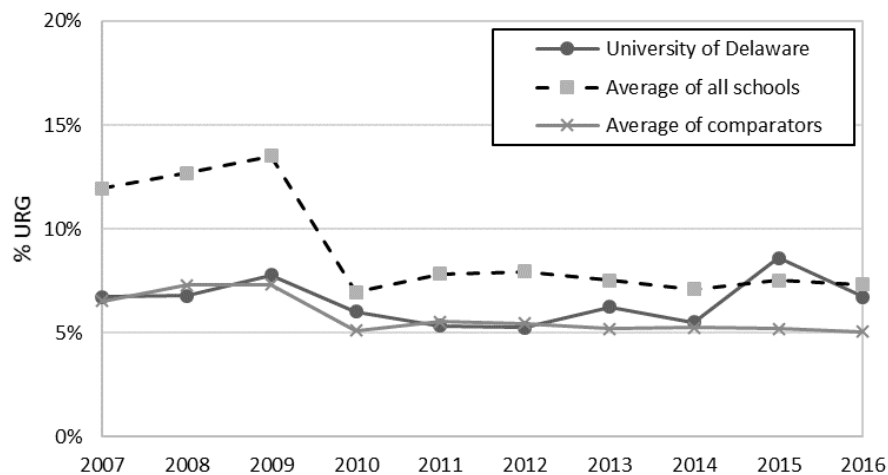


Figure 3. Percentage of URG faculty in the College, 2007-2016

Table 4. % URG by department and for COE as a whole, for T/TT only, for 2016

	Department							
	BMEG	CHEG	CIEG	CISC	ELEG	MEEG	MSEG	COE
	Percentage URG, all ranks							
University of Delaware	0%	10%	10%	5%	11%	0%	8%	7%
Average of all schools	6%	10%	8%	6%	6%	7%	7%	7%
Average of comparators	6%	6%	5%	3%	5%	5%	5%	5%
75th percentile among all schools	9%	14%	12%	7%	7%	9%	9%	8%
25th percentile among all schools	0%	0%	0%	0%	0%	0%	0%	3%
UD's percentile among all schools, in terms of %URG	0th	64th	65th	66th	84th	0th	68th	66th
Num. comparators	22	20	23	12	24	23	19	25
Total num. T/TT faculty at UD	7	21	20	19	19	20	13	119
Num. needed to get UD to 75th percentile	0.6	1.0	0.5	0.3	---	1.8	0.2	1.4

* BMEG=Biomedical; CHEG=Chemical & Biomolecular; CIEG=Civil & Environmental; CISC=Computer & Information Sciences; ELEG=Electrical & Computer; MEEG=Mechanical; MSEG=Materials Science

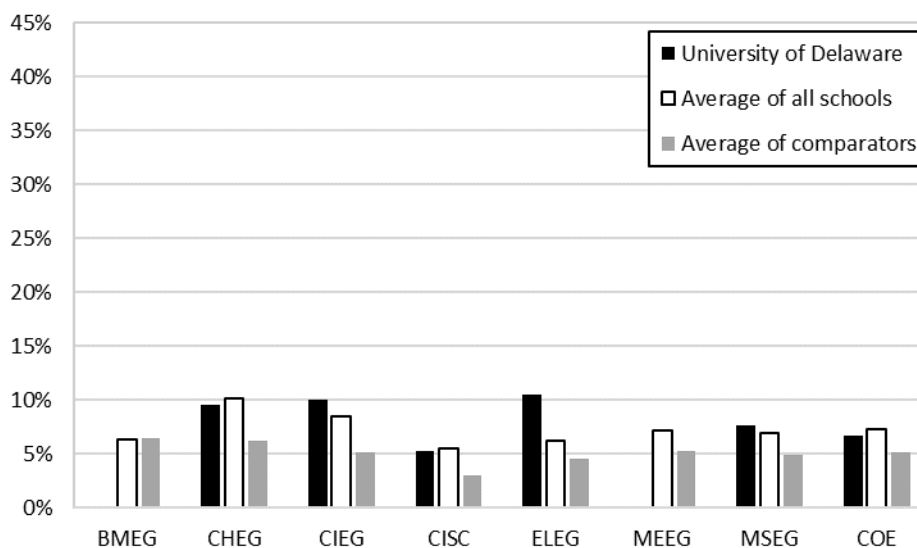


Figure 4. Percentage of URG faculty by department and for the College as a whole (2016)

3.2. College of Engineering faculty data for June 2017

In this section we focus on data for the College of Engineering as of June 2017 so that we can examine a few issues that cannot be investigated using the ASEE data—faculty type (T/TT vs. CT), faculty rank, and URG faculty who are citizens vs. foreign nationals. A few notes about the data deserve mention. The data do not include non-COE faculty with secondary appointments in the College. Faculty are assigned a department based on their primary appointment. Faculty with administrative positions (e.g., Dean, Associate Dean) are included in the data for their home department. Appendix C includes the raw data analyzed in this section.

Figure 5 shows the percentage of female and percentage of URG faculty by type and rank. They indicate that while overall, the College has 22% FF and 7% URG faculty, the percentages vary by type and rank. In particular, women are better represented among CT faculty than T/TT

faculty, and the proportion of T/TT women declines with rank. This is largely because the number of men increases substantially at the higher ranks. While there are 6, 9, 11, and 7 female CT, T/TT Assistant, T/TT Associate, and T/TT Full professors, respectively, there are 10, 18, 26, and 62 males in the same groups. For URG faculty, there are none in the CT group, and the percentages do not show a trend in terms of T/TT rank. On the one hand, CT faculty tend to do a lot of teaching, especially to younger students, so it is positive that they are particularly diverse with respect to gender. On the other hand, CT faculty and T/TT Assistant Professors tend to have less power within the College structure, so it can be problematic if too many of the women are concentrated in those groups and not the tenured ranks.

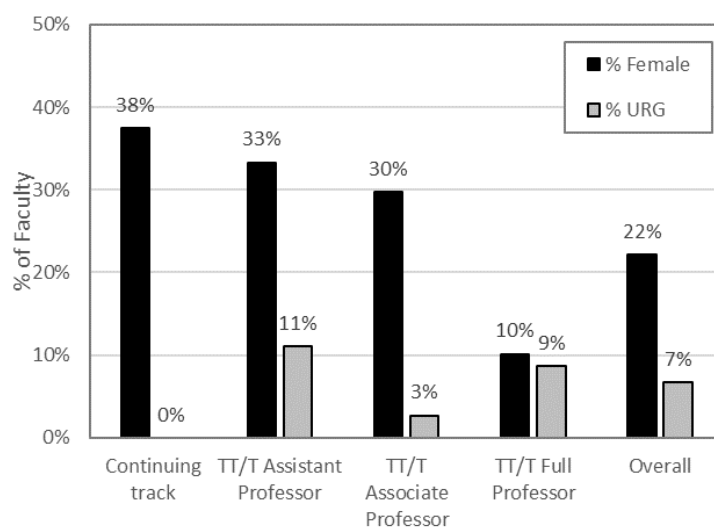


Figure 5. Percentage of faculty who are female and percentage of faculty who are URG by type (CT vs. T/TT) and rank, as of June 2017

To investigate the effect of type and rank more closely, we examine the breakdown by department. For each department and the College as a whole, Figure 6 indicates the percentage of faculty who are female among all faculty, tenured faculty only, and full professors only. Table 5 presents the associated data, together with the number of additional faculty needed to meet the 30% FF and 15% URG faculty targets (including both T/TT and CT). Figure 6 indicates some variability across departments with BMEG (which only has 11 faculty total) and CISC having high percentages of FF, 45% and 29%, respectively, and CHEG having a low percentage (15%). For all departments except BMEG and CISC, and to some extent CIEG, the percentage of FF declines with rank. Notably, CHEG, ELEG, and MEEG have no female full professors. Since tenured faculty and especially full professors tend to have more influence in department affairs, this is important to note. Figure 7 (and Table 5) shows the same information for faculty from URGs. In this case, CHEG has a relatively high percentage of URG faculty, while MEEG is the lowest, with zero URG faculty. Again, at the full professor level, BMEG, CISC, MEEG, and MSEG have no URG faculty at all (although note that BMEG has only one full professor (Table 5)).

To meet the targets of 30% FF and 15% faculty from URGs in all departments (including both T/TT and CT) would require an additional 0 to 4 FF and 1 to 4 faculty from URGs in each

department, all else remaining constant (Table 5). Overall, the College would need to hire 12 additional FF and 12 additional faculty from URGs.

We recognize that there are both similarities and important distinctions between faculty of color who are from the U.S. vs. from another country (e.g., African-American vs. African). Although perfect information on this is not available (i.e., who grew up where), we did examine the breakdown of URG faculty (non-White, non-Asian) who are U.S. citizens vs. those who are not (permanent resident or N/A). Of the 10 URG faculty in the College, 6 are U.S. citizens.

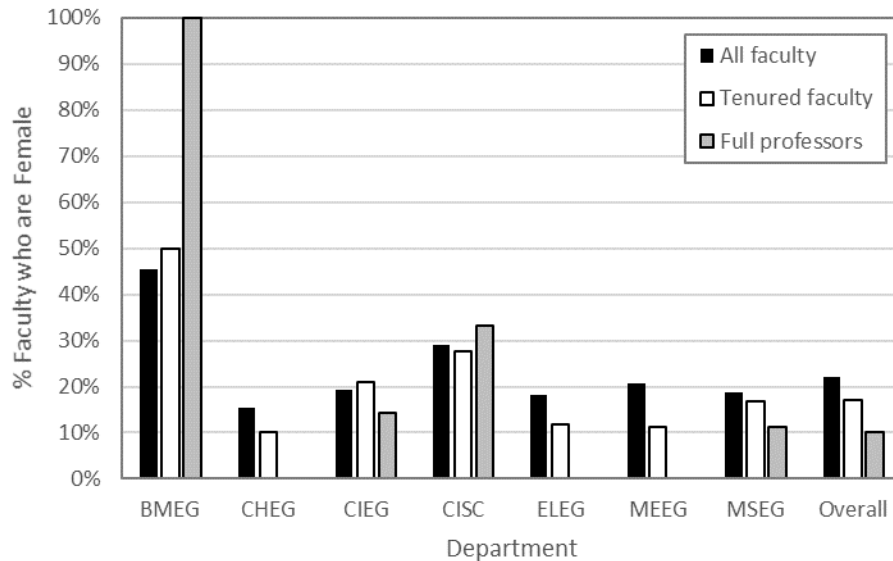


Figure 6. Percentage of faculty who are female among all faculty, tenured only, and full professors only, by department, as of June 2017

(Note: BMEG has only two tenured faculty and only one Full professor, Table 5)

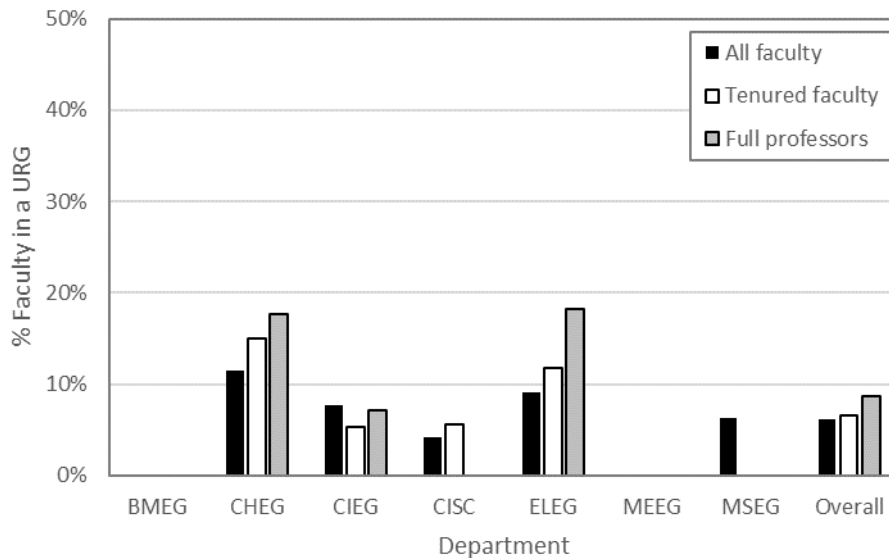


Figure 7. Percentage of faculty who are URG among all faculty, tenured only, and full professors only, by department, as of June 2017

Table 5. Percentage of faculty who are female/URG among all faculty, tenured only, and full professors only, by department, as of June 2017

Department	BMEG	CHEG	CIEG	CISC	ELEG	MEEG	MSEG	COE
All faculty								
Total num.	11	26	26	24	22	24	16	149
% Female	45%	15%	19%	29%	18%	21%	19%	22%
% URG	0%	12%	8%	4%	9%	0%	6%	7%
Num. FF needed to get UD to 30%	---	3.8	2.8	0.2	2.6	2.2	1.8	11.7
Num. URGs needed to UD to 15%	1.7	0.9	1.9	2.6	1.3	3.6	1.4	12.4
Tenured faculty only								
Total num.	2	20	19	18	17	18	12	106
% Female	50%	10%	21%	28%	12%	11%	17%	17%
% URG	0%	15%	5%	6%	12%	0%	0%	7%
Full professors only								
Total num.	1	17	14	9	11	8	9	69
% Female	100%	0%	14%	33%	0%	0%	11%	10%
% URG	0%	18%	7%	0%	18%	0%	0%	9%

* BMEG=Biomedical; CHEG=Chemical & Biomolecular; CIEG=Civil & Environmental; CISC=Computer & Information Sciences; ELEG=Electrical & Computer; MEEG=Mechanical; MSEG=Materials Science

4. Past and Existing Efforts

The College of Engineering has several past and existing efforts aimed at impacting greater recruitment and retention of diverse faculty. Three of the principal efforts are described below: (1) Implementing best practices in faculty searches, (2) implementing best practices in faculty mentoring, and (3) faculty of the future workshops. The discussion of each includes an assessment of the need for improving, expanding, or ending the effort.

Implementing Best Practices in Faculty Searches

As an outgrowth of the work on UD's initial NSF ADVANCE PAID grant, the College of Engineering developed recruiting workshops to train faculty search committee members. The workshops have been adapted over time based on feedback from participants. The delivery of these workshops continues, and is now part of the current NSF ADVANCE activities. The College's NSF ADVANCE Faculty Fellow, along with the College's faculty diversity working group, plan and put on the workshop. To date, all assigned faculty search members have been asked to attend (note that the university ad-hoc committee working on protocols for faculty searches is recommending that search committee members must have attended a workshop within the past three years to be eligible to serve on faculty search committees).

While the statistics to show whether or not the training has led to broader pools and to hires that better support UD's diversity and inclusion goals are still ongoing, the feeling is that these workshops should be continued and institutionalized. The effort for ongoing evaluation and improvement should also be maintained. The College believes that having past participants at the workshops to share their experiences is valuable, and since most faculty do not serve on a search committee more than every three years, the College of Engineering plans to mandate

that all search committee members must attend a recruitment training workshop to serve on a faculty search committee.

Implementing Best Practices in Faculty Mentoring

As an outgrowth of the work on UD's initial NSF ADVANCE PAID grant, the College of Engineering developed mentoring workshops to train faculty mentors. Along with the workshop, the College of Engineering mandated that all assistant professors (TT and CT) be assigned a mentor. To date, the requirement of assistant professors having a mentor continues. The workshop for mentors has not been given in several years. Furthermore, each department has slightly different ways in which they implement the mentoring program, and little monitoring of the program by department chairs exists.

The College feels that mentoring is an essential part of ensuring faculty success and excellence, and plans to not only continue, but expand its mentoring efforts. The College plans to continue requiring that all assistant professors be part of a mentoring program. The current program will be evaluated by the College's faculty diversity working group and improved. The concept of creating a hybrid one-on-one and cohort-based faculty mentoring program is being considered. Furthermore, the past workshop for mentors will be expanded to be a workshop for mentors and mentees, and it will be updated in collaboration with the ongoing NSF ADVANCE efforts. Finally, chairs will be asked to monitor the mentoring efforts of their faculty by including this activity in the annual evaluation process.

Faculty of the Future Workshops

Twice in the past, faculty of the future type workshops have been held at UD by the College of Engineering. These workshops involve inviting a diverse group of doctoral and post-doctoral students to UD to learn about what it takes to become a successful faculty member. These workshops serve to help build the pipeline of talented and diverse faculty candidates. The workshops also introduce these talented prospective faculty to UD. These workshops have been very well received, and the College of Engineering plans to run these in the future on an ongoing basis (every other year).

At future workshops, we will allow some or all of the participants to give scientific talks to the relevant departments (perhaps one per department). This would allow our graduate students to have more exposure to diverse scientists than we may be able to accomplish normally. We should also consider having our junior faculty participate in the activities as the speakers that typically attend present information that are beneficial to junior faculty.

5. Specific Aims

The College of Engineering has four primary aims with regard to diversity and inclusion. The aims are: (1) Improve recruiting of excellent, diverse faculty, (2) Improve faculty mentoring, (3) Improve climate as it relates to diversity and inclusion, and (4) Educate chairs on issues concerning faculty diversity and inclusion. The following sections describe the specific actions being taken to address each of these aims, as well as the metrics being used to evaluate the progress. The College is considering creating an overall "Diversity Report Card" that can be used to tabulate and display its progress on a yearly basis. The aims and actions were developed and

are being implemented in close coordination with UD-ADVANCE to ensure the University and College initiatives complement and support each other.

A. Improve recruitment of excellent, diverse faculty

The specific actions to be taken to help the College improve recruiting of excellent, diverse faculty are:

1. Hold annual recruiting workshops for all faculty search committee members. These workshops will be given early in the process each year so search committees can get the information needed at the outset of the search. All UD requirements will be included, as will be examples of best practices.
2. Utilize networks of diverse scholars. The college has numerous faculty that are tied into various networks that can be leveraged when searches are conducted. These networks should be utilized to the fullest extent.
3. Learn from search committee chairs via surveys and interviews what worked well and what did not. The lessons learned will be used to update the workshops.
4. Hold faculty of the future workshops on campus every other year.
5. Develop new programs that can be used to recruit diverse faculty such as fellowship programs for postdocs with an explicit pathway to a faculty position (assuming good performance as a postdoc).
6. Create new named junior and senior professorships to recruit diverse faculty.

The effectiveness of these actions will be evaluated as follows:

1. Demographics of applicant pools, short lists, and hires over time.
2. Results of search committee chair surveys conducted in conjunction with UD-ADVANCE.
3. Number of "Faculty of the future" workshops and attendees.

B. Improve faculty mentoring

The specific actions to be taken to help the College improve faculty mentoring are:

1. Hold annual mentoring workshops for mentors and mentees. These workshops will cover the responsibilities of both parties, as well as presenting best practices.
2. Develop improved mentoring practices that will explore including hybrid one-on-one/cohort-based mentoring approaches.
3. Work with the dean and department chairs to ensure that mentoring is evaluated during the annual evaluation process. This will ensure mentoring accountability.

The effectiveness of these actions will be evaluated as follows:

1. List of college mentors and mentees to ensure that all assistant professors have at least one mentor.
2. Results of surveys of mentoring effectiveness that will be given to mentors and mentees as part of mentoring workshops.
3. Results from exit interviews of faculty that leave UD.
4. Inclusion of mentoring activities on annual evaluation forms.
5. Results climate surveys held in conjunction with UD-ADVANCE, questions on mentoring in particular.

C. Improve climate as it relates to diversity and inclusion

The specific actions to be taken to improve climate as it relates to diversity and inclusion are:

1. Include diversity and inclusion topics in department faculty meetings, deans/chairs meetings, and college faculty meetings.
2. Message from the deans and chairs on the importance of diversity and inclusion. Inclusion of diversity and inclusion topics in college and department PR materials including being sensitive to materials and displays that do not represent our diversity goals.
3. Hold a college-sponsored distinguished seminar series in which we bring in diverse speakers to give scientific talks, perhaps one per semester. This could be organized either by having departments nominate speakers, having the faculty diversity working group solicit nominations and select speakers, or having the talk rotate among departments. This would have a direct impact on climate in allowing students and other faculty to interact with more diverse faculty than just those at UD.
4. Hold 1-2 social gatherings to build community. These can be a combination of gatherings for specific groups, like a women faculty lunch, to gatherings of the College faculty as a whole.

The effectiveness of these actions will be evaluated as follows:

1. Results of climate surveys held in conjunction with UD-ADVANCE.
2. Results from exit interviews of faculty that leave UD.

D. Educate chairs on issues around faculty diversity and inclusion

The specific actions to be taken to educate chairs on issues around faculty diversity are:

1. Develop and hold a chairs workshop once a year to engage, educate and support chairs on issues influencing diversity and inclusion.
2. Make diversity and inclusion actions and accomplishments a portion of the annual evaluation of chairs by the dean.

The effectiveness of these actions will be evaluated as follows:

1. Measures of department faculty diversity over time.
2. Results of climate surveys held in conjunction with UD-ADVANCE.
3. Results from exit interviews of faculty that leave UD.
4. Diversity and inclusion actions and accomplishments become part of chairs annual evaluations.
5. Chair feedback on effectiveness of workshops.

6. Budget and Timeline

The following are the needed budget and related timeline.

Budget

Budget removed from this version.

Timeline

A 5-year timeline with aims and actions is shown below. It is hoped that within this timeframe, the College as a whole, and every department within the College will achieve the goal of having 25% female faculty and 10% faculty from URGs within five years. To achieve all the goals stated herein, the faculty diversity working group will ensure that specific people/groups are assigned and held accountable for the aims/actions listed below.

[illegible]

References

- Childs, S., and Krook, M.L. (2008). Critical mass theory and women's political representation. *Political Studies* (56), 725-736.
- Etzkowitz, H., Kemelgor, C., Neuschatz, M., Uzzi, B., and Alonzo, J. 1994. The paradox of critical mass for women in science. *Science* 266(5182), 51-54.

Appendix A: Projection of Faculty Demographics

Assumptions

- As of 2017, the numbers of faculty by demographics are as given in Appendix C.
- Based on data from 2007 to 2017, the average years of service of faculty prior to leaving the College is 20. This is made up of roughly 25% of the faculty that leave early on (average of 4 years), and 75% of the faculty that stay for a significant amount of time (average of 25 years). Together, this translates into roughly 5% of the college faculty leaving each year.
- Women, men, URG, and non-URG faculty will leave at the same rates (e.g., if there are 10% faculty from URGs in Year 1, then 10% of the faculty that leave that year will be from URGs).
- The College is expected to expand. It is assumed that the College will hire 2% more faculty than those that leave each year (i.e., hiring 7% each year). At the current college size, this would result in roughly 15 new faculty over the next 5 years.
- On average, one in every three faculty hires will be women (33.3%).
- On average, one in every six faculty members will be from URGs (16.7%).

Note: The College currently has 149 faculty members which include 33 female faculty members and 10 faculty members from URGs. To achieve 30% FF and 15% faculty from URGs (assuming no growth and no loss of FF or faculty from URGs) would mean the addition of 12 FF and 12 faculty members from URGs. This translates roughly into the addition of 2 FF and 2 faculty from URG's per department.

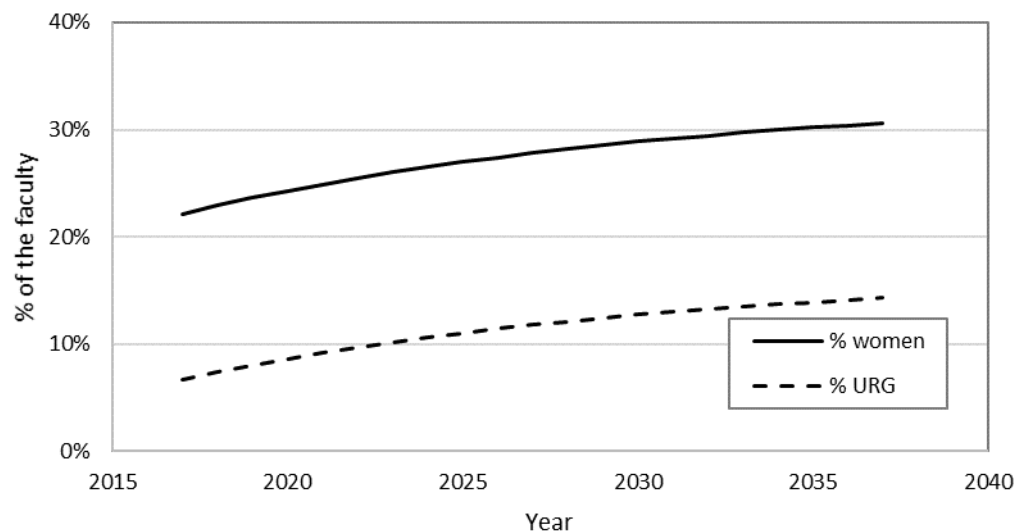


Figure A1. Projected change in demographics of faculty over 20 years, given stated assumptions

Table A1. Projected changes in faculty demographics over 25 years, given stated assumptions

Year		Women		URG		Total number	Num. who leave	Num. hired
		Number	%	Number	%			
0	2017	33	22%	10	7%	149	7.5	10.4
1	2018	35	23%	11	7%	152	7.6	10.6
2	2019	37	24%	12	8%	155	7.8	10.9
3	2020	38	24%	14	9%	158	7.9	11.1
4	2021	40	25%	15	9%	161	8.1	11.3
5	2022	42	25%	16	10%	165	8.2	11.5
6	2023	44	26%	17	10%	168	8.4	11.7
7	2024	45	27%	18	11%	171	8.6	12.0
8	2025	47	27%	19	11%	175	8.7	12.2
9	2026	49	27%	20	11%	178	8.9	12.5
10	2027	51	28%	21	12%	182	9.1	12.7
11	2028	52	28%	22	12%	185	9.3	13.0
12	2029	54	29%	24	12%	189	9.4	13.2
13	2030	56	29%	25	13%	193	9.6	13.5
14	2031	57	29%	26	13%	197	9.8	13.8
15	2032	59	29%	27	13%	201	10.0	14.0
16	2033	61	30%	28	13%	205	10.2	14.3
17	2034	63	30%	29	14%	209	10.4	14.6
18	2035	64	30%	30	14%	213	10.6	14.9
19	2036	66	30%	31	14%	217	10.9	15.2
20	2037	68	31%	32	14%	221	11.1	15.5
21	2038	70	31%	33	14%	226	11.3	15.8
22	2039	71	31%	34	15%	230	11.5	16.1
23	2040	73	31%	35	15%	235	11.7	16.4
24	2041	75	31%	36	15%	240	12.0	16.8
25	2042	77	31%	37	15%	244	12.2	17.1

Appendix B: University of Delaware Comparator Institutions (as of September 2016)

1. Boston University
2. Case Western Reserve University
3. Georgia Institute of Technology – Main Campus
4. Indiana University – Bloomington
5. Iowa State University
6. Michigan State University
7. North Carolina State University at Raleigh
8. Ohio State University – Main Campus
9. Pennsylvania State University – Main Campus
10. Purdue University – Main Campus
11. Rutgers University – New Brunswick
12. Stony Brook University
13. Texas A&M University – College Station
14. University of Arizona
15. University of Connecticut
16. University of Illinois at Urbana-Champaign
17. University of Maryland – College Park
18. University of Massachusetts – Amherst
19. University of Michigan – Ann Arbor
20. University of Minnesota – Twin Cities
21. University of North Carolina at Chapel Hill
22. University of Pittsburgh
23. University of Utah
24. University of Virginia – Main Campus
25. Virginia Polytechnic Institute and State University

Appendix C: University of Delaware College of Engineering Faculty Data as of June 2016

Table C1. Faculty by department, type/rank, and gender

Department	Continuing track		TT/T Assistant Professor		TT/T Associate Professor		TT/T Full Professor		Total		
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Total
BMEG Biomedical Engrg.	0	2	5	2	1	0	0	1	6	5	11
CHEG Chemical & Biomolecular Engrg.	1	1	3	1	1	2	17	0	22	4	26
CIEG Civil & Environmental Engrg.	4	0	2	1	3	2	12	2	21	5	26
CISC Computer & Info Sciences	2	0	2	2	7	2	6	3	17	7	24
ELEG Electrical and Computer Engrg.	2	0	1	2	4	2	11	0	18	4	22
MEEG Mechanical Engrg.	0	3	3	0	8	2	8	0	19	5	24
MSEG Materials Science & Engrg.	1	0	2	1	2	1	8	1	13	3	16
Total	10	6	18	9	26	11	62	7	116	33	149

* Based on faculty with primary appointments with COE as of 6/6/17

* Includes all faculty who are administrators (e.g., Dean, Deputy Dean, Assoc. Deans, Chairs) in their home departments. Does not include

* Does not include non-COE faculty with secondary appointments with COE, Non-Tenure Temporary Faculty (e.g., Research Faculty), or faculty on non-paid leave of absence.

Table C2. Faculty by department, type/rank, and race

	Continuing track				TT/T Assistant Professor				TT/T Associate Professor				TT/T Full Professor				Total				
	URG-Non-U.S.		URG-U.S.		URG-Non-U.S.		URG-U.S.		URG-Non-U.S.		URG-U.S.		URG-Non-U.S.		URG-U.S.		URG-Non-U.S.		URG-U.S.		
Department	White	Asian	citizen	citizen	White	Asian	citizen	citizen	White	Asian	citizen	citizen	White	Asian	citizen	citizen	White	Asian	citizen	citizen	Total
BMEG Biomedical Engrg.	2	0	0	0	6	0	1	0	1	0	0	0	1	0	0	0	10	0	1	0	11
CHEG Chemical & Biomolecular Engrg.	1	1	0	0	2	2	0	0	1	2	0	0	10	4	0	3	14	9	0	3	26
CIEG Civil & Environmental Engrg.	4	0	0	0	2	0	1	0	3	2	0	0	9	4	1	0	18	6	2	0	26
CISC Computer & Info Sciences	2	0	0	0	2	2	0	0	7	1	0	1	4	5	0	0	15	8	0	1	24
ELEG Electrical and Computer Engrg.	2	0	0	0	0	3	0	0	3	3	0	0	6	3	0	2	11	9	0	2	22
MEEG Mechanical Engrg.	3	0	0	0	1	2	0	0	8	2	0	0	3	5	0	0	15	9	0	0	24
MSEG Materials Science & Engrg.	0	1	0	0	2	0	1	0	2	1	0	0	8	1	0	0	12	3	1	0	16
Total	14	2	0	0	15	9	3	0	25	11	0	1	41	22	1	5	95	44	4	6	149

* Based on faculty with primary appointments with COE as of 6/6/17

* Includes all faculty who are administrators (e.g., Dean, Deputy Dean, Assoc. Deans, Chairs) in their home departments. Does not include

* Does not include non-COE faculty with secondary appointments with COE, Non-Tenure Temporary Faculty (e.g., Research Faculty), or faculty on non-paid leave of absence.

Strategic Plan for Graduate Student Diversity and Inclusion

Graduate Student Diversity Subcommittee
College of Engineering Committee

Robert L. Opila, chair and Julia Maresca, co-chair

Benjamin Carterette, Pierre Desir, Camil Diaz, Heather Doty, Arthi Jayaraman,
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September 2017

I. Introduction

The Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development set the goal of achieving “the full and equitable participation of all Americans in science, engineering, and technology fields” (Congressional Commission on the Advancement of Women and Development, 2000). To reach this goal, it is necessary to increase the number of women and students from underrepresented groups (URGs), defined as non-white, non-Asian, earning graduate degrees. As in many American colleges of engineering, approximately half the graduate student population is international. At UD, they are predominantly Asian. As a result, graduate students are quite diverse in terms of country of origin. However, since Asians are not underrepresented in engineering, most international graduate students are not considered to be from an underrepresented group. Unfortunately, available data do not disaggregate international students, and as a result, we cannot determine how many international students are from URGs. Therefore, although it would be of interest to know the percentage of students from URGs among all graduate students, it is only possible at this time to analyze and track the percentage of domestic students from URGs and thus the plan discusses the goals and current status in these terms. Future efforts will continue to try to collect and track the percentage of all graduate students from URGs for UD at least (even if the data are not available for other schools).

In the University of Delaware College of Engineering in the five-year period 2012-2016, an average of 26% of the students earning graduate degrees were women, while 13% of domestic students belonged to URGs. We propose that the College of Engineering: (1) Improve recruitment of underrepresented groups, with college-wide goals to increase the number of incoming women and URG graduate students to 33% and 25%, respectively, in every department within 5 years; (2) Provide better support for current graduate students, to ensure that retention rates of students in all demographic groups are similar; and (3) Develop a climate that ensures that all students are supported through their graduate careers. With the University President’s stated desire to increase the size of the College graduate student population substantially over the next several years, we have an unusual opportunity to improve diversity and inclusion as part of that process.

In this strategic plan, as a starting point, we focus on improving the representation of women and URGs in engineering. However, diversity and inclusion has many other dimensions. We expect that the retention and climate goals described here will support all students and improve diversity and inclusion in the College as a whole. We also anticipate that as the goals laid out here are reached, our focus will shift to include other aspects of diversity.

Goals

“Critical mass” for a minority population to self-perpetuate and affect cultural change within the broader community is usually taken to be 15-30% (Etzkowitz et al., 1994), and these numbers have often been used to set goals for participation of women or URGs in historically male-dominated fields. However, critical mass alone has been shown to be insufficient to improve the climate for women or URGs in the field (Childs and Krook, 2008; Lord et al., 2009; Lichtenstein et al., 2014). In general, although women and URG students in engineering graduate programs

graduate at rates similar to those of white male students, fewer women and URG students transition from one stage of education to the next (e.g. from a bachelors degree to graduate program) (Etzkowitz et al., 1994; Lord et al., 2009; Lichtenstein et al., 2014). Ultimately, participation of women and students in URGs in Engineering should reflect their fraction of the general U.S. population. According to the 2010 U.S. Census, 50.8% of Americans are women, and 36.2% of Americans belong to non-white, non-Asian ethnic groups (US Census Bureau, 2010). For this reason, long term, the College of Engineering should aim for ~50% of its students to be women, and ~35% to belong to URGs. Based on the current situation in the College (Section II) and what is considered a realistic rate of change, however, we propose that the College of Engineering work towards the following 5-year goals:

1. Improve recruitment of underrepresented groups, with college-wide goals to increase the percentage of incoming women to 33% and the percentage of incoming domestic students to 25% from URGs in every department;
2. Provide better support for current graduate students, to ensure that retention rates of students in all demographic groups are similar; and
3. Develop a climate that ensures that all students are supported through their graduate careers and beyond.

Increasing the number of women and URG students graduating from the College of Engineering graduate programs will require not only improved recruitment into the programs, but also enhanced retention efforts and changes in department climates. Increasing the number of women and URG students in graduate programs is critical to increasing the diversity of practitioners in engineering fields, but increasing enrollment alone does not improve retention in the field long term. In addition to improving recruitment efforts and retention in the graduate programs, we must also improve the climate for graduate students such that they can see places for themselves in the field long-term. This effort should be coordinated with the planned university-wide growth of graduate education and the proposed graduate college.

II. Current status of the College of Engineering at UD

A. Underrepresented groups among graduate students in the College of Engineering

Women and URGs have historically been poorly represented in science, technology, engineering and mathematics (STEM) fields. At UD in 2016, 92 PhD students graduated from the College of Engineering (42 domestic; 50 international), and 139 MS degrees were awarded (63 domestic; 76 international). Of the PhD students, 22 were women (24% of all PhD students) and 8 were members of underrepresented groups (19% of domestic PhD students). Among the students who earned MS degrees, 36 were women (26% of all MS students) and 13 were members of URGs (21% of domestic students).

The percentage of women students in each engineering department at UD is close to or above the average percentage of women students in engineering programs nationwide as well as in engineering programs at the “comparator” universities defined by President Assanis (<http://www.udel.edu/003954>; Fig. 1). In fact, Materials Science and Engineering is already above the 33% threshold (35%), and the departments of Civil and Environmental Engineering

and Chemical and Biomolecular Engineering are very close (32% and 30%, respectively). These departments should focus on ensuring that these students are supported throughout their graduate careers. The other departments range from 18% (Electrical and Computer Engineering and Mechanical Engineering) to 27% (Computer and Information Sciences). Because the total number of PhD students entering each department is less than 25 per year, and the total number of MS students is generally 50 or less, small changes (less than 5 per department, with the exception of ELEG, see Aim 1 and Tables 1 and 2 in Section III) in the number of women or URG students enrolling and graduating will suffice to meet the targets. We thus believe that the proposed goals for women graduate students can be achieved within 5 years in every department.

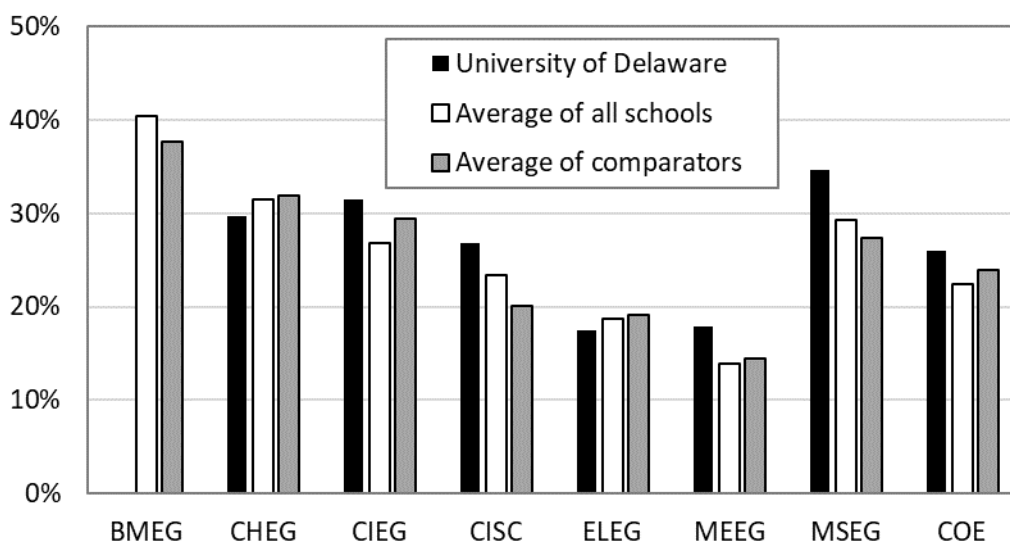


Figure 1. Percentage of all graduate students who are women, averaged over five years 2012-2016, by department and for the College as a whole. Data is from the Engineering Data Management System Database maintained by ASEE (edms.asee.org). Note UD's BMEG department is new, so it is omitted.)

The number of students from URGs in the College of Engineering is much lower than the total number of women, and UD has lower percentages of domestic students from URGs in every department when compared both to engineering programs nationwide and to a subset of “comparator” universities (Fig. 2). The percentage of domestic students who are members of URGs ranges from 9% to 16% in departments in the College of Engineering. Although these percentages are much lower than those at similar universities, because the numbers are small, the 25% goal within 5 years is reasonable: again, departments need to recruit 3 or fewer additional domestic students from URGs per year to reach this goal (less than 5 per department, see Aim 1 and Tables 1 and 2 in Section III). Support for these students during their graduate careers will be especially important to ensure successful graduation for matriculated students.

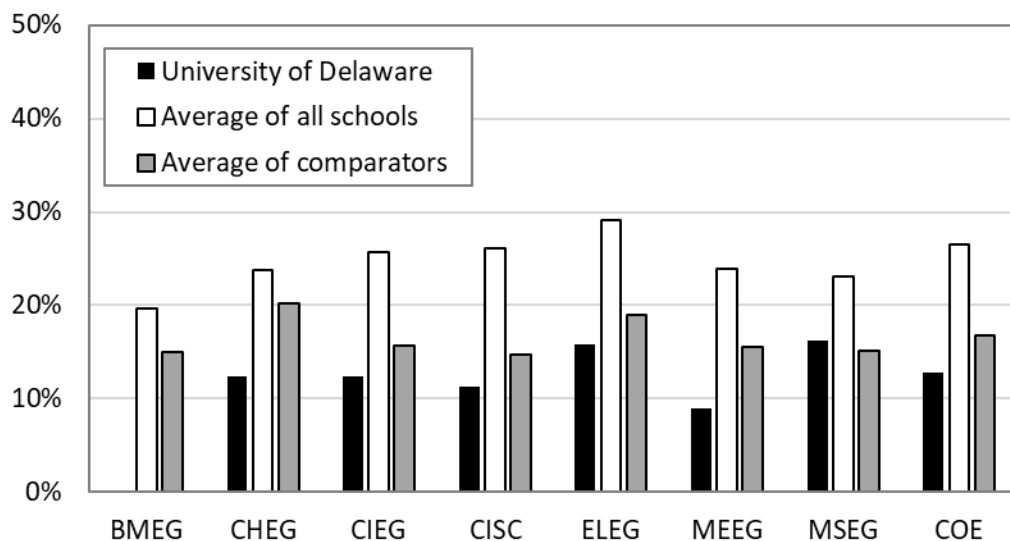


Figure 2. Percentage of all domestic students who are from URGs, averaged over five years 2012-2016, by department and for the College as a whole. Data is from the Engineering Data Management System Database maintained by ASEE (edms.asee.org). Note UD's BMEG department is new, so it is omitted.)

Retention rates cannot currently be tracked by the College of Engineering Academic Analysis staff. However, it is possible to obtain this data from the Registrar's Office. As an example, in the class of students who matriculated in the Civil and Environmental Engineering department in 2010, 13/15 incoming MEng students graduated, and 13/16 incoming PhD students graduated. Both of the MEng students who left without degrees were international students (one male, one female), while 2 of the 3 PhD students who left were white men and the third was another international student. See Task 2.1 for details on additional data to be gathered.

B. Past and current efforts to increase diversity in the College of Engineering

Because the College of Engineering has been working to increase diversity in the graduate programs for several years, several efforts toward recruitment and retention of women and URG students are already under way at both departmental and college levels. These include research experience programs, advising/mentoring, and student group efforts to improve both recruitment and retention. Several of these programs are briefly described below; these programs could be examined to see if these programs might be better utilized to recruit URGs.

Graduate student recruitment via research experience for undergraduates

The university runs several efforts to use research experience to improve recruitment of women and URGs into graduate programs. For example, UD is part of a consortium of universities that participate in the **Bridge to the Doctorate** program (<http://www.udel.edu/003927>), an NSF-funded program designed to provide students with financial support for their graduate studies, mentorship, guidance and a support network as they transition from undergraduate to graduate study and then into roles as leaders in STEM fields.

Similarly, the **McNair Program** (<http://mcnair.udel.edu/>) is a national program which offers effective preparation for graduate study to low-income, first-generation college students and

students from groups underrepresented in graduate education. McNair Scholars participate in undergraduate research internships in their field of interest, since undergraduate research has been found to be a predictor of future graduate studies (Russell et al., 2007). The McNair program at UD has supported both UD students and a cohort of visiting summer scholars from other universities. The UD students receive support for undergraduate research, mentoring, and participate in graduate school and career preparation activities. The visiting summer students are McNair Scholars from other universities; they come to UD to perform research under the direction of faculty here.

The **National GEM Consortium** (<http://www.gemfellowship.org/>) is a consortium of industry, government, academic, and research institutions that helps students from URGs who are interested in STEM careers to match their interests with those of potential graduate advisors or other career paths. This pool of students represents high-achieving students from URGs, who would, like the McNair scholars, be excellent potential graduate students at UD. UD has an institutional membership to this consortium, and has a past president in Michael Vaughn, the College's Associate Dean for Academic Affairs, and thus is in a position to reach out to these students during the period before graduate school applications are due.

Graduate student mentoring

The systems in place to support current graduate students include individual faculty mentors, departmental graduate coordinators, and student organizations. For PhD and thesis-MS students, mentoring by their advisors is one of the primary mechanisms of support and direction during their graduate career; however, to our knowledge, graduate student mentors are not currently trained in how to be effective mentors or supported in that role. In addition to formal faculty advising, graduate coordinators assist students with paperwork and ensure that students meet program requirements, and while doing this, often provide informal advice and support for students. Last, several student organizations support graduate students in engineering programs, either generally or in specific disciplinary programs. The largest of these are Women in Engineering, the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers, and the Mechanical Engineering Graduate Association.

The goal of the **Women in Engineering (WIE)**, (<http://www.udel.edu/003928>) program is to promote, mentor, and enable the participation of women students and faculty in engineering studies and the workplace. WIE provides activities that bring together female and male engineering students, faculty, and administrators, as well as external representatives from industry, government agencies, and other academic institutions, with the goal of promoting a healthy institutional climate for all members of the engineering community at UD. Overseen by the Associate Deans for Faculty and Diversity, and advised by a faculty member, the program is primarily organized by the WIE Graduate Student Steering Committee. This committee is made up of two women graduate student representatives from each of the COE's seven departments. The committee plans a number of events each semester, including a lunch to welcome all new women graduate students each September, coffee/networking breaks, "Meet Your Faculty" lunches, career panels, panels for undergraduates about graduate school, external speakers, and professional-development workshops. WIE also awards mini-grants on a proposal basis to

women undergraduates, graduate students, postdocs, or faculty for activities or projects that will enhance their careers. WIE funding comes from the Dean of the College of Engineering, alumni gifts, and the Haines WIE endowment.

UD has an active chapter of the **National Organization for the Professional Advancement of Black Chemists and Chemical Engineers** (NOBCChE), a non-profit professional organization dedicated to assisting black and other minority students and professionals in fully realizing their potential in academic, professional, and entrepreneurial pursuits in chemistry, chemical engineering, and allied fields. UD's chapter is overseen by Prof. Sharon Neal as the faculty advisor and currently has 26 graduate student members. The group organizes monthly career development seminars, in which students meet and interact with visiting scientists and engineers to learn about post-graduate career opportunities and build their professional networks. Separate career development seminars further promote and encourage minority participation in STEM by presenting and acknowledging the scientific work and contributions of pioneer black chemists and engineers in their respective fields. Student members also present research, take part in workshops, seminars, and career fairs, and network with other young professionals at regional and national NOBCChE conferences.

The Mechanical Engineering Graduate Association (MEGA) is a graduate-student group in the Department of Mechanical Engineering. Their purpose is to support fellow graduate students and be a liaison between the graduate students and faculty in Mechanical Engineering. They host several professional and social events every semester. Example events include professional-development workshops, networking events, and social events. Other graduate engineering student groups, such as the student chapter of the Materials Research Society, hold similar events.

The **EmPOWER** (Empathetic Peers Offering Wisdom, Encouragement, and Resources) is a confidential, low-barrier mental health peer-support group in the Department of Chemical and Biomolecular Engineering. Its goals are to break the stigma associated with mental health problems, to encourage open dialogue on graduate student well-being, and to offer readily-accessible resources for students seeking a support network, through peer coaching sessions and workshops. Student mentors go through formal mental health training through the UD Center for Counseling and Student Development, cultural sensitivity training at the Center for Diversity and Inclusion, and LGBTQ+ Ally Training.

Summary

Through formal and informal recruitment and mentoring efforts, the College of Engineering has reached 26% women and 13% domestic URG graduates. Although these numbers fluctuate slightly from year to year, they have remained fairly stable since 2008. Additional efforts at recruitment, retention, and improving the climate will be necessary to increase these percentages within the next 5 years.

III. Specific aims

To reach the stated goals, we propose that the College of Engineering:

1. Improve recruitment of students, especially women and those from underrepresented groups;
2. Provide better support for current graduate students, to ensure that retention rates of students in all demographic groups are similar; and
3. Develop a climate that ensures that all students are supported through their graduate careers and beyond.

We expect that recruitment will have a greater impact on the number of women and URG graduates than retention (see below), while changes to the climate in the College of Engineering will have long-term effects on retention in the field.

Progress towards achieving each of the specific aims will be quantified by monitoring the demographics of graduate students (domestic and international, women and URG) who apply, enroll, pass their qualifying exams, and graduate. Additional data will be collected using an annual graduate student climate survey that will be developed based on the focus group study (Task 3.1) and conducted in conjunction with the Delaware Education Research and Development Center (DEDRC). All assessments will be reported annually in a College Diversity Scorecard that assesses progress towards diversity and inclusion goals for all four groups—faculty, graduate students, undergraduates, and staff.

Because the series of activities we propose will require intensive effort and time, we recommend that the College hire a college-wide graduate student coordinator who could ensure that departments are instituting specific changes, provide information to departments and graduate students, and maintain a database of student demographic and academic information. This person would coordinate the planning, implementation, and monitoring of existing and new recruitment and retention initiatives, and help to link the activities of the Undergraduate Diversity Committee with the Graduate Diversity Committee. Any activity in the Timeline (Section III) with “CGC” (College Graduate Coordinator) in column 2 should, in our opinion, be either done or led by this staff member.

Aim 1. Improve recruiting of an excellent, diverse group of graduate students at both Master’s and PhD level.

In general, although women and URG students in engineering fields graduate at rates similar to those of white male students, fewer women and URG students transition from one stage of education to the next (e.g. from a bachelors degree to graduate program) (Etzkowitz et al., 1994; Lord et al., 2009; Lichtenstein et al., 2014). Thus, **improving recruitment of diverse graduate students has the greatest potential to affect overall diversity** in engineering graduate programs. Currently, 25% of incoming graduate students in the UD College of Engineering are women, and 13% of domestic students belong to URGs. Raising these percentages to 33% and 25%, respectively, would require recruiting an additional 13 women and 11 domestic URG students across the College of Engineering, all else being equal (Tables

1 and 2). We recommend focusing efforts on departments with the lowest percentages of women (Electrical and Computer Engineering, Mechanical Engineering) and/or domestic URGs (Mechanical Engineering) first, but all departments should aim to increase the percentages of women and URG students within 5 years (Tables 1 and 2, bottom rows).

Table 1. Percentages of women students in individual engineering departments and for the College as a whole, averaged over five years 2012-2016. Data is from the Engineering Data Management System Database maintained by ASEE (edms.asee.org).

	% of all graduate students who are female							
	BMEG	CHEG	CIEG	CISC	ELEG	MEEG	MSEG	COE
University of Delaware	---	30%	32%	27%	18%	18%	35%	26%
Average of all schools	40%	31%	27%	23%	19%	14%	29%	22%
Average of comparators	38%	32%	29%	20%	19%	14%	27%	24%
Approx. num. to reach 33%	---	0.9	0.5	2.7	6.7	3.1	---	13.0

* BMEG=Biomedical; CHEG=Chemical & Biomolecular; CIEG=Civil & Environmental; CISC=Computer & Information Sciences; ELEG=Electrical & Computer; MEEG=Mechanical; MSEG=Materials Science; COE=College of Engineering

Table 2. Percentages of domestic students from URGs in individual engineering departments and for the College as a whole, averaged over five years 2012-2016. Data is from the Engineering Data Management System Database maintained by ASEE (edms.asee.org).

	% of domestic graduate students who are URG							
	BMEG	CHEG	CIEG	CISC	ELEG	MEEG	MSEG	COE
University of Delaware	---	12%	12%	11%	16%	9%	16%	13%
Average of all schools	20%	24%	26%	26%	29%	24%	23%	27%
Average of comparators	15%	20%	16%	15%	19%	16%	15%	17%
Approx. num. to reach 25%	---	2.1	3.1	1.4	1.7	1.5	0.6	10.6

* BMEG=Biomedical; CHEG=Chemical & Biomolecular; CIEG=Civil & Environmental; CISC=Computer & Information Sciences; ELEG=Electrical & Computer; MEEG=Mechanical; MSEG=Materials Science; COE=College of Engineering

To improve recruitment of excellent graduate students from diverse groups, we suggest that the College of Engineering leverage current programs, build on existing successes, and develop new initiatives.

Task 1.1 Leverage current outreach programs for graduate student recruiting. The Bridge to the Doctorate and McNair Scholars programs already provide mentoring to help excellent undergraduates at UD and at partner institutions to prepare for and apply to graduate schools in their chosen fields. However, many faculty who could supervise these students' research, either during summer research programs or for graduate work, remain unaware of these programs. We suggest that these existing, funded programs be better integrated into the overall recruitment strategies for the College of Engineering as follows:

- Improve awareness among engineering faculty of the **Bridge to the Doctorate** program and **GEM Consortium** students. Students in these programs who are interested in engineering degrees should be identified during the late summer or early fall of their senior years. Representatives of the relevant departments should reach out to them with information about the graduate programs at UD as well as offers of assistance with the application process. This will require close collaboration with the PIs in these programs, and the rest of the college, largely through the graduate student coordinator. **Time frame: could be done immediately, for students applying in the Fall of 2017.**
- The visiting **McNair Program** students who do summer research comprise a pool of students who would be excellent candidates for graduate research fellowships at UD. A panel of faculty and/or graduate students from the College of Engineering should host a roundtable (or ice cream social) with the visiting students during the summer, again to offer information, answer questions, and address potential concerns. The head of the McNair Scholars Program at UD has run a summer research program at UD in the past, and could do it again; \$56,000 would cover stipends, travel, and other incidentals for 10 visiting students. **Time frame: Planning for Summer 2018 could begin immediately after commitment of funds.**
- Better utilize and coordinate the many Research Experiences for Undergraduates (REU) programs that already exist at UD. Many of these programs emphasize participation by women and URG students, but only include a few, if any, engineering students. **Time frame: Discussions with UD-EPSCoR, Summer Scholars, and the Undergraduate Diversity Committee should occur before Summer Scholars applications are due (normally the first week of the spring semester).**
- Support faculty interested in implementing diversity and inclusion-related efforts as part of Broader Impacts requirements for NSF proposals. The Committee on Graduate Student diversity will write a short description of the recruitment programs, student mentoring programs, and assessment tools that faculty can utilize in the Broader Impacts sections of NSF proposals. We hope that this will simultaneously ensure that faculty are aware of these recruitment programs, encourage faculty to use them to recruit women and URG students, and ensure that NSF-funded Broader Impacts efforts are aligned with College of Engineering diversity and inclusion goals.

Task 1.2 Expand existing successful departmental programs. Some departments have already instituted successful systems for recruiting diverse graduate student cohorts. To build on these systems and replicate their successes across the College of Engineering, we suggest that

- Graduate program coordinators share the current practices for recruiting across departments. **Time frame: Fall 2017.**
- Discuss student participation in recruitment activities with student groups (WIE and departmental graduate student groups) to identify activities and individuals willing to help. **Time frame: Fall 2017.**
- This information, along with enrollment statistics and surveys of current students, be used to establish best practices for recruitment of women and URGs. **Time frame: Spring-Summer 2018.**

- These best practices would then be adapted to specific departmental needs and implemented college-wide. **Time frame: Fall 2018 and beyond.**

One example of a program that could potentially be replicated in other departments is the fall early recruitment program in Chemical and Biomolecular Engineering. The College of Engineering could support expansion of this effort by providing funds to replicate this program in other departments.

Task 1.3. Develop new recruiting initiatives. Last, the College of Engineering should develop new initiatives in outreach and undergraduate research for engineering recruitment. Specifically, we suggest that

- A program for outreach to and recruitment from area universities, specifically from nearby historically black colleges and universities, (Delaware, Eastern Maryland, and Southeastern Pennsylvania) be developed. Departments can provide 2-3 slides as well as any paper materials for distribution to small teams of faculty and current graduate students. These teams can travel to area universities to talk with undergraduate students about their interests, present information about UD's graduate engineering programs, and encourage students to apply. **Time frame: Materials developed during summer/fall 2017, teams travel to 2-3 colleges during Fall 2017, efforts expand during spring and fall 2018.**
- Engineering-focused Research Experience for Undergraduates program should be developed. Because undergraduate research experience is highly correlated not only with ambition to go to graduate school but also with success in graduate programs, this kind of program has the potential for high impact (Kyoung Ro et al., 2017). Students who successfully complete research in the REU program might also be provided with incentives to apply to UD for graduate school, such as early admission or guaranteed funding for a Masters degree. This program should be coordinated with the undergraduate diversity committee, which is also planning to develop an REU program. **Time frame: within 5 years.**
- In large Silicon Valley companies such as Google, Facebook, and Intel, increasing the diversity of the workforce has become an important goal; however, few companies have successfully increased the numbers of women or URGs more than 1 percentage point (Mundy, 2017). The companies that have had more success have connected increased diversity in hiring with company-wide bonuses (Mundy, 2017). For this reason, we suggest providing financial incentives to faculty, primarily in the form of student fellowships, to increase diversity in recruiting.

Task 1 Outcomes. The success of all of these efforts will be tracked by monitoring the diversity of both the applicant pools and enrollees over time. Students who matriculate will be asked which programs, if any, contributed to their decision to attend UD.

Aim 2. Improve formal and informal advising and mentoring for graduate students.

To ensure that women and URG students recruited into engineering graduate programs receive effective mentoring from faculty and support from their peers, we suggest that the College of

Engineering leverage the activities of successful student organizations, identify best practices for faculty mentoring, and develop new initiatives in both faculty and peer mentoring.

Task 2.1 Assess retention rates for departments in the College of Engineering. The College of Engineering Academic Analysis staff does not currently have demographic data for matriculating graduate students. For this reason, it is not currently possible to assess retention rates. However, departmental graduate coordinators have access to this data through the Registrar's Office. We propose that the Committee on Graduate Diversity gather demographic data for PhD and MEng cohorts from 2006-2011 (all or most of these students should have graduated by Spring 2017) from the Registrar to assess retention rates throughout the College.

Task 2.2 Leverage existing peer mentoring programs. Recent work has found that having women mentors at or near the same career stage is especially important to women students in engineering (Dennehy and Dasgupta, 2017). This research assigned male, female, or no mentors to first-year engineering students, and found that although male and female mentors were equally conscientious, students with female mentors had better educational outcomes and were more likely to stay in engineering long-term (Dennehy and Dasgupta, 2017). Because of the importance of student groups in supporting graduate students, and because these groups already have missions to mentor students, the College of Engineering should take advantage of existing structures and provide additional support for these groups.

- The Department of Chemical and Biomolecular Engineering has already put a peer mentoring program, EmPOWER, in place for incoming graduate students. This group connects every incoming graduate student with a senior graduate student mentor. Student mentors receive mental health training from the Center for Student Counseling and Development, and cultural sensitivity and LGBTQ+ Ally Training from the Center for Diversity and Inclusion. The EmPOWER program could potentially be replicated in all of the departments in the College of Engineering.
- Alternatively, since the WIE student group already reaches graduate students in all departments, organizing peer mentoring through this group might be more effective than requiring the 7 departments to independently establish peer mentoring programs.
- Determine appropriate incentives to ensure committed participation of peer mentors (e.g., partial fellowships).

Task 2.3. Provide support for better faculty and staff advising and mentoring. The relationship between a graduate student and his or her mentor is critical to success in graduate school, but students belonging to URGs feel, more often than white students, that their ideas are not respected (Noy and Ray, 2012). To ensure best practices for faculty mentoring of graduate students, we recommend that a workshop on student advisement be developed and offered annually.

- The graduate diversity committee will identify best practices in graduate student mentoring and develop a summary of recommendations to be distributed to faculty.

Time frame: Fall 2017-Spring 2018.

- A brief workshop on advising and mentoring engineering graduate students, with some attention to the importance of diversity in training future engineers, should be developed and offered to faculty in the College of Engineering.

Task 2.4. Clarify policies related to graduate student progress and grievances. A graduate student handbook describing policies and resources applicable to all engineering students has, in the past, been published and distributed by WIE (<http://www.udel.edu/003929>). This handbook could be updated to include policies on and resources for grievance resolution, such as a staff ombudsperson, finding and/or changing advisors, and obtaining or losing funding. The graduate student advisory diversity committee and WIE could collaborate, potentially with the proposed new university-wide Graduate School, on this project.

Aim 2 Outcomes. Success of the initiatives in Aim 2 will be assessed by comparing the numbers of women and URG students enrolling in the College of Engineering, passing their qualifying exams, and graduating. We aim to have similar rates of graduation for all demographic groups in the College.

Aim 3. Improve the climate for diverse groups in the College of Engineering

During graduate school, women students and students in URGs report feeling a “chilly climate,” in which even well-meaning supervisors and colleagues deliver both overt and subtle messages regarding “real” engineers and who can and should succeed in the field (Lichtenstein et al., 2014; Walton et al., 2015, and references therein). The feelings of isolation and self-doubt that may develop as a result of this climate do not necessarily affect graduation rates, but can affect students’ long-term retention in the field (Powell et al., 2006; Lichtenstein et al., 2014). These problems cannot be improved simply by recruiting more women or URG students into engineering programs; however, both individual and department-level interventions have been reported to improve outcomes. Some of these include faculty and peer mentoring support, access to women- or minority-targeted student or professional groups, activities that strengthen feelings of “belonging,” and exercises that strengthen students’ individual senses of their own values (Lichtenstein et al., 2014; Walton et al., 2015). We suggest that as a start to improving the climate for graduate students in Engineering, the College ask graduate students to describe the current climate, enhance peer mentoring, and offer better mental health support for graduate students. We fully expect that as time goes on, these initiatives will change. Some of the initiatives described in Aim 2, such as peer mentoring and support for student groups, will also contribute to the climate in the College.

Task 3.1. Graduate student focus groups. To improve the climate for women and URG students in the College of Engineering, it will first be necessary to determine whether the students perceive any climate issues in the College, and if so, what those issues are. We thus propose that the College of Engineering conduct a formal focus group study to identify climate issues among graduate students. We will use the undergraduate focus group study conducted in Spring-Summer 2017 as a model, and like that one, plan to conduct these in collaboration with Delaware Education Research and Development Center (DEDRC). Common themes identified by the focus group study will be used to direct further interventions by the committee. The focus

group study will also be used to develop, in collaboration with DEDRC, an annual survey to track progress towards improving the climate (Task 3.3).

Task 3.2. Support for graduate student mental health. In response to concerns from both graduate students and faculty, the departments of Chemical and Biomolecular Engineering, Civil and Environmental Engineering, and Materials Science and Engineering have recently begun offering 1-hour seminars, given by staff from the Center for Student Counseling and Development, for students and faculty on stress management and mental health. Student feedback suggests that students would like these seminars to cover imposter syndrome, motivation, time management, and anxiety and depression in the context of graduate school. With additional support from the College of Engineering, these workshops could be offered either more frequently, or to all COE students.

Task 3.3 Assessment of diversity initiatives. For evaluation purposes, the new graduate student coordinator and College diversity working group will work with DEDRC to develop a survey for current and former graduate students in the College of Engineering. This survey, based on results of the focus group study (Task 3.1), will be used to identify the efforts with the most impact on recruitment and retention, monitor the climate in the College of Engineering, and provide data to enable continuous improvement of the climate. It will be done in parallel with similar efforts for the other College constituencies—faculty, undergraduates, and staff; and it will be reported annually in a College diversity scorecard.

Aim 3 outcomes. The annual climate survey developed and implemented following the focus group study will be used to track progress on Aim 3. The graduate diversity committee will also work with departments and the graduate student coordinator to track the career paths of alumni. This is necessary because “leaks in the pipeline” have been identified at transition points between career stages (Etzkowitz et al., 1994; Lord et al., 2009; Lichtenstein et al., 2014). Our goal is for the women and URG students to go on to careers in engineering fields at the same rate as white and Asian men.

Future efforts of the Graduate Student Diversity Committee. This committee’s composition and mission will likely change over time, as we reach milestones in diversity, gather additional data on current strengths and weaknesses in the College of Engineering, and identify successful initiatives. We strongly suggest that the Graduate Student Diversity Committee include more graduate student representation in the future. The graduate students in engineering are highly motivated and intelligent and already demonstrate the ability to develop and implement initiatives for graduate student support. Including student perspectives on this committee will undoubtedly allow us to better address the challenges that current graduate students face in the UD College of Engineering.

Further, although we have focused for the past semester on improving the representation of women and URGs in engineering, socio-economic status (SES) is an increasingly recognized aspect of diversity; students who are first-generation college graduates, who come from low-income backgrounds, or who have faced educational challenges. This data is currently not

tracked by the College of Engineering, but addition of check boxes for low-income or first-generation college students on the graduate student application would allow for collection of this data and the potential for addressing this under-appreciated component of diversity in the graduate student population.

IV. Budget and timeline

Budget

Budget removed from this version.

Timeline

Task	Person	F17	Sp18	Su18	F18	Sp19	Su19	F19	Sp20	Sp20	F20	Sp21	Su21	F21	Sp22	Su22
Hire College-level Graduate student Coordinator (CGC)	CoE															
1.1.1 iGEM recruiting	Dept grad committees, CGC															
1.1.2 McNair Summer	McNair, CoE															
1.1.3 REU programs	CGC															
1.2.1 share recruiting strategies	Dept grad committees, CGC															
1.2.2 Identify best practices	Grad div. committee															
1.2.3 implement best practices	All departments, CGC															
1.3.1 Recruiting outreach	Fac/student teams															
1.3.2 Engineering REU	CGC															
2.1 Collect retention data	Grad coordinators															
2.2 EMPoWER for all CoE students	CGC															
2.3.1 Identify best practices for mentoring	Grad div. committee															
2.3.2 Develop workshop on mentoring	Grad div. committee															
2.4 Update policies and handbook	WIE, graduate students															
3.1 Grad focus groups																
3.2 Mental health seminars	CGC with Center for Counseling & Student Development															
3.3 Survey development	CGC with DEDRC															
3.3 Survey data collection and analysis	CGC with DEDRC															

CGC=College Graduate Coordinator

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Strategic Plan for Undergraduate Diversity and Inclusion

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Executive Summary

Women and under-represented groups (URGs, def. non-white, non-Asian) are persistently and near-universally under-represented in undergraduate engineering programs. This lack of diversity negatively impacts the field by limiting the size of the talent pool and hindering the ability to solve complex problems. The causes of under-representation are well established and can be distilled into two categories, namely, (1) real or perceived “deficiencies” in preparation or exposure within the minority population, and (2) teaching and cultural practices within engineering programs that fail to resonate with students from diverse backgrounds.

Universities that have been successful in diversifying their undergraduate population have simultaneously addressed both “deficiency” and cultural causes of under-representation by mainstreaming diversity issues within the core functions of their undergraduate programs, namely, admissions practices, student support, and, most importantly, teaching practice.

Relative to other universities nationally, the UD College of Engineering is decidedly average in representation and retention of women and URGs in our undergraduate programs. Excellence is achievable through relatively modest shifts in our enrollment demographics combined with eliminating disparities in retention between URG and majority populations.

The objective of this strategic plan is to help the College of Engineering achieve academic excellence by broadening participation within the undergraduate population. We recommend accomplishing this objective by tightly integrating diversity considerations into everyday operations, so that inclusive excellence becomes a central part of the culture rather than a peripheral issue addressed in isolation. In particular, we recommend pursuing three Specific Aims:

Specific Aim 1: To refine and continuously evaluate our recruitment practices to increase enrollment of women and URGs in the College. In doing so, we will develop and support departments in adopting specific best practices around student recruitment. We define recruitment broadly, including not only pre-college applicants but also Engineering Undecided students and internal and external transfer students. Action items for this Specific Aim fall into three categories, namely, marketing, direct outreach, and change of major management, with all action items to be undertaken within 1-2 years. The primary outcome will be increasing the enrollment of women and URGs within specific engineering programs, with the target being sufficient representation (30% women, 15% URG). These department-level outcomes are achievable within one graduation cycle (4-5 years).

Specific Aim 2: To strengthen existing student support services and extracurricular programming around student recruitment, retention, and achievement, particularly for women and URGs. The thought here is that cultural factors that lead to under-representation and disenfranchisement of women and URGs happen both within and outside the classroom; and, given the existing resources within the College, it may be more feasible to initiate cultural change in student learning environments outside of the classroom before addressing more systematic curricular and pedagogical approaches (see Specific Aim 3). Action items for Specific Aim 2 are clustered in three areas: (1) establishing best practices for student advisement at the College and departmental levels; (2) empowering and incentivizing student organizations to

advance College diversity goals; and (3) re-envisioning college-wide diversity initiatives such as Resources to Insure Successful Engineers (RISE) Program and the K12 Engineering Outreach Office. Outcomes for this Specific Aim are more short-term and include improvement in student advisement assessment scores, increased engagement of student organizations, and execution of external evaluations of college-wide diversity resources. These outcomes will ultimately lead to improved student retention rates for each engineering program within the College. Action items for this Specific Aim can be executed within 2-3 years with results observed on a similar time frame.

Specific Aim 3: To educate and empower the faculty to implement cultural and curricular changes that have been proven effective with diverse learners within and across undergraduate programs in the College. The current state of undergraduate diversity in the College suggests that improvements may be warranted in our teaching practices to ensure the success of minority populations, and, in doing so, also benefit the majority students. If we do not focus on improving our pedagogy and curricula, we will achieve only modest success in diversifying our undergraduate population through recruitment (see Specific Aim 1) and academic support efforts (see Specific Aim 2). There are at present five suggested action items for this Specific Aim, although we expect to continually refine this list as we engage faculty in discussions about best classroom practices. Action items are: (1) routinely educate and engage all faculty in constructive dialogue about diversity issues in the classroom; (2) ensure that first and second year courses are taught by the most effective faculty instructors; (3) empower faculty through seed grants to carefully examine and address cultural issues proximal to their own programs and classrooms; (4) embed “alternative routes” through first and second year courses; and (5) investigate whether the current, direct-to-department admissions process is truly the best option for promoting college-wide diversity efforts. Outcome measures for this Specific Aim are long-term and will require continued monitoring and vigilance. They include: (1) increased diversity of graduating class, with the target again being sufficient representation (30% women, 15% URG); and (2) elimination of any gender and racial disparities in graduating GPA. Action items for this Specific Aim will take 4-5 years to complete with results within 1-2 graduation cycles (4-9 years).

Successful execution of this Strategic Plan will require dedicated funding as well as coordination across multiple units within and outside the College. We estimate that the total budget for this Strategic Plan will be approximately \$930k over 5 years, with annual budgets ranging from \$115k (Year 1) to \$230k (Year 3), not including potential modifications to the RISE budget. We estimate that 44% of this budget represents new expenditures, with the remaining 56% already being incurred annually by the College on existing student outreach and support services.

Background & Motivation

Historically, the dominant culture in engineering within the US has been white, male, and middle to upper-middle class¹. Women and under-represented groups (URGs, def. non-white, non-Asian) did not pursue engineering as an undergraduate major at many institutions, including the University of Delaware College of Engineering, until the 1960's, and then not in non-trivial numbers until the late 1970's¹. Despite massive, federally-funded recruitment and retention efforts over the past 40 years, national rates for women and URGs pursuing undergraduate engineering degrees have plateaued at 20% and 14%, respectively^{2 3}, which is well below the generally accepted 30% threshold needed for sustainable persistence of minority populations^{4, 5}. URGs are under-represented in all engineering disciplines; however, the distribution of women is markedly uneven, with chemical, biomedical, and environmental engineering graduating 30-50% women and electrical, mechanical, and computer engineering/science at 12-15%³.

Engineering is fundamentally a creative, collaborative discipline, and, as such, the field as a whole stands to benefit from increased diversification through at least two distinct mechanisms. First, diversification broadens the talent pool. Since the 1980's, researchers have speculated that we have over-selected middle-to-upper class white males for engineering programs, at the exclusion of talented women and URGs who may be better qualified – but perhaps not as interested initially – in pursuing engineering⁶. For example, in 2015, equal numbers of men and women high school students received college-level marks on the Advanced Placement Calculus exam⁷, yet STEM-inclined women pursue engineering in college at one-third the rate of men⁸. A second benefit of diversification is the ability to solve complex problems, particularly those at the interface of technological, societal, and economical realms⁹. Compared to homogeneous teams, gender and racially heterogeneous teams have been proven to lead to better performing companies¹⁰ and higher impact scientific papers¹¹. Within engineering teams specifically, diversity has been shown to optimize efficiency in solving complex problems⁹.

The causes of the under-representation of women and URGs in undergraduate engineering programs are multifaceted and can be generalized into two, well-established sources. First, women and URGs who choose to pursue engineering at the undergraduate level may present with several perceived or actual “deficiencies” relative to the majority population. Both women and URGs face substantial stereotype-threat within historically white male-dominated field of study¹², which predisposes them towards underachievement academically despite equal academic qualifications and prior performance measures. Both women and URGs may also have less exposure to pre-college engineering curriculum, physics, advanced mathematics, hands-on construction, and spatial visualization tasks^{13 14 15}. Compounding these “deficiencies” are teaching and cultural practices within engineering programs of study that fail to resonate with women and URGs, perpetuate the stereotype of the white male engineer, and may further isolate women and URGs within their chosen discipline^{2 1 13}. Engineering pedagogy, particularly in the middle years of the curriculum when students are most at-risk of dropping out^{16 17}, can be highly decontextualized and utilize behavioral learning strategies, which have been proven less effective than more modern cognitive and situated approaches in retaining diverse

learners^{2 18}. Outside of the classroom, women and URGs may face issues integrating into the majority culture, particularly forming productive study groups and navigating engineering team dynamics that may reinforce perceived or actual “deficiencies” and stereotype threats^{12 19}.

The multifaceted nature of diversity issues in undergraduate engineering programs necessitates solutions that simultaneously address both student “deficiency” and cultural sources of the problem. When implemented at the departmental or college level, these solutions can produce dramatic change. In the mid-1990’s, Carnegie Mellon undertook such an effort to reverse dwindling female participation in its computer science program²⁰. They grew their percentage women enrollment from 7% to 42% by changing admissions criteria to admit students with strong academic credentials but no prior programming experience. They then accommodated this student “deficiency” by segmenting the student population in the first semester introductory course into novice and experienced programmer sections. This one-semester intervention reduced stereotype threat amongst the novice students, who were predominantly women. Learning outcomes at the end of this first course were identical across novice and experienced sections, and this intervention has since been replicated with similar success at other programs, like University of Virginia, University of Washington, and Harvey Mudd.

More recently, the American Society for Engineering Education (ASEE) has highlighted the efforts of several institutions to boost student enrollment, particularly amongst under-represented groups²¹. From this report, there are two distinct strategies that emerge as best practices: (1) academic “gold shirt” programs aimed at addressing incoming student “deficiencies” in math and science preparation with additional remedial training; and (2) improving the quality of instruction for first and second year engineering and math/science core courses. The latter strategy was particularly successful at the University of Maryland Clark School of Engineering, which recruited and rewarded a cadre of elite faculty instructors who employed research-based teaching methods in their classroom. This approach obviously benefitted all students, boosting 5-year graduation rates by 13% across the entire student population.

In examining the literature^{2,13,16,20,21}, it is obvious that comprehensive intervention is needed to diversify the undergraduate engineering population at a given institution. Institutions that are not continuously fostering gender and racial diversity and evaluating progress towards that end are at risk of decaying back to baseline performance (<20% women, <15% URG). Programs that are the most successful at diversifying their undergraduate engineering population begin with a thorough understanding of issues of student recruitment and retention specific to their own institution²¹. They then take strategic actions that have a firm basis in the existing, rich body of knowledge on educational theory, psychology, and pedagogy. While a motivated group of individuals can certainly advocate for change, most institutions that serve as models for diversification practices, e.g., Carnegie Mellon and University of Maryland, have achieved broad-based support from faculty and administration. Furthermore, these institutions do not consider “diversity” to be an issue separate from the other inner workings of an undergraduate program, particularly, enrollment management, financial aid, student advising, and, most importantly, teaching practice.

Metrics for Diversity

In developing this Strategic Plan, we carefully considered the metrics – or measurable quantities – that we will use to both analyze our current state of affairs and monitor progress towards our undergraduate diversity goals. Our efforts will first focus on under-representation of women and URGs as a first effort towards diversification, recognizing that there are many other diverse groups, e.g., LGBTQ+, religious minorities, that will benefit from our efforts and will subsequently receive explicit consideration. Our metrics for gender and racial diversification were developed through benchmarking against other US engineering programs as well as researching underlying sociological phenomenon that result in persistent under-representation.

One of these phenomena is “critical mass,” which can be defined as sufficient representation of a minority population to self-perpetuate that population and affect cultural change within the broader community⁴. Targets for critical mass are famously hard to pinpoint; however, it is generally accepted that 30% represents a valid “critical mass” for women in business, academia, and the sciences^{4,225}. For racial minorities in STEM, under-representation is so severe that 30% critical mass is unreachable without substantive shifts in secondary education practices; and we advocate for eventually targeting a “skewed” distribution of 15%⁴, which still represents substantial progress from present conditions.

In developing metrics for this plan, we also considered national benchmarks for the gender and racial composition and retention rates for undergraduate engineering students. Using a published database containing demographic information for the graduating classes in every ABET-accredited engineering program in the US²³, we set a metric for “average” to be the median and “excellent” to be the top quartile of programs nationally for gender and racial diversity in their graduating class. These metrics were considered for each engineering discipline separately, i.e., UD civil engineering vs. all civil engineering programs in the US. Similarly, we data-mined a national report on student retention²¹ to establish “average” and “excellent” measures of student retention. Based on 6-year graduation rates, “average” retention was determined to be approximately 60% for majority (white male) and women students and 40% for URGs. “Excellent” retention rates were 70% with no disparities by race or gender.

Considering all of our proposed metrics, we advocate for the following specific goals for each undergraduate engineering program within the College: (1) sufficient representation of these groups (30% women, 15% URG); and (2) excellence nationally in student retention (70% 6-year graduation with no racial or gender disparities). We will also track and report the percentile ranking among engineering programs nationally in %Women and %URG in graduating class.

State of the College for Undergraduate Diversity

The UD College of Engineering is not meeting our diversity metrics across all programs of study (Tables 1 & 2; see also Appendices A & B). Gender distribution by discipline strongly aligns with national trends, with biomedical, chemical, and environmental engineering exceeding 30% women; and computer science, computer engineering, and electrical engineering at less than 15% women. UD Biomedical, Chemical, and Environmental Engineering have achieved critical mass for women (30%), and Mechanical Engineering ranks just outside of the top quartile nationally in %Women (74th percentile). In terms of racial diversity, all of our programs fall far short of the top quartile nationally, ranging from 30th (Chemical Engineering) to 48th (Biomedical) percentile nationally; and they are also far below our “sufficient mass” target of 15% URG.

Table 1: Demographics for all UD engineering programs, with %Women and %URG representing mean diversity percentages in graduating class for 2011-2015. “Percentile Nationally” refers to a particular UD department’s ranking for %Women and %URG versus all other ABET-accredited programs in the US. Higher percentiles represent more diversity. Additional information in Appendix A.

Major	Class Size	%Women	%URG	Percentile Nationally %Women	Percentile Nationally %URG
Biomedical Engineering	49	43.3%	5.7%	57 th	48 th
Chemical Engineering	57	28.8%	4.3%	32 nd	30 th
Civil Engineering	58	20.9%	4.9%	9 th	44 th
Computer Science	63	7.0%	5.9%	18 th	32 nd
Computer Engineering	28	9.8%	6.2%	45 th	43 rd
Electrical Engineering	46	11.9%	6.0%	46 th	37 th
Environmental Engineering	19	41.9%	11.5%	23 rd	34 th
Mechanical Engineering	92	17.2%	6.0%	74 th	38 th

The College’s student retention rates also fall short of our metric for excellence (Appendix B & Table 2). Civil and Environmental Engineering have achieved 70% or greater 6-year graduation rates for the majority population, with Biomedical, Computer Science, Electrical, and Mechanical Engineering all performing at the national average of 60%. Computer Engineering (42%) and Chemical Engineering (55%) are presently below average even for the majority population. Most departments show little to no disparity by gender in terms of 6-year

graduation rate, with the exception being Computer Science and Computer Engineering, which demonstrated 15%-point deficit for women. Unfortunately, nearly all departments, with the exception of Biomedical and Electrical Engineering, demonstrated racial disparities in 6-year graduation rates, with Computer Science, Computer Engineering, and Chemical Engineering performing below the national average of 40% 6-year graduation for URGs. No programs are presently close to achieving our target of 70% retention for URGs.

Table 2: Retention rates, quantified by 6-year graduation rates, for all undergraduate majors in the College, for both majority and minority populations. Additional information in Appendix B.

Major	6-Year Graduation Rate		
	Majority	Women	URG
Biomedical Engineering	61.0%	66.0%	57.2%
Chemical Engineering	55.2%	51.8%	38.5%
Civil Engineering	70.5%	63.2%	48.4%
Computer Science*	59.3%	42.9%	37.9%
Computer Engineering	41.9%	27.8%	29.7%
Electrical Engineering	63.0%	60.0%	55.9%
Environmental Engineering**	79.0%	76.7%	42.8%
Mechanical Engineering	65.3%	68.0%	48.3%

* Retention rates reported for BS degree, not BA.

** Environmental Engineering B-EN degree designations are further sub-divided within the BHSC system. Results are reported only for the Water Resources and Water Quality sub-degree.

Given the small numbers of women and URGs within each discipline, only relatively modest changes to our recruitment and retention practices are necessary to achieve our diversity goals (Table 3, see also Appendix C). For instance, our electrical engineering program, currently in the 46th percentile nationally, could boost their ranking into the top quartile by enrolling 3 additional women annually and increasing retention for all students from 60% to 70%. For URGs, similarly modest shifts in enrollment and retention are needed in order to achieve sufficient mass (15% URG) or top-quartile national performance. This can only be achieved, however, if the college first prioritizes eliminating the near 20%-point disparity in retention between URGs and the majority population (see Table 2). Given equivalent 6-year graduation rates, each discipline need only recruit 2-8 additional URGs in order to achieve sufficient mass or top-quartile performance nationally.

Table 3: Suggested enrollment targets for women and URGs to achieve either “sufficient mass” (30% Women, 15% URG) or top-quartile national performance. Current enrollment shown for reference. Additional information in Appendix C.

Major	No. Women		No. URGs	
	Current	Target	Current	Target
Biomedical Engineering	22	22	5	7
Chemical Engineering	37	37	15	23
Civil Engineering	13	21	7	11
Computer Science	9	18	8	16
Computer Engineering	3	5	5	7
Electrical Engineering	4	7	3	6
Environmental Engineering	16	16	4	7
Mechanical Engineering	12	12	12	20

The depth of talent exists here at the pre-college and college level to achieve our diversity goals within each discipline (see Table 3). At the pre-college level, UD admits approximately 57% of its applicant pool in engineering, with applicant and admitted demographics being remarkably consistent (Appendix D). The “yield” of admitted applicants – or rate at which admitted students enroll at UD – averages 25% across the College, with yield rates being fairly uniform across disciplines and demographics. While this yield rate is comparably high versus other majors at UD, there is clearly an opportunity for targeted recruitment of women and URG students who already meet the College’s high admission standards. For example, Computer Engineering averages 18 women accepted to the program annually and yields only 21% (3-4 students). Boosting yield to 27% (5 women students) – through direct outreach, financial aid, or targeted marketing to the admitted population – would allow the program to meet its diversity goals.

Diverse talent also exists within the broader UD student body, specifically, enrolled women and URG students who have declared Engineering Undecided (EGU) or University Studies (UST) majors. EGU students, who have already met the College’s admissions criteria, are more gender diverse – but interestingly less racially diverse - than the broader student body in the College (Appendix E). Departmental enrollment caps now restrict the flow of EGU students into their choice engineering discipline, and there has been little to no consideration of diversity efforts in the EGU transfer process. Similarly, there is demand amongst UST students, many of whom applied to the engineering program but were placed in UST due to academic qualifications. For the Fall 2016 freshmen class, 127 students who were accepted into UST applied to engineering as their first or second choice major, with 31% of these students being URG and 23% women,

which is substantively more diverse than the College's overall student body. Even when these students take sufficient steps to address the academic "deficiencies" that prevented their direct admission into engineering majors, enrollment caps within departments and prioritization of EGU transfers make it unlikely that they will be admitted to an engineering major.

Assessment of Current College-Wide Resources Impacting Diversity

The UD College of Engineering has invested substantial human and capital resources towards addressing undergraduate diversity. At present, the principal resources and infrastructure related to undergraduate diversity are the purview of COE's Office of Engineering Academic Affairs (EAA). Over the past 25 years, EAA has directed over \$2.0M in internal and externally funded research and programming related to undergraduate diversity. The core units within EAA that related to undergraduate diversity efforts include: (1) the Engineering Advisement Office (EAO); (2) the Resources to Insure Successful Engineers (RISE) Program; and (3) the UD K12 Engineering Outreach Office.

Engineering Advisement Office

The Engineering Advisement Office (EAO) is a tremendous resource for all students, and it nominally oversees all advisement and recruitment activity across the College. That said, the principal function of this unit, at least for students in good academic standing who have declared an engineering major, is more of coordination of department-level advisement and recruitment activities rather than implementation or evaluation. Case in point, the OUA interfaces with Office of Admissions for all university-wide student recruitment events, e.g., Blue and Gold Days and Decision Days; however, the messaging of these events is largely left to the individual departments, many of whom select faculty and student representatives based more on availability and service requirements than whom would make the most compelling case for potential student recruits.

This same fragmentation of responsibilities is apparent in general student advisement protocols, which are recommended to the departments by OUA but not enforced, and also student transfer requests. The latter is particularly concerning as OUA arguably has the most comprehensive view of enrollment and diversity issues across departments. Yet the departments themselves largely control their own enrollments, with capacity, prior student major, and student performance as the primary factors dictating admissions. In order to address diversity issues within the College, OUA must be given more power to oversee and enforce consistent, effective student recruiting and advising practices across departments.

RISE Program

It is a point of pride that the Resources to Insure Successful Engineers (RISE) Program is one of the longest running academic support programs for URGs in the country, receiving its initial funding in 1972 from the Minority Engineering Program (MEP) supported by the GTE Foundation. RISE offers multi-year admission scholarships and off-semester tuition support, requiring recipients to achieve a minimum 2.5 GPA and attend programmatic activities. These consist of monthly group meetings with guest lectures on a variety of career and professional

development topics as well as one-on-one mentoring sessions with RISE staff. RISE administration estimates that 85% of the black and 50% of the Hispanic student population in the College participate in the program. Approximately 35% of all RISE participants receive scholarships through the program and are in turn required to attend RISE monthly meetings and workshops. Intended or not, the programming and support services provided by RISE are consistent with the “deficiency” intervention model for URG populations, that is, implying that URG students may not be as academically prepared as their majority peers. This assumption simply does not hold true for many RISE participants who have incoming credentials on par with their majority peers and may thus affect interest in the RISE program both from a recruiting and a retention standpoint.

That said, the overall infrastructure and strong community ties with RISE are incredibly valuable, and RISE plays a critical role in providing a “safe space” and academic support for minority students in the College. Given its importance and the potential opportunities afforded by the new overarching COE diversity initiative, we recommend completely re-envisioning the RISE program to best support both our current and aspirational URG student populations.

K12 Engineering Outreach Office

A final college-wide resource that currently supports our diversity goals, but could do so more directly and effectively, is the K12 Engineering Outreach Office. This unit originally supported both professional outreach, that is, continuing education for professional engineers, as well as a multi-day summer camp for K12 students. In 2011, the responsibilities were split across separate offices, forming the K12 Engineering Outreach Office and a separate unit for professional outreach. Summer camps were expanded and extra and intra-curricular engineering programs were added at the discretion of the office’s director, who specializes in elementary and early childhood education. The Outreach Office also began to collaborate with faculty on broader impact projects for NSF awards and, at present, has 22 awards in preparation or review with 11 active. The office’s current program portfolio focuses on elementary and middle-grades, with interventions including single or multi-day exposure programs (such as the camps), technical skills workshops, and a lending library with some custom curriculum for this age group designed through NSF broader impact projects.

Although recruitment of undergraduates—and women and URGs in particular—to the UD COE could potentially be a goal of the K12 Outreach office, it is not the focus of the Office at this time. Diversity outcomes in the undergraduate population are not currently part of the already broad charge for K12 Engineering, nor does that Office have direct accountability for it. Thus, not surprisingly, it does not appear to be having a large effect towards achieving that goal. The Outreach Office has not collected data on whether student participants have matriculated to UD engineering programs, but survey data collected from the 2016 COE freshmen class indicated that less than 16% of students participated in any outreach programming on the UD campus (Appendix G), which would include Outreach Office programs as well as individual intra and extra-curricular efforts run through the University at large as well as individual departments.

Objective of Strategic Plan

As a college, we have for some time invested substantial human and financial capital in addressing issues of diversity amongst our undergraduate population. However, our performance has been persistently at or below national averages, potentially due to decentralization of responsibilities for student recruitment, advising, and support, and curricular structure and pedagogical approaches that may not best support diverse learners.

The objective of this strategic plan is to help the College of Engineering achieve academic excellence by broadening participation within the undergraduate population. We recommend accomplishing this objective by tightly integrating diversity considerations into everyday operations, so that inclusive excellence becomes a central part of the culture rather than a peripheral issue addressed in isolation. While our efforts will be directed specifically towards improving representation of women and URGs, we anticipate that the proposed changes to our student support and instructional practices will also improve representation of other minority groups, e.g., LGBTQ+ and religious minorities, as well as improve the overall learning experience for all students.

The objective of this strategic plan will be accomplished through three Specific Aims, which are presented in more detail in the next sections:

Specific Aim 1: Refine and continuously evaluate our recruitment practices to increase enrollment of women and URGs in the College.

Specific Aim 2: Strengthen existing student support services and extracurricular programming around student recruitment, retention, and achievement, particularly for women and URGs.

Specific Aim 3: Educate and empower the faculty to implement cultural and curricular changes that have been proven effective with diverse learners within and across undergraduate programs in the College

Specific Aim 1: Recruitment

Our first Specific Aim is to refine and continuously evaluate our recruitment practices to increase enrollment of women and URGs in the College. In doing so, we will support departments in adopting specific best practices around student recruitment. We define recruitment broadly, including not only pre-college applicants but also Engineering Undecided students, transfer students from other majors, and transfer students from outside the University. These best practices fall into three categories, namely, marketing, direct outreach, and transfer management.

Marketing

Best practices in marketing involve ensuring that all college and department-specific student marketing materials, e.g., “slicks”, banners, student-facing webpages, and videos, resonate with diverse student learners and are inherently appealing to students and parents. Rather than focusing on faculty research and achievements, these materials should show current students engaged in hands-on learning in collaborative settings. Contextual learning and personalized mentoring should also be emphasized. Diversity in the student body should be explicitly highlighted, and we should regularly update these materials to showcase any achievements in terms of representation of women and URGs, e.g., top-quartile performance nationally for UD Mechanical Engineering in percentage of women graduates. Updated materials should be immediately provided to Admissions. Furthermore, we should strongly consider distributing marketing materials directly to key recruitment influencers, such as STEM teachers and college counselors at feeder high schools.

Direct Outreach

Direct outreach encompasses all one-on-one contact between current UD students, staff, or faculty and potential recruits. These may include personally scheduled or university-sponsored on-campus visits, student-led tours, and email or phone conversations with faculty. Our survey data indicate that direct outreach is very influential in making admissions decisions (Appendix G), with the majority of our current freshmen class having attended university on-campus events and rated their attendance as positively influencing their decision to attend UD.

Given the importance of events and tours in recruiting all students, we propose several immediate action items: (1) review and revise department presentations for university on-campus events, e.g., Blue & Gold Days; (2) carefully select faculty representatives for events based on their ability to “sell” their program of study; (3) create a cadre of current students within each program who are experienced at giving department tours and hosting classroom visits; and (4) coordinate timely and strategic faculty outreach to women and URG recruits through email or phone. Training should be provided for all faculty and students who interface with potential recruits to ensure that they are not only knowledgeable about their programs but that they also highlight department resources and values that may be particularly appealing to diverse learners. Furthermore, the UD Office of Admissions has recently launched a new student portal (Slate) that includes personalized landing pages for applicants as well as powerful marketing and analytics functions. Every effort should be made by the College and individual departments to utilize this portal for student recruiting purposes.

Transfer Management

As a college, we must prioritize diversity in the transfer management process and ensure that qualified women and URGs who have an expressed interest in studying engineering at UD are presented with a clear and realistic pathway for matriculation into their desired major. Transfer students mainly come from three sources, namely, Engineering Undecided (EGU), other majors within the University but outside the College, and outside the University. Our recommended interventions for recruiting and supporting are inherently different for each group.

For Engineering Undecided students (EGUs), who now represent 18% of the incoming student body within the College, we have several recommendations. First, allow some flexibility in the departmental enrollment caps and be cognizant of the goal of broadening participation in placing EGUs, USTs, and other transfer students. Second, continue recruiting efforts for EGUs through the fall semester. This includes direct outreach from faculty to women and URGs through thoughtful in-class presentations, departmental events, and mentoring during office hours. Introduction to Engineering (EGGG101) is a great opportunity for departments to “sell” their undergraduate programs to EGUs. Lastly, encourage diverse EGU students to remain within the College, even if they are not placed within their first choice major. EGU students in this situation should be identified early and referred to faculty and staff advisors in potential alternative departments.

UD students who have an expressed interest in studying engineering but are not presently enrolled in the College are another source of talent. Our internal data suggest that there may be a relatively diverse pool of students who are admitted to University Studies (UST) in lieu of engineering due to their admissions scores. We recommend these students – that is, all USTs with engineering interest – should be identified upon admission and offered two opportunities: (1) to enroll in Introduction to Engineering (EGGG101); and (2) to be co-advised by the College’s Office of Undergraduate Advising. At the completion of the freshmen year, USTs whose academic performance and completion of pre-requisite courses meet College entrance requirements should be enrolled in their major of choice, regardless of departmental caps, similar to our recommendations for EGUs.

Lastly, transfer students from outside the University, particularly from local technical and community colleges, as well as regional historically black colleges and universities (HBCUs) that do not offer engineering degrees, should be presented with a clear pathway to entrance and degree completion within the College. At present, the authors of this plan do not have a clear understanding of the size or demographics of our transfer population, nor do we know the barriers to entry that this group may face. We will therefore conduct further investigation into these issues, both from an administrative and student perspective, before making any recommendations.

Evaluation

The goal for this first Specific Aim is straightforward, namely, to increase enrollment of women and URGs in the College. We seek specifically to boost representation of URGs in all majors and women in the under-represented disciplines of mechanical, electrical, civil, and computer engineering and computer science. Our enrollment targets (see Table 3) put each department within reach of graduation demographics that reflect “sufficient mass” (30% women, 15% URG)

or top-quartile national performance, assuming an 70% 6-year retention rate for these populations. This is an overestimation of our current retention rates, which are 60% for women and 40% for URGs (see Appendix B); however, we assert that our work in Specific Aims 2 and 3 will improve retention rates and that discrepancies in student diversity at enrollment versus graduation may motivate departments to more intensely focus on their teaching and advising practices.

For this Specific Aim, we will monitor several outcomes, each at a different time point in the annual admissions cycle. At the start of the fall semester, we will report the demographics of the College student body, disaggregated by major. We will complement this with a survey, administered to all students in Introduction to Engineering (EGGG101), that assesses which marketing and recruiting practices were most effective, similar to the assessment performed for this report (see Appendix G). This analysis will be repeated after the mid-year (January) transfer student placement process occurs, thereby finalizing the demographics for the first year student body. Simultaneously, we will consider student demographics for the subsequent year's class. From late fall through mid-April, we will closely monitor the composition of the applicant and admitted pools (see Appendix D), issuing brief reports to the departments as to whether they are within range of their diversity goals at approximately monthly intervals until the end of the spring semester.

Specific Aim 2: Student Support

Our second Specific Aim is to strengthen existing student support services and extracurricular programming around student recruitment, retention, and achievement, particularly for women and URGs. The thought here is that cultural factors that lead to under-representation and disenfranchisement of women and URGs happen both within and outside the classroom; and, given the existing resources within the College, it may be more feasible to initiate cultural change in student learning environments outside of the classroom before addressing more systematic curricular and pedagogical approaches (Specific Aim 3). We advise focusing on three areas: (1) establishing and disseminating best practices for student advisement at the College and departmental levels; (2) empowering and incentivizing student organizations to advance College diversity goals; and (3) re-envisioning college-wide diversity initiatives such as Resources to Insure Successful Engineers (RISE) Program and the K12 Engineering Outreach Office.

Student Advisement

Student advisement practices and effectiveness vary widely across the College, and we advocate that the College take a more active role in ensuring the consistency and effectiveness of these practices. This begins by staffing each department with a staff-level academic advisor with the proper background and credentials to deal with the range of academic, social, and psychological issues that present regularly in the undergraduate population. Furthermore, the workload for these individuals should be primarily if not exclusively focused on undergraduate advisement. At present, several departments are staffed by non-credentialed academic advisors and/or individuals who have substantial additional duties that prevent them from

advising on anything more than a triage basis. In order to retain women and URGs, the College must facilitate more proactive advisement, that is, checking in with students regularly and not just during academic or personal crises. Department-level academic advisors could also coordinate and monitor faculty advisement practices, for instance, highlighting for faculty specific student advisees who may be at risk academically and assigning (or un-assigning) student advisees to particular faculty members based on advisement performance.

Lastly, the College should specifically consider the role of student advisement in faculty tenure and promotion. At present, there is no formal mechanism for evaluating faculty performance in undergraduate advising. Annual reviews require reporting only the number of advisees per year. Student feedback on advisement is periodically solicited at the department level, mostly for ABET accreditation purposes, but these data do not disaggregate student-perceived effectiveness by faculty advisor. For this reason, we advocate that end-of-semester advisement surveys be administered to all students within the college using a process that is similar, if not identical, to end-of-course surveys. Advisement survey scores should be presented and rated similarly to teaching performance on faculty appraisals.

Student Organizations

There is tremendous untapped potential within our engineering-focused student organizations to advance the diversity goals of the College. Our diversity-aligned student organizations, e.g., Society of Women Engineers (SWE), National Society for Black Engineers (NSBE), and Society for Hispanic Professional Engineers (SHPE), already have as their mission recruiting and support of diverse student populations. Other student organizations that are engineering focused but not necessarily diversity aligned, e.g., Engineers Without Borders and the Inventors Club, provide opportunities for all students to acclimate to engineering culture outside of the classroom and could be used as a tool for retention of women and URGs. At present, our student organizations, although well intentioned, frequently fail to meaningfully contribute towards diversification efforts for two, easily remedied reasons.

First, student membership and leadership in these organizations is inherently transient, which makes it necessary to have permanent, experienced faculty or staff advisors who are familiar with diversity issues. These advisors must work closely with student leaders within these organizations to define the group's mission, core values, and annual programming. This work must be seen as the major service commitment that it is, and department and College leadership could do more to recognize faculty advisement for student organizations. Faculty must also be held accountable for their commitments to advise student organizations, and their performance should be periodically reviewed, most appropriately by College administration.

Second, student organizations must be incentivized to promote diversity in their membership and the broader community. For diversity-aligned student organizations, the College should provide the groups with a base operating budget, which frees the membership from engaging in fundraising to support core activities. Preliminarily, these organizations would include NSBE, SHPE, SWE, and potentially AOE. In exchange for funding, these organizations will provide an annual Diversity Impact Report, detailing the group's activities and outcomes that align with the College's diversity goals. Student organizations that are not inherently diversity-aligned, e.g.,

Engineers Without Borders, will also be invited to submit a Diversity Impact Report, and may receive supplemental funds from the College based on past-year performance.

College-Wide Diversity Initiatives

The College is presently investing substantial human and financial resources into two initiatives that related to undergraduate diversity, namely, the RISE program and the K12 Engineering Outreach Office. RISE is a long-standing program that involves the majority of URG students in the College. Given its importance in the diversity effort and the potential opportunities afforded by the new overarching COE diversity initiative, we suggest re-envisioning RISE to better support our current and aspirational URG student populations. The re-envisioning process will take approximately 6 months and will involve the development of a strategic plan specific to RISE mission, organizational structure, programming, and budgeting. The Undergraduate Diversity Working Group will lead this effort, which will involve: (1) benchmarking minority-serving programming at other institutions to understand best practices; (2) informal assessment of effectiveness of current RISE programming through student focus group study (see Aim 3); and (3) program cost estimation and prospecting for philanthropic and foundational grant support.

The K12 Outreach office is currently focused on community service aimed primarily at elementary and middle school grade levels. While this is a valuable endeavor, there is also an important opportunity for outreach aimed more directly at recruiting a diverse pool of students to the UD COE undergraduate population. Specifically, in supporting the recruitment action items in Specific Aim 1, Outreach Office personnel could: (1) help to ensure consistent, student-friendly messaging in all student-facing marketing materials and presentations; (2) facilitate direct outreach by faculty to diverse student recruits; and (3) reach out to student recruitment influencers in the community, such as STEM teachers and counselors at feeder schools. In addition, the Outreach Office could support existing departmental-based outreach activities that have proven effectiveness in the community, such as Title II-sponsored and Project Lead The Way teacher professional development sessions, in-school computer science outreach (NSF funded), and the semi-annual engineering education conference. We strongly advocate that some centralized human resources within the College be dedicated to undertake these student recruitment and outreach activities.

Evaluation

The objective of this Specific Aim is to strengthen and align the College's existing extracurricular support services and programming with our diversity goals. In doing so, we anticipate that we will modestly boost measures of recruitment, retention, and achievement amongst women and URGs in the College. We use the caveat "modestly" because: (1) the action items in Specific Aim 1 will most directly affect recruitment outcomes; and (2) substantive changes in retention and achievement will only occur with the curricular and pedagogical change that we are advocating for in Specific Aim 3.

That said, we plan to evaluate our progress towards realignment of extracurricular support in several ways. With regards to academic advisement, we will examine departmental data collected for ABET; and, if faculty assessments are modified to include undergraduate

advisement ratings, we consider departmental means and distributions of these scores. For student organizations, we will look for gains in engagement of these organizations in college-wide recruiting efforts as well as gender and racial diversification of membership. These measures will be assessed from the Diversity Impact Reports submitted by the organizations to receive College funding. The first year reports can be used as a baseline for measurement of improvement.

Specific Aim 3: Cultural Change

Our third and final Specific Aim is to educate and empower the faculty to implement cultural and curricular changes that have been proven effective with diverse learners within and across undergraduate programs in the College. Our relative performance to other universities in terms of the gender and racial diversity of our graduating classes (see Appendix A) as well as the disparity in retention of URGs (see Appendix B) strongly suggest that we as a College may need to improve our curricular and pedagogical approaches to engineering instruction in order to ensure the success of all students. If we do not address the deficiencies in our pedagogy and curricula, we will achieve only modest success in diversifying our undergraduate population through recruitment (see Specific Aim 1) and academic support efforts (see Specific Aim 2). Simply put, the burden of change lies primarily with us – the faculty – not with the diverse student populations.

We recommend several actions to foster positive cultural and curricular changes within the College. However, it must be said that we expect this plan to morph as we continually engage with the faculty about their specific challenges and also learn more about effective practices from experts in the education field. At present, we have five suggested interventions: (1) routinely engage and educate all faculty in constructive dialogue about diversity issues in the classroom; (2) ensure that first and second year courses are taught by the most effective faculty instructors; (3) incentivize the faculty to design and study programmatic and classroom-based interventions that address cultural barriers to success; (4) embed “alternative routes” through first and second year courses; and (5) investigate whether the current, direct-to-department admissions process is truly the best option for promoting college-wide diversity efforts.

Engage Faculty

Cultural change will only happen if the majority of the faculty who engage with the undergraduate population feel educated and empowered to address potential diversity issues in their own classrooms. In developing this strategic plan, we attended faculty meetings in each department and had offline conversations with faculty members who were essentially uninvolved in diversity efforts. Universally, we found faculty to be receptive and energetic about student diversity issues; however, they were mostly unfamiliar with the topic and at a loss regarding effective interventions. Furthermore, we found that the broader faculty population was not receptive to workshops, invited speakers, or online training, and that they would prefer periodic updates and “tips” on diversity-related issues from faculty colleagues during regular departmental faculty meetings. Based on this informal assessment, we

recommend piloting an effort to visit faculty meetings each semester to present updates on diversity efforts and educate the faculty community at large on diversity-related teaching and advising issues. These visits would be brief (15-20 min) and would consist of presentations that include: (1) data on diversity specific to that department; (2) a research-based teaching or mentoring strategy that has proven effective in reaching diverse learners; and (3) opportunities for further training or ways to get engaged in the College's effort.

We also propose that these routine departmental visits be supplemented with optional opportunities for faculty to gain more in-depth training and exposure to diversity issues through professional development opportunities sponsored by the College. In October 2016, we started a monthly journal club focused on undergraduate diversity in STEM. It has been attended primarily by members of the College's diversity committee, and we plan on advertising more broadly to all college faculty and graduate students. We also propose hosting a one-time, multi-day workshop on diversity in the classroom that is externally facilitated by experts in this topic. We are in dialogue with the National Alliance for Partners in Equity (NAPE), which runs a 3-day workshop for STEM instructors that provides a research overview and some educational research training related to diversity. We would target Summer 2017 or Winter 2018 for such a workshop, and it would be open to all faculty in the College and possibly promoted in partnership with UD's Center for Teaching and Assessment of Learning (CTAL). Lastly, we propose running a 1-semester seminar series on diversity in engineering. The seminar series will be advertised broadly within the university community, and there may be opportunities for co-sponsorship with the Office of Vice Provost for Diversity and the College of Education and Human Development.

Improve Teaching Effectiveness

Our own preliminary analyses (Appendix F) and past engineering education research^{24 17 2 21} has shown that students are at most risk of dropping out of engineering during their second through fourth semesters. Considering that students are also taking general STEM and breadth requirements, it is particularly crucial that students experience effective and engaging instruction in the few engineering courses that they take during these early semesters. Other universities, such as University of Maryland,²¹ have improved student retention overall – and URG retention in particular – by focusing on the quality and type of instruction for freshmen and sophomore engineering students. Departments should be encouraged to place their most capable, engaging instructors in these introductory courses, which are critical for students developing the correct “mental models” of fundamental engineering concepts that will be utilized in latter courses². To assess learning outcomes – and, in some part, teaching effectiveness – the College should promote the adoption of validated Concept Inventories²⁵⁻²⁹, which can be administered pre and post-course and used formatively to adjust course learning objectives.

Address Proximal Cultural Issues

There is enthusiasm and expertise amongst College faculty for carefully examining and addressing cultural issues proximal to their own programs and classrooms that may adversely affect retention and achievement of women and URGs. As a first step, we advocate for

immediately conducting an in-depth ethnographic study of women, URG, and majority students across all departments and select student organizations, such as RISE, SHPE, and SWE/AOE. DERDC is willing and able to conduct this work, which will involve initial surveys, interviews, and focus groups. Within 4-6 months, they will issue a comprehensive report that details advisement, teaching, and broader cultural phenomena, e.g., maker spaces, study group formation, that may positively or adversely affect minority populations within the College and individual departments.

Using these data as a starting point, the College should incentivize the faculty to design and study programmatic and classroom-based interventions that address cultural barriers to success. Specifically, the College should offer competitively awarded seed grants (2-3 annually) to faculty for addressing cultural issues within their own classrooms and departments. Such grants could eventually lead to larger scale funding, for instance, through NSF, as well as engineering research publications. Already, there is interest amongst our faculty for this type of effort. For example, faculty in our own Computer Science department are discussing adopting Carnegie Mellon's approach to segment introductory computer science classes by experience level²⁰. Seed funding could be used to pilot this approach, with results that could be applicable to introductory-level courses in other majors that also demonstrate prior experience disparities, e.g., Computer Aided Design (MEEG202). Additionally, the Mechanical Engineering Department is experimenting with a "stage-gate" approach to problem-based learning within its Design Studio that involves assigning students individual hands-on prototyping projects prior to teaming them with other students. They hypothesize that individualized experiences, in a safe and supportive environment, will empower women and URGs in particular to assume more active roles in their design teams. This type of research effort would benefit tremendously from seed funding that would allow for collaboration with professional evaluators.

Establish Alternative Routes

Most of the College's undergraduate programs have a fairly rigid curriculum even within the first two years of general STEM and engineering fundamental courses. This rigidity makes it difficult for transfer students to enter with partially fulfilled STEM requirements, and it also severely penalizes enrolled students who misstep academically in pre-requisite courses during these first semesters. Our preliminary analysis of College retention rates (see Appendix B) suggests that URGs in particular may be persisting in engineering majors by taking these alternative routes. We therefore recommend formalizing and in some cases creating new "alternative routes" through the first four semesters in all engineering programs. This can be done by utilizing summer and winter course terms and staggering common courses across disciplines so that they are offered every semester, e.g., Statics in the fall semester in Mechanical Engineering and the spring in Civil Engineering. Historically, the main objection to establishing "alternative routes" has been that mainstreamed students will "course shop" and enroll off-sequence in courses that are perceived to be easier or have higher quality instructors. In the short term, this can be combatted by restricting enrollment to majors-only and allowing "alternative routes" students to enroll by special permission. In the long term, courses could be opened across the first and second years, but only after departments improve instruction quality across these early courses and standardize learning objectives using Concept

Inventories. Summer and winter courses would need to be similarly restricted at first to avoid “course shopping,” and the College may need to increase financial aid to women and URGs through programs such as RISE to cover the additional tuition associated with these off-semester courses.

Evaluate Admissions Process

There are many different models nationally for admissions processes in engineering programs. Some universities, like Penn State, admit students into a “pre-engineering” designation for the first two years, during which they take pre-requisition STEM and fundamental engineering courses. Students then apply and are accepted into their desired engineering discipline in their junior year, with the restriction that they must have a 3.0 GPA or better. Historically, UD has directly admitted students into their preferred engineering majors, with a relatively common course sequence in the first year allowing students some degree of flexibility should they wish to transfer majors within the College. More recently, the College implemented the Engineering Undecided (EGU) admissions designation, with these students (18% of the incoming class) deciding on their major after the first semester. Now that all departments have restricted undergraduate enrollment, the EGU major has become difficult to manage from a transfer management perspective.

The justification for the EGU major is that it is a recruiting tool; however, there has been no market research into this. Our internal data (see Appendix E) suggest that the EGU designation may appeal to a more gender diverse student population, yet racial diversity is relatively low (8%) and direct-to-major admissions may resonate more with the URG population. Given that the EGU designation makes it more difficult for the College to manage student enrollment, particularly as it relates to gender and racial demographics in each department, we recommend further market research by UD Admissions into whether EGU is truly necessary from student recruitment standpoint. In conducting this market research, we ask that UD Admissions consider both the College’s prior model of direct-to-major admission as well as delayed, performance-based admission, similar to Penn State.

Evaluation

This Specific Aim, which is to inspire cultural change, will take time to realize; however, it has the biggest potential to impact minority student retention and achievement, which is the ultimate goal for this entire Strategic Plan. For Specific Aim 3, we will monitor the following outcomes in each department, taking current performance as baseline: (1) diversity of the graduating class; (2) retention rates; and (3) student performance, taken as GPA at graduation. We will target either “sufficient mass” of women and URGs or top-quartile national performance (see Appendix A) as well as 70% retention of all students with no discrepancy by gender or race (see Appendix B). We will also target a mean GPA at graduation of 3.0 - a recruitment threshold for some major corporations – again with no discrepancy by race or gender. We will monitor these outcomes annually and issue a report to each department on its performance and trajectory.

Timeline & Budget

This Strategic Plan is immediately executable, although each Specific Aim will have a different timeline for completion and expected results (Figure 1). We estimate that the action items in Specific Aim 1 will take 1-2 years to complete, with a review of our external transfer processes being the most complex. We expect to see results in terms of improved enrollment demographics well within one graduation cycle (4-5 years). For Specific Aim 2, the external evaluation of RISE can be completed within 4-6 months by DERDC. Engagement of student organizations should take 1-2 years and would be best to initiate at the start of the fall semester with new student leadership in each organization. Changes to student advisement will take 2-3 years to complete and may involve the College's Human Resource office to reclassify departmental staff advisors. We expect Specific Aim 3 to take 4-5 years to execute with another 5-9 years (1-2 graduation cycles) for the intended outcomes to occur. The student climate study can be undertaken immediately and will inform the priorities for the faculty seed grant program. Some level of faculty engagement has already started, e.g., department visits and journal club; and the seminar series and faculty workshops would be best to undertake in years 2 or 3 of this plan. Reassignment of teaching duties and development of "alternative routes" will likely take 4-5 years to implement, as it requires College and department-level buy in and potentially adjustments to programs of study.

Figure 1: Simplified Gantt Chart showing timeline for select action items for this Strategic Plan.

	Action Item	Responsible Entities	Year 1	Year 2	Year 3	Year 4	Year 5
Specific Aim 1	Revise marketing materials	COE Dean, OUA, Communications, Admissions	■				
	Direct outreach to recruits	Dept faculty & students, Admissions	■				
	Recruit EGUs	Dept Faculty & Students, OUA	■	■			
	Co-advise USIs	OUA, Dept Faculty	■	■			
	Override departmental caps	Dept Chairs	■				
	Study transfer student process	COE Dean	■	■			
Specific Aim 2	Hire staff academic advisors	COE Dean, Dept Chairs		■	■		
	College-level advisement coordination	COE Dean, OUA		■	■		
	Evaluate faculty on advisement	COE Dean, Dept Chairs & Faculty		■	■		
	Engage student organizations	COE Dean, OUA, Dept faculty		■	■		
	Re-envision RISE	COE Dean, DERDC		■	■		
Specific Aim 3	Presentations at faculty meetings	COE UG Diversity	■				
	Journal club	COE UG Diversity	■				
	Faculty workshop	COE UG Diversity			■		
	Seminar series	COE UG Diversity		■	■		
	Climate survey	COE UG Diversity, DERDC	■				
	Faculty seed grants	COE Dean		■	■	■	
	Alternative routes through curriculum	COE Dean, Dept Chairs & Faculty		■	■	■	■
	Focus on 1st & 2nd year teaching	COE Dean, Dept Chairs & Faculty		■	■	■	■
	Market research on admissions policies	COE Dean, Admissions			■	■	

Abbreviations: COE Dean = COE Dean's Office; EAO = COE Engineering Advisement Office; UG Diversity = Undergraduate Diversity Working Group

Successful execution of this Strategic Plan will require dedicated funding as well as coordination across multiple units within and outside the College (Table 4). We estimate that the total budget for this Strategic Plan will be approximately \$930k over 5 years, with annual budgets ranging from \$115k (Year 1) to \$230k (Year 3), not including the budget for the re-envisioned RISE program. We estimate that 44% of this budget represents new expenditures, with the remaining 56% already being incurred annually by the College on existing student outreach and support services. Specifically, the primary expenditure for Specific Aims 1 and 2 is a staff coordinator focused on student recruitment (estimated at \$80k annually, burdened). The College presently supports 2.0 FTE in the K12 Outreach Office and may consider adding

recruitment efforts to this unit's portfolio, either through an additional hire or a reassignment of duties. Additionally, the College presently provides partial financial support to diversity-focused student initiatives, such as NSBE, SHPE, and SWE; and, in Specific Aim 2, we advocate doubling financial support to student organizations. Additional funds beyond current College expenditures are requested for external evaluators to review the RISE Program (Specific Aim 2) and assess student culture through focus groups (Specific Aim 3). Additional funding is also requested for faculty engagement, training, and seed grants (Specific Aim 3).

Table 4: Estimated budget for this Strategic Plan.

Budget removed from this version.

Summary of Action Items

Specific Aim	Action Items	Outcomes & Timeframe	Necessary Resources
Refine recruitment practices	- Revise student-facing marketing materials - Customize marketing by departments through Admissions portal - Train faculty and students for University-sponsored recruiting events - Have faculty conduct direct outreach to student recruits - Recruit EGUs into departments through freshmen year - Recruit and co-advise UST students with interest in engineering - Allow for case-by-case override of departmental enrollment caps - Develop best practices for facilitating external student transfers, particularly from diverse feeder institutions	- Meet departmental enrollment targets for diversity (Appendix C) 1-2 years for implementation, with 4-5 years for results	- Departmental representatives from Undergraduate Diversity Working Group - Coordination with Admissions - Support from College communications personnel
Strengthen student support services	- Hire properly credentialed staff academic advisors in each department - Provide college-level oversight and coordination of staff and faculty advisors - Incorporate undergraduate student advisement into faculty evaluation system - Select appropriate faculty advisors for critical student organizations - Underwrite base operating budgets for diversity-focused student organizations - Incentivize student organizations to join diversity effort through merit-based supplemental funding - Re-envision the RISE program, starting with the development of a strategic plan	- Improvement in ABET outcomes for student advising. - Level of engagement of student groups assessed through Diversity Impact Reports - Creation of strategic plans for college-wide organizations, e.g., RISE, based on external evaluations 2-3 years for implementation & results	- College Human Resources Office - Office of Undergraduate Advisement - Annual budget of \$40k-\$60k for 5 years - TBD budget for re-envisioned RISE program
Educate & empower faculty	- Routinely present diversity issues at departmental faculty meetings - Sponsor a college-wide diversity journal club - Sponsor a one-time, externally funded faculty workshop on diversity in the classroom - Run a semester-long diversity seminar series - Assign faculty most effective at teaching to first and second year courses - Conduct a comprehensive student-focused climate study - Fund faculty seed grants for diversity research - Establish "alternative routes" through first and second year courses - Conduct market research into admissions policies, specifically EGU designation	- Achieve national excellence (75th percentile) in graduation of women and URGs (Appendix A) - Boost retention rates to levels of national excellence (70%, Appendix B) - Achieve average 3.0 GPA at graduation across all student populations 4-5 years for implementation, 4-9 years for results	- College-wide faculty buy-in for cultural change, led by Dean and Department Chairs - UD Admissions for market research - Annual budget of \$15k-\$90k for 5 years

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Appendices

Appendix A: Current and Target Undergraduate Demographics

Scope

We reviewed and analyzed institutional data and reports from the literature to determine current and target undergraduate demographics for the College.

Methods

Annual aggregate data was procured from UD Institutional Research for graduation class size of each engineering undergraduate major for the years 2011-2015. Graduation included spring and winter graduation for a given year. Data were obtained for overall class size as well as the numbers of women and under-represented groups (URG) graduates, with the latter defined as non-White, non-Asian students. Percentage women and URGs were calculated per year, and descriptive statistics (mean and st.dev) were computed across all years and reported as the primary outcomes, %Women and %URG.

To benchmark the College's performance, %Women and %URG for each undergraduate program was compared to all other ABET-accredited programs nationally. Current data from other programs were obtained from the American Society for Engineering Education (ASEE) Engineering Data Management System, and reported %Women and %URG values from this database were fit to normal distributions for each major discipline. UD's ranking as a percentile on the normal distribution was then determined, with higher percentiles indicating more representation of minority groups.

Results

Following national trends, female representation in Biomedical Engineering, Chemical Engineering, and Environmental Engineering majors approaches or exceeds 30% of the graduating class, while gender diversity in Computer Science, Computer Engineering, and Electrical Engineering is severely skewed at less than 15% women (Table A.1). URGs are consistently under-represented within each discipline in the College, ranging from approximately 4% to 12% across programs.

Relative to other universities nationally, the UD Mechanical Engineering program stands out in terms of gender diversity, ranking at the 74th percentile nationally, with Biomedical, Computer, and Electrical Engineering near or slightly above the national mean (50th percentile). At present, none of our programs stand-out with regards to racial diversity, although Biomedical Engineering is approaching the national mean (48th percentile).

Conclusions

Defining "excellence" to be the top quartile nationally, only Mechanical Engineering is performing at the "excellent" level, and then only in terms of gender diversity. For most other programs, we are performing "average" in terms of gender diversity and below average for racial diversity.

Table A.1: Demographics for all UD engineering programs, with %Women and %URG representing mean diversity percentages in graduating class for 2011-2015. “Percentile Nationally” refers to a particular UD department’s ranking for %Women and %URG versus all other ABET-accredited programs in the US. Higher percentiles represent more diversity.

Major	Class Size	%Women	%URG	Percentile Nationally	
				%Women	%URG
Biomedical Engineering	49	43.3%	5.7%	57 th	48 th
Chemical Engineering	57	28.8%	4.3%	32 nd	30 th
Civil Engineering	58	20.9%	4.9%	9 th	44 th
Computer Science	63	7.0%	5.9%	18 th	32 nd
Computer Engineering	28	9.8%	6.2%	45 th	43 rd
Electrical Engineering	46	11.9%	6.0%	46 th	37 th
Environmental Engineering	19	41.9%	11.5%	23 rd	34 th
Mechanical Engineering	92	17.2%	6.0%	74 th	38 th

Appendix B: Undergraduate Student Retention

Scope

We reviewed and analyzed institutional data and reports from the literature to determine current and target undergraduate retention rates for the overall population as well as women and under-represented groups (URGs).

Methods

Four and six-year graduation rates were procured from Institutional Reports on the Blue Hen Success Collaborative (BHSC) software system. These data were taken directly from BHSC, which reported aggregated results for students who enrolled between and including the Fall 2006 to 2012 Spring Semesters (these are the most current data available). Data were reported for the entire graduating cohort and separately for women and URG graduates.

Due to limitations in the BHSC software, URG was not directly measurable as a subpopulation, so it was calculated as the population size-weighted average of the Black, Hispanic, and Multi-Ethnicity populations. Due to similar software limitations, graduation rates for the white male majority population were reported as the white population as a whole. Lastly, data on student retention for the Biomedical Engineering Program only reflects 2-3 graduation cohorts because it was founded during the 2006-2012 period.

For benchmarking purposes, national data for retention rates in engineering programs was taken from a comprehensive report from the American Society for Engineering Education (2012, *Going the Distance*). This report suggested that national averages for 6-year graduation rates were approximately 60% for the majority population (white males), 61% for females, and 38-44% for URGs. Programs that are achieving excellence in student retention reach 6-year graduation rates of 75-80% for their entire student body and 60-70% for URGs.

Results

Retention rates across the College are for the most part in line with national averages; however, our performance is not exceptional (Figure B.1). 6-year graduation rates for majority students met or exceeded the national average of 60% for all departments except Chemical Engineering (55.2%) and Computer Engineering (41.9%). Computer Science and Computer Engineering showed a 15%-point deficiency for women versus the majority population. With the exception of Biomedical and Electrical Engineering, all departments demonstrated a 20%-point gap between URGs and the majority population, which unfortunately is in-line with national average (38% URG retention). Computer Engineering was an outlier in this regard, with URG retention that was 10% lower than the national average.

There were some interesting patterns in 4 versus 6-year graduation rates across different groups. All majors saw gains in graduation rates from 4 to 6 years, suggesting that some students may take longer, potentially alternative routes through the curriculum. Increases in graduation rates for women tended to be similar to the majority population, indicating that men and women as a whole follow the same pathways through our programs. URG populations

tended to demonstrate more substantial gains in 4 to 6-year graduation rates than their majority peers for Computer Science, Electrical Engineering, and Mechanical Engineering. This suggests that URGs are persisting in these majors by taking extra time to complete their coursework. Women in Computer and Electrical Engineering behave similarly to URGs in this regard and may also be taking “alternative routes” at higher frequencies than the majority students.

Conclusions

Retention efforts for the College should be in particular focused on URGs in all majors with the target of eliminating the 20%-point disparity in 6-year graduation rates. Gender disparities in retention for Computer Science and Computer Engineering must also be addressed. We recommend targeting 70% retention for all students across all disciplines, which is mid-range for exceptional 6-year graduation rates nationally. Differences in 4 versus 6-year graduation rates for URGs suggest that these students may persist in engineering majors by taking “alternative routes” through the curriculum, and care should be taken not to restrict these routes or we risk increasing disparities.

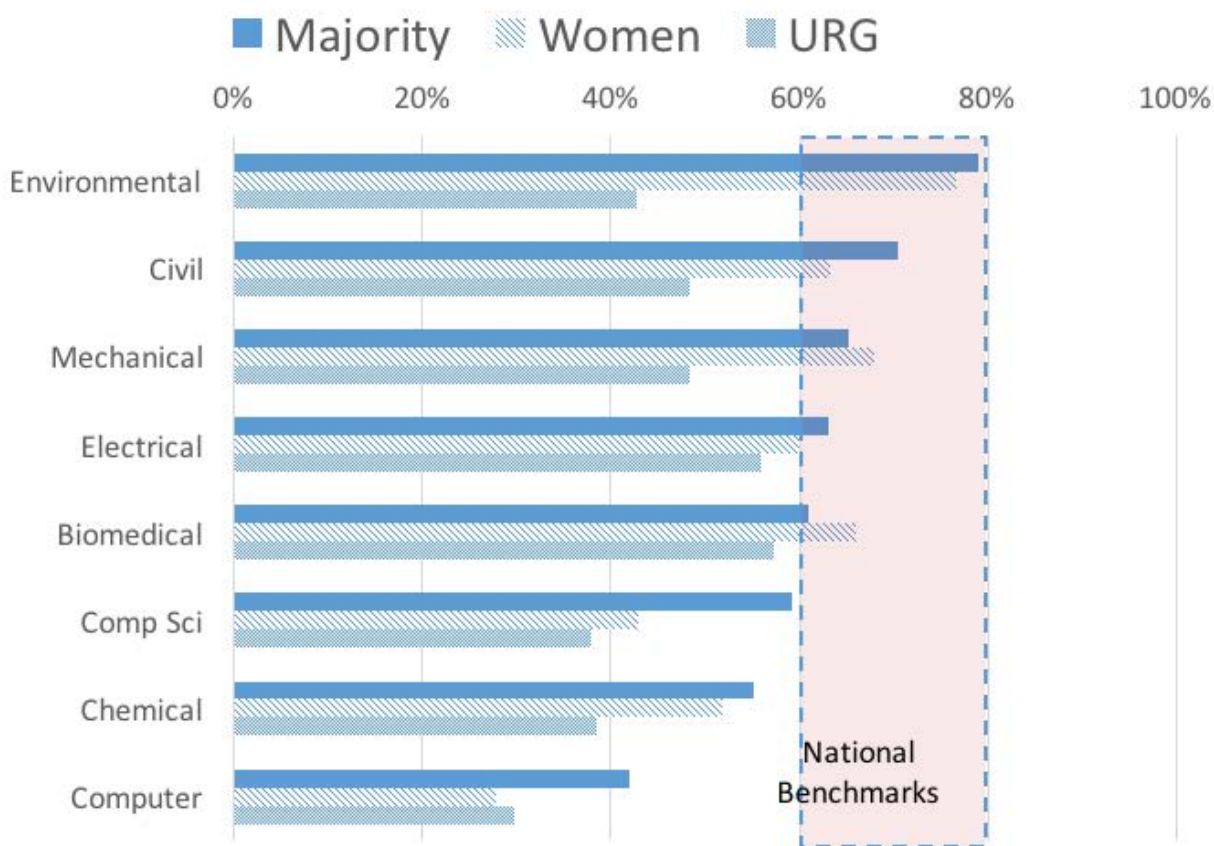


Figure B.1: 6-year graduation rates in UD College of Engineering majors for majority population, women, and URGs. Data taken from Table B.1. National benchmarks (60-80% 5-year graduation) presented for reference.

Table B.1: Graduation rates for all undergraduate majors in the College, for both majority and minority populations.

Major	4-Year Graduation Rate			6-Year Graduation Rate		
	Majority	Women	URG	Majority	Women	URG
Biomedical Engineering	49.5%	58.0%	50.0%	61.0%	66.0%	57.2%
Chemical Engineering	49.3%	45.9%	28.8%	55.2%	51.8%	38.5%
Civil Engineering	62.1%	61.8%	38.5%	70.5%	63.2%	48.4%
Computer Science*	40.2%	28.6%	20.7%	59.3%	42.9%	37.9%
Computer Engineering	33.8%	27.8%	25.9%	41.9%	27.8%	29.7%
Electrical Engineering	54.9%	46.7%	38.2%	63.0%	60.0%	55.9%
Environmental Engineering**	61.3%	65.1%	42.8%	79.0%	76.7%	42.8%
Mechanical Engineering	56.1%	58.2%	31.9%	65.3%	68.0%	48.3%

* Retention rates reported for BS degree, not BA.

** Environmental Engineering B-EN degree designations are further sub-divided within the BHSC system. Results are reported only for the Water Resources and Water Quality sub-degree.

Appendix C: Target Enrollment for the College

Scope

Using institutional data and benchmarks from the literature, we created a simple model to determine how many additional women and URG students are needed in each engineering program within the College in order to meet national standards of excellence.

Methods

Excellence was defined as graduation rates for women and URGs that are the lesser number of students that either: (1) meet the 75th percentile of ABET accredited programs nationally (see Appendix A); or (2) achieve sufficient representation, as defined by sociological phenomenon (30% Women, 15% URG; see *Metrics for Diversity*). The size of the graduating class in each department was assumed to be fixed. Target retention rates of 70% were assumed for both women and URG populations (see Appendix B), except in cases where departmental retention already exceeded this threshold, in which case it was kept at its current value.

Results & Conclusions

This model suggests that excellence in diversity can be achieved through relatively small changes in the demographics of the incoming class for some departments (Table C.1). For instance, Electrical Engineering need only recruit 3 more women into its freshmen class, while Biomedical and Civil Engineering needs only 2 and 4 more URG students, respectively. Some of our departments with larger class sizes and average national performance need relatively higher numbers of women and/or URGs, e.g., 8 more URGs for Mechanical Engineering; however, these demographic shifts are still achievable.

Table C.1: Results of model showing current and target number of minority students enrolled in each department.

Major	No. Women		No. URGs	
	Current	Target	Current	Target
Biomedical Engineering	22	22	5	7
Chemical Engineering	37	37	15	23
Civil Engineering	13	21	7	11
Computer Science	9	18	8	16
Computer Engineering	3	5	5	7
Electrical Engineering	4	7	3	6
Environmental Engineering	16	16	4	7
Mechanical Engineering	12	12	12	20

Appendix D: Target Admissions Yield Rates

Scope

We examined data from UD Admissions to determine the necessary gains in yield, defined as the ratio of enrolled to accepted recruits, to achieve the College enrollment targets that we determined in Appendix C.

Methods

UD Admissions provided admissions data for the overall population, women, and URGs, for each undergraduate program in the College for Fall 2013 through Fall 2016 admissions cycles. These data were used to calculate the total size of each applicant pool, as well as admission percentages, and yield rates (percentage of admitted students who enrolled) for each group of interest. Outcomes for the majority population (white males) were derived from overall and minority populations. These outcomes were averaged across all years reported. Using the target enrollments for women and URGs from Appendix C, the necessary yield rates were then calculated.

Results

The size and demographic composition of the applicant pool varied by program (Figure D.1). Acceptance rates were $57 \pm 11\%$ (mean $\pm$ st.dev) for the majority population across all departments, being slightly higher for females ($66 \pm 11\%$) and lower for URGs ($44 \pm 12\%$). Current yield rates were fairly uniform across departments and demographic groups at $25 \pm 5\%$.

There are sufficient numbers of qualified – that is, accepted – women and URG candidates to meet target enrollments for each department (see Appendix C). Yield rates would need to increase modestly for women to approximately 30% for most departments (Table D.1), with the exception of Civil Engineering which will need to boost its yield to nearly 50%. For URGs, the necessary yield rates are much higher than present values, with most departments needing yield rates of approximately 50% to meet enrollment targets with the current acceptance pool.

Conclusions

Taken together, these data suggest that target enrollments for women could mostly be met through increasing yield amongst the admitted pool of students. For URGs, increasing yield to nearly 50% would be difficult, so another recruitment strategy is needed to supplement achievable, more modest gains in yield.

Figure D.1: Number of applicants for each program with in the College, broken down by majority population (white male), women, and URGs.

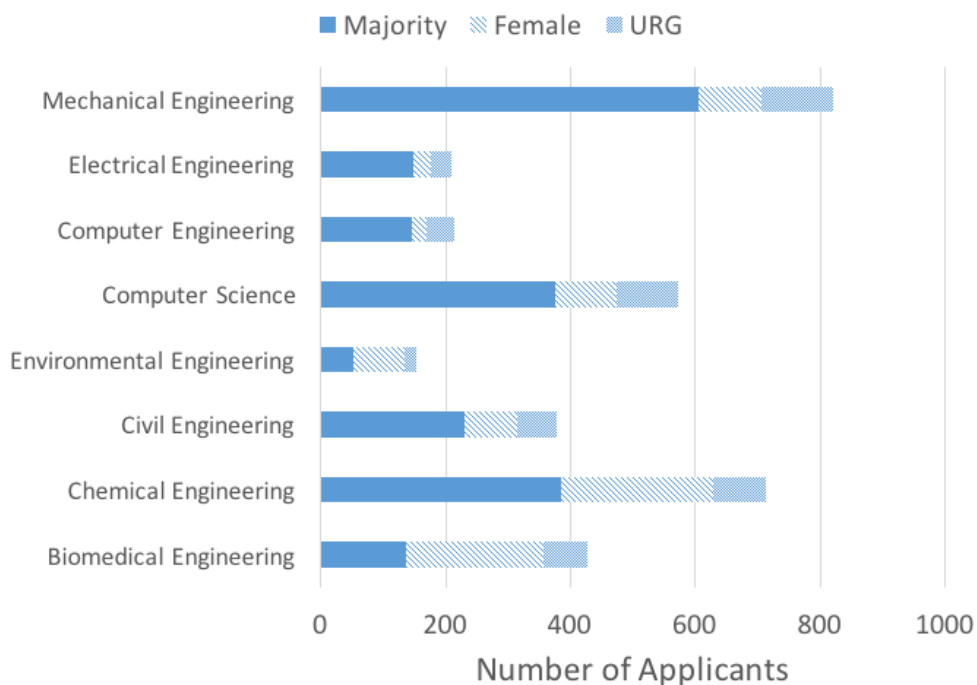


Table D.1: Size of the admitted student pool, as well as current and target yields to meet enrollment targets for women and URGs.

Major	Women			URG		
	No. Admitted	Current Yield	Target Yield	No. Admitted	Current Yield	Target Yield
Biomedical Engineering	115	21%	22%	22	20%	32%
Chemical Engineering	132	28%	34%	36	31%	65%
Civil Engineering	58	24%	48%	28	25%	40%
Computer Science	50	18%	36%	28	25%	54%
Computer Engineering	18	21%	27%	21	30%	53%
Electrical Engineering	23	13%	31%	17	28%	54%
Environmental Engineering	64	23%	33%	14	34%	64%
Mechanical Engineering*	64	27%	N/A	43	32%	52%
	Mean	22%	33%		28%	52%
	St. Dev	5%	8%		4%	12%

*Mechanical Engineering currently reaches its enrollment target for women.

Appendix E: Pathways for Engineering Undecided Students

Scope

Engineering Undecided (EGU) is an admissions designation designed for students who wish to decide on their engineering major later in the program, ideally within the first year of study. These students have met all of the admissions criteria for the College and are guaranteed placement into an engineering major. In this model, we consider how the chosen pathways for EGU students could be used to meet individual department's diversity needs.

Methods

Data for this analysis was pulled from multiple sources. UD Admissions provided data on applications, admissions, and yield rates for the EGU population, broken down by demographics, for Fall 2013 through Fall 2016 admissions cycles. Enrollment data for 2011-2015 were obtained through UD Institutional Research. Lastly, a single year cohort (Fall 2011 enrollees) were studied to determine EGU pathways through the College.

Results

The EGU applicant pool (780 students) is the third largest in the College, trailing only Mechanical and Chemical Engineering. Overall acceptance rates for the majority, women, and URG populations are in-line with students applying directly to engineering majors (see Appendix D). On average, 125 women and 42 URGs are accepted into the EGU designation annually. The yield rates for women EGUs are 21%, which is at the department average (22%); however, the yield rate for URG applicants to EGU is lower than any other program (19% versus 27% program average).

On average, the enrolled EGU population is 25.5% women and 8.8% URG (Table E.1), making EGU more gender diverse than the average first-year cohorts of students in mechanical, civil, computer science, computer engineering, and electrical engineering. Interestingly, EGU is markedly less racially diverse than any of the departments.

Our cohort analysis showed that 82% of all EGUs were placed in an engineering major by the end of their first year, with no difference by race or gender. Of these students, approximately half (54%) went into Mechanical Engineering, and a quarter (26%) into Civil Engineering (Figure E.1). Computer Science, Computer Engineering, Electrical Engineering, and Environmental Engineering received almost no EGU students.

Conclusions

Currently, the EGU population could – and does – serve as a mechanism of gender diversification but not racial diversification. Mechanical Engineering in particular sees large gains in gender diversification (12% enrolled to 19% graduated) due to an influx of women from the EGU designation. Computer Science, Computer Engineering, and Electrical Engineering enroll very few EGU students; and they could benefit from increased recruitment efforts with this group, particularly as means for boosting female enrollment. There are some potential gains to be made in terms of admissions yield rates for the EGU population. The admissions pipeline for women EGU applicants is similar to women applying directly to engineering majors, and, for this reason, we recommend targeting 30% yield (see Appendix D). A top priority should be to investigate and mitigate the relatively low yield for URG students applying to EGU.

Table E.1: Percentage of women and URGs in the first-year (enrolled) class in each major, including the Engineering Undecided (EGU) designation, which is shown in bold. These data represent average values for Fall 2011 – 2015 enrolled cohorts.

Major	%Women	%URG
Environmental Engineering	52.1%	15.6%
Biomedical Engineering	45.0%	11.1%
Chemical Engineering	28.8%	11.5%
Engineering Undecided	25.5%	8.8%
Civil Engineering	20.9%	12.4%
Computer Science	17.4%	14.2%
Mechanical Engineering	12.5%	12.6%
Electrical Engineering	10.8%	13.0%
Computer Engineering	8.8%	18.4%

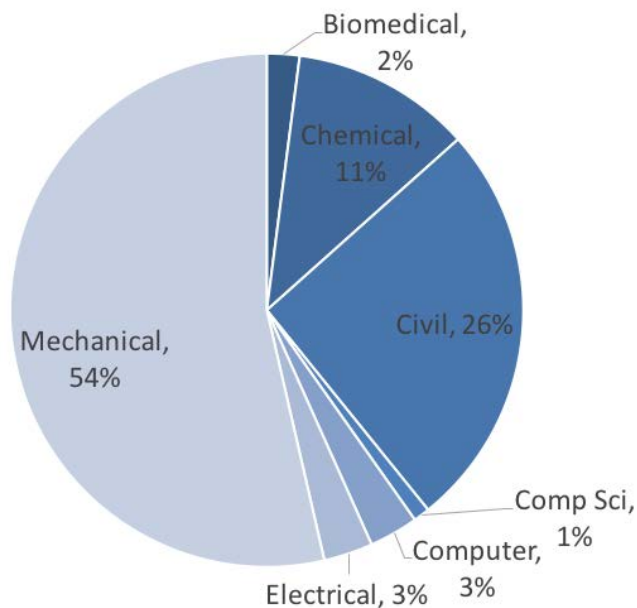


Figure E.1: Choice of major by EGU students. Data taken from incoming class of 2011.

Appendix F: Multi-Year Retention of Students in the College

Scope

We conducted a retrospective cohort study of students who entered and exited all engineering programs in the College in order to better understand retention and persistence in each discipline.

Methods

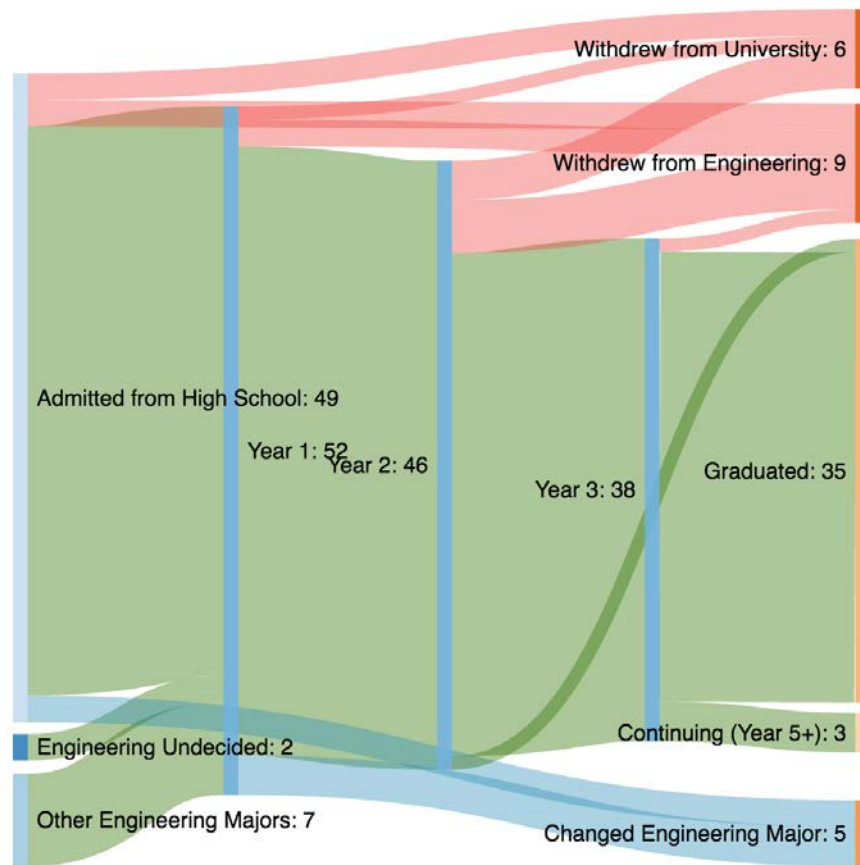
This analysis relied on data from a cohort of students who enrolled in the College in Fall 2011. Year-by-year enrollment was manually tracked by College staff using data from Institutional Research and processed into a single dataset that reported, by engineering discipline, the number of students enrolled annually as well as the volume of students entering or exiting on common pathways, e.g., transferring in from majors outside the College or exiting to attend another University. These data were then visually represented using a Sankey Plot, using online software (SankeyMATIC, Beta version). Analysis was purely qualitative based on these plots.

Results & Conclusions

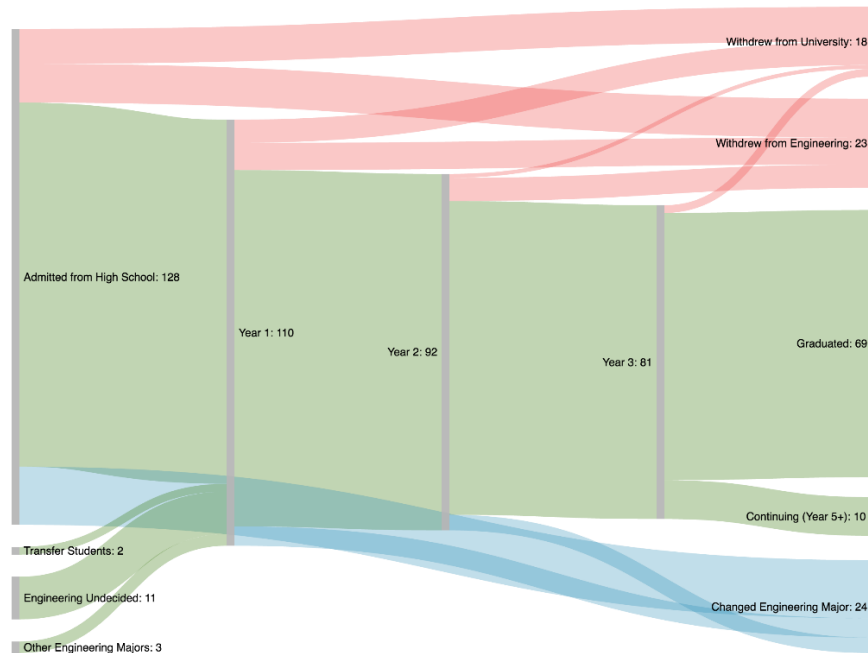
Our qualitative analysis of retention patterns in each major suggests a few themes (Figure F.1). First, sources for first year students differ across departments. Biomedical and Chemical Engineering rely on direct admissions; Mechanical and Civil Engineering have a substantial volume of students coming from Engineering Undecided (EGU); and Computer Science and Electrical Engineering rely on transfers from outside of the College to fill out their first year class. After the first year, most majors showed a steady outflow of students through the sophomore year, with little attrition in late junior into senior year. The exception to this trend was Electrical and Computer Engineering, which showed more complex exit and entry patterns for students into their upperclassmen years.

Figure F.1: Sankey plots for all engineering majors within the College showing the number of students entering and exiting the programs at different time points.

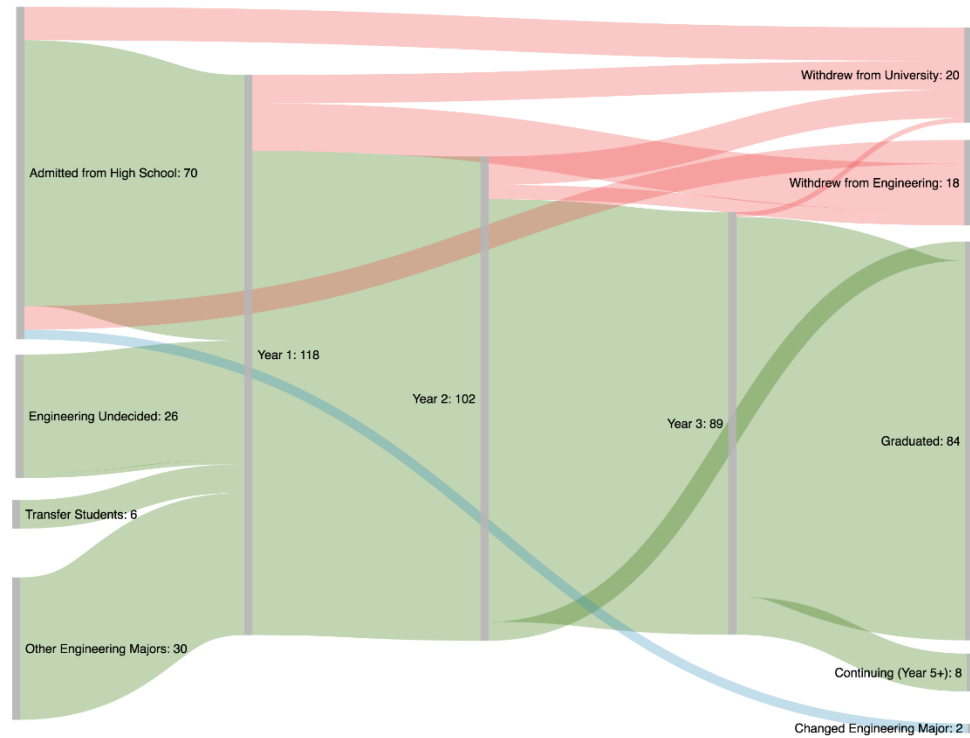
Biomedical Engineering



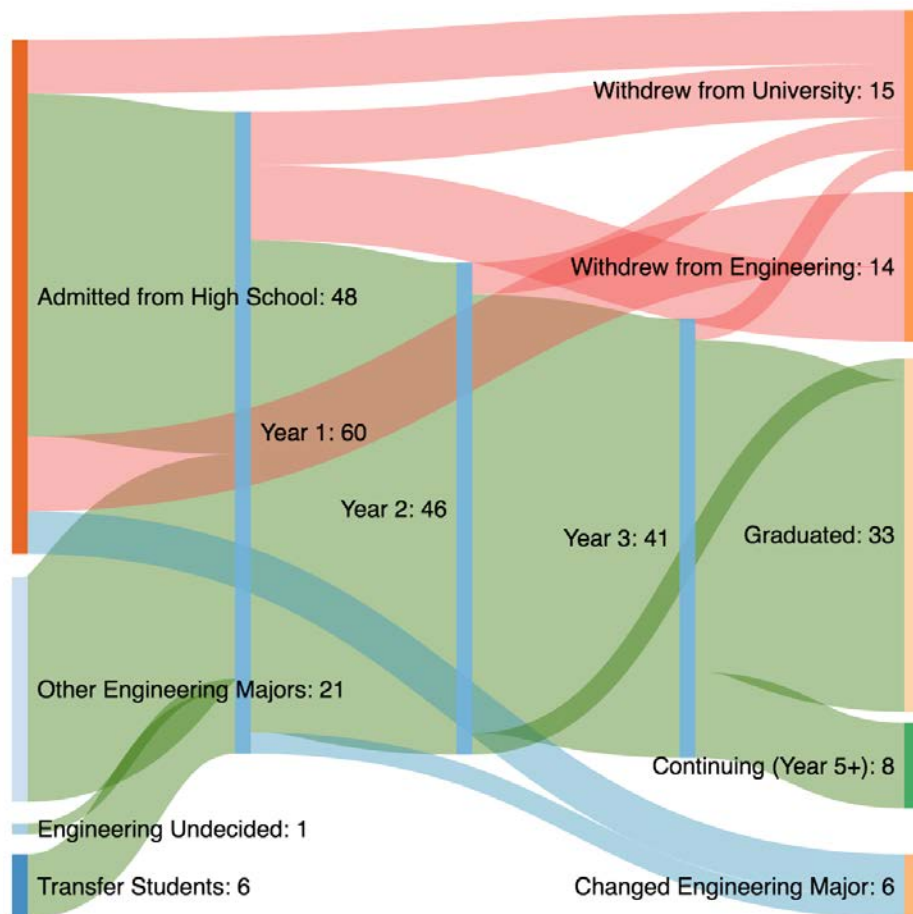
Chemical Engineering



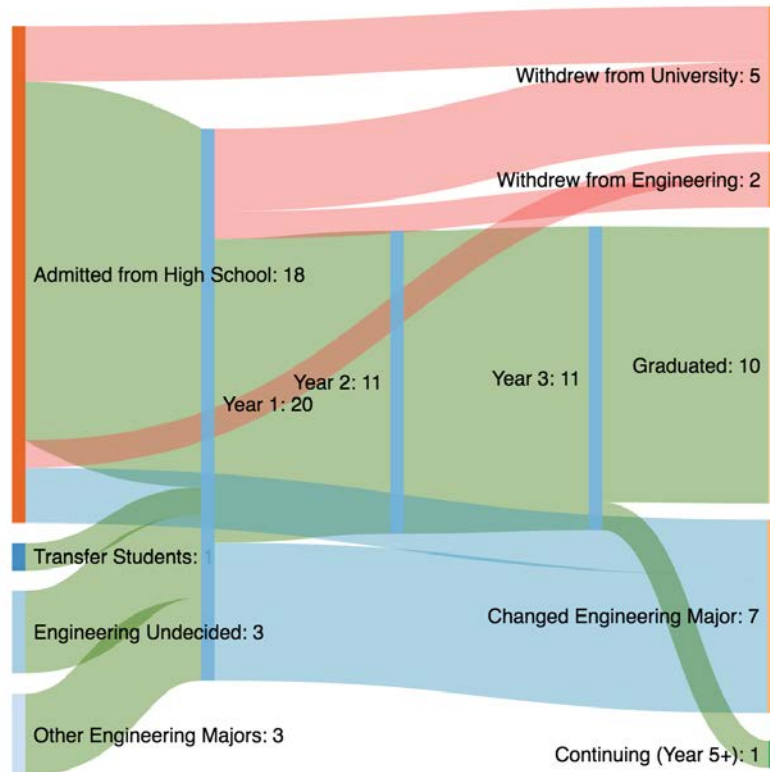
Civil Engineering



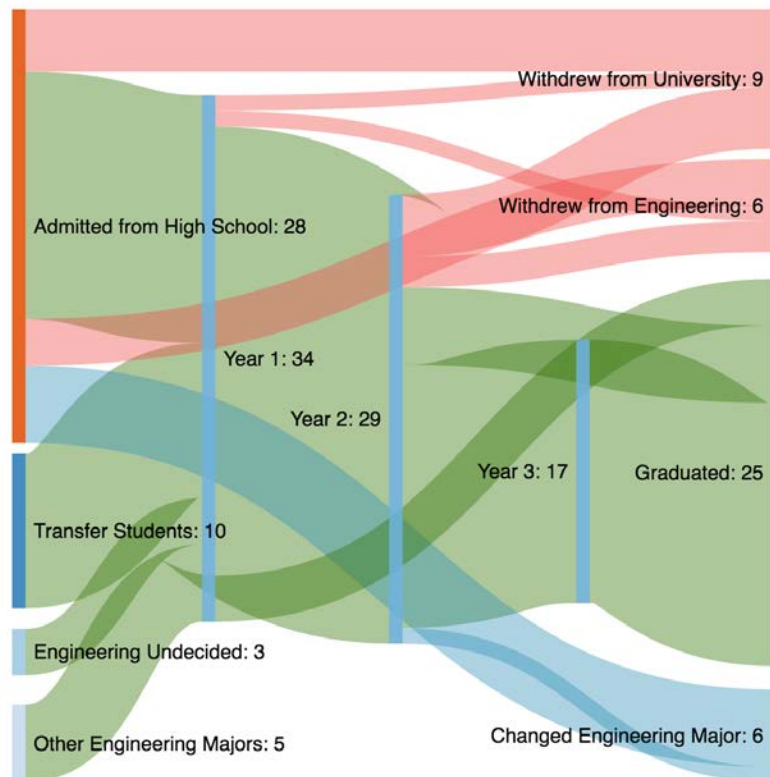
Computer Science



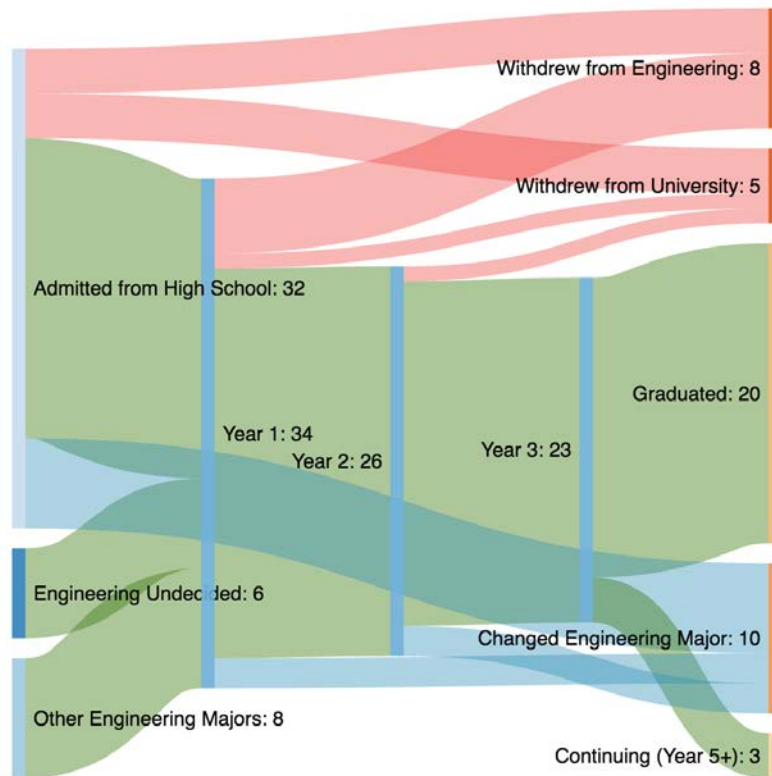
Computer Engineering



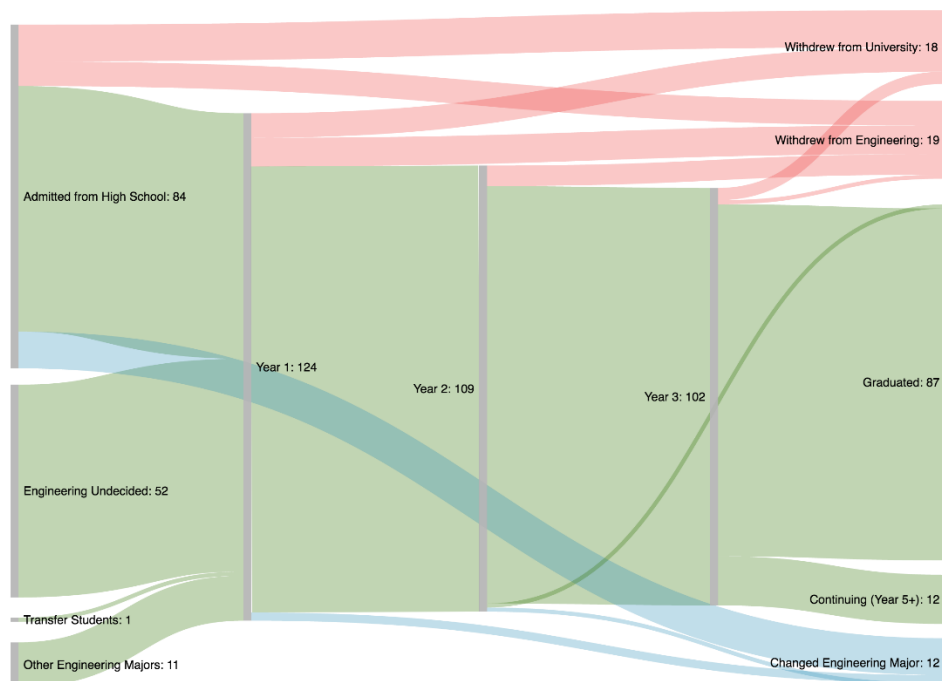
Electrical Engineering



Environmental Engineering



Mechanical Engineering



Appendix G: Recruiting Effectiveness Survey

Scope

We conducted a brief survey of the current freshmen class to gauge the effectiveness of different interventions on recruiting students to the College.

Methods

In Fall 2016, a survey was administered to all students enrolled Introduction to Engineering (EGGG101), which is typically taken during the first semester for all engineering majors. The survey was also distributed in Introduction to Biomedical Engineering (BMEG101). Survey completion was optional, and the survey was administered using online software (Qualtrics). Survey questions asked students to recall and rate the effectiveness of different recruitment efforts performed by the University or the College over the past year.

Results

There were 471 survey responses (approximately 67% response rate), and demographics of the respondents were consistent with the overall college population. For half of our students (50.9%), UD was not their first school choice. On average, students visited the UD campus 3 times, during which they took a campus tour (63%), heard a general presentation about the engineering programs (55%), and talked with current students in their major of interest (51%). All of these recruiting experiences were viewed positively. Fewer students talked with faculty (35%), toured research labs (21%), or experienced engineering outreach programming of any kind while on campus (16%).

Conclusions

These data suggest that University-sponsored on-campus events are critical recruiting tools, and that current students also heavily influence recruitment

Strategic Plan for Staff Diversity and Inclusion

Staff Diversity Working Group
College of Engineering, University of Delaware

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September 2017

1. Introduction

Like many colleges nationally, the UD College of Engineering has not historically had as much of a formal focus on diversity and inclusion for staff as it has for students and faculty. Nevertheless, we recognize that staff play an important role in the functioning and climate of the College of Engineering, and thus we are committed to ensuring that the staff exemplifies inclusiveness and diversity as well as faculty and students do. Most staff interact with students and faculty daily; all provide invaluable support without which the College would not operate. Many staff stay for years, so as students come and go, they help set the tone that defines the College. Thus, not only is it critical for staff to participate in the process of achieving inclusive excellence among students and faculty through the support they provide, it is also important for staff themselves to represent inclusive excellence through best practices for staff recruitment and retention. Other universities that have recently initiated diversity efforts specifically towards staff include University of California at Berkeley, Penn State, North Carolina State University, University of Texas at Austin, University of Michigan, and University of Illinois at Urbana-Champaign.

2. Goals

A few notes about definitions are important before defining goals. First, faculty who act as administrators (e.g., Dean, Associate Deans, Department Chairs) are not included in this plan, although they are often considered staff for some accounting purposes. In this context, they are considered to be faculty first, and thus are included in the faculty diversity plan. Second, in this plan, we consider staff based on their job type (administrative support, technical support, and research) and level (managerial or non-managerial) (Table 1). We include research staff in the analysis, but do not address them directly in the specific aims and action items because the way they are recruited by Principal Investigators (faculty) and their job descriptions make them more similar to faculty or graduate students than other support staff. Managerial positions are assumed to include those for which the title includes the word *manager*, *director*, *supervisor*, *business administrator* or *business officer*. Distinguishing managerial versus non-managerial is a way to examine any possible discrepancies in staff rank and, hence, compensation.

Table 1. Jobs included in each type

Job type	Jobs included
Administrative support	Human resources staff, department support staff (administrative assistants, academic advisors, business administrators), sponsored research and procurement staff, outreach, Dean's support staff, financial services, academic affairs, communications
Technical support	Facilities, lab coordinators, core facilities (machine shops, electronics), information technology
Research staff	Lab and center researchers (Engineers), post-doctoral researchers, limited-term researchers

The overarching goal of the staff diversity and inclusion plan is to support inclusive excellence in the College of Engineering by hiring and retaining highly qualified staff who reflect a range of backgrounds and perspectives, and by creating a supportive and inclusive culture among them. These goals are important both because, like all workplaces, the College can benefit from the increased creativity and innovation that comes from leveraging diversity and because as an academic environment in particular, the staff serve as role models for the students. To achieve this vision, we have set the following five-year

goals. We recognize that demographic changes among the staff will be limited by turnover rates. Based on a simple analysis and reasonable assumptions (Appendix A), we believe the following are aggressive but possible.

- Critical mass (30%) of women among the technical support staff. Like faculty, technical staff are role models for engineering students, implicitly demonstrating what people in technical jobs look like. We are targeting a critical mass of women undergraduate and graduate students across all engineering majors; therefore, we propose the same target for our technical support staff, especially those in student-facing jobs, such as, lab coordinators.
- A percentage of staff from URGs that matches regional demographics. Staff positions predominantly pull from the local (New Castle County) and regional (Mid-Atlantic States) population; thus, ideally we would like 30% URG among staff to match the broader population. However, given the current status and reasonable assumptions about turnover among staff, 20% is a more realistic five-year target.
- 20% men among the administrative support staff
- Continuous improvement towards the ultimate aim of eliminating racial and gender disparities in the distribution between managerial and non-managerial positions.
- An inclusive and supportive climate among staff where individuals from all backgrounds feel welcome, share in common goals for diversity in the college, and support and promote diverse talent from within the organization. We will conduct an annual climate survey to assess progress towards this goal.

3. Current status

Using the definitions presented in Section 2 and data from 2017, we analyzed the current demographic breakdown by staff type (administrative support, technical support, and research) and level (managerial or not). Appendix B includes the data on which the analysis is based. Specifically, we examine gender and membership in underrepresented groups (URGs, defined as non-White, non-Asian). Consistent with the University's Inclusive Excellence Diversity Action Plan, we seek diversity in all dimensions (e.g., age, race, gender identity). Nevertheless, we focus here on gender and URGs, same as the faculty and student plans, since they are two of the most obvious potential sources in our lack of diversity. We also fully expect that many actions taken will support diversity and inclusiveness more generally since they are primarily meant to implement best practices for hiring, retention, and climate improvement. Since the College currently recruits most administrative and technical support staff from the New Castle County population, we use that as a comparison group.

Of the 150 College staff, 94, 35, and 21 are administrative support, technical support, and research, respectively. Figure 1 shows the 2017 gender and URG data for College administrative support staff, technical support staff, research staff, and for the New Castle County population. It highlights a stark gender divide among staff. Administrative support staff are overwhelmingly female (87%), while technical support and research staff are overwhelmingly male (80% and 81%). It also shows low numbers of staff from URGs—13% of administrative, 9% of technical, and 0% of research staff are from URGs, compared to 35% in New Castle County.

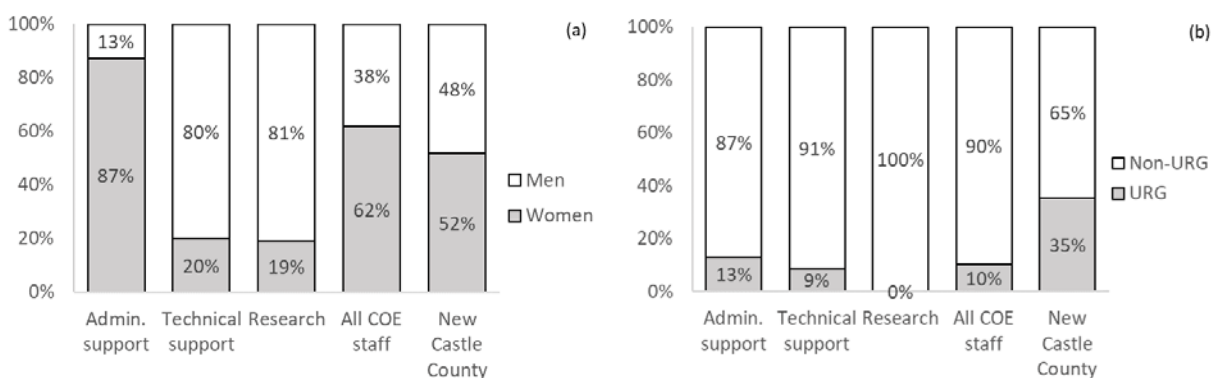


Figure 1. UD COE administrative support staff, technical support staff, research staff, and New Castle County population, (a) by gender and (b) by underrepresented group (URG) and non-URG

Focusing on the administrative and technical support staff, Figure 2 presents the 2017 gender and URG data for the College managerial and non-managerial staff. Although men make up only 31% of the administrative and technical support staff (40 of 129, Appendix), they hold more than half (55%) of the managerial positions. Women do hold close to half the managerial positions (45%), but given that there are more women in general, that represents a disproportionately low percentage of managerial positions. Staff from URGs hold an equally small percentage of managerial and non-managerial positions (10% and 12%) though they account for 35% of the New Castle County population.

Together these data suggest that the College staff could benefit from increased percentage of women in technical support and managerial roles, and an increased percentage of staff from URGs in all roles.

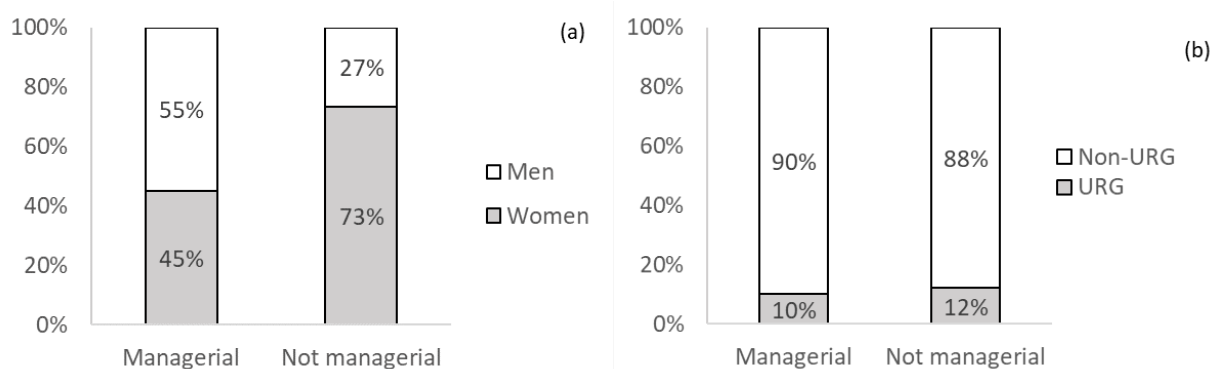


Figure 2. UD COE managerial staff and non-managerial staff, (a) by gender and (b) by underrepresented group (URG) and non-URG. (Does not include research staff.)

4. Specific aims

To move from the current status to the stated targets, we propose two specific aims: (1) Improve recruitment of excellent, diverse administrative and technical staff; (2) improve the climate for staff, particularly as it relates to issues of diversity and inclusion.

Specific aim 1. Improve recruitment of excellent, diverse administrative and technical staff

- Ensure best practices are implemented in all staff searches. UD's Employee Development Group provides a mandatory search committee training for all members who have not served on a search committee within the last 12 months. This training reviews best practices including information on unconscious bias, strategies for engaging diverse applicants, and other search committee members' roles and responsibilities. CoE HR will ensure that all search committee chairs are made aware of the training and that their members are participating as required. We are anticipating enhancements in training, reporting and applicant information as the University moves to the planned recruitment software implementation this summer.
- Broaden the pool of applicants for staff positions. At present, procedures for staff searches vary widely by job classification and organization within the College. Many searches are performed locally, with many candidates being pulled internally from other divisions within UD. Since UD as a whole suffers from similar staff diversity issues as COE, this practice rarely leads to a diverse candidate pool. Recognizing that a key step in finding the most qualified staff is ensuring a broad, highly qualified diverse pool of applicants, we will make an effort to develop and implement new, more proactive strategies for developing an applicant pool. For example, professional societies for women in the trades could be leveraged for staff searches for technical positions in UD COE Facilities. As an action item, the committee will create a list of recommended venues for posting open staff positions by staff type with the specific objective of diversifying the applicant pools.

Specific aim 2. Improve the climate for staff, particularly as it relates to issues of diversity and inclusion

- Conduct a focus group study to identify and prioritize climate issues among the staff. Building on the lessons of the College undergraduate diversity focus group study conducted in Spring to Summer 2017, we will conduct a formal focus group study in collaboration with the Delaware Education Research and Development Center (DEDRC). Focus groups will be clustered by job type, rank, gender, and race; and the DEDRC facilitator will engage each group with specific issues related to staff diversity, including climate, recruiting practices, opportunities for advancement, and strategies for improvement by the College. Data collection and analysis will be conducted entirely by DEDRC to preserve the anonymity of the subjects and mitigate bias. Focus groups could be initiated as early as Fall 2017, with results available by early 2018. Common themes identified by the focus group study will be used to direct further interventions by the committee.
- Regularly communicate with staff about diversity and inclusion-related topics. At present, diversity and inclusion topics for staff are relegated to HR and mandatory trainings, which can have the effect of restricting open and honest dialogue about these issues. We recommend establishing regular, more informally structured opportunities for staff to learn and discuss issues of diversity. These include: (1) brown bag lunches with a rotating "theme" centered on a relevant article or internal report from the institution and facilitated by a staff or faculty member with expertise in the field; (2) semi-annual presentations by the Associate Dean for Diversity at the College-wide staff meeting; and (3) workshops for staff with external facilitators focused on diversity and inclusion-related topics.

5. Evaluation

Evaluation of the efforts made will include two components, both of which will be administered at the College-level in coordination with the other three diversity working groups, and thus are discussed in the College-wide plan document. First, we will track on an annual basis, both the demographics of the staff hired and the overall demographics of the staff. The latter is the ultimate goal since the composition of the overall staff at any point in time is what defines the College. However, that is slower to change because it depends on the rate at which new staff are hired and existing staff leave. The former, is easier to change more quickly, so progress may be more noticeable in the hiring initially. Second, we will conduct an annual staff climate survey. All assessments will be reported annually in a College diversity scorecard that assesses progress towards diversity and inclusion goals for all four groups—faculty, graduate students, undergraduates, and staff.

6. Timeline and budget

6.1. Timeline

	Action Item	Year 1	Year 2	Year 3	Year 4	Year 5
Aim 1	Broaden staff job applicant pools					
	Develop best practices for job searches					
Aim 2	Staff Focus Group Study					
	Brown Bag Lunches					
	Presentations by Associate Dean					
	Staff Diversity Workshops					

6.2. Budget

Budget removed from this version.

APPENDIX A. PROJECTION OF STAFF DEMOGRAPHICS

Assumptions

- As of 2017, the numbers of staff by type and demographics are as given in Appendix B
- Based on data from 2016 and 2017, 8% of administrative staff will leave each year and the same number will be hired, 8% of technical staff will leave each year and the same number will be hired.
- Women, men, URG, and non-URG staff will leave at the same rates (e.g., if there are 10% staff from URGs in Year 1, then 10% of the staff that leave that year will be from URGs)
- 75% of the administrative support staff hired each year will be women, half of the technical support staff hired each year will be women, and one-third of the administrative and technical support staff hired each year will be from URGs.

Table A1. Project changes in staff demographics over 20 years based on stated assumptions

	Year	Administrative support					Technical support					All support				
		Women		URG		Total	Women		URG		Total	Women		URG		Total
		Number	%	Number	%	Number	Number	%	Number	%	Number	Number	%	Number	%	Number
0	2017	82.0	87%	12.0	13%	94	7.0	20%	3.0	9%	35.0	89.0	69%	15.0	12%	129
1	2018	81.1	86%	13.5	14%	94	7.8	22%	3.7	11%	35.0	88.9	69%	17.2	13%	129
2	2019	80.2	85%	14.9	16%	94	8.6	25%	4.3	12%	35.0	88.8	69%	19.2	15%	129
3	2020	79.5	85%	16.2	17%	94	9.3	27%	4.9	14%	35.0	88.8	69%	21.1	16%	129
4	2021	78.7	84%	17.4	19%	94	10.0	29%	5.4	15%	35.0	88.7	69%	22.8	18%	129
5	2022	78.1	83%	18.5	20%	94	10.6	30%	5.9	17%	35.0	88.7	69%	24.4	19%	129
6	2023	77.5	82%	19.5	21%	94	11.1	32%	6.4	18%	35.0	88.6	69%	25.9	20%	129
7	2024	76.9	82%	20.4	22%	94	11.6	33%	6.8	19%	35.0	88.6	69%	27.2	21%	129
8	2025	76.4	81%	21.3	23%	94	12.1	35%	7.2	20%	35.0	88.5	69%	28.4	22%	129
9	2026	75.9	81%	22.0	23%	94	12.5	36%	7.5	21%	35.0	88.5	69%	29.6	23%	129
10	2027	75.5	80%	22.8	24%	94	12.9	37%	7.8	22%	35.0	88.4	69%	30.6	24%	129
11	2028	75.1	80%	23.4	25%	94	13.3	38%	8.1	23%	35.0	88.4	69%	31.6	24%	129
12	2029	74.7	79%	24.0	26%	94	13.6	39%	8.4	24%	35.0	88.4	69%	32.4	25%	129
13	2030	74.4	79%	24.6	26%	94	13.9	40%	8.7	25%	35.0	88.3	68%	33.2	26%	129
14	2031	74.1	79%	25.1	27%	94	14.2	41%	8.9	25%	35.0	88.3	68%	34.0	26%	129
15	2032	73.8	79%	25.6	27%	94	14.5	41%	9.1	26%	35.0	88.3	68%	34.7	27%	129
16	2033	73.5	78%	26.0	28%	94	14.7	42%	9.3	27%	35.0	88.3	68%	35.3	27%	129
17	2034	73.3	78%	26.4	28%	94	15.0	43%	9.5	27%	35.0	88.2	68%	35.9	28%	129
18	2035	73.1	78%	26.8	28%	94	15.2	43%	9.6	28%	35.0	88.2	68%	36.4	28%	129
19	2036	72.9	78%	27.1	29%	94	15.3	44%	9.8	28%	35.0	88.2	68%	36.9	29%	129
20	2037	72.7	77%	27.4	29%	94	15.5	44%	9.9	28%	35.0	88.2	68%	37.4	29%	129

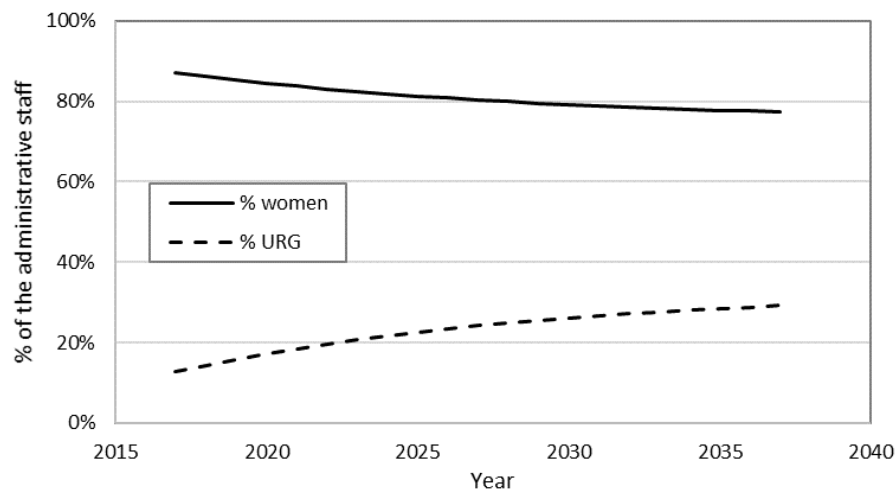


Figure A1. Projected change in demographics of administrative support staff over 20 years, based on stated assumptions

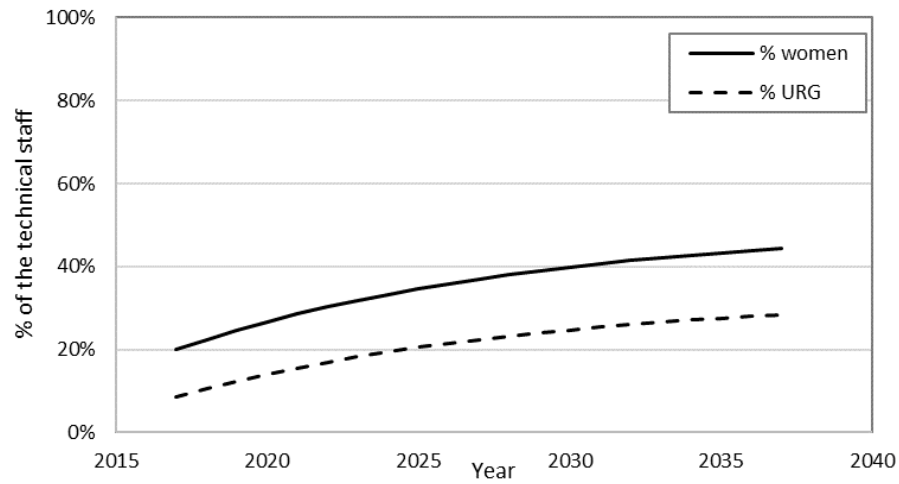


Figure A2. Projected change in demographics of technical support staff over 20 years, based on stated assumptions

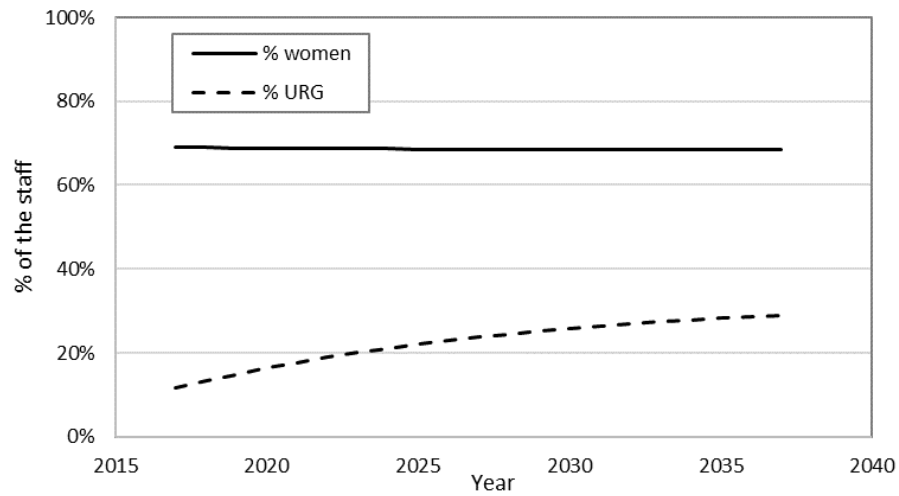


Figure A3. Projected change in demographics of administrative and technical support staff over 20 years, based on stated assumptions

APPENDIX B. 2017 DEMOGRAPHIC DATA FOR STAFF

Table A1. College of Engineering staff data by job type, gender, and race

		Asian	Black/ African American	Hispanic/ Latino	N/A	Not Specified	White	Grand Total
Admin. support	Total	6	12		1	1	74	94
	Female	5	10		1	1	65	82
	Male	1	2				9	12
Tech. support	Total	3	2	1			29	35
	Female						7	7
	Male	3	2	1			22	28
Research	Total	11					10	21
	Female	4						4
	Male	7					10	17
	Grand Total	20	14	1	1	1	113	150

Table A2. College of Engineering administrative and technical support staff data
by job type, gender, and race (Does not include research staff.)

		Asian	Black/ African American	Hispanic/ Latino	N/A	Not Specified	White	Grand Total
Managerial	Total	3	2				15	20
	Female	1	1				7	9
	Male	2	1				8	11
Not managerial	Total	6	12	1	1	1	88	109
	Female	4	9		1	1	65	80
	Male	2	3	1			23	29
	Grand Total	9	14	1	1	1	103	129