Leadership Through Excellence

WASHINGTON UNIVERSITY SCHOOL OF ENGINEERING & APPLIED SCIENCE

Strategic Plan

2018
Leadership Through Excellence

While literally hundreds of people contributed to the success of this process and the final plan, the strategic planning committee invested thousands of hours, and this plan would not have been possible without their tremendous dedication:

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WASHINGTON UNIVERSITY SCHOOL OF ENGINEERING & APPLIED SCIENCE

Strategic Plan

Research universities are multidimensional organizations. On any given day — or even hour — the focus can change dramatically: from an educational institution creating the next generation of citizens to a bevy of researchers frenetically trying to produce the next scientifically important discovery; from a training school preparing a workforce to a crucible of knowledge being applied to solve the problems of humanity; from a somewhat isolated hamlet — the proverbial ivory tower — that promotes development of thought to a quite visible institution embedded in a world context that buffets the policies and practices of the faculty and staff.

Likewise, an engineering school within a research university has a multitude of tasks and practices. But the context is somewhat narrower. Inherently, engineering is about both exploring and creating — understanding phenomena both natural and man-made and then advancing our ability to impact those worlds. We both produce new knowledge that changes the world and educate students so they can follow us, exploring and creating in a world we cannot yet imagine.

Because of these many different activities of the School, it is wise to have a set of principles and of bold aspirations that can guide our decisions at every scale. Otherwise execution becomes an act of merely continuing. Those principles and aspirations should both draw from existing strengths and challenge us to grow in directions that will significantly enhance our ability to achieve our goals.

To arrive at such a set of principles and aspirations, the School of Engineering & Applied Science undertook a strategic planning process, beginning with an internal assessment in spring 2016 and then in earnest that fall. A strategic planning committee of 20 faculty, students and staff was formed to shepherd a more organic process of ideation and refinement than is typical in many strategic planning efforts. The committee developed a “call for ideas” — an invitation to all our constituents to provide suggestions and ideas about possible opportunities. Students, faculty, staff and alumni along with partners in industry, government and other organizations were all invited to provide input through a variety of channels including email, web forms and even personal communication. The goal of the committee was to gather these ideas and then to distill the important thematic efforts identified. Once these efforts were refined, the resulting documents could be considered and from those initiatives a set of objectives and goals articulated; likewise, the mission and vision would be self-evident. This document, along with the 19 SEAS Strategic White Papers, are the result of that process.

Research
- Quantitative Biology & Pharmacology
- Mechanobiology
- Imaging Sciences & Technology
- Energy Systems
- Smart Environmental Systems
- Nanoscale Materials & Engineering
- Data Sciences for Humanity

Education
- Enhancing Undergraduate Curricula
- Supporting the Life Cycle of Undergraduate Students
- Effective & Efficient Master’s Programs
- Teaching Faculty
- Degree Program in Engineering Science
- Recruiting & Supporting PhD Students

Culture & Operations
- Diversity & Inclusion
- Faculty Development
- Creating a Front Door to Industry
- Why Staff Recognition Matters
- Enhancing the Entrepreneurial Spirit
- Enable Digital Learning & Research (IT operations)

READ ALL 19 WHITE PAPERS: ENGINEERING.WUSTL.EDU/STRATEGICPLAN
VISION

The School of Engineering & Applied Science at Washington University in St. Louis will be recognized as a leader in providing scientific insights and enabling technologies critical to solving fundamental research challenges of the world today and in preparing students for the rapidly changing world of tomorrow.

MISSION

The mission of the School of Engineering & Applied Science at Washington University in St. Louis is to promote independent inquiry in engineering research and education with an emphasis on scientific excellence, innovation and collaboration without boundaries.

SUMMARY OF OBJECTIVES

Through an organic process of soliciting ideas and aspirations from our communities of students, faculty, staff, alumni, industry leaders and other constituencies, a set of 19 proposals to advance the School were generated. These white papers, provided as an appendix to the overall plan, were used as the basis of establishing core objectives for the School and for identifying concrete goals and tactics that would help achieve these objectives:

I. Provide an undergraduate education experience that promotes independent inquiry, is grounded in fundamentals, affords opportunities for innovation, and leads to successful career outcomes.

II. Achieve internationally recognized contributions in both fundamental and translational research.

III. Develop world-class researchers.

IV. Through research and education, create a positive impact on the local community, the country, and the world.

V. Promote an environment where all faculty and staff are encouraged, empowered, and incentivized to pursue excellence.

VI. Ensure the financial stability and health of the School.
Our undergraduate students are among the best in the world. They choose Engineering at WashU because of the strength of our science, an environment that encourages exploration, and the opportunity to collaborate with both peers and faculty.

To keep our undergraduate curriculum and pedagogy focused and modern requires continued investment of time, energy, and resources. Engineering continues to evolve — now more rapidly than ever. Our curriculum and educational delivery must evolve as well.

OBJECTIVE
Provide an undergraduate education experience that promotes independent inquiry, is grounded in fundamentals, affords opportunities for innovation, and leads to successful career outcomes.

I. Goal 1: Support a vertically integrated educational environment and increase the participation of undergraduates in research.

At WashU Engineering, the distinctions of being an undergraduate student, a graduate researcher, or a postdoctoral fellow are blurred; the creation of knowledge in the lab is fundamental to the identity of the School and should be experienced by all students. Metrics include undergraduate participation rate, length of engagement, and extent of scholarly output.

Goal 2: Ensure a modern, relevant curriculum for each major.

While fundamentals of disciplines change slowly, the skills relevant to the practice of engineering or to the pursuit of new knowledge in research evolve more rapidly. To ensure that our curriculum meets the needs of our students for both today’s world and that of tomorrow, it must be critically assessed in a modern context. Review and comment from industry, alumni, and research partners will provide the necessary assessment.

Goal 3: Increased opportunity for design and collaboration during the four-year undergraduate experience.

Innovation is the process of applying a new and original approach or set of approaches to solve a problem. In engineering, design is the practice of innovation. And the design process can be greatly amplified when performed collaboratively. Metrics include the number of design and collaboration opportunities in which students participate, both as part of the curriculum and outside of class.

Goal 4: Develop a first-year experience for each department that students find engaging, which provides proper exposure to a selected major, and establishes “engineering thinking.”

While some Engineering students begin their studies with a clear understanding of the domain they wish to pursue, many only know they enjoy the analytical thinking embodied in engineering and that they have an aptitude for the quantitative methods that underlie the domain. Metrics are student retention and satisfaction with the first year.
Goal 5: Increase the adoption of best pedagogical practices by instructional faculty into the teaching and learning environment of their classes. (NTT, Enhancing, Support, Digital)

As Engineering has evolved, so has the pedagogy of engineering education. Assessment can be measured both qualitatively and quantitatively, ranging from the percentage of classes adopting effective instructional paradigms to results of annual surveys.

Goal 6: Increase the connectivity between our undergraduates and career opportunities.

Our students — and their parents — expect the university to provide them not only with career opportunities upon graduating, but also with learning experiences during the entire four-year journey that result in a more sophisticated understanding of their various career choices. Faculty most naturally provide insight into graduate school and academic research options. More challenging is insight into industrial and corporate possibilities. Metrics include placement statistics regarding highly desirable positions, as well as student and parent satisfaction.

Goal 7: Promote a more diverse student body and ensure that students develop communication and interpersonal skills effective across disciplines and cultures.

Engineers and researchers have the most impact and success when they can communicate their ideas and perspectives to others outside their disciplines, and indeed outside the technical sphere. WashU is often the first place our students encounter cultures and values different than their own. Establishing the value of such cultural diversity encourages communication and discourse. Metrics include the diversity of our student body and the number of opportunities students have to interact with cultures outside their own.

Goal 8: Establish targeted mentorship and advising in Undergraduate Student Services to support disadvantaged and minority students with the goal of achieving better retention and graduation rates within those populations.

The university has significantly increased its undergraduate recruiting efforts targeting disadvantaged and underrepresented students, and the results of these efforts are visible within the School. But our success rates with those students are lower than those overall. The goal is to identify opportunities to provide better mentoring and advising to disadvantaged and underrepresented students, with the metrics being retention and graduation rates.

WashU is a world-class research university, and we are committed to conducting world-class research within Engineering.

Being world-class means performing research that has impact, both on fellow researchers advancing the state-of-the-art and on practitioners who leverage research to address significant technical and engineering problems.

Our goals must focus on increasing the amount of truly significant research performed by the faculty and students and on enhancing the impact of that work.
Goal 1: Execute strategic-level investments in targeted research areas in which (i) WashU Engineering is likely to become a significant contributor and leader, and (ii) success will have great impact on important societal and/or technical challenges.

As part of the strategic planning process, seven research thrusts were identified as potential investment domains:

i. Quantitative Biology & Pharmacology
ii. Mechanobiology
iii. Imaging Sciences & Technology
iv. Clean Energy Systems
v. Smart Environmental Systems
vi. Nano-scale Engineering
vii. Data Sciences for Humanity

White papers for each of these were developed by the faculty by considering existing strengths and potential large-scale impacts; these proposals include specific road maps to achieve critical mass and research impact on the community. Specific investment categories required for these thrusts are discussed in the remaining goals of this objective.

Goal 2: Invest in growth in the size and stature of the tenured/tenure-track faculty, with a target of 105 faculty in five years and 120 in 10 years.

At 90 tenured/tenure-track faculty members, the size of the faculty is a challenge for both our educational and research goals. The research thrusts listed above each require a critical mass of research talent at the faculty level. Strategic growth means not hiring merely to increase the numbers, but subjecting faculty recruiting to a strategic enablement criteria. Hiring strong mid-career researchers provides visibility and research strength. Additionally, retention is critical to ensure that precious resources invested in faculty growth actually increase the total number and do not merely replace departing faculty.

Goal 3: Develop and support interdisciplinary PhD programs.

The engineering research challenges of the 21st century do not respect departmental boundaries. Interdisciplinary PhD programs provide a strong mechanism to eliminate research silos. Metrics are the number of degree programs created and the number of students within them.

Goal 4: Establish world-class facilities and shared infrastructure to attract leading researchers.

The School already has state-of-the-art facilities for many of the research disciplines — visitors comment often on the quality of the space. We do not, however, have extensive shared instrumentation. Such facilities enable individual PIs to pursue work they could not attempt with only the equipment procured with only their own funding. Similarly, shared computing infrastructure can enable computational analysis and experimentation that are difficult for a single PI to support. Metrics include the inventory and usage of such shared facilities.

Goal 5: Increase the research volume of the faculty overall, and increase the number of large-scale, multi-PI initiatives.

The research volume per FTE at our aspirational peers is significantly higher than our School. And while volume does not guarantee quality, the correlation is unmistakable and unsurprising: with more students and researchers doing more work, the likelihood of significant findings increases. Metric is research volume per faculty, with attention paid to development across all ranks and a specific target of $400K/FTE. A second proposed metric is the number of large-scale proposals emanating from SEAS.

Goal 6: Increased visibility in both scientific and thought leadership communities.

Visibility is often key to great research influencing the world. Traditional methods of dissemination of scholarly work are good measures of quality: appearance in certain journals or conferences and citations of those papers are proven hallmarks of research strength. But visibility requires a concerted effort to connect our researchers with the interests of the world. Metrics include references to our research in important media outlets — e.g. NY Times, Forbes, WSJ, NPR — as well as the number of our faculty sought out by thought-leading journalists as having the expertise in specific domains.
A research university produces two products that impact the research world. The explicit output of our research endeavor is new knowledge — insights and inventions that advance the state-of-the-art. However, a top-tier research university also produces outstanding researchers.

For SEAS to have an impact on the world through our research enterprise, we need to produce the people who will influence the research community of the future, and they must be strong enough that they find their way to the significant research institutions of their fields.

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<th>III.</th>
<th>OBJECTIVE</th>
<th>Develop world-class researchers.</th>
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<td>Goal 1: Increase the number of PhD applications from strong technical institutions and resulting matriculation rate. The quality of the PhD researchers we graduate is impacted greatly by the strength of the PhD students we recruit. After identifying strong engineering and science undergraduate institutions (including WashU), we need to increase the PhD applicant pool from these schools. Metrics include application numbers and matriculation rates, tracked by department.</td>
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<td>Goal 2: Provide nontechnical training and support to complement the research development of PhDs. For our PhD students to develop into and be viewed as significant researchers, they need to communicate well and learn skills beyond their technical domain. Quantitative metrics include the number of successful placements into high-quality research positions. Qualitative metrics include reports from faculty colleagues regarding the strength of presentation and communication of our PhD graduates.</td>
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<td>Goal 3: Produce more professors from our PhD and postdoctoral students. University research is recognized not only for the technical results produced but also for the researchers that the School develops. A key element is the number of PhD and postdoctoral students who go on to become professors, and in particular professors at significant research universities. Metrics are the number of graduated PhD and postdoctoral students who take academic positions and the number at highly ranked universities.</td>
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<td>Goal 4: Achieve a greater balance between domestic and international PhDs. We have been explicitly developing international visibility through a variety of universitywide initiatives. But less attention has been paid to enhancing our domestic presence. Proposed metrics include the number of domestic PhD applications (visibility and attractiveness of WashU), acceptance rate (student quality), and yield (WashU competitiveness).</td>
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Objective
Develop world-class researchers.

Goal 5: Develop a research population whose demographics more closely reflects those of society.

World-class researchers are present in every sector of society. We must seek participants from all backgrounds, cultures, races and gender to find the best such talent. Whether at the PhD, postdoctoral or faculty level, the pursuit of a diverse research population is a critical goal. Metrics must include both number of applicants (reflecting outreach) and successful recruitments.

Goal 6: Develop all faculty regardless of rank.

It is understood that beginning assistant professors need guidance in both executing a successful research agenda and navigating the academic environment at WashU. But all faculty can benefit from effective mentoring to improve their research, increase their impact, and enhance their stature. Metrics here are the extent of implementation and persistence of the mentoring programs for faculty of all ranks.

Objective
Through research and education, create a positive impact on the local community, the country, and the world.

As a leading university, WashU’s mission includes the imperative to have a positive impact on society. Within Engineering, we support student-centric efforts focused on expanding awareness of societal challenges and on promoting engagement with our community.

As a School, we have specific opportunities to dramatically impact society at every level, from creating employment opportunity, to advancing economic development to mitigating environmental impact and global inequities. This objective focuses the School on being an agent of change to achieve broad societal benefits.
Goal 1: Create a more diverse set of graduates and facilitate their growth into impactful positions across the country.

One of the ongoing challenges within our community and our country is diminishing upward mobility, especially among minority populations. Producing more highly skilled engineering graduates from diverse backgrounds and helping them secure high-quality positions impacts the community and country in profound ways. Metrics include the number of underrepresented minority graduates and indicators of their career success.

Goal 2: Emphasize the importance of the workforce development mission of SEAS.

The United States faces a potential crisis in the looming shortage of engineering talent needed to drive the economy. As an engineering school, our mission includes workforce development, the impact of which will be felt at both local and national levels. While faculty can focus on knowledge creation and technical education, the School must also consider our broader contributions to the workforce. Metrics include the number of professional master’s degrees and graduate certificates offered by the Sever Institute, as well as the number of academic graduates who, upon graduation, practice engineering.

Goal 3: Increase the number of faculty and students engaged in entrepreneurial activities.

WashU as an institution has embraced an entrepreneurial agenda. The Skandalaris Center, Cortex, and new makerspaces are all investments in nurturing innovation tied to entrepreneurial opportunity. Engineering should leverage this investment by establishing practices that encourage faculty and students to exploit such opportunities. The desired outcomes are more SEAS-incubated startups and more students who leave WashU with entrepreneurial aspirations. Metrics include the percentage of students who have at least one entrepreneurial experience while at WashU and the number of faculty who pursue such activities.

Goal 4: Increase the number of patents pursued, issued and licensed.

State-of-the-art engineering in the 21st century is a blend of discovery and invention, and it is the invention (or innovation) component that can produce intellectual property of value and impact. But to do so requires a culture of innovation and development to coexist alongside the aspiration for great science. The numbers of patents sought, issued and licensed are measures of the vitality of that culture and of the extent to which it considers economically significant problems of the day.

Goal 5: Increase the extent of industrial engagement both in research and in the placement of our undergraduate and graduate students.

A world-class engineering school produces both people and knowledge that influence the practice of engineering in the world. Our ideas must influence the thinking of industry, and our graduates must become deeply embedded across the industrial spectrum of the country, especially in the most innovative engineering and technology companies. Metrics include sponsored research agreements and breadth of key companies that recruit our graduates.

Goal 6: Create greater visibility in the international engineering academic community.

Any significant engineering school has a reputation beyond its country’s borders. This reputation is critical to attracting graduate students — the majority of our graduate student body is international — as well as faculty. The School should target key institutions and countries to promote our brand of academic excellence and industrial relevance. Metrics are tied to both PhD recruiting numbers and international public recognition.
Objective
Promote an environment where all faculty and staff are encouraged, empowered, and incentivized to pursue excellence.

Goal 1: Develop a coherent mission and vision for non-tenure-track, full-time faculty.
As a small Engineering School that seeks to offer a broad portfolio of degree programs, Engineering relies on non-TT faculty (NTTF) for a significant amount of teaching and curriculum delivery. These faculty need to be integrated into the departments and School as first-class citizens. The first step is an unambiguous statement of their roles, responsibilities, and privileges within the School. Metrics are subjective but include job satisfaction and clarity of role for NTTF.

Goal 2: Improve the voice of the staff and teaching faculty.
Our goal is to establish a variety of channels for staff and NTTF to communicate with School leadership to express concerns and to surface issues that affect them.

Goal 3: Ensure career development plans for all staff.
The School provides an unusual work environment for staff in that many staff report to faculty whose responsibilities do not typically include staff development. The work environment for staff in Engineering should provide clear paths for career advancement. We need to establish an HR structure that ensures all staff have effective career-development plans. Metrics include staff satisfaction reports and progression of staff.

Goal 4: Ensure that the value of all faculty and staff is both explicitly and implicitly recognized.
There are many mechanisms by which someone feels valued — or not. Being explicitly recognized shows that the administration values an employee’s contribution. Being denied the same benefits afforded others sends the opposite message. We need to ensure our practices are designed to explicitly demonstrate to all employees that they are valued. Not all positions have equal reward, but all employees are entitled to feel valued. Metrics include self-assessment of job satisfaction.
Goal 5: Establish diversity in all forms, including race, gender, religion, age, sexual orientation, and politics as an asset.

Diversity of the leadership, the faculty body, and the student body are explicit goals of the university. Such goals must permeate throughout the organization. By embracing diversity, all members of the School know that they are equal partners in our aspirations, that the School does not tolerate bias or abuse, and believe that diversity is a strength that enables it to address a variety of challenges with a broader perspective.

Financial stability of the School is essential if we are to pursue aggressively the objectives listed above. Without a secure base of tuition, research funding, and philanthropy, the School may become overly focused on revenue-generating activities and fail to invest in the important goals necessary to achieve our core objectives.

Financial resilience is a different objective than those listed above, because it is a means to an end rather than an explicit statement of our mission and values, but it is critical to our efforts.
Goal 1: Continued growth of size and quality of academic master’s programs.

Unlike undergraduate tuition, tuition from master’s programs directly supports the School. Ensuring those programs are strong and stable is critical to the financial health of the School. Metrics include the number of robust programs, the business value of each program, and the satisfaction of the master’s students with the content and logistics of their programs.

Goal 2: Develop structured business models for Sever Institute offerings.

The Sever Institute is the Professional Development arm of Engineering and is vital to the financial health of the School. Its offerings of master’s degrees, graduate course certifications, and short courses need to be academically strong, industrially relevant, and financially sustainable. Each program needs a business model that considers customer demand and availability, recruiting strategies, and modes of content delivery. Metrics are the number of programs with well-articulated models and the extent to which the programs are being executed in accordance with their proposed models.

Goal 3: Establish robust, multi-faceted relationships with key companies.

As articulated in several of the objectives and goals above, deep relationships with industry are essential to advance the overall research and education missions of the School. In addition, strategic partnerships with particular companies can significantly strengthen the financial stability of the School. Companies can provide recurring overall support for departments, research funding for faculty, career development investment for graduating students and scholarships for students. The metrics are the total level of industrial financial support and the amount that is recurring.
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