The Sky’s the Limit

Is an end to the air-traffic bottleneck in sight?

Clarity, Focus, and Execution
Creating a sustainability culture

The 2008 Outstanding Industrial Engineers

A Passion for People
Desire to aid students fuels future professor
On My Mind

Welcome to Industrial Engineering Impact. In this and future issues, we look forward to bringing you news about the people and many activities of our school.

The fast-paced dynamics of globalization and rapid advances in technology are creating tremendous challenges and opportunities in the many complex systems that make up our society. These challenges demand constant improvement and new solutions at the local, national, and global level. Industrial engineers must provide leadership to make a difference. Purdue Industrial Engineering is striving to do its part.

In the pages that follow, we examine the work of Professor Steve Landry, a former military pilot who focuses on air-traffic management and control. His research is aimed at improving the air-traffic system, which is currently relying on technology developed in the 1960s and 1970s. Advances could result in fewer delays, increased safety, better aircraft fuel economy, and such innovations as unmanned aerial vehicles.

We are also proud to profile our 2008 Outstanding Industrial Engineers, Ed Schreck and Rick Echevarria. Both men serve on IE’s Advisory Council, with Ed Schreck as chair. We are very grateful for their service and their leadership.

We hope you enjoy this inaugural issue of Industrial Engineering Impact.

Joseph Pekny
Interim head of Industrial Engineering, director of E-Enterprise Center, professor of Chemical Engineering
Faculty News

Chunghorng Richard Liu, professor of industrial engineering, received the 2008 William T. Ennor Manufacturing Technology Award from the American Society of Mechanical Engineering’s Manufacturing Engineering Division and Alcoa. Liu is recognized for his research on the integrity and fatigue performance of finish machined surfaces, which, the sponsors said, led to significant economic, reliability, and safety benefits for load-carrying components made of hardened steels.

Shimon Y. Nof, professor of industrial engineering, co-edited a special issue of Computers and Industrial Engineering: An International Journal on collaborative e-work networks in industrial engineering. The special issue was organized by the PRISM Center (Production, Robotics and Integration Software for Manufacturing and Management). The issue, which was co-edited by Wootae Jeong (PhD 2006) of the Korean Research Institute for Railroad Transportation, will be published later this year. Of the 12 articles in the publication, five are co-authored by Purdue IE faculty (Seokcheon Lee, Mark R. Lehto, and Nof) and former students (Sundar Kumara, Jose A. Ceroni, Chin-Yin Huang, Pilsung Choe, and Jeong); one was co-authored by a former visiting scholar at the PRISM Center (Namkyu Park).

Professor Gavriel Salvendy retired in fall 2008 from an academic career in industrial engineering that spanned more than 40 years. Salvendy, who joined Purdue’s IE faculty in 1971 and is a member of the National Academy of Engineering, received the American Publishers Association Award for Best Book in Engineering in 1982. He became chair professor and founding head of the Department of Industrial Engineering at Tsinghua University in Beijing, China, in 2001. He has authored more than 450 publications, including 30 books and 250 journal papers, and served as the founding editor of two scientific journals. Salvendy has endowed the triennial “Gavriel Salvendy International Symposium on Frontiers in Industrial Engineering,” which will focus on strategic directions and leadership in the frontiers of Industrial Engineering. The first symposium will take place in 2010.

Industrial Engineering welcomed two new faculty members in fall 2008.

Nelson Uhan joined the operations research area. He holds a PhD in research from Massachusetts Institute of Technology and an SM and AB in applied mathematics from Harvard University. Uhan’s research interests are mathematical programming and combinatorial optimization and their applications to problems in a variety of areas, including scheduling, game theory, logistics, transportation, and network design.

Ji Soo Yi joined the human factors area. He has a PhD from the School of Industrial and Systems Engineering at the Georgia Institute of Technology and a BS from Seoul National University. Yi’s research interests are human-computer interaction, information visualization, decision making, mobile computing, and assistive technologies.

Student News

The Industrial Engineering Graduate Student Organization was formed in fall 2008 to enhance scholarly communities within the school, help recruit new graduate students, and mentor students.
The Sky’s the Limit

Is an end to the air-traffic bottleneck in sight?

by Kathy Mayer
If you think air travel is busy now, just wait. More airplanes are coming. So are unmanned aerial vehicles, supersonic business jets, and large transports.

If Steven Landry has his way, transition to next-generation air travel and super-density airports will be smooth, safe, and more automated, and there will be less noise and better air quality in the neighborhood.

It’s a tall order, supported by National Aeronautics and Space Administration (NASA) funding and fellow researchers around the world. And it’s a dream fulfilled for Landry.

“Even from a young age, I always wanted to do the job I’m doing now,” says the native of Medway, Mass., who earned his bachelor’s degree from Massachusetts’ Worcester Polytechnic Institute in 1987.

Next came an eight-year Air Force stint, where he flew more than 2,500 heavy-jet hours. “That was a formative influence,” Landry says. “The training was rigorous. I had a lot of responsibility and was in charge of a crew on an airplane. I learned leadership skills and to work as part of a team.”

Landry then earned his master’s in aeronautics and astronautics at Massachusetts Institute of Technology and a doctorate at Georgia Institute of Technology, concentrating on human-machine systems. He also spent time as a research engineer at NASA’s Ames Research Center in California.

He joined the Purdue faculty in 2005, drawn by what he calls “one of the best human-factors programs in the country” and “the chance for a lot of collaboration.”

Interest: human factors, air transportation systems

With personal and professional goals of making an impact in human factors and air transportation systems engineering, Landry got to work.

“Human factors is a fairly new and open area of research,” he says. “There are still a lot of things we have to learn, so it’s challenging from that perspective. There are a lot of contributions you could make.”

On the transportation side, he likes the possibility for near-term and future implementation of next-generation systems. “When I was at NASA, I helped develop a decision-making tool that has been implemented. Having that kind of impact is very rewarding,” Landry explains.

Landry advises four graduate students, co-advises two others, and teaches. He’s program chair-elect for the Human Factors and Ergonomics Society’s Human Performance Modeling Technical Group and book review editor for the International Journal of Human-Computer Interaction. And he’s working on several NASA-funded projects.

Air-traffic pattern to reduce emissions

“Steve is a creative researcher who has an incisive perspective, because he brings a pilot’s experience,” says Joseph Pekny, interim head of Industrial Engineering. “Because of his unique skills and practical knowledge, Steve is helping provide the intellectual leadership and technology necessary for the next-generation air-traffic system, and he’s engaged with practitioners who will bring it about.”

A major focus for Landry is his role as principal investigator on the Transition to Super Density Operations project. “The idea is that you fly in, drop down a little, fly in, drop down—like a staircase,” Landry explains. “We want planes to fly in pretty far and coast down. It’s so much more efficient.”

He’s working on this with Gary Slater, professor in the Department of Aerospace Engineering and Engineering Mechanics at the University of Cincinnati, and Boeing personnel in Southern California and Spain.

The maneuver under study is called a “continuous descent approach” (CDA), Slater explains. “This maneuver results in major reductions in carbon emissions and noise pollution around the airport. The CDA gives these benefits by way of a rapid descent directly to the runway.”

But it presents another problem, Slater says. “Our research is looking at how to do all this and maintain an orderly and safe traffic flow that the air-traffic controllers are comfortable with.”

continued on next page
Simulations are the next step; they will occur at Boeing’s research facility in Madrid, Spain. Sally Moore, with Human System Integration Technology, Phantom Works at The Boeing Co., says a simulator is being modified to combine aircraft scheduling logic, provided by Landry, with several Boeing airspace simulation tools.

“The combined Purdue/Boeing capabilities will allow testing of environmentally friendly and fuel-saving procedures to identify applicability at busy airports during peak traffic times,” she says.

**Easing air-traffic jams**

In a separate project, Landry is helping find ways to automate some air-traffic-control functions.

“Right now, air-traffic control is a bottleneck,” he says. “An individual controller can handle about 12 planes. NASA, the Federal Aviation Administration, and other government organizations are looking at building a system that would be capable of handling two to three times that.” Landry is analyzing a NASA-developed system that would automate the separation assurance function—keeping planes far enough apart—now managed by air-traffic controllers.

“We’re validating the algorithms through a modeling exercise, using a system safety method to ensure that agents—automated or human—have sufficient control,” he says. “We’ve also developed algorithms to mitigate conflict like controllers do.”

In the human factors area, Landry is a coinvestigator on a project looking at what happens to controllers’ and pilots’ roles and responsibilities, situation awareness, and workload when there is more automation. “We’re running distributed simulations of these,” he says. To conduct the simulations, Purdue is networked with NASA’s Ames Research Center, California State/Long Beach, San Jose State University, and California State/Northridge. “We’ll all be online at the same time,” he says.

Landry is also a coinvestigator on a project examining integration of different types of air transportation vehicles, such as large transports, unmanned vehicles, and supersonic business jets.

**Astronaut next?**

While it’s nearly all work and no play for Landry, he enjoys golf now and then. And he’s “little by little fixing up” his West Lafayette home.

He’s also in the running for what he admits is a long shot. He’s one of 400 on a list under scrutiny for the astronaut program. “I’m still in the mix,” he says. “If I go, it would be a leave from Purdue.”

“Because of his unique skills and practical knowledge, Steve Landry is helping provide the intellectual leadership and technology necessary for the next-generation air-traffic system.”

**JOSEPH PKNY**

**INTERIM HEAD OF INDUSTRIAL ENGINEERING**
Clarity, Focus, and Execution

Creating a sustainability culture

Year 2008 was a time of great volatility. Financial volatility. Oil price and commodity-index volatility. Geo-political volatility. Given such upset, it would be easy for companies to lose focus on their core business operations, financial controls, environmentally green initiatives, and other key areas required for success.

The response to such volatility is sustainability. In addition to working to recover shrinking revenue driven by a down economy and recovering brand erosion caused by a lost focus, businesses will be energized to create a more sustainable business model.

Sustainability comes from having controls in place in key areas of operation that form a buffer against potentially disastrous events. Having spent more than 20 years in the airline industry—an industry characterized by volatility—I have been able to apply many of the principles that engineers bring to the workplace to influence success.

I believe that the goal of “sustainability success” can be achieved by focusing on key areas of strength. The first areas—clarity, focus, and execution—are key to achieving improved results at a faster pace:

▶ **Clarity:** Be clear about what you really want to achieve, both in business and in life.

▶ **Focus:** Avoid distractions and concentrate on high-leverage activities that produce the most significant results.

▶ **Execution:** Use strategic communication to exceed expectations and get faster results.

▶ **Process:** Clearly define processes in all areas of business that work for employees and customers. This includes processes to ensure financial controls, and, in a service industry, processes that ensure consistent delivery for all customer touch points. It is also important to have processes that ensure that environmental goals are achieved. As consumer expectations change, or as manufacturing and technology change, processes must keep pace with the change to remain effective.

▶ **Ownership:** Engage employees at all levels when a process is designed, implemented, executed, or changed. In this component, there must be clear ownership at all levels of hierarchy within the company’s infrastructure. Senior management must be engaged to offer direction, support, and investment; mid-level leaders must be committed to overseeing the day-to-day operations; and front-line leaders, along with employees, are essential to effective delivery.

▶ **Accountability:** Employ simple metrics that are understood by all, communicated frequently, and measured often to ensure that your business is aware of changes caused by external volatility and can adapt and manage appropriately through turbulent times. Customers expect quality products in manufacturing and consistent delivery in service-oriented businesses.

The key is to keep it simple. Volatility breeds complexity. A simple approach to sustainability will ensure a desirable end result. A constant review of the six key areas for effective sustainability, coupled with an intense focus on execution, should lead engineers down a path towards sustainability in their chosen fields.

Mark Mitchell (BSIE ’85) is managing director of Customer Experience for American Airlines.
In October 2007, Rick Echevarria was recognized by *Hispanic Business* as one of the “100 Most Influential Hispanics” for his achievements in the corporate sector. It was a big honor—and Echevarria’s accomplishments are noteworthy—but Echevarria is humble about the notoriety. “I’m sure there are many, many more deserving people around the country,” he says. “I hope they all get recognized over time.”

For the last 14 years, Echevarria has been a rising star at Intel. In his current role, as vice president and general manager for Enterprise Solution Sales, he overseen Intel’s worldwide sales to Global 2000 corporations as well as government, education, and telecommunication companies. He is also responsible for the integration of Intel technology through consultation and project collaboration to over 900 accounts that make up over $4 billion of revenue. He says his IE education gave him not only the knowledge, but also the confidence to do his job. “Knowing that you have learned and graduated from a top engineering school gives you the confidence to tackle any challenge along the way,” he says. “Technology is a great enabler of the optimization of systems. That’s the value we bring to our customers at Intel, and my industrial engineering education is a perfect match for this role.”

After graduating from Purdue, Echevarria worked in Information and Communication Systems at Exxon. He then spent five years at IBM as a software developer. He earned a master’s degree in computer management systems from Union College before joining Intel in 1994. His early years with the company were spent as director of product marketing for Intel’s Communication Products Group and director of internet marketing for the Enterprise Server Group.

Echevarria is a member of IE’s Advisory Council.

As a child growing up in Birmingham, Mich., Ed Schreck was no stranger to Purdue. His mother was a Lafayette native, and both parents were Purdue graduates. His college choice was a natural. As for the area of study, he took his father’s advice—an undergraduate degree in industrial engineering and a master’s degree in business. The advice served Schreck well.

Schreck spent two years in the U.S. Army following Purdue. In 1975, the year he earned an MBA from the University of Michigan, he joined Accenture, which was at that time Arthur Andersen’s consulting division. He never left the company, retiring from it in 2002.

Schreck specialized in technology for the global management consulting, technology services, and outsourcing company, and worked with clients in numerous industries on IT strategy and large-scale technology-enabled business-change programs.

In 1991, Schreck was named managing partner of the Carolinas Consulting Practice and the South U.S. Technology Consulting Organization. Three years later, he became the global managing partner of Technology Competency. In this role, he was Accenture’s top technology consulting leader with responsibility for technology vision, technology research and advanced development, and technology competency/capability development programs.

In August 2000, Schreck became Accenture’s CIO, with responsibility for all of the company’s internal technology capabilities. “My industrial engineering education at Purdue was outstanding,” says Schreck. “I learned many specifics, but, most importantly, I learned how to think logically, define and solve problems, and take a systems perspective. I also developed an interest in learning that continued throughout my career at Accenture.”

Schreck is chair of IE’s Advisory Council.
A Passion for People

Healthcare research and student contact fuel this future professor

One might say that Ashley Benedict is a people person. “I enjoy working with students not only in the classroom, but also helping them realize their goals and aspirations,” says Benedict, an industrial engineering graduate student. “The main reason I came back to school was to obtain a PhD that would allow me to assist college students,” she explains.

Benedict, however, is not waiting for her degree to start making a difference either at Purdue or within her extended community. “When I arrived at Purdue I didn’t want my experience to be one of nothing but a focus on graduate school and research,” she says.

So, over the past two years, Benedict has volunteered in Lafayette as a big sister for Big Brothers Big Sisters. “I find I need to have outlets in order not to burn out as a graduate student, and volunteering is a great way to stay focused and balanced,” she says.

Originally from New Smyrna Beach, Fla., Benedict spent three years as an industrial engineer for a hospital system in Gainesville before moving to West Lafayette. “Purdue had a solid reputation in the field of industrial engineering,” she says, “and I was looking to try something new.”

Purdue proved to have exactly what she was looking for. Benedict enrolled in the IE graduate program in 2006, a year after the College of Engineering added its healthcare engineering signature area to address the urgent need for engineering solutions to problems inherent in the healthcare industry. The new signature area immediately captured her attention as an ideal place to develop a research focus on “how healthcare providers in small, private practices implement healthcare information-technology applications.”

Benedict’s choice to pursue a career in academia stems in part from what she sees as a general lack of awareness today among students of the many opportunities that exist within the healthcare industry. “As an undergraduate, I didn’t even realize there were industrial engineering opportunities in this field,” she says. Benedict hopes that as a professor she will be able to help students become more mindful of how they can combat what she sees as a current healthcare crisis facing the United States.

During fall semester 2008, Benedict added another extracurricular activity to her already busy life when she helped found the Industrial Engineering Graduate Student Organization, a group for which she now serves as president. The new organization, Benedict says, “aims to enhance scholarly communities within the school, help recruit new graduate students, and mentor students from the time they are admitted.” The group is actively looking for sponsors to keep the program available for future IE graduate students. Benedict hopes the organization will grow to become an important resource for students by providing opportunities for professional development and networking.

Benedict was named a 2008 Student Member with Honors by the Human Factors Ergonomics Society. The annual award acknowledges students who have made an outstanding contribution to the human factors/ergonomics discipline.

I came back to school to obtain a PhD that would allow me to assist college students.

—Ashley Benedict
Seemingly the stuff of futuristic gaming, this illustration uses rocket experimentation data from Purdue researchers. The two figures shown in repetition are Delayed Detached Eddy Simulations of combustion instability in an experimental rocket combustor. Guoping Xia, a senior research scientist, and Randy Smith, a graduate student, created the simulations while working with Charles Merkle, the Reilly Professor of Engineering with appointments in aeronautics and astronautics and mechanical engineering. The experiments are conducted by a research group led by William Anderson, an associate professor of aeronautics and astronautics.