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ENGINEERING SOLUTIONS

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UMASS LOWELL

Empowering our soldiers through research and innovation

Dear Alumni, Colleagues and Friends,

This issue's tribute to our work with the military is fitting, as U.S. Veterans Magazine named UMass Lowell among its top veteran-friendly schools in its latest "Best of the Best" awards. The university enrolls more than 1,600 veterans, with many studying in the Francis College of Engineering. These students are served by our Veterans Services Office and our Student Veterans' Organization, which is led by a chemical engineering undergraduate highlighted in this issue. But our relationship with the military goes far beyond having veterans, guardsmen, reservists or active-duty students on campus.

A true partnership has emerged through our initiative called HEROES—Harnessing Emerging Research Opportunities to Empower Soldiers. In this co-location model, scientists and engineers from the nearby U.S. Army Natick Soldier Research, Development and Engineering Center (NSRDEC) spend time on campus, working shoulder to shoulder with our students, faculty and staff on challenges faced by the Army soldier.

Co-directed by Assoc. Prof. Ramaswamy Nagarajan of plastics engineering and NSRDEC Senior Scientific Adviser Lynne Samuelson, Ph.D., HEROES engages in basic and applied research relating to airdrop and aerial delivery, technologies for soldier protection (clothing and protective equipment) and combat feeding (meals). We highlight a number of the projects being undertaken in these areas of research that involve faculty and span across campus. In addition to taking advantage of space and labs on campus, the NSRDEC facilities in Natick, such as the Ouellette Thermal Test Facility and the Doriot Climatic Chambers, are also made available to our researchers. This issue also highlights some of our research activity sponsored by the Navy and the Air Force.

This past fall, engineering alumni Joseph Albanese '84 and Gabriel Barton '96 were inducted into the UMass Lowell Military Alumni Hall of Fame. Barton is currently a lieutenant colonel in the Army based at Fort Bragg, N.C., while Albanese is a retired captain in the Navy Civil Engineer Corps and is highlighted in this issue. We also feature five of our lecturers who have served in the armed forces (Army, Navy, Air Force and Coast Guard). In fact, two of them are academy graduates (West Point and the Coast Guard). Read on to learn more.

In closing, I would like to personally thank our current service members and veterans. We are truly indebted for your service to our country, and I look forward to continuing to serve you on campus through our educational, research and outreach programs.

As always, please feel free to contact me (Joseph_Hartman@uml.edu; 978-934-2576 or via LinkedIn) if you have a story to share or would like to partner with the college. I look forward to hearing from you.

Sincerely,

Joseph C. Hartman, Ph.D., P.E.
Dean, Francis College of Engineering
University of Massachusetts Lowell

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ON THE COVER

Researchers from UMass Lowell and the U.S. Army Natick Soldier Research, Development and Engineering Center (NSRDEC) are collaborating through the HEROES initiative. This portrait of Staff Sergeant Courtney Williams, taken by NSRDEC photographer David Kamm, shows the various research being conducted on campus.

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Shipyard workers in Portsmouth, Va., paint one of the propeller shafts on the nuclear-powered aircraft carrier USS Dwight D. Eisenhower(CVN-69). The ship has a total of four massive bronze propellers, or screws, each weighing 30 metric tons.

Researcher Investigates Surface Erosion in Naval Vessel Components

Elastomeric Coating May Help Mitigate Cavitation Damage

Cavitation poses a major challenge to Navy ships and submarines. The process occurs when water (or any other fluid) is moving very fast over a solid surface. When the pressure in the fluid drops, air and vapor bubbles are created.

"The bubbles eventually collapse and burst, and if this happens near the solid surface, the resulting intense shock wave can cause surface damage," explains mechanical engineering Asst. Prof. Alireza V. Amirkhizi. "Eventually, this process may even create pits or holes in the fast-spinning metallic components of ships and subs such as propellers, turbines and pump impellers and gears."

The Navy recently awarded Amirkhizi a three-year grant totaling more than $300,000 to find the mechanisms of premature wear, damage or failure in materials exposed to cavitation conditions.

"Our goal is to find out whether compliant coatings, such as those used in everyday applications like truck-bed linings, may be used to combat this issue," he says. "Specifically, my research team and I would like to find out what the mechanisms of damage in compliant coatings are compared to bare metal surfaces."

In this Navy water-tunnel experiment, the blades of a propeller produce cavitation bubbles.

According to Amirkhizi, elastomeric materials have surprising resilience and have been used in applications under extreme dynamic conditions. "This is the reason why we are approaching this potential nonconventional solution to a problem that previously was only approached by fabricating increasingly hard materials to resist erosion," he notes.

Amirkhizi adds: "The equipment used by the Navy operates in far more challenging environments than commercial vessels, therefore their durability and reliability are of paramount importance. There hasn't been a lot done in understanding elastomeric coatings under extreme conditions, and that makes our research quite exciting." ■

HEROES
UMass Lowell/NSRDEC

HARNESSING EMERGING RESEARCH OPPORTUNITIES TO EMPOWER SOLDIERS

University, Army Join Forces to Improve Troops' Well-Being

Parachutes that deliver critical supplies quietly and more accurately; Army uniforms that resist liquids, flame, heat and insect bites; fabric that repairs itself and meal rations that are safer and last longer in the field.

These are just some of the more than 25 collaborative projects that UMass Lowell researchers are working on as part of an innovative research and development partnership with the Army's Natick Soldier Research, Development and Engineering Center (NSRDEC). Called HEROES—Harnessing Emerging Research Opportunities to Empower Soldiers—the initiative was launched at UMass Lowell in 2013 to enhance military members' survivability and sustainability.

Lynne Samuelson, Ph.D. '90

Assoc. Prof. Ramaswamy Nagarajan, Ph.D. '00

Co-directing the effort are NSRDEC Senior Scientific Advisor Lynne Samuelson '90 and UMass Lowell plastics engineering Assoc. Prof. Ramaswamy Nagarajan '00. Both earned their Ph.D. in polymer science/plastics engineering from the university, under Profs. Sukant Tripathy and Jayant Kumar.

"HEROES is leveraging the vast intellectual assets and resources of the U.S. Army and UMass Lowell to work together to find creative and effective solutions to the challenges faced by our men and women in uniform every day around the world," says Samuelson.

Nagarajan adds: "Unlike most defense grants, where funding is provided to academic institutions based on a research proposal and there is minimal interaction during the course of the project, our students and faculty members involved in HEROES projects are interacting closely with Army Natick Soldier scientists and engineers on a weekly basis. This constant synergy and co-location has been extremely beneficial, and the model is being emulated by other research labs."

A SHARED VISION

The joint research is being conducted both at Olney Hall on North Campus and at NSRDEC labs. HEROES' 5,000-square-foot campus space includes laboratories, offices, conference rooms and a "think-tank" area where researchers work side-by-side, brainstorming new ideas. The initiative, which is under the auspices of the university's Center for Advanced Materials, is also benefiting from access to state-of-the-art equipment at UMass Lowell's $80 million Mark and Elisia Saab Emerging Technologies and Innovation Center, as well as the wide range of expertise provided by university faculty and student researchers in the fields of nanomanufacturing, plastics engineering, mechanical engineering, electrical engineering, physics and chemistry.

Meanwhile, unique Natick facilities such as the Doriot Climatic Chambers are made available to university faculty and student researchers. The chambers can simulate virtually every climate or environmental condition in the world to test the performance of humans, materials and equipment.

"HEROES is a one-of-a-kind partnership that allows our dedicated scientists and engineers to work directly with world-class UMass Lowell faculty and students, either on campus or at the center, to advance science and technology for our nation's soldiers," says NSRDEC Director Douglas A. Tamilio. "This powerful collaboration also serves as a catalyst, fostering other external partnerships with academia, industry and state and federal entities. When different organizations and creative minds come together to work on challenging problems, great things happen. I look forward to seeing what new scientific achievements, technical breakthroughs and soldier innovations will result from HEROES."

UMass Lowell Vice Provost for Research Julie Chen notes that the research and development happening in the labs will result in benefits not just to the troops in the field but also to businesses in the region. "This will be a boon to local companies as the resulting new products and technologies are commercialized," she says.

For more information about HEROES, go to www.uml.edu/Research/HEROES.

A Growing Spectrum of HEROES Research Projects

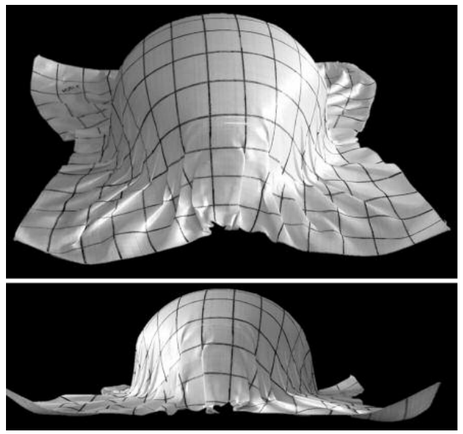
Here are some examples of projects being conducted by UMass Lowell and NSRDEC researchers through HEROES:

"MODELING THE FORMING PROCESS USED IN THE FABRICATION OF COMBAT HELMETS"

UMass Lowell: *Prof. James A. Sherwood; doctoral students Lisa M. Dangora, B.S. '12, M.S. '14, Ph.D. '15; Cynthia J. Mitchell, B.S. '12, M.S. '14, Ph.D. '15 and Kari D. White, B.S. '03, M.S. '11 (all mechanical engineering)*

NSRDEC: *Jason Parker (research mechanical engineer)*

Currently, combat helmets are manufactured from sheets of fiber-reinforced thermoplastic fabric, which are drawn into helmet shapes and processed with heat and pressure to form the final helmet shell. The project aims to predict changes in fiber orientation and ply thickness during the fabric's drawing process and their effects on pressure distribution during the final helmet-forming process. These changes in fiber direction and effective helmet thickness can have a detrimental effect on the helmet's stiffness and ballistic performance. By understanding the changes that take place in the laminate during forming, processes can be developed that minimize these deleterious effects. The UMass Lowell team is using a novel finite-element approach that incorporates a material model to track the changes and predict if and where defects may develop in the helmet. It also provides insight on ways to improve this composite manufacturing process.



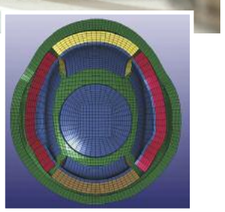
HEROES researchers are studying the changes that occur in composite laminates during the helmet-forming process. The photos show severe wrinkling in the helmet's hemisphere made from Dyneema HB80 laminate that was formed at 100° Celsius with 2,900 pascals of binder pressure.

"MULTI-MODE ENERGY ABSORPTION FOR HELMET LOW-VELOCITY IMPACT PROTECTION"

UMass Lowell: *Prof. James A. Sherwood and Lecturer Jennifer L. Gorczyca (both mechanical engineering); Assoc. Prof. Nese Orbey (chemical engineering), Patrick Drane (assistant director, UMass Lowell Baseball Research Center) and doctoral students Joshua Fortin-Smith (mechanical engineering) and Marisel De Jesus Vega (chemical engineering)*

NSRDEC: *John Fitek, M.S. '11 (mechanical engineer)*

The goal of this project is to create a multi-layer helmet liner that will improve energy dissipation in combat helmets during low-velocity impacts. The liner—which uses a combination of energy-absorbing foam and an impact-energy distribution layer—will act as a type of sandwich composite in conjunction with the helmet's outer shell. Researchers hope this novel composite-design technology will meet, or exceed, the current protection requirement against low-velocity impact. In addition, the use of a thermally stable and high-energy absorbing foams will enable the helmet to be used in a wide range of operational temperatures. The team is using the Dynamic Mechanical Analyzer in the university's Core Research Facilities to quantify the energy dissipation of foams and the LS-DYNA finite-element analysis program to investigate how combinations of materials and insert configurations influence the effective energy-absorbing ability of the new liner designs.



A finite-element model of the helmet is being used to investigate a new helmet liner system.

"DEVELOPMENT OF A STANDARD TEST TO EVALUATE FABRIC RESISTANCE TO INSECT BITES"

UMass Lowell: *Prof. James A. Sherwood, Asst. Prof. Scott Stapleton and doctoral student Christie Bielmeier (all mechanical engineering)*

NSRDEC: *Judith Sennett, Ph.D. (physical scientist)*

This research is motivated by the need to outfit soldiers in tropical climates with lightweight uniforms for thermal comfort while also providing protection from insect bites. Mosquitoes are of particular concern because they can transmit deadly diseases such as malaria, dengue fever and West Nile virus. Chemical repellants are effective, but they also pose a health risk to the soldiers. The project aims to develop a standard test method for evaluating fabric resistance to insect bites. The data from this test will guide the design of new fabrics for bite protection without the need to use toxic chemical repellants. UMass Lowell researchers are using a glass micro-surgical needle to simulate the mosquito proboscis. They also use the Dynamic Mechanical Analyzer to insert the needle into a sample fabric and measure the fabric's resistance to penetration. This test is quick and inexpensive compared to current live-mosquito "blood-feeding" experiments, which cost relatively more and are time-consuming.

Mosquitoes bite using a proboscis, a long, flexible hollow tube 50 micrometers in diameter and 2 millimeters in length. To simulate the bite, a micro-surgical needle mounted in a Dynamic Mechanical Analyzer (DMA) machine is used to puncture different types of fabrics used by the military. The DMA measures the very tiny force exerted by the needle through the fabric to test each sample's penetrability.

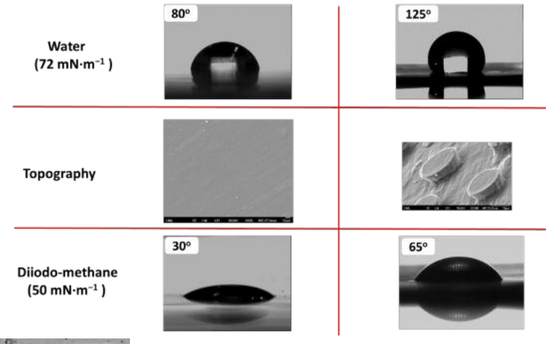
"NANOMANUFACTURING OF FUNCTIONAL SURFACE MATERIALS" AND "NANOTAILORING OF SUPEROMNIPHOBIC TEXTILE SURFACES AND FIBERS"

UMass Lowell: Graduate students Philip Mooney and Nischay Kodihalli Shivaprakash, post-doctoral researchers Artee Panwar and Jinde Zhang, Profs. Joey Mead and Carol Barry (all plastics engineering, Center for High-Rate Nanomanufacturing)

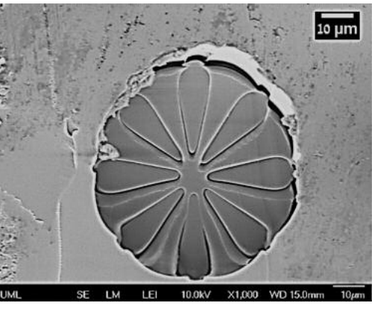
NSRDEC: Quoc Truong, B.S. '84, M.S. '99 (physical scientist)

Superomniphobic surfaces are both superhydrophobic (repel water) and superoleophobic (repel oils and low-surface-tension organic solvents). Applications of superomniphobic fibers include chemical-biological protective clothing and self-cleaning fabrics and tents (reduced soiling and cleaning cycles), whereas transparent superomniphobic surfaces include anti-graffiti surfaces, vehicle windshield, windows, protective visors and goggles, etc. The objective of the first project is to create superomniphobic surface features on a plastic substrate using a continuous high-rate, roll-to-roll process. In the process, the surface of the substrate is embossed using heat and pressure to create micro and nanostructures. Because of the nature of the continuous process, novel flexible tooling is also being developed. Extrusion processes for creating sheets from a variety of materials have been explored, and these sheets were then embossed to produce the desired micro/nanostructures.

The second project aims to develop superomniphobic coatings and fibers through nanotailoring of their surfaces and the fibers' core structure, respectively. The goal for the superomniphobic coatings is to create durable nano-size features on the surface of the fibers, where the coating does not interfere with air flow through the fabric to maintain the comfort level of the base fabric that it is applied onto. For superomniphobic fibers, the aim is to create a continuous fiber-extraction line to remove a water-soluble polymer from a bi-component fiber. The extracted fibers have a petal-like structure that gives them superomniphobic properties. Bi-component fibers from the NSRDEC labs were successfully extracted to create the desired structure.



The photos show how the contact angles of the droplets of water and di-iodo-methane (methylene iodide) increases when applied to the original plastic substrate (at left) and to the superomniphobic surface (at right), which is embossed with micro/nanostructures.



A cross-sectional scanning electron microscope view of an extracted bi-component fiber (magnified 1,000 times) showing the fiber's petal-like structure that gives it superomniphobic properties.

NSRDEC Physical Scientist Quoc Truong '84, '99 discusses with UMass Lowell postdoctoral researcher Artee Panwar a process to create superomniphobic surfaces at the university's Saab Center using the roll-to-roll machine in the background.

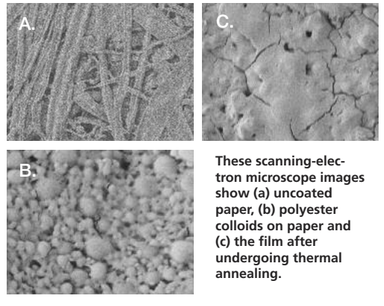
HEROES investigators are developing a completely biodegradable cardboard packaging for storing and transporting combat rations, such as the Meals, Ready-to-Eat, or MREs.

"Polymer Processing and Characterization of High-Barrier Paper Coatings for 100 Percent Biodegradable Military Ration Packaging"

UMass Lowell: Asst. Prof. Margaret Sobkowicz-Kline, doctoral student Bin Tan and undergraduate student Kyla Emery (all plastics engineering)

NSRDEC: Christopher Thellen, B.S. '02, M.S. '03, Ph.D. '10 (materials research engineer) and Jo Ann Ratto Ross, M.S. '88, Ph.D. '93 (polymer research engineer)

Keeping American soldiers strong and well-nourished in the field has always been a top priority for the U.S. military. The university team is working with the NSRDEC Food Protection and Innovative Packaging group to improve the cardboard packaging used to store and transport combat-ration systems, such as the Meals, Ready-to-Eat, or MREs. This project combines the center's expertise in performance and biodegradability testing with the university's experience in synthesis, formulation and film-processing to accelerate the development of durable and sustainable food-packaging solutions for military applications. The researchers are creating protective plastic barrier films that keep moisture out and are developing a process for coating these films on the carton. They have created aqueous latex suspensions of novel biodegradable polyesters derived from succinic acid and are exploring their applicability as coatings on paper that are impervious to water and oil. The goal is to create 100 percent biodegradable paper food packaging for MREs.



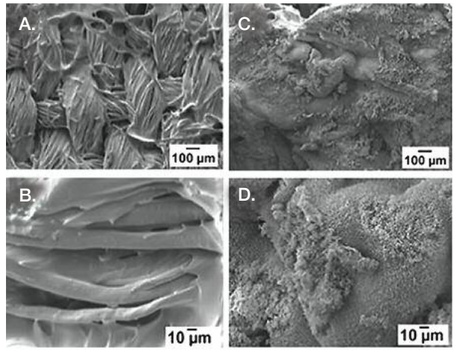
These scanning-electron microscope images show (a) uncoated paper, (b) polyester colloids on paper and (c) the film after undergoing thermal annealing.

"DEVELOPMENT OF SAFER AND EFFICIENT FLAME-RETARDANT MATERIALS"

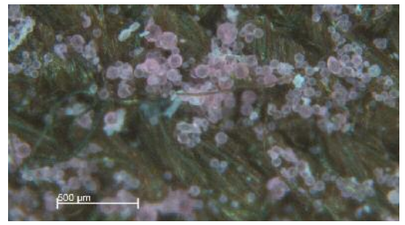
UMass Lowell: Prof. Jayant Kumar (physics), Assoc. Prof. Ramaswamy Nagarajan (plastics engineering), post-doctoral researcher Sammaiah Thota (chemistry) and graduate students Mahesh Narkhede, Weeradech Kiratitanavit, Zhiyu Xia and Shiran Yu (all plastics engineering).

NSRDEC: Ravi Mosurkal, Ph.D. (research chemist)

The need for improved, environmentally safe and cost-effective flame-retardant (FR) materials for soldier protection is becoming extremely important, due to the increased incidence of fire-related injuries and deaths from thermal weapons and blasts. Researchers are developing new approaches to environmentally benign FR materials. One of them involves sequential (layer-by-layer) deposition of cationic polysiloxane and anionic sodium polyphosphates onto the Nyco (1:1 nylon/cotton blend) fabric typically used for soldier uniforms. Polysiloxanes exhibit good thermal and oxidative stability, and soldier apparels coated with these polymers show superior thermal and FR properties compared to uncoated fabrics. In addition, new classes of environmentally safe and easy-to-process aramid-siloxane block copolymers that are inherently fire-resistant have also been developed. More recently, the team has been developing bio-inspired FR additives and coatings based on natural phenols (tannins) typically obtained from barks of trees.



Scanning-electron micrographs of fabric samples coated with polysiloxane and poly(sodium phosphate) before the vertical flame test (A) and (B), and after the flame test (C) and (D), show how the polymer coatings have become enlarged or swollen when exposed to heat. This process helps prevent damage to the fibers while conserving the fabric's weave structure.



Microcapsules—shown here sprayed on Army fabric—contain self-healing fluid that can quickly mend cuts, tears or holes in chemical-biological garments to keep the troops safe from nerve agents, viruses and bacteria.

"SELF-HEALING SHAPE MEMORY POLYMER-BASED COATINGS FOR PROTECTIVE GARMENTS"

UMass Lowell: Asst. Prof. Chris Hansen, doctoral student Jesse Hamilton and undergraduate students Jessica Ferguson and Stephen Kender (all mechanical engineering)

NSRDEC: Quoc Truong, B.S. '84, M.S. '99 (physical scientist)

Researchers are collaborating with Chelmsford-based Triton Systems, Inc., to develop self-healing coatings that contain micro-capsules of healing fluid, which can be used to mend gaps or holes in chemical-biological protective clothing. Self-healing technologies will enable cuts, tears and punctures in fabrics to quickly repair themselves. This means that the barrier qualities of Army garments will be far less apt to become compromised and will keep the soldiers isolated from their environment and any harmful agents, such as nerve gases, viruses and bacteria. The technology will eventually be incorporated into both the Joint Service Lightweight Integrated Suit Technology garment and the Joint Protective Aircrew Ensemble garment.

"SHELF-LIFE QUANTIFICATION AND ANALYSIS OF POLYPROPYLENE-FABRIC PARACHUTES: MACROSCOPIC APPROACH"

UMass Lowell: Assoc. Prof. David Willis, Asst. Prof. Alireza Amirkhizi and Prof. Christopher Niezrecki (all mechanical engineering)

NSRDEC: Kenneth Desabrais, Ph.D. (research aerospace engineer) and Marc Tardiff (mechanical engineer)

The objective of this project is to gain a fundamental understanding of how storage length and environmental conditions can change the macroscopic response of polypropylene-fabric parachutes used in military and civilian equipment airdrops. The findings can be used as a guide in modifying the storage conditions to prolong the parachute systems' useful life. The researchers want to develop a testing procedure to estimate the remaining useful life of parachutes that have been stored both short and long term.

"PARACHUTE SUSPENSION-LINE BRAID ARCHITECTURE AND THE RESULTING FLUID-STRUCTURE INTERACTION"

UMass Lowell: Prof. James A. Sherwood, Assoc. Prof. David J. Willis, post-doctoral researcher Helga Krieger and doctoral student Brad Olson, B.S. '13, M.S. '14 (all mechanical engineering)

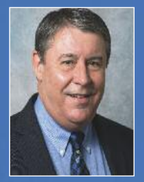
NSRDEC: Keith Bergeron, Ph.D. (senior aerospace research engineer)

This research is motivated by the vibration and lift phenomena that occur in a parachute's suspension lines as the chute is descending. These vibrations add to the system's drag, which reduces performance and contributes to unwanted noise. Studies have shown that suspension-line drag, which makes up a third of the system's total drag, can increase two to three times due to unwanted vibrations. In addition, noise from these induced vibrations may sometimes be heard from miles away and potentially compromise operational security. While paratroopers have some control of the parachute canopy for directing their trajectory, the same level of control does not exist when dropping autonomously guided cargo loads. Thus, it is important to mitigate outside forces that can alter the intended trajectory and undermine the silent entry of a jumper or cargo during insertion into the field. These vibration and lift phenomena can be traced back to the physical construction of the parachute suspension lines. Researchers are exploring the interaction of the braided-textile suspension line with the surrounding air, that is, the fluid-structure interaction, to develop a fundamental understanding of this interaction and guide the design of new braids that will minimize the aerodynamic forces and vibrations that can occur in currently used lines.

MAKING SMART WEAPONS SMARTER

Researchers Use Mathematical Modeling to Improve Performance

"Bunker busters" are designed to destroy hardened military targets such as underground command centers and missile silos as well as aircraft shelters (as shown in this bomb test conducted at Eglin Air Force Base in Florida).



Destroying an enemy target that is heavily fortified or buried deep underground requires a special type of bomb or missile. The so-called "bunker buster" delivered by aircraft is designed to penetrate steel-reinforced concrete or granite bedrock before exploding, thereby maximizing its effectiveness.

A team of researchers from the university's Structural Dynamics and Acoustic Systems Laboratory (SDASL) led by mechanical engineering Prof. Peter Avitabile recently received more than $425,000 in funding from Eglin Air Force Base (AFB) in Florida to help improve the efficiency of the bunker buster's conventional fuze, which detonates the bomb once it has penetrated deeply enough to destroy the target.

The four-year project—entitled "Nonstationary System State Identification Using Complex Polynomial Representations,"—utilizes mathematical modeling and analyses to develop the design tools.

"Current missile-penetration strategies need to be augmented with 'smart fuzes' that quickly assess the structural health of a missile in real time as it penetrates barriers and very rapidly make decisions regarding the mission profile," says Avitabile, who is the SDASL co-director and the project's principal investigator. "The damage detection that provides the missile's current condition needs to be identified at an extremely fast pace."

Previous work by Avitabile for Eglin AFB, which was funded by an earlier three-year contract for $380,000, had identified highly efficient methodologies to predict a missile's state of health. "Basically all the previous analytical modeling methodologies are being completely revamped and repurposed for this unique damage-detection program. The approaches we are taking in the new project are a radical departure from the conventional ones that are often taken by many researchers in the field," he says.

In addition to Avitabile, other members of the team include mechanical engineering graduate students Tina Dardeno '14 and Patrick Logan '14, who are conducting their Ph.D. research at SDASL. For more information about the lab, go to www.uml.edu/Research/SDASL. ■

An F-15E Strike Eagle fighter jet releases a GBU-28 bunker buster, a 4,700-pound laser-guided bomb. Conventional smart bombs and guided missiles were first used during the 1991 Gulf War and, more recently, in Iraq, Afghanistan and Syria.

FROM WARRIOR TO SCHOLAR

Student-Veteran Gets the Help He Needs to Succeed in Life

For Nicholas Marinelli, life as a teenager was tough. Growing up in Brockton, Mass., Marinelli attended public school his entire life, dropping out when he was 16. "While working on my GED, I took on dead-end jobs for three years," he says. "That's when I decided to do something with my life, so I enlisted in the Massachusetts Army National Guard when I was 19."

Marinelli underwent a year of combat training before he was deployed to Iraq in 2011. He was assigned as a mechanic and crew chief on a Sikorsky HH-60M medevac Black Hawk helicopter unit that covered most of western Iraq as part of Operation New Dawn.

"After my tour of duty ended, I really felt like I no longer had a purpose, and it was bothersome. I started working another dead-end job and I was unsure of my next move," he recalls. "Luckily for me, my leaders really hassled me about using my military benefits, and I'm probably one of few people who actually knew how to use the G.I. Bill after returning home from combat."

Marinelli went back to school in 2012, studying at two local community colleges and obtaining an associate degree in liberal arts before transferring to UMass Lowell in the fall of 2014.

"I'm currently a junior in the chemical engineering program, with a concentration in nanomaterials, and I couldn't be more excited," he says. "The campus veteran community is very welcoming, and it really helps to be surrounded by fellow vets who share such a unique bond with you."

This is part of the reason why Marinelli became involved with the Student Veterans of America (SVA). He has been working with the organization for three years beginning in 2013, when he helped establish a chapter at Bunker Hill Community College. This year, he was elected president of the UMass Lowell chapter, called the Student Veterans' Organization.

"I'm proud of the progress our chapter has made," he says. "We participated at this year's SVA annual business plan national competition in Orlando, where we presented a budget and business plan for the chapter that details how revenue is generated and used, as well as our future plans for the organization. We won third place in the contest, beating 1,300 other clubs from across the country!"

Marinelli adds: "The military has really helped shape who I am today. A lot of my personal principles were instilled in me while I was in the Army, such as punctuality so I can arrive to class on time, flexibility so I can fit easily into any group or project I'm assigned to and determination to get the mission done."

After graduation in 2017, he plans to pursue a career in the biotech industry or the sustainable energy field. "Either way, I'll definitely continue with my graduate studies, hopefully earning a technical master's degree or an MBA in the process," he says.

A GRATEFUL NATION

U.S. Veterans Magazine has named UMass Lowell among its top veteran-friendly schools in its annual Best of the Best awards, published in its summer 2015 issue.

The university's Veterans Services Office is dedicated to providing student-veterans with all the benefits available to them through the state and federal governments. Services director Janine Wert and her staff and volunteers help veterans negotiate the procedures for using the G.I. Bill, various fee waivers, tuition assistance plans, vocational rehabilitation/education programs and links to other services on and off campus. The office's Edge4Vets program helps transition student-veterans into the workplace, maximizing their skills, resumés and access to professionals already in the workplace.

"UMass Lowell has more than 1,600 student-veterans enrolled in the past year, which is the largest in the state," says Wert. "Approximately 1,000 of them are using their VA benefits this year. Of the total population of student-veterans, more than 40 percent report minority status and 15 percent are women."

At the Francis College of Engineering, about 240 veterans are enrolled in various undergraduate programs, with 22 of them females, according to Wert.

"We are grateful to student-veterans like Nicholas for their service to the nation," she says. "They are an asset to any classroom and campus because of their motivation to learn and graduate and their increased insight, maturity and practical understanding of world events and cultures. They are familiar with working in teams and with diverse races, religions and orientations. They have experience with taking responsibility and leadership positions and often assume these positions naturally. They usually have a clear vision for their future and are very 'mission-focused.' Nicholas is a perfect model for all of these attributes!" ■

During Nicholas Marinelli's tour of duty, he and his crewmates would fly their Black Hawk helicopters from their base in Iraq halfway to the border with Syria to pick up wounded ground troops and medevac them to the nearest hospital.

To Serve and to Teach

Engineering Faculty-Veterans Draw on Military Experience to Enrich Teaching

The Francis College of Engineering currently has 21 lecturers, five of them in visiting roles. These full-time faculty members teach three to four courses per semester across a variety of disciplines, while also taking on various other duties such as student-club and academic advisers, recruiters and transfer coordinators.

"We are truly fortunate to have such a talented group of lecturers on campus," says Dean Joseph Hartman. "They provide invaluable service to the college. They are tremendous educators, whether in the classroom, labs or even hallways, and have a passion for ensuring student success. I doubt we could function without them."

Academically, each lecturer holds a doctoral degree. Practically, each lecturer on average has accumulated professional experience exceeding 10 years, whether in industry, research laboratories or teaching at other institutions. "This diversity and depth of knowledge truly enhances the educational experience of our students," says Hartman.

Five of these lecturers share a common experience: military service. They served honorably in the U.S. Armed Forces—Army, Air Force, Navy and Coast Guard—and try to impart virtues in students such as dedication, professionalism, integrity, toughness, flexibility and a "can-do" attitude. Here are their stories:

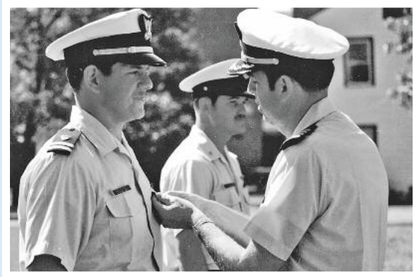
Edward L. Hajduk, B.S.'95, M.S.'99, D.Eng.'06, P.E.

Civil and Environmental Engineering

Edward Hajduk was an enlisted soldier (active duty) in the U.S. Army from 1987 to 1990, and served in the Massachusetts National Guard from 1990 to 1994. "I decided to join the military after high school because I wanted to serve my country and earn money for college," he recalls.

Hajduk was a corporal and a sergeant when he left the Army and the National Guard, respectively. During his Army tour of duty, he served 2½ years with the 3rd Infantry Division in West Germany. In the National Guard, he served with the 101st Field Artillery in Lynn, Mass. He was awarded five Army Achievement Medals and an Army Commendation Medal for his service.

"In the military, I learned that repetition is a key component in learning," says Hajduk. "I also learned that people learn by doing. I try to incorporate these concepts into my courses whenever possible. The military also taught me that service to others is important. This is another trait I try to incorporate into my work at UMass Lowell, which is why I am faculty adviser to several student groups and do various outreach to the community."



Paul D. DeStefano, Ph.D., P.E.

Civil and Environmental Engineering

Paul DeStefano went to the U.S. Coast Guard Academy after high-school graduation and was commissioned into active duty as an ensign in 1978. He served in various duties as a civil engineer at several locations, including Florida, New York and Virginia. He resigned his commission and received an honorable discharge in 1988 as lieutenant in the Coast Guard, and then served in the U.S. Naval Reserve (Seabee battalion in New York) as lieutenant for a short term. He was awarded the Coast Guard Commendation Medal and Achievement Medal for outstanding service in several engineering projects.

"I'm proud to have served my country, protecting our shores and supporting multiple missions of the Coast Guard as a civil engineer," says DeStefano. "The military provides excellent opportunities for leadership and management as well as practical education and professional practice. All of these play a significant role in teaching, mentoring and advising young adults toward developing their careers in the professional practice of civil engineering."

Michele M. Putko, Ph.D., P.E.

Mechanical Engineering

"When I was in high school I wanted to do something exciting and at the same time not financially burden my parents," says Michele Putko. "The U.S. Military Academy at West Point had just started to admit females at the time. I applied and became the first female from my county in Western Massachusetts to be accepted as a cadet. I didn't consider myself a trailblazer, but rather lucky that the academy opened its door to women just in time for me."

At West Point, Putko studied civil engineering and became a logistics officer in the Ordnance Corps. After graduating in 1983, she served on active duty for 28 years, retiring in 2011 with the rank of Army colonel. She served several tours of duty, including her role as the first base commander at LSA Anaconda in Balad, Iraq, at the onset of the Iraq War. She also served as assistant chief of staff for logistics in the Army's 32nd Air and Missile Defense Command, and was responsible for coordinating the deployment and maintenance of U.S. Patriot missile systems across the globe. She received numerous awards during her service, including the Bronze Star, Legion of Merit, Meritorious Service Medal, Humanitarian Assistance Medal, U.S. and German Parachutists Badge and the Army Space Badge.

"In the military I learned a lot about life and leadership," says Putko. "I try to instill the same lessons in my students—that is, to focus on academics, don't accept failure, don't ever give up and help your classmates. I believe academic success is mostly about attitude and work ethic, and I encourage my students to work hard, stay positive, get help when needed and give help too!"

Walter Thomas, Ph.D.

Mechanical Engineering

"An Air Force ROTC scholarship was the only way for my parents to afford Cornell University, so I joined the service in 1988," says Walter Thomas. After completing pilot training and earning his wings, he went on to become an airlift pilot, flying the Lockheed C-141B Starlifter, the Beechcraft C-12 Huron and the C-21 Learjet, and serving as an instructor pilot for all three aircraft. He flew numerous support missions for Operation Desert Storm in the Persian Gulf and planned humanitarian relief efforts in Africa. He spent a tour with the 3rd Air Force in England and learned how to fly the Boeing KC-135 Stratotanker, serving as operations officer of a tanker squadron at MacDill Air Force Base in Florida. He ended his military service in 2008 in Alaska as chief of staff for a commander of a training wing at Eielson Air Force Base.

"All told, I spent just over 20 years on active duty, and have logged more than 4,000 hours of flying time," says Thomas, who attained a rank of lieutenant colonel. He received numerous Air Force decorations, including the Meritorious Service Medal, Aerial Achievement Medal and Humanitarian Service Medal.

He adds: "The discipline and time-management skills I learned in the military certainly helped me to prepare and organize new classes. More importantly, my time as instructor pilot taught me many instruction techniques that I apply in class, such as how to break down a complicated subject into easier-to-understand pieces. I had a lot of experience working with young men and women in the military, and that made my transition to the classroom easy and smooth."

Lawrence D. Thompson, Ph.D., P.E.

Mechanical Engineering

Growing up in the small eastern Maine town of Calais, Lawrence Thompson always wanted to go somewhere and see something. Faced with limited job opportunities in the area, he decided to enlist in the Navy in 1979, right after high school. During his 18-month training, he studied basic electronics, radars, digital computers and electromechanical control systems for shipboard weapon systems. Afterward, he was assigned to the guided-missile frigate USS Jack Williams (FFG-24), where he spent the remainder of his enlistment.

Thompson's primary role aboard the ship was fire controlman. He also served on the ship's master-at-arms and self-defense forces and shore patrol. He has sailed through the Panama and Suez canals and in all five oceans. During these deployments, he made nearly 30 ports of call in more than 20 different countries. While in the Mediterranean, the ship provided air cover for the USS New Jersey off the coast of Lebanon, following the deadly attack on the U.S. Marine compound in Beirut in 1983. Thompson was one of about 20 sailors from the Jack Williams sent ashore to assist with search and recovery efforts. He completed his enlistment in 1985 as first-class fire controlman, and was awarded a Presidential Unit Citation, Navy Expeditionary Medal, Good Conduct Medal, Battle Efficiency Ribbon, Sea Service Ribbon and various letters of commendation.

Thompson's technical training comes through in the Instrumentation Laboratory course he teaches at the Francis College of Engineering. "I believe my military training and experience have given me a unique perspective on the meaning of teamwork and the individual's personal responsibility to the team to ensure success," he says.

Alum's Company Named One of the State's Largest Veteran-Owned Businesses

In 2014, Commodore Builders performed restoration work on Boston's Old State House, which was built in 1713. It is one of the oldest public buildings in the country and a designated National Historic Landmark. Here workers hoist the newly restored life-size statue of a unicorn to its perch on top of the building's facade.

Commodore Builders Focuses on Leadership, Collaboration, Innovation

Commodore Builders, founded in 2002 by Joseph J. Albanese '84, was ranked by the Boston Business Journal last year as the sixth largest veteran-owned business in Massachusetts. The Waltham-based construction company currently employs 177 people and generated nearly $300 million in revenues in 2015. Among its recent projects are major commercial office complexes and retail centers, hospitals, hotels, schools and universities, biotech companies and condominiums across the Bay State. The company also performed restoration work on Boston's most iconic landmarks such as Faneuil Hall and the Old State House.

"I'm proud the Commonwealth of Massachusetts relied on us to restore the Old State House, a historic national treasure," says Albanese, a retired captain in the Navy Civil Engineer Corps who serves as Commodore's president and CEO. "We're also managing major renovations on respected academic campuses like Harvard and Tufts University, and life-science projects for industry leaders like Biogen and Shire. Each of these projects is an expression of trust in which I take great pride."

In 2015, Commodore Builders was named by Boston Globe as one of the top places to work in the state for the second consecutive year.

What's the secret behind Albanese's success?

"My 29-year military service—and the global perspective it gave me—helped me keep the long view as I guided the company through rocky economic times from 2008 to 2010," he says. "Those were tough years, but my military training gave me the courage to lead with purpose, to keep my moral compass and to remain loyal to my convictions. I learned that complacency kills—on the battlefield and in the business world. In the military, everyone has a clearly defined job. In my civilian career, I value the same clarity around roles and responsibilities because in an integrated organization, success depends on each person doing his or her job."

Albanese, who received a bachelor's degree in civil engineering in 1984 from the University of Lowell (as UMass Lowell was called at the time), credits his education for giving him a solid foundation for his naval and business roles.

"In the Navy, I found out quickly just how practical my civil engineering education would be as it related to the critical thinking I had to do there," he says. "My education was also instrumental in helping me obtain my MBA from Boston University in 1992. I was particularly proud, and relieved, in 2006, when I finally broke out my college textbooks and notes and studied for my professional engineering license—22 years after graduating—and I was able to pass the test the first time. That's a clear testament to the quality of education and training I received at ULowell."

A DISTINGUISHED NAVAL CAREER IN CONSTRUCTION

Joseph J. Albanese '84, the president and CEO of Commodore Builders, signs the steel beam during the topping-off ceremony for the four-story 375 Newbury Street building in Boston in 2013.

Albanese served on active duty with the Navy Civil Engineer Corps (CEC) from 1981 to 1988, and as a Navy Reservist from 1988 to 2010. In his early years as a CEC officer, he oversaw civilian contractors for a major base expansion in Sigonella, Sicily, and managed construction projects in New Orleans, La. Later in his career, particularly after the start of the Persian Gulf War, he was directly engaged with the Navy Seabees.

Over the course of two decades, Albanese worked in a variety of staff and command positions. In 2003, he commanded a 600-person construction battalion, and in 2008 he was assigned commodore of the 7th Naval Construction Regiment, leading three construction battalions in preparation for their deployment to the Middle East. In his own service in the region in 2007, he was commander of the 22nd Naval Construction Regiment (Forward) and Task Group 56.2, operationally responsible for Seabees throughout Iraq, Afghanistan, Kuwait, Bahrain and the Horn of Africa.

"I have mentored many junior officers and enlisted Seabees," he says. "For me, the most gratifying thing has been to watch them grow and to see them today running regiments and battalions and playing such a key role in support of our nation."

He adds: "I also have many great memories from my years at ULowell. In business today, I'm still associated with a number of my former classmates. I was a member of the university's Pi Lambda Phi fraternity. Those brothers are among my best friends today. I've been an adviser for the Department of Civil Engineering and a member of the Industrial Advisory Board for the Francis College of Engineering. Through these positions, it's been great to reconnect with some of my former professors and to see how far the school has come."

In 2015, Albanese was inducted into UMass Lowell's Francis Academy of Distinguished Engineers. He resides in Newton, Mass., and has three grown children— Joseph, 24, Emily, 22, and Rachel, 20.

Reflecting on his success, Albanese offers some simple advice to others: "Life is short. Every day is important. Make each one matter." ■

Classon Endowed Scholarship to Benefit Engineering Student-Veterans

Ken Classon '71 and his wife, Louise, reside in Gaithersburg, Md., outside Washington, D.C. They have two children, Brian and Chris, who are both electrical engineers.

Ken Classon '71 and his wife, Louise, have set up an endowed scholarship fund for student-veterans in the Francis College of Engineering. Classon, who retired in 2014 after a four-decade career with Bechtel Corp., credits much of his professional success to the civil engineering education he received at Lowell Technological Institute, a predecessor institution of UMass Lowell. And that education would not have been possible without the tuition support that Classon, who served in the Air Force from 1963 to 1966, received through the G.I. Bill and from the Commonwealth of Massachusetts.

"I felt I had an obligation to do something positive for the university that helped me succeed as an engineer," he says. "Setting up an endowed scholarship with Louise was an excellent way to support UMass Lowell and at the same time to help veterans." The Classon Scholarship will be awarded to veterans enrolled full-time in the Francis College of Engineering, with preference given to students pursuing civil engineering degrees.

"UMass Lowell has 1,600 student-veterans, the largest number of any college in the state," says Engineering Dean Joseph Hartman. "The kind of support that Ken and Louise are providing is one of the reasons why we're also considered one of top institutions for military veterans."

Applications for the Classon Scholarship will be available this spring. Go to www.uml.edu/thesolutioncenter/financial-aid/Scholarships/Current-Undergraduates/Endowed.aspx. To contribute to the Classon Scholarship, contact Sally Washburn, director of development, at 978-934-4821; Sally_Washburn@uml.edu. ■

New Faculty

- **Hualiang (Bruce) Zhang, Ph.D.,** has been appointed associate professor of electrical and computer engineering. He earned his doctorate from the Hong Kong University of Science and Technology and was recently a faculty member at the University of North Texas.
- **Arcan Dericioglu,** Ph.D., has been appointed visiting professor in mechanical engineering. He received his doctorate from the University of Tokyo.

New Research Awards

- In 2015, Assoc. Prof. **Sukesh Aghara** (nuclear engineering) was awarded grants totaling $600,000 by the U.S. Nuclear Regulatory Commission to recruit and retain top undergraduate and graduate students in nuclear engineering and health physics at UMass Lowell. The funds will be used to provide undergraduate scholarships and graduate fellowships.
- Assoc. Prof. **Hengyong Yu** (electrical and computer engineering) was awarded a grant by the National Institutes of Health for his project, "High-Dose Efficiency CT System."
- Profs. **Christopher Niezrecki** and **Peter Avitabile** (both mechanical engineering) were awarded a two-year, $104,131 grant by the Massachusetts Clean Energy Center for their work on "Innovative Blade Testing."

Faculty and Student Successes

- Asst. Prof. **Juan Pablo Trelles** (mechanical engineering) won an NSF CAREER award for his proposal, "Sustainable Chemical Synthesis by Plasma-Enhanced Solar Energy." The project will investigate the direct use of concentrated solar energy enhanced with plasma discharges to achieve chemical synthesis processes with greater efficiency and resilience than current methods. The research could lead to economically viable and sustainable approaches for the synthesis of so-called solar fuels from carbon dioxide (e.g., directly from power-plant exhaust), water, or natural gas, providing alternatives to fossil fuels while helping mitigate greenhouse-gas emissions. (Photo 1)

1

- The Raytheon–UMass Lowell Research Institute won the Academic R&D Award at the IDTechEx Printed Electronics USA 2015 showcase. Ph.D. student **Mahdi Haghzadeh**, advised by Profs. **Alkim Akyurtlu** and **Craig Armiento** (both electrical and computer engineering), worked on the project to develop ferroelectric ink for direct printing of dielectrics on flexible substrates for tunable RF and microwave applications. (Photo 2)

2

- Engineering Dean **Joseph Hartman** has been voted president-elect of the Institute of Industrial and Systems Engineers.
- Civil Engineering undergraduate students **Gabriel Gerardo Rojas Perez** (photo 3) and **Micah Strauss** (photo 4) have been selected as national ASCE 2016 New Faces of Civil Engineering — College Edition, of which there are 10 students in total.

3

4

- **ThetMyatNoe Sein** of civil engineering won the Molitoris Leadership Scholarship for Undergraduates from the WTS Boston Chapter. WTS is concerned with advancing women in the transportation industry. She works with Assoc. Prof. **Tzuyang Yu** (civil and environmental engineering).
- Asst. Prof. **Yuanchang Xie** (civil and environmental engineering) and graduate student **Julian Chen** were given the 2015 Deborah Freund Paper Award by the Transportation Research Board Truck and Bus Safety Committee (ANB70) for their research, "Machine Learning for Commercial Motor Vehicle Drivers' Driving Pattern Recognition."
- An interdisciplinary team of students from electrical and computer engineering, mechanical engineering and biology, advised by Assoc. Prof. **Yan Luo** (electrical and computer engineering), has advanced to the semi-finals of the Intel-Cornell Cup competition.
- **Junwei Su,** advised by Assoc. Prof. **Hongwei Sun** (mechanical engineering), was named a Sukant Tripathy Memorial Graduate Fellowship winner for 2015. That year's inaugural Tripathy Memorial Undergraduate Fellowship was awarded to **Patrick Facendola**, a senior in plastics engineering. (Photo 5)

5

University and College Notes

- The Office of Naval Research recently awarded the Francis College of Engineering a STEM grant to run a summer bridge program this year with significant mentoring support. The goal is to increase the likelihood of success of incoming students, especially those who may not have had the opportunity to take advanced math and science courses in high school. Many of these students come from underrepresented groups in engineering. The program will be delivered in partnership with the Portsmouth Naval Shipyard in Maine and a number of local defense contractors. Engineering Dean **Joseph Hartman** is the principal investigator for the bridge program.
- Full-time undergraduate engineering enrollment grew 10.4 percent over last year, to 2,286 last fall. Including part-time students, the college enrolls 2,511 undergraduates. Graduate enrollment increased slightly, to 764 students.
- The Massachusetts Board of Higher Education approved new degree programs—bachelor of science in biomedical engineering and master of science in engineering management—this past fall.
- Medical device incubator M2D2 significantly expanded its offices and laboratories with more than 11,000 square feet of space at 110 Canal Street, a renovated former mill building in downtown Lowell. The university opened the Innovation Hub on another floor in the same building.
- According to a recent UMass Donahue Institute report, UMass Lowell contributes a total of $854 million to the state's economy and that of the southern New Hampshire region, twice what it was just five years ago.
- UMass Lowell was ranked the fourth most-underrated college by Business Insider. The report ranks "outstanding schools that don't always get the recognition they deserve" by examining both U.S. News and World Report rankings and PayScale's College Salary Report.
- The Brookings Institute ranked UMass Lowell 33rd in the country (out of more than 1,000 entries) in "occupational earnings" and 52nd (out of more than 800 entries) in "earnings."

uml.edu/engineering

UMASS LOWELL

Learning with Purpose

Francis College of Engineering
University of Massachusetts Lowell
One University Ave.
Lowell, MA 01854

WE KNOW OUR PLACE

At the Francis College of Engineering, we know Our Place.

We know our proud place in history, and the future. We know ours is a place of opportunity and action, ingenuity and innovation. We know our place is where our students get the engineering education they need to take their place in the world.

On Thursday, April 14, UMass Lowell will publicly launch its first-ever comprehensive fundraising campaign. Our Legacy, Our Place: The Campaign for UMass Lowell will build on the tremendous growth in size, scope and reputation the university has experienced in recent years.

By raising $125 million to support student scholarships, our first-rate faculty, our growing campus and our Division I athletics program, we can take our place among the top public universities in the country.

So join us on our journey, and let's leave a legacy we can be proud of.

To learn more, please visit ***www.uml.edu/ourlegacy-ourplace***