

**Purdue University strengthens interdisciplinary efforts**

# Building on Collaboration



**Purdue University's acclaimed engineering** and technology schools have been hard at work doing what they do best: reimagining, enhancing and expanding. The focus: a new initiative to transform engineering and technology research and education. The initiative also will foster synergistic collaborations between engineering and technology disciplines to prepare students for employment environments where engineers and technology graduates must regularly work together.

Purdue is able to pursue this initiative thanks in part to a \$40 million Lilly Endowment grant. The largest cash gift to the university since its founding in 1869, the grant is designed to help Purdue complete a list of projects crucial to plans for transforming its engineering and technology schools. In doing so, Purdue wants to create a model 21st century program that better prepares students for a competitive workforce and creates a powerful engine to drive the Indiana and national economies.

At issue is the need for engineering and technology graduates who are innovative problem solvers. They must have exceptional skills in collaboration and communication and the ability to tackle the most pressing global problems in a vast array of fields, among them sustainable energy, environmental security, biosciences and infrastructure.

"This will make a difference, both in the number of graduates and in their quality," says Purdue President Mitch Daniels. "More students, better prepared – and more important research with global impact."

The initiative's interdisciplinary and collaborative features appealed to the Endowment because of the success of Purdue's Discovery Park, a multidisciplinary learning complex of 18 core research centers and institutes where faculty and students use interdisciplinary approaches to tackle a variety of global challenges. A \$25.6 million Endowment grant helped Purdue launch the park in 2001, which began with six diverse centers focused on life sciences, nanotechnology, cyber research, advanced manufacturing, public policy and



**Projects funded by the grant:**

- **The Maurice J. Zucrow Laboratories: \$5 million toward a significant expansion of the university's propulsion lab, including five new cells for the testing of jet, rocket and turbine engines**
- **The Flex Lab: \$13.5 million toward construction of 60,000 square feet of new laboratory space equipped and configured to accommodate research in an array of disciplines and to encourage collaboration**
- **The Bechtel Innovation Design Center: \$13 million toward construction of a facility to support the development, creation and testing of student projects**
- **Professional development at the Purdue Polytechnic Institute: \$3.5 million to help faculty members create carefully planned, project-oriented courses**
- **The Wilmeth Active Learning Center: \$5 million toward completion of an innovative new facility that will combine library, classroom and study spaces to encourage learning in both new and traditional ways**

entrepreneurship. In 2004, a second Endowment grant of \$25 million helped grow the park as it attracted new researchers, strengthened its internship program and continued to build collaboration across disciplines, including energy, oncology, engineering and systems management. Since its beginning, Discovery Park has generated more than \$1.15 billion in research support from government and private sector funding sources. More than 1,000 faculty researchers work in the park each year, and it has assisted in establishing more than 100 new companies. More than 1,250 disclosures, patents, licenses and options on intellectual property have been facilitated at the park, and more than 5,000 students have participated in the park's Certificate in Entrepreneurship & Innovation Program.

The Endowment's \$40 million grant is helping Purdue, which is the only university in the Big Ten conference that has both a college of engineering and a college of technology, further this interdisciplinary approach in these fields.

The Endowment's participation, Daniels said, has been the decisive ingredient necessary to push forward each project on the list.

Purdue's drive to evolve carries with it a sense of urgency. It stems, in part, from a 2012 finding by President Barack Obama's Council on Jobs and Competitiveness that U.S. universities must graduate 10,000 more engineers annually for the nation to stay competitive in the world economy. That year, Purdue committed to expanding its engineering faculty by a third among other steps to help meet the goal. In 2015, Purdue joined 121 U.S. colleges and universities with engineering programs to pursue the goal as part of the National Academy of Engineering's Grand Challenge initiative.

"Here at Purdue, with the Endowment's help, we will supply 5 to 7 percent of that challenge all by ourselves," Daniels says.

And it will do so while educating students in innovative ways that hone crucial workplace skills and emphasize hands-on experience.

**Poised for takeoff at the Zucrow labs**

Case in point: the Zucrow labs, inaugurated in 1946 near the Purdue airport to develop jet and rocket engines. For nearly seven decades, Zucrow has created one of the nation's most respected programs for developing and testing propulsion systems, even though the newest of its six buildings dates to 1965.

The Endowment grant, said Scott Meyer, managing director of Zucrow,



Construction projects are transforming spaces where students work collaboratively (opposite). Updated labs and other work spaces will benefit students and support innovation (below).





That, Frosch adds, will create the potential for research breakthroughs that can propel Indiana's economy into the future.

### **A center for student creativity**

Purdue's commitment to prepare graduates who will strengthen Indiana companies extends to the Bechtel Innovation Design Center, as well. The new building, which will be centrally located and open around-the-clock, is being designed to help students plan and build projects arising either from class assignments or extracurricular activities, regardless of academic discipline.

The \$18.5 million Bechtel Center is named for Stephen D. Bechtel, Jr., a Purdue alum who co-owns Bechtel Corp., a global construction and engineering firm based in

San Francisco. The center's design is intended to pique curiosity and encourage students to mix and share ideas. That starts with large windows, Frosch says. "So, if you're walking outside, on the sidewalk, you might see things that can draw you into the facility and say, 'Hey, I want to be part of this.'"

The center will have multiple levels of resources: an atrium where teams will meet; a manufacturing lab packed with equipment and work stations; design areas on a second floor; and assembly and storage areas for long-term projects on a lower level. Its most intriguing feature may simply be gathering a critical mass of student creativity in one spot, where teams will work side-by-side on solar cars, electronics or other projects.

### **Guides by the side**

Intriguing things certainly are happening in the classroom of Patrick Connolly and Esteban Garcia Bravo. Connolly, a professor and department head, and Garcia Bravo, an assistant professor, both work in the Department of Computer Graphics Technology. Together, they teach a large, freshman-level class called Fundamentals of Computer Graphics and Foundations of Digital Imaging.

In years past, the course has been taught as two separate classes, heavy on traditional lectures and tests – what Connolly refers to as "the sage-on-the-stage" model. Today, that has been flipped, with most of the lectures recorded and posted online for students to view on their own. Then, class sessions include hands-on work, with instructors circulating among the students to coach, ask questions and provide feedback – a "guide-by-the-side" model.

"With this approach we saw a great opportunity to ask the students, 'Why don't we learn computer graphics by doing computer graphics?'" says Garcia Bravo.





Center will combine Purdue's six science and engineering libraries into one building designed with a mix of classrooms and study and traditional library spaces. Designers gleaned ideas from visits to several libraries, including those at Duke and North Carolina State universities, and Purdue's own experience as the IMPACT teaching program has gained traction.

### Reaching around the globe

As significant as they believe the efforts supported by the Endowment's grant will be for students, Purdue officials also want to be sure these efforts are noted for the impact they will have on the Indiana and national economies.

One international company that routinely recruits Purdue graduates is Rolls-Royce Corp., which has a large Indianapolis facility for designing, testing and building aviation engines. Phil Burkholder, president of Rolls-Royce Defense Aerospace North America, noted that Rolls-Royce has hired more than 300 Purdue grads since 2003 and finds them "exceptionally well-prepared for the workplace." Rolls-Royce has announced plans to house a research and development team in a new

The ever-changing demands of global companies, including those with a strong Indiana presence, mean that Purdue must continue to adapt. The transition to project-based teaching and toward a more integrated approach to research and innovation must reach students so that they can make a difference at Purdue, across Indiana and beyond.

"This is exactly the kind of experience we would be looking for – hands-on problem solving, along with excellent communications skills and demonstrated team work," Burkholder says. "Young engineers with that skill set would make great future Rolls-Royce employees."

What a handsome return on investment that would be indeed, for the university, the state and beyond.



44,000-square-foot facility in Purdue's new aerospace district, which includes the Zucrow labs. In the facility, the company will develop and test jet engines, work with Purdue researchers and create a pipeline for Purdue graduates to employment opportunities at the company.



The Neil Armstrong Hall of Engineering is a cornerstone of Purdue University's efforts to remain at the forefront of engineering research and education.