Momentum in the Tagliatela College of Engineering continues unabated. This newsletter features several accomplishments, and we will give more details of others in the fall. Here are some of the highlights:

- The M.S. in Big Data program that we will launch at NEU at the University of New Haven in Palo Alto, California in the fall of 2014 is a model educational partnership between a non-profit university and a for-profit company and the first of its kind pursued by a university in Connecticut. We are charting new territory with this program and intend to re-engineer engineering education.

- The cyber forensics initiatives led by Professor Ibrahim (Abe) Baggili are making a big splash — details are in the faculty spotlight article in this newsletter.

- We recently received funding from the Kern Family Foundation for the first year of a multi-year project titled “Developing Entrepreneurial Thinking in Engineering Students by Utilizing Online Modules and a Leadership Cohort.” This project has the potential to brand the TCoE.

- The first cohort of engineering freshmen who participated in our study abroad program in Prato, Italy in the fall of 2013 gave the program rave reviews, as did many of their parents. We are recruiting incoming freshmen for what we hope will be a larger second cohort in the fall of 2014.

- We received approval from the State of Connecticut to offer a fully online master’s degree program in environmental engineering that will launch in the fall of 2014.

- For the second summer, we will host the TEAM Summer Camp in partnership with Georgia Tech and sponsored by Sikorsky Aircraft. This year the premier Kent School will participate as a second Connecticut site.

- More of our students are engaging in research and scholarship, and several projects are highlighted on pages 2-3 of this newsletter.

- Our third Senior Design Expo, held on May 8, 2014, was the most successful to date, with many outstanding student projects and presentations and satisfied company sponsors.

These are good times at the TCoE, and I thank the faculty, staff, and students who are contributing to our success by working hard and working smart!

Ron Harichandran
Dean

Re-engineering Engineering Education

A Silicon Valley start-up is looking to create “T-shaped” engineers to meet the global need for more innovation.

In-depth knowledge in one’s own discipline topped off with broad knowledge across a range of related fields — that, basically, is what a T-shaped engineer is, and it’s the only type of engineer that is going to feel at home in the 21st century. It’s all about collaboration and the ability to understand and interact with professionals in other areas.

Training T-shaped engineers turns traditional engineering education on its ear — which is precisely the motivating force behind New Engineering University (NEU), a start-up institution located in Palo Alto, California. Through a unique partnership with the University of New Haven, NEU aims to give birth to a new generation of T-shaped engineers by building “the most relevant, collaborative, and industry-connected engineering university on earth.” NEU’s program revolves around hands-on, project-based experiences that emphasize teamwork, communication, leadership, and entrepreneurship. The approach is expected to unleash a new wave of innovation and creativity to solve today’s complex global challenges.

The term “industry-connected” is key. Traditional engineering programs focus on theory in a single discipline and perpetuate the disconnect between education and industry interests. NEU has embedded within its structure an enviable network of industry partnerships, which include such luminaries as Oracle, Facebook, LinkedIn, IBM, and Palantir. These industry partners play an essential role in developing competency-based curricula, in developing the course material, and in providing the real-world projects that students engage in.

They also supply the leading practitioners and industry mentors that make up NEU’s faculty, thereby giving students direct access to working engineers and enabling them to forge strong ties with employers.

The first degree to be launched at NEU, in September of 2014, will be a 30-credit, one-year Master of Engineering in Big Data. In keeping with NEU’s mission to marry technical training to 21st century skills, the program zeroes in on a high-demand market sector in order to give students the relevant experience they need to land jobs. Addressing the intersection
of teams driving Big Data — technologies, analytics, and business needs — the program trains students to manage data driven decisions-making as well as use, analyze, and evaluate technologies and techniques in an enterprise setting. Graduates holding this degree will be able to design innovative solutions to Big Data challenges while taking economic and societal interests into consideration.

Although the program resides on the NEU campus in Silicon Valley, the degree will be granted by the University of New Haven.

To fill its inaugural class, NEU is targeting recent engineering graduates and underemployed engineers. They are also going out of their way to try and attract more women, as the field has been overwhelmingly male-dominated. There is plenty of room for them. NEU’s Provost, Lueny Morell, explains: “Last year, nearly 90 percent of U.S. companies reported difficulty hiring engineering talent, and 1.7 million cloud-related jobs went unfilled globally — in a sector that will produce 14 million jobs by 2015.”

Several organizations are lending a hand in the recruiting: GoldieBlox, the female targeted engineering toy company; the Geena Davis Institute for Gender in Media, led by the Academy Award winning actor; Codecademy, the online coding platform; and MAKE, the drivers of the Maker Movement — the fast-growing trend of people using do-it-yourself (DIY) and do-it-with-others (DIWO) techniques to create technology products.

Because perception often makes up nine-tenths of people’s reality, changing how potential students view the field of engineering is another facet of NEU’s mission. Women, especially, tend to lose interest in the STEM disciplines (science, technology, engineering, and math) way back in middle school, so they never make it to the point where they can start seeing the exciting possibilities in an engineering career. NEU believes that emphasizing problem solving, design thinking, and social relevance over tools and technology can change perceptions of the field of engineering is another facet of NEU’s mission. Women, especially, tend to lose interest in the STEM disciplines (science, technology, engineering, and math) way back in middle school, so they never make it to the point where they can start seeing the exciting possibilities in an engineering career. NEU believes that emphasizing problem solving, design thinking, and social relevance over tools and technology can change perceptions of the field of engineering.

Hadoop Framework to Provide Fault Tolerance in the Cluster

Dr. Amir Esmailpour with Santoshi Kalyan. With the vast increase in the amount of information — nearly 90% jump in the volume of data compared to previously recorded values in the past two years alone — it is essential to have proper facilities to handle big data. New database management technologies, such as those offered by the Hadoop framework, are being developed. Hadoop is an open-source software that is used for reliable, scalable, and distributed computing. Yet Hadoop has its own problems in its architecture, which results in point of failure in the job tracker. In this project, the researchers are designing a solution to handle the problems that may occur if the job tracker fails.

Xbox One Forensics

Dr. Ibrahim Baggili with Jason Moore, Andrew Harrington, and Armando Rodrigues. Video game consoles can no longer be viewed as just gaming consoles but either as full multimedia machines, capable of desktop computer-like performance. Game consoles have been used in criminal activities such as extortion, identity theft, and child pornography, but with their ever-increasing capabilities, the likelihood of the expansion of criminal activities conducted on or over the consoles increases. This research aimed to take the initial step of understanding the Xbox One, the most powerful Microsoft console to date, and documented the outcome of conducting a forensic examination of the Xbox One. The Xbox One was found to have increased security measures over its predecessor (Xbox 360). Various applications had different levels of security, and game traffic is encrypted. The encryption of the data and the new file types introduced made it difficult to discern potential digital evidence. Nevertheless, the team was able to find digital evidence such as times when the user initially set up the console and times when the system was restored or shut down as well as what games and applications had been downloaded, along with when the games were played. Jason Moore presented this work at the 2014 UNH Graduate Student Showcase and received the Best Presentation Award.

Android Malware Forensic Toolkit

Dr. Ibrahim Baggili with ZhaoHeng Yang. Using a data set obtained from North Carolina State University, Dr. Baggili and his student are working on developing a machine-learning algorithm that is capable of looking at an Android application and deciding whether or not the application is malicious, based on its behavior characteristics. The goal is to come up with a tool or methodology for investigators that categorizes malware and shows in what part of its code the malware could be doing something malicious.

Increasing the Power Output of Wind Turbines While Decreasing the Size of their Blades.

Working with Dr. Maria-Isabel Carnasciali, for his master’s thesis, undergraduate student John Hamilla carried out a performance analysis of the small-scale SunForcer® 600W wind turbine mounted on Buckman Hall. Graduate student, Rahul Rad, for his master’s thesis, is modeling the wind interaction between the building and surrounding structures and the placement of the wind turbine. Graduate student Barath Reddy is beginning work on modeling the placement of the funnels or shrouds surrounding the small turbines, following the lead from Ogin Energy, which is applying the technology to utility-sized wind turbines.

Energy Harvesting and Vibration Suppression Using a Piezoelectric Transducer.

Piezoelectric-based energy harvesting devices can convert ambient vibration energy into useful electrical energy. The circuitry used for piezoelectric energy harvesting sensors is conceptually similar to piezoelectric vibration dampers. Working with Dr. Cheryl Li, for his master’s thesis, Zhengping Liu explored a dual purpose shunted circuit that can facilitate simultaneous energy harvesting and vibration control. They developed a fuzzy logic-based algorithm to select the circuitry elements for balanced optimization between energy harvesting and vibration control.

Make a Gift
Your generous donation will keep our students innovating. To make a gift, visit: www.newhaven.edu/engineeringpriorities
Study Abroad is an experience that most students dream of. And, most students have the opportunity to fulfill that dream. Unfortunately, engineering students are the exception. While students in arts and sciences, business, and other colleges excitedly pack their bags, jet off for a semester, and return with a broader world view and a certain “je ne sais quoi,” students in engineering programs—whose courses are planned according to a critical sequence—have had to stay home. A missed or delayed course would definitely cause a glitch in the system. UNH wanted to change that. Our new campus in Prato, Italy beckoned, our universities excitedly pack their bags, jet off for a semester, and return with a broader world view and a certain “je ne sais quoi,” students in engineering programs—the ones who built since antiquity, and the secrets of engineering such a structure without it collapsing under its own weight during construction had been lost. It took Michael Tracz, an electrical engineering student who was a member of the group, to this golden opportunity to practice their skills in the art of networking and some subtle (or not-so-subtle) self-promotion.

What do the parents of his students say about the whole experience? For today’s engineer, living in a global neighborhood, that lesson needs to hit home hard. But whether they were gazing awestruck at the Duomo or at the actual telescope used by Galileo, these future engineers were also picking up a critically important lesson during their explorations. They were learning that there are other ways of thinking, designing, and doing. For today’s engineer, living in a global neighborhood, that lesson needs to hit home hard. Fortunately, there’s scarcely a place on Earth more ideally suited to learning that lesson than Italy, thanks to its political history. The country was once made up of a collection of independent city-states, which were in perennial competition with one another. Each one had its own way of doing things and its own standards— even for measurement.

In addition to their engineering courses, the students were required to take an Italian language class so that they could immerse themselves more fully in the day-to-day Italian lifestyle. The local cafés bore witness to the fact that they did exactly that— “con molto entusiasmo.” According to Adams, the benefits of studying abroad are apparent as soon as the students return to the U.S. “They come back with a level of maturity and leadership ability that you don’t see in many first-year students.”

Adams believes that first-semester, freshman study abroad actually helps in the transition to college life. “Think about it,” he says. “You yank a kid out of the classes— they landed in Prato, a medieval town with a rich and tumultuous history, just minutes by train from Florence, Siena, Pisa, and Lucca. There’s a certain rightness about engineering students studying in the cradle of the Renaissance, surrounded by breathtaking works of art. As Adams told his group, “The artists were the engineers of that time, thanks to their understanding of dimension and linear perspective. They were the ones responsible for the rebirth of engineering.”

The students found the Duomo in Florence— also known as the cathedral of Santa Maria del Fiore— particularly fascinating. Begun in 1296, the cathedral was, by 1418, ready for its roof. But a dome of this size hadn’t been built since antiquity, and the secrets of engineering such a structure without it collapsing under its own weight during construction had been lost. It took Filippo Brunelleschi, a former master goldsmith, to design and engineer the solution. His four-million-brick dome is a testament to his mathematical genius and a revelation to all students of engineering.

To see past issues of TCoE Trends, go to www.newhaven.edu/engineering/TCoE-trends

3rd Annual Engineering and Science Career Fair. The Employment Numbers Are In.

• Consigli Construction is interviewing four students for a project management internship position.
• BRASH Engines is interviewing three to four students for internship positions.
• Encon is considering three to four applicants for full-time positions.
• Northeast Utilities accepted four to five students into their internship program.
• Perkin Elmer is interviewing two students for full-time positions.
• Stanley Engineered Fastenings has conducted three phone interviews with students.

It was fertile ground for student job hunters at the 3rd annual Engineering and Science Career Fair, which was held, for the first time, in the Beckerman Recreation Center on February 20th. It had to be held at Beckerman. It was the only venue on campus large enough to accommodate the spectacular turnout. The event drew thirty-three companies and 175 students from UNH’s engineering and science majors, armed with their résumés and a little courage, the students took this golden opportunity to practice their skills in the art of networking and some subtle (or not-so-subtle) self-promotion.

The event was intentionally planned to coincide with National Engineers Week, which takes place the third full week in February. This year, UNH’s Career Development Center took the lead in planning, logistics, and employer recruitment for the Career Fair and expanded the event to include science majors as well as engineering majors, another first. Thanks to the Center’s efforts, twice the number of companies attended, with the whole event taking on a new professional sheen.

Meanwhile, “The TCoE faculty and Dean Harichandran’s office did a great job in getting students to attend the event,” said Matt Caporale, Executive Director of Career Development.

At the end of the day, the students were extremely glad they listened to them. The participating companies were:

- APS Technology
- Ashcroft, Inc.
- ASR Corp
- BRASH Engines
- ClarkDietrich Building Systems
- Connecticut Dept of Energy and Environmental Protection (DEEP)
- Consigli Construction Company
- Dealertrack Technologies
- Registration & Titling Services
- Diversified Technology Consultants
- Emerson Process Management
- Encon Inc.
- Enthone
- FM Global
- Gems Sensors
- General Dynamics Electric Boat
- Glenwood Systems LLC
- GoDcart
- Kitchen Brains
- MacDermid
- Noble Consulting Group
- Northeast Utilities
- PerkinElmer Inc.
- Professional Women in Construction
- Proton OnSite
- Stanley Engineered Fastening
- State of Connecticut Department of Transportation
- Thule
- U.S. Navy
- UNAPEN Inc.
- UNITED STATES MARINE CORPS RECRUITING
- Virtusa
- Whiting-Turner
- Yale New Haven Health

Hard Work Has Its Awards

TCoE Trends’ Fall 2013 issue took home a Silver Award in the Twenty-Ninth Annual Educational Advertising Awards, a national competition sponsored by the Higher Education Marketing Report.

Writer: Susan Bowd, Graphic Designer: Alicia Post

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Ibrahim Baggili has a message for cyber criminals: We’re helping your computer cooperate with investigators.

“You’re always tracking a person. At the end of the day, you’re dealing with a human being who wants to commit a crime, not a computer that wants to commit a crime.”

That, in a nutshell, is the passion that drives Dr. Ibrahim (Ike) Baggili, one of the leading cyber forensics researchers in the world and an exciting new addition to the faculty in the Tagliatela College of Engineering. To him, it’s all about the quest for the human being behind the computer.

The short definition of cyber forensics is scientifically finding digital evidence on computer systems that can be used as legal evidence in a court. In his field, Dr. Baggili gravitated to after earning a bachelor’s in network engineering technology and a master’s in programming and mobile development at Purdue University. Fascinated by the psychological aspects of cyber forensics after years on the purely technical side of things, he stayed on at Purdue for his doctorate, writing his dissertation on the psychological profiling of cyber criminals and working as a researcher at The Center of Education and Research in Information Assurance and Security (CERS) as well as Purdue’s Cyber Forensics Laboratory.

“Today, you profile people by profiling their devices,” he explains. Within two months of joining the faculty at UNH, he established a research group here whose mission includes doing exactly that, using the same state-of-the-art laboratory equipment and software currently used by industry and government agencies.

Known as the UNH Cyber Forensics Research & Education Group (UNHFRED), their work focuses on several key areas. Interestingly, job #1 is validating cyber forensics as a science. “A lot of computer scientists believe it’s not a science, that we’re just applying forensic methods already exist,” Baggili explains. “But it is a science. We’re very methodologically in what we do, and we’ve published in high-impact, peer-reviewed journals. We’re solving real-world problems with existing knowledge, but we’re still using the scientific method to do that.”

The group will be getting first-rate experience with those real-world problems when they start working with the U.S. Department of Defense. Thanks to a partnership agreement with the department’s Defense Cyber Crime Center, Air Force Office of Special Investigations – a couple pulled off by Baggili as Director of UNHFRED – students will be able to engage in remote internships with the agency. The partnership also will allow the College, through its programs in Computer Science and IT, to focus on becoming designated as a National Center of Digital Forensic Academic Excellence by the agency.

Small-scale digital devices is another area of intense interest to Baggili and his group. “Mobile phones intrigue me because they change so frequently,” he says. Before coming to UNH, Baggili had done groundbreaking work during a stint on the faculty at Zayed University in Abu Dhabi, where he started the first cyber forensics research lab in the Arab world. There, he and his students were one of the first groups to publish how to analyze an iPhone. The methods were used to solve a number of cases for that: Busted.

Although, cyber crimes include cyber bullying, cyber stalking, identity theft via websites, hacking, sexual predation or sexual exploitation using the Internet, Phishing, Spamming, Spyware, and Malware, Baggili stresses that cyber forensics applies to non-computer-related crimes as well. If a criminal simply uses a computer, is like going into a house with thousands of rooms because a hard-drive has thousands of gigabytes of data,” Baggili explains. “First, we have to make a copy of what’s on the hard-drive, but it can take up to 11 hours to copy one terabyte (1000 gigabytes) of data. We can’t even begin to sift through and analyze the data until that’s done.” Analysis can then take months.

That’s a challenge that UNHFRED is meeting head-on. “Can we detect things in real time, even at the scene of a crime? We’re developing techniques that will enable us to analyze data while we’re copying it off the hard-drive, such as an agent that can be installed on a computer or computer system to collect forensically important digital evidence,” he says.

Exactly what types of data can investigations uncover? Web browsing history is what immediately comes to mind for most people, but that’s just a small part of an area known as forensic artifacts. “Applications, software, systems... they all leave things behind,” Baggili notes. “If you install Skype, does it leave your chat log behind? Or Facebook – what data does it leave that can be used for evidentiary purposes? “Beyond that, can we profile you as a person from your hard-drive?” Using Natural Language Processing techniques, we can look at the text on your computer – that is, text in Word documents, in applications, and web history. We then take those words and try to figure out what kind of person you are from them.

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For criminals – cyber or otherwise – there’s a simple, one-word translation for that: Bustled.

A More Power-Packed Internship Program with Sk kosky

The Sikorsky Engineer-Entrepreneur in Residence program has evolved into an exciting new model, redesigned to give students a greater jumpstart in launching a career. The program, which formerly resided in Room B101 in Buckman Hall, has become the UNH-Sikorsky Aircraft Engineering Internship Program and is now on-site at the Sikorsky campus in Stratford.

These are no ordinary internships, though, which typically span a summer or a semester. They are intensive, year-long relationships – a company partnership, in effect.

The goal of the former Engineer-in-Residence program had been to give students practical experience to complement their technical education by learning first-hand from professionals. In that way, they would be better able to make immediate contributions when they entered the workforce.

The redesigned internships with Sikorsky will ramp up that experiential learning, giving students a depth and breadth of real-world knowledge and experience in aircraft engineering that is rare. Graduates will hit the job market with a decided and enviable edge – in the job search itself and from their first day at work.

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and show that they’re thinking beyond their small area of programming. It’s something that will distinguish them from students graduating from other universities.”

Meanwhile, in month-long workshops, the students are learning how to program tablets and iPhones. In the fall, the entrepreneurial aspect is slated to start in earnest and will give the students insight into a more exciting career scenario than they might have envisioned. CEO Chris Allen commented, “We’re aiming to provide students with a direct bridge from higher education to the professional world. We believe this program will help them start careers for which they have a real passion and desire.”

**A packed house**

Humming along beside the internship program — which involves 3 juniors and a sophomore — is a senior design project in full swing, with iDevices providing the technological support. Unlike most senior design projects, which typically are determined by the sponsoring company, the students came up with the idea for the project themselves. They are collaborating with the Athletics Department on this one, which involves designing and developing a mobile app that will allow UNH alumni to attend football games virtually.

**Sikorsky blazed the engineer-in-residence trail at UNH**

iDevices is following in the footsteps of a giant when it comes to engineers-in-residence at UNH. Sikorsky, the Stratford, Connecticut-based helicopter manufacturer, opened its Engineer-in-Residence program on the UNH campus in 2009. Students worked on actual projects underway at Sikorsky and received a salary as part-time employees. Although the Sikorsky Engineer-in-Residence program has closed on campus, the UNH partnership with the company is as strong as ever — students are now working directly with engineers at the Sikorsky plant itself in year-long internships through the UNH-Sikorsky Aircraft Engineering Internship program.

**The Extended Forecast**

One thing is certain about the collaboration with iDevices — it’s giving these interns not only a depth and range of experience far beyond the norm, but it’s also putting them on the leading edge of the next generation of Connecticut entrepreneurs. “You can see a spark in the students,” said Martinez. “This is something they know is different from what they’ve done in class. Something they know they are going to be able to use.”

Prediction? Look for a fresh wave of engineering start-ups in a few years.

**Want to join us?**

The Tagliatela College of Engineering is seeking other industry partners to participate in the EiiR program. UNH’s new Orange Campus provides an ideal — as well as idyllic — setting for corporate partners to work with students. Interested companies should contact Dean Ron Harichandran at rharichandran@newhaven.edu