INDIVIDUALLY
WE’RE DISTINCT

TOGETHER
WE’RE GLOBAL

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This year marks the 30th anniversary of the Thomas J. Watson School of Engineering and Applied Science. We’ve made great strides over the course of those three decades, and we continue to do so today. Even as the world changes at a breakneck pace, we are adapting and growing right along with it. In fact, the Watson School is the 17th fastest-growing engineering school in the nation. Applications to our graduate programs increased by more than 75 percent in 2013, and we’ve hired more new faculty and staff than at any other time since I arrived at Binghamton in 1988.

Growth is an important theme of President Stenger’s Road Map for the University. As we strive to realize the vision he set forth of becoming “the premier public university of the 21st century,” growth is critical for us as well. The Watson School will play a central role in achieving many of the Road Map’s goals. Along with our focus on recruiting the best and brightest for our graduate programs, we are simultaneously elevating the high quality of our undergraduate students. In addition, the Watson team is working hard to enhance our already-strong talent base, for example in the areas of smart energy and healthcare, while also increasing our emphases on research (including undergraduate research), diversity and globalization.

We remain committed as a school to being good global citizens. That means leading the way in educating the engineers of tomorrow and working across cultures, languages, regions and academic domains, as demonstrated by our partnerships with top universities and industrial partners in South Korea, India, Israel, Turkey, Jordan and China. It also means continuing our efforts to support our students and graduates throughout their careers, as demonstrated by the great work of our Career and Alumni Connections office.

Academic excellence and teaching are as vital as ever as we continue to provide our students with a superb education. The Watson School helps make that education accessible through a variety of academic and financial assistance programs, such as the Bridge-to-the-Doctorate program.

Today, as the Watson School celebrates 30 years of outstanding accomplishments, our commitment to improving society through research has never been stronger. The breadth and depth of the innovative scholarship being conducted by our faculty, staff and students in the Watson School is growing in many areas, as evidenced by substantial increases in research proposals submitted and the growth in our graduate (doctoral) programs. Our cutting edge research is vital to the excellent education provided to our students and to the future of the School.

Krishnaswami “Hari” Srihari
Dean and Distinguished Professor, Thomas J. Watson School of Engineering and Applied Science
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Broadening international engagement, on campus and abroad

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PITARRESI TO HEAD ENHANCED CENTER FOR LEARNING AND TEACHING

James Pitarresi, distinguished teaching professor of mechanical engineering, has been appointed assistant provost and executive director of Binghamton University’s Center for Learning and Teaching (CLT). The revitalized and enhanced center emerged from the Road Map process to focus on student learning and provide faculty support for instruction.

“What we are doing is signaling that this is a place where teaching really matters,” says Donald Loewen, vice provost for undergraduate education.

Pitarresi envisions the CLT as a place with a holistic view of teaching that will encompass all the skills and technologies that enable faculty to help students learn, whether they are interested in distance education methods or the Socratic method. “We will help faculty understand how to combine these methods in ways that engage students effectively,” he explains. “Some with the use of a piece of chalk, notes and conversation; others may embrace other approaches to technology. We’ll take a new and what we hope is a broad approach to supporting faculty in doing what they currently do better and more effectively, with more institutional support.

“That will be a way for me to extend beyond that and support others who are new or in mid-career who want to change the way they teach.”

Pitarresi will continue to teach, but stepped down as chair of the Department of Mechanical Engineering to assume the new position.

UNIVERSITY RECEIVES HIGH ENERGY PERFORMANCE AWARD FROM NYSERDA

The New York State Energy Research and Development Authority (NYSERDA) recognized Binghamton University’s Engineering and Science Building as a High Performance Building in April. The building is rated to perform at 44 percent above the state’s energy code, saving as much as $400,000 annually in energy expenditures.

“Our Engineering and Science Building is a shining example of how seriously Binghamton University takes its commitment to sustainability,” said President Harvey G. Stenger. “We’re especially proud of this remarkable building, but what is even more impressive is the research we do here, and the way the building helps us in the process of discovery. It features state-of-the-art, flexible research laboratory space and is a teaching facility where students gain hands-on experience in their fields as they learn about the value of sustainability in a really cool building.”

Binghamton University President Harvey G. Stenger accepts a High Energy Performance plaque from NYSERDA President and CEO Francis Murray Jr.
ENGINEERING BUILDING RENOVATIONS CONTINUE

Renovations on the third floor of the Engineering Building at the center of campus are slated to be complete in September 2013. Work on the ground, first and second floors has already finished. The renovations throughout the building will provide new office, lab, classroom and conference space.

“We are excited to be in our new location where our graduate coordinator can join undergraduate advisors to better serve Watson School students at all levels. This carefully planned space will maximize efficiency while providing a convenient location for all we serve: current and prospective students, faculty, plus other campus offices.”
— Lorna Wells, director of Watson School advising

FACULTY HIRES

SEOKHEUN CHOI
Assistant Professor, Electrical and Computer Engineering
Research/teaching focus: bioelectronics and microsystems, biomedical engineering, electrical and electronic engineering, manufacturing technology, bioMEMS/MEMS/NEMS, microfluidics, biosensors, biofuel cells

CHUN-AN CHOU
Assistant Professor, Systems Science and Industrial Engineering
Research interests: mathematical optimization modeling and computation, data mining/machine learning, medical applications, computational biology, engineering systems management

AMBER DOIRON
Assistant Professor, Bioengineering
Research interests: nanotechnology, biomaterials, drug delivery, molecular imaging, atherosclerosis

GUY GERMAN
Assistant Professor, Bioengineering
Research interests: multiscale mechanics of tissues, microstructures for encapsulation, drug delivery

TIMOTHY MILLER
Assistant Professor, Computer Science
Research areas: computer architecture, graphics hardware

QUANG SU ’98, PHD ’05
Assistant Professor, Mechanical Engineering
Research/teaching focus: vibration and acoustic measurements, MEMS characterization, biomechanics

30 YEARS OF SIMULATION

In 1929, Edwin A. Link received his first patent for a pilot trainer in Binghamton. What Link started as a simple and ingenious way to train pilots has evolved into an integral part of the engineering design process. Today, simulation saves lives, time, money and the environment. It also provides a means to prepare for tasks that cannot be trained for on a real system.

For 30 years, Binghamton University has proudly hosted the Flight and Ground Vehicle Simulation courses. Registration for the January 2014 courses begins in October.
EXECUTIVE MS IN HEALTH SYSTEMS PROGRAM IN MANHATTAN BEGINS

In April 2013, 33 students joined the inaugural cohort of the executive master’s in health systems Manhattan program. President Stenger, Provost Nieman and Dean Sizhaci were on hand to welcome the students to campus.

“Health systems is a growing field, with new innovations and processes coming up every day, and I want to be a part of it,” says Steve Caiola ’13, who will continue his Watson School education in the program.

The program brings the disciplines of industrial and systems engineering and systems science to bear in improving the efficiency and effectiveness of healthcare systems. The research methodology looks at the current flow of patients and work, identifies bottlenecks and then proposes solutions and recommendations using a variety of tools, such as modeling and simulation, statistical analysis, lean six sigma, operations research, human factors engineering and data mining.

“The goal,” says Professor Mohammad Khasawneh, “is to make healthcare more efficient, more effective, with higher quality and fewer errors — and, in the process, save lives.”

ZIEGLER TO BECOME SUNY CO-OP CURRICULUM COORDINATOR

William Ziegler ’76, associate professor of computer science, has accepted an offer to work with the chancellor’s office as the SUNY co-op curriculum coordinator for all 64 SUNY campuses. The appointment is part of a SUNY Works and SUNY 2020 initiative. One goal is to increase the number of SUNY students employed part-time in their fields of study prior to graduation. Ziegler will continue in his role as director of the Binghamton University Scholars Program.

BRUCE MURRAY BECOMES MECHANICAL ENGINEERING CHAIR

Professor Bruce Murray has accepted the chair’s position in the Department of Mechanical Engineering, effective June 1. “We are delighted that Dr. Murray accepted the role,” says Dean Sizhaci. “I know under his thoughtful leadership the department will continue its legacy of and commitment to excellence in undergraduate and graduate education and innovative research. Along with a team of top-notch faculty and staff, the department has a very exciting future under Murray’s leadership.”
2012-13 CHANCELLOR'S AWARDS

Sarah Lam, associate professor and graduate program director for industrial and systems engineering, Excellence in Teaching

Zhongfei (Mark) Zhang, professor of computer science, Excellence in Scholarship and Creative Activities

Shelene VanKuren, undergraduate and graduate secretary for electrical and computer engineering, Excellence in Classified Service

Voya Markovich is hooded by Provost Donald Neiman (left) and President Harvey G. Stenger

MARKOVICH RECEIVES HONORARY DEGREE

Voya Markovich was awarded an honorary degree during Binghamton University’s Doctoral Hooding Ceremony on May 17.

A leading expert in advanced electronic packaging, Markovich is known as one of the industry’s experts in laminate product materials and processes, and first- and second-level electronic packaging. He retired from Endicott Interconnect Technologies (EI) in 2012.

Markovich was instrumental in the establishment of Binghamton University’s Center for Advanced Microelectronics Manufacturing (CAMM) and has served on and chaired the CAMM’s board. He also chaired the Industrial Advisory Board for the Integrated Electronics Engineering Center and serves on the Watson Advisory Board. He is current president of the International Microelectronics Assembly and Packaging Society.

DOCTORAL CANDIDATE WINS THREE CONTESTS

Siva P. Adusumilli ’10, an electrical and computer engineering doctoral student, won three poster contests during the 2011-12 academic year; one at the Integrated Electronics Engineering Center Electronics Packaging Symposium for a presentation titled “Synthesis of Zn3P2 Film Using Low Temperature Chemical Reflux Method”; a second at the Binghamton University Energy Innovation Day for “Synthesis of Pyrite through Atmospheric Pressure Chemical Vapor Deposition”; and the third at the New York State American Physical Society New Energy Materials Symposium, for “Development of Earth Abundant and Zinc Phosphide Based Thin Film Solar Cells.”

NIKULIN AND SKORMIN WIN BEST PAPER AWARD

Two faculty in the Department of Electrical and Computer Engineering, Associate Professor Vladimir Nikulin, MS ’97, PhD ’02, and Distinguished Service Professor Victor Skormin, won a best paper award at the International Conference on Engineering Education in Finland in 2012 for “Worldwide-Accessible 1.25 GBPS Advanced Laser Communication Laboratory,” a paper created as part of their NSF-sponsored project.

TONEY AND MILLER NAMED PARRIS FELLOWS

Undergraduate electrical engineering student Christopher Toney from University of Maryland Eastern Shore and industrial and systems engineering senior Christina Miller have been named the 2013 Parris Foundation STEM Summer Research Fellows. Parris Foundation Founder and President Tonya O. Parris ’92 is “e Minds and Magnifying Dreams in the Watson School.”

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Help promote the Watson School: link to our website from yours.
Joint projects are the new norm in most professions — whether it’s collaborating with colleagues in a different department, a different state or even a different region of the world, or using products or parts from an original equipment manufacturer in another country.

Take, for example, Mazda’s Tribute SUV hybrid: The engine is built in Mexico, the transmission comes from Japan, and the vehicle is assembled in Missouri.

Watson School partners and employers such as IBM, BAE and Lockheed Martin also outsource portions of the products they’re developing — something Amanda Bailor, international alumni and career connections coordinator, knows well. “Engineers need to be able to communicate across time zones, cultures and languages,” says Bailor, who joined the Watson School in September 2012 after eight years with BAE, most recently as senior contract administrator negotiating partnerships in India, Brazil, Japan and Sweden.

In her new role, Bailor taps her international prowess to find and maintain engagement opportunities for students, faculty and alumni with industry and educational partners. Her strategy is two-fold: foster meaningful relationships and advance academic opportunities — two paths that are very much intertwined. “We’re trying to bring our international connections together and use those networks strategically to create valuable opportunities for our alumni and students, faculty and staff,” she explains.

Currently there are a dozen or so universities across South and Southeast Asia and the Middle East with which the school partners. These partnerships include universities in China, India, South Korea, Turkey, Japan, Jordan, Thailand and Vietnam. The Watson School has also joined an international engineering exchange consortium, Global E3, that connects Binghamton University with partner institutions in 18 countries.
global window
Over the past decade, the Watson School has developed a collaborative partnership with Samsung — a household name and the largest cell-phone manufacturer in the world. The relationship is principally attributed to Seungbae ‘SB’ Park, professor of mechanical engineering, whose research with Samsung for the past 10 years has focused on the mechanical reliability of electronic products. Today, in addition to working with research centers on campus, Samsung is also working with faculty on specific research endeavors.

President Stenger met with Cheol Kyo Kim, president and CEO of Samsung Techwin, in South Korea this past March to sign a memorandum of understanding providing for the internship and fellowship program with the company.

As a result, beginning this summer, Binghamton University students are experiencing the challenge and reward of working with this technology giant when they intern in Korea. "As Samsung interns, our students are part of a truly international company and will have an invaluable opportunity to enhance their engineering skills while working across cultures, developing a skill set integral to our increasingly globalized world," says Dean Srihari.

Becoming a Samsung intern in the flagship year was competitive. Approximately 80 students attended an information session, after which they submitted a résumé, cover letter and recommendation. Those who met the minimum requirements and could sell their strengths in print entered the two-part interview process. Students faced a panel of Binghamton faculty and staff and then interviewed with employees from the technology giant using Skype.

In addition to the annual internships, there are opportunities for faculty to spend a summer at Samsung or take sabbaticals working with this multinational industrial leader.

A Seoul-ful summer

Samsung Interns in Seoul, South Korea, for their official first day on the job
“India is rising in the world of engineering both as a market and a competitor. We need to know their business practices in order to cater to them and compete.”

— Paul Watrobski

Quick trip, lifelong journey

Adapting the undergraduate engineering curriculum to allow for study abroad can be challenging. Doing so without adding a semester can be a tall order for even the most hardworking Watson School student.

For those left with the international bug, an attractive alternative is a cohort trip, such as the one to India now offered to students of the Watson School over winter break through a collaboration with the School of Management.

Paul Watrobski, then a junior studying computer engineering, was one of three Watson School students who capitalized on the opportunity. “India is rising in the world of engineering both as a market and a competitor,” he says. “We need to know their business practices in order to cater to them and compete.”

It was not Watrobski’s first time abroad, but it was his first trip to India. During the 10 days, he took advantage of every outing and absorbed every insight he could — receiving kudos from his fellow travelers for being the group’s most adventuresome.

The experiences were diverse: He visited the Taj Mahal and the Lotus Temple; rode elephants and camels; toured Fortis Hospital and a manufacturing plant; met with employees of PwC and a small startup, Oxigen Services; and tasted a beefless Big Mac at McDonald’s.

Oxigen is creating a phone-based banking system for use in areas without automated teller machines. The company’s fundamental criterion was that the final product had to be affordable for the poorer populations. “The head of Oxigen said to make the device with these features for this amount of money,” Watrobski explains. “The goal then was to use the minimum amount of resources necessary to make it do what it was supposed to do, and not add on a bunch of special features.”

Watrobski returned with a few fresh business principles and a better sense of self. He also became a vegetarian. “It is definitely more difficult to eat vegetarian in the United States than in India. But adopting some of the Indian flavors into my diet when making food has made it easier.”
Faculty exchange programs are increasingly popular in higher education as internationalization in research and education stays in step with the demands of the global economy. What starts as an individual sabbatical or leave to collaborate with a colleague overseas can turn into a mutually beneficial partnership for both institutions.

For years, Daryl Santos, professor of industrial and systems engineering, has been a frequent visiting professor at the Korea Advanced Institute of Science and Technology (KAIST) in Daejeon, South Korea. Referred to as the MIT of Korea, KAIST is among the top 25 engineering and technology schools in the world.

Santos has taught two summer sessions (‘05 and ‘06) in the Industrial and Systems Engineering Department and three winter sessions (January ‘11, ‘12 and ‘13) in the Graduate School of Innovation and Technology Management (I&TM).

I&TM founding dean Dr. Taeyong Yang, in turn, spent a one-year sabbatical with the Watson School for the 2011-12 academic year.Additionally, two of their students did summer exchanges to work on technology transfer, IP and technology road-mapping projects.

And the partnership is growing. Santos and KAIST Assistant Professor of Industrial and Systems Engineering James Morrison received a grant to design and execute an international senior design project program that will feature joint BU-KAIST student teams. The exercise will simulate true-to-life issues such as scheduling meetings for workers in different time zones and across different cultures.

During the January 2013 break, both Bruce Murray, professor of mechanical engineering, and Mohammad Khasawneh, associate professor of systems science and industrial engineering, also traveled abroad to teach, at Vishwakarma Institute of Technology (VIT), in Pune, India.

Murray’s senior-level heat transfer course was condensed into an intensive two weeks. The 40-hour course covered the design of thermal systems and how to cool anything from electronic devices and computers to refrigeration systems and power plants.

“I’d lecture from 9 a.m. to 1 p.m. with only a break or two in there. It was my first time teaching like this, and their first time in this type of course,” he says. “They had to solve a lot of problems and had three large exams in a small period of time. It was a lot of work for both sides, but Murray found the students attentive and open to asking questions.

While in Pune, Murray — who received funding for his trip through the Lois B. DeFleur International Innovation Fund — also met with faculty and master’s students regarding energy efficiencies and his research associated with the Center for Energy-Smart Electronic Systems.

Bruce Murray, professor of mechanical engineering, taught a two-week, 40-hour heat transfer course at Vishwakarma Institute of Technology in Pune, India.
In the United States, if you declare a major but later realize it’s not a good fit, you change it — two, three, four times — until you find what interests you. For Peihan Ren, a student from Hebei University of Technology (HUT) in Tianjin, China, it wasn’t that simple. “In China, it is very hard to change your major, only the top five percent of students can.” She was enrolled in HUT’s top electrical engineering program, but the classes didn’t pique her interest.

So she made a decision to travel 7000 miles to the opposite side of the globe to enroll in the Watson School 2+2 program. “If I came to America, I could try a different major.” But a change wasn’t necessary after all.

“It’s a different type of learning environment here,” Ren explains. “In China, you just have to know how to answer the problem and do the exam. Here you have to understand the why and how to come up with a solution.”

She experienced her first group project in junior design, assembling a computer-controlled robot that could track a line and turn right or left. Then Ren designed an analog circuit in Assistant Professor Christopher Twigg’s senior-level course. She was hooked.

“At Binghamton, I learned something real that it is not just theory. It made me interested in my major again.” — Peihan Ren

Ren will continue at Binghamton for one more year to complete her master’s degree, also in electrical engineering. This summer she returned home for a much-welcomed visit with her family and an internship at State Grid Corporation of China. “I hope I can work there after I graduate,” she says. “It is hard to get into this company, and it is famous for its high salary and good working environment.”
INTO THE LAB

The acoustic lab’s **ANECHOIC CHAMBER** is among the **QUIETTEST PLACES** on Earth.

**Testing...testing...**

**DEFINITION:** Anechoic | an-*e*CHO-ik | adjective.
Free from echoes and reverberations.

**PURPOSE:** For testing the sensitivity of microphones being developed to improve hearing aids.

**RESEARCHER:** Ron Miles, distinguished professor of mechanical engineering and associate dean of research

**LOCATION:** The chamber is isolated underground, 2½ feet beneath the floating cement pavers at the entrance of the Engineering and Science Building.

**INSIDE:** More than 600 fiberglass wedges absorb and minimize sound-wave reverberations down to 80 hertz. (Speech is between 500 and 5,000 hertz.) The floor is wire mesh (with wedges underneath), and a removable plank system allows tables and equipment to be moved in and out of the room.

**OUTSIDE:** The chamber is inside a sound-stopping shell, which is inside a lab, which is underground. Thick walls of concrete and layers of insulation help block vibrations and noise. Going into the chamber requires going through four sets of doors; the heaviest doors are 260 pounds each.

**BOTTOM:** The 250-square-foot chamber “floats” on nine 4x4-inch springs that serve as shock absorbers.

**TOP:** A microphone positioning system that moves on five axes in the chamber can create 3-dimensional maps of sound fields. The maps show how sound radiates from complex noise sources and loudspeakers.

**ABOUT RON MILES**

**BACKGROUND** Noise control

**RESEARCH** Improving the way directional microphones work in hearing aids, which will allow users to more easily follow sounds they want to hear — such as conversations — in places with abundant and often overwhelming background noise

**NEXT STEPS** Increase microphone directionality and find practical ways to manufacture it

**OUTSIDE OF WORK** Plays the violin, owns a farm
BIOENGINEERING

Tracking nanoparticles

Imaging studies, such as MRI and CT scans, rely on contrast agents to improve the visibility of structures, tissues and diseases in the body, and that helps doctors identify patients who are at risk for a heart attack or stroke. The more effective these agents are in detecting dangerous plaques, the more effective doctors can be when making decisions about appropriate care and treatment.

Amber Doiron, assistant professor of bioengineering, is researching nanoparticles and their ability to act as contrast agents and carry a payload of drugs to disease sites. Her research is funded by the National Institutes of Health.

Doiron also is working with bioengineering colleague Assistant Professor Gretchen Mahler to better understand the interaction of nanoparticles with human cells and tissues. Though increasingly used in consumer products and research, the effect of nanoparticles on the body is not well understood.

COMPUTER SCIENCE

Powering down

Nearly 70 percent of electricity in the United States is generated by burning coal, petroleum or natural gas; 21 percent is generated by nuclear power stations. These conventional sources of energy have a number of negative environmental, economic and geopolitical side-effects.

The biggest users of that electricity are buildings, accounting for 72 percent of consumption. Of those buildings, 54 percent are residential homes. Ting Zhu, assistant professor of computer science, says homes and buildings can become more sustainable by monitoring and controlling energy usage.

Zhu’s group tracks and profiles energy consumption of different appliances — refrigerators, ovens and coffee makers — to identify wasted electricity in a building. They then automatically schedule the workload of these appliances to work at times when the off-peak demand, and thus cost, is lower, and integrate renewable energy sources such as solar and wind to further reduce reliance on the traditional power grid. Finally, they are developing a secure method to protect the consumer’s energy usage information.
With academic and financial support covered through Bridge-to-the-Doctorate program, minority students are better poised for graduate-level success

BY JIM H. SMITH

Born in Colombia, Adriano Garcia ‘10, MS ‘13, came to Binghamton University from Brooklyn, New York, where his family has lived since 2001. This spring he completed his master’s degree in computer science. His graduate research has focused on development of an autonomous navigation system for a miniature air vehicle, or MAV. With remote image-based sensing and flight control algorithms, the highly sophisticated device, called a “quadcopter,” expands the capacity of such mini-drones to probe dangerous settings such as burning buildings or contaminated nuclear facilities without putting human first-responders in danger.

Californian Kelli Crosby, a master’s candidate in industrial and systems engineering, is wrapping up her thesis on open access scheduling (OAS) for patients at healthcare outpatient clinics. An alternative to traditional scheduling, which books appointments weeks or months in advance, but suffers from high “no-show” rates, OAS schedules patients within one or two days of appointments and decreases the rate of no-shows while improving continuity of care and patient satisfaction rates.

Mikhail Coloma, who completed his undergraduate work in mechanical engineering at the University of Hawaii last year, is intent upon earning his PhD at Binghamton. His research is on numerical and experimental studies of the fluid mechanics in the perivascular space, the essential pathway through which fluid flows in and around the brain. There is evidence that disease related to impaired fluid flow may be a factor in Alzheimer’s disease. Coloma hopes that his research may contribute to improved treatment options.

While areas of research are decidedly different, Garcia, Crosby and Coloma are linked by a common thread. They are three members of Binghamton’s inaugural class of Bridge-to-the-Doctorate (BD) Program students.

The Bridge-to-the-Doctorate is a National Science Foundation initiative that aims to increase the number of minority students who obtain a PhD degree in a science, technology, engineering and math (STEM) field. It is an extension of the Louis Stokes Alliance for Minority Participation (LSAMP) program, which was first funded at SUNY institutions in 1996 to increase the number of underrepresented minority students in STEM fields. At Binghamton, until recently, it was known as the Binghamton Success Program.
“Through LSAMP and Bridge-to-the-Doctorate, the Watson School is working to address the national need to increase participation by students from underrepresented groups in STEM and graduate degree programs,” says Peter J. Partell, MA ’97, PhD ’99, associate dean for academic affairs and administration, and co-PI of the LSAMP BD at Binghamton.

It’s working.

In the past 16 years, the enrollment of underrepresented minority students in SUNY STEM programs has increased by almost 400 percent. Some 5,000 students have earned bachelor’s degrees. Nearly 700 have been awarded master’s degrees. And over 150 have received a PhD. “LSAMP has taken a leadership role in STEM curricular reform and has acted as an agent of change on a range of issues related to the needs of underrepresented minority STEM students,” says David Ferguson, distinguished service professor and associate provost, diversity and affirmative action, at Stony Brook University, co-PI and director of the SUNY LSAMP Alliance.

Declaring the program “highly successful,” he says, “LSAMP has provided us with an effective means to attract minority students to STEM programs. Now, with Bridge-to-the-Doctorate, we can encourage those same students to enroll in graduate education.”

“LSAMP helped tremendously during my undergraduate years at Binghamton,” says Giancarlo “John” Cuadra, who graduated with a BS in biological sciences in 2004 and completed his PhD in biology in 2012. “It gave me the necessary strategies and tools to maintain a high GPA.”

Cuadra, who is currently completing post-doctoral work at the University of Florida, credits the collegial environment engendered by LSAMP. “Meeting other students in the same condition as myself gave me a sense of belonging and the feeling that ‘I’m not alone’ when it came to stress and hard work week by week.”

In order to qualify for BD, applicants must have participated in a LSAMP program and earned a bachelor’s degree in a STEM discipline with 3.0 GPA or better, must be a U.S. citizen or permanent resident, must have been accepted in a STEM graduate program, and must wish to pursue a PhD in a STEM discipline. If accepted, a BD fellow is not obliged to complete his or her PhD at Binghamton, or anywhere else for that matter, but, “We hope that they will earn their doctorate and remain in academia or do research,” says Shanise Kent, associate director of LSAMP and the other co-PI of LSAMP BD at Binghamton.

Students selected to participate receive some very attractive incentives, including tuition, student health insurance, and waiver of fees for the first two years, plus a $30,000 student stipend annually for the first two years. “They also get to participate in professional conferences and meetings, receive faculty mentoring, and get enriched academic services and support, including links to research and professional opportunities,” she adds. “We provide a diverse portfolio of support aimed at helping these students complete their degree and gain employment.”

There were 26 applicants when Binghamton’s BD program was announced in 2011. Last fall the program achieved a full cohort of 12 students.
“The Bridge-to-the-Doctorate program really takes a lot of pressure off students and allows you to concentrate on your education. I wanted to get an advanced degree and now I am considering going on for my doctorate. I’d be working on my master’s degree even if this program didn’t exist, but the Bridge program has made it much easier.” — Kelli Crosby

Garcia, who moved to Seattle after completing his master’s work, concurs. “I would certainly be in graduate school,” he says, “but getting my master’s degree would have taken me longer. I would have needed a part-time job and that would have meant I would have needed to reduce my course load each semester. This has really reduced the burden.”

Garcia plans to enroll in a doctoral program once he gets settled on the West coast.
The war on hackers

BY RACHEL COKER
I
formation security matters to anyone who uses a computer. These days, of course, that includes not only engineers at major corporations, but artists and kindergartners. We strive to think of clever passwords, take pains to back up our data and buy virus protection for our computers.

Consider, however, the ways that the term "computer" is expanding. Cell phones, tablets and other devices are part of this landscape, too. What happens if you lose your smart phone? Maybe you’re concerned about your password for online banking. Now imagine your worries if you work for the Department of Defense.

Researchers in the Thomas J. Watson School of Engineering and Applied Science work through these and other scenarios to protect individuals and the nation alike from hackers. And while traditional approaches have often relied on software modifications, several of their innovations aim to provide built-in security with improved hardware.

"Every day, hundreds of thousands of hackers try to attack America’s cyberinfrastructure," says Yu Chen, assistant professor of electrical and computer engineering. There are already real-world examples of cyber warfare, he notes, citing conflicts between Israelis and Palestinians and between Russia and Georgia.

Chen develops hardware that can be integrated into a network and detect attacks automatically. Now imagine your worries if you work for the Department of Defense.

Researchers in the Thomas J. Watson School of Engineering and Applied Science work through these and other scenarios to protect individuals and the nation alike from hackers. And while traditional approaches have often relied on software modifications, several of their innovations aim to provide built-in security with improved hardware.

The ‘Nanny Chip’

Ponomarev and Abu-Ghazaleh see new threats as well as new opportunities as computer architecture undergoes a period of rapid change.

Moore’s Law, which predicted that the number of transistors on a chip would double every 18 months to two years, has held up for decades. But many experts now expect a breakdown in Moore’s Law, which is driving manufacturers to place processors with multiple cores onto a single chip. This “multicore” approach improves speed and performance but can open new avenues of attack.

“Computer architecture performance has been improving at such a rapid rate, eclipsing probably any other human system,” Abu-Ghazaleh says. “But Moore’s Law is coming to a screeching halt.”

Most modern processors run multiple programs at once. The main program is running, but there is also hardware available to run something else. Abu-Ghazaleh and Ponomarev propose using the “spare” hardware as a baby sitter — a “Nanny Chip” or “Nanny Core,” if you will.

When programs run, there are expected behaviors. You can check up on them just like a nanny would check on a toddler at the playground. “It’s OK if we let our kids do something wrong as long as we catch them soon after, right?” asks Abu-Ghazaleh. “Permanent changes to the system are done at something called the system call boundary. As long as we’re OK when the system call happens, it’s all right.”

This kind of protection is called reference monitoring. As instructions exit a program, the “Nanny Core” makes sure the program follows the rules.

Ponomarev and Abu-Ghazaleh are also working on a related defense against a class of vulnerabilities called code injection. Let’s say you have a Web form in which you ask for someone’s address. A hacker can put in not just that type of data but files from which she’s able to generate a new program within your machine. Her code has been “injected” into your server.
In this scenario, the “nanny” assumes that any data coming from outside the program is not to be trusted.

“Let’s say I have a Web server and the bad guys connect to it and provide some garbage,” Abu-Ghazaleh says. “What we do is mark that data as untrustworthy, and any data that it touches is also suspicious. Then, as we are running our program, we check what it is doing with this bad data.”

There’s a major drawback to this approach, known as “information flow tracking,” however: It can slow down a program.

Ponomarev says they’re proposing a small change in hardware that doesn’t touch the rest of the carefully designed architecture. It’s a small box at the back end of the processor pipeline, and they’ve built the necessary VLSI circuits using Sun Microsystems’s public core as a demonstration.

They propose using several cores for security purposes only, rather than having a machine fire up every core to run programs. "Architecture changes are difficult except if they are not difficult,” Abu-Ghazaleh says. “If they’re small and don’t touch the major structures that Intel and AMD have spent a ton of their energies optimizing, then it becomes feasible.”

A ‘Data Dog’

Chen shares many of Abu-Ghazaleh and Ponomarev’s motivations. They also share research sponsors: Both the National Science Foundation and the Air Force have funded this work.

Chen proposes using a technique called “out-of-order data division” to strengthen security for mobile devices. Normally, once a hacker breaks a device’s encryption — a sort of secret code — he can access all of its data by using this key. But “out-of-order data division” involves storing information in segments, making it harder to reassemble even with the encryption key.

“Mobile devices are concerned with computing power and memory,” he says. “A cell phone doesn’t normally have the power to fend off a strong attack.”

Chen’s “Data Dog,” a highly flexible mechanism, could be a special chip or a function incorporated into another chip. There’s also a software version. The chip, Chen notes, wouldn’t conflict with existing encryption standards.

“You can use our Data Dog on top of that, for an extra level of encryption,” he says.

They're interested in preventing "side-channel" attacks, in which a hacker gains access to information that’s unintentionally revealed in a space shared by two chips. For example, one chip can’t “see” what another has put in the small storage area known as the cache, but it can detect what line of code in the cache was accessed. From there, it’s possible to reconstruct an encryption key.

Ponomarev and Abu-Ghazaleh’s technique, called non-monopolizable cache, prevents the attacker from taking over the cache. "We reserve small portions of the cache to be private to each processor," Ponomarev says. "The rest of the cache is shared. The private partition is sufficient to keep most of the side-channel information from an attacker."

Ponomarev and Abu-Ghazaleh say their solution is inexpensive and easy to do with a few extra transistors and less than a 1 percent cost in terms of performance.

"These are advanced attacks," Abu-Ghazaleh says. "People are just becoming aware of their impact. But they're powerful enough that we have to be aware of them as we build these machines."
“Over here is food waste, and over there is something that can burn it. Figure out how to go from A to B.”

— Alex Hantman '13

Student finds fuel in dining hall scraps

When the call came out for senior design proposals to be funded by the Iberdrola USA Foundation’s $100,000 gift to the Watson School, Alex Hantman ‘13 brought forth two — converting food waste into biomass briquettes for green energy, and anaerobic digestion of food waste to generate power and compost. Both were picked up.

Hantman, a bioengineering senior, led one of the five-person teams that included Tim Miller, Adam Morgan, Devan Tracy and Megan Watkins.

According to the National Resources Defense Council, 40 percent of food in the U.S. goes to waste. At Binghamton University that equals 2,000 lbs. of food waste daily.

Hantman is exploring ways to transform the energy that remains in the waste after it hits the garbage to fuel for campus.

The challenge: "Over here is food waste, and over there is something that can burn it — figure out how to go from A to B.”

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His efforts are right in line with the University’s 2009 Climate Action Plan that outlines strategies to achieve campus climate neutrality.

One initiative in particular aims to transition away from coal usage for heat by converting the central campus plant to 100 percent biomass by 2020.

It is estimated that this option alone will offset between 31 and 42 percent of the total campus greenhouse gas emissions.

Two technologies currently exist for converting biomass to burnable briquettes, pressing and extrusion — essentially the difference between batch and continuous production.

"Extrusion is what you would want at University scale," says Hantman. "Right now we’re prototyping with batch processing while developing an implementation plan for how to deploy extrusion at the University level.”

The team successfully created the biomass briquettes and tested to prove that the University boilers are compatible. "Our goal is to be net economically positive by the end of the semester," explains Hantman. "We’re looking at different ways to transport the food, and different drying methods to optimize cost and energy usage.”

Post graduation, Hantman will remain on campus in the ITC Startup Suite in an effort to commercialize the process. With the help of Adam Ibrahim, a Harpur College junior studying financial economics, he’ll try to bring in pre-seed dollars to continue funding the project, known as Discard Dynamics.

"Energy is one of the most important issues of our time," says Hantman. "There are a lot of opportunities for innovation and entrepreneurship."
Imagine being born blind, and then imagine beginning to lose your hearing at the age of five. Now imagine that you’re graduating from Binghamton University with a degree in computer science and will begin working for Amazon. Overwhelming? Not for Michael Forzano ’13, who suffers from Norrie Disease — a rare, genetic disorder.

At age 15, Forzano addressed his hearing impairment. “My hearing was getting so bad that I couldn’t hear well, even with the best hearing aids, so I got cochlear implants,” he says. “I had to re-learn how to hear. My hearing is now so much better, and it can only improve as the technology improves.”

Three years ago Forzano made another change, trading a cane for Delta, a yellow Labrador who has transformed his life. “I got her from Guiding Eyes for the Blind,” Forzano says. “They match you up to a dog by personality and how fast you walk — and Delta walks pretty fast.”

Training was intensive. “Every day we’d train in different environments. One day we went to New York City; Delta was amazing at handling the subways, trains and busy city streets,” he says. “Learning how to work with the dogs takes time. They say it takes about six months to a year to become a solid team, but I lucked out the day I got her. She’s smart and learns fast.”

Student and his guide dog conquer computers, college and life’s challenges

BY KATIE ELLIS
Delta is a working guide dog whenever her harness is on—but when removed, she’s a “normal” dog, great with people and very friendly.

A four-year resident of Hinman, Forzano felt he would fit in at Binghamton and he did. He has a younger sister who thinks the same and has been accepted into the Binghamton Advantage program for the fall.

He’ll have quite a trek to visit his sister at Binghamton, though. He starts working for Amazon in Seattle in August, after interning last summer writing the software that sends reminders to renters to return their textbooks. He expects to work as part of the trade-in or rental team when he begins his full-time position.

“I’ve always been really good with computers, always enjoyed them, and I felt it was something I would be good at,” he says. “I was considering possibly becoming a lawyer, but I’ve been playing with computers since I was young and thought I would give computer science a try and found that I really liked it.”

Forzano credits one faculty member in particular for encouraging him at Binghamton.

“Eileen Head (undergraduate program director for computer science) has been great. She always has her door open and is there to give advice on what classes to take and what internships to apply for,” he says. “She always encouraged me to apply to these big companies and I wasn’t sure I would be good enough. She said I have something unique to bring to a company, being blind and hearing impaired. She’s a big part of the reason I’m at Amazon.”

Still, Forzano faces daily challenges. When he arrived at Binghamton he got lost, a lot. But then like now, he remains positive. He also relied on staff in the Services for Students with Disabilities (SDD) Office for help getting books for classes, working out accommodations with professors and ensuring notes were accessible.

Everyone is great in Services for Students with Disabilities, he says. “Every time I go in there, they work hard to make my life easier.”

“Partnering with Michael to ensure the access he needed to excel has been a joy,” says B. Jean Fairbairn, SSD director. “He’s graciously partnered with SSD and the Computer Science Department in exploring new realms of accessibility for the campus and has literally been a pioneer in our development of Braille and tactile access to his academic materials.”

One way Forzano stays involved is through music. “I played alto sax in the pep band,” Forzano says. “It’s something I really enjoy, so I’m hoping to continue playing once I move to Seattle.” An Eagle Scout, he also hopes to do some hiking and camping there.

And one day, to run his own company.

“The challenge is coming up with the new idea, something interesting or innovative. The thrill for me is writing software that people use and that improves their lives. Working on a project of my own that makes lives easier in a new and innovative way is something I’d love to do in the future.”

—Michael Forzano ’13

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See more of Michael Forzano and his dog, Delta, at youtube.com/BinghamtonUniversity
It’s five o’clock on a Wednesday evening with five minutes on the clock to get to know that person sitting across from you before the bell rings and you move to the next seat. “Hi, my name is Chris. I’m an electrical engineer. What types of jobs do you have open in your organization?”

Speed networking, a spin off of speed dating, allows students to have one-on-one contact with industry professionals and develop their conversational ability and interviewing skills in a low-risk environment. The February event hosted 40 students and 40 industry professionals from 12 different companies including Raymond, Lockheed Martin, NYSEG and BAE.

This networking event along with numerous other outreach efforts by the Watson School’s Office of Career and Alumni Connections create a strong community network for the Watson School’s 2,700 students, 10,000-plus alumni and numerous industry partners.

“As a student I attended almost every event that featured an alumni presence, because I was eager to learn as much as I could,” says Assad Tabatabaie ’10, MS ’12, plumbing and fire protection engineer for Syska Hennessy Group. “I had so many questions but so little time to find answers.”

With the shoe squarely on the other foot, he has taken part as an alumnus in events such as the New York City Metro Career Fair to give current students the same opportunities he had — or better.

“Having been there myself, I know how eager students are to learn from people who have walked the same path. I would like to go one step further, though, and also provide them what I may not have had available to me that I would have found helpful.”
An international engineering consulting firm, Syska’s New York city office alone includes six Binghamton alumni — five Watson and one School of Management — and a summer intern. “Alumni networking brought all of us here,” says Tabatabaie.

The Watson office also provides services in extension of the Career Development Center, including tailored guidance for résumé and cover letter writing and interview preparation.

“Having been there myself, I know how eager students are to learn from people who have walked the same path.”

— Assad Tabatabaie ’10, MS ’12

As a junior, mechanical engineering student Sharon Aluma saw Director Denise (Liburdi) Lorenzetti ’94, MBA ’97, speak at a workshop about networking and résumé writing. But it was an individual consultation that she found a refreshing reality check. “Everyone I consulted before said my résumé looked great. This was the first time someone was straight with me. Denise and the student assistants had me move things around, expand bullets and quantify my results,” says Aluma. Lorenzetti also reassured Aluma about her GPA, which Aluma worried was unimpressive. “Including it, [Lorenzetti] said, shows that there’s room for improvement. Leaving it off will let a potential employer think the worst.”

“Academically, our engineering and computer science students are maxed out,” says Lorenzetti. “Therefore, the professional skills — networking, résumé writing, interviewing, organizing a job search — come in on the back burner when they’re seniors, and then that’s too late. Their curricula are difficult, their coursework demands are high, but it’s critical for the students to start their career planning early and obtain the professional skills needed to land a job once they obtain their degree.”

**WATCH FOR THESE EVENTS AND MORE IN 2013-14**

**INSIGHT ONSITE**
The Insight Onsite program allows students to network with an alumnus or industry representative, and take advantage of their career knowledge. Some of the sessions are 20-minute one-on-ones, while others are small round-table sessions. Students are encouraged to ask questions — nothing is off the table: What skills transferred to your first job? What difficult questions do you ask in an interview? What is your least favorite thing about your job?

**ALUMNI EVENTS**
Events are taking place from the East to West coasts, with a focus on speakers and topics related to technologies that have a broad impact on society. “Smart energy, small-scale electronics and healthcare are not only important to Watson alumni but alumni from a range of disciplines,” says Susan Ryan ’90, assistant director of career and alumni connections. The goal is to develop the alumni-student network and increase engagement in order to create a stronger Watson community, and, in turn, career pathways for students. Events range from the café-style gathering held in Albany this past April, to a full-scale reception with President Harvey G. Stenger this June in San Jose.

**ENGINEERING PROFESSIONAL DEVELOPMENT**
A variety of seminars are offered to ensure engineering students are ready to enter the workforce, including networking, business etiquette, strategic career development, interviewing, résumé writing and self-promotion. These workshops teach the professional skills critical to successfully land a first job.

**FACILITY TOURS**
Students get a firsthand look at firms and determine if their personality type would fit that particular culture. This is a great opportunity to network for both the student and employers. Recurring tours include BAE and Lockheed Martin, with more planned for the upcoming semesters.

**SPEAKERS AND PANEL DISCUSSIONS**
Alumni and leaders in industry share insights gained from years of experience in the varied fields of engineering. As soon as the formal sessions are completed, students gather around the guest speakers to network and to obtain valuable career guidance.

**ENGINEERS WEEK**
Events bring together students, alumni, faculty and staff to celebrate the annual Engineers Week in February. This past year, a kickoff event hosted an alumnus from Chobani who shared his insights regarding the company and the skill set needed to be a success on the job. Thomas J. Watson’s birthday was also celebrated during the kickoff event. During the week, a special guest of President Stenger Dr. Lester Gerhardt of RPI, delivered a powerful speech, “All the Right Stuff,” highlighting what Watson students must understanding to launch their professional technical careers. A speed networking event also took place during E-week.

**30TH ANNIVERSARY OF THE WATSON SCHOOL**
June 14 began a year of celebration as the Watson School kicked off its 30th anniversary with a local event with faculty, staff, alumni, students and friends. A variety of events will be held throughout the year in various locations to celebrate this major milestone, so stay tuned!

**If you would like to learn more or take part in our events, contact Suzy Ryan at sryan@binghamton.edu or 607-777-2871.**
Electrical and computer engineering students program robots in Associate Professor Douglas Summerville’s class.