



Dean's Remarks



Not only has the College shown strong growth in recent years in the numbers of students and faculty, program accomplishments, publications, and grants, but also each year has surpassed the previous one! Here are some of the exciting highlights of the 2014–15 year:

- ▶ With support from the Kern Family Foundation, we deployed four online modules related to entrepreneurial thinking in required freshman and junior courses spanning multiple engineering programs. The instructors developed activities to connect and reinforce course content with what students learned in the modules. The pilot launch was well received by students and faculty, and broader deployment will occur in the coming year.
- ▶ Following up on their exposés last year of security vulnerabilities in numerous social networking apps, student and faculty researchers in the UNH Cyber Forensics Research and Education Group (UNHC-FREG) developed and released Datapp, which the public can use to check unencrypted data-leak vulnerabilities in their apps. Soon thereafter, they discovered security flaws in smart watches. Both stories received worldwide coverage. Further details can be found at www.newhaven.edu/engineering/
- ▶ In March 2015, the first cohort of 11 students began their master's program in Data Science, which is offered in San Francisco in partnership with Galvanize. This unique partnership was reported by *The Chronicle of Higher Education's* Wired Campus blog on March 20, 2015 (chronicle.com/blogs/wiredcampus/u-of-new-haven-and-upstart-coding-school-team-up-on-masters-program/56219)
- ▶ For the first time, the College held its student awards program on the morning of Commencement Day, May 17, 2015, in Charger Gymnasium. Over 300 students and their families attended the event and applauded the approximately 25 award winners.

R Harichandran

Ron Harichandran, Dean

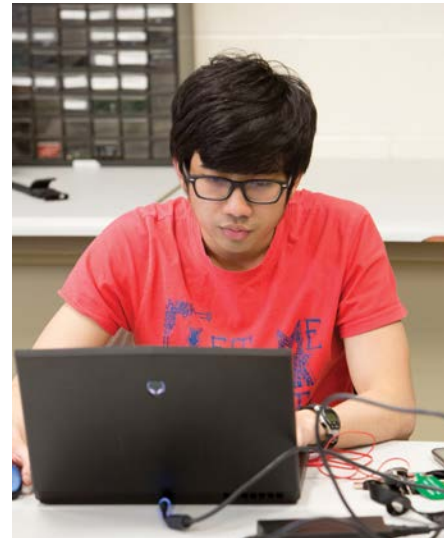
eLearning: Expanding On Success

The TCoE's ambitious entry into online learning has met and exceeded all expectations. Next step? An even broader presence in the College.

Online or eLearning has shown exactly what it's capable of.

No longer an outlier in the field of teaching, it has received good performance reviews for its ability to educate and for the quality of faculty involved. While some programs are totally online, another form of digital learning – the online module – works in tandem with the brick-and-mortar classroom.

The Tagliatela College of Engineering has been anything but digitally challenged in the eLearning area. Last year, the College embraced the marriage of classroom and eLearning with its series of Kern Entrepreneurial Engineering Network (KEEN) modules, which teach entrepreneurial engineering – business principles and marketing savvy married to the engineering discipline – to students in traditional classrooms. Another set of modules currently in development will instill written, oral, and visual communication skills. Known as PITCH – Project to Integrate Technical Communication Habits – the modules are a kind of engineer's finishing school, whose goal is to give students the poise and deftness in communicating their ideas that engineering employers are looking for today. The College places so much importance on these skills that three PITCH modules on written communication are slated to be one-credit courses spread out over three years, and a fourth module on oral communication and presentation will expand an existing freshman course.



In January of this year, the College also launched a totally online master's program – the M.S. in Environmental Engineering.

Getting the Terminology Straight

The rise of online learning has spawned a whole new crop of terms. Although some people throw them around rather freely, they actually have specific definitions.

When online learning is used to supplement the classroom and only makes up a small component of a course, the appropriate term is “web-enhanced learning.” UNH's KEEN modules fall into this category.

Another term, “hybrid learning,” means that a student can complete a degree by taking 50% or more of the courses online.

There's also "totally" online — having no on-ground component at all — which describes all the courses in the College's new online M.S. in Environmental Engineering program.

"Online with an On-Ground Component," might include an in-person meeting or exam.

"Blended Learning" goes with the flow — it means whatever a specific institution wants it to mean.

Brought to You via Blackboard

Whether we're talking about creating modules or complete online programs, Blackboard, the online course management system used by classroom instructors at many universities to interact with students, is the platform that makes it happen at UNH. Instructors who are familiar with Blackboard definitely have an edge when it comes to working with online education, but the College offers technical training for those instructors who need it.

Bonnie Riedinger, UNH's Director of eLearning, uses a Blackboard shell in faculty workshops to familiarize instructors with the content of the KEEN modules and show how to incorporate that content into the classroom. The instructors needn't become experts on the subject matter, but if one of the KEEN modules explores strategies for effective team building, for example, the instructor would time that module to coincide with a team class project. The workshops also give tips on how to run discussion boards and formulate questions based on the modules' materials.

The College's totally online M.S. in Environmental Engineering uses a Blackboard shell as well. Here, the curriculum of the online program is identical to that of the on-ground program. Each faculty member is assigned a professional instructional designer from Riedinger's office to help make the content work well in the online platform. The instructional designer and the resulting professional look of the program is, in fact, one of the major points of distinction between the TCoE's online environmental engineering program and that of some other institutions, which essentially just project videos of professors teaching on-ground classes.

The Totally Online M.S. Program — Making the Virtual More Real

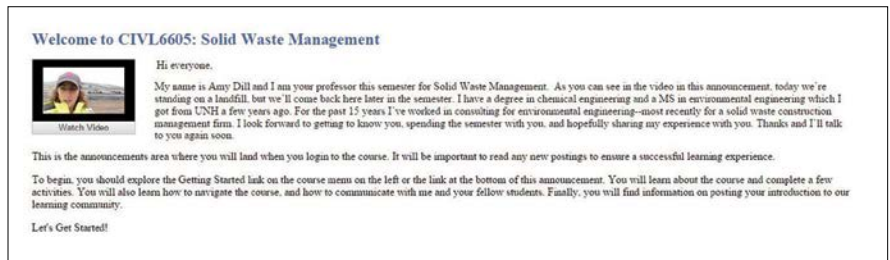
Skeptics of online programs express concerns about a lack of immediacy in interaction, a feeling of being "lost in cyberspace." Although it's true that online programs are asynchronous and don't occur in real time, there's plenty of interaction in the College's online M.S. in Environmental Engineering program. "It's not just passively reading things, and it's not all text-based," Riedinger explains. "Video and audio tools allow instructors to give feedback to students and allow students to post videos as well. There is a lot of interaction — between students and instructor and students with each other," she adds. "Every course has several discussion forums — it's not as though a student emails the instructor and asks a question with no one else benefiting from the answer. It's an open conversation — with instructors replying to students within 24 hours."

As for the quality of the education received in the online M.S. program, look to the on-ground program and the reputation the College has built in the field, says Agamemnon Koutsospyros, professor of civil and environmental

engineering. "UNH has been a pioneer in instituting the graduate environmental engineering program since the '70s," he says. "We've been well-recognized by students in the region and have graduated over 500 students who went on to work for environmental firms.

"Now we are pioneers again by establishing the first asynchronous, online program in the state. We're just building on the rich tradition that we have accumulated over the years."

Program Coordinator for the program, Assistant Professor Emese Hadnagy, takes the connection one step further. "I don't think it's possible to have a good online program unless you have a good on-ground program," she declares.



Amy Dill, instructor and developer of the Solid Waste Management course in the online Environmental Engineering graduate program, welcomes students to her course with a video tour of a landfill she has been working on.

Although online programs give the student some latitude to choose when he or she studies or works on an assignment, the extra rope is fairly short — the latitude is only within the day. That means working at midnight instead of 7 p.m., for instance, not skipping whole days. The College's M.S. program has strict deadlines to meet — one in the middle of the week and one on Sunday night. Each course is eight weeks long, and each has an authentic learning project, so that's a lot of deadlines. There are ten courses in all — 30 credits — for the degree.



Another instructor-guided video tour: a solid waste-treatment plant that Dill is also working on.

Initially, the online M.S. program was designed with the idea that students in the on-ground program would not be participants. However, in the TCoE's version of "blended learning," students in the on-ground program are now allowed to take some of their courses online — pretty solid confirmation that the online version is every bit the quality education that the on-ground program is.

Recognition

Meticulously thought-out, professionally designed and architected, with highly trained instructors at the virtual lectern, eLearning in the Tagliatela College of Engineering is earning the esteem of faculty and students alike. With plans for expansion into other programs over the next few years, its great reputation is likely to spread as well.

Ravi Gorthala: A prolific inventor who ignites the creative spark in his students

“If you invent something, there’s a 99.5% probability that it was invented 20 years ago,” says Associate Professor of Mechanical Engineering Ravi Gorthala with a wry smile. “Most inventing is taking what’s already been done to the next stage. There is more hidden treasure in the untapped old patents.”

As a mechanical engineer, Dr. Gorthala finds inventing to be practically second nature. He has four patents, two provisional patent applications, and several inventions in various stages of development and the patent process, with additional patents in the pipeline. Looking back, though, he describes an early career path that didn’t follow the straight line he envisioned but veered off onto the take-what-you-can-get track: “I thought once I got my Ph.D., the mechanical engineering job offers would just roll in. Wrong. My first job was working for a physicist – for no pay or occasional pay. What he did for me, though, was to take the blinders off and get me to see and think out of the box.”

The collaboration between the two proved to be highly synergistic. Together, they became a powerful idea generator with the self-imposed mission of coming up with one idea for research every week. Within three months, they had \$75,000 in grant money for their ideas. Within six, they had \$500,000.

With his creative powers in full-release mode, Gorthala then spent 16 years with Steven Winter Associates, a building sciences company, in Norwalk, Connecticut and New York City. During this time, he received funding for his ideas from NASA, the U.S. Department of Energy, the U.S. Army, the Electric Power Research Institute, the Long Island Power Authority, and New York State Energy Research and Development.

The years in industry ultimately led to a career-changing discovery, and that was a passion for teaching. “We’re all inventors. We’re all creators. But a stimulus is needed to tap into the brain, and most of the time that simply doesn’t happen. I try to provide that stimulus ... to inspire my students to be entrepreneurs, to be creative,” he explains.

An Idea That’s Seeing the Light of Day

One way he succeeded in doing that was to hand off to his students an idea he had for a skylight with an integrated solar collector and let them run with it. Called Tri-Sol, the project has developed into next-generation skylight technology. If mounted in commercial buildings underneath a south-facing skylight, the device would generate electricity, produce hot water, and provide ambient light for the building.

Tri-Sol is currently in its second incarnation. While occupying the same footprint – 4 feet by 6 feet – as the original Mark I version, the Mark II is lighter and more compact. Both versions feature a thermal absorber, photo sensor, and light tracker, but whereas the Mark I used solid acrylic concentrating Fresnel lenses two feet in height (focal length), the Mark II uses Fresnel film instead of solid acrylic for its lenses, which are only eight inches high. The Mark II’s lenses also focus solar radiation on a smaller, one-inch photovoltaic (PV) strip, reducing the amount of PV materials needed. Finally, replacing the Mark I’s wood frame with aluminum was a major weight-reducer, knocking off 172 lb from its original 250 lb.



Associate Professor Ravi Gorthala, right, with graduate student Adam Shelley and the Tri-Sol skylight.

Gorthala has filed a provisional patent application for this technology. Both the Mark I and the Mark II are known as proof-of-concept, pre-prototype models. The next step? A field-ready prototype, a tantalizing goal that is rapidly nearing realization.

Obviously, the sun plays a hero’s role in projects like Tri-Sol, but in the next project – a cooling challenge – it’s definitely more of an antagonist.

The Ice Bear Cometh

In the Northeast, there are several weeks in the spring when everyone gets a financial breather. Heating costs have pretty much petered out, and the evil twins, Hot and Humid, have yet to make an appearance, so air conditioning is not a huge expense. Come June or July, that’s all a fond memory. United Illuminating, in its continuing quest to reduce peak electricity demand from 1 p.m. to 5 p.m. in June, July, and August, installed a unit called Ice Bear in two local restaurants last summer. The utility chose Gorthala and his mechanical engineering students to be the third-party testing team to study the unit’s operational characteristics.

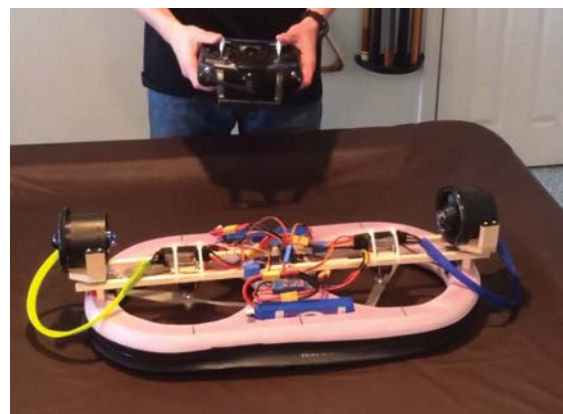
Ice Bear, made by a company called Ice Energy, works in conjunction with a business’ regular rooftop air conditioning unit (RTU). It’s essentially a big ice-making machine that stores thermal energy by making ice during the night and using it the next day for cooling during peak hours.

The two restaurants – TGI Fridays and the Bear & Grill – both had existing 10-ton RTUs consisting of two compressors, each having a 5-ton capacity. The Ice Bear unit, which was integrated to the RTU from the ground, was able to shut down one of the compressors every day by supplying the cooling that the compressor would ordinarily provide. How does Ice Bear cool? Fluid circulating through the ice inside the unit becomes ice-cold itself. The cold fluid is brought into the building space, where fans blow across it and cool the building’s interior.

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What Every Born Tinkerer Needs:

Room to Strew Parts, a Phenomenal Engineering Program, and a Very Understanding Mother



Matt Sheehy with hovercraft #9. Photo by Arnold Gold/New Haven Register

Mrs. Sheehy: “Matt has taken apart all of our hair dryers...”

Matt Sheehy: “I’ve messed up a lot of our hair dryers.”

Mrs. Sheehy: “He’s taken apart the vacuum cleaners...”

Matt (gleefully): “Of course. Those are good motors – a lot of RPMs in those things!”

Mrs. Sheehy: “Matt has never used anything as it was intended to be used.”

And that, in a nutshell, is what makes 17 year-old Matt Sheehy – incoming freshman and tinkerer extraordinaire – tick. But now the years of tinkering in the basement and leaving no appliance in its natural state – or at least as it emerged from the box – have paid off for Matt Sheehy and his long-suffering family. Sheehy is the inaugural recipient of a Kaufmann Scholarship – also known as \$150,000 – which will cover all four years of study at UNH.

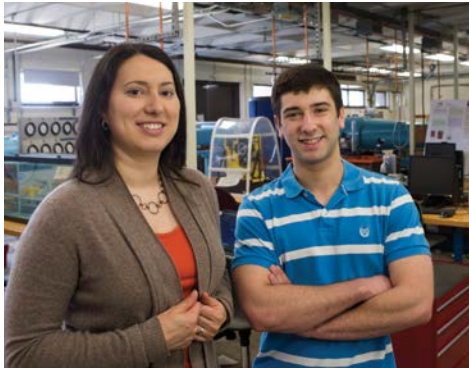
Sheehy had joined six other high-school seniors at UNH’s campus for a project competition that was designed to showcase talent in innovative engineering. Sheehy won the scholarship for “White Lightning” – a remote-controlled hovercraft that he designed and built and which is #9 in a series. “This started two years ago in my after-school program,” he explained. “One of the projects we did was a hovercraft.”

Hovercrafts, or air-cushion vehicles, use blowers to produce a large volume of air that is slightly above atmospheric pressure beneath the craft. Because the ambient air above the craft has lower pressure, lift occurs.

“Each student had about 20 minutes to make an oral presentation of their project to show their prototype,” said Dean Ron Harichandran. “Sheehy’s presentation, which demonstrated his inventiveness, his motivation, and his dedication, was a stand-out. He has the kind of commitment that we like to see in our students.”

The University of New Haven’s Richard O. Kaufmann Scholarship is granted to one student every two years. The scholarship was named in honor of Kaufmann, now deceased, who received his associate’s and bachelor’s degrees in mechanical engineering from UNH in 1963 and 1967.

Incoming Fire: For mechanical engineering student and new University Innovation Fellow Jonathan Spiegel, great ideas can strike at any moment. A trusty notebook records the creative fire as it happens.



Assistant Professor Maria-Isabel Carnasciali and Jonathan Spiegel.

Sometimes a simple notebook trumps an iPhone.

That tends to be the case with Jonathan Spiegel, who has made a practice of carrying a notebook and quickly jotting down ideas on the fly since his senior year in high school. With his considerable powers of observation and out-

of-the-box mindset, ideas make a frequent appearance in the mind of the sophomore student. The way he figures it, “Nothing has to be the way it is right now. Products, the ideas that are in place – people came up with them. I think, ‘How could I change that and make everyone’s life a little easier?’”

The passion and promise of this innovator-in-the-making was apparent to Assistant Professor Maria-Isabel Carnasciali right from the start when Spiegel was taking her Introduction to Engineering course. She urged him to participate in Startup Weekend in New Haven, a global initiative that brings entrepreneurs together, and followed that up by encouraging him to apply to the National Center for Engineering Pathways to Innovation (Epicenter) Fellows program, which is funded by the National Science Foundation. Stanford University and VentureWell direct it.

The program is designed to develop strategic thinking and entrepreneurial skills and to help Fellows formulate action plans to implement their ideas – thus becoming agents of change at their schools, with the end goal of bringing their ideas to life for the benefit of the economy and society.

Applying to the program involved a rigorous virtual interview conducted by a panel of Fellows. When all was said and done, Spiegel became one of 123 new Fellows – joining a network of nearly 300 Fellows pulled from 114 universities around the country. Spiegel wasted no time becoming involved in everything the Fellowship offered, attending the Fellows’ annual meeting in Silicon Valley and participating in leadership and idea workshops at Stanford University and Google’s world headquarters. The time spent at Google was an eye-opener. “There were so many brilliant students, some who’ve already started their own companies,” he raved.

Back at UNH, Spiegel’s action plan includes a Startup Weekend event at the University in the fall, when he hopes that 50 students from all engineering disciplines will take part in workshops on ideation, 3-D printing, and rapid prototyping. The plan is for teams to develop ideas and then make their sales pitch to a panel of experts. Spiegel is also excited about creating a Maker Space on campus, an idea that Dean Ron Harichandran has lobbied for over the past several years.

Dean Harichandran hopes that others will catch the fire of Spiegel’s enthusiasm. “We need passionate students who can develop momentum within the College for entrepreneurial thinking,” he stated. “That will be Jon’s task in the next few years. His leadership in rallying other students will be extremely important at this nascent stage.”

TCoE Professional Advisory Board: Three more members take a seat.

Dean Ron Harichandran is delighted to announce three additions to the Board. All successful alumni of UNH and good friends of the College, they joined existing members for the Board’s semi-annual meeting in June. They are:

- ▶ **William E. Turner (MBA '88)**, President and Founder of APS Technology, designers and manufacturers of innovative, off-the-shelf and custom electromechanical, instrumentation, and sensor equipment for the oilfield and other harsh environments. Bill was Director of Engineering at Teleco Oilfield Services from 1982–92 before founding APS Technology in 1993. In December 2014, APS Technology received the Innovation Excellence Award from Connecticut Technology Council. Bill was also approved as the new Chair of the Board.
- ▶ **Elaine Penta Rampone (M.S., Industrial Engineering '92)**, Owner and Chief Executive Manager of RAMP Enterprises, LLC, providers of quality

assurance systems that help companies in the commercial, aerospace, medical, automotive, and military markets achieve recognized international quality standards. Prior to RAMP, Elaine worked for General Dynamics, Electric Boat Division and a series of small family-owned businesses, with positions in Project and Design Engineering, Quality Procurement Engineering, and Quality Management.

- ▶ **Elizabeth (Betsey) L. Doane (M.S., C&IS/Systems Software Concentration '88)**, retired math and science professor, Housatonic Community College. After teaching at HCC for 30-plus years, Doane now teaches there part-time. Intrigued by how computers could be used to teach theory in calculus, she developed a course called “Mathematical Applications of Computers” while completing her master’s degree at UNH.

UNH Faculty Awards for Excellence

When your colleagues think you're pretty special.

Praise is always welcome. When it comes from those who actually understand what you do, it counts even more. After enthusiastic nominations by their peers, two members of the engineering faculty were honored with awards at the 2015 Faculty Awards dinner – an end-of-the-academic-year opportunity for faculty to gather together to celebrate the year and recognize outstanding achievements by their colleagues.



The “Last Lecture”— which is awarded to a faculty member whose identity is kept secret until he or she is announced — was given to **Dr. Pauline Schwartz**, professor of chemistry. In “Chemistry’s Web,” the title of her talk, Dr. Schwartz shared her thoughts on how chemistry is connected to the origins of our universe and to the origins of life on Earth and, perhaps, elsewhere. She spoke on the research she conducted with colleague Carl Barratt, professor of mechanical engineering, and a group of UNH students, which showed how even a simple set of chemical reactions might behave in an unexpected, non-linear manner. That unexpectedness is seen in much of nature and is also completely at odds with the linear thinking in which scientists are trained. Scientists, she said, need to look beyond simple patterns to understand more complex behavior.



Dr. Maria-Isabel Carnasciali, assistant professor of mechanical engineering, received the Excellence in Research and Creative Activity Award. As one colleague described her:

“Her research and creative activity encompasses publications, presentations, collaborations with colleagues at other institutions, industry partnerships, and grants — submitted and awarded.”

She has two NSF awards, which are highly competitive — one as PI and a second as co-PI. Through her role as a reviewer on several NSF panels, she has become a resource for other researchers on campus who are applying to the NSF.”

And Now For Our Linchpin

When the Tagliatela College of Engineering thinks “indispensable,” they immediately think of **Paula Hackenjos**, Assistant to Dean Ron Harichandran.



In recognition of her uncanny ability to hold the disparate elements of the College together, Paula received the Bartels Service Award earlier this year. Dean Harichandran summed up her talent, dedication, and genuine love for the College:

“Paula epitomizes exemplary service to administrators, faculty, and students. She goes way beyond the call of duty — planning events a year ahead of time, anticipating issues well before they arise, and keeping her dean on track by inserting reminders on his calendar and sending texts even after hours and on weekends. She does it all with unflagging good cheer. In fact, she is so good and efficient that the College’s faculty naturally gravitate to her when they need things done rather than seeking the help of people they should be asking!”

Clearing the High Bar: Dean Ron Harichandran Elected to the Connecticut Academy of Science and Engineering



Ron Harichandran was counted among Connecticut’s leading experts in science, engineering, and technology by the prestigious Connecticut Academy of Science and Engineering. He and 22 other newly elected members were introduced at the Academy’s 40th Annual Meeting and Dinner on May 19, 2015 at the Crown Plaza Cromwell Hotel in Cromwell.

Election to the Academy is a mark of high achievement and is based on scientific and engineering distinction attained through significant contributions in theory or applications. These must be demonstrated by original published books and papers, patents, the pioneering of new and developing fields and innovative products, outstanding leadership of nationally recognized technical teams, and external professional awards in recognition of scientific and engineering excellence.

Dr. Harichandran is internationally recognized for seminal contributions to the characterization of the spatial variation of earthquake ground motion and the study of its effects on structural response as well as his contributions to the mechanistic analysis of flexible pavement systems. He is also recognized for leadership in engineering academic programs and engineering education.

32nd Annual Alumni Scholarship Ball

The extraordinarily generous outdo themselves again.



Left: Robert Alvine; top: Ernie Schaub and President Kaplan; right: Anil Shah; bottom right: Emcee Jane Condon; bottom left: a chance to cut loose

For the second year in a row, the Alumni Scholarship Ball raised more than a million dollars in scholarship funds for students without the financial wherewithal to pursue their dream of a college education. The event also was an opportunity to recognize the contributions and accomplishments of distinguished alums who embody the “Do good and do well” career philosophy.

Ernie Schaub '72, of Bonita Springs, Florida, and Anil Shah '86, of Concord, Massachusetts, both received the Distinguished Alumni Award. Robert Alvine of Woodbridge, Connecticut was honored with the President's Award.

Schaub, a member of the University's Board of Governors since 2008, graduated from high school when he was 16 and went right into college at Southern Connecticut State. He dropped out after a year, opting to join the job world. “Too young to be in college,” was his verdict. But UNH beckoned, and Schaub found his niche here. A re-envisioned career path led to his becoming executive vice president of Goodrich Corporation and then president and CEO of EnPro. “I was fortunate in my life in that I recognized my second chances and used them,” he said. “UNH enabled me to open the first door to what was a very rewarding career.”

Schaub has a long record of service to the community, including volunteer service with the YMCA and Junior Achievement. He also established the Ernest F. Schaub Scholarship Fund at UNH.

Shah, president of MRCC, one of the fastest growing companies in the software industry, arrived from India years ago with a clear plan and the ambition to activate it. In very short order, he enrolled in a UNH master's

degree program in computer science. “A desire to succeed and advance my education brought me to UNH,” said Shah. “My time here was a big part of my success.” He credits UNH with not only providing him with the technical expertise he needed but also the soft skills – the people skills – that 21st century engineers must have in their tool kit.

Today, Shah helps UNH establish educational partnerships around the world, assisting Dean Ron Harichandran in evaluating potential partnerships with Indian universities, based on MRCC's experience in that country.

Robert Alvine is an emeritus member of UNH's Board of Governors, served as chair of the Board for six years, and headed up the Commission on the Future of UNH – the strategic task force that spurred the transformation of UNH from a commuter college to a residential university.

Alvine first became involved with UNH in the mid-1990s, when he led the task force that created the initial business plan for the Henry C. Lee Institute of Forensic Science.

He has been a generous benefactor throughout his association with the University, contributing to UNH's goal of creating “smart” classrooms and establishing an endowed scholarship. He also supports the Lee Institute, the Peterson Library, and UNH athletics. Alvine is especially renowned in the TCoE for his funding of the Alvine Engineering Professional Effectiveness and Enrichment Program lecture series, which brings to campus some of the leading lights in their fields to speak, share their expertise, and network with students.



THE BEST OF THE BEST

The Tagliatela College of Engineering has been ranked in the top tier of undergraduate engineering programs nationwide by **U.S. NEWS & WORLD REPORT**. The University of New Haven has been recognized as a Best College in the Northeast by **THE PRINCETON REVIEW**.

SUPPORT THE TAGLIATELA COLLEGE OF ENGINEERING

and help us earn a **\$50,000 gift** that will be awarded to the UNH college with the highest alumni participation rate. The challenge is being sponsored by UNH Board of Governors member Jeffery P. Hazell '83. **Make your gift today!**

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continued from page 3...

Gorthala and his student team designed and installed monitoring equipment with more than 20 sensors. They then monitored the Ice Bear/RTU integration for three months, dialing in from a cell phone modem to access one-minute interval data. By summer's end, UI was satisfied that Ice Bear had reduced peak demand by 30 ton-hours a day for each restaurant. The takeaway for UNH's future mechanical engineers? A good deal of excitement. When 25 students in Gorthala's Energy Efficiency class recently opened up the Ice Bear unit and took a close look at the innovative mechanics inside, sparks flew. Idea sparks.

The Two Things Needed for an Invention

Gorthala names the idea spark as one of the two essentials for every invention. The other one is problem identification. These are concepts that Gorthala's undergraduate students not only learn about in class but also experience first-hand in the lab – where they create the physical reality of what their minds have conceived.

Gorthala sums it up: "Engineering students at the undergrad level don't get this kind of hands-on experience at very many places. Our undergrads are actually building next-generation technology. They not only do the conceptualizing and designing but also the machining, welding ... everything, really."

And why shouldn't they? Once an idea spark has been ignited, it deserves all the fanning it can get.