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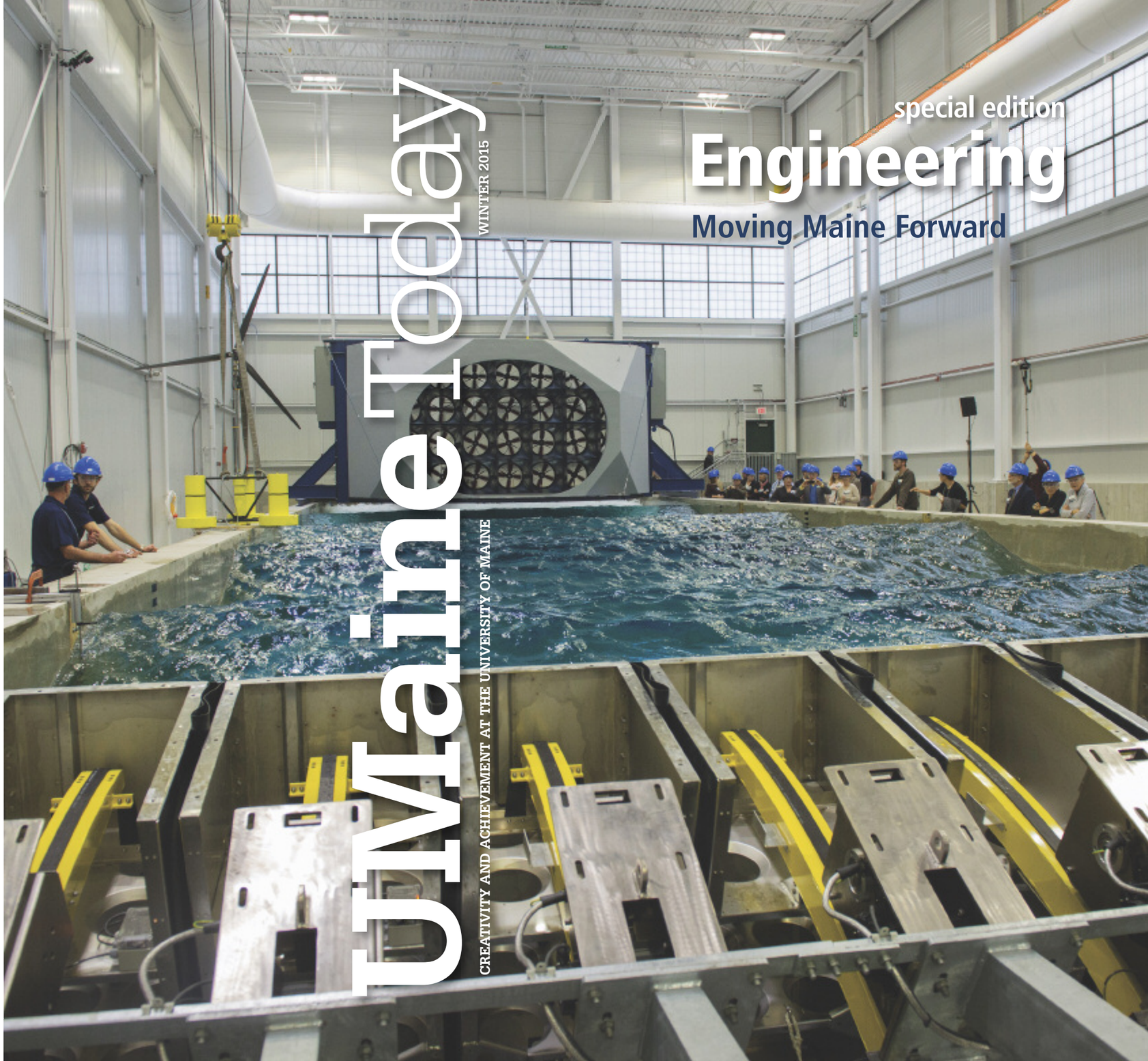
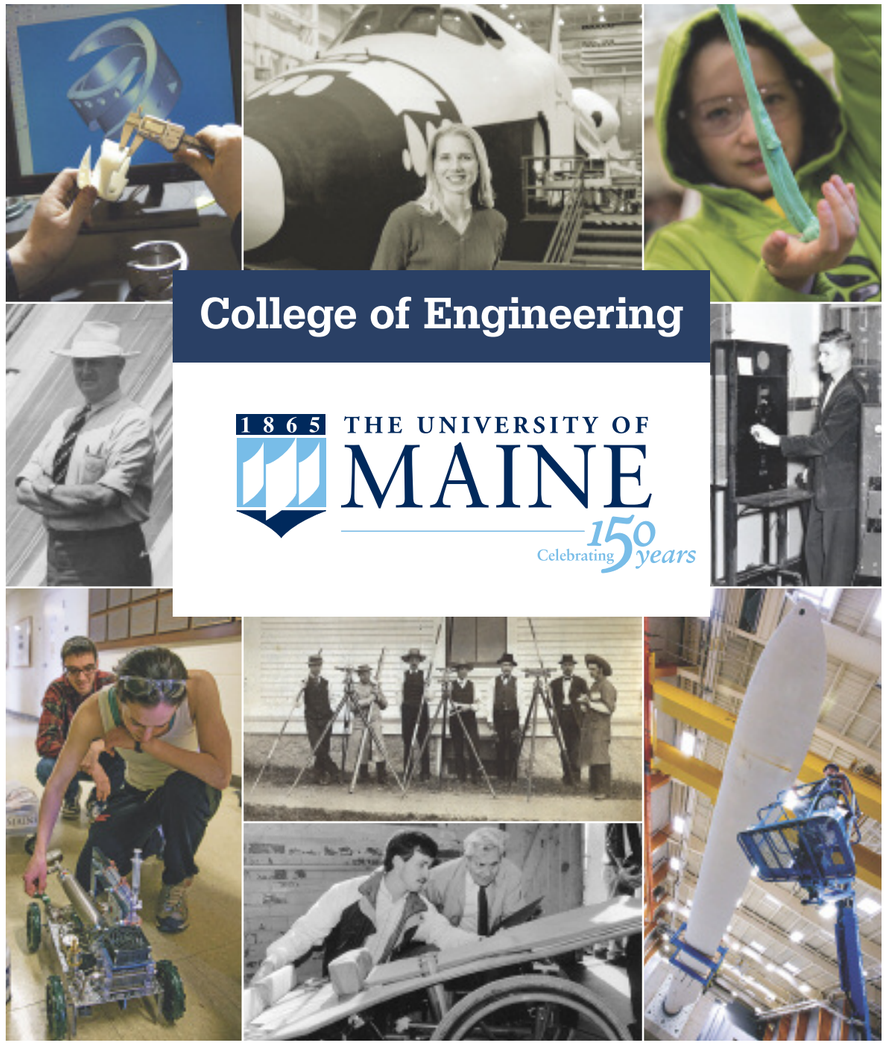


UMaine Today
WINTER 2015
CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE

special edition

Engineering

Moving Maine Forward



Photos clockwise from top left: Advanced Manufacturing Center; alumna Bridget Ziegelaar, NASA; STEM education; Electrical Engineering; Advanced Structures and Composites Center; Civil Engineering; Mechanical Engineering Technology; Chem-E Car Competition; alumnus Francis Crowe.

WELCOME TO the 2015 College of Engineering magazine, where our theme is Moving Maine Forward, exploring the education, partnerships and research, and the role that our alumni play in Maine.

The University of Maine is celebrating its 150th birthday this year, and as part of that celebration we are reminded how we began. The very first graduate was a civil engineer and four out of six in the first graduating class were engineers. It is from the past that our engineering excellence began and continues to grow.

This fall, the College of Engineering has set a new undergraduate enrollment record with 1,889 students. This marks 74 percent growth when compared with 1,088 students enrolled in 2001. Adding in graduate students, the total enrollment exceeds 2,000 for the first time.

The College of Engineering continues to be the sole institution in Maine to offer 11 engineering and engineering technology majors, and full M.S. and Ph.D. programs, granting 94 percent of all engineering degrees in Maine.

In this year's magazine, you'll read about innovative partnerships between faculty and preK–12 science teachers, and partnerships with the Maine Department of Transportation to improve the safety of the state's bridges. Also in this issue, you'll read about the Stormwater Management Research Team (SMART) Institute and how it is engaging a diverse group of students and teachers in training for the implementation of STEM in their schools and addressing an important environmental issue — stormwater runoff.

Furthermore, you will read about alumni who are leaders in Maine and beyond in electrical and smart grid technology; developing global markets to keep Maine industry strong; R&D to develop new products; and mapping to help us better understand the world around us.

Our faculty, staff, students and alumni are all key to Moving Maine Forward.

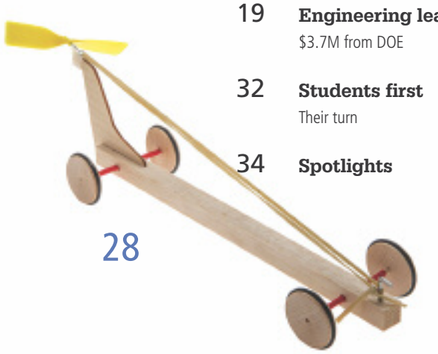
Dana H. Humphrey

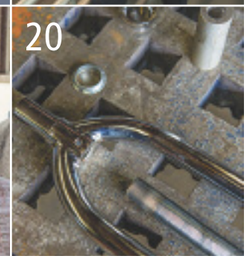
Dr. Dana Humphrey
Dean, College of Engineering

contents

features

departments





ON THE COVER: The new $13.8 million Harold Alfond W² Ocean Engineering Laboratory and Advanced Manufacturing Laboratory at UMaine's Advanced Structures and Composites Center was dedicated Nov. 23. The lab will prototype coastal and offshore structures, including ships, aquaculture facilities, oil and gas structures, and ocean energy devices under extreme wave, wind and current environments. It was made possible by a $3.9 million grant from the Harold Alfond Foundation and $9.98 million raised through grant competitions, including the U.S. Economic Development Administration, National Science Foundation, National Institute of Standards and Technology, and Maine Technology Institute, as well as a Maine voter-approved bond in June 2015.

engineering.umaine.edu

SMART Stormwater Management Research Team

THIS SUMMER, about 100 students and teachers from 12 high schools and local Native American communities gathered at the University of Maine for a three-day program that focuses on creating innovative solutions to environmental problems related to stormwater management. UMaine Stormwater Management Research Team (SMART) Institute participants worked with university faculty, undergraduates and graduate students; city water planners; and representatives from the Maine Department of Environmental Protection during the program. Now in its second year, the SMART Institute engages a diverse group of students and teachers in training for the implementation of science, technology, engineering and mathematics (STEM) in their schools, all while addressing an important environmental issue — stormwater runoff. The institute is supported by a more than $735,000 grant awarded by the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCoR) Track III program that aims to empower female and minority high school students who are often underrepresented in STEM fields. The program also is supported by Emera Maine, Maine Community Foundation (Haskell-Stetson Trust) and IDEXX Corp. ■

In power

UMaine alumni are on the front lines of Maine's electric industry

UNIVERSITY OF MAINE graduates contribute to Maine's economy in many fields and industries, and one of the areas in which their presence is most keenly felt by the most people statewide is in the electric power industry.

Each year, the Electrical Engineering Technology Program graduates up to 35 students, and about 85 percent of those alumni go into the electric power industry in Maine. The Department of Electrical and Computer Engineering graduates a similar number annually, and up to 20 percent go into the power industry or work with power systems.

"Few industries are going through the transformative changes currently taking place in the power industry," says Donald Hummels, chair of the Department of Electrical and Computer Engineering. "Grid modernization, resiliency and security; support of renewable energy sources; and electrification of the heating and transportation sectors are just a few of the challenges and opportunities facing the industry in the coming decade. That's why the partnership between UMaine and the power industry is critical to our ongoing success."

Many electrical engineering and electrical engineering technology majors get their start with local companies, working as interns and moving into long-term positions after graduation.

> "It's critical to the industry and the state of Maine **that the university remains at the forefront of such a key part of the state's economy."**
>
> Gerry Chasse

"They're working with Central Maine Power (CMP) or Emera Maine, or with other companies, both large and small, that support them. They are working on projects that matter to Maine's people and economy," says Judith Pearse, professor of electrical engineering technology. "They cover all different aspects of the industry."

Whether it's developing or maintaining the state's power generation and transmission infrastructure, planning for ways to integrate renewable sources of power into existing systems or planning for the customer and system needs of the future, UMaine graduates are on the front lines of those efforts.

Those alumni also give back to the university and to the next generation of engineers. They meet regularly with the faculty to discuss the latest developments in the industry and their impacts. Some also come back to the university to teach courses on specific technologies.

"(Alumni) provide current information about the industry so we can tailor our courses based on what's happening now," Pearse says. "We're grooming the next generation of engineers to hit the ground running."

UMaine Today magazine talked to five engineering alumni who, through their leadership, have helped develop Maine's power industry and are helping shape the systems that will meet the power needs in Maine and New England in the future. We asked them about their fields and how their UMaine experience prepared them — and continues to inform their vision and leadership today.

Gerry Chasse

IT'S MORE than 2,200 miles from Bangor, Maine to the Caribbean island of Barbados. But Gerry Chasse sees a close connection between what is happening with renewables and electrification there, and what can happen in New England and the Maritimes.

Chasse is a career employee at Emera, starting at Bangor Hydro Electric Company right after he earned his degree in electrical engineering from UMaine in 1990. He worked his way through engineering and electrical operations and, in 2010, was appointed president and COO of Bangor Hydro. A year later, he also became president and COO of Maine Public Service, eventually overseeing the merger of the two companies into Emera Maine.

This past May, Chasse left that post for a seat on the Emera Maine board of directors, where he serves as vice chair and is leading a grid modernization effort for all affiliates in Nova Scotia, Emera Maine and three utilities in the Caribbean.

There's a lot happening with grid modernization and integration of renewables. For example, in Barbados, there is a commitment to achieving 100 percent renewable generation and all-electric transportation by 2045.

"Electricity produced in most island countries using photovoltaics and wind is competitive with oil-fired generation, even at today's low oil prices," he says. "And with an island that is just 24 miles long, electric vehicles work well; there are no long distances between recharging stations and no range anxiety like there is here.

"We'll learn a tremendous amount from what we do in Barbados and we will bring that experience back to the utilities in Maine and Nova Scotia."

While the economics of renewables aren't the same in the Northeast as

Gerry Chasse and Deborah Manning

they are in the Caribbean, Chasse maintains, at some point, the economics will work here, too.

Part of the work he is doing with a team throughout the Emera companies will help make Maine ready for a major shift away from conventional electric power generations sources.

"We need to plan for a distribution grid that integrates wind, tidal or solar, and supports (electric) vehicles and heat pumps," he says.

Emera Maine also is advancing electrification of heating by proposing a program to make efficient electric heat pumps available to Mainers at no up-front cost. The company's goal is to help shape the industry, enabling it to install 50,000 heat pumps in northern and eastern Maine over the next 10 to 15 years — a move that Chasse says will reduce total energy consumption by about 50 percent and carbon emissions by almost 80 percent, and save customers money.

Although Chasse's current role involves work in the Caribbean, he remains based in Bangor, which allows him to maintain strong ties with UMaine's College of Engineering. He has served for a number of years on the Electrical Engineering Technical Advisory Committee and, for the past five years, has served on the Dean's Council.

Chasse says UMaine provided him a great foundation in electrical and power engineering, and that the students today also are well prepared. That's important, given the projections that jobs in the power industry will double in the next five or six years.

Brian Conroy

"It's critical to the industry and the state of Maine that the university remains at the forefront of such a key part of the state's economy," he says.

Brian Conroy

QUALITY AND reliability. Those are words to live by for Brian Conroy.

Conroy, a 1986 graduate with a degree in electrical engineering, is director of network projects for Central Maine Power, a subsidiary of Iberdrola USA, where he works to seek efficiencies among the utility company's three companies in the Northeast: CMP, New York State Electric and Gas Corp., and Rochester Gas and Electric.

One of the challenges, Conroy says, is to achieve those efficiencies as the companies move more to automated systems.

"We're responsible for operating and monitoring the grid, and making sure that we can maintain electricity delivery with quality and reliability. That's our reason for being," he says.

Conroy went to work at CMP right out of college. He had worked there as an intern for two summers prior to graduation.

Conroy said his four years at UMaine gave him a "great tool kit on which to build." In addition, he had a leg up on most new hires and many of the existing employees because of the computers at the university, which, in the 1980s, were not nearly as prevalent in the industry as they are today.

Conroy started in the metering side of the industry and worked with the utility's automation, which includes the development of its smart grid with the introduction of its advanced metering infrastructure (AMI) technology throughout its distribution area in Maine — a total of about 600,000 meters in the state.

Smart meters are part of an emerging, Web-based communications system that will provide the utility with more information about individual consumer uses and facilitate system management.

"We can bring in more data to and from each customer, and leverage it to be more effective in how we manage our system," he says, noting that the system tracks only the amount of electricity used, not the specific appliances or devices that are using the power.

Introduction of the 600,000 smart meters also eliminated about 2 million miles of driving to take readings each year, which, along with other company-wide measures, has significantly reduced CMP's carbon footprint.

CMP's control system, under an arrangement with ISO New England, also runs the grid for Maine. Conroy's current project is to upgrade the computer systems and expand grid automation, including AMI technology to systems at CMP's affiliated companies in New York state. That plan involves installation of almost 2 million natural gas and electric smart meters across that state's systems by 2023.

The work Conroy is doing, along with the company's $1.4 billion upgrade to its bulk transmission system, is helping set the foundation for the future of the power grid in New England. It also puts the company in a good position to meet the wider demands of the national sustainability policy to continue to provide reliable power into the future, and to incorporate renewables into power generation. Integrating renewable energy sources with the existing generating plants and monitoring them throughout the system is the work of the future.

"It's progress, and adapting to change is what keeps it fresh and exciting," he says.

Deborah Manning

DEBORAH MANNING has her fingers on the pulse of electricity running through Maine.

The 1987 UMaine graduate is the senior transmission planning engineer at Emera Maine, where she assesses the utility's transmission system. In conjunction with ISO New England, which administers the interconnections of the large generators statewide, she also monitors for impacts to the transmission system as generators come online.

> "There is a great deal of **job satisfaction** when you are able to **apply your skills to real-life technical problems."**
>
> Deborah Manning

There are a lot of challenges, Manning says. Some involve computer modeling of how the power moves through the system, assessing high- and low-demand periods, and analyzing the system to show any weaknesses. Manning uses that information to help determine timing of system upgrades.

"There is a lot of problem solving, a lot of 'what-ifs' as you develop and analyze different solutions," she says. "You need to plan so that you have the capability to support what comes in the future."

There are a lot of exciting aspects to the industry now, Manning says, which require a great deal of flexibility in the workplace. Renewables, she says, will have a big impact on operations at Emera, now and in the future, and it will be part of her job to support those new power generators as they come online, while ensuring reliable service for existing customers. Smart grid technologies can provide a tool to assist with this balance.

"We're using technology in different ways to make the power system more efficient," she says. "We need to be flexible so that we can be in a position to provide the best service we can."

Part of that flexibility is being able to work with a diverse group of engineers and adapt to a variety of disciplines. As the industry evolves, utility engineers could be involved in many new areas.

Manning came to what was then Bangor Hydro right out of college, having worked at the utility as an intern the two previous summers.

"I felt well prepared. The UMaine engineering program really builds up your problem-solving skills. It's a tough program, but if you persevere, it's absolutely worth it. There is a great deal of job satisfaction when you are able to apply your skills to real-life technical problems.

"Part of the fun of this work is how often you get to learn new things. The job is constantly changing."

Matt Pelletier

WHEN MATT Pelletier graduated from Old Town High School in 1983 and enrolled at UMaine, electrical engineering technology was the field with a reputation for graduating students "who were immediately capable of going to work."

"Electrical engineering technology is applied engineering, meaning we take engineered devices and equipment, and use those to design a functional system, versus theoretical engineering which is more suited to R&D and

> With reliability and renewable energy being so important, **this has been a nearly recession-proof industry** for the past 15 years." Matt Pelletier

involves designing new devices. Applied engineering is often used in industries such as pulp and paper, manufacturing, power generation and power delivery, which is what I do now," says Pelletier, the Northeast regional substation manager for POWER Engineers, Inc., working in Freeport, Maine for the global consulting services and engineering firm headquartered in Idaho.

The School of Engineering Technology is an ABET-accredited program, and prepares students to enter the engineering workforce with the ability to build on the foundation they learned at UMaine, Pelletier says. Once hired, students immediately apply what they've learned and continue to develop the skills needed for their chosen career.

True to the UMaine student experience, Pelletier got plenty of hands-on training. He spent a co-op year with the Old Town paper mill, collaborating on small electrical projects and maintaining the distributed control system known as "Big Red," followed by a six-month, full-time co-op with Central Maine Power Co.

He was there in 1987 for what was dubbed the April Fool's Day flood that resulted in the destruction of many hydroelectric power stations. One of his jobs was to go through the recovered protective relays to see if they could be salvaged.

"The R&D that went into protective relays 100 years ago is astonishing. Today, we stand on the shoulders of giants. While the devices we employ today are much more reliable, they had less to build on a century ago than we do today," he says.

"I got my hands dirty on a lot of equipment and found it fascinating. At that point, I knew I really wanted to get into the electrical power field of engineering, working with generating stations and transmission substations," Pelletier says.

That experience and his coursework — especially classes on power systems and industrial electronics — solidified his career path, he says. "Everybody needs electricity, whether generating power or delivering it. I've been fortunate to work in both fields."

Pelletier graduated from UMaine in 1988 and went to Central Maine Power "doing my first dream job — protection and controls and automation of hydro stations." Seven years later, he moved into industrial consulting, working in the U.K., Scandinavia, Asia and the Middle East, among other places, and across the U.S. Pelletier also owned his own engineering firm.

But after a decade, he found himself missing the power field. He spent two years as a senior electrical engineer with EPRO, later acquired by TRC. In 2004, he joined POWER Engineers as a senior project engineer, designing large-scale 345kV bulk-power substations. In May 2006, he took over as substation department manager and office manager. In November 2006, the growing office relocated from Yarmouth to Freeport with 18 employees. Today, there are more than 90 employees, many of them EET grads.

Since becoming regional manager in mid-2014, he has been involved in hiring electrical engineering technology graduates for multiple offices. Some UMaine EET grads have gone as far as Michigan, Colorado, Idaho and California. Those involved in field services (commissioning) have gone much farther.

"With reliability and renewable energy being so important, this has been a nearly recession-proof industry for the past 15 years," says Pelletier, who serves on EET's Industrial Advisory Committee. "We're not the largest firm that does power delivery, but we have the largest staff dedicated to power delivery in the U.S., and we continue to grow."

Shawn St. Jean

SHAWN ST. JEAN first came to the University of Maine in 1982 to study animal and veterinary sciences, but soon realized that wasn't his field.

"I love to fix things, take them apart, see what the problem is," he says. "That's difficult to do with an animal."

He turned to carpentry, a skill he learned from his grandfather and, eventually, intrigued by the electricians he often worked with, he signed on with a local electrician as an apprentice. He is now a master electrician in Maine and New Hampshire.

In 1996, he graduated with a degree in electrical engineering. His work for companies included Cianbro — first in Portland, where he was the senior electrical commissioning engineer for a 12,000-ton, offshore exploratory semisubmersible oil drilling platform, and last, in Brewer, tearing down the Eastern Fine Paper mill and building Cianbro's new modular facility. He stayed on to work on the first modular project, an oil refinery.

Rather than spend more years on the road away from his family, St. Jean joined SGC Engineering, then located in Orono. Although he had taken the power program at UMaine, he hadn't worked much in that field in the previous 13 years. But since joining SGC in 2009, that all changed.

Today, he works on a variety of power projects, both small and large.

St. Jean worked with two students at Maine Maritime Academy to rehab the Goose River Hydro Mason's Dam in Belfast.

When UMaine researchers wanted to test their design for a floating wind turbine platform, they turned to SGC and St. Jean, who worked as the senior electrical engineer on the project, overseeing the land-based connections, protection and controls for VolturnUS 1:8, a 65-foot-tall floating turbine prototype of a 6 MW, 450-foot rotor diameter design and the first grid-connected offshore wind turbine in the Americas, deployed off the coast near Castine for 18 months.

> We like the **UMaine-type of engineers. We like the way they work."** Shawn St. Jean

He also has worked on more conventional projects, such as the upgrade of the medium voltage electrical system and installation of the COGEN plant at Eastern Maine Medical Center. Coincidentally, he says, he is working on the former project with an engineer from WBRC, Stephanie LaPlant (Archer), who had been his senior project partner at UMaine.

St. Jean credits UMaine with instilling a confidence in his ability to do the work he does.

"I learned a lot at the university," he says. "Even if you don't know exactly how to do something, know that you can. If you truly want to understand something, take it apart and you'll understand every single part of the problem or project. That was one of the big takeaways from the university. Be confident in your ability that you can fix it."

St. Jean keeps in close contact with the university. He serves on the Industry Advisory Council, providing feedback to the department regarding the training and experience new engineers will need coming into the industry. He helped found the new Protective Relay Lab (opening spring 2016) with donations from various vendors.

SGC maintains that UMaine connection by bringing in summer interns each year and often hiring them. Most of the engineers in the company's four offices in Maine are UMaine alumni.

"We like the UMaine-type of engineers. We like the way they work. It's been a good combination for us. They're doing things right there," he says. ■

Bridge work

In 2007, when Gov. John Baldacci issued an executive order instructing the Maine Department of Transportation to inspect bridge infrastructure in the wake of the collapse of the I-35 bridge in Minnesota, one of the engineers to get a call was Dr. Bill Davids.

Structural engineer Bill Davids partners with Maine DOT to apply research to address state needs

For almost a decade, Davids had been working with state transportation officials on a number of projects, including bridge safety. The chair of the University of Maine Department of Civil and Environmental Engineering was on the team of experts who reviewed the condition of Maine's bridge inventory and issued the "Keeping Our Bridges Safe" report. In 2014, he also served on the team that reviewed bridge improvements and issued an update on work that still needs to be done.

Davids has conducted internationally recognized research and has worked on some high-profile projects at the university, including the research and development of blast-resistant panels and the composite arch bridge system, commonly known as Bridge-in-a-Backpack™, at UMaine's Advanced Structures and Composites Center. There, he's also leading a NASA–funded project researching atmospheric re-entry systems for spacecraft.

Dr. Bill Davids is UMaine's 2015 Distinguished Maine Professor, cited as a gifted, committed educator and outstanding researcher with a strong record of public service. His popular and rigorous upper-level undergraduate and graduate courses produce well-prepared structural engineers who truly understand how engineers design.

But it's as a structural engineer with a strong background in bridge engineering and design that he implements much of his applied research in collaboration with Maine's transportation department to ensure the state's bridges are safe.

DAVIDS AND other UMaine researchers, both faculty and students, have partnered with MDOT to address issues identified as part of the state's ongoing bridge assessment and improvement programs. In recent years they have developed ways to more accurately assess the structural safety of certain types of bridges. They have been in the field to do some of the critical load testing for the department and have done research and development of a repair system that has the potential to extend the life of those aging bridges.

Davids was the chief developer of software used for load rating of flat concrete slab bridges. Several hundred of those types of short-span bridges are in the state, he says, many of them built between 1930 and 1960, and many of those were underdesigned for today's heavy truck loads.

In the past, the department has used design calculations to determine whether bridges were adequate, but those calculations, Davids says, can be conservative and often don't provide a realistic assessment of the structure's capacity.

"The condition of many of those bridges is pretty good," he says, "but if you do the calculations alone, you'll conclude that they're insufficient to carry today's loads, and they'll be at risk for posting for reduced loads, which can have economic consequences."

Those consequences became very real in 2003 when the transportation department posted the former Waldo-Hancock Bridge across the Penobscot River, reducing the load limit on the bridge and sending heavy commercial vehicles on a 40-mile detour, traveling to and from Down East Maine. That bridge was eventually removed after the new Penobscot Narrows Bridge opened in 2006.

The UMaine SlabRate finite-element software provides more realistic assessments of bridge capacity that has allowed the department to keep open a number of Maine bridges that — using the more conservative calculation — might have required posting for reduced loads or closure.

"Those bridges actually are OK," says Davids, UMaine's John C. Bridge Professor of Civil Engineering. "That's significant. They can be taken off the table. That's a real tool they can use and it saves real money at the end of the day."

That software is now being used not only by the transportation department, but by other consulting engineers working for MDOT to load rate other slab bridges.

UMaine's **FRP technology** includes design elements that allow the strips to be bolted onto existing structures — a method that has **attracted industry attention.**

IN ADDITION to developing the software for testing bridges, UMaine students and faculty are regularly in the field with MDOT crews to perform live load field testing on existing bridges. For example, in winter 2014 they were on and under a five-span truss bridge between Enfield and Howland, using the MDOT's inspection truck to reach the underside to attach sensors and other instruments. Those instruments were used to measure the effects of very large loads — four 50,000- to 60,000-pound dump trucks positioned across one span — on the bridge structure and to accurately assess its capacity.

"It was a challenging test, but we got really good data," he says. "That bridge will be OK for the next couple of years without any additional work."

That was important for MDOT engineers to know. At the time of the test, the bridge was slated for replacement within the next few years, but engineers had discovered structural shortcomings and were concerned that they would have to strengthen the bridge temporarily until they were ready to begin construction to replace it. Knowing the bridge was safe saved the department the cost of that work.

The cost for UMaine to test and analyze that bridge was about $10,000, plus the time of MDOT personnel on-site during the test, Davids says. "That's a lot less than the cost to retrofit even a small part of the structure."

UMaine researchers are also working with the department on a number of other bridges, targeting those with the most critical safety issues. Davids stressed that he and other UMaine researchers do not make any of the engineering decisions regarding actions taken on any of the state bridges.

"We provide the data, conduct analyses, and make recommendations that help them make good, informed engineering decisions," he says.

There are times when that information indicates that a bridge does need repairs, which points to a third prong of the UMaine civil engineering work on bridge safety with the transportation department. Under Davids' direction, a UMaine graduate student recently developed a repair technique using fiber-reinforced polymer (FRP) flexural retrofitting that has the potential to be a lightweight, lower-cost alternative that can extend the life of deteriorating concrete slab bridges by as much as 20 years.

The FRP technology is not new; it has been around for some 30 years, Davids says. But most of its application has used adhesives to attach the FRP sheets to the existing bridge structure, a method that can prove problematic with deteriorated concrete in Maine's challenging climate. The new technology includes design elements that allow the FRP strips to be bolted onto the existing structure. That method has attracted a lot of industry attention.

"The difference is that we used a mechanically fastened piece of FRP," Davids says. "There are relatively few people who have looked at that. There's a lot of interest in seeing how this works out."

There are still some challenges with the method and some questions to be answered, but Davids says the new techniques offers a lightweight, corrosion-resistant alternative that could extend the life of a bridge by 20 years and possibly much longer.

> I enjoy it and it's **important work for us to do.** We take this very seriously. It doesn't bring a lot of money into the university but we are the University of Maine. **This is the kind of work a state university needs to do."** Dr. Bill Davids

WORK ON the FRP technology put students through a full range of project research and development. Although the materials used to create the FRP retrofit pieces are readily available, UMaine researchers had to design the right combination of materials to create a product that was strong enough for the mechanical fastening technique, working closely with a Maine contractor who then manufactured the FRP sheets.

There were no industry guidelines for mechanically fastened FRPs, so the new project underwent extensive testing, under real-life conditions and in the Advanced Structures and Composites Center, where they tested 12-foot-long concrete beams reinforced with the FRP strips under static load and fatigue load conditions.

That UMaine project, as well as the many others, exposed students to the kinds of real engineering problems that they will be asked to solve in the workplace, Davids says, and it prepares them for their careers as engineers.

The high placement rate for civil engineer graduates indicates that that preparation is appreciated in the industry.

"Our students are prepared for this," he says. "They are going out there and they are finding jobs in Maine and outside Maine."

The work with the bridge safety project also puts students in regular contact with working engineers, many of whom are UMaine alumni. Davids notes that UMaine provides the only civil engineering degree program in the state, and more than 60 percent of the graduates take their first job in Maine.

There's a great demand for UMaine engineers, he says, and those graduates "don't forget where they came from."

There is a wide network of UMaine civil engineers who provide the civil engineering faculty with information on the industry, both informally and in regular on-campus meetings, and occasionally, as guest lecturers.

DAVIDS WAS the UMaine valedictorian in 1989. He also received a master's degree in civil engineering from UMaine in 1991, and a Ph.D. in civil and structural engineering from the University of Washington in 1998. That year, Davids joined the UMaine College of Engineering faculty. He has chaired the Department of Civil and Environmental Engineering since 2012.

His many national, state and UMaine awards include the 2012 L.J. Markwardt Wood Engineering Award from the Forest Products Society and the George Marra Award from the Society of Wood Science and Technology.

In 2010, he was named the Civil Engineer of the Year by the Maine chapter of the American Society of Civil Engineers.

Davids also is UMaine's 2015 Distinguished Maine Professor, cited as a gifted, committed educator and outstanding researcher with a strong record of public service. His popular and rigorous upper-level undergraduate and graduate courses produce well-prepared structural engineers who truly understand how engineers design.

As a member of Maine's only civil engineering degree program, Davids says he feels a great responsibility to do the kind of work he does with MDOT on bridge safety, as well as public service research in other areas. It is an important part of the university's mission.

"I enjoy it and it's important work for us to do," he says. "We take this very seriously. It doesn't bring a lot of money into the university, but we are the University of Maine. This is the kind of work a state university needs to do." ■

Dr. Habib Dagher

White House Change Champion

THE LIGHTWEIGHT, corrosion-resistant Composite Arch Bridge System is for short- to medium-span bridge construction. It uses FRP composite arch tubes that start out flat, packed in a bag. The tubes are inflated and bent to any curvature over a mold and infused with a resin. The tubes cure in three hours, resulting in a curved hollow arch twice as strong as steel, which is then filled with concrete on site. Prior to placing the concrete, a 60-foot span arch can be lifted into place by two people. The FRP tubes provide exoskeleton reinforcement, formwork and a protective layer for the concrete. The patented bridge technology saves both time and money, reduces the carbon footprint of the bridge by 30 percent compared to current technologies, and provides for up to a 100-year life.

DR. HABIB DAGHER, founding director of the University of Maine Advanced Structures and Composites Center, was recognized as a 2015 White House Transportation Champion of Change on Oct. 13.

The White House Champions of Change event in Washington, D.C., focused on "Innovators in Transportation for the Future," and was hosted by the U.S. Department of Transportation and the White House Office of Public Engagement. U.S. Secretary of Transportation Anthony Foxx recognized 11 of the nation's top innovators for their exemplary leadership in advancing and leading change that benefits the nation's transportation system.

Dagher is the primary inventor of the award-winning Composite Arch Bridge System known as Bridge-in-a-Backpack™. His history of innovation includes being named on 24 patents, with eight more pending.

The American Society of Civil Engineers nominated Dagher as a White House Transportation Champion of Change, noting that the composite arch bridge technology developed at UMaine is "a wonderful example of knowledge transfer to the private sector and a valuable innovation to the transportation industry." ■

> The University of Maine continues to prove that it is a **first-class research institution,** and Dr. Dagher and his team at the Composites Center are **exemplary of that excellence."**
>
> Sens. Susan Collins and Angus King

Paper's **strength**

Maine's mills part of an evolving global market

DESPITE THE highly publicized closures of paper mills in Maine, the paper industry worldwide is still robust — and it's changing, according to industry leaders such as Marco L'Italien.

And Maine is part of that global industry.

As evidence of industry vitality, L'Italien, a vice president at International Grand Investment Corp. (IGIC), points to the recent creation of St. Croix Tissue at his company's Woodland Pulp mill in Baileyville, Maine — a $120 million investment that will add tissue manufacturing to the facility's operations.

The project, which will add two tissue machines, will be a boon to the town and the region, revitalizing the mill and adding an estimated 80 jobs there, along with as many as 200 jobs in other related operations.

The company, which employs upward of 20 other UMaine engineering alumni, expects to begin producing tissue early in 2016.

"The industry is a mixed bag of stories right now," says L'Italien. "We've lost some production in Maine. In Lincoln, 200 jobs were eliminated. The Bucksport mill is closed, and the Millinocket and East Millinocket operations are gone. There's a lot of that. But we're still getting new production, like what we're doing. It's a challenging global market, but it is a very mature industry and it's evolving. You need to look at the whole industry to get the right perspective on it."

> "It's a challenging global market, but it is a **very mature industry and it's evolving.** You need to look at the whole industry to get the right perspective on it." Marco L'Italien

L'ITALIEN, A 1986 graduate of the University of Maine with a degree in chemical engineering, has spent his career in papermaking in the state, joining IGIC last year from Lincoln Pulp and Paper, where he'd been the mill manager. He worked in Lincoln's integrated pulp and tissue operations, giving him expertise in both the pulp and tissue operations. That drew the interest of IGIC.

L'Italien is currently working to build St. Croix Tissue's management team that will oversee the tissue operations.

"I'm extremely fortunate to have this opportunity, and I keep pinching myself to make sure it's not a dream," he says. "It's a challenging job.

"The work is intense, and the days are long and hard. But it is very gratifying to be involved in making the significant changes we're doing here. And it's a lot of fun."

A Maine native, L'Italien grew up in Lincoln in a blue-collar family and looked to UMaine as the logical choice, close to home. As a first-generation college student, he says his father was concerned that he would graduate and not be able to find a job, a fate that was a reality for some college graduates in the '80s.

"My father was skeptical about me going to college, so it was important

Marco L'Italien

> There is a lot of dialogue in this industry. **We're working globally now,** and over the past 30 years, I've had a lot of interaction with people in **England, Finland, Ireland, India, China.** There's a lot more collaboration with diversified groups. If you're working in this industry, **you're going to be working as part of a team."**
>
> Marco L'Italien

to me to get a degree in something where I could get work," he says. "The placement rate for chemical engineering was very high, so that was some comfort, and I'd always been good in math and science. I was paying my own way through school and in my junior year, I got the Pulp & Paper Foundation scholarship, which was a big help."

L'Italien's leadership includes his work with his alma mater, where he has been active in the UMaine Pulp & Paper Foundation, serving for a number of years on the foundation's scholarship committee and now on its executive committee.

The first of its kind in the nation, the Pulp & Paper Foundation supports both the university and the chemical engineering students through a co-op program with as many as 70 paper industry corporations nationwide. It also provides financial support through 90 scholarships each year.

"The Pulp & Paper Foundation scholarship has been a really important program over the years," L'Italien says. "The finances are tough and the scholarship can help students when they need it the most. That's how it was when I received the scholarship, and I felt that it was important to give back."

ALTHOUGH HE knew that chemical engineering was a demanding program, L'Italien says he didn't realize the real value of earning a UMaine degree until he had completed the program and was ready to join the workforce. Industry recruiters were always impressed when they learned he was a UMaine graduate, which gave him a leg up in his interviews.

"I'd always get an extra check mark for that. It was clear to me then that Maine was a really strong school," he says.

It is important for the university to continue to set high standards for its students, to maintain the rigorous program and adapt it to meet the expectations of the evolving, global paper industry so that graduates are not only talented engineers with strong, analytical problem-solving skills, but also engineers who are exposed to different cultures as part of their education.

L'Italien says he also was encouraged by the efforts of the Pulp & Paper Foundation and other UMaine initiatives to attract more young women to careers in engineering — and the chemical engineer/paper program, in particular. Those programs work to reach girls in schools — elementary to high schools — to develop an interest and ability in science and math that can open opportunities in science and engineering fields for them.

In addition to providing him with a solid engineering background and specialized skills in pulp and paper, L'Italien says UMaine prepared him to work with diverse groups of people.

"There is a lot of dialogue in this industry," he says. "We're working globally now and over the past 30 years, I've had a lot of interaction with people in England, Finland, Ireland, India, China. There's a lot more collaboration with diversified groups.

"If you're working in this industry, you're going to be working as part of a team. The more effective you can be at that, the more successful you will be," he says. ■

$3.7M
from Department of Energy

THE UNIVERSITY OF MAINE-led New England Aqua Ventus I offshore wind project will be awarded an additional $3.7 million from the U.S. Department of Energy (DOE), subject to appropriations, to complete engineering, planning and financing for the project. "The additional funding is a result of our excellent progress over the last year, demonstrating the cost-effectiveness of UMaine's VolturnUS floating concrete hull technology," says Dr. Habib Dagher, principal investigator for the project. The funding, announced by Sens. Susan Collins and Angus King Nov. 16, is in addition to $3 million awarded by DOE in September 2014 to advance the design to deployment readiness. In May 2014, New England/Maine Aqua Ventus I was selected as an alternate by DOE for the next phase of its Advanced Technology Demonstration Program, which started with nearly 70 projects. At that time, DOE noted that Maine's VolturnUS technology, which was successfully demonstrated on a pilot scale near Castine, Maine was highly favorable and innovative. ■

New England/Maine Aqua Ventus is **part of the DOE's offshore wind portfolio** under the Offshore Wind Advanced Technology Demonstration Projects, along with projects in New Jersey, Virginia, Oregon and Ohio.

For love of R&D

Success in engineering services leads to product development

WHEN University of Maine mechanical engineering graduate Ryan Beaumont was ready to enter the workforce, he wanted to pursue opportunities that fit his wide-ranging interests in engineering and computing, as well as research and development.

Using the connections, education and experience gained at UMaine, Beaumont started his own engineering services provider company.

Beaumont, who received his bachelor's in mechanical engineering in 2004 and master's in 2007, worked in the paper industry for three years. In 2009, he started R.M. Beaumont Corp. (RBC) to support the growing renewable energy industry in Maine. Within four years, RBC had seven employees.

Today, the Brunswick-based company hires mechanical and systems engineers, providing engineering services to firms around the state. And it recently started offering commercialization support.

What fascinates Beaumont most is R&D work.

"That's where I personally like investing my time. I like the challenge," he says. "R&D presents fun problems for engineers to tackle, starting from nothing. It keeps me from being bored, which is probably the same reason I would avoid taking a job at a desk somewhere."

BEAUMONT'S INTEREST in engineering started at a young age; his father was a mechanical engineer in the paper industry. Following in his footsteps, Beaumont attended UMaine on a pulp and paper scholarship.

Unsure if he wanted to work for a large engineering firm, he began subcontracting for contractors he'd met while in research labs on campus.

"That's how I was able to grow to the point where, at the end of grad school, I was able to get enough work on the side to support myself, so I decided to just do this and see what happens," he says of starting his business.

RBC's first focus was a three-year

Ryan Beaumont

project in the paper industry supporting mills in Maine and North America. When the contract was completed, Beaumont was introduced to an opportunity in renewable energy by Dr. Michael Peterson, one of his former mechanical engineering professors.

Peterson was approached by an engineer from Ocean Renewable Power Co. (ORPC) in Portland who was looking for someone with the right skill set to develop the company's technology, including its experimental turbines, Beaumont says.

Peterson thought Beaumont would be an ideal candidate.

"I met with ORPC and it led to a four-year relationship that grew my business from just a company of me to seven employees," Beaumont says.

"We've always been able to hire, and the university has been a big part of that equation," he says, "providing access to some of the best students, and the ones that want to do cutting-edge, innovative work. We're able to find them and say, 'Hey, come work for us.'"

FROM 2010 to 2014, RBC worked in tidal and offshore wind energy in Maine, again providing engineering services supporting those two developing sectors, he says.

Beaumont estimates RBC has worked with about 50 Maine-based companies in a variety of sectors. In the paper industry, the firm has worked with mills in Old Town, Jay, Bucksport and Baileyville. On the manufacturing side, RBC has worked with companies that include General Electric in Bangor, Kenway Corp. in Augusta and Lyman Morse in Thomaston.

For research and development, the company has worked with research institutions, including UMaine and Maine Maritime Academy.

Beaumont credits word of mouth as being RBC's strongest means of making connections with other local Maine businesses.

"You see that in Maine more than other places. Maine businesses really want to do business with other Maine businesses. I think we try to take advantage of that to the greatest extent possible. That's one of our strengths," he says.

ABOUT TWO years ago, Beaumont was contacted by Dr. Vince Caccese, who also was one of his former mechanical engineering professors. He introduced Beaumont to an opportunity that has led to an RBC-spin-off to commercialize mobility products.

That opportunity involved becoming a commercialization partner for the Afari™, a stylized aid designed to aid upright mobility and enable people who seek balance, stability and/or weight-bearing assistance to participate in outdoor jogging, running and distance walking.

Afari was conceptualized by UMaine professors Stephen Gilson and Liz DePoy, and engineered by Caccese. Drs. Gilson and DePoy began the project with two seed grants from the Maine Technology Institute, and then sought collaboration with Caccese and Beaumont to form Mobility Technologies and develop the product.

As the chief operating officer of Mobility Technologies, Beaumont directs the vice president of sales and vice president of operations, and also is responsible for compliance with codes and standards.

Afari was the first consumer products venture for RBC. Since then, the firm has engaged in other ventures, including being involved with a product in the paper industry.

RBC worked closely with a fabrication partner to help with the redesign of a piece of heavy equipment workers are required to lift many times a day. The new design, which is patented by the fabrication partner, is lighter and reduces the risk of injury, Beaumont says.

AS HIS business evolves, Beaumont has been working closely with the Maine Center for Entrepreneurial Development (MCED).

"We're a services company, but we have to build this team around a products company," he says. "It's not completely in our wheelhouse right now, but there are resources out there to make that happen; MCED has been very helpful so far."

Other UMaine R&D projects Beaumont has been involved with include VolturnUS 1:8, the nation's first grid-connected offshore wind turbine built by UMaine and industry partners. RBC was the instrumentation team leader and worked with employees at UMaine's Advanced Structures and Composites Center, as well as external contractors.

RBC also has worked with Peterson to help establish his Racing Surfaces Testing Laboratory. The firm helped to prove test protocols at a small scale for horse racing tracks, and when the lab was ready to upgrade, it hired staff and moved to its permanent location, Beaumont says.

"That's sort of what we do," he says. "We're traditionally involved in the prototype and development phase, and when it's ready to scale up, we move on — with the exception of Afari.

"Looking toward the future and seeing where the business could go, we are interested in having a stake in some of these projects through to commercialization."

While at UMaine, Beaumont worked closely with Peterson and Caccese. He credits Caccese with teaching him how to run a business and help make industry connections. Peterson, he says, emerged as a mentor during graduate school when he was trying to strategize a business plan. Peterson suggested Beaumont consider renewable energy.

"I don't think I would have met the network of people that allowed me to start my business without being here and being in the research labs," Beaumont says. "That was very key. And then maintaining ongoing connections here with the professors, even more opportunities come up."

Even though Beaumont has 15 years of technical experience that has grown throughout his career, he says he would like to develop more business skills.

"For me personally, it's not so difficult to run a services company, but now with this products venture, I really need to develop my own skills to be able to manage or develop a team that could help that venture," he says.

"You don't know what you don't know, they say."

He says he's working on developing those skills now, and it will be a professional priority for the next three to four years.

"And beyond that, I'd like to retire early," says Beaumont, who lives in Topsham with his wife and 2-year-old.

Beaumont's wife, who also is a UMaine engineering graduate, works for Bath Iron Works. The pair met during undergraduate school.

"We've thought about moving at times when business was slow and she was concerned about her job, but if we can work in this state, we'll stay in this state," he says. ■

> "You see that in Maine more than other places. **Maine businesses really want to do business with other Maine businesses.** That's one of our strengths." Ryan Beaumont

CONCEPT TO COMMERCIALIZATION

Afari™ was conceptualized by University of Maine professors Stephen Gilson and Liz DePoy, and engineered by professor Vince Caccese — all of whom are named co-inventors on the patent. Gilson and DePoy began the project with two seed grants from the Maine Technology Institute, then collaborated with Caccese to make the assistive jogger a reality. Ryan Beaumont of RBC contributed his biomechanics experience in product development and manufacturing as the commercialization partner. Together, they launched Mobility Technologies to bring Afari to market. The team is working with a Maine-based fabricator for development of fixtures and manufacturing methods. Afari is an aid for upright mobility, enabling persons who need or want balance, stability and/or weight-bearing assistance to participate in outdoor jogging, running and distance walking activity in diverse terrain.

Worldview

Bangor-based company a recognized leader in digital mapping

CLAIRE KIEDROWSKI has the world at her fingertips. Kiedrowski is president of KAPPA Mapping in Bangor, Maine, where she and a small staff view that world from above. Keen to adapt to the rapidly changing technologies that drive the aerial mapping industry, she and her team have earned a reputation for delivering creative solutions to their clients' mapping challenges.

> As engineers, that's what we do. We want to **come up with new ways to creatively use the software to meet or exceed the client's needs.**" Claire Kiedrowski

KAPPA's message to its clients: "Let us help you observe, record and analyze the world around you."

To do that, they rely on techniques and technology that are not part of everyday conversation: photogrammetry (making measurements from photographs); and orthophotography (aerial photography that is geometrically corrected or "orthorectified" to eliminate distortions and allow accurate measurements on the resulting maps), LIDAR (light detection and ranging) that uses lasers to model elevations and topography, as well as geographic information systems (GIS). These are all tools that the KAPPA Mapping team uses to develop engineering-quality mapping.

And the technology within the technology is a moving target.

"The industry is in constant transition," says Kiedrowski, a 1990 UMaine graduate in surveying engineering. "The technology is constantly changing, and there are always new ways to use, acquire and process data. Keeping up with it all is exciting — and exhausting."

Keeping up with the technology earned Kiedrowski a shout-out in 2013 from *Mainebiz* magazine, which tapped her as a Woman to Watch in the state's technology sector. KAPPA earned recognition at the annual Management Association of Private Professional Surveyors (MAPPS) meetings and drew the attention of clients for some high-visibility projects in Maine and beyond in recent years.

FROM THE base mapping for the Penobscot Narrows Bridge and Hollywood Slots, vernal pool and wetland mapping for the town of Bar Harbor, airport obstruction mapping in Connecticut and Maine, and mapping for municipal planning in Anchorage, Alaska, to the famed Beth Page Black golf course and Baxter State Park, Kiedrowski's crew at KAPPA Mapping has found different ways to create 21st-century maps that help its clients solve complex issues, monitor important resources and better manage their communities.

A few years ago, KAPPA Mapping worked with the Maine Department of Marine Resources (DMR) to pinpoint and map more than 65,000 lobster buoys along the coast of Maine. The maps will help DMR scientists identify potential points of entanglement in fishing gear by migrating whales, particularly the endangered right whale.

UMaine alumni at KAPPA Mapping and Shyka, Sheppard & Garster Land Surveyors include, front row, left to right, Glenn Griswold, PLS for SSG; Claire Kiedrowski, CP and president of KAPPA; Rob Garster, PLS and treasurer of SSG and KAPPA; second row, left to right, Andy Brown, LSIT for SSG; Stevenson "Shep" Sheppard, PLS, president of SSG and vice president of KAPPA; and Bruce Berry, CP and production supervisor of KAPPA.

"As engineers, that's what we want to do. We want to come up with new ways to creatively use the software to meet or exceed the client's needs," Kiedrowski says. "There's nothing off the shelf here; every project is unique, different. That's what makes it fun."

Robert Garster, who occupies an adjacent State Street office as a principal with Shyka, Sheppard & Garster Land Surveyors, and Stevenson Sheppard are both partners in KAPPA Mapping. Like Claire, they are both UMaine alums, as are a number of the people who work at KAPPA.

Kiedrowski met Garster, her husband, at the University of Maine. He was in the civil engineering program and took surveying courses. The pair married right after college and moved to Alabama, where Kiedrowski worked for Intergraph Corp.

In 1993, they returned to Maine to work for James W. Sewall Co.

Kiedrowski worked for a few companies in the Bangor area, always in surveying- and mapping-related fields. When one of her clients wanted to sell his established mapping business, Kiedrowski and a partner, Lori Phillips, bought it and chose KAPPA as an acronym for Kiedrowski and Phillips Photogrammetry Associates.

The word also has a connection to aerial photography. Omega, phi and kappa are used as references to the three variables — roll, pitch and yaw — that mappers have to adjust for in aerial photography.

"Kappa is also known as the 'crab angle,' but 'Crab Angle Mapping' didn't sound good, so we went with KAPPA," she says. "It's an inside joke to mappers."

IN THE past 12 years, the company has made a name for itself in the field. Kiedrowski says she hopes to continue to draw clients, and repeat clients who understand and appreciate what KAPPA Mapping can provide.

"My goal is to be the first choice for engineering firms," she says. "We won't be the least expensive, but we'll get it right the first time and we can deliver it so they can drop it right into their CAD system. We know what they need, and we can save them time and money."

KAPPA Mapping has found different ways to create 21st-century maps that help its clients **solve complex issues, monitor important resources and better manage their communities.**

Although Kiedrowski relies on aerial photography, she is rarely in the sky. KAPPA does not own a plane or high-tech photography equipment. That would be too expensive for a small company such as KAPPA, so they rent time on the aircraft and, based on the needs of each client, determine which equipment to use and how to use it — and how high the plane should fly. Kiedrowski says she has become adept at asking the right questions of her clients to determine which equipment and technology will meet their needs.

It is at KAPPA's State Street office where they take the data from the aerial shoot and work their technological magic to create a wide variety of detailed maps for their clients use in various purposes, such as planning for a new school design, a design of a toll highway, university infrastructure upgrades, airport obstructions, wind farm designs or impacts of sea level rise.

Often, the crew at KAPPA Mapping works as a subcontractor for a larger company. Currently, they are working as part of a team on the Maine Geolibrary Orthoimagery Program, a five-year effort designed to collect new orthoimagery of Maine and make that information available to local participating municipalities. The information can then be used for a number of purposes — from land use assessment to emergency response and transportation planning.

THE ATMOSPHERE at KAPPA Mapping is fairly informal. On some projects, they collaborate, working together on different sections of larger projects or solving different parts of a problem. Other times, team members are on their own.

Kiedrowski talks about the team at KAPPA Mapping the way some people talk about a jazz combo, where everyone gets a chance to step up and take a solo.

"We're truly an ensemble here," she says. "We all have an opportunity to step forward, to take the lead; and sometimes, we step back and support. Mapping is our passion and we want to work with people who are excited about what they do.

"I like people who understand that change is inevitable and who like learning. You're going to be a life-long learner if you're here at KAPPA."

That collegiality harkens back to her days at the university. Kiedrowski recalls that there was a close collaboration among the students in the surveying engineering program and part of the training they received was learning how to work as a team. Kiedrowski often speaks to UMaine students, telling them to "look around. These are the people you'll be working with in the future."

"There was a 'roll up your sleeves and get it done' attitude then," she says. "You relied on your colleagues and they relied on you."

That was especially true in the days when GPS was new technology and the one satellite was only accessible for observations at certain times, often in the middle of the night. They had to move the equipment — known then as the "elephant" — to a field, then team up so that whoever was going out there didn't have to take it out there alone.

"There was a lot of excitement about the technology at that time among the students and the professors," Kiedrowski says. "We knew we were on the leading edge of technology. We knew what was going on. And if we didn't, we knew we could learn it."

She says she felt prepared to take on the challenges of the industry when she left the university, but, more important, she was prepared to adapt to the changes that were taking place — and continue to be a part of her career.

"The university gave me a wonderful foundation to pursue this discipline. It's respected around the entire U.S. and by people around the world. And, for a woman, that sometimes provided me with an extra step to get a foothold,'" she says.

"But learning is nonstop. The university teaches you how to learn and how not to be afraid of technology. What the university taught me was how to learn and how to retain what I learned." ■

Aug. 24, 2013, New Hampshire coast. Piscataqua Regional Estuaries Program wanted color imagery to help monitor eelgrass beds. This image shows the borders between land, sea and marsh, and highlights developed versus nondeveloped areas.

May 2015, Hampden, Maine. This image represents LiDAR data that was processed to bare earth so that 1-foot contours can be generated. It is shaded by elevation: light colors represent higher elevations; darker colors, lower elevations. Interstate 95 is in the top left of the image, with a road crossing over it. A stream is in the lower right corner. The large white polygon in the center is a landfill.

Images courtesy of KAPPA Mapping

STEM partners

Statewide initiatives build a community of educators to enhance student learning and engagement

NOW IN its sixth year, the Maine Physical Science Partnership (MainePSP), as well as its companion program, the Maine Elementary Science Partnership (MaineESP), both based at the University of Maine, are being recognized for their success. Their work in promoting research-guided science instruction to students, from early childhood through ninth grade, impacted the STEM learning experience of more than 20,000 children statewide in the past year.

In October, the Maine Science Teachers Association awarded the MaineESP the 2015 Philip Marcoux Award. The award recognizes a science education professional or partnership that makes continuous and enduring contributions to science education; demonstrates capacity for creating and implementing successful science education-related activities; shows creative approaches to improving student achievement in science; and makes a permanent contribution to the Maine Science Teachers Association by integrating with national initiatives, promoting the science education profession, or providing training and resources to other science education professionals.

Earlier this summer, the National Science Foundation awarded the MainePSP a supplemental grant of more than $2 million, a follow-up award to the $12.3 million grant to the university's Maine Center for Research in STEM Education (RiSE) — funding which was used to create the partnership. The new funding will be used to improve science and mathematics teacher recruitment, preparation and retention in Maine by involving experienced classroom teachers in preservice teacher preparation in order to bridge the gap between theory and practice.

"Both the MainePSP and the MaineESP support teachers to bring high-quality instructional resources and research-supported pedagogy to their science classes, increasing student learning and engagement. These two programs also give Maine districts an unprecedented opportunity to build a coherent, vertically aligned science curriculum for their students, as part of a community with similar goals," says Dr. Susan McKay, principal investigator of the MainePSP and MaineESP, UMaine professor of physics and director of the RiSE Center.

> "MainePSP materials engage students in **solving engineering problems** that provide **real-world context and improved retention** for science and math concepts." Mickie Flores

THE RiSE Center has established innovative partnerships between university faculty and preK–12 science teachers, creating a diverse learning community of educators discussing and demonstrating best practices in science education. Initially, the MainePSP program focused on students in grades six through nine, a time when many students lose interest in science. It also focused on improving teaching and learning in science, mathematics and engineering at the University of Maine.

The Schoodic Institute, the Maine Mathematics and Science Alliance, and the Institute for Broadening Participation also have been part of this partnership.

The program has used a collaborative task force approach, with middle school and high school teachers working with UMaine faculty and graduate students to review potential instructional materials informed by the latest science education research.

The research drives innovations in the classroom that, in turn, generate new research that drives additional innovations.

The partnership has selected a common set of instructional resources recommended by the task force, along with materials for each science unit. That provides a more interactive, hands-on science learning experience that results in more engagement for both the student and the teacher.

In the past year, the Maine Physical Science and Elementary Science Partnerships **impacted the STEM learning of more than 20,000 children statewide.**

THE EARLY successes of the MainePSP approach drew interest among elementary school teachers and curriculum coordinators, who asked for a similar type of support for science education in the lower grades. Elementary teachers generally teach multiple subjects and their classroom needs were different. So, backed by a Maine Department of Education grant, RiSE created the MaineESP. The new partnership adapted the "train-the-trainer" model to leverage the innovative model of teacher leadership to share professional development in school districts across the state.

The MaineESP currently works with teachers in more than 100 partner schools in more than 50 Maine school districts. Science resource partners are selected from each of the partnering schools to join a statewide professional learning community with STEM and STEM education faculty from the university. Partners receive preparation and support to lead study groups in their schools about research-supported and innovative instructional strategies for science teaching.

Now in its third year, the program provides ongoing professional development for more than 1,000 teachers statewide.

"The development of practical ways to extend the reach of UMaine to teachers throughout the state is a major accomplishment of our partnerships. Using science resource partners, well-prepared through high-quality, ongoing professional development, as a link between RiSE and their districts is a strategy that is invaluable in a rural state such as ours. We are studying this approach closely to understand how to continue improving its effectiveness," McKay says.

Although it is still early to provide definitive statistics on the program's success, early indications show that MainePSP students have scored higher on state standardized tests than their statewide counterparts, and the number of MainePSP students that have not met state standards is shrinking. Surveys also indicate that those successes have affected student and teacher attitudes toward the science classroom. More students have indicated that they consider themselves good or very good science students.

Teachers have said that they have strengthened their science knowledge as a result of participating in the partnership, and the majority has indicated that they consider themselves better science teachers. Among their comments:

Mickie Flores, the 2015 Hancock County Teacher of the Year and one of eight semifinalists for Maine State Teacher of the Year, teaches sixth and eighth grade at the Deer Isle-Stonington Elementary School. **THE ADVANTAGE OF NETWORKING:** My desire was for my students and me to become part of a larger network because of our geographic isolation, and also to share in the most current STEM education practices. This is the third year I have employed Project-based Inquiry Science (PBIS) in my eighth-grade classroom and the second year with the Science Education for Public Understanding Project (SEPUP) in my sixth-grade classroom. Not only are the resources thoroughly engaging, we also have appreciated visits by the UMaine Master of Science in Teaching students, joining us as teaching partners. **ENGINEERING SOLUTIONS:** MainePSP materials engage students in solving engineering problems that provide real-world context and improved retention for science and math concepts. MainePSP keeps me current as an educator and provides a phenomenal network for my classroom and me. I'm not on an educational island anymore.

Bill McWeeny uses the SEPUP: Earth Science materials with his fifth- and sixth-grade classes at the Adams School in Castine. He spreads the program over two years, adding other science curricula, including oceanography, botany and Newtonian physics, among others. **INSPIRATION:** I find working with colleagues inspiring. I like to bounce ideas off people, compare strategies and hear about others' successes. The MainePSP was a no-brainer for me when I heard about all the meetings that allowed these kinds of exchanges. As a bonus, we also received wonderful training in content area. Absolutely a win-win situation. The MainePSP is the best professional development I have taken part in in 20 years. **IMPROVING TEACHING:** I think college professors and outside researchers working with teachers to improve classroom experiences is a great mix. The MainePSP atmosphere is a wide variety of professionals working together to improve things. I think it is the best way to make progress in improving teacher skills. In addition to having access to great activity-based curricula, every month I get new ideas from talking with the colleagues at the MainePSP and now the MaineESP. This program inspires me to be a better teacher and gives me the confidence that I can.

Lori Matthews teaches eighth-grade physical science at the Reeds Brook Middle School in Hampden. **ENGAGED LEARNING:** As a biology-based major in college who ended up teaching physical science, I was always open both to better understanding of the content, as well as to improving instruction of topics, such as force and motion, energy and chemistry. The other strength that I could see from this grant was that we would be working with university professors who were interested in this same topic. I have been teaching an engineering/design unit, a force and motion unit, a chemistry unit and an energy unit with my eighth-grade classes for several years now. The students have asked and answered the most amazing questions. They are engaged in activities that all tie together toward a common challenge, and they have design and engineering practices woven throughout the curriculum. **MAKING A DIFFERENCE:** We should never underestimate the power of a group of dedicated teachers who want to do their best for their students. It doesn't matter that we are from rural Maine, that we might be the only science teacher in our school or that we are teaching four other subjects besides science. We can make a difference in how science is taught and learned in Maine, especially if we are provided with a great platform like the MainePSP or MaineESP. The MainePSP has been a tremendous gift for my students and me. **THE FUTURE:** By having a common curriculum in our area of the state, students have the benefit of the research and data that I have been able to access from the UMaine team that has impacted my teaching. A strong network of teachers in a rural area through technology has made me and my students feel the strength of a partnership. I often share with them what their counterparts are learning and discovering in other classrooms throughout the partnership as a way of extending their borders. The strong leadership in the MainePSP has also supplied opportunities for teacher leadership that are not always available in rural districts. This is important for the future of science teaching and learning in Maine.

Melissa Lewis teaches seventh-grade science at J.A. Leonard Middle School in Old Town. **TALKING STEM:** As a new teacher in 2012, I began attending collaborative meetings with the MainePSP because I was interested in having conversations with other science teachers about the way they teach science. After the first meeting, I felt that I had found a community of science educators that I could relate to and that I felt were going to lead a change in science education in our state. In my second year of teaching (2012–13), I piloted the SEPUP: Issues and Earth Science program in my seventh-grade classroom. I used these materials for two years in my classroom and students love this program. **CONNECTED:** The classroom culture has changed, with increased focus on empowering students to take ownership of their learning. The program connects them to real-world issues in science and society, so they feel more connected. I am better at teaching the content, encouraging my students to use scientific practices and assessing their learning so they can expand their thinking, and feel more confident as scientists and decision makers. ■

Their turn

Three engineering majors reflect on their student experience and their alumni role models — their parents

UNIVERSITY OF MAINE College of Engineering students take inspiration from the countless number of alumni who are leaders in their fields and help define tomorrow in Maine — and beyond.

For at least three UMaine engineering students, those alumni role models are their parents.

Kevin Conroy of Falmouth, Maine is a senior in electrical engineering, with a concentration in power systems. Nicholas L'Italien of Enfield, Maine is a senior in chemical engineering, and Ryan Manning of Hampden, Maine is in his second year as an electrical engineering major.

"I come from a tried and true University of Maine family," says Conroy. "Both my mother and my father (Linda and Brian Conroy) are graduates of UMaine, and my older sister also attended. My parents always had positive things to say about their UMaine experience, and their continued devotion to the college speaks volumes.

"My father attributes his success in his career to the strong foundation he received at UMaine. To top it all off, my parents met while students."

The College of Engineering is demanding, not only academically, but personally, Conroy says. "You have to be convicted in your desire to pursue this industry to not just survive, but to thrive there. The college offers courses and professors that really challenge you and take you out of your comfort zone. You'll dedicate hours to studying and projects, but ultimately, it's for your own sake."

Conroy says the College of Engineering, one of UMaine's Signature Areas of Excellence, launches "competent engineers, prepared to hold their own in a difficult field."

"While the journey is tough, it's incredibly rewarding," says Conroy, who has accepted a position as a power system engineer at RLC Engineering in Hallowell, Maine, where he interned for three summers.

A decade from now, Conroy says he'll be found "making a difference in the electrical engineering community, on both small and large scales. I hope to be succeeding as an electrical engineer, developing my professional skills and serving as an asset to my company. I hope to be an informed, involved citizen, a dedicated family member and, of course, a proud alum of the University of Maine," he says.

L'Italien says his father, Marco L'Italien, "always said that college was a really fun time of his life, but he also stressed the fact that he had to work hard to be successful.

"He also loved the friends that he made and still stays in touch with many of them to this day," L'Italien says.

UMaine's engineering program has a good reputation for producing hard-working, quality engineers, L'Italien says. "I knew I wanted to come to a college where I could make the most of my education, and UMaine has done a great job at offering that to me," he says.

His coursework was essential preparation for his two co-ops at Madison Paper Industries in Madison, Maine. "Engineering classes really challenge you to think outside the box, so even if some of the material we learned in class wasn't directly applicable to the work I was doing, I still could take the problem-solving skills I learned in the classroom and apply those to my job," he says.

L'Italien plans to be a process engineer in the pulp and paper industry and, 10 years from now, "will be an integral part of the success of a manufacturing site somewhere in North America," he says.

Manning's parents, Deborah and Richard Manning, are both UMaine graduates and he grew up hearing about — and being part of — their alma mater.

"Both my father and mother told me that they enjoyed their UMaine experiences very much, and told me the importance of staying focused while there," he says.

His experience: "I always get great vibes from the atmosphere in the College of Engineering. The people you meet are very skilled and willing to help."

Take that first-year introductory electrical class — typical of the support for student success, he says.

"Andy Sheaff was very helpful every time I went into his office to ask for help, and never failed to tell me like it was if I wasn't catching on," Manning says.

"He pushed me to push myself, which made a lot of meaningful changes in the way I did my schoolwork."

Now in his third semester, Manning says he looks forward to co-op and internship opportunities on the horizon.

"By the time I graduate, I'll have some good critical thinking skills and the right mind-set to be able to successfully go out and find a career in something I love to do," he says.

"UMaine has made me a more socially conscious and hardworking person." ■

Left to right: Ryan Manning, Kevin Conroy and Nicholas L'Italien

Electronic tuning fork named one of the

TOP 10

innovations in podiatry by *Podiatry Today* magazine

Photo courtesy of O'Brien Medical

ON THE MARKET

A NEW device on the market, developed by O'Brien Medical in Orono in collaboration with the University of Maine Advanced Manufacturing Center and Dr. Bruce Segee, the Henry R. and Grace V. Butler Professor of Electrical and Computer Engineering, has the potential to improve detection of diabetic peripheral neuropathy that can lead to limb loss. ETF128, an electronic tuning fork named one of the Top 10 innovations in podiatry by *Podiatry Today* magazine, was patented last year and is now manufactured by Saunders Electronics in South Portland, Maine. The 128-Hz device offers a significant improvement over current methods used by doctors to detect diabetic peripheral neuropathy, a nervous system disorder with symptoms of pain, sensation loss and weakness in limbs. The development of ETF was made possible through a collaboration with Dr. Todd O'Brien, president and founder of O'Brien Medical, and UMaine's Advanced Manufacturing Center, an engineering support and service center dedicated to promoting manufacturing economic development in Maine.

CONCRETE LAB UPGRADE

UMAINE CIVIL engineering alums will be glad to know that, with Maine bond funds, the S.W. Cole Concrete Laboratory in the basement of Boardman Hall underwent much-needed renovations over the summer. New materials handling equipment and storage, drains with sediment traps, cabinets and benches, dust collection equipment, and a safe exit that eliminates the need for the concrete canoe to be taken out through a window were all part of the project. Work was completed just in time for the fall 2015 CIE 111 students to make and test concrete.

RISING WATERS

NEW RESEARCH finds increasing potential of compound floods along the U.S. coastline. The confluence of storm surges and heavy precipitation can bring dangerous flooding to low-lying coastal regions, including major metropolitan areas. The study of the United States coastline by a U.S.-German team of researchers found the risk of such flooding is higher on the Atlantic coast than the Pacific, and the number of these compound events has increased significantly in many major cities in the past century.

The research team was led by Thomas Wahl, a postdoctoral researcher at the University of South Florida and University of Siegen, Germany, and involved four other researchers, including Dr. Shaleen Jain, a University of Maine associate professor of civil engineering. Their findings were published in the journal *Nature Climate Change.*

With nearly 40 percent of the U.S. population residing in coastal counties, accurate estimates of compound flooding can help assess the adequacy of flood-protection infrastructure and improve engineering design. The 2013 Infrastructure Report Card issued by the American Society of Civil Engineers assigned the following grades: levees (D-), ports (C), wastewater (D), roads (D). With this daunting perspective in mind, the researchers sought to quantify the frequency of occurrence of compound flood events, as gleaned from the historical record. The goal was to develop a new approach to assess spatial patterns of the risk of compound flooding, as well as its variability over the past century, says Jain.

OUT OF THIS WORLD

CIVIL ENGINEERING doctoral student Andrew Young has been named a 2015 NASA Space Technology Research Fellow for his work on the Hypersonic Inflatable Aerodynamic Decelerator (HIAD) project at the Advanced Structures and Composites Center.

HIAD is a nose-mounted device on a spacecraft that slows the craft as it enters a planet's atmosphere. The NASA technology is intended to make it possible for a spaceship large enough to carry astronauts and heavy loads of scientific equipment to explore Mars — 34,092,627 miles from Earth — and beyond.

UMaine is assisting NASA by testing its structures in the lab, and analyzing stresses and deformations in the HIAD.

NASA annually selects a group of graduate and doctoral students to become NASA Space Technology Research Fellows. The goal is to sponsor U.S. citizen and permanent resident graduate students who show significant potential to contribute to NASA's goal of creating innovative new space technologies for the nation's science, exploration and economic future.

The yearlong fellowship includes a 10-week visiting technologist experience.

On hand for the check presentation were, left to right, Pratt & Whitney North Berwick General Manager Michael Papp, UMaine President Dr. Susan J. Hunter, Professor of Mechanical Engineering Technology Karen Horton and Dean Dana Humphrey.

PRATT & WHITNEY GIFT

THE SCHOOL of Engineering Technology has received a boost to its Mechanical Engineering Technology program with a gift of $100,000 from Pratt & Whitney's North Berwick, Maine facility. Pratt & Whitney's contribution will go to the Mechanical Engineering Technology program, with a focus on training the next generation of mechanical engineers in Maine for careers in the manufacturing industry.

"Our partnerships with the colleges and universities in and around the communities in which we operate — including the University of Maine and local community colleges and vocational schools — are a crucial part of our growth strategy," says Michael Papp, general manager, Pratt & Whitney North Berwick.

> "This funding will help prepare today's students to become **the next generation of engineers."** Michael Papp

"Pratt & Whitney is an outstanding manufacturing leader in the aircraft and aerospace industry," says Dr. Dana Humphrey, dean of the College of Engineering. "I am deeply appreciative of our relationship with Pratt & Whitney and its support of UMaine's engineering programs."

Karen Horton, professor of mechanical engineering technology, says the Pratt & Whitney gift will have an enormous impact. "It will bolster recruiting efforts for prospective students considering UMaine's College of Engineering," she says.

Pratt & Whitney is committed to developing the next generation of engineers, scientists and manufacturers by sponsoring K–12 and college-level Science, Technology, Engineering and Math (STEM) programs that spark students' interest and inspire innovation.

THE LEARNING GAME

USING A popular video game to immerse rural Maine students in computer science and math concepts is the focus of a three-year, $2 million research project being led by the University of Maine.

Dr. Bruce Segee, the Henry R. and Grace V. Butler Professor of Electrical and Computer Engineering at UMaine, is leading the project that aims to advance efforts of the National Science Foundation's Innovative Technology Experiences for Students and Teachers program to better understand and promote practices to increase the likelihood that students will gain important skills and ultimately pursue careers in science, technology, engineering or mathematics (STEM).

> "Use of computer games as a mechanism for teaching **computer science concepts** while also improving the effectiveness of the **core curriculum** is incredibly exciting." Bruce Segee

The researchers — Segee and co-principal investigators Dr. Craig Mason, a UMaine professor of education, and Stephen Foster, CEO and co-founder of ThoughtSTEM — will develop and use a curriculum for rural middle school children to engage them with programming, spatial reasoning and problem-solving skills by using Minecraft. The popular open-world game enables players to construct buildings and environments using cubes.

The project will look at using the game in school and after-school programs, including those offered by University of Maine Cooperative Extension 4-H.

2015 OUTSTANDING GRADUATING STUDENTS

ZOE BERKEY of Duncan, British Columbia, Canada, majored in civil engineering. A midfielder on the UMaine field hockey team, her America East Conference honors include All-Academic Team since 2012. For four consecutive years, Berkey also was named to the National Academic Squad of the National Field Hockey Coaches Association, Division I. In the summers of 2012 and 2013, she worked as an engineering summer student in the municipal wastewater treatment plant of North Cowichan, Duncan, British Columbia. Her plans include pursuing a career in hydrology and environmental engineering.

BENJAMIN POMEROY of Cape Elizabeth, Maine, majored in civil engineering. He holds a bachelor's degree in international development studies from McGill University, which he earned in 2011. Pomeroy served as president of the UMaine chapter of Tau Beta Pi honor society, and since 2012 has been a member of Engineers Without Borders, which took UMaine student crews to Honduras for a wastewater treatment project and a clean water initiative in Ecuador. For two years, he worked for UMaine's Advanced Structures and Composites Center, first in lab research and design related to VolturnUS, UMaine's 1:8 scale model floating wind turbine platform, and engineering design related to composite arch bridges. He also had a structural bridge design internship with HNTB Corporation in Westbrook, Maine. Pomeroy plans to pursue a career in structural bridge design in Maine.

EDWARD T. BRYAND RECOGNITION BANQUET

At the 36th annual recognition banquet on Nov. 13, the award recipients included, left to right, Senthil Vel, Ashley S. Campbell Award; Vincent M. Weaver, Early Career Teaching Award; Peter W. Hart '85, '88G, Edward T. Bryand Distinguished Engineering Award; Aileen L. Co '13, Graduate Assistant Teaching Award; Anne Levasseur, Leila C. Lowell Award; Xudong Zheng, Early Career Research Award; and Shawn Brackett '14, Graduate Assistant Teaching Award.