

2009-2014

# Purdue Engineering Strategic Plan

*Extraordinary People, Global Impact*



## Transforming the 21<sup>st</sup> Century University

*"We must serve as a hub for global innovation and global collaboration. We have the opportunity as never before to link business enterprises to a worldwide network of strategic partners and to ensure our students have global credentials."*

*Purdue President France A. Córdova*

### **Conditions for Change**

In 1945, the federal government issued *Science: The Endless Frontier*, a report authored by Vannevar Bush that redefined the role of universities and transformed scientific research. Today, leaders of the U.S. National Academy of Engineering, believe that we are in the midst of another defining moment.

*"Growing global competition and the subsequent restructuring of industry, the shift from defense to civilian work, the use of new materials and biological processes, and the explosion of information technology - both as part of the process of engineering and as part of its product - have dramatically and irreversibly changed how engineers work.*

*"Every engineering project...occurs in a holistic, noisy, messy social environment."*

*William A. Wulf, president emeritus of the National Academy of Engineering*

*"Engineering education is undergoing a revolution that will take how engineers learn and work from the world of the 20th century to the limits of the 21st century and all that this new kaleidoscopic, interdependent, global world demands.*

*"The research university of the 21st century can and must be a great force for enlightenment, for integration, and for prosperity. The research university of the 21st century should not flourish only in one nation, or on one continent, or in one region. It should grow and spread its good works in all regions and on behalf of all people."*

*Charles M. Vest, president of the National Academy of Engineering*



### ***Inspiration for Change***

Today there are major forces driving change in engineering. The profession is becoming more global every day. This changes how we think about research collaborations and opportunities, it changes the nature of our research and our engagement, it changes who our students are, and it changes the experiences our students will need in order to compete and thrive in the global profession.

A second dramatic change that has already affected engineering is in the growth of interdisciplinary research. The greatest strides in engineering, and in other fields, are happening at the boundaries, where disciplines meet. Sensors and simulation, nano-materials and electronics, energy and environment, and healthcare and engineering are just a few examples.

A third challenge is the phenomenal rate of technological change. The doubling of technology knowledge every five years or less has profound implications for curriculum, continuous learning, and collaboration.

Students entering the world of engineering have distinct interests and concerns that reflect their experience. They are focused on environment and sustainability, alternative energy sources, intelligent systems, integrated media, and virtual reality. Whether they are studying in Europe or Asia, North or South America, Africa or beyond, all want to make a difference. Our challenge is to live up to their expectations; to create the educational experiences that will allow them to make the difference they care so passionately about. This will be the hallmark of the great global universities.

Purdue Engineering is uniquely positioned to rise to world preeminence, drive research agendas which respond to the challenges and opportunities of the 21st century, and shape engineers who will impact the global engineering profession and society.

We invite you to join us on this amazing voyage into a new world.

With warm regards,

Leah H. Jamieson

*The John A. Edwardson Dean of Engineering*



## Societal Impact – Global Reach

***“Global universities can bring knowledge and new ideas to address the issues and challenges of a connected yet disconnected world. They can also facilitate dialogue and respect across diverse civilizations and cultures.”***

*SHIH Choon Fong, president of the National University of Singapore*

### ***Discovering Our Future; Celebrating Our Past***

This strategic plan envisions a future beyond its six years and builds on a platform of excellence, which was made stronger than ever in our most recent past by investing in a wellspring of talented faculty and new facilities. It is the product of two years of conversation with faculty, students, and staff as well as input from our key stakeholders worldwide: parents; alumni and friends; and academic, corporate, and governmental partners. The details of the plan reflect our commitment to each other and all the people who support us. It honors the noble pursuits of discovery and learning and sets us on a path to reach our aspiration of international preeminence, not just for the college, but for our people and our programs.

When we ***Think Impact***, we recognize our obligation to serve society. Through our endeavors and achievements in discovery and learning, we engage students and colleagues, neighbors and neighboring Hoosiers, fellow Americans and fellow citizens of the world. Engagement weaves through the plan as a cohesive and compelling context for all that we do. Another source of strength and pride, our worldwide network of alumni, partners, friends, and colleagues is loyal and passionate. They share our desire to make a difference.

Our heritage as a land grant university is to teach agricultural, military and mechanical arts, the fundamental values reflected in the bold vision of Vermont Senator Justin Smith Morrill, whose legislation in 1862, laid the foundation for Purdue and established Engineering as its strongest anchor. *“This bill proposes to establish at least one college in every State upon a sure and perpetual foundation, accessible to all, but especially to the sons of toil, where all of needful science for the practical avocations of life shall be taught,”* he wrote.

Morrill changed higher education in the 19<sup>th</sup> century. Vannevar Bush redefined the role of higher education in the 20<sup>th</sup> century. Now, in the 21<sup>st</sup> century, Morrill’s definition of *“science for the practical avocations of life”* and Bush’s role of the modern research university are transforming again. Universities today are challenged to change or founder as our world becomes increasingly interconnected and interdependent. Purdue can deliver on this challenge.

From these solid foundations, we are poised to reach our ultimate goal to benefit humanity by graduating engineer leaders and innovating in research.

In short, we believe ***Extraordinary People*** pursuing shared passions in a spirit of mutual benefit will make ***Global Impact***.



**Vision:**

***We will be known for our impact on the world.***

By empowering our faculty, staff and students to excel, engage, and make a difference, our Purdue Engineering Graduates and Research will impact the well-being and prosperity of Humanity with compassion and concern for the sustainability of our Planet and beyond.

Our impact will be recognized through measurable human and economic benefit at home and abroad, the esteem of our peers and stakeholders, the generosity of our alumni and friends, and the demand for our graduates, expertise, and discoveries.

**Mission:**

***To advance engineering learning, discovery, and engagement in fulfillment of the Land Grant promise and the evolving responsibility of a global university.***

**Leadership Values:**

***Relevance and Impact, Creativity and Vision,  
Excellence and Commitment, Leadership and Action,  
Respect and Community, Collaboration and Connection,  
Concern for Humanity and Ethical World Citizenship***

Our power is in our people. While we embrace all of the characteristics of good citizenship and collegueship, we are emphasizing these attributes as ideals that will help us shape our future as one of the world's most distinguished Colleges of Engineering.



## Seizing Opportunities

*“As a society transforms, the education system must respond to change. It is only then that it will be relevant.”*

*Pratibha Devisingh Patil, President of India*

### Goal 1: Graduates Effective in a Global Context

***Purdue Engineers will be prepared for leadership roles in responding to the global, technological, economic, and societal challenges of the 21<sup>st</sup> century.***

***Our graduates will be ready to make a difference at home and around the globe by***

- a) adding value and innovation to engineering projects and collaborations,
- b) identifying and addressing significant problems and opportunities,
- c) learning and broadening professionally and as global citizens throughout life,
- d) engaging with critical stakeholders, high performance teams, and knowledge networks,
- e) celebrating diversity and respecting differences in ideas, people and cultures
- f) leading from a global perspective and commitment to a sustainable future

### Goal 2: Research of Global Significance

***We will focus our talent and facilities on research with great potential for expanding the boundaries of science and technology and addressing the global challenges and opportunities of the 21<sup>st</sup> century.***

***Our research will serve society by***

- a) translating what is known across disciplines to innovate effective and sustainable solutions to local and global societal challenges,
- b) discovering breakthrough science and disruptive technologies that change paradigms and create technology revolutions,
- c) engaging critical stakeholders to help appropriately identify and solve problems of concern to society and to anticipate and respond to opportunities presented in the dynamic global market,
- d) stimulating creativity and high performance through knowledge networks and flexible, vibrant, risk-tolerant environments
- e) leading from a global perspective and commitment to a sustainable future

### **Goal 3: Empowering Our People; Enriching Our Culture**

***Together, WE – Faculty, Staff, and Students – will make the environment in which we work, create, and study, the best in the world for the creative intellect we already have and the talent that will join us.***

***Our Faculty, Students and Staff will serve, create, and learn by***

- a) continually learning and improving
- b) acting on opportunities and taking creative risks
- c) engaging with critical stakeholders and knowledge networks
- d) creating a mutually supportive and inclusive community
- e) adding value to teams, committees, projects, and relationships
- f) recognizing and responding to the needs and concerns of guests, peers, students, and colleagues
- g) leading from a global perspective and commitment to a sustainable future

## Strategy 1: Developing “Virtuoso” Faculty Talent

***We will transform engineering education and produce transformative research by embodying the attributes identified for 21<sup>st</sup> Century global leadership and success as a Purdue Engineering professional.***

### **Strategy Elements:**

- a) *Provide opportunities to develop Purdue Faculty of 2020 so the knowledge, abilities, and qualities identified in the Purdue Engineer of 2020 strategy will be internalized and modeled by our teachers and researchers and integrated into curriculum and research development.*
- b) *Cultivate faculty ability to recognize and tune their research strategy to a changing environment, nurturing their creative talents, and honing their skills for identifying and managing creative and intellectual risks in a process and environment that is safe and career enhancing.*
- c) *Recruit faculty who demonstrate the leadership qualities deemed necessary for a 21<sup>st</sup> century engineer with particular emphasis on creativity, adaptability and the ability to effectively communicate and collaborate across disciplines, institutions, and cultures.*
- d) *Provide progressive leadership development for faculty to prepare them to envision and lead large-scale, high-impact research programs, assume high-profile, prestigious advisory and administrative appointments, and excel as teachers, mentors, and role models.*
- e) *Evolve Promotion and Tenure.*  
*Aspects identified by faculty include a) aligning the review process to evaluate effectively contributions beyond traditional boundaries, e.g., home department or discipline; international projects or partners, b) redefining scholarly contribution and how it is demonstrated, c) recognizing accomplishments in high-impact, non-traditional activities, e.g., exploration and creation of new fields, invention and commercialization of intellectual property.*  
*Aspects identified by students and staff a) recognizing teaching excellence described as motivating, inspiring, and passionate and b) commitment and contributions to the overall well-being of the college and the university beyond the traditional faculty committees and service obligations.*

### **Attributes of the PURDUE ENGINEER OF 2020**

#### **ABILITIES:**

- **Leadership**
- **Teamwork**
- **Communication**
- **Decision-making**
- **Recognize and manage change**
- **Work effectively in diverse and multicultural environments**
- **Work effectively in the global engineering profession**
- **Synthesize engineering, business and societal perspectives**

#### **KNOWLEDGE AREAS:**

- **Science and math**
- **Engineering fundamentals**
- **Analytical skills**
- **Open-ended design and problem solving skills**
- **Multidisciplinarity within and beyond engineering**
- **Integration of analytical, problem solving and design skills**

#### **QUALITIES:**

- **Innovative**
- **Strong work ethic**
- **Ethically responsible in a global, social, intellectual and technological context**
- **Adaptable in a changing environment**
- **Entrepreneurial and intrapreneurial**
- **Curious and persistent continuous learners**

**Strategy 2: Giving Our Students the “Wings” to Succeed**

***We will provide students a winning atmosphere, safe learning environment, and easy access to services that address the “holistic” needs of the student and help them thrive from start to finish as they pursue their dreams.***

***Strategy Elements:***

- a) Develop quality metrics used to select incoming students so that these indicators are in tune with faculty expectations of ability, drive and potential for success and ensure excellence, access and inclusiveness within the student body.*
- b) Create new pathways and tailored messages to excite and equip the brightest young scholars, in particular, women and underrepresented minorities, to see engineering as a way to make a difference, pursue it as a career, and choose Purdue as their college of choice.*
- c) Recruit where our students of interest study, assemble, and live in ways that can be sustained over time for maximum visibility and success by leveraging our networks, tracking and cultivating prospects, and personalizing our communications.*
- d) Provide safe avenues for students to express concerns about the classroom or campus environment, develop mechanisms to quickly respond to issues and concerns voiced in these forums, and incorporate the student voice into on-going assessments of the quality of the learning environment and student experiences.*
- e) Integrate and coordinate student-oriented services and communications to improve overall student success as well as the quality and appropriateness of service delivery, student access to services, efficiency of time and effort to get what they need when it is needed, and the quality of their interactions with faculty and staff.*
- f) Develop instructional and support strategies for classes where students are most vulnerable to early failures and loss of confidence and which form the foundation for future learning.*
- g) Develop a funding strategy that creates competitive advantage, economic access, and access to the caliber and diversity of the students we want to become Purdue Engineers and that increases cost effectiveness and removes cost of education as a barrier to entry and long-term success.*

**Strategy 3: Inspiring Leadership, Realizing Dreams, Achieving Success**

***Together, we will create a climate where every person is treated with respect, empowered to succeed, and contributes to raising the visibility and reputation of the college and a Purdue Engineering degree. In short, we will make Purdue the place we choose to be even when we have opportunities to go elsewhere.***

**Strategy Elements:**

- a) *Emphasize in administrator, faculty, and staff hiring leadership that supports a respectful and inclusive environment, personal responsibility and accountability to address issues and improve service to faculty, staff, students, and guests, and willingness to listen, learn and improve.*
- b) *Support grass-roots efforts to establish knowledge communities and communities of practice by faculty, staff and students who want to interact with and learn from others who share common interests.*
- c) *Integrate multicultural and diversity representation, training and topics into faculty, staff, student, and administrator recruitment, orientations, campus organizations and committees, speakers, partnerships, courses, etc.*
- d) *Improve channels and opportunities for sharing information with the college community and for inviting open dialogue on issues of community concern.*
- e) *Develop ombuds program so students, staff and faculty have a safe way to share highly sensitive issues and concerns with a person who is empowered to help them*
- f) *Improve overall performance assessment and leadership development planning which includes 360° style review process college-wide so clerical, service, professional and grad staff, as well as faculty and administrators can provide feedback up and down the hierarchy.*
- g) *Offer staff leadership development opportunities and design and implement a staff advancement scheme for classifications not covered by other programs.*
- h) *Develop a funding strategy that creates competitive hiring advantage and access to top quality, diverse talent across all faculty, staff, and graduate student staff classifications and which recognizes significant impact on Purdue's international stature of engineering pre-eminence in higher education.*

**Strategy 4: Educating “Renaissance” Engineers for the 21<sup>st</sup> Century World**

***We will provide learning experiences that develop the knowledge, abilities, and qualities necessary for 21st century engineering students to graduate with a Global perspective, commitment to continuous personal improvement, and readiness to translate their education and experiences to success as global professionals and as citizens of our world.***

***Strategy Elements:***

- a) Redefine the boundaries of what we consider the College of Engineering to include P-12 students and lifelong learners, to create a continuum of learning that has no borders.*
- b) Integrate Purdue Engineer of 2020 attributes into engineering curricula, student experiences, and learning outcomes. Strengthen and recognize how these attributes are acquired and demonstrated through student organizations and other co-curricular activities.*
- c) Develop students’ creativity and ability to apply it to decision and design processes and include opportunities for students to learn how to identify and manage creative and intellectual risk in a safe learning environment.*
- d) Create international cooperative work experiences and internships and pre-graduation work opportunities for international students. Strengthen the connection of learning to career aspirations through engagement of practicing engineers and engineer leaders in industry, academia, government and non-traditional career paths.*
- e) Offer a variety of avenues for students to engage with leaders and communities locally and globally to apply their knowledge and abilities to improve society in ways that are ethical and environmentally sensitive.*
- f) Design multi-mode delivery of educational content to accommodate the broad range of student preparation, learning styles, and readiness to advance and reconfigure the learning infrastructure to complement redesigned curricula and new ways of teaching and learning. Increase flexibility for students to personalize their education and experiences.*
- g) Examine undergraduate learning experiences, particularly the first and second years, to identify opportunities to innovate new teaching strategies, develop teacher/mentor role models, and close gaps between student readiness to advance and faculty expectations for performance.*
- h) Create a “Professional” masters for engineering-trained executives or rising professionals who need advanced technical and management education.*
- i) Evaluate doctoral learning outcomes to identify ways to incorporate experiences that will make them ready to enter the academic workforce as teachers, mentors and research leaders.*
- j) Innovate hybrid approaches to earning an engineering doctorate and new ways to document scholarly progress at the Qualifying Exam stage and/or to demonstrate scholarly contribution as an alternative to the traditional dissertation.*

**Strategy 5: Leveraging Research Prowess for Maximum Impact**

***We will respond to the complex demands of society for humanitarian and economic progress by leveraging the great strength of our expertise, facilities, and international networks to mobilize powerful teams to tackle the enormous challenges and opportunities that face the world today.***

**Strategy Elements:**

- a) *Build a vibrant research community with diverse groups of faculty, research staff and doctoral students by continuing to grow our research enterprise both in size and scope , re-evaluating signature area foci with an eye on reconfiguring for improved effectiveness, and tailoring support according to short- and long-term potential for impact.*
- b) *Develop research strategies to tackle mega-scale problems that leverage Disciplinary, College, and Campus expertise and facilities and convey compelling impact visions which will attract collaborators, donors, and sponsors so the efforts can be sustained over very long spans of time and connected across diverse teams and geographies.*
- c) *Identify and provide support structures and resources needed to build and sustain large scope, international teams that take advantage of our research strengths and address issues of the type cited by National Academy of Engineering in its 21<sup>st</sup> Century Grand Challenge themes and the United Nations' Millennium Goals.*
- d) *Expand our portfolio of partners to include with our traditional partners – industry, academia, and government – and non-traditional partners such as communities, pre-university education, non-governmental organizations, not-for-profits, and international faculty and business to improve problem identification and solution and long-term sustainability of effort and impact.*
- e) *Evolve research faculty guidelines so this important resource can significantly expand the capabilities and productivity of these large-scale research groups and sustain stable employment through the peaks and valleys of research funding.*

**ENGINEERING SIGNATURE AREAS**

- ***Advanced Materials and Manufacturing***
- ***Energy***
- ***Global Sustainable Industrial Systems***
- ***Healthcare Engineering***
- ***Information, Communications and Perception Technologies***
- ***Intelligent Infrastructure Systems***
- ***Nanotechnologies and Nanophotonics***
- ***System of Systems***
- ***Tissue and Cellular Engineering***

**DISCOVERY PARK CENTERS**

- ***Bindley Bioscience Center***
- ***Birk Nanotechnology Center***
- ***Burton Morgan Entrepreneurship Center***
- ***Center for Advanced Manufacturing***
- ***Center for the Environment***
- ***Cyber Center***
- ***Discovery Learning Center***
- ***E-Enterprise Center***
- ***Energy Center***
- ***Oncological Sciences Center***
- ***Regenstrief Center for Healthcare Engineering***

**Strategy 5 – CONTINUED**

- f) Offer a portfolio of opportunities and resources for research faculty, staff, and students to engage with gifted research innovators and inventors, science and engineering thought leaders, expert communities, and visionary leaders who translate technology implications to business, policy, funding agencies, media and society to develop research leadership and vision, and expand access to a rich network of leaders and role models.
- g) Expand opportunities for undergraduate students to participate in exciting research teams and create research experiences for first year engineering students.

**National Academy of Engineering  
21<sup>st</sup> CENTURY CHALLENGES**
**Alternative Energy**

- Make Solar Energy Economical
- Provide Energy from Fusion

**The Environment**

- Develop Carbon Sequestration Methods
- Manage the Nitrogen Cycle
- Provide Access to Clean Water

**Health**

- Engineer Better Medicines
- Advance Health Informatics

**Security**

- Secure Cyberspace
- Prevent Nuclear Terror
- Restore and Improve Urban Infrastructure

**Learning/Computation**

- Reverse Engineer the Brain
- Enhance Virtual Reality
- Advance Personalized Learning
- Engineer the Tools of Scientific Discovery

**United Nations  
MILLENNIUM GOALS**

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empower women
- Reduce child mortality
- Improve maternal health
- Combat HIV/AIDS, malaria, and other diseases
- Ensure environmental sustainability
- Develop a global partnership for development

**Strategy 6: Taking Risks, Fueling Innovation**

***We will fuel invention, breakthrough discoveries, and innovations across our three mission areas by creating an environment that stimulates curiosity, fosters risk-taking, and provides intellectual space and freedom to explore and evolve ideas to see where they will lead.***

**Strategy Elements:**

- a) *Create a “Skunkworks” / “Gordon Conference” type environment that stimulates free-thinking for faculty, staff, and students to generate and pursue novel and/or risky ideas for new research threads, for designing new curriculum, learning experiences and integrative technologies, for creating new physical and virtual learning environments, for exploring different disciplines for potential research synergies, for inventing new products, processes or systems, and for shaping new engagement opportunities.*
- b) *Develop a “think tank” atmosphere where ethical, political, sociological, environmental and other implications of technology development and deployment can be explored in healthy, open debates and which can help faculty and students develop skills to increase their involvement in national and international science and technology agenda setting and their interest in transdisciplinary collaboration.*
- c) *Organize a community of 21<sup>st</sup> Century “Renaissance” scholars who represent a wide spectrum of knowledge from across the university, who are creative and who possess the power and leadership to integrate diverse knowledge and give them time and resources to develop programs and projects so they can demonstrate these abilities and coach select students who are imaginative, innovative, curious, versatile, and take initiative.*
- d) *Tailor research support, resources, administrative processes and policies, and performance expectations to recognize evolution of research across the continuum from idea seeding to large-scale programs. Leverage expertise and facilities at the Purdue Research Park and the network of alumni venture capitalists and entrepreneurs to increase commercialization of intellectual property and high-tech start-ups.*

**Strategy 7: Creating a “Web” of Resources and Connections**

***We will provide access to education, research, and expertise by using technology to share tools and information, and provide access to courses, degrees, and expertise.***

***Strategy Elements:***

- a) *Leverage the Network for Computational Nanotechnology’s NanoHUB model and expertise for “dynamic, communally-constructed” (Vest, 2006) content to mobilize the computing horsepower and networks, visualization, massive data storage, and integrated systems necessary to create the leading networked cyber-infrastructure (CI) in the world which is openly accessible and easily adapted to serve any discipline across the three missions of learning, discovery and engagement.*
- b) *Create an Open Courseware (OCW) initiative in nanotechnology to create THE major educational presence in this area worldwide and leverage this initiative to define and launch a broader cyber-enabled education strategy that identifies the research issues, develops new models for learning, and explores simulation-based education and learning through experiences in virtual environments.*
- c) *Embed cyber-infrastructure (CI) into research activities to increase competitiveness for future large scale calls for proposals and to show how CI enhances the quality and impact of any research endeavor. Develop other virtual research environments to share computational tools, advanced technical concepts, and expert networks, and to expand into educational delivery modes for open access to these same tools, concepts, and networks.*
- d) *Explore new audiences for on-line and distance delivery of science and engineering education content such as high schools needing access to Advanced Placement science courses or course content, pre-university teachers needing advanced certifications or wanting to learn how to incorporate engineering principles into their curriculum, engineering students who are away from campus for coops, internships, research, or international study, faculty who wish to learn about new science and engineering developments or transdisciplinary concepts, executives who manage technical staffs or technology based companies, and political and government science and technology advisors.*
- e) *Integrate new delivery and access modes into the on-line and distance education environment such as instructional games, CI and OCW, and explore new instructional models such as instructors from corporate, academic and governmental partner organizations, research faculty who need to bridge funding gaps, and hiring geographically distributed instructional talent for on-line course support and/or distance delivery of course content.*
- f) *Examine IT infrastructure and support to create a cyber-technology team and to develop a strategy for exploiting the power of the web, increasing access and visibility of on-line resources, developing advanced technologies and user interfaces to meet the growing need to communicate and manage relationships and information across disciplines, cultures, languages, geographies, time and time zones.*

**Strategy 8: Making a Difference in the World**

***We will engage students, faculty, staff, and a range of partners to learn about and address the complex, systemic problems that challenge global citizens.***

***Strategy Elements:***

- a) Develop integrated research and learning teams that incorporate principles of service learning, multidiscipline/multifunction talent, scientific inquiry, engineering design, social science implications, complex partnerships and local activism to translate knowledge and technology solutions to problems in underprivileged and developing areas of the nation and world.*
- b) Expand Engineering Projects in Community Service (EPICS) to include more global partners and projects and incorporate EPICs style practices and procedures into the complex global design teams noted above so project transfer as teams migrate and transform is smooth and progress is sustained over time.*
- c) Leverage the significant cadre of faculty and professionals throughout the Engineering disciplines and Signature Areas and across campus in other colleges and Discovery Park where Purdue's wealth of expertise spans the broad areas affecting the developing world such as Water, Health, Food, Energy, Environment, and Education, where recent investment in facilities creates unparalleled capabilities to support large scale distributed teams, and whose networks of influence span the globe.*
- d) Emphasize the interdependence of disciplines, technologies, economies, cultures, and environment by exposing teams to a range of expertise and engaging in dialogue on a broad range of topics that affect their process, decisions, and outcomes.*
- e) Improve student and faculty mobility and technology-enhanced communications and networking, and provide multi-mode access to tools, cultural resources, shared team resources and information, etc. so language, geography and time zone differences can be effectively bridged making global teams more effective and productive.*
- f) Capitalize on the rich network of alumni and industry partners to establish and nurture new relationships with local governments, schools, communities, etc. and create mechanisms to track and maintain important relationship and local information.*

## Creating 21<sup>st</sup> Century Impact

*"Never doubt that a small group of thoughtful committed people can change the world; indeed it's the only thing that ever has."*

*Margaret Mead*

### ***Catalyst for Change***

Our plan will lead the way as we transform engineering education and research to meet the needs of the innovation economy of the 21st century.

The Purdue Engineering strategic plan is bold and assertive, committing us to lead in engineering education; deepen our research capabilities and grow creative discovery; inspire action and innovation by our faculty, staff, students, and alumni; and focus on quality and flexibility while managing change. It cannot be done alone, but must be done in collaboration with others across our university and with our academic, institutional, industrial, and government partners; our state legislators and citizenry; and our friends worldwide.

We will succeed, because our culture embraces creativity, innovation, and risk taking, and because our people, our greatest asset, lead with passion, energy and vision.

We will know we have reached our goals, because we will all – faculty, staff, and students – thrive in an environment that values diversity, a global perspective, and limitless ideas borne of the richness of multiple viewpoints.

The world will benefit from the contributions of our people who are engaged, concerned global citizens driven to make a difference.

Today we are launching the revolution. We hope you will share in the adventure.



## Plan Execution

The execution plan will turn dreams and ideals to actions and aspirations for impact and preeminence to reality. To this end, the college has identified ten Key Strategy Areas and Engineering Leadership Team members to serve as Strategy Area Champions. The Strategic Actions under each Key Strategy Area will be defined and driven by Stakeholder Teams under the leadership of Team Captains.

The Champions are accountable to the Dean of Engineering and serve the Stakeholder Teams by managing the resources allocated for team support, addressing organizational hurdles as they are identified, providing relevant data and administrative support, and reporting to and interfacing with the Engineering Leadership Team on progress, proposals, and concerns. The Champions will organize and facilitate the Steering Committee for their respective Key Strategy Areas. The Steering Committees will be comprised of representatives from the Engineering Advisory Council and the Stakeholder Team Captains for each underlying Strategic Action.

Team Captains will be faculty and/or staff members from the College. Team composition will include faculty, staff and students as well as other stakeholders from inside or outside Purdue including alumni, parents, faculty and/or students from other Purdue colleges or other Universities, and industry and government representatives. All Captains and Team members will be selected based on their passion for the initiative and commitment to advancing the strategic plan.

Teams will define the initiative purpose, identify the objectives, milestones, timelines, and resource implications (people, money, space), and recommend specific success measures and targets. Additionally, teams will research and evaluate the competitive/collaborative environment, capture insights from non-traditional activities and audiences, recommend ways we can achieve efficiencies and/or reduce or eliminate lower value activities so we can increase or add high value efforts, and identify creative avenues to accomplish our goals and differentiate Purdue as the leader in each of the initiatives and key investment areas. Finally, each member will be responsible for identifying other internal and external stakeholders who are most likely to share their passion and contribute effort and/or resources to the initiative.

### Key Strategy Areas

#### I. **Faculty of 2020**

**Steering Committee** - ELT Champions (*Bernie Engel, Klod Kokini*); EAC members (*Esin Gulari*); Team Captains for Actions below

Strategic Actions:

- a. Alignment of professional development with the ideals of the Purdue Engineer of 2020 and the evolving scope of the college (*Team Captains: Suresh Garimella, Jim Litster, Karl Smith*)
- b. Alignment of criteria and processes for hiring and Promotion & Tenure with the evolving scope of the college and its Leadership Values (*Team Captains: Kathleen Howell, Tim Sands*)

**II. The Research Enterprise**

**Steering Committee** - ELT Champions (Ragu Balakrishnan, Joe Pekny, Arvind Varma); EAC members (Rita Colwell, Sigmar Wittig); Team Captains for Actions below

Strategic Actions:

- a. Alignment of people, resources, and processes to double research (over six years) and meet the unique needs of the lifecycle stages of an evolving and expanding research program (Team Captains: Joerg Appenzeller, Monika Ivantysynova)
- b. Address Global Challenges and establish System of Systems Institute (Team Captains: Doug Adams, Srinivas Peeta, Yuehwern Yih)

Initial focal areas include

- i. Health Systems (Focal Leaders: Charlie Bouman, Rex Reklaitis)
- ii. Space Systems (Focal Leaders: Bill Crossley, Dan DeLaurentis)
- iii. Energy Systems (Focal Leaders: Jay Gore, Joe Pekny)

**III. Students of 2020**

**Steering Committee** - ELT Champions (Audeen Fentiman, Dale Harris, Mike Harris); EAC members (Gary Gabriele, Chris Privon); Team Captains for Actions below

Strategic Actions:

- a. The Purdue Engineer of 2020 Curriculum (Team Captains: Diane Beaudoin, Peter Meckl)
- b. Defining the role of Engineering in pre-university education (Team Captains: Bill Oakes, Johannes Strobel)
- c. Professional Masters (Team Captains: R.S. Govindaraju, Dale Harris)
- d. Hybrid PhD (Team Captains: Monica Cox, Hong Tan)

**IV. Learning Environment**

**Steering Committee** - ELT Champions (Kathy Banks, Teri Reed-Rhoads); EAC members (Jane Daniels, Deb Grubbe); Team Captains for Actions below

Strategic Actions:

- a. Alignment of recruiting metrics and student support services with evolving scope of the college and ideals of the Purdue Engineer of 2020 (Team Captains: Virginia Booth-Gleghorn, Elliott Slamovich)
- b. Developing Effective and Passionate Teachers (Team Captains: Steve Beaudoin, Phil Wankat)

**V. Development of a Leadership Culture**

**Steering Committee** - ELT Champions (Keith Bowman, Vince Bralts, Matt Ohland); EAC members (Kathy Kilmer, Sarah Rajala); Team Captains for Actions below

Strategic Actions:

- a. Progressive Faculty Leadership Development (Team Captains: Jayathi Murthy, Marika Santagata)
- b. Connect student leadership development with the Purdue Engineer of 2020 curriculum (Team Captains: Jean Paul Allain, Beth Holloway)
- c. Alignment of Staff hiring, professional and leadership development, and career advancement with the evolving scope of the college and its Leadership Values (Team Captains: Dan Leaird, Deanna McMillan)
- d. 360° Review and Ombuds Program (Team Captains: Linda Davis, John Sullivan)
- e. Diversity Recruiting, Retention, and Partnership Development (Team Captains: Dulcy Abraham, David Bowker)

**VI. Creativity and Risk Taking**

**Steering Committee** - ELT Champions (Jim Cooper, Inez Hua, George Wodicka); EAC members (Emily Liggett); Team Captains for Actions below

Strategic Actions:

- a. Skunkworks, Innovation Institute (Team Captains: Barrett Caldwell, Joe Sinfield)
- b. Creativity Development (Team Captains: Carol Handwerker, Karthik Ramani)
- c. Technology Ethics, Global Impact, and Policy Think Tank (Team Captains: David Radcliffe, Kumares Sinha, C.T. Sun)

**VII. Virtual Reach**

**Steering Committee** - ELT Champions (David Carmichael, Riwitti Roy, Tom Shih); EAC members (Sandy Postel); Team Captains for Actions below

Strategic Actions:

- a. HUBzero development (Team Captains: Ashlie Martini, Alejandro Strachan)
- b. Engineering Professional Education satellite facilities and program innovation (Team Captains: Chuck Krousgrill, Richard Liu)
- c. Creating a powerful web presence (Team Captains: Brian Brinegar, David Ebert)
- d. IT integration and evolution (Team Captains: Ed Delp, Sundeep Rao)

**VIII. Global Portfolio**

**Steering Committee** - ELT Champions (Melba Crawford, Rabi Mohtar, John Sutherland); EAC members (Juan Ernesto de Bedout, Joe Schoendorf); Team Captains for Actions below

Strategic Actions:

- a. International student experience including service learning (EPICS), COOP/Internships, undergraduate research (SURF), Global Design, and Global Minor (Team Captains: Bill Anderson, George Chiu, Eckhard Groll, Dimitrios Peroulis)
- b. Global Engagement (Team Captains: Shimon Nof, Arvind Raman)
- c. International Faculty Exchanges and Internships (Team Captains: Kaushik Roy, Gudrun Schmidt)
- d. International visibility and partnerships (Team Captains: Tim Fisher, Kinam Park)

**IX. Long Range Resource Planning**

**Steering Committee** - ELT Champions (Ahmed Hassanein, Chris Martin, Amy Noah); EAC members (Harold Force, Chris Maziar); Team Captains for Actions below

Strategic Actions: (Team Captains: Robert Frosch - Finance, Patricia Davies - Facilities, Andy Weiner - Staffing)

- a. Financial modeling
- b. Facilities development
- c. Staffing

**X. Assessing and Achieving**

**Steering Committee** - ELT Champions (Mark Hastak, Dan Hirleman); EAC members (Gary Cummings, Kirk Law); Team Captains for Actions below

Strategic Actions:

- a. Engaging and empowering faculty, staff, students, alumni, industry, and other critical stakeholders (Team Co-captains: J. Allebach)
- b. Inviting external review teams to assess our performance in research and teaching (Team Co-captains: M. Ladisch, D. Ramkrishna)
- c. Setting bold goals for internal and external measures of success (Team Captains: Jerry Woodall)

### Measuring Impact *(metrics under development)*

We will measure ourselves against the top performers in the US and internationally to understand how we stack up and how we differentiate.

	Discovery Indicators	Learning Indicators	Engagement Indicators	Diversity Indicators	Resource Indicators	Alignment Indicators
Societal Impact	Demand indicator e.g. citations per faculty; citations per paper?	Demand indicator e.g. growth in apps, rise in yield %; increase in % of entering students who indicated PU was first choice?	Demand indicator??	Rankings by diversity serving publications: Hispanic Business Sept 2008 = 2 Target: 1	Growth in endowment	
Impact of Graduates	Increase in % PhD graduates hired as faculty and post docs	Distribution trends of graduates among job types and industry types/sizes	US News Employer Reputation Ranking Mar 2008 = 7 (4.3) Target: Top 1 Top Performers: MIT (4.8) Stanford (4.7) Berkeley (4.6) CalTech (4.6)	Demographic trend of graduates by discipline/program vs national	# gifts >\$10M Increase in % alumni donors	
Research Impact	Rank US News Graduate Pgm Aug 2008 Overall = 15 Target: Top 5 Top Performers: MIT Stanford Berkeley Rank Academic Analytics Faculty Productivity 2007 Overall = <25 Target: Top 15 Top Performers: UC San Francisco CalTech UNC Chapel Hill 2 areas = Top 10 Electrical Eng. (10) Computational Science & Eng. (6) Target: All Areas in Top 10	Growth in U-G research participants PhD grads/faculty	Shanghai Jiao Tong Oct 2008 = 17 Target: Top 10 Top Performers: MIT Stanford UIUC Increase in Intellectual Property licenses, patents, or commercialization	Growth in diversity serving institutional research partners	Rank of NSF Engineering research expenditures	Rank Peer Reputation US News Graduate Program Mar 2008 = 11 (4.1) Target: 5 (4.6) Top Performers: MIT (4.9) Stanford (4.8) Berkeley (4.8) CalTech (4.7) Growth in number of large scale centers & institutes (>\$25M)
Global Reach	Growth in Intl research projects	Growth in student and faculty participants	Growth in international partners and partnerships	Demographic trend of student and faculty participants	Growth in giving for Intl activities Growth in % of Intl alumni donors	World University Eng./Tech. Rankings: Times of London Higher Education Oct 2008 = 33 Target: Top 15 Top Performers: MIT (1) Cambridge (5) Tokyo (9) Toronto (10) Nat'l Univ. Singapore (11) Tsinghua (12) ETH Zurich (13) Growth in Intl Research Awards

**Measuring Impact CONTINUED**

	Discovery Indicators	Learning Indicators	Engagement Indicators	Diversity Indicators	Resource Indicators	Alignment Indicators
Academic Reach		Rank US News U-G Aug 2008 Overall = 9 Target: Top 5 Top Performers: MIT Stanford Berkeley 3 areas = Top 5 AAE (4) ABE (5) IE (3) Target: All Areas Top 5 Top Performers: MIT (9 areas) Berkeley (9 areas) UIUC (7 areas) GaTech (6 areas)		Demographic trend of pre- and post-university participants		
Virtual Reach	Growth in usage statistics of virtual research tools	Growth in usage statistics of virtual educational tools	Growth in number of HUBs	Demographic trend of EPE students and HUB users		
Multidiscipline & Multicultural Richness			Growth in number of diversity serving partners	Demographic trends of faculty, staff, students by discipline/program vs national		
Creative Richness						Improvement in Creativity Index as measured by baseline and biennial surveys
Quality of Life	Improvement in Overall Climate Quality & Work Experience by faculty group as measured by baseline and biennial surveys	Improvement in Climate Quality and Learning Experience as measured by baseline and biennial surveys	Improvement in Overall Partner Experience as measured by baseline and biennial surveys	Improvement in Overall Climate Quality by demographic group as measured by baseline and biennial surveys	Top 10 percentile of Big Ten Plus faculty and ASEE grad staff compensation	Improvement in: Inspired Leadership; Unique Culture; Focus on Growing Talent; Strong Sense of Accountability; Aligned HR Practices & Excellent Execution by fac, staff, stu

## **Resourcing the Plan**

### ***Advancement***

Private fundraising is our most flexible source of new investment. We anticipate raising funds in the following categories.

- Access and Success Campaign
- Creativity and Discovery
- Leadership Development
- Innovative Learning Environments
- Global Initiatives
- Other

### ***Sponsored Programs***

Both the University and the College have set goals of doubling research expenditures over the next six years, which suggests an annual growth rate of ~15% per year for the College.

### ***Reallocation***

To support the strategies outlined in this plan we will reallocate 2% of General Funds and align our discretionary expenditures to support our highest priorities.

### ***Cost Management***

As a Land Grant institution supported by the State of Indiana, we recognize our obligation to the state's citizens to provide affordable education and stewardship of the funds entrusted to us for this purpose. The College will search for implementable cost efficiency measures in all its operations, including improvements to policies and procedures, provision of required services, and cost effective improvements to infrastructure. These efforts will be on-going; performed in a culture of continuous improvement.

### ***State Assistance***

With the assistance of the university's Office of Government Relations, we will develop a long range plan for state assistance that supports our key investment areas and continued implementation of our facilities plan and development of our evolving degree and research programs.

### ***University Leverage***

We will work with the University to share investment in and fund development for supporting common goals and strategies.

### ***Generated Fees***

We will continue to look for ways to generate new revenues to develop sustainability for new initiatives. Currently, the Engineering Professional Education Program is the only such cost center.

## **The Engineering Leadership Team**

Chaired by the dean, the Engineering Leadership Team membership includes all school and division heads, the dean's cabinet, directors of the Global Engineering Program and the Engineering Professional Education Program, and the chairs of the dean's Faculty Advisory Committee and the Junior Faculty council.

### **Current Membership**

#### **Leah H. Jamieson**

*Leadership Team Chair, John A. Edwardson Dean of Engineering, Ransburg Distinguished Professor of Electrical and Computer Engineering*

#### **Venkataramanan Balakrishnan**

*Associate Dean of Engineering for Research, Interim Head and Professor of Electrical and Computer Engineering*

#### **M. Katherine Banks**

*Bowen Engineering Head of Civil Engineering, Professor of Civil Engineering*

#### **Keith Bowman**

*Head and Professor of Materials Engineering*

#### **Vincent Bralts**

*Associate Dean of Engineering for Resource Planning and Management, Professor of Agricultural and Biological Engineering*

#### **David Carmichael**

*Director of Information Technology*

#### **James Cooper**

*Chair of the Dean's Faculty Advisory Committee, Jai N. Gupta Professor of Electrical and Computer Engineering*

#### **Melba Crawford**

*Interim Associate Dean of Engineering for Research; Director Laboratory for Applications of Remote Sensing; Professor of Agronomy, Civil, and Electrical and Computer Engineering, Chair of Excellence in Earth Observation*

#### **Bernard Engel**

*Head and Professor of Agricultural and Biological Engineering*

#### **Audeen Fentiman**

*Associate Dean of Engineering for Graduate Education and Interdisciplinary Programs, Professor of Nuclear Engineering*

#### **Nancy Hannibal**

*Liaison to Purdue Marketing and Media, Assistant Vice President for Strategic Marketing and Research*

#### **Dale Harris**

*Executive Director of Engineering Professional Education, Professor of Engineering Education*

#### **Michael Harris**

*Associate Dean of Engineering for Undergraduate Education, Professor of Chemical Engineering*

#### **Makarand Hastak**

*Head of Construction Engineering and Management, Professor of Civil Engineering*

#### **E. Daniel Hirleman**

*William E. and Florence E. Perry Head of Mechanical Engineering, Professor of Mechanical Engineering*



**Klod Kokini**

*Associate Dean of Engineering for Academic Affairs, Professor of Mechanical Engineering*

**Christopher Martin**

*Director of Financial Affairs*

**Rabi Mohtar**

*Director of Global Engineering Programs, Professor of Agricultural and Biological Engineering*

**Amy Noah**

*Director of Engineering Advancement*

**Matthew Ohland**

*Chair of the Junior Faculty Council, Associate Professor of Engineering Education*

**Joseph Pekny**

*Interim Head of Industrial Engineering, Director of E-Enterprise Center, Professor of Chemical Engineering*

**Carolyn Percifield**

*Director of Strategic Planning and Assessment*

**David Radcliffe**

*Interim Head of Engineering Education, Epistemology Professor of Engineering Education*

**Teri Reed-Rhoads**

*Assistant Dean of Engineering for Undergraduate Education, Associate Professor of Engineering Education*

**Thomas Shih**

*Head and Professor of Aeronautics and Astronautics*

**John Sutherland**

*Head of Ecological and Environmental Engineering, Professor of Mechanical Engineering*

**Arvind Varma**

*Head and R. Games Slayter Distinguished Professor of Chemical Engineering*

**Sharon Whitlock**

*Administrative Director*

**George Wodicka**

*Head of Weldon School of Biomedical Engineering, Professor of Biomedical Engineering and Electrical and Computer Engineering*

## The Engineering Advisory Council

Chaired by a member appointed by the dean, the Engineering Advisory Council is comprised of executives from around the world and represents all types of enterprise including industry, government, not-for profits, and academia. Its purpose is to advise the dean and the Engineering Leadership Team on all matters of concern to the College.

### **Current Membership**

#### **Juan Ernesto de Bedout**

*Advisory Council Chair, President of Kimberly Clark Latin American Operations*

#### **Rita Colwell**

???

#### **Gary Cummings**

*Engineering Director, General Motors (Retired)*

#### **Jane Zimmer Daniels**

*Program Director of the Clare Booth Luce Fund, Luce Foundation*

#### **Ahmed Demyati**

*Undergraduate Student representative, Bachelors candidate in Electrical and Computer Engineering*

#### **Gary Gabriele**

*Dean of Engineering, Villanova University*

#### **Dana Gary**

*Graduate Student representative, PhD Candidate in Chemical Engineering*

#### **Deborah Grubbe**

???

#### **Esin Gulari**

*Dean of Engineering and Science, Clemson University*

#### **Kathleen Howell**

*Hsu Lo Professor of Aeronautical & Astronautical Engineering*

#### **Kirk Law**

*Vice President, System Products engineering Netapp, Inc.*

#### **Emily Liggett**

*Chief Executive Officer, Apexon, Inc.*

#### **Christine Maziar**

*Vice President and Associate Provost, University of Notre Dame*

#### **Sandra Postel**

*Vice President and General Manager, Boeing Production Strategy (Retired)*

#### **Chris Privon**

*Vice President and General Manager, Hewlett-Packard Americas (Retired)*

#### **Arvind Raman**

*Junior Faculty representative, Associate Professor of Mechanical Engineering*

#### **Joseph Schoendorf**

*Executive Partner, Accel Partners*

#### **Sigmar Wittig**

*Chariman, Executive Board of the German Aerospace Center, Chairman of the European Space Agency Council*

#### **William Wulf**

*President Emeritus, National Academy of Engineering, AT&T Professor of Engineering and University Professor, Department of Computer Science, University of Virginia*



## Planning Process

### ***Philosophy: Convert Growth to Impact***

- Long horizon: 10-20 year vision, 5-year action
- Global scope
- High touch and inclusive process
- Leverage strengths in education and faculty expertise to set bold goals
- Convert previous plan investment in research, faculty and facilities to extraordinary impact

### ***Process highlights: Global Engagement of Stakeholders***

We began thinking about our future and exploring issues of the present in October 2006, shortly after Leah Jamieson became dean. These earliest conversations spanning the 2006-07 academic year were with the Engineering Leadership Team, the Engineering Advisory Council, and key stakeholder groups in the college as well as deans from the other Purdue Colleges and programs. More than 230 individuals participated in these dialogues

Augmenting these meetings was extensive on-line research and travel to Latin America, Europe, Africa and Asia as well as other parts of the U.S. and conversations with students and leaders in more than 25 countries. Visits to private high schools, International universities, alumni gatherings, corporations, and professional meetings and workshops involved more than 600 students, faculty, staff, corporate and academic leaders, planning experts, and alumni in conversations.

### ***Key Themes and Insights:***

In Academic Year 2007-08 time was spent brainstorming ideas in potential opportunity areas with the Engineering Leadership Team, interviewing our own faculty and staff, and meeting with focused groups of faculty, staff and students. Approximately 100 individual interviews were conducted and 28 meetings with the faculties of each of our schools as well as representative staff and student groups (involving ~300 individuals) to more deeply explore the themes that were emerging.

In addition to these themes we gained intriguing insights as to how faculty saw themselves and/or colleagues positioned to make a difference and students' view of this century's top challenges.

However, everyone, everywhere agreed that **INNOVATION** is critical to being competitive in the future. The new age has been referred to variously as the **knowledge economy**, the **innovation economy** and the **creative economy**. To add value through innovation was considered the single most valuable skill for individuals, organizations and countries.

*Office of Engineering Strategic Planning and Assessment*

