



*Florida Institute of Technology*  
High Tech with a Human Touch™

*Dream, Innovate, Experience ...*

**FLORIDA TECH ENGINEERING**

# *Dream, Innovate, Experience ...*



In this year's College of Engineering report you will find many exciting stories of how our undergraduate students are engaged in a variety of research projects. Many times this research experience begins at the freshman level and continues until our students graduate. However, all of our engineering students receive an equivalent research experience. Many of these projects are multidisciplinary and are partially funded by a large endowment from Northrop Grumman Corporation.

# Projects and Undergraduate Research

In some cases this research experience involves combining graduate research with capstone and undergraduate research experiences. This was the case recently with a group of our undergraduate engineering students who participated in NASA's Facilitated Access to Space Environment for Technology (FAST) program in Houston, Texas, where they flew experiments on the Zero-G research aircraft. Florida Tech's team, led by two professors in our mechanical and aerospace engineering department, was one of only 17 teams selected out of 52 applicants for the program. Our team was the largest in attendance. The project explored the behavior of liquid dynamics in a reduced gravity environment to simulate the behavior of rocket propellants in space.


The idea of hands-on education is not a new idea; however, we have carried this concept to a new level ensuring that our graduating engineering students possess the necessary skills to be highly successful engineers. The fact that we have been able to successfully cultivate this research oriented environment for our undergraduate students is evidenced by our location. Our students live and work in a unique environment on Florida's Space Coast. Florida Tech is a relatively small institution located in the heart of a very high-tech area. The Florida High Tech Corridor, which includes NASA's Kennedy Space Center, over 5,000 high-tech companies and three major universities, offers many opportunities for our students including co-ops and internships. All of this is located in a beautiful subtropical environment. Our local area is very rich with high-tech companies; the most recent U.S. Census Bureau's American Community Survey indicates that nearly 15 percent of the local population has engineering degrees, which is twice the national average.

At Florida Tech, we have concentrated on focusing our undergraduate research experience so that it is in line with the fundamental vision that is outlined in *Educating the Engineer 2020* (NAE 2005). Moreover, our College of Engineering is a member of the Grand Challenge Scholars Program. All of these initiatives support the notion of hands-on learning for our engineering students. We are able to provide this level of hands-on education because of a small student-to-faculty ratio. Also outlined in the vision of the engineer of 2020 is that engineers be "global," possessing international experience. At Florida Tech our students are immersed in an environment with 25% of our students from 87 countries. This fact, along with the standing committee working on "internationalizing" the Melbourne campus, gives our students true interaction with international students while learning engineering. The ability to work and learn in a global environment will ensure the global success of our students.

Like many other universities, our undergraduate students routinely compete in various competitions. These include, for example, Baja endurance vehicles, Formula One cars, the annual ACM Intercollegiate Programming Contest (Florida Tech has had five appearances in the world finals), the MATE (Marine Advanced Technology Education) ROV competition, satellite launches, bridge design and the concrete canoe competition.

Please enjoy reading about some of the experiences of our undergraduate engineering students at Florida Tech.

*Fredric M. Ham, Ph.D.  
Interim Dean, College of Engineering  
Harris Professor*



**W**hen senior **Jhenelle Williams** came to Florida Tech from Jamaica at 17, she knew no one. Now she has more friends than she has time to enjoy. Her circle has grown from capstone ocean engineering project teammates, Caribbean Students Association members and Clemente Center for Sports and Recreation co-workers. Williams is among the 25 percent of international students at Florida Tech.

And she is one of many international students choosing engineering. In fact, the most popular majors for the past five years for Florida Tech international students have all been in the College of Engineering (COE). This year, electrical, mechanical, aerospace and computer engineering, and computer science top the list.

In COE as anywhere on campus, it is an extra adjustment for international students. They are not only away from home, but many must study in a second language and must adapt to new cultural experiences.

“We try every way we can to make these students feel at home,” said **Judy Brooke**, director of International Student and Scholar Services. “We continue to check in with them to see how they’re coming along and offer a variety of campus programs and activities where international students can socialize with U.S. students and those from many countries.”

Williams chose Florida Tech as her home away from home for ocean engineering. With a

*The International Spirit of Florida Tech*

family immersed in maritime professions, it's not surprising that as a youngster she was known as "The Fish." She enjoyed swimming, fishing, diving and even competed internationally in water polo before docking herself temporarily at Florida Tech.

Her culminating project is the Wing Wave, which her seven-member team designed to produce electrical power from wave energy. "All of us just meshed together so well. We learn how to be on top of everything you need to know in industry," she said.

Wing Wave earned a lot of buzz when it was exhibited last summer and tested in the Atlantic Ocean last fall. It has attracted the attention and funding of corporate sponsors who want to link it to the nearby power grids off Brevard or Indian River counties.

"Jamaica has plenty of coasts and I want to take my knowledge back to my country and improve the coastlines. I've found my niche."

**Shashank Bishnoi**, from New Delhi, India, began his college studies near Bangalore, "an IT hub," he said. Bishnoi decided to finish his undergraduate degree at Florida Tech when he met representative **Stephanie Enstice** at a college fair in India. Florida Tech's reputation and the warm climate sealed the deal, he recalled, as well as the fact that friends from home had already come to the university.

A big challenge for him as well as for other international students is getting used to the food. It's just not like home. From a family of

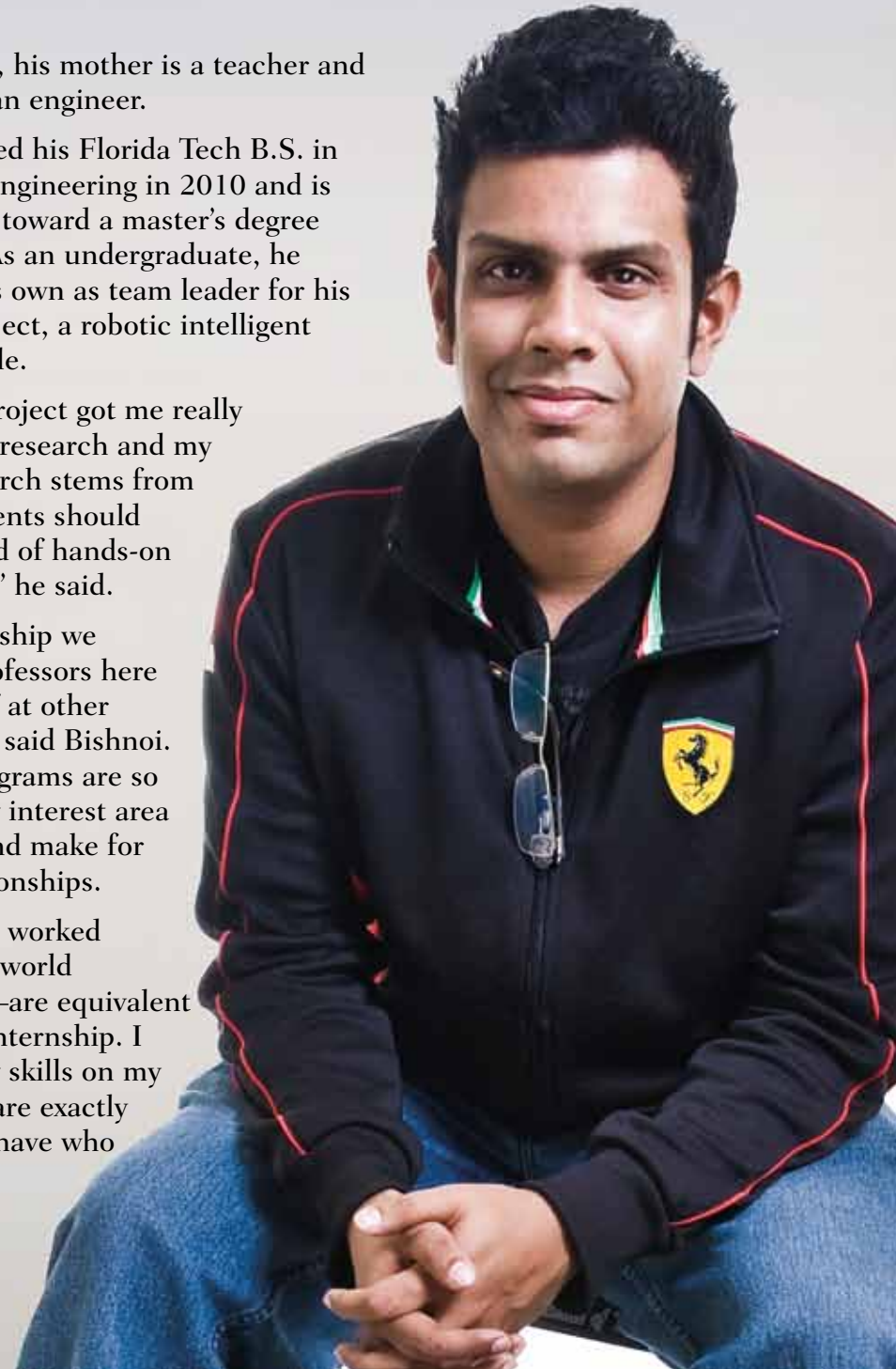
professionals, his mother is a teacher and his father is an engineer.

Bishnoi earned his Florida Tech B.S. in mechanical engineering in 2010 and is now working toward a master's degree in the field. As an undergraduate, he came into his own as team leader for his capstone project, a robotic intelligent ground vehicle.

"My senior project got me really interested in research and my current research stems from this. All students should have this kind of hands-on involvement," he said.

"The relationship we have with professors here is unheard of at other universities," said Bishnoi. "And our programs are so focused; they interest area businesses and make for unique relationships.

"Everything I worked on—the real-world experiences—are equivalent to doing an internship. I can list many skills on my résumé that are exactly what people have who already work in industry."





The passions of **Juan Avendano**, a senior aerospace engineering major from Colombia, take him skyward. He's the team leader for the Morphing Wing project, a wing design intended to create better aerodynamics. All team members emerged from the campus chapter of the American Institute of Aeronautics and Astronautics when he was chapter president. So, they are very close.

Avendano, a member of a large extended family, came from the small capital city of Armenia. A younger brother and former roommate attending Florida Tech help him stay in touch with his Colombian roots.

Comfortable in the English language from attending an American high school in Colombia, he was a translator for Enstice when she visited. He thinks that the early exposure to English helped him fit in at the university.

"People know me by name. I go to an office here and everyone is very helpful and giving of their free time. Most classes are small and it's a good learning environment. We have a good chance to ask questions and get to know everyone in class."

The drawback to his U.S. education is one Avendano shares with most other international students. It's the distance from their families. "That's the main obstacle," he said.

A downside for gregarious **Fahad Alowaini**, a senior and computer engineering major from Riyadh, Saudi Arabia, is missing his large family and neighborhood gatherings. Riyadh is an 18-hour flight away.

A cousin and older brother in Florida Tech engineering programs, however, hold his homesickness at bay. Also, like many other international students, the high energy and nightlife of their hometowns are fondly remembered.

This makes for fewer distractions, though, as he keeps busy with challenging schoolwork. The work is made easier by the time he spent earlier in Los Angeles studying English.

Alowaini is finishing his bachelor's degree while earning master's degree credits in the *FastTrack* program in computer engineering. He's also entering the final leg of his senior project, a smart parking system.

When he's not studying, he spends time with friends. He's a mover and shaker among the Saudi students in cultural events, including the campus spring International Festival.

"It goes two ways," said Brooke. "We want to help international students adapt and feel comfortable on campus, of course. But, their presence here, and the sharing of their culture, provides a rich experience for all the students."

*Karen Rhine*



# Flying High



Ran Zhou





Torin Crandall



Brittany Essink



Five Florida Tech engineering students experienced Zero G gravity and research in NASA's Facilitated Access to the Space Environment for Technology (FAST) program last fall. They assisted **Daniel Kirk**, associate professor of aerospace engineering, with his research on the liquid dynamics "sloshing" of rocket fuel in a reduced gravity environment. Team members were **Brittany Essink**, **Torin Crandall**, **Richard Schulman** and **David Becknell**, aerospace engineering undergraduates; and **Ran Zhou**, mechanical engineering Ph.D. doctoral degree candidate.

# *Building Stronger Engineers*

The faculty and staff of Florida Tech's College of Engineering know what it takes to get the competitive advantage in today's job market: hands-on experience. As early as their freshman year, students work in teams and build a project often using machine shop equipment, said Stephanie Hopper, director of laboratories.

"Our students don't just watch the instructor use the equipment—they get to build things for themselves," said Hopper. "Right away, we have students working on small robots, building radio-controlled boats and projects in electrical engineering."

Getting hands-on experience on a boat in ocean engineering, with concrete in civil engineering or in the machine shop in mechanical or aerospace engineering in the freshman year equips students with valuable information for selecting the best majors, said Hopper. "It gives the student a chance to focus on what a particular major will be like, which helps them know early on whether they've made the right decision." This year, freshmen taking the Introduction to Mechanical Engineering course will team up to build small, autonomous robots. The teams will compete against each other in time trials in an obstacle course. "It's always more fun when you're building something that you'll actually use," said Hopper.

Before students start working in the machine shop, they receive a six-week training course, which reviews OSHA

safety rules and offers instruction on the proper use of the equipment. The students are never left unattended, as the shop is always staffed with experienced machinists who are there to offer advice. "The machine shop staff members are there to help, but it's the students who are doing the work," said Hopper.

Employers appreciate the advantage of hiring engineering graduates who have spent a lot of time in the machine shop or working in hands-on environments. "Students learn that projects take a certain amount of time and money, and that improves their decisions because they have more realistic assessments of the tasks at hand," said Hopper.

After getting the early start, engineering students hone their hands-on skills through the junior and senior design projects. Each year, the more than 100 projects displayed during the Northrop Grumman Engineering and Science Student Design Showcase, range from mechanical, civil, electrical, computer, ocean, environmental and chemical engineering. Dozens of judges from local industry volunteer their time to evaluate the projects and meet the students face-to-face. Northrop Grumman's commitment to the program is so strong that the company pledged \$1 million to create an endowment to help fund student design projects each year.

In addition to the showcase, many students join teams to compete against other universities in areas such as Concrete Canoe, Steel Bridge Design, Mini Baja, Autonomous Unmanned Vehicle, Intelligent Ground Vehicle, Rocket Competition and Formula Car races.



Several of these teams consist of multidisciplinary teams with students from different engineering majors working side-by-side. “Our students learn important ‘real-life’ skills by participating on these teams,” said Hopper. “Their understanding of scheduling, budgeting, teamwork and engineering give them a considerable advantage when entering today’s competitive job market.”

*Gretchen Sauerma*

# Chemical Engineering Gains Momentum



Students, from left, are Kyan Ali, Laura Gaydusek, Tyler Miller and Janelle Branch.

Florida Tech's department of chemical engineering is reaching new milestones. The department is claiming the highest total enrollment of 111 students across undergraduate and graduate degree programs in department history in fall 2010. The department has seen a 70 percent growth in undergraduate students over the past five years, yet manages to maintain small class sizes and hands-on lab experience.

Not only has the incoming class size and total enrollment steadily increased, but the number of women entering the program is also tipping the balance, said Interim Department Head **Manolis Tomadakis**.

"From 2006 to 2010, 45 percent of our graduates were women," he said. "This is, by far, the most among all of Florida Tech's traditional engineering fields."

The rise in female participation in the chemical engineering department is evident in the program's faculty members

# *Through Quality, Diversity and Versatility*

as well. Two out of the six faculty members, **Maria Pozo de Fernandez** and **Yekaterina Lin**, are women, a figure that is also the highest among all of Florida Tech's College of Engineering programs, Tomadakis said.

Typically, chemical engineers concern themselves with the multi-stage processes that turn raw materials into valuable products. The necessary skills encompass all aspects of design, testing, scale-up, operation, control and cost optimization, and require a detailed understanding of the various chemical, physical and biological processes that make these conversions possible, as well as the associated financial, safety and environmental aspects.

"Chemical engineering is not easy to describe because we, as engineers, are involved in so many different disciplines," Tomadakis said. "We apply knowledge of chemistry, math, physics and economics to model, design and improve equipment to manufacture new products and improve existing ones. Generally, there is a very high demand in the job market for chemical engineers because they can be employed in just about any field and collaborate with all other scientists and engineers, including medical doctors in biomedical applications."

Florida Tech chemical engineering students work hard both inside and outside the normal confines of the classroom, maintaining some of the highest grade point averages at the university. Students have also earned numerous honors and awards at the national, regional, state and university level in recognition of their academic research and excellence, extracurricular activities, leadership skills and outstanding teamwork performance in design competitions.

"Chemical engineering students quite often earn the highest per capita number of Distinguished Scholar Awards in the Florida Tech Honors Convocation Ceremonies," Tomadakis said.

Additionally, in the last decade, Florida Tech's chemical engineering students have taken home nearly two dozen national and regional awards in engineering competitions, including the American Institute of Chemical Engineers (AIChE) Chem-E-Car Competition, National AIChE Student Research Competitions, National Science Foundation (NSF) Undergraduate Research Awards, the United States Achievement Academy (USAA) Award and the National Tau Beta Pi Scholarship Award. Tau Beta Pi is the National Engineering Honor Society, founded in 1885.

This standard of excellence prepares students for real-world on-the-job applications.

In fact, in all surveys of Florida Tech chemical engineering alumni, 95 to 100 percent of respondents agree that "Chemical Engineering graduates from Florida Tech are as well or better prepared for employment as graduates from other universities," Tomadakis said.

A distinguished program evaluator once wrote in his accreditation report, "The Chemical Engineering Program at Florida Tech presents a refreshing initiative in the national engineering education scene."

"If you are talking about program quality, you can't hide this," Tomadakis said. "It counts."

*Jennifer Nessmith*

# Lounge and Learn

College of Engineering students can learn and lounge in their building's new second-floor Learning Lounge.

Formerly half the space and just a place to hang out, zap a burrito from the vending machine and watch TV, now the space accommodates student collaboration pods, rooms to work on projects and to study, and a TV viewing area.

“So much of the Florida Tech learning model is how to be a member of a team,” said **Stephanie Hopper**, director of laboratories. “The central part of the design for this space was to encourage group work and collaboration.” There are two “quiet” rooms for distraction-free studying. Also, four collaborative pods with two 42-inch screens allow students to connect to their laptops or go on their u-drive for a design drawing or to look at a report on a screen as a team. In another space, a large table for eight lets everyone seated plug into their laptops and share information.

It's a bright space. Eleven windows let in the sun and room dividers made of glass allow light to permeate throughout. Color and sound are also a consideration. “The color scheme incorporates the lighter blue and green shades. The colors and a padded carpet create a space conducive to quiet learning,” said Hopper.

Study-weary students can still relax. A big TV room has two large flat screen TVs with directional speakers as well as comfortable sofas and chairs. “This is quite a wonderful new asset for our students,” added Hopper.



From left: Nevin George, Luis Delamoza and Michael McLeod



# Engineering Co-op Program Merges with Fast Track to Success

Long known for its high-tech, “hands-on” education, Florida Tech takes this concept further with the *ProTrack Co-op* program for engineering and applied science students. The first class began in August 2010.

The new program combines the benefits of traditional university cooperative education with a unique, student-centered approach. Engineering students can complete three semester-long paid work experiences related to their major and career interests while earning a bachelor’s degree in the traditional four years, with no graduation delay. Graduates are then ready to begin their careers with valuable, applicable work experience under their belts.

“We are very pleased to offer what we believe will give a tremendous advantage to engineering students and meet the needs and expectations of industry,” said Gary Hamme, Florida Tech associate vice president for enrollment management.

Benefits include major-related work experience, professional skill honing, co-op earnings, insight into one’s professional strengths, experience with the latest technologies and expanding a professional network by building valuable relationships.

Brevard County is home to a large high-tech workforce and to thousands of scientific and technological companies, organizations and agencies. Many are close to Florida Tech’s Melbourne campus, but students have opportunities to work with employers in all 50 states. Current co-op employers include Apple Inc., Boeing Company, Florida Power and Light, GE, Harris Corporation, Lockheed Martin, Microsoft, NASA, National Security Agency, Northrop Grumman, Raytheon, Siemens and United Space Alliance.



**The *ProTrack Co-op* program is open to students admitted to any College of Engineering degree program at the university.**

**For more information visit [www.fit.edu/co-op](http://www.fit.edu/co-op)**

# COLLEGE OF ENGINEERING



*Florida Institute of Technology*

<http://coe.fit.edu>