SCHOOL OF ENGINEERING

ACADEMIC PLAN

Sequenced Strategies

May 2021

UNIVERSITY OF CALIFORNIA, MERCED

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SCHOOL OF ENGINEERING

INTRODUCTION

The School of Engineering (SoE) is the one of the youngest engineering schools in the nation and the youngest in the University of California system. In the fourteen years since the first freshmen arrived on campus, the School has been expanding over time, developing its sense of identity and building the foundations for excellent academic programs.

During the past four years, from Fall 2015 to Fall 2020, the School experienced significant growth in undergraduate and graduate enrollments, faculty size, and extramural contract and grant activity. Comparative numbers are shown below in Table 1.

Table 1. School of Engineering Growth, Fall 2015 to Fall 2020

	Fall 2015	Fall 2020*
Faculty	44	59
Undergraduate students	1,454	2,298
Graduate students	143	226
Research awards, $	$14.9 million (FY 2016)**	$17.6 million (FY 2019)

*Excludes MCS, which is to become part of the Gallo School of Management
** FY 2015 data not available for SoE

In addition to enrollment and faculty growth, the School officially established five departments (six with MCS), received CCGA approval for four graduate programs (six with MCS programs), and recently approved one new undergraduate program, Civil Engineering (CIE).

Over the next five years, the School hoped to continue with rapid growth, particularly with the completion of Project 2020 construction project. The strategic plan for the SoE outlined in this document were based on input and goals developed before the COVID-19 outbreak. However, they now represent more of a longer-term strategy that will need to be stretched out longer than originally envisioned. The recent COVID-19 pandemic has resulted in a significant shifting of planned resources, both current and future, to address immediate campus COVID-19 operational needs.

While the School remains optimistic in its goals and aspirations, there is underlying angst that the needs and workloads associated with continuing growth are overwhelming given the recent budget realities. Already, there is a strong sense among the faculty and staff that there are insufficient resources (both human, cyber, and monetary) to meet the current needs associated with the research, teaching, and service mission of the SoE. Among certain faculty and staff members there exists a perception that the SoE is asked to grow and thrive with little in the way of campus support for the administrative resources needed. Thus, faculty and staff members are discouraged and tired.

As a campus and school that has considered itself to be a “startup”, there was a strong tendency to focus on new directions and programs, to expand outwards. Over the first 15 years, the School has developed emerging areas of strength, which the School hopes to enhance during the coming years with less emphasis on expanding broadly in the scope of research endeavors . In other words, we seek to build bench strength and critical mass needed for excellence in teaching and research in existing areas with focused growth in areas where there is capacity and opportunity to generate new revenues for the School and campus.

During the Fall 2019 semester each department was directed to consider a review and planning exercise in advance of a school-wide retreat held on January 24-26, 2020 at an off-site location. The preparation directions for the departments is included as Attachment A.

Following this planning exercise, each department chair reported on their assessment and proposed goals of their respective departments to all faculty members and senior staff members at the retreat. Thereafter, faculty members and key staff members were assigned to a breakout session for either research, graduate education, undergraduate education, public service, or diversity. Faculty members for each breakout group were pre-selected to ensure a mix of faculty rank, department, ethnicity, and gender.

During these breakout sessions, each group was charged with addressing and then summarizing key priorities, issues, actions, and challenges for their respective assigned areas. Facilitation questions for the breakout groups are included in Appendix B. Each breakout group gave a summary presentation to all faculty participants for feedback that was later incorporated into a final summary for each breakout topic.

This overall strategic plan document reflects the input and guidance developed from the departmental plans and the outcomes from the School-wide retreat breakout sessions. The individual department plans as presented at the retreat are found in Appendix C through Appendix G. Summaries from each of the cross-departmental breakout groups for diversity, research, public service, graduate education, and undergraduate education are found in Appendixes H through L, respectively.

A major goal for the campus academic planning process is to establish resource priorities for the schools. Each school will determine how those resources will be allocated to the departments. The individual department goals and plans will provide important information in helping the School leadership decide the timing and allocation of the resources assigned to the SoE.

While the Department of Management of Complex Systems (MCS) is currently administered under the School of Engineering currently, MCS along with two other different departments from the School of Social Sciences, Humanities, and Arts (SSHA) has proposed to establish a new school, the Gallo School of Management. The Gallo School proposal is undergoing review at the campus level currently. MCS plans were not considered with the other SoE departments. However, any plans established by the MCS department could be readily added to the overall SoE strategic plan.

FOUNDATIONS FOR THE SCHOOL OF ENGINEERING

Mission

The mission of the School of Engineering at the University of California, Merced is to:

- Transform students into tomorrow's leaders,
- Create a continuously improving environment in which outstanding faculty, students, and staff thrive in research, education and service, and
- Make local and global impact by creating solutions and developing technologies that address society's challenges.

Vision

Our vision is to become a recognized world leader in engineering innovation and education.

Values

The School of Engineering values collaboration, creativity, integrity, strong work ethic, life-long learning, and responsibility for improving our world sustainably.

Aims

- Our school aims for excellence through educating future leaders in engineering who understand the context in which they live and work, and who are comfortable with managing and driving change. We will focus on developing innovative education that provides deep engineering competence, promotes high ethical standards, and delivers solutions to our challenges in an economically, environmentally, and socially responsible manner.
- We seek to be internationally recognized for our cutting-edge, interdisciplinary research by focusing on select, high profile areas, and attracting the best faculty and graduate students to build our signature areas of distinction. We will strive to be on par with our sister UC campuses in the quality and impact of our research.
- As a diverse school and campus, we seek to leverage our diversity to be innovative and distinct and apply our knowledge to solving important problems related to our human and natural environments. We will achieve this by attracting a dynamic faculty, and grafting sustainability into our culture, education, and research.
- We strive to engage our communities, and to promote a value exchange between our students, our faculty, and our communities. By using the local region as our lab, we aim to solve global problems by finding sustainable solutions to the local challenges, incubate the creation of new enterprises and good jobs, and facilitate prosperity of the San Joaquin Valley.

Guiding Principles

The guiding principles that hold true for all our strategic plans.

- We must emphasize excellence in the research, education, and service that we deliver.
- We must create an environment that attracts outstanding faculty and staff.
- We must create an environment that attracts outstanding students, both at the undergraduate and graduate levels.
- We must develop an entrepreneurial mindset that promotes innovation in research, education, and service, while being cost effective in its operations.
- We will foster ethical leadership among a diverse community within our faculty, staff, and students.
- We must strive to gain recognition for our positive contributions in research, education, and research.

FIVE-YEAR ASPIRATIONAL GOALS

The progress and success of the strategic vision and plan will be assessed by marking progress towards, and meeting the aspirations described below.

- Rank within the top 100 graduate engineering schools by the U.S. News & World Report.
- Have one or more SoE faculty member elected to the National Academy of Engineering (NAE).
- Be a partner in at least one NSF Engineering Research Center (ERC), NSF Science and Technology Center (STC), or NSF Materials Research Science and Engineering Center (MRSEC).
- Surpass $25 million in annual research expenditures and awards.
- Each SoE-associated research center will have at least one Professional Researcher faculty member that generates her/his salary from extramural funding
- Increase undergraduate enrollment to 3,200 with a student-to-faculty ratio of less than 35:1, preferably closer to the UC average of 25:1
- Achieve an average of one Ph.D. awarded per faculty member every other year or better.
- Achieve an average of one M.S. awarded per faculty member every year or better.
- Increase four-year and six-year graduation rates by an average of 10 percent each.
- Exceed 80 percent job placement of graduates within one year of graduation.
- Increase the diversity of students in SoE graduate programs by increasing the number and percentage of 1) women, 2) domestic students (vs. international students), and 3) underrepresented minorities.

STRATEGIES FOR ACHIEVING GOALS

The strategies for achieving the School of Engineering five-year goals are outlined below. They are updated based on campus guidelines set forth in a 14 December 2020 memo from the Executive Vice Chancellor and Provost (EVCP) and a 8 January 2021 memo from Laura Martin. In these communications, strategies are prioritized/sequenced loosely based on expected resource limitations for at least the next two fiscal years. During this timeframe we are to prioritize strategies that a) contribute to growth in undergraduate enrollment, b) increase grant funding, and c) support diversity objectives.

This revision also addresses suggestions from the Senate Committee on Academic Planning and Resource Allocation (CAPRA) provided in a 25 November 2020 memo. The principal suggestions from CAPRA are relation to identifying more action-oriented strategies to meet School goals.

Strategies for the Next Two Years

Strategies for the next two year forwarded by the School apply to more than one of the three priority areas recommended by the EVCP and CAPRA. Most of these activities are already in process as they were outcomes from the January 2020 School of Engineering Planning Retreat. These will be ongoing activities with no specific projected milestone date.

Contribute to Growth in Undergraduate Enrollment

Recruitment Efforts

- Develop and implement a communications plan that publicizes the quality of our programs and their benefits to others.
- Gain recognition for our positive contributions in research, education, and service.
- Engage in outreach activities with high schools, community colleges, other 4-yr institutions, HSIs, and HBCUs.
- Create an environment that attracts outstanding faculty, staff, and students.
- Have all engineering undergraduate degree programs accredited by ABET.
- Revise/add new undergraduate degree programs
    - Civil Engineering has already been approved and opening Fall 2021
    - Bioengineering has submitted a revised B.S. curriculum and will seek ABET accreditation when the first graduate completes the revised degree program.
    - Exploration new Chemical Engineering and Electrical Engineering programs are underway.
- Establish professional M.S. degree programs and 4/1 B.S./M.S. programs.

Student Success/Retention

- Incorporate professional development into the curriculum and work with Career Services to improve internship opportunities for undergraduate students at companies.

- Transform Engineering Service Learning into a freshman design experience.
- Promote student success actively through enhanced extramural support from both government and industry sources.
- Foster ethical leadership among a diverse community within our faculty, staff, and students.

Increase Grant Funding

As of Fall 2020 (discounting incoming new faculty), the percentage of SoE faculty members who received an extramural grant award as the lead-PI within the past three years is 71%. These percentages vary by department, from a low of 22% in the Department of Management of Complex Systems (MCS) to 92% in the Department of Mechanical Engineering (ME). Therefore, most of the effort for increasing grant funding needs to be towards increasing per faculty extramural grant awards and/or the size of the grant awards.

Increase Funding Opportunities

- Continue and expand our network of associations with industry locally in the San Joaquin Valley, the Bay Area, nationally, and internationally.
- Increase collaborations with other preeminent institutions around the world.
- Focused, but interrelated, areas (themes) for research synergy and growth as:
    - Sustainable Systems
    - Technologies for Biology and Human Health
    - Computer Systems, Data, and Analytics
- Develop an entrepreneurial mindset that promotes innovation in research (e.g., faculty startups)

Increase Number and Size of Grant Awards

- Focus areas (themes) for research synergy and growth as:
    - Sustainable Systems
    - Technologies for Biology and Human Health
    - Computer Systems, Data, and Analytics
- Expand research efforts focused on global challenges related to the environment, sustainability, and security.
- Seek to establish centers/institutes that focus research in the theme areas, increasing research capabilities (expertise, facilities, equipment).

A primary concern raised by SoE faculty towards increasing number of grant awards and research expenditures per faculty members is the research administrative support provided by the campus. Those concerns are not addressed in this document but are related to 1) reliable and timely post-award financial management, 2) administrative support for large multi-unit/institutional research proposals, 3) policy/legal support for industry collaborations, 4) workshops for junior faculty on how to submit

compelling proposals, 5) an established cost share policy, and 6) project management support for large research centers when the campus receives an award.

Support Diversity Objectives

The School developed a Diversity and Inclusion Plan in the 2018-19 academic year that was developed as part of its submission to the American Society of Engineering Education Diversity Recognition program. For engineering, diversity objectives are related to both gender and ethnic diversity. The diversity goals established at that time are summarized in the table below.

Tenured and Tenure-Track Faculty	Women: ≥25% URM: >20%
Other Faculty*	Women: ≥25% URM: >20%
Undergraduates	Enrollment: Women: ≥20% URM: ≥50% Six-Year Graduation Rate: Within Engineering: ≥40% Within Campus: ≥75% B.S. Degrees Awarded: Women: ≥20% URM: ≥50%
Master's Students (entering)	Enrollment: Women: ≥25% URM: ≥25% (excluding international students) Graduation Rate: ≥75% M.S. Degrees Awarded: Women: ≥20% URM: ≥25% (excluding international students)
Doctoral Students	Enrollment: Women: ≥25% URM: ≥25% (excluding international students) Graduation Rate: ≥75% M.S. Degrees Awarded: Women: ≥20% URM: ≥25% (excluding international students)
Postdoctoral Researchers*	Women: ≥25% URM: >20% (excluding international students)
Non-Teaching Academic Staff*	Women: ≥25% URM: >20% (excluding international students)
Administrators	Women: ≥25% URM: >20%
Advisory Board Members*	Women: ≥25% URM: >20%

**No data available currently. Request being made to institutional research.*

The Academic Planning strategies listed below align with the efforts laid out in that plan. However, it must be recognized that increasing the diversity of faculty and staff will require additions/replacements to faculty and staff. This need is at odds with the campus budget situation during this two-year period.

- Enhance recruitment efforts to increase the number of domestic graduate student applicants through organizations such as the National GEM Consortium.
- Establish MOUs with partner domestic schools for BS or MS transfer to SoE graduate programs with high URM enrollments.
- Establish a dedicated seminar series to bring in academic researchers with diversity backgrounds.
- Take advantage of the Presidential Post-Doctoral Fellowship Program (PPFP), Chancellor's Post-Doctoral Fellowship Program (CPFP), and Target of Opportunity hires to increase diversity of the faculty.
- Attend and recruit at professional society conferences that support those from diverse backgrounds such as the American Indian Science and Engineering Society (AISES), National Society of Black Engineers (NSBE) Society of Women Engineers (SWE), Society for the Advancement of Chicanos/Hispanics and Native American Scientists (SACNAS), Society of Hispanic Professional Engineers (SHPE).

Additional Strategies After the Next Two Years

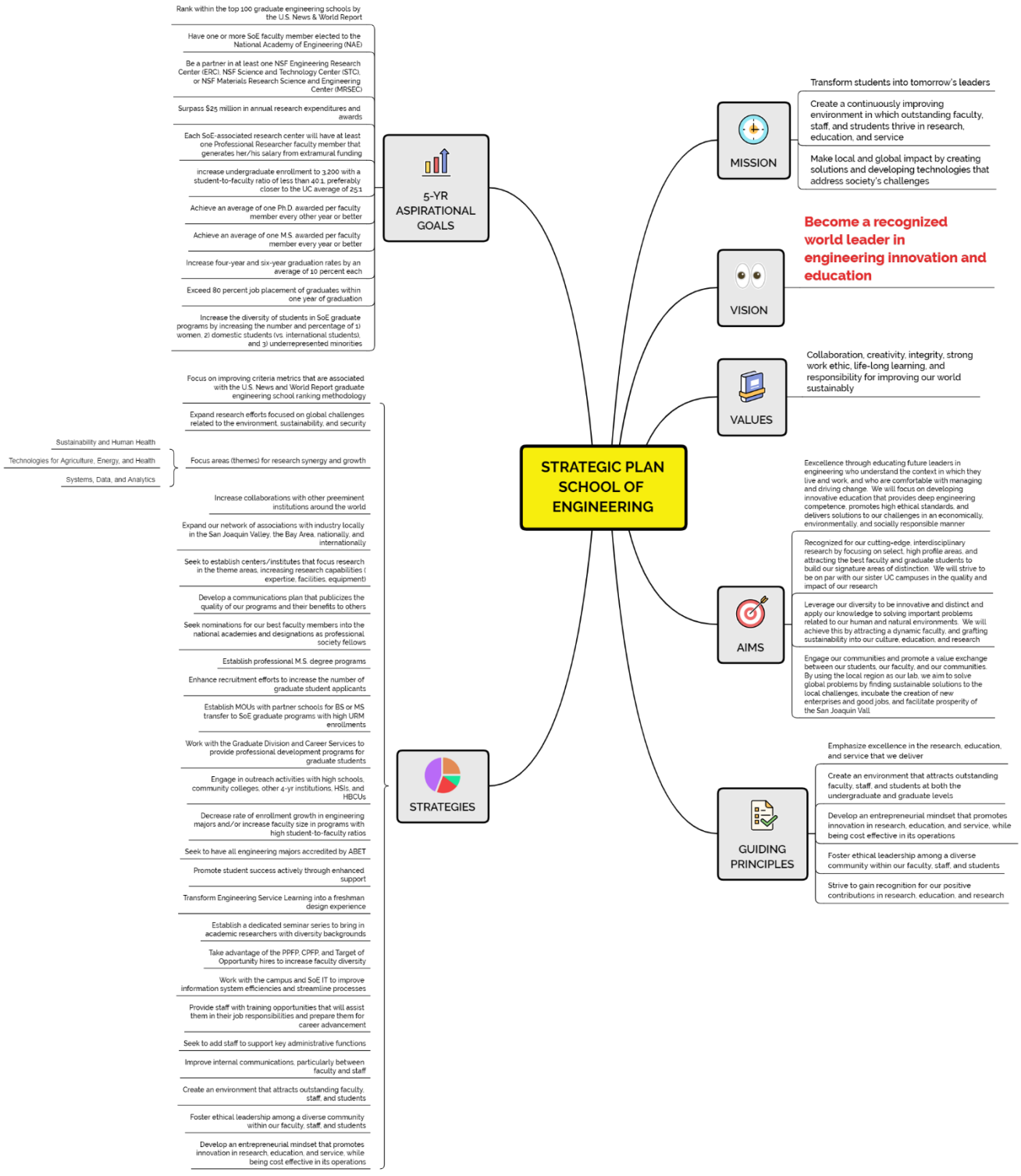
In addition to continuing the strategies outlined above for the first two years, the strategies listed below will be added.

- Forward and seek nominations for our best faculty members into the national academies and designations as professional society fellows.
- Work with the Graduate Division and Career Services to provide professional development programs for graduate students.
- Decrease rate of enrollment growth in specific engineering majors with concomitant increase in enrollment in other and new engineering majors, and/or increase faculty size in programs with high student-to-faculty ratios.
- Improve internal communications, particularly between faculty and staff.
- Develop an entrepreneurial mindset that promotes innovation in education and operations in a cost-effective manner.
- Work with the campus and SoE IT to improve information system efficiencies and streamline processes.
- Provide staff with training opportunities that will assist them in their job responsibilities and prepare them for career advancement.

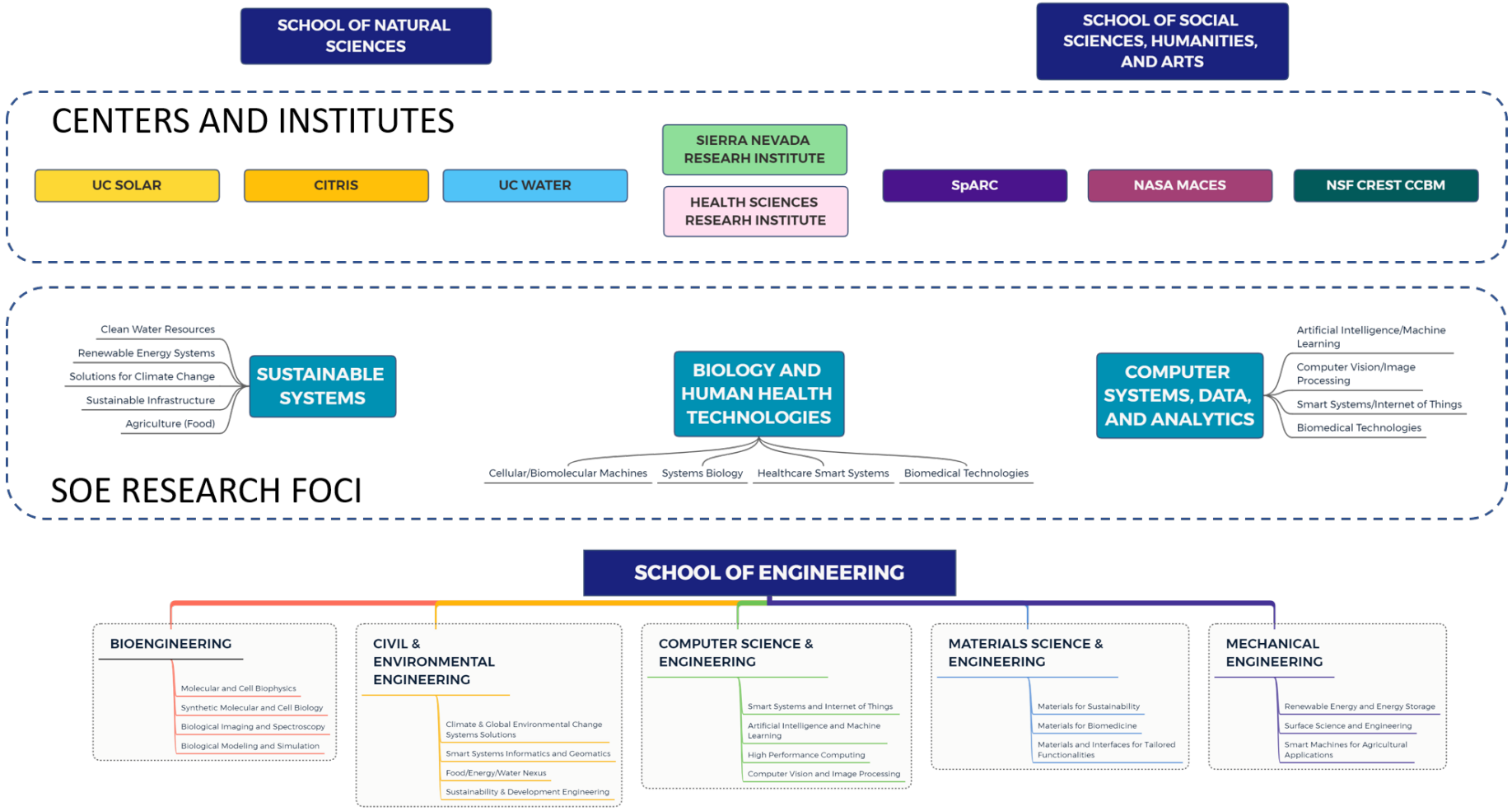
The strategy to focus on improving criteria metrics that are associated with the U.S. News and World Report graduate engineering school ranking methodology is an overarching strategy that is covered by many of the strategies previously noted. The factors and weightings used in the *graduate* engineering school rankings are

summarized below. Similarly, improving the metrics in these areas will be beneficial in helping the overall campus goal to research Carnegie R1 status in the shortest time possible.

- Quality assessment (40%)
    - Peer assessment (25%)
    - Recruiter assessment (15%)
- Graduate student selectivity (10%)
    - Mean GRE quantitative score (6.75%)
    - Acceptance rate (3.25%)
- Faculty resources (25%)
    - FT PhD/FT LRF (7.5%)
    - Ft MS/FT LRF (3.75%)
    - PhD degrees awarded (6.25%)
    - NAE members (7.5%)
- Research activity (25%)
    - Total research expenditures (15%)
    - Research expenditures per faculty (10%)



VISUAL STRATEGIC PLAN FOR THE SCHOOL OF ENGINEERING



SCHOOL OF ENGINEERING RESEARCH FOCI AND RELATION TO CAMPUS RESEARCH CENTERS/INSTITUTES

MILESTONE TARGETS AND PROJECTIONS

A table of desirable milestone metrics is presented in the table below.

METRIC	CURRENT	5-YR TARGET
U.S. News & World Report graduate engineering school rank	129	99
SoE faculty in the National Academy of Engineering (NAE)	1	2
Partner in NSF ERC, STC, MRSEC	1	3
Annual research expenditures and awards	$12M	$25M
Professional researchers generating full salary from grants	0	3
B.S. degrees awards per year	296	450
Ph.D. degree awards per faculty per year	0.35	0.50
M.S. degree awards per faculty per year	0.64	1.00
Four-year graduation rates within a SoE major by 10%	20%	30%
Six-year graduation rates within a SoE major by 10%	45%	55%
Job placement of graduates within one year of graduation	??	80%
Percentage of URM domestic students in SoE graduate programs	32%	40%
Percentage of women in SoE graduate programs	33%	40%
Percentage of domestic students in SoE graduate programs	33%	50%
Percent of faculty with Fellow status in professional societies	??	50%
Number of freshman applications	5,280	8,000
Number of transfer applications	900	1,800
Number of graduate applications	400	800

Proposed growth projections for the School are summarized in the table below. These numbers are based on a overall campus enrollment of 12,000 in Fall 2025, of which 10,800 are undergraduates and 1,200 are graduate students.

GROUP	CURRENT	5-YR TARGET
Undergraduate Students	2,300	3,200
Graduate Students	244	450
Ladder-Rank Faculty	55	90
Teaching Faculty	5	10