Beating the Boom
From Here to There in Record Time

Increased Competition
Globalization and the Aerospace Market

Alumnus in Space
Mark Polansky and the Discovery Mission
On My Mind

When we combine forces toward common pursuits, we take research and discovery into exciting new territory. Consider our relationship with Rolls-Royce, a partnership that underscores the growing impact globalization has on academia and industry. The School of Aeronautics and Astronautics has built a productive association with Rolls-Royce, and our joint University Technology Center provides a valuable outlet for groundbreaking initiatives. In this issue of Engineering Impact we spotlight the center’s mission and leadership, and we also showcase an innovative project that seeks to revolutionize supersonic travel.

Also in this issue, Dennis Mendoros from Euravia Engineering continues our global theme. He shares his views on the challenges facing the aerospace market amid increased consolidation and heightened global competition. We also turn the spotlight on longtime AAE professor Terry Weisshaar, who inspires our students toward personal success, and alumnus Mark Polansky, a NASA astronaut who successfully led the recent Discovery mission.

Once again we thank you for supporting AAE and encourage your feedback.

Thomas N. Farris
Professor and Head
School of Aeronautics and Astronautics
AROUND AAE
Alumni awards and additional news of note.

IN MY VIEW
Dennis Mendoros on globalization and the aerospace market.

COVER
AAE and Rolls-Royce—a stellar international team with ‘supersonic’ aspirations.

UP CLOSE: STUDENTS
A lifelong passion for rocket technology enhances Lloyd Droppers’ education.

UP CLOSE: FACULTY
Terry Weisshaar’s influence extends from Purdue to nations abroad.

UP CLOSE: ALUMNI
Astronaut Mark Polansky turns his dreams into reality.

CAMPAIGN IMPACT
Alumni gift benefits our future home in Armstrong Hall.

DEA Award for Gerstenmaier
William Gerstenmaier (BSAAE ’77) was one of 10 recipients of this year’s Distinguished Engineering Alumni (DEA) Award from the College of Engineering. Gerstenmaier serves NASA as associate administrator for space operations. In presenting him this honor, the college noted his “outstanding accomplishments in a career dedicated to the human exploration of space and international cooperation in space.” His work includes programmatic oversight for the International Space Station, the space shuttle, space communications, and space launch vehicles.

Welcome Aboard
The School of Aeronautics and Astronautics is pleased to introduce Nathan Wight, our new director of development. Wight hails from central Illinois and is a graduate of both Illinois State University and Ball State University. Prior to joining Purdue’s development team, he worked for Delta Sigma Phi Fraternity in Indianapolis. You can reach Nathan at (765) 494-9124 or nwight@purdue.edu.
School Honors Top Alumni

Six alumni recently received our Outstanding Aerospace Engineer Award. Each has demonstrated career excellence in industry, academia, governmental service, or other endeavors reflecting the value of an aerospace engineering degree.

- **Thomas Adamson Jr.** (BSAE ’49), professor emeritus and chairman (retired), Department of Aerospace Engineering, University of Michigan
- **Steven Ehlers** (BSAAE ’77, MSAAE ’78, PhD ’91), vice president of product design and development, Callaway Golf Company
- **Jerry McElwee** (BSES ’68, MSIA ’70), vice president, joint and adjacent programs, The Boeing Company
- **Doris “Dodie” Hurt Powers** (BSATR ’49), owner/president (retired), Shielding Technologies, Inc.
- **Richard Rivir** (BSAE ’60), scientific advisor, U.S. Air Force Research Laboratory, Propulsion Directorate
- **Norman Scurria Jr.** (MSASE ’80), advanced technology development, DRS TAMSCO

People in the News

- Congratulations to AAE faculty members who were among the recipients of this year’s College of Engineering Faculty Excellence Awards. Associate Professor **William Crossley** received the A. A. Potter Award for the most outstanding teacher, while the Leadership Award went to Professor **Anastasios Lyrintzis**.
- Professor **John Sullivan** has been named to the NASA Advisory Council by Michael Griffin, NASA administrator. The council works to provide key advice regarding NASA programs and activities.
- Now anyone can think like a rocket scientist, thanks to a book written by Professor **James Longuski**. The publication, *The Seven Secrets of How to Think Like a Rocket Scientist*, relates the methods rocket scientists use, which people can employ to complete any project.

NASA Leader

**Headlines**

**Boeing Lecture**

NASA’s top administrator, Michael Griffin, discussed the history and importance of aerospace education and research as the keynote speaker of the eighth William E. Boeing Distinguished Lecture at Purdue. The School of Aeronautics and Astronautics sponsored the March 28 talk, “System Engineering and the Two Cultures of Engineering.”

Nominated by President George W. Bush and confirmed by the U.S. Senate, Griffin began his duties as the 11th administrator of NASA in 2005. He leads the NASA team, managing its resources to advance U.S. space exploration.

“It is a great honor for Purdue to have someone of Michael Griffin’s stature come to the campus to talk with our students and faculty,” says Thomas Farris, head of Aeronautics and Astronautics.
Evolution in a Volatile Global Aerospace Market

In the post-9/11 world the aerospace supply chain is evolving to meet the demands of a market characterized by continuing consolidation (mainly in Europe and the United States), increasing competition, and a trend toward globalization.

Re-evaluation of defense budgets and activities (mainly in the U.S.), coupled with a tendency to transfer risk from defense organizations to the private sector, is driving the primes (the original equipment manufacturers—OEMs) to focus on long-term support solutions, ranging from design to maintenance, repair, and overhaul (MRO), and these are mainly underpinned by the retention of intellectual property rights and license agreements. This in turn is forcing the first-tier suppliers to modernize their supply chain and invest in product development and risk sharing. Said activities will compel the second- and third-tier suppliers to bear the brunt of the cost-down pressures by restricting growth, resulting in major reductions in the skilled workforce, which is then difficult to replace.

Leading U.S. and European aerospace companies are seeking new forms of cross-border links in an effort to gain or maintain international market presence. U.S. primes tend to prefer short-term teaming agreements whereas their European colleagues favor acquisitions of strategic U.S. defense companies to allow them access to the U.S. defense expenditure. It is anticipated that the emerging pan-European companies will soon be the same size as the current leading U.S. firms.

At the same time, other nations are now recognizing the importance of a strong aerospace industry and are developing national strategies to build and expand their activities. It is clear that yesterday’s customers are now becoming our prime competitors.

China, for example, has established a wide-ranging aerospace policy that encourages offset agreements aimed at gaining access to new technology and advanced manufacturing methods in a short time. Said policy is enhanced by China’s critical mass, technical ability, low labor cost, and government-backed policy. The results are impressive. China is already a successful contractor for most U.S. and European primes and is investing heavily in technology acquisition and product development. China is also planning the development of its own large aircraft and to expand its activities in space by aiming to land an unmanned vehicle on the moon by 2010.

In addition, the defense companies of some other important non-NATO countries are steadfastly seeking access to the U.S. and European markets through the formation of alternative business relationships based on tactical alliances. Conflict between the up-and-coming global competition and established bilateral agreement partners may be indicative of a potentially greater tension between national security objectives and national interests. Said issues can be addressed by legislating on export control and harmonization agreements in the form of a letter of intent (LOI) or framework agreements. However, this will require a deeper understanding of the industrial, political, and military environments globally, as well as a structured approach by a leading nation or a group of influential countries that share a common interest in establishing international regulations concerning the control of the global aerospace market.

Globalization is here and getting stronger. It is clear that the era of bilateral agreements is over and the time has come to introduce umbrella, program-wide export licenses to deal with the rapidly changing market and protect critical interests, including national security. The U.S.A. and Europe are on the defensive, and now it is vital that new plans are introduced to protect employment, investments, national security, and sensitive defense technology.

Dennis Mendoros, OBE, DL, LAE, is managing director at Euravia Engineering (www.euravia.co.uk).
Purdue and Rolls-Royce take aeronautical research to new heights through their joint University Technology Center.

As globalization transforms the economic playing field, many all-star companies call America home. In fact, *Fortune* magazine’s “Global 500” corporations include 170 from the U.S. Within the top 10, we find six U.S.-based, multinational companies: ExxonMobil (No. 1), Wal-Mart Stores (2), General Motors (5), Chevron (6), Ford Motor (9), and ConocoPhillips (10).

While nationally based enterprises support our economy and advance technology, partnerships with other global leaders also enhance our market. Rolls-Royce—headquartered in the United Kingdom—has built a prominent North American presence. Its partnership with Purdue University, which continues to evolve, facilitates cutting-edge discovery in groundbreaking areas like supersonic business jets.

Just last year *Business 2.0* reported that the number of multinational companies exceeded 60,000. As one of these corporations, Rolls-Royce provides power for land, sea, and air and has tapped countless Purdue graduates for its North American team. When the company launched a joint University Technology Center (UTC) with Purdue in 2003, the West Lafayette-based entity became the first of its kind in the United States.

It remains the only UTC located in the U.S., one of 28 worldwide centers created since 1990 (the majority based within the U.K.). Today Rolls-Royce continues to expand its UTC partnerships, recently adding centers in Germany, Italy, Japan, and South Korea, which places Purdue in fine international company.

Several factors contributed to Purdue’s selection as a UTC site. The university’s top research facilities played a key role in the decision, as did the large number of Purdue graduates living and working near Rolls Royce’s Indianapolis hub. Rolls-Royce Corporation (RRC)—a Rolls-Royce subsidiary located in Indianapolis—serves as a key Purdue partner. This prompted RRC representatives to lobby for a West Lafayette UTC. “[RRC was] able to convince the folks at Derby, England, that it was a good idea,” says Stephen Heister, Purdue’s UTC director and a professor of aeronautics and astronautics. “We owe them a debt of gratitude for carrying the flag forward there to the boardroom and getting those decisions made at a very high level.”

Purdue engineers working in the UTC perform research sponsored by NASA, the U.S. Air Force and Army, other federal agencies, and aerospace companies. The group’s initial activities have been varied, from studying the behavior of jet fuels at the high temperature and pressure required for high-Mach propulsion aircraft, to seeking a new class of jet-engine fuel injectors. continued on page 6
University-corporate partnerships like this—mutually beneficial to all involved—represent a growing trend in the global marketplace. “We’ve been able to build up a number of laboratories and knowledge to contribute in a number of areas to Rolls-Royce and Rolls-Royce products,” Heister says. While the company gains access to Purdue’s faculty expertise, student talent, and state-of-the-art laboratories, for example, it also provides technical oversight and financial support to the UTC, enhancing Purdue’s research and educational goals.

Compared to the corporate world, academia typically operates at a more incremental pace, characterized by high-impact, step-by-step advances. This model works well for Purdue and the UTC. Due to class schedules and other time commitments, students are unable to devote themselves full-time to the center’s work. Professors, too, must balance other time commitments, which makes more extensive projects a good fit. “For us, it’s tremendous in that it gives us some longevity,” Heister says. “We know it’s not just a one-year project. We can think in longer terms, plan, and build up expertise over a number of years.”

**Leavin’ on a ‘Supersonic’ Jet Plane**

While the center boasts an array of initiatives, researchers are devoting considerable energies toward developing propulsion systems for supersonic business jets, which fly faster than the speed of sound. Faced with countless responsibilities, business executives know full well the value of time. And when their work requires cross-country travel to attend meetings, getting from point A to point B can consume an excessive number of hours, hindering productivity.

Yet what if engineers could design jets that significantly reduce the time executives must spend in the air, away from the office? New research under way at Purdue’s UTC aims to do just that, seeking to cut travel time in half. Many companies would be willing to pay for such a service, making this a highly competitive research area. The key is to enable supersonic travel while minimizing the environmental impact of CO₂ emissions and noise.

A cooperative agreement between Rolls-Royce, Gulfstream, and Purdue makes this four-year project possible. Gulfstream manufactures high-end business jets, and all the aircraft types it designs and produces at its U.S. headquarters in Savannah, Georgia, have been powered by Rolls-Royce engines. “To improve on what they have is a big challenge for us,” Heister says of the task at hand. Purdue formally kicked off the project last September following discussions that began a year ago. Nearly 20 people from the university contribute to the work.

“We’re looking at both the front end and the back end of the engine, the inlet system—how it performs, various design tradeoffs, and the nozzle system, what type of nozzle system might one want to use in that sort of application,” Heister explains. This requires an analysis of current design options toward offering fresh alternatives that satisfy the travel needs of larger corporations while also meeting environmental needs. While the group’s work holds great promise for traveling executives, it does pose significant challenges. “Noise is a big issue with these aircraft,” Heister says. Producing engines that generate the desired amount of thrust can cause excessive and bothersome noise. Therefore, Purdue’s engineers seek to mitigate sounds from the jet’s fans and exhaust, plus ways to minimize the sonic boom—which can be quite irritating to the human ear. This will be essential if the aircraft is to be used over populated areas.

“When you’re flying supersonically, you generate a sonic boom that can be heard on the ground,” Heister says. In fact, current FAA regulations stipulate that no aircraft may fly over land supersonically. That’s why commercial supersonic flights to date have occurred predominantly over the ocean. Therefore, the project team aims to design aircraft that produce a low, almost imperceptible boom. “That’s one of the hurdles,” Heister says, but it’s one they’re eager to clear toward improving supersonic business travel.

Certainly, it would be advantageous to fly supersonically from New York to Los Angeles in half the time currently required. Researchers at the Purdue UTC agree, and they stand at the threshold of exciting discoveries poised to take supersonic travel into exciting new territory.
A Team Effort

Research pertaining to business jet propulsion systems requires a team-based effort, drawing on the expertise of several individuals. As team leader, Heister shares his proficiency in propulsion, in addition to atomization/injector modeling and high-Mach propulsion systems.

He’s joined on the project management team by the following principal investigators/task leads:

Tasos Lyrintzis, professor of aeronautics and astronautics
- Expertise in aeroacoustics, computational fluid dynamics

Charles Merkle, Reilly Professor of Engineering
- Expertise in fluid mechanics, propulsion, CFD, combustion

John Sullivan, professor of aeronautics and astronautics; director of the Center for Advanced Manufacturing
- Expertise in aerodynamics, laser instrumentation, luminescent sensors for temperature and pressure measurements

Greg Blaisdell, associate professor of aeronautics and astronautics
- Expertise in computational fluid dynamics, turbulence modeling and simulation

William Crossley, associate professor of aeronautics and astronautics
- Expertise in design methods and optimization

Scott Meyer, senior engineer
- Expertise in propulsion testing, test facility and test article development

Rolls-Royce: A Global View

- Rolls-Royce is a major provider of power systems and services for land, sea, and air.
- The company operates in four global markets: civil aerospace, defense aerospace, marine, and energy.
- Rolls-Royce’s customer base includes 600 airlines, 4,000 corporate and utility aircraft and helicopter operators, 160 armed forces, and 2,000-plus marine customers (including 70 navies). Rolls-Royce has energy customers in 120 countries.
- The company boasts 38,000 employees located across 50 countries. Rolls-Royce North America includes 7,300-plus people at locations throughout the United States and Canada. Worldwide, 8,000 Rolls-Royce employees are engineers or technologists.
- More Rolls-Royce engines are built in the United States than anywhere else in the world.

Source: www.rolls-royce.com

At work in the High Pressure Lab propulsion facility (from left): grad student Loren Crook, Professor Stephen Heister, Professor Paul Sojka from Mechanical Engineering, and grad student Robert Rachedi. Inset: a supercritical fuel jet exhausting into a high pressure/temperature nitrogen atmosphere.
Building a hybrid rocket will lend itself to developing a small satellite launch vehicle. The rocket at left was built by Lloyd Droppers and other Purdue students.
A Taste of the World

Terry Weisshaar enjoys a life and career spiced with international flavors.

A grandmother from Lithuania; guest lectures in Japan, Korea, and Russia; and evenings at home with graduate students from around the globe have all given Terrence “Terry” Weisshaar a taste of the world he calls “a gift that keeps on giving.”

“It’s absolutely important,” the aeronautics and astronautics professor says of international relations and ties. “The best way to influence people is to meet them, enjoy them, and be nice to them.” It’s almost a lifelong passion, yielding collaborators and friends in many countries.

Born in St. Louis, Missouri, Weisshaar grew up in Illinois and Iowa. While his father’s military flying career sparked some interest in aviation, the Russians’ 1957 Sputnik launch had the greatest impact. “That, more than anything, influenced me,” he says. “And I also liked science and astronomy.”

Pursuing higher education was a message he heard young. When he started kindergarten, he recalls his mother saying, “This is the first day of your school life, and then you will go to college.” His grandmother, who came to the U.S. from Lithuania and sewed tennis shoes for 10 cents an hour during the Depression, reinforced that. “She’d always say, ‘You need education.’”

Weisshaar made them proud. He earned his mechanical engineering bachelor’s with highest distinction at Northwestern University, then a master’s in aeronautics and astronautics at Massachusetts Institute of Technology, and his PhD from Stanford University.

He spent a decade serving in posts at the University of Maryland and Virginia Polytechnic Institute and State University, coming to Purdue in 1980, where his research led to international acclaim for work in aeroelasticity, smart structures, and aircraft design. That fueled international invitations and connections—with Russian institutes and industry, Japan’s National Aerospace Laboratory, and Seoul National University in Korea, among others.

He’s also worked with about 45 graduate students, where his hallmark is helping them understand difficult information, says current graduate student Mike Skillen. “He has a unique way of reducing complex problems. He can break it down and convey it to others in a way that is motivating, more easily understood, and extremely helpful,” Skillen states.

“I like to make it easy for students,” Weisshaar says. “The complexity should be in the subject matter, not in guessing what I want.”

Weisshaar’s most recent work, on leave from Purdue from August 2002 through August 2006, was leading the morphing aircraft structured program from concept to testing at the Defense Sciences Office of the Defense Advanced Research Projects Agency in Arlington, Virginia. “We built demonstrator wind tunnel models of unmanned vehicles with wings that change shape, area, and span. They tested and worked well,” he says.

Back on campus, he’s in the classroom, re-establishing his research program, and also focusing on education systems and course sequences. “I’m interested in how you can improve teaching because of technology,” he says.

His tastes in pastime pursuits are as varied as his international research and teaching palate. They include tracing his family’s genealogy to Pocahontas, being “interested in almost everything,” and reading—religious history, philosophy, military history, science fiction, and “trashy spy novels.” ■ Kathy Mayer
The Wow Factor

From Purdue to the outer reaches of space, Mark Polansky is making his dreams come true—and encouraging others to do the same.

Astronaut Mark Polansky (BSAAE ’78, MSAAE ’78) didn’t know what to expect from his first NASA flight. It’s no surprise. The 2001 trip proved to be more than he could imagine. “The very unscientific word was wow,” he says of the seven-day STS-98 Atlantis mission, which entailed building and enhancing the International Space Station (ISS). Last December Polansky returned to the ISS, leading a seven-member crew on the STS-116 Discovery.

The 2006 mission represented the first night liftoff in four years and posed several challenges. Most of the crew was “green” to space travel, for example, with five members experiencing their first mission. The 13-day trip also required rewiring the ISS power system and delivering a key component of its structure, which will enable future missions to attach a new set of solar arrays.

The mission marked the 20th shuttle flight to the ISS. And by the time the crew successfully landed at Kennedy Space Center on December 22, they had logged more than 5.3 million miles in orbit, and had even communicated with a group of schoolchildren in Alaska.

Polansky’s personal journey into space began in childhood, which was characterized by a natural interest in science—if not engineering. When he arrived at Purdue as a freshman, he set out to pursue a physics degree. Yet by his sophomore year, he had switched majors to aeronautics and astronautics. “I found that I liked physics more than it liked me,” Polansky says. He also had become close friends with an aero major during his freshman year.

After graduating, Polansky received an Air Force commission, earning his pilot wings in 1980 at Vance Air Force Base in Oklahoma. He later attended U.S. Air Force Test Pilot School in California, and by 1992 was pursuing a career at NASA as an aerospace engineer and research pilot assigned to the Aircraft Operations Division of the Johnson Space Center. He became an astronaut candidate in 1996, commencing two years of training and evaluation.

Reaching his level of success took dedication and hard work. Yet Polansky believes good fortune also played a role, considering the tremendous number of skilled people competing for a job like his. Therefore, he encourages students interested in a similar career path to prepare themselves for stiff competition. “You better learn to handle and deal with rejection,” he notes, adding that students should strive to be patient and not restrict themselves by believing they can only be astronauts.

“Rejection is a life lesson,” he says. Still, he hopes students in aeronautics and astronautics will actively pursue their dreams and the goals they have set—regardless of others’ opinions. “Don’t let people tell you what you can and can’t do,” he says. He also encourages them to be well-rounded, extending their studies into other areas, like art and history. “The goal of college ought to be to better your life.”

■ Matt Schnepf
Robert Hostetler has set academic records, headed companies, scaled mountains, and led backpacking trips into remote areas. He is drawn by challenges and new frontiers, an interest that led him and his wife, Elly, to generously support the School of Aeronautics and Astronautics and its future home, Neil Armstrong Hall.

“I had a particular interest in the space program when it was being laid out in the 1960s,” Hostetler says. “I followed it thereafter, even though my job had nothing to do with the space program. My wife is fascinated by it as well.”

Hostetler (BSES ’64, MSIA ’65) grew up in the small town of Harlan, Indiana. His father, an automotive engineering manager, bestowed on him an interest in things both theoretical and practical. A work ethic from both parents influenced him, too.

As a Purdue freshman, Hostetler chose the engineering science program due to its reputation for having the university’s toughest curriculum. The high-level math and physics courses prepared him for graduate study in engineering, but he took a different course, enrolling in the Krannert School’s MSIA (industrial administration) program. Again, the bar was set high through the 11-month technically oriented program. The 80-hour-a-week studies didn’t slow him down, however, as Hostetler’s GPA was the highest in the school’s history.

As an undergraduate, Hostetler wrote for Purdue Engineer, a student publication that by senior year he ran as editor-in-chief. That experience set his future in motion. An article he wrote on the space program kindled a lifetime interest in space exploration, while his experience running a student operation set him on the road to management.

After completing his Purdue studies, Hostetler took a position with CTS Corporation, an Indiana-based manufacturer of electronic components and subsystems. He remained there until 1987, rising in his 22 years with the company from director of corporate planning to a six-year tenure as president and CEO. When a corporate takeover left him without a job, he and his wife decided to explore life as entrepreneurs and start their own company.

The result was the Choice TV Group, a series of 13 companies that developed wireless cable television, then a fledgling technology. The couple was successful at drawing investors, raising $5.5 million to build up the companies. Then, in 1993, they merged the Choice TV Group companies into American Telecasting Inc. As CEO, Hostetler led the company into high-speed data transmission, selling the company to Sprint Corporation in 1999.

Now retired and living just north of Colorado Springs, the Hostetlers are busy with their four children’s families, including 11 grandchildren. That is, when they’re not actively volunteering with local parks projects such as the world-famous Garden of the Gods or when Bob isn’t setting rock-climbing routes or leading treks in the Grand Canyon. They also enjoy taking “trips of a lifetime.”

Three of Hostetler’s four children are Purdue graduates, so he has remained firmly connected to Purdue. He is grateful for the education he received both in Aeronautics and Astronautics and Krannert, supporting both over the years. The couple’s largest gift, however, will commemorate a young man’s long-ago article on space that sparked a lifetime fascination with the space program. That gift will support Neil Armstrong Hall, flagship facility for the College of Engineering.

“We’re both looking forward to commercial space travel,” Hostetler says.

The Hostetlers have four children: John (BSCEE ’89, MSIA ’90); Michael (BSME ’95); Karen (BS, early childhood education ’97); and Kevin (BA, elementary education ’97, Ball State University).

— Linda Thomas Terhune
This image of Earth’s city lights was created with data from the Defense Meteorological Satellite program Operational Linescan System, which NASA uses to map urbanization. The brightest spots are the most urbanized but not necessarily the most populated. (Compare Western Europe to China and India, for example.) See “Prime Numbers” on page 10 (college side) for a numerical quick look at our world.