

THAYER WINS  
National Academy of Engineering's  
**GORDON PRIZE**  
for Innovation in Engineering  
and Technology Education

SPRING 2014

# DARTMOUTH Engineer

THE MAGAZINE OF THAYER SCHOOL OF ENGINEERING

## GROWTH FACTORS

WITH ENGINEERING ON  
THE RISE AT DARTMOUTH,  
DEAN JOSEPH J. HELBLE  
OUTLINES OPPORTUNITIES  
FOR AN EXPANDED  
THAYER COMMUNITY.

► NEW SURGICAL CENTER ► DUAL-DEGREE STUDENTS ► ALUMNI IN THE NEWS



VIEW



#### CRUNCH TIME

As the end of term nears, students hunker down in the Great Hall.

## DARTMOUTH ENGINEER

VOLUME 10 / NUMBER 1

### Editor

Karen Endicott

### Design

Wendy McMillan

### Senior Editor

Kathryn LoConte Lapierre

### Alumni News Editor

Theresa D'Orsi

### Online Manager

Alison Findon

### Senior Writer

Anna Fiorentino

### Contributing Editors

Alex Arcone, Catharine Lamm, Lee Michaelides, Wesley Whitaker

### Editorial Board

Joseph J. Helble (ex officio), Ian Baker, Harold Frost, Elsa Garmire, Karl Griswold, Marcia Craig Jacobs, Peter Robbie '69

### Office of Communications

Thayer School of Engineering  
14 Engineering Drive  
Hanover, NH 03755

### Contact Us

[dartmouth.engineer@dartmouth.edu](mailto:dartmouth.engineer@dartmouth.edu)  
Tel. 603.646.3521 Fax: 603.646.9133

### Dartmouth Engineer Online

[dartmouthengineer.com](http://dartmouthengineer.com)

### Thayer School Website

[engineering.dartmouth.edu](http://engineering.dartmouth.edu)

### Report Address Changes

[engineering.alumni.records@dartmouth.edu](mailto:engineering.alumni.records@dartmouth.edu)

DARTMOUTH ENGINEER is published twice a year for the Thayer School community.

© 2014 Trustees of Dartmouth College  
Printed by Villanti & Sons, Printers Inc.

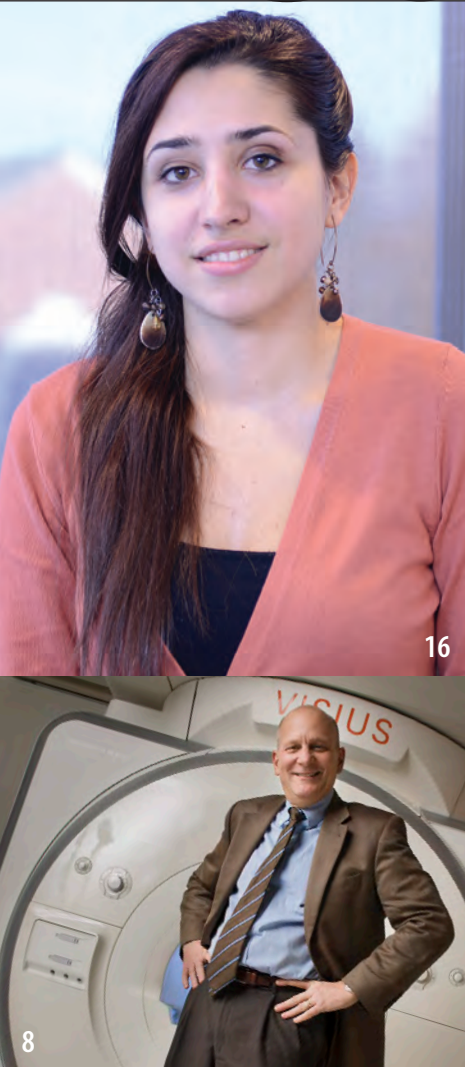
### FPO

Villanti: add FSC certification  
here

# Contents



2



16



22

## 8 Room to Operate

Dartmouth's new Center for Surgical Innovation makes space for research in clinical care.

BY ANNA FIORENTINO

## 12 Growth Factors

With engineering on the rise at Dartmouth, Dean Joseph J. Helble outlines opportunities for an expanded Thayer community.

BY KAREN ENDICOTT

## 16 Schools of Thought

Dual-Degree Program students call two institutions home.

BY KATHRYN LOCONTE LAPIERRE



32

### DEPARTMENTS

2 The Great Hall

22 Alumni News

32 Inventions

33 Random Walk

#### COVER

Dean Joseph J. Helble

Photograph by John Sherman

#### BACK COVER

Scott Mitchell DD'14, left, and William Persampieri '16 display their ENGS 21 project, a standing frame for children with cerebral palsy.

Photograph by Douglas Fraser



# THE Great Hall

>>NEWS FROM AROUND THAYER SCHOOL



## WINNING TEAM

Left to right, Dean Joseph Helble, Professors John Collier, Charles Hutchinson, and Robert Graves established elements of Dartmouth's Engineering Entrepreneurship Program.

## EDUCATIONAL INNOVATION

### Faculty Awarded National Prize

THE NATIONAL ACADEMY OF ENGINEERING (NAE) has awarded its 2014 Bernard M. Gordon Prize for Innovation in Engineering and Technology Education to Professors John Collier '72 Th'77, Robert Graves, Joseph Helble, and Charles Hutchinson '68A for integrating entrepreneurship into all levels of Thayer's curriculum to prepare students for technology leadership. The prize will be conferred at a May 2 ceremony in Hanover.

The prize recognizes the professors for their contributions to a long-standing Thayer educational paradigm now formally called Dartmouth's Engineering Entrepreneurship Program (DEEP).

Collier, the Myron Tribus Professor of Engineering Innovation, transformed ENGS 21: Introduction to Engineering into a hands-on engineering experience that requires student teams to develop a project idea, brainstorm a technology or product solution, research the market, build and test a prototype, develop a business plan, and present their idea to a review board of potential funders. Collier also mentors Bachelor of Engineering students taking the capstone ENGS 89/90:

Engineering Design Methodology sequence, in which students undertake real-life projects for industry sponsors.

Hutchinson, Dean Emeritus and the John H. Krehbiel Sr. Professor for Emerging Technologies, Emeritus, launched Thayer's Master of Engineering Management (M.E.M.) program in 1989. Combining engineering with business management and entrepreneurship courses taught by faculty from Tuck School of Business at Dartmouth, the M.E.M. program prepares students to advance rapidly in industry management and to create startups.

Assuming leadership of the M.E.M. program in 2003, Graves, the John H. Krehbiel Sr. Professor for Emerging Technologies, enhanced the curriculum, created a technology assessment course, and expanded leadership training and experiential learning opportunities. He established the Corporate Collaboration Council

of industry leaders who offer advice on industry trends, mentor students, and provide them with internships. He also initiated the M.E.M. Programs Consortium, a group of professional graduate engineering management programs that shares best practices and promotes the M.E.M. degree.

Helble, Dean of Thayer School, launched Dartmouth's Ph.D. Innovation Program in 2008 as the nation's first doctoral-level program in engineering innovation and entrepreneurship. Innovation Program students complete traditional Ph.D. requirements and receive entrepreneurial and leadership training through special coursework and experiential learning opportunities, including interning in a startup or pursuing their own venture. In their final three years, Innovation students receive independent funding to support development of their own innovations. During the program's first five years, two participants

“The National Academy’s prize validates Thayer School’s efforts to wholeheartedly encourage students in the entrepreneurship that underlies successful engineering.”



launched successful companies—Ashifi Gogo Th'10 founded the product authentication company Sproxil, and Dax Kepshire Th'06 '09 cofounded the utility-scale energy storage company SustainX.

The Gordon Prize comes with \$500,000, half of which is granted to the recipients and half to the institution “to support the continued development, refinement, and dissemination of the recognized innovation.” Thayer’s plans for using the prize funding include developing a summer workshop to teach college administrators, faculty members, and advanced Ph.D. students how to educate students in entrepreneurial thinking and leadership through project-based experiential study.

“It is a privilege to receive this award on behalf of the faculty of the Thayer School of Engineering,” says Helble. “Dartmouth has a long history of educational leadership, and to be recognized nationally for our innovations in engineering education is truly an honor for our school.”

“The National Academy’s prize validates Thayer School’s efforts to wholeheartedly encourage students in the entrepreneurship that underlies successful engineering in America,” says Elsa Garmire, a National Academy of Engineering member and the Sydney E. Junkins 1887 Professor at Thayer who nominated her colleagues for the Gordon Prize. “I hope that engineering programs across the country will be inspired to replicate our approach to engineering entrepreneurship.”

The NAE is a private, independent, nonprofit institution that provides engineering leadership in service to the nation.



#### AWARDS

## N.H. Professor of the Year

ENGINEERING PROFESSOR VICKI MAY was named the 2013 New Hampshire Professor of the Year by the Council for Advancement and Support of Education (CASE) and the Carnegie Foundation for the Advancement of Teaching. CASE and the Carnegie Foundation give the award annually to undergraduate teachers “who excel in teaching and positively influence the lives and careers of students.”

May teaches courses in solid mechanics and structural analysis and co-teaches a popular course for non-majors, ENGS 2: Integrated Design: Engineering, Architecture, and Building Technology with studio art Senior Lecturer Jack Wilson.

In all her courses May prefers project work to lectures. “There’s lots of theory and that’s important,” she says, “but being able to tie everything together by actually building something gets students excited and helps them learn, because they see a real context to all the math and science they’ve been doing.” Her course projects have ranged from designing affordable housing for earthquake-devastated Haiti to constructing a wheelchair-accessible tree house in the woods at Hanover’s Storrs Pond Recreation Area.

May earned her M.S. and Ph.D. in civil and structural engineering from Stanford and got her pedagogical start as a teaching assistant there. “I really liked the work,” she says. “Now teaching is my focus, my passion.”

That passion extends to bringing engineering into elementary school, middle school, and high school classrooms. Last summer May organized and ran Thayer School’s first Design It! Build It! workshop, a two-week hands-on introduction to engineering for high school students. She is planning an even more extensive Design It! Build It! workshop for this summer.

“Engineering gives context to math and science,” May says. “You’re never too young to learn about engineering.”

—Alex Arcone

## kudos

- >> Professor Tillman Gerngross was named a 2013 National Academy of Inventors (NAI) Fellow for creating “inventions that have made an impact on quality of life, economic development, and the welfare of society.” Gerngross has cofounded five startups—GlycoFi, Adimab, Arsanis, Avitide, and Alector—focused on translating engineering and medical research into methods for treating disease.
- >> The Society for Risk Analysis gave Professor Mark Borsuk its 2013 Chauncey Starr Distinguished Young Risk Analyst Award in recognition of his work in decision theory, uncertainty analysis, and Bayesian statistics used to help quantify and address risk in areas such as climate change and sustainability.
- >> Professor Charles Sullivan was named a 2014 fellow of the Institute of Electrical and Electronics Engineers (IEEE). He earned the honor—bestowed on less than 1 percent of total institute membership—for his “contributions to the design of power electronic circuits and magnetics.” He joins George Cybenko, Eric Fossum, Elsa Garmire, and Eugene Santos as Thayer faculty members recognized as IEEE fellows.
- >> The Arctic continues to show evidence of a shift to a warmer, greener state, according to Professor Donald Perovich, one of three experts who unveiled the National Oceanic and Atmospheric Administration’s 2013 Arctic Report Card ([arctic.noaa.gov/reportcard](http://arctic.noaa.gov/reportcard)) in December. “In summary, I’d say that 2013 was another year in the new normal of reduced Arctic sea ice,” he said. “The long-term warming trend has implications for other components of the Arctic system, including the marine and terrestrial ecosystems.”



“I devote one third of the course to technologies of prevention. Thus we can avoid problems of pollution in the first place.”

## STUDENT PROJECTS

### I Want One of Those!

#### ▼ Ergonomic Serving Tray

THIS ELEGANTLY SIMPLE AND FUNCTIONAL BAMBOO TRAY makes it easy and comfortable to carry and set down multiple glasses. Shinri Kamei, Carly Kuperschmid, Krystyna Miles, and Yvette Zou, all members of the Class of 2016, won the Phillip R. Jackson Prize for outstanding performance in ENGS 21: Introduction to Engineering. Their teaching assistant was Sean Hammett '14. The team has initiated the process of filing for patent protection.



Shinri Kamei '16 demonstrates her team's ergonomic serving tray.

## CLASSROOM

### ENGS 37: Introduction to Environmental Engineering

PROFESSOR BENOIT CUSHMAN-Roisin wants students taking his ENGS 37: Introduction to Environmental Engineering course to do a particular kind of problem solving: preventing environmental problems before they happen.

“I devote one third of the course to technologies of prevention,” he says. “We put environmental engineers right out front with the engineers who design the cars, the buildings, the coal plants, before their technology gets out the door. Thus we can avoid problems of pollution in the first place.”

Cushman-Roisin also introduces students to technological, policy, and risk-assessment issues related to water and air pollution, solid waste, and the fate and transport of pollutants in the environment. He pulls in environmental chemistry, life-cycle assessments, green design, and matters of scalability.

“One assignment was to design our own waste-water treatment plant,” says Sarah Hammer '15, one of 62 fall-term ENGS 37 students. “I had to ask myself questions like, if I increased the amount of organisms feeding on the waste water,

how would that affect the plant's efficiency?”

The course included field trips to examples of existing solutions to environmental challenges: the Hanover Water Reclamation plant, the Dartmouth Organic Farm, and The Class of 1978 Life Sciences Center, which attained the highest level of Leadership in Energy & Environmental Design (LEED) certification. “The Life Sciences Center has many science labs, so it's really impressive that the builders still met all of LEED's Platinum standards,” Cushman-Roisin says.

For Cushman-Roisin, environmental engineering borders on a calling. As he tells students in a series of bullet points early in the course: “Engineers are responsible for the Industrial Revolution. The Industrial Revolution has spread across the globe. There is a growing set of negative consequences, some local and some global. Thus, it stands to reason that engineers are called to play a central role in amending current technological practices and designing and deploying sustainable technologies.”

—Alex Arcone



## FACULTY

# New Profs



Associate Professor **Jane Hill** joined the faculty in September. She earned a B.S. in chemical engineering and an M.S. in environmental management and policy from Rensselaer Polytechnic Institute. She received her M.S. and Ph.D. in environmental engineering from Yale. Her research interests include infectious disease prognosis and diagnostics, aerobiological processes, and methods of engineering soils for greater fertility.



**Ryan Halter Th'06**, an assistant professor at Thayer since 2006, joined the tenure-track faculty in July. He earned a B.Sc. in engineering science and mechanics and a M.Sc. in engineering mechanics from Pennsylvania State University and his Ph.D. at Thayer School. His research interests include biomedical instrumentation, electrical impedance tomography and spectroscopy, medical imaging, tissue bioimpedance, cancer detection technologies, traumatic brain injury, and medical robotics. He is also an adjunct professor of surgery at the Geisel School of Medicine at Dartmouth.



Visiting Assistant Professor **Vikrant Vaze** has become a full-time assistant professor. He earned his Bachelor of Technology in civil engineering from the Indian Institute of Technology in Bombay, India. At MIT he received an S.M. in transportation, a second S.M. in operations research, and a Ph.D. in transportation systems. His research interests include logistics and transportation, aviation, healthcare analytics and healthcare systems modeling, building energy analytics, systems optimization, game theory, and data driven and statistical modeling.



**John X.J. Zhang** will join the faculty in July. He earned his B.S. from Shanghai Jiao Tong University, his M.S. in electrical engineering from the University of Maine at Orono, and his Ph.D. in electrical engineering from Stanford. He has been teaching at the University of Texas at Austin since 2005. His research interests include miniature imaging and biosensing systems, lab-on-chip design, advanced nanofabrication technologies, and multi-scale modeling of fundamental force, flow, and energy processes in biological interactions.

## Q & A

# 2014 Rhodes Scholar Jonathan Pedde '14

**JONATHAN PEDDE '14**, an economics and mathematics double major with a minor in engineering sciences, was recently named one of 83 Rhodes Scholars for 2014. He and fellow Canadian Joseph Singh '14, a government major, were the two students selected from Dartmouth to receive full scholarships to pursue graduate degrees at the University of Oxford.



Pedde is the second Dartmouth engineering student to win a Rhodes Scholarship. The first was Ian Sue Wing '93 Th'94, who majored in both engineering and environmental studies and is now an associate professor in Boston University's Department of Earth & Environment.

Pedde says he hopes to earn a master's in economics and then pursue a career at a public policy think tank. We asked him:

**What led you to minor in engineering?**

In high school, I enjoyed studying physics, and I particularly enjoyed solving some of the more applied problems in this subject. When I was choosing which university to attend, Professor Erland Schulson was kind enough to speak with me about the opportunities afforded by Thayer, and he made a pretty persuasive case in favor of engineering.

**How does engineering dovetail with your interests in economics and math?**

I am particularly interested in macroeconomics. While most macroeconomists today take a scientific and mathematical approach to studying the macroeconomy, the field originally arose as a result of the Great Depression, and many early practitioners viewed themselves as engineers who were trying to solve the problem of depression prevention. Given the events of the last few years, this early perspective is of great interest to me.

**How do you think your engineering studies will aid your future work in public policy?**

In ENGS 21, I really enjoyed learning the engineering problem-solving method. Since then I've realized that this method can be applied in all sorts of different situations—including public-policy problems.



“The projects that came out of ENGS 125 are a great opportunity for students to better understand the confusing black box systems that electrical systems can be.”

## FIRST PERSON

# Travels with Humanitarian Engineering



I TRAVELED TO RWANDA IN THE summer of 2013 with five other members of Dartmouth Humanitarian Engineering (DHE)—Joey Anthony '12 Th'13, Max Sloan '13 Th'13, June Shanguan '13 Th'13, Alison Polton-Simon '14, and Sophie Sheeline '16—to update two DHE pico hydropower sites

As a freshman, I had yet to take any electrical engineering classes and only had my experiences training with DHE to rely on. But before the trip, our group had spent two weeks working with Professor Charles Sullivan, a power electronics expert and one of DHE's advisors, to hone our knowledge of the Banda hydro system and basic electrical engineering. During those two weeks, I went from an embarrassing lack of knowledge about charge and diversion control to being able to justify every component of our system before a Thayer review board.

The hydro sites in Banda function as a business. Customers own large batteries, typically car batteries, that they charge at the sites for a price and carry home to use to power electric lights and appliances. Revenue from this system pays the site's employees. The business had been operating smoothly for the past few years, but our surveys revealed instances of corruption by some local employees. We also found technical problems.

We reached out to Ben Koons '08 for help. In 2007, the year he helped start the DHE hydro project, he had met a former forest guide and self-taught electrician named Rick Masumbuko. Rick helped Ben with site assessment. The following fall, DHE sponsored a project in ENGS 89/90. Ben and

other Thayer B.E. students designed and tested a small-scale hydropower system that could be entirely locally sourced in Rwanda, and in the summer of 2008, returned to Banda to build systems at Kigogo and Nyiragasigo.

I met Rick near the end of our time in Rwanda. He had been looking for us. He told us that Ben had asked him to help us.

When I explained what we were doing with the electrical system, Rick pulled out a multimeter, which we later learned Ben had given to him, and started taking data. We traveled together to look for electrical components to replace those that had been fried during an earlier round of testing.

Rick was skilled and resourceful, finding replacement parts by going around Banda and asking people for their broken radios. He even showed us the 12V DC light that he had designed by studying electrical engineering textbooks that foreigners had left with him. The battery used the head of a fluorescent bulb (originally designed to run off of the 220 AC that runs through the electric grid in Rwanda) and other inexpensive parts, most of which can be found in old radios. “He is very serious,” the village doctor told us over and over again—“serious” being Rwandan English for a good, smart, honest man. When we left, we hired Rick to oversee the management and operation of the sites. We knew he would take care of both the technical and business aspects of the projects.

Upon our return to Dartmouth, we got some bad news from Rick: One site's electrical system, which we had just replaced, had broken. Our team was upset, both because the community would have less access to electrical power and because we couldn't believe that something we had spent so long carefully designing and implementing could fail so quickly. When we approached Professor Sullivan with the news, he suggested that perhaps the team could move away from our dependence on commercially produced products, which were both expensive and difficult to fully understand. Then he tasked the students in his ENGS 125: Power Electronics and Electromechanical Energy Conversion course with a new final project: to design their own version of DHE's electrical system.

In the ensuing months we learned that the issues with the hydro sites were due to operator mistakes rather than inherent flaws in the system. However, the projects that came out of ENGS 125 look promising and are a great opportunity for students to better understand the confusing black box systems that electrical systems can be.

As a student organization doing aid in a foreign country, DHE faces a lot of challenges, but they aren't ones that can't be overcome. The steadfast support from Thayer faculty and the commitment of Thayer alums is integral to our work. I am so thankful to have had the chance to discover these resources.

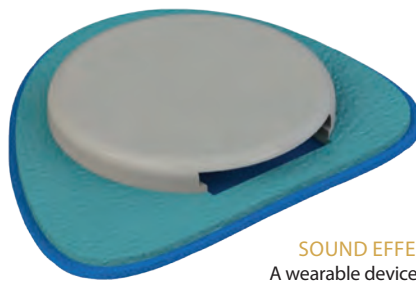
—Shinri Kamei '16

## PARTNERSHIP

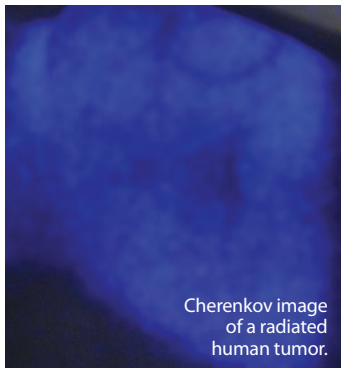
Shinri Kamei '16, left, and Rwandan Rick Masumbuko discuss the hydro sites that DHE is leaving in his experienced hands.



# lab reports



**SOUND EFFECTS**  
A wearable device can monitor asthma symptoms.



Cherenkov image of a radiated human tumor.

## HUMAN CHERENKOV IMAGING

Dartmouth's Optics in Medicine Laboratory completed the world's first human trial of the Cherenkov effect as a means of seeing radiation therapy in action.

The lab devised a technique for using the Cherenkov effect—the emission of light by a charged particle passing through a medium at a speed greater than the speed of light in that medium—to collect detailed images of the effects of radiation on tumors.

Led by Thayer Professor Brian Pogue and Geisel School of Medicine medical physicist David Gladstone and radiologist Lesley Jarvis, M.D., the initial trial was conducted at Dartmouth-Hitchcock's Norris Cotton Cancer Center on a woman undergoing radiation for breast cancer. The research group then conducted a pilot study on 12 breast cancer patients.

"Our lab has researched a number of applications of the Cherenkov effect in radiation therapy including spectroscopy, tomography, and dosimetry in a water tank," says Thayer Ph.D. candidate Adam Glaser. "We have found that imaging the surface dose in breast radiotherapy is one of the most impactful applications of this technique."

"While our main research focus is improving this new technique, our team is also looking at how Cherenkov imaging can be used to study delivery accuracy in cancer treatment regimens, as well as looking at molecular signals which can be probed from the blue light within the targeted cancer tissue," says Dartmouth physics graduate student Rongxiao Zhang.

According to Geisel medical student Whitney Hitchcock, the radiation used to treat cancer tumors can produce "hot spots" on a patient's skin. While most of the 12 women in the trial experienced only temporary skin irritation from their planned radiation, the data-rich Cherenkoscopic images allow the researchers to study correlations between hot spots and the development of skin problems such as swelling, redness, and scaling.

The Optics in Medicine Lab group is currently using a single camera for Cherenkoscopic images, but in future the researchers hope to develop a multiple camera system to improve imaging and eventually apply the technique to other types of cancer.

—Wesley Whitaker

## ASTHMA MONITOR

Professor Kofi Odame is developing a wearable device that will monitor asthma symptoms—an aid for the nearly 19 million Americans with asthma who, according to the Centers for Disease Control and Prevention, do not manage their symptoms adequately and may end up in hospitals or ERs.

The device consists of any modern smart phone, a thin strip of adhesive silicone that sticks to a patient's chest, and a piezoelectric transducer (PZT) embedded in the

silicone that picks up sounds in the chest and transmits them to a smart phone equipped with software that detects if the sounds are asthmatic coughs or wheezes. "People's smart phones will display the frequency of their coughing and wheezing—which will indicate to them whether they should leave an area, step up their medication, or even see a doctor," Odame says.

Several students are contributing to the project. Justice Amoh '13 Th'13 is leading the design team and developing machine-learning algorithms for detecting wheezes and coughs. Engineering major Teresa Ou '15 built the circuit board that filters and amplifies signals from the PZT sensor and is installing a Bluetooth system for wireless communication with a smart phone. Malika Khurana '15, from Dartmouth's Neukom Digital Arts Leadership and Innovation lab, heads product design and prototyping. Computer science (CS) graduate students Vibhu Yadav (advisor: CS Professor Daniel Rockmore) and Athina Panotopoulou (advisor: CS Professor Lori Loeb) are contributing to the smart phone app development and algorithm design, respectively.

"You need an algorithm that tells you whether someone's coughing or whether he's talking, laughing, sneezing, or just moving around," says Amoh.

The goal is to make the system capable of detecting subtle changes in airway constriction that people may not notice on their own. "The device will help make people more aware of their symptoms and what's triggering them. Then people can play a more active role in managing their disease," says Odame.

—Alex Arcone

# kudos

>> In a new study published in the *Proceedings of the National Academy of Sciences*, Thayer research scientist **Mark Laser** and **Professor Lee Lynd** compared the efficiency of vehicles powered by biofuels or bioelectricity produced from cellulosic biomass, a form of renewable energy. The authors, both experts on converting cellulosic biomass into alternative fuels, say their analysis differs from prior work in that it considers heavy-duty vehicles as well as light-duty vehicles, assumes comparable technological maturity for biofuel- and bioelectricity-powered vehicles and supply chains, and factors in the decline in efficiency that comes with increased range for battery-powered vehicles. Assuming typical driving ranges in the United States today, Laser and Lynd find that light-duty vehicles are similarly efficient whether powered by biofuel or bioelectricity. However, heavy-duty vehicles are more efficient when powered by biofuel than by bioelectricity. According to the authors, the key implication of their study is that it is reasonable to expect overall efficiency to be as high or higher for vehicles powered by biofuels as compared to vehicles powered by bioelectricity.

>> Engineering major **James Mock '15** has cofounded SquareOne Mail (squareonemail.com) with Dartmouth alums CEO **Branko Cerny '13** and designer **Sang Lee '13**. As the lead software developer, Mock is working on an application—now available in beta—that will allow users to configure various categories to sort incoming emails. The San Francisco-based company recently added two more employees, including software engineer **Arthur Conner '91**.

>> The eighth annual **Formula Hybrid Competition**, which Thayer founded and hosts, will be held April 28 – May 1 at the New Hampshire Motor Speedway in Loudon, N.H. This year's competition has attracted 24 student teams, including one from Turkey, two from Canada, and three from India.

# ROOM TO OPERATE

DARTMOUTH'S NEW  
CENTER FOR SURGICAL  
INNOVATION MAKES SPACE FOR  
RESEARCH IN CLINICAL CARE.

BY ANNA FIORENTINO





VISIUS

**VISIONARY**

Imaging expert Keith Paulsen helped create the nation's first surgical center reserved for research.



**THE CSI PROVIDES A  
UNIQUE OPPORTUNITY  
TO IMPROVE SURGICAL  
PRACTICE. THE  
INTERSECTION OF  
EXCELLENT ENGINEERS  
AND SURGEONS  
MAKES THE PROSPECTS  
SO PROMISING.**

**—JOHN WEAVER**  
ADJUNCT PROFESSOR  
OF ENGINEERING

Imagining what life would be like if medical technologies never advanced is not hard. “We would be dying sooner and of many more diseases if we hadn’t put money and effort into research,” says Keith Paulsen, Thayer’s Robert A. Pritzker Professor of Biomedical Engineering.

The value of medical research is why Paulsen and Dr. Sohail Mirza, chair of Dartmouth-Hitchcock’s Department of Orthopaedics, have worked together to create the Center for Surgical Innovation (CSI), the nation’s first surgical facility dedicated to translational research.

Paulsen, CSI scientific director, and Mirza, CSI medical director, will oversee research that combines Thayer expertise in biomedical engineering, imaging, and computation with clinical expertise at Dartmouth-Hitchcock Medical Center and Geisel School of Medicine—research that uses the CSI to test new approaches in the operating room, such as complex real-time image-guided surgical procedures.

The CSI mitigates a major limitation for researchers: a lack of operating room time and space for the clinical studies on animals and humans that must be carried out before any new technique or technology becomes standard practice. While various hospitals, including those affiliated with Duke and Johns Hopkins universities, have surgical centers dedicated to imaging research and innovation, the CSI is the only one where research won’t have to compete with clinical care. Completely separate from Dartmouth-Hitchcock’s busy operating rooms, the 12,000-square-foot CSI is largely free from the scheduling and financial realities that drive high-volume clinical surgical units. “The pressure to make this a profit center where patients need to get in and out won’t be prevalent,” says Paulsen.

Although most of the research will benefit patients in the future, Paulsen says the CSI gives Dartmouth-Hitchcock surgeons access to the most advanced surgical environment for handling complex cases that would otherwise end up elsewhere. “If we didn’t build this center, all of our patients would go to Boston,” Paulsen says. “If you want to do research, you have to create your own space.”

**THE \$20-MILLION CSI BEGAN TO TAKE** shape in 2010 when Thayer, Geisel, and Dartmouth-Hitchcock matched \$10-million in federal stimulus money. Adjoining Dartmouth-Hitchcock’s Advanced Imaging Center—which Paulsen, an imaging expert, also directs—the

CSI occupies space below a new clinical radiology unit, which factored into the project planning.

The CSI features two operating rooms that are large enough to accommodate multiple researchers and equipment. Computed tomography (CT) scanning and magnetic resonance imaging (MRI) systems can be moved from one operating room to the other along ceiling-mounted tracks. Two diagnostic imaging rooms can be used for nonsurgical or minimally invasive procedures. Windows overlook the operating and diagnostic rooms so researchers and students—from undergraduates to graduate and medical students—can observe surgeries, imaging sessions, and other research activities. The CSI also includes ancillary offices, patient holding spaces, control rooms, and labs, including a small wet lab for tissue studies.

Carefully planned elements of the CSI will allow researchers to use the same operating room for either animal or human procedures. Animals enter the operating room through a separate entrance. A state-of-the-art ventilation system minimizes the risk of cross-contamination between human patients and animal subjects. Differential pressurization sensors maintain positive pressure with laminar airflow over the table during human surgeries and negative pressure during animal procedures. If the pressure isn’t at the correct level, the doors to the operating room won’t even open. “We wanted to get the floor as clean as possible,” says CSI managing director John Peiffer.

The CSI will leverage previously funded research in brain and breast imaging and also roll out new programs in interventional psychotherapeutics and intraoperative biomarkers for guiding surgical resections. The CSI will introduce emerging research programs in prostate surgery, intraoperative oximetry imaging, and *in vivo* optical microscopy.

Paulsen expects the facility to lend itself to employing and refining image-guided technology used in the da Vinci robotic surgical system, which the surgeon manipulates from a console outside the operating room. Paulsen says that research conducted in the CSI may help bring to life a machine with vision sharper than the human eye. The day may come, he says, when “we can let images obtained by scanners drive the surgery, especially in orthopaedics, where not a lot of soft tissue is moving around.”

Another project Paulsen and his team will take to the CSI explores fluorescence imaging to guide neurosurgeons as they resect brain tumors. In research that began in 2008, Paulsen’s lab group





is among the first to harness fluorescence to prevent tissue damage during brain surgery. German doctors had discovered that if a patient is given an oral dose of a 5-aminolevulinic acid solution before brain surgery, a chemical reaction causes certain cells, including cancer cells, to fluoresce—illuminating tumors so they can be removed during surgery. Paulsen and his team, along with doctors from the Ontario Cancer Institute in Toronto, took even more of the guesswork out of fluorescence-guided brain surgery by creating a fiber-optic probe that can detect early-stage, low-grade tumors via fluorescence not visible to the naked eye. With the probe already sharpening the accuracy of fluorescence-guided tumor detection from 64 to 94 percent, Paulsen's group will further assess how to use fluorescence more precisely so neurosurgeons can consistently perform safer and more complete resections.

The work may well open new treatment options for deadly tumors. “By the end of this next phase of research we plan to conduct at the Center for Surgical Innovation, we will have implemented and evaluated wide-field techniques in human surgeries,” says Paulsen. “We expect to demonstrate that these innovations improve surgical outcomes when added to visually detected fluorescence imaging in a prospective enrollment of patients with malignant glioma.”

Thayer students and graduates are among the many people who will be conducting research in the CSI. For example, Ph.D. candidate Kolbein Kolste will continue to improve the fluorescence-detection probe for neurosurgery. In another project, research associate and Ph.D. graduate Xiaoyao Fan Th'12 is working with Dr. David Roberts, a Dartmouth-Hitchcock neurosurgeon, on a non-invasive, ultrasound-based registration method for guiding surgery, a technique used last year at Dartmouth-Hitchcock for the first time. According to Fan, the CSI will magnify the scope and

outcomes of their work. “The intraoperative MRI and CT can be used together with the navigation system to update information during a partial or complete tumor resection to ensure all tumor tissue has been resected,” she says.

“The CSI will make Thayer the magnet school for students and faculty interested in improving surgical technology,” says Mirza. “In return, Thayer faculty and students will change surgery in meaningful ways that benefit patients by developing technology to make surgery safer and more effective for patients.”

The CSI will also be open to researchers beyond the Upper Valley, including companies that need to conduct preclinical trials en route to securing FDA approval for new technologies, products, and procedures. “My goals for the CSI is to have enough resources and personnel to allow maximal use of the facility, and provide easy access to any student or faculty member anywhere in the world to bring their ideas here,” says Mirza.

“The CSI will be a national destination for patient care and innovation,” he says. “We want outside engineers, biomedical scientists, and physician-researchers to bring their ideas to the CSI because it will have the very best capabilities.”

According to imaging specialist and Thayer adjunct professor John Weaver, the CSI will be a vital means to a critical end: saving lives. “The CSI provides a unique opportunity to improve surgical practice. The intersection of excellent engineers and surgeons makes the prospects so promising,” he says. “Professor Paulsen and Dr. Mirza know how to improve the surgical process so the entire system can be optimized and the right innovations can be incorporated in effective ways.”

Anna Fiorentino is senior writer at *Dartmouth Engineer*.

## THE CSI WILL BE A

NATIONAL DESTINATION FOR PATIENT CARE AND INNOVATION. WE WANT OUTSIDE ENGINEERS, BIOMEDICAL SCIENTISTS, AND PHYSICIAN-RESEARCHERS TO BRING THEIR IDEAS TO THE CSI BECAUSE IT WILL HAVE THE VERY BEST CAPABILITIES.

—DR. SOHAIL MIRZA  
MEDICAL DIRECTOR, CENTER FOR SURGICAL INNOVATION




WITH ENGINEERING ON THE RISE AT DARTMOUTH, DEAN JOSEPH J. HELBLE OUTLINES OPPORTUNITIES FOR AN EXPANDED THAYER COMMUNITY.

INTERVIEW BY KAREN ENDICOTT

# GROWTH FACTORS





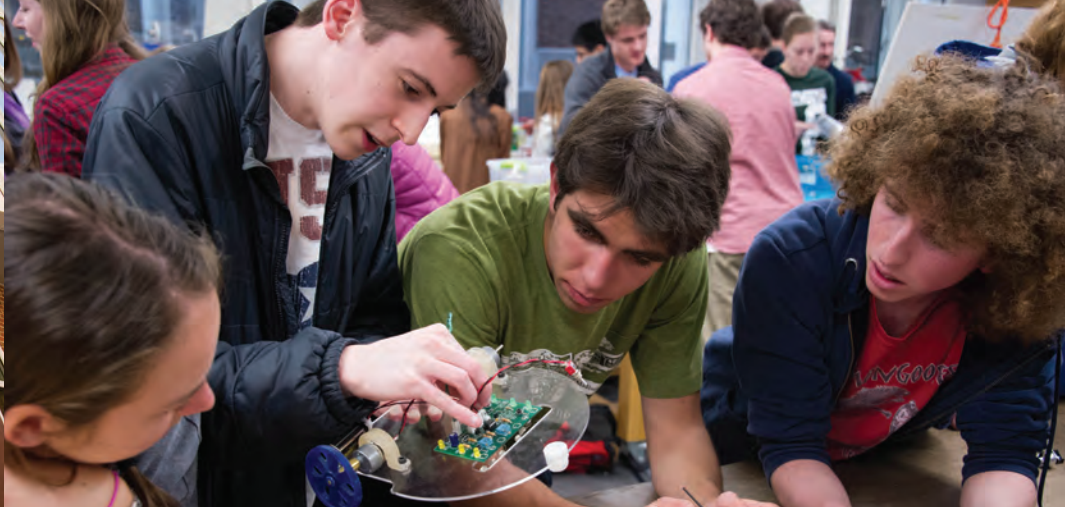
DARTMOUTH PRESIDENT PHILIP J. HANLON '77 announced in November that expanding engineering was one of his top priorities for the College. "Thayer School is a site of research impact, innovative experiential learning, and interest in learning technologies," he said, "It is also a unit of academic excellence well below critical mass by any measure."

With expansion of engineering a key part of President Hanlon's drive to increase Dartmouth's experiential learning opportunities, entrepreneurial activities, and scholarly impact on the world, Thayer Dean Joseph J. Helble talked with *Dartmouth Engineer* about the future of the school.

#### WHY GROW?

There are three reasons growth is important. First, demand for an engineering education is reaching unprecedented levels. We have roughly 110 majors in the senior class, which will be an all-time record number of students graduating with engineering degrees, surpassing the record we set just last year. The numbers of matriculating freshmen and sophomores who say they're interested in engineering are even greater. We don't have enough faculty to meet this demand and maintain the class size and the intimate, closely connected experience that we offer. We need to increase faculty to reduce the student-faculty ratio, increase project and research opportunities for our students, and develop new courses to challenge our students at all levels of the curriculum.

Second, by expanding the engineering faculty we can enhance the liberal arts education for all Dartmouth students. By making a real engineering experience part of a much larger number of Dartmouth students' undergraduate education, Dartmouth can take a leadership role in defining what a liberal arts education means in the 21st century. Every educated citizen, every worker, will need to deal with technology. It's a technology-driven world, and it's going to be a technology-driven century. It's hugely important for all Dartmouth students to gain some familiarity with how technology is conceived, how it's developed, how it works. I would love to have the capacity to give every



Dartmouth student the opportunity to take a design-thinking class like Peter Robbie's ENGS 12, or to take ENGS 21, our project-based introductory engineering course. We already have 50–60 non-majors a year taking ENGS 21. More want to take these classes but can't because we don't have sufficient capacity. All Dartmouth students should have the opportunity to get a real project-based engineering innovation experience like this as part of their education.

Third, we want to expand the scope of our scholarly work, particularly in energy and at the interface between engineering and medicine. Through the faculty we've hired, we've been building expertise in key problem-based areas—in alternative energy, power electronics, protein engineering, tissue imaging. We've worked with faculty in the Geisel School of Medicine at Dartmouth to establish the NIH-sponsored Dartmouth Center of Cancer Nanotechnology Excellence. I would like to see more opportunities for our graduate and undergraduate students to engage in cutting-edge research and for Thayer to be a leader in working on applied problems in these areas. We're already an entrepreneurial leader—with one in four of our faculty having started a company based on their work.

An added benefit of more sponsored research is that it allows us to have more state-of-the-art analytical equipment and research tools in house—for graduate and undergraduate students alike.

#### WHAT IS THE SCOPE OF GROWTH?

We want to significantly expand the faculty—perhaps by as much as a factor of two—over the next decade. If we double the faculty, we can educate a larger undergraduate student body and still reduce our student-faculty ratio. I would love to see an increase in the number of students majoring in engineering at Dartmouth, including significant growth in the Bachelor of Engineering (B.E.) population. We anticipate some slight growth in our Master of

Engineering Management (M.E.M.) and M.S. student populations. By doubling the faculty, assuming our new professors are as successful as our current faculty, we expect our research funding will grow accordingly, supporting up to a doubling of our Ph.D. student population.

#### DO THAYER'S EXPANSION PLANS TAKE ACCOUNT OF CURRENT UNCERTAINTY SURROUNDING NATIONAL SOURCES OF RESEARCH FUNDING?

Yes, they do. The research funding climate is more challenging now than it was five or 10 years ago, but federal support for sponsored R&D remains strong; the United States continues to spend more on R&D than any other country. Like many of my fellow academic deans, I am concerned about the impact of sequestration on federal sponsored-research funding. Cutting support at a time when many other nations are dramatically increasing their investment in engineering education and scientific research doesn't make a great deal of sense. The cuts are not helpful to expanding an economy based on technology innovation and entrepreneurship. The recent two-year federal budget deal was an encouraging sign that Congress appreciates the challenges created by sequestration-imposed uncertainty on the R&D climate in this country. I certainly can't predict what's going to happen to the federal budget five years from now, but there is bipartisan recognition that the research investment the federal government has made for many decades has paid great dividends for the country. I'm fairly optimistic that there will continue to be strong support for academic research—particularly engineering research that leads to technology development and job creation over many decades.

Our faculty have been very successful in getting their ideas funded—and that's something that hasn't changed in the tighter funding climate that we've seen in the past two years. If we continue to have high expectations, hire carefully, and bring in successful people, we will

be able to maintain a well-funded research program well into the future.

#### WILL THAYER RETAIN ITS NON-DEPARTMENTAL STRUCTURE?

Our interdisciplinary, integrated nature is one of our great strengths—and also something that significantly differentiates us from the vast majority of our peers. When we make decisions about faculty hires, we think about the greatest needs within the school, rather than having a mechanical engineering department arguing its case and then an electrical engineering department arguing its case. It's absolutely essential to me that through this expansion, we continue to function as a single, integrated school, and hire faculty according to areas of greatest need across the school.

#### HAVE YOU TALKED WITH PEOPLE BEYOND ENGINEERING ABOUT OPPORTUNITIES TO BUILD NEW INTERDISCIPLINARY COURSES?

Some. Those conversations happen best when it's two members of the faculty who have a shared interest in a subject exploring what they might be able to do. ENGS 2: Integrated Design: Engineering, Architecture, and Building Technology, a course open to non-majors that engineering Professor Vicki May and studio art Senior Lecturer Jack Wilson have developed, is a great example of people with different perspectives coming together to teach students about architecture and design in a way that gives them a very different perspective than if they were simply taking an architecture class or taking a structural engineering class. Students are able to see the important interplay between those two fields. Professor Peter Robbie is lending his design thinking expertise to Dartmouth Roots [dartmouthroots.com], an initiative with the Rockefeller Center for Public Policy that is using design methodology to develop ways to improve life at Dartmouth. We also are exploring opportunities for integrated A.B./B.E. degree programs with computer science and physics. I expect many more oppor-



# OUR INTERDISCIPLINARY, INTEGRATED NATURE IS ONE OF OUR GREAT STRENGTHS—AND ALSO SOMETHING THAT SIGNIFICANTLY DIFFERENTIATES US FROM THE VAST MAJORITY OF OUR PEERS.



tunities like these will develop naturally as we build a larger faculty.

## HOW CAN THAYER MAINTAIN ITS SENSE OF COMMUNITY AS THE SCHOOL GROWS?

Thayer's sense of community comes up in virtually every conversation I have with faculty, students, staff, and alumni—people who are excited about the opportunities this growth presents for Dartmouth and for Thayer, but who want to be sure we maintain the close community that helps make Thayer such a special place.

By growing our faculty and reducing our student-faculty ratio, we can do an even better job of giving all students the opportunity—through the classroom, through research, through interactions in places like the Great Hall—to get to know many members of the faculty well, and to count them among their close mentors and supporters. This is a part of Dartmouth culture that reducing class size and the student-faculty ratio will only enhance. Some have pointed out that with growth we may reach the point where a single professor will probably not be able to know every member of the graduating class well, but I think we are already there, with graduating classes that will soon be more than 100. To me, what's most important is having smaller class sizes so that all students have the opportunity to get to know several members of the faculty well.

By not setting up structured departments within the school we can help maintain a sense of community that's school-wide. It's important to continue all the little things we do to bring people together—from Thayer community events in the GlycoFi Atrium, to Thayer-wide events like the physical fitness challenge the school held last spring, to something as simple as free coffee in the kitchens. We need to think purposefully about the design of any new building so that it is structured to bring people together in common places, design elements that the Great Hall and GlycoFi Atrium

do so well. Our practice of not having faculty offices grouped by disciplinary area is essential to maintaining a broader Thayer community. I expect this will continue in any new facility that we build, so that faculty and staff will continue to run into one another and our students on their way to the lab and the classroom.

## WHAT FACILITIES WILL THAYER NEED—AND WHERE WOULD AN ADDITION BE?

Clearly if we grow the faculty substantially—certainly if we double the faculty—we're going to need a new facility. It's hard to believe, but we are already at capacity in the MacLean Engineering Sciences Center, even though it was dedicated only seven years ago. We already need more classroom, studio, and project laboratory space. We need more common space for our students to sit together and discuss project work or research. The couches in GlycoFi Atrium and the tables in the Great Hall seem to be nearly full almost all the time. We've just completely renovated the machine shop, so our needs there are not likely to be extensive. But we'll need significantly more research laboratory space.

We all recognize that we will need a facility that offers maximum flexibility to accommodate change as some research areas expand over the years and others contract. For example, we're thinking about open-concept laboratory space for some of our research laboratories to provide some of this flexibility.

It's too early to say how it's all going to fit together. We're in the early stages of conceptualizing what a facility might be, and where near Cummings and MacLean it could be located. We had a first conversation at a faculty retreat in December. The next step is to engage an architectural and engineering firm to begin working with us to explore options and ultimately provide some conceptual design options for us to consider. We'll need to have many conversations with faculty, staff, current students, our Board of Overseers, and others to refine our needs list and bring us to the point

where we can engage an architectural firm in a formal design.

## WILL VISIBILITY INTO PROJECT AND RESEARCH LABS BE CONTINUED IN A NEW FACILITY?

I certainly hope so—that is an important goal. Many visitors have told me how impressed they are by the sense of openness of our building, particularly of the project labs, and how our students are very willing to be interrupted, to discuss their project with anyone curious enough to ask. I am also often told how impressed our visitors are by the ability of our students to describe their work in a clear, articulate, and understandable fashion, and explain why it's important, why the visitor should care. That's such an important part of our programs and our community. This deliberate notion of open spaces with a lot of light, where visitors can see inside, wander in, and get a sense of the creative things that are happening—we absolutely want to preserve that.

## HOW DOES IT FEEL TO BE DEAN NOW?

This is a tremendous opportunity for Thayer, and for Dartmouth. I feel privileged to be here as the Thayer dean at this point in time. When I came to Dartmouth in 2005, I was not only impressed by Thayer's history and record of accomplishment, but was excited by where the school was heading then. Sitting here nearly nine years later, I'm even more excited by the opportunity ahead of us now. With the growing Dartmouth-wide emphasis on innovation and entrepreneurship, the recognition our students, programs, and faculty have received for their teaching, for their creativity, and for their research these past few years, and with the support of a new president for a larger role for engineering at Dartmouth, I can't imagine a more exciting time to be dean.

Karen Endicott is the editor of *Dartmouth Engineer*.







## DUAL-DEGREE STUDENTS CALL TWO INSTITUTIONS HOME



Some undergraduates make their way to engineering with a quick stroll beyond the Dartmouth Green. Others—Thayer's dual-degree students—travel a more distant route from campuses across the country.

Since the early 1970s, Thayer School has welcomed undergraduates from other colleges during their junior or senior year and, after they graduate from their own institutions, a year of Bachelor of Engineering study. Originally open to students from the Twelve-College Exchange Program—Amherst, Bowdoin, Connecticut, Mount Holyoke, Smith, Trinity, Vassar, Wellesley, Wesleyan, Wheaton, and Williams, besides Dartmouth—Thayer's Dual-Degree Program extended engineering to a wider number of young men and women with science backgrounds. Other colleges joined the program over the years. Colby, for example, began sending students in 1990. Today some 20 colleges officially participate in the Dual-Degree

Program, and students at other institutions can apply for the program as well.

During the last decade, 104 students graduated from the Dual-Degree Program with their B.E. degrees. This year, 22 of Thayer's 58 B.E. candidates are dual-degree students. Another 29 dual-degree students are completing their first year, fitting six engineering courses into a tight time frame. "They're very enthusiastic," says Professor Eric Hansen, director of the Dual-Degree Program. "They've bonded with their home colleges, yet they so want to do engineering that they uproot themselves to come here. They're determined, they take a tough course load, and they enjoy what they're doing."

In the following pages, seven dual-degree students tell us what drew them to Thayer and why two schools are better than one.

There's more online, too, at [dartmouthengineer.com](http://dartmouthengineer.com).

BY KATHRYN LOCONTE LAPIERRE

**ALEXANDER CHIN DD '11***B.E. CANDIDATE***CARLETON COLLEGE***MAJOR: PHYSICS*

**THE APPEAL:** I heard about the Dual-Degree Program when I was in high school. I wanted to play tennis in college and that unfortunately limited the schools I could choose from that also offered engineering. I attended Carleton College, played Division III tennis, and pursued the Dual-Degree Program. I wanted the opportunity to explore and solve real world problems, and I knew that Thayer had the curriculum and resources to provide an in-depth and yet broad enough education to tackle that goal. I visited Thayer and met with a professor. After that, it was clear to me that professors here are not only invested in their research, but are also dedicated to their classes and to building relationships with students.

**FAVORITE CLASS:** My favorite class was ENGS 21: Introduction to Engineering because the scope was so incredibly broad. The assignment was to come up with an invention that could either improve safety or the way that someone learns. We built a prototype that teaches elementary school children how to type properly. We invented a pair of gloves with vibrational motors on

each finger. When the letter A pops up on the software screen, the glove sends a vibrational stimulus to the child's left pinky, indicating that the child should press A with that finger. Traditionally you're solely supposed to rely on your sense of sight and memory. But this product added a new dynamic, your sense of touch, so that is what the premise of our project was.

**SENSE OF BELONGING:** I came to Dartmouth during my sophomore summer, which was an awesome experience. I feel a part of the Thayer and Dartmouth community. There are dual-degree students everywhere, at every hour. Going between both institutions has helped me be more adaptive to foreign situations.

**PREPARING FOR THE FUTURE:** From Carleton I developed a broader skill set in the liberal arts, and here at Dartmouth I developed a foundation in engineering. The Dual-Degree Program made me think in a more structured and more logical manner than I did before. Thayer added the innovative dimension. I'd like to combine my interests in an energy technology consulting role. That type of job would provide the dynamic that I'm looking for.

**ARLINDA REZHDO DD '11***B.E. CANDIDATE***COLBY COLLEGE***MAJORS: MATHEMATICS AND BIOLOGY*

**THE APPEAL:** I initially didn't want to do engineering, but when I went to Colby, everyone was talking about the Dual-Degree Program and how amazing it was. I really loved the experiences that I heard about. I didn't expect to love studying engineering at Thayer quite as much as I do.

**THE EXPERIENCE:** I focused especially on the hands-on experience at Thayer, which is very real. Every class that I took required completing a project of some sort and involved things that I had not done before. I pulled a lot of all-nighters because working on a project is nothing like writing a paper. You have to be at Thayer and focus on how the prototype is working, and what changes you can make. And then you have to actually construct your design, which takes a lot of time. But when you actually get that prototype working, it's the best feeling in the world.

I especially enjoyed the project we did in ENGS 21, taught by Professor John Collier. We designed an interactive learning system for children in primary school. Children would sit on our interactive exercise balls while teachers asked them questions, and the children would playfully touch the area of the ball where the color corresponded to the color of their answer. We tried it out with the kids, and they absolutely loved it and enjoyed playing around on our device. It was a very interesting experience, and I think it's better if you focus on the societal need and try to come up with a solution to that problem rather than trying to design a product that is mind-blowing.

I immediately fell in love with engineering



because of the way that Professor Collier explained the material and how he makes you feel passionate about what you are studying—it just really hit me. So I decided to do even more engineering research, and have joined his biomedical materials research lab.

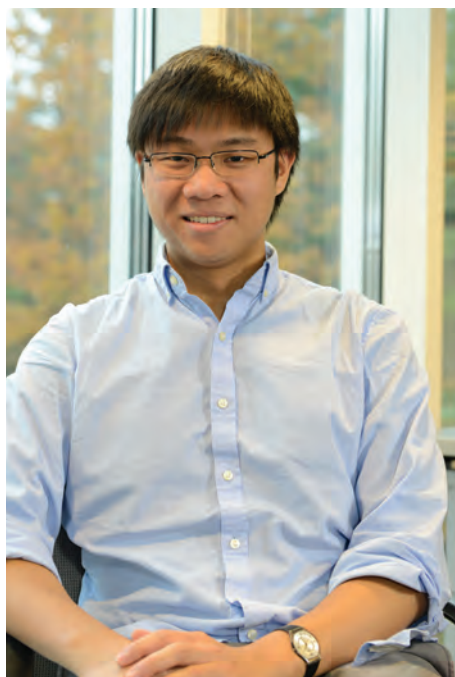
**THE INSTITUTIONS:** Coming here to Dartmouth I'd already had some experience at Colby as a freshman and sophomore, so I did know that getting involved in campus activities is big. I'm from Albania, and I joined the International Students Association at Dartmouth. It's incredible to meet people from all over the world who share the same experiences as you do. At Thayer it seems like we're a big family. We engineering students are here all of the time. We complete group projects together, take classes together, and help each other in everything that we do.

Colby was a great experience because it was my first time in the United States, and for me college was a new world filled with new experiences. It made me realize that there are a lot of different types of people in the world, and that there are a lot of different types of things you can do as a student. At Colby, I learned how to be my own person away from home. Here at Dartmouth, I found myself understanding more about the world of professionalism. When I went back to Colby I realized there was a great difference between my friends who didn't participate in the Dual-Degree Program, and those who had gone to Dartmouth and studied at Thayer. We were much more involved in professional activities, with interviews, and with networking. The Dual-Degree Program became part of who we are, and I value the experience because it has been very important for my career. It has been really enriching.

**PREPARING FOR THE FUTURE:** Studying engineering put me on a different academic path. Before coming to Dartmouth, my path was based upon the very theoretical education that I was receiving at Colby. In professional terms, the Dual-Degree Program gave me a better understanding of how the real world works. I learned exactly what companies are looking for. But, at the same time, all of the theoretical information that I received from the physics and math classes that I took at Colby ended up being very useful. At Dartmouth, I found myself suddenly needing to use this theoretical knowledge to solve project-based problems.

My dream job would be something that challenges me every day and makes me think about how to improve society's quality of living. Working in world health institutions would be ideal.

IN PROFESSIONAL TERMS,  
THE DUAL-DEGREE PROGRAM GAVE  
ME A BETTER UNDERSTANDING OF  
HOW THE REAL WORLD WORKS.



**JAMES CHIN DD'14**

**BRANDEIS UNIVERSITY**

*MAJORS: BIOCHEMISTRY AND ECONOMICS*

**THE APPEAL:** At Brandeis I studied biochemistry and economics. I loved how biochemistry helped me to understand the complex world of biology and the human system. But I soon found that it wasn't as quantitative as I wanted it to be. I wanted to bridge the two and make it more applied, so thought I should try some engineering. Dartmouth appealed to me because of its interdisciplinary style of teaching. I also liked the location.

**FOCUS:** I'm in my first term of the program

and love it so far. I'm considering focusing on chemical engineering, and within that I will probably specialize in biochemical engineering, which fits well with my background in biochemistry. I am still very much fascinated by complex systems in biology and I think that will give me good quantitative tools to study it further.

**THE INSTITUTIONS:** Studying at two different institutions has been good for me. Coming from a research university to an engineering school has helped me appreciate things like access to faculty and the kinds of relationships that you can build with professors in a small classroom setting. Here there's a collaborative community. In the Couch Lab you can ask anyone a question and come together and talk about ideas. That kind of community wasn't really apparent at Brandeis because you're kind of siloed into your own field of research. Dartmouth as a whole has been really welcoming to me—the institution, undergraduate clubs, and Greek life as well. I really feel at home here.

**PREPARING FOR THE FUTURE:** I would like to apply what I have learned in engineering, economics, and biochemistry to solve problems on a daily basis and be challenged by that. I think that all of my majors will come together into some sort of career, perhaps consulting or healthcare management.

The Dual-Degree Program will definitely give me an edge when I graduate. Having the additional engineering degree really does show that I can approach problems in a structured way. I've spoken to alumni, and they have said that this is a really strong academic program with great access to professors and post-graduate opportunities. That story has been consistent from alumni to current students to professors, and it's been true for me, too. Having that consistent story speaks volumes to what the program stands for.

**KARINA KOSSLER DD'14****AMHERST COLLEGE***MAJOR: MATH*

**THE APPEAL:** I wanted a diverse experience, and Dartmouth encouraged me to balance the liberal arts and engineering. Thayer has smaller classes, the faculty attention of a small college, and there is also a lot of hands-on learning. I like the fact that there are not specific concentrations, and you don't graduate with a specific focus, so it's a different kind of engineering. At Thayer you gain access to all aspects of engineering, which makes you more versatile.

**THE UNEXPECTED:** In ENGS 25: Introduction to Thermodynamics, we made Stirling engines. I originally resented the project because I wasn't trained on the machines in the machine shop. Eventually I got more comfortable, and took more pride in my work during the last week of the project. I became one of the top ten machinists in my class based on speed. It was a challenge for sure, but what stood out personally was that I was more surprised with my ability to complete the project—and complete it well.

**THE INSTITUTIONS:** The good part about being a dual-degree student is that I have two different types of academic backgrounds. Amherst is smaller, so generally I walk around and know pretty much everyone on campus. It was hard coming into Dartmouth during Dartmouth's sophomore summer, which is kind of that class's bonding time. But Dartmouth is nice because you're always meeting people from different backgrounds. It will be really interesting for me going back and forth.

I'm also in two different alumni networks—well, almost three because Thayer has its own network. That's three different career centers to build from.

**PREPARING FOR THE FUTURE:** I'm concentrating on biomedical engineering. I've always had an interest in medicine but have liked the technical side of math. My dream job is being a CEO of my own biomedical engineering company. The other aspect that I'm looking into is being able to be more on the financial consulting side of things. Being able to mix my interests would be a sort of ideal situation. The bulk of my time at Thayer is still to come. There will be more adventures.

**OLIVIA CAMERON DD'12***B.E. CANDIDATE***SKIDMORE COLLEGE***MAJOR: MATH*

**THE APPEAL:** I have always loved math and science, but I didn't want to go into pure mathematics, so I tried to find a way to study applied math. When I went to Skidmore, I heard about the Dual-Degree Program and thought it would be a great way to combine



GOING BACK AND  
FORTH BETWEEN  
DARTMOUTH AND  
SKIDMORE HAS MADE ME  
LOVE EACH PLACE MORE.

my interest in science, my love of math, and my desire to find something that was applied math.

**THE FOCUS:** The really nice thing about Thayer is that the program requires you to have a broad knowledge base before you go into any specific concentration. I wasn't sure when I first came here in 2011 what I wanted to do. ENGS 21 was the first class I took when I came here, and it was a great class to throw yourself into at Thayer. I worked with all dual-degree students. Our project was an avalanche helmet. In an avalanche, the main cause of death is asphyxiation, so when people breathe on the snow in front of their face, it melts and refreezes as ice. So we created a helmet that had a heating device. The pressure of the snow would trigger the heating pad, and melt the ice to create a pocket of air to breathe. The project was definitely very stressful, and the batteries in the device died after about 15 minutes, but it was the process that was the most important thing. I think that's the message: You do everything possible to prove that your product is going work or it's not, and it's okay either way.

**THE INSTITUTIONS:** I was very nervous about coming here my junior year of college and not knowing anyone. I was on the equestrian team at Skidmore, and I joined the riding team at Dartmouth. The girls there told me that Greek life was a huge part of the Dartmouth experience. That's not something I ever would have thought of, but I have great friends now. I live with two girls in my sorority. I love school and love this program and I love Thayer, but having those outside groups and people who I'm really close with made such a difference to me coming here. Going back and forth between Dartmouth and Skidmore has made me love each place more.

**PREPARING FOR THE FUTURE:** I'm still trying to figure out what my dream job is. Though I love engineering, I'm not sure if I'm going to go work in a lab for the rest of my life. I completed a finance internship at a wealth management company as just another way to use math, and I loved that. I also worked at a real estate investment company this summer writing marketing reports on biotech properties. That was kind of a fun way to combine biomedical engineering and a little bit of finance and business.

I might not be an engineer or be in a lab, but I love engineering. Here at Thayer you learn more than just engineering. You learn presentation skills and team management skills. I've learned so much every term I've been here.





## PATRICK HEFFERNAN DD '11

B.E. CANDIDATE

### COLLEGE OF THE HOLY CROSS

MAJOR: PHYSICS

**THE APPEAL:** I decided to do the Dual-Degree Program because I've always had an interest in engineering. I really liked the idea of combining a well-rounded liberal arts education with all of the technical aspects of engineering.

**STUDIES:** The studies I've focused on here at Thayer have been mostly mechanical and electrical courses. My favorite course so far has been thermodynamics. I really enjoyed the time in the machine shop that I spent building the Stirling engine. I feel like I'm more of a hands-on learner, so that was a great experience.

Combining physics and engineering has been a perfect fit. Math and science are really the languages of engineering, and it's been important to understand the theoretical side of what you're learning in engineering classes. Having the physics background has really allowed me to get a more intuitive feel of what I'm learning, and this background has helped me explain engineering ideas to other people.

**THE INSTITUTIONS:** It has been a privilege to attend two such prestigious schools. Dartmouth and Holy Cross have two very different settings. Worcester is a more metropolitan area with great culture and more of the city life, where Hanover is more rural and there are more opportunities to do things outdoors. I've been able to meet people in both schools, and it's opened up a range of networking opportunities.

**PREPARING FOR THE FUTURE:** The experiences I had here at Thayer really affected my final year at Holy Cross. Thayer gave me a different view on problem solving. I was able to use the tools that I learned at Dartmouth in the upper level math and physics courses that I took during my senior year at Holy Cross. To

have a Bachelor of Engineering degree from Dartmouth College is a dream come true. My ideal job would be a position in the renewable energy industry. I really want a role that helps the environment as well as people.



## SCOTT MITCHELL DD '14

### BOWDOIN COLLEGE

MAJOR: BIOCHEMISTRY WITH A CHINESE MINOR

**THE APPEAL:** I'm really excited about engineering, and I aspire to be a surgeon. Surgery is changing a lot right now with developments in techniques and equipment. I want a background in engineering to interact with the changing environment for surgery.

**STUDIES:** I came in expecting to be a rigorous science major, which is what I'm doing. However, I've been able to incorporate other classes and course work. I'm trying to learn as many languages as I can because I plan to do a lot of medical missions. I'm almost fluent in Spanish, I'm studying Russian here at Dartmouth, and my minor back home is Chinese. To interact one-on-one with the patients and not have the barrier of an interpreter is really important to me.

The engineering aspect and the humanitarian aspect need to be bridged. That's kind of the whole aspect of engineering. The children's standing frame that we built for ENGS 21 incorporates this. Right now 17 million people

in the world have cerebral palsy, and a lot of them are children. One third of those people are unable to stand by themselves, which is a very important activity for all of your bodily systems and functions. Physical therapists I had worked with in Arequipa, Peru, told us that standing devices are really needed for children. Currently they are inaccessible and expensive, costing anywhere from \$800 to \$1,500. So the therapist requested that we come up with a method for constructing a device with local materials. We decided that this could really become a global project and help more people if we looked into how we could make and get them to consumers for less than \$45. So that was the goal. By the time we finished the project we were extremely excited. When our device came together it was just beautiful, it was easy to clean, and we were so proud of ourselves. [See photo on back cover.]

**THE INSTITUTIONS:** Life at Thayer is great. I spend a lot of time in the building getting to know my fellow engineers. We slog through problems sets and run ideas past each other. It's a lot of hard work, but it's hard work that really brings you together. You really get to make those deeper connections, and that's fantastic. At Bowdoin I spent a good amount of time going back and forth between buildings, between disciplines, whereas here it's very focused toward one thing. I think that both have merits. Here you really set your mind to one thing at a time. Sometimes I'd spend almost the entire week working on my ENGS 21 project, whereas at Bowdoin I was balancing four things at a time. And that is definitely a different skill set.

Both places are very supportive and collaborative, and that's something I appreciate. You're really trying to help each other out, because when you help someone else, you're also helping yourself understand. I think everyone benefits from that kind of environment.

**PREPARING FOR THE FUTURE:** I see myself more as a surgeon than an engineer, but I imagine working intensively with engineers, and helping them develop their ideas. Being here and understanding how engineers are trained to think and how they go about solving every problem—that's extremely valuable. It's definitely a very good education that is leading me down the path that I need to be a successful surgeon. And I see myself putting it to work already.

Kathryn LoConte Lapierre is senior editor at *Dartmouth Engineer*.

# Alumni News

## ▶ spotlights



Simdul Shagaya Th'99

E-commerce pioneer **Simdul Shagaya Th'99** has been named 2013 Leadership CEO of the Year by the Nigeria Leadership Newspapers Group for "his ardent efforts to making online shopping a mainstream activity" in Nigeria and building the country's largest online shopping mall. The M.E.M. grad and serial entrepreneur also earned the 2013 Entrepreneur of the Year Award from CNBC Africa and made the Forbes List of The 10 Most Powerful Men in Africa 2014. Shagaya founded Konga.com in 2012 as the Amazon of Africa, selling the region's increasingly affluent con-

sumer class everything from groceries to electronics. Shagaya previously founded DealDey, a Groupon-style group-buying site that employed a fleet of motorcycles to meet online shoppers across Lagos waiting to pay for their purchases with cash. Shagaya says that this type of infrastructure is essential to e-commerce in developing countries. As he told CNN, "Many times the Internet is an enabler of a business but you still need an offline component, strong logistics, you still need to be able to have a physical presence in front of the developing country customer to keep that customer think-

ing that you are real and are here for the long-run."

Data streams from U.S. financial companies and foreign governments sent across the Internet have been diverted, spied upon or altered, then shot to their expected destinations with barely a delay and no one the wiser. Well, almost no one. Internet intelligence analyst **Doug Madory Th'06** uncovered mass data hijackings last year as part of his day-to-day monitoring of global net links for web tracking firm Renesys. Digging deeper, he found that redirections—to Moscow and Belarus before continuing to the intended destinations—had happened almost daily in February and again in August 2013. "We saw it start off looking like a criminal operation, targeting the financial companies," he told the *Christian Science Monitor* in November. "The next day we saw it targeting foreign governments, so we thought maybe it's a nation state. Now it's not clear whether this group was a government or a criminal operation." Madory has become the go-to expert in Internet shutdowns and startups, and has been quoted in *The New York Times*, *Washington Post*, *Miami Herald*, and on National Public Radio, BBC, and CNN. In the past year, he has reported on ongoing Internet outages in Syria and cyberattacks against the state telecom there, discovered that a submarine cable connecting Cuba to the Internet has been activated after two years of lying idle on the bottom of the Caribbean Sea, and tracked attacks against North Korea's networks. Madory, who worked with **Professor George Cybenko** as a graduate student, was previously the chief of computer security at Dartmouth-Hitchcock Medical Center.

**Hannah Dreissigacker '09 Th'10** competed in Sochi as a member of the U.S. Biathlon Team—with fellow Dartmouth alums Susan Dunklee '08 and Sara Studebaker '07—at the Winter Olympics. With an engineering degree modified with studio art, Dreissigacker records her ski travels with paintings and posts at [hannahsartventures.blogspot.com](http://hannahsartventures.blogspot.com). Recent paintings

include night racing in Ostersund, Sweden (site of the first biathlon World Cup of the year) and a view from a chalet across La Chaine des Aravis in France (for the third World Cup). Her artistic eye is always open. As she writes in one post about skiing in Sweden: "I'm not sure if it's a good thing, but I couldn't help but notice that there was a beautiful sunset the entire time I was racing. Every time I came down the final turn into the stadium, I would think about how pretty it was."

**Bjong Wolf Yeigh '86** has been named chancellor of the University of Washington, Bothell, a 128-acre campus in the Puget Sound region that enrolls 4,600 students in more than 30 undergraduate and graduate degree programs. He takes the reins as the school brings on 29 new tenure-track faculty, completes construction on a \$68 million science and math building, and expands its technology offerings with the School of Science, Technology, Engineering and Mathematics. Yeigh, who emigrated from South Korea when he was 11, wants to ensure that students who come from a background similar to his can receive the same kinds of opportunities to help them succeed. "For me, staying in higher education was important in the pathway for me to give back," Yeigh told *Northwest Asian Weekly*. After Dartmouth, Yeigh earned a master's in mechanical engineering from Stanford and a master's and doctorate in civil engineering and operations research from Princeton. Yeigh was most recently president and professor at the State University of New York Institute of Technology at Utica/Rome. During his tenure at SUNYIT, he secured \$15.5 million in capital grants for cybersecurity and nanotechnology programs and established a \$240-million nanotechnology partnership with SUNY Albany. He has also served as assistant provost for science and technology at Yale and as dean of the St. Louis University Parks College of Engineering, Aviation, and Technology and director of its Center for Space, Technology, and Engineering Policy. An elected fellow of the American Society of Mechanical En-





gineers, Yeigh is an active researcher, working in mathematical and computer modeling, analytics, simulation, science and technology, engineering physics, engineering management, and safety and security studies.

Avitide cofounder and CEO **Kevin Isett Th'11** says he has secured the first round of financing necessary to continue developing affinity purification technology for improving the expensive and risky process of manufacturing protein drugs. Avitide is a fee-for-service affinity purification discovery service, he says, focused on solving therapeutic and vaccine purification challenges in the biopharmaceutical industry. Isett cofounded the Lebanon, N.H.-based company in 2012 with serial biotech founder and Thayer Professor **Tillman Gerngross**, former Thayer researcher **Warren Kett**, and venture capitalists **Errik Anderson '00 Tu'07** and **Jon Sheller '09**.

Cincinnati, Ohio-based entrepreneur **Mike Collette '84** has been named entrepreneur-in-residence at public-private seed-stage investor CincyTech, where he'll work with existing and new portfolio companies in the digital and healthcare markets. It's another step in the startup path he began during his years as an engineering major at Dartmouth, when he painted houses during the summer. He founded marketing agency OnTarget Media, zeroed in on healthcare, and changed the company name to Healthy Advice Networks. The company, now called Patient Point, is a \$70-million operation offering educational materials to patients and programming to doctor's offices and hospitals. He'll remain with Patient Point while working with CincyTech. As a private investor and board member, he has contributed to the growth of startup Zipscene and Canadian-based insurance company Signature Risk Partners and serves on the advisory board of Medaxion, an electronic medical record platform. "An idea must be a game-changer," he told Cincytechusa.com. "For many, the passion for the idea becomes blinding. That's why you need an independent board. You also have to spend signifi-

cant money in creating demand for the product or service either through marketing and PR—or through pushing the product to customers directly through a sales team. The product or service won't sell itself."

**Arville Hickerson '56 Th'57** has been inducted into Harvey High School Hall of Fame in Painesville, Ohio. He was valedictorian at Harvey High in 1952. After earning an M.S. in mechanical engineering from Thayer, he began a 27-year career in the U.S. Army. He served as platoon leader of the 82nd Airborne Division (1958–60), commander of the 2nd Battle Group of the 6th Infantry Company in Berlin when the wall was being built (1960–64), battalion commander in the 7th Cavalry of the 1st Air Cavalry Division in the 1968 and 1969 Tet offensives, and battalion commander of the 23rd Infantry of the 2nd Infantry Division in Korea during oil embargo crisis (1973–74). He retired as a colonel in 1983 after serving as an investigator and division chief in the Army's inspector general office. Honors he earned during his service include two Legion of Merits, four Bronze Stars, a Purple Heart, five Air Medals, and two Vietnam Cross of Gallantry medals.

Gyrobike cocreator **Hannah Murnen '06 Th'07**, **Augusta Niles '07**, **Nathan Sigworth '07**, and **Debbie Sperling '06 Th'07** have sold the technology's rights and patents to U.K.-based entrepreneur Robert Bodill, who has plans to grow the market from children to seniors and people with disabilities. The former Thayer students developed the stabilizing Gyrobike in 2004 when they tackled the problem of learning to ride a bike in Thayer's ENGS 21: Introduction to Engineering course. The inventors and **Errik Anderson '00 Tu'07** formed the company GPSS, LLC, which developed the intellectual property, filed the original patent, created prototypes, and wrote a business case. Under the business leadership of **Daniella Reichstetter Tu'07**, thousands of children's Gyrobike wheels were sold directly to customers and through K-Mart and other retailers. Gyrobike's newest owner has given the name a

brand-new spelling: Jyrobike. See it at [jyrobike.com](http://jyrobike.com).

**Ashfi Gogo Th'10**, CEO and founder of the product authentication company Sproxil, has racked up another honor. The Thayer Ph.D. Innovation Program graduate has received the IEEE's inaugural Global Humanitarian Engineer of the Year Award. "His motivation to create a simple, inexpensive way to identify counterfeit products was driven by the 700,000 deaths each year due to fake malaria and tuberculosis drugs," the award nomination stated. The IEEE noted that consumers in developing regions of Africa and Asia have used Sproxil's cell-phone-based technology to verify the authenticity of more than 4.3 million products in less than five years.

**Max Fagin Th'11** has made the first cut to become a member of the first Mars One manned mission to the red planet. He is one of 1,058 applicants willing to take a one-way trip to Mars in 2024. A lifelong space zealot, Fagin came to Thayer as a Dual-Degree Program physics major from Vassar, completed his B.E., worked as a design fellow in the machine shop, and is now studying aerospace engineering at Purdue. His perspective on the possibility of moving to Mars—and never returning to Earth—is out of this world. "You can't inhabit a planet if everyone is a tourist. Someone has to go there to stay. Might as well be someone who actually wants to be there, like me," he told

*Dartmouth Engineer*. "I have no doubt that leaving my family forever will be a painful experience, both for them and for me. I would be alarmed if I felt otherwise. But my family has had my entire life to come to terms with the notion of me leaving Earth, and I know they would support me, which makes me feel very proud and eager not to let them down. As for leaving my friends, that too would be difficult. But all the way back to high school, I find that my strongest friendships are the ones that formed not through 'traditional' forms of socializing, but through sharing strife and working together toward a goal that we both deeply wanted to see realized. The only people who would choose to go on a one-way trip to Mars will be people who necessarily also care passionately about my goal of opening Mars to humanity, and thus whose goals and passions are the same as mine. They are the people who will become my new friends, and I cannot wait to meet them. Besides, it is not as if I am losing my old friends and family forever. They will still be there for me, even if 'there' is hundreds of millions of kilometers away. And while I realize it is an unbearable cliché, I actually do think it will be a great comfort to them that for half of the nights of the year, they will be able to look up into the night sky and say, 'It's okay, he's right there, on that red dot.' For me, it will be even easier, as Earth will be visible in my sky virtually all year round."

## ▶ just one question

### Q. What skills beyond technical skills do you think are most important for engineers to have?

Good interpersonal relationships, especially the ability to work with clients, associates at all levels, contractors, and the public in general; and the ability to express oneself accurately and concisely. Engineers must be able to apply these traits rapidly, under all sorts of working conditions. They must also anticipate the effect that these conditions may have on family and friends.

—Tom Streeter '44 Tu'48 Th'48

The ability to communicate in a constructive way.

—Bob Sundblad '44 Th'48

There is a great need in engineering for caution, deliberation, vigilance, and attention to detail. In structural work, the great failures, accidents, and catastrophes are invariably attributable to carelessness, laziness, and shortcuts.

—Sam Florman '46 Th'46

Knowledge of accounting and the time value of monetary assets (engineering economy and basic accounting) and the ability work with and manage people. The first is easy to learn from courses; the second requires interpersonal skills and usually some training.

—Hank Parker '46 Th'47

It is important to be able to project our ideas, but perhaps even more important to be able to receive, respond, and, if appropriate, react to the ideas of others. The broader an engineer's exposure to society, the more likely an engineer's technical skills will be of value to others.

—Warren Daniell '48 Th'50

Communication skills, both written and oral. Our company was involved in developing a portable instrument landing system for the Army. I had

determined that the workload meant closing down part of a plant. The congressman whose district contained the plant wrote to our company president demanding to know why. Our president asked me to draft a response. I did that, making it clear that it was in the government's best interests for the congressman to help keep our company competitive. The president not only signed the letter without changing a word, but told me how impressed he had been with it. We didn't hear from the congressman again.

—George Hartmann '49 Th'50

The ability to speak, to present lucidly, cogently, and clearly while on your feet in front of an audience. While the text may have been written in advance, it should not ever be read! Rather, the presentation should always be "said."

—William B. Conway '52 Th'54

Communication skills: speaking to an audience and writing.

—Bart Lombardi '52 Th'54

The ability to communicate the outcome of his or her work to others (to all educational levels) in understandable terms. One of the most valuable parts of my Dartmouth education was the combination of the liberal arts undergraduate program with the graduate engineering program of Thayer. Many times in my 50-plus years since graduation from Thayer have I experienced the reaction, "Gee, an engineer who can write!"

—John Kennedy '53 Th'54

Conceptual skills and human skills. These will make it possible to adapt technology to address real problems in economically and organizationally sound ways.

—John Ballard '55 Tu'56 Th'56

Weaknesses in people skills tend to limit a person's ability to perform well in positions of higher responsibility. A converse to this is that many persons with good people skills fail in positions of higher responsibility because of weakness in technical skills.

—Pete Knoke '55 Th'56

An in-depth understanding of the human condition, hence the importance of the liberal arts to engineering.

—Emerson Houck '56 Tu'58 Th'58

I've been teaching for 20 years (while working in private industry as director of engineering) in the technical management program at UCLA Extension and the University of Wisconsin-Madison engineering professional development department. Our courses help technical professionals transition into managerial/team leader roles. The most important people skills we teach are building interpersonal relationships, understanding and applying the theories of motivation (and demotivation), and using situational management styles that are tailored for the specific issue at hand. We teach the Johari Window concept for building interpersonal relations, the motivational theories of Maslow and Herzberg to understand the hierarchy of needs, and the "management grid" to relate the balance between a manager's focus on both people and performance. I recommend reading *The Effective Executive* by Peter Drucker.

—Ron Read '57 Th'58

Having an open mind in order to evaluate all aspects of a project and an ability to communicate your ideas to win acceptance and funding.

—Charles A. Schneider Jr. '57 Tu'58 Th'58

Writing competence, verbal expres-

sion (being able to engage audiences), being interested in nontechnical topics (engineers interface with a wide variety of people, many of them not technically inclined), being able to function well as a team leader or member as well as an individual, being able to recognize and act when opportunity knocks, and knowing the cost of things (having some financial sense). Honesty and ethics are also necessary attributes. Without them, you've got nothing.

—Jerome Allyn '59 Th'60

A key skill is experience—the give and take of real life. Frequently in business, outcomes are not black and white but in-between.

—Barry MacLean '60 Th'61

There are three: an ability to write clearly, an ability to make presentations, an understanding of the time-value of money and familiarity with various present-value calculations. When I was working for Frito-Lay, a writing consultant, Barbara Minto, taught us the value of holding "meetings to confuse." She noted that if the decision-makers expect a recommendation that is different from the one you are going to present, you should not press for a decision. They will only turn you down. Instead, your goal should be to raise a question in their minds about the "expected answer." I used this approach when presenting the unexpected conclusion the data was suggesting for a change in fuel in potato-chip cookers. Later, following up with this established uncertainty, I gained approval for the new option.

—Harris McKee '61 Th'63

Managerial skills.

—Roger Schulze '61

Communication, in all its forms, is important—being able to speak clearly with anyone, from the unskilled laborer to the CEO, and having writing skills in letters, emails, text messages, etc. It is also essential to be well informed about matters such as politics, economics, the arts, and sports. I spent 29 years in a technical/marketing position that I enjoyed, and I think that the liberal arts





IT IS IMPORTANT TO BE ABLE TO PROJECT OUR IDEAS, BUT PERHAPS EVEN MORE IMPORTANT TO BE ABLE TO RECEIVE, RESPOND, AND, IF APPROPRIATE, REACT TO THE IDEAS OF OTHERS.

—Warren Daniell '48 Th'50

education I received at Dartmouth was very important to my success. I met people from very different walks of life and found that I was able to communicate with them on technical and non-technical matters equally well. I came from Hungary, where engineers (i.e., someone with a university degree) were looked up to not just for technical knowledge, but also because he or she would be considered a well-educated and well-rounded individual.

—Peter Tuschak '61 Th'62

The same answers to the question when it was asked in the 1960s when I was at Thayer: communication and persuasion skills (written and oral), an appetite for continuous improvement, and an intolerance for “close enough.” Newcomers to the list: the capacity to appreciate diversity, the ability to think strategically, a willingness to tolerate ambiguity, the ability to see around corners, an interest and capacity to work collaboratively, a willingness to embrace change, recognition of one’s limitations, a capacity to learn from mistakes, the ability to build and exercise social and professional networks, the insight to know when technology may not be the leading pathway to a solution, and the ability to see situations through multiple lenses.

—Neil Drobny '62 Th'64

Engineering investment math was one of the most valuable courses I took at Thayer. How to calculate investment returns, long-term costs of machinery, bond values, annuities, comparative costs of two manufacturing processes, loan costs, etc., turned out to be of far greater worth than the fluid dynamics course I took! Engineering is all about solving problems within a limited time frame at a budgeted cost.

—John D. Pearce '62

To promote ideas and respond to criticism, an engineer needs speaking and writing skills. An engineer also needs the ability to evaluate an individual as to suitability for a given position.

—Richard A. Zartler '62 Tu'63

I found interpersonal skills to be essential. I entered the workforce after grad school and Vietnam service. My career spanned many business disciplines since I worked with emerging technologies. For a long time I read business journals with significant psychology content. At the base level of technical management, you have to work with people. It is monumentally important in fostering a creative process that is timely and highly innovative. Ideas and creativity matter, and one needs to understand how to get the best of both staff and oneself. In today’s team-based environment, it is essential to effectively engage the entire group. One must be an enabler, striving to make team members the heroes.

—Ivars Bembris '64 Th'65

The ability to write clearly! All my career I’ve been rewriting stuff for engineers so the rest of the world can understand it. And the ability to speak in front of a crowd.

—Ward Hindman '65 Th'68

The ability to: write a clear one-page memo; independently learn new skills and material; prepare a talk and deliver it effectively to colleagues, management, or customers; work in teams or with colleagues (one needs to be able to lead or follow as needed); be aware of knowledge outside of the immediate needs of the project. A breadth of knowledge enables “thinking outside the box” and prevents being blind to nonstandard ways to get the job done.

—Sidney Marshall '65 Th'72

Communication skills. Social-interaction skills to function effectively as a team member up and down and outside the organization. Leadership skills, including focus and the will to make others successful. Business and finance skills to manage the interaction between science and technology and the real world. Marketing and sales skills, including the ability to understand the market value of products and services and sell that market value within and outside the organization.

—Tom Brady '66 Th'68

Communication skills.

—Bill Reilly '67

The most important skill is writing ability, followed by a skill to work in teams. I developed both skills at Thayer as a student of **Professor Robert C. Dean Jr.**, who constantly wrote me 10 pages of comments and guidance in reviewing a two- or three-page project report. He also guided my student colleagues and me in team internship projects. **Professor Graham B. Wallis** guided my doctoral thesis documentation and presentation. I also extend my indebtedness to **Dean Myron Tribus** and **Professor George Taylor**, who taught me “Engineering Economy,” which I have found of great value.

—Joseph K. Nwude Th'69

An engineer who is interested in commercializing technology needs communication skills to be able to present his or her ideas to investors, partners, potential customers, and employees. Enthusiasm and tenacity for the project is essential. Without it, no one else will be excited either. A high level of integrity must be present, or the communication will not be believed. Personal care for the people involved with the project must be strong, or those around the entrepreneur will lose interest and trust. Combine these skills with solid knowledge of the engineering initiative and the competitive environment, and the chance for success is immeasurably improved.

—Bill Holekamp '70

I went from Thayer School into medicine (surgery). My training at Thayer gave me the ability to objectively review large amounts of seemingly contradictory data. A scientist approaches interests with a different perspective than most physicians. My experience at Thayer was a great benefit to me.

—Peter Areson '72 Th'73

An engineer must: be a good presenter in front of his team, her boss, or a customer; have team skills; and be self-starting, able to see the problem, decide on a solution, and work toward

it without a lot of supervision

—Peter E. Brown Th'72 Tu'73

Presentation, project management (scheduling, budgeting, delegating, tracking), and listening skills.

—Chris Cain '72 Th'71

Communication, otherwise engineering is worthless.

—Eric Kankainen '72 Th'73

To be exceptional innovators, engineers need fundamental business skills: marketing, finance, economics.

—Mike Rieger '72 Th'73

Great writing and communication skills. Accounting can be a huge plus.

—Bill Kellogg '73

It has been my experience from 10 years in engineering positions and another 35 in energy technical consulting that communications skills are critical.

—Bill Veno Th'75

Writing with clarity and brevity and the skill to make presentations.

—Steve Askey '76 Th'77

Creative problem-framing—the ability to set a problem broadly enough so that it does not force the solution into too narrow an approach but narrowly enough to accomplish a good solution in a solid time frame—is a valuable skill.

—Ron Shores '76 Tu'78 Th'82

The obvious first answer is communication skills. Lapses in communication are frequently cited as a root cause for project failures, accidents, and people problems. Second is teamwork skills; you have to be able to collaborate and lead and persuade, even if you are not in a formal management or leadership role. Third, you have to be able to make decisions with incomplete information or conflicting data. In the energy industry, we often have to make high-dollar decisions with limited or incomplete data, so we are trained in techniques such as

decision-risk analysis and probabilistic decision making. Most Thayer School grads have already gained experience making formal presentations (from ES 21 onwards) and working in teams. That gives them a grounding in several key areas needed for success beyond the Hanover Plain.

—William Fraizer '78

Having good language skills allows one to understand better the culture of people from different countries and sometimes why they behave the way they are. Good language skills also allow one to mix with others—and, when one moves up the management ladder, to be more effective at managing a large multinational team.

—Lapyiu Ho '78

The ability to communicate in a manner that a layperson can understand.

—Kay McKusick Ralston '78

In order of priority: communication skills, relationship skills, and project management skills.

—Michael Geilich '79 Th'82

Continuing education is important; never let your technical skills become obsolete. Communication skills are essential. Engineers need to state issues concisely and accurately, while being sensitive to the knowledge of their audience. Project management skills can and should be learned. The two main areas where I see engineers fail are an inability to plan a project properly and an inability to process change orders and manage change effectively. Engineers should be disciplined and demonstrate professional maturity when working with others, show respect for their opinions, not rush to judgment, be positive and energetic, lead by example, and view constructive criticism as a gift.

—Newt Green Tu'80 Th'85

Effective requirements gathering, which requires creativity and patience. Requirements (or at least an accurate problem statement and goal) are critical to get right as early as possible, but

the folks responsible for providing them often don't have a clear idea of what they want or need. A great engineer finds creative ways to elicit requirements (perhaps through rapid prototyping or simulation to better understand and visualize possible outcomes) and takes the time to iterate and uncover the true vision. And along the way, a great engineer can help to shape (and heal, if needed) that vision.

—Alison Vogel '80

Working in groups involves a learned set of skills, including dividing the work, making sure everything is progressing on schedule, assessing risks, and reallocating resources to meet deadlines or future needs.

—Jeff Johnson '81

The ability to listen, ask questions driven by curiosity (even if they are not exactly on point), model the operations at hand, and prepare a new and improved model. If people are smart and curious, they can learn anything. Applying the scientific approach to problem solving is tried and true.

—Toby Reiley '81

Communication, written and verbal.

—Michael Adams '83

Presentation skills and some basic financial modeling skills if they want to be entrepreneurial.

—West Griffin '83 Tu'85 Th'85

Communication, presentation, and basic business or economics skills.

—Alexander Stein '83 Th'85

Problem-solving skills, communication skills, the ability to translate between user needs and engineering specs, and the ability to frame trade-offs between functionality and cost in alternative designs.

—Christine Bucklin '84

Solid communication skills, leadership skills (to motivate and guide teams), and innovation skills (being creative, taking risks, making decisions, not fearing mistakes, and extracting im-

portant insights from those mistakes).

—Eric Schnell '84 Th'85

As the CEO of a multi-billion-dollar company, I believe one needs problem-solving, innovation, and communications skills. Problem-solving is about having a process to identify issues or opportunities, create potential solutions through broad and diverse input, evaluate the pros and cons, and make and execute a decision. Thayer has this as part of its curriculum, but this is a skill that should be refined throughout one's career. Innovation is critical to an organization's long-term success and sustainability. Some engineers confuse innovation with invention. While innovation often includes some invention, it is not a requirement. Some of the best business successes I have experienced were highly innovative in that they uniquely and profitably solved a real customer issue in a manner that had not yet been utilized in that space (but was often used in other spaces or applications). Today's need for speed in decision-making requires that engineers (and non-engineers) are comfortable and adept at communicating in writing and in presentations up, down, and across organizations.

—Dave Swift Th'84

People and management skills.

—Ann Weaver '84

Concise writing skills, good practice management skills (tracking time for billing purposes, timeliness in communicating with clients, delegation when appropriate), the ability to step back from a problem and rethink the approach, the ability to work collaboratively, and good presentation skills.

—Lisa Wade '85

Engineering design of anything has become such an interconnected web of dependencies among technologies that you're going to have to form alliances with others, leverage their abilities (which may exceed your own in many areas), deal with all of the quirks and foibles that come with real people, and

bring your own messy self to the table and expose it for what it is. Having a sense of self-worth that's grounded in reality is critical. I've learned to separate what people think about my work from my own personal worth as a human being. That's allowed me not to be defensive when some design of mine is criticized. Confidence comes with both accumulated success and a few really spectacular failures that teach that you can screw up badly and not have it be the last word. I've also had the highly useful experience—at least in its preparing me to run a small business—of having terminal cancer. It drives home the point that one day the sun will come up, you won't be around to see it, and the earth will still continue to function. Humility is key to getting things done, and I'm not sure where it's taught other than the school of hard knocks. But when you can accept blame and give credit away, you've taken a big step on the road to effective leadership, whether or not you have the official title of leader.

—Eric D. Overton '87 Th'89

Basic business acumen, including Accounting 101, Internet Protocol 101, and knowledge of how to build a business model, read a financial statement, build a team, and manage a project.

—Jim Bramson '88

You need a keen sense so you can read your team and differentiate true supporters from those who pretend to support you, influencing skills to get a team to buy in to your point of view, and courage to make bold decisions and stand by them. You also need to practice consistency and do what you say.

—Sumit Guha Th'88

Communication skills—for presentations, team discussions, business cases and plans, and patents. Engineers need to convey the big ideas without having to tell a linear story. They need to answer the questions: Why is it good? What do you need to succeed? What is the time line?

—Andrew Shepard '89



THE ABILITY TO CLEARLY AND CONCISELY  
COMMUNICATE COMPLEX IDEAS  
WILL MAKE OR BREAK YOUR CAREER.

—Todd Donovan '92 Th'92



The ability to clearly and concisely communicate complex ideas will make or break your career.

—Todd Donovan '92 Th'92

Although I retired from Navistar several years ago, my first thought is a second language. This is so important in today's global market. Learning Russian (which I am still learning) was very beneficial when we opened up business opportunities in Russia.

—Jim Bradley '94A

I've been active in pollution prevention and sustainability for many years and believe that all engineers should work with a sustainable mindset, finding the process or design that results in the least environmental impact while remaining cost effective. Both environmental and economic mindsets are critical to ensure long-term viability of engineered systems.

—Gene Park '94

Communication skills and interpersonal skills.

—Carmen Manoyan Th'96

The ability to draw together concepts from disparate fields to solve problems. Engineers "connect the dots." Also, communication. If you cannot effectively communicate the concept, it doesn't matter how good it is.

—Kyle Teamey '98

Communication skills. How can engineers positively impact society if they can't make themselves and their ideas understood?

—Amanda Plagge '03 Th'04

Communication is not solely about speech and PowerPoint; it is in notebooks, drawings and schematics, software documentation, assembly instructions, test procedures, scribbles in the margins, readme.txt, even comments on websites. Communication to yourself can be important, too, when you are puzzling over a design or notebook many years later and wondering, "What was I thinking?"

—Alex Streeter '03 Th'05

The most successful, both financially and productively, engineers I know are great communicators and orators. If you can explain your ideas and get people excited about your products or skills, it'll make all the difference.

—Laura Weyl Th'08

Seeing the big picture. Many engineers over-analyze situations prior to even asking if they are solving the correct problem. A concrete example: optimizing trucking routes without looking into aerial freight. Many engineers struggle to maximize their impact. It's critical to work cross-functionally. It's more realistic for an engineer to talk marketing than for a marketing expert to talk chemical engineering.

—John Engstrom Th'10

The ability to communicate. As part of my job, I perform failure analyses on products that have failed development tests or in the field. In the few cases I've been a part of, the root causes of these failures are very subtle, and finding them can often take joint input from experts of different fields. It's critical to my job that I both communicate my technical understanding and receive other viewpoints so that everyone has an accurate portrayal of the failure and we decide on the best corrective action.

—Sam Peck '10 Th'13

Customer interaction and sales skills are important. Meeting skills are also essential. What you bring to the table is the only way upper management, coworkers, and production workers interact with you or get to know you. You need to have a positive attitude, be able to think on the fly, and know when to ask for something and when to wait. Another essential skill is the ability to give and take criticism of ideas. In design reviews, it's important to critique in a way that will be meaningful to the designers, not put them on the defensive.

—Matt Strand '10 Th'12

Interpersonal skills, management skills, and the ability to look at the bigger picture beyond the technical com-

plexities of the project.

—Saryah Azmat '11

Engineers need the ability to think on their feet and solve small and large problems, keeping in mind constraints such as cost, time, and ease of implementation.

—Pruthvi Desaraju Th'11

If it is an engineering student's goal to work in industry, start a business, or commercialize discoveries out of academia, then a fundamental understanding of business principles is key.

—Kevin Isett Th'11

Successful engineers I've seen know not only how to collaborate with other engineers but also communicate technical decisions with other shareholders, such as business owners, very well.

—Jincheng Li Th'11

The ability to communicate coherently to both a layperson and another engineer without direct experience with the system. Also, the humility to recognize that a plan can be flawed.

—Max McClorey '11

Presentation/communication ability, business sense (such as an interest in innovation and new ideas), writing ability, and working on a team.

—Alison Stace-Naughton '11 Th'13

It's important for engineers to be able to empathize with the people they're designing for. They need to be able to look at a problem from the perspective of their clients and find solutions that best fit the needs of the users. My team did a fecal microbiota transplantation project for our ENGS 89/90 project, and we were hung up on how to eliminate poop odors to reduce the "ick factor." When we spoke to gastroenterologists, they told us, "We deal with awful smells all the time—that's not an issue," and we decided to channel our energies to more useful purposes!

—Sharang Biswas '12

Communication across teams and people of different backgrounds, the

ability to present persuasively and effectively, and management skills.

—Ermira Murati Th'12

Oral and written communication skills.

—David Wu '12

A good sense of humor and lightheartedness are key to being able to blow off steam and get along with colleagues. Unforeseen problems with designs crop up all the time, whether or not it is of your own doing. When it is of your doing, accept the blame, work through it, and move on. It is necessary to be self-critical (of ideas), accept criticism, and give constructive criticism. What really makes a company fly is the team. Being a constructive member of that team helps everyone succeed.

—Preston Manwaring Th'13

The skill that I find valuable is the ability to venture into uncharted territories. I am a Ph.D. student at the University of Michigan and some of the research work that I am developing has few precedents. Sometimes I dig information from forums, blogs, and interest groups to find out how to proceed. I have been thankful for my ENGS 89/90 courses in which my team and I took on a problem that few solved before: building a hull-cleaning robot. It was frustrating at first to have no textbooks to follow. It was extremely rewarding to learn how to divide and conquer an unprecedented problem. I learned the Tao of figuring out how to build a system with no guidance, and it has been really valuable to me in my research.

—Yuan Shangguan '13 Th'13

Interpersonal and communication skills. You can't learn how a system works and potentially improve it without being able to learn from others or articulate your ideas. Organizational skills are important as well. You have to know how to prioritize what about your systems, processes, etc., are most important.

—Deidra Willis '13

Creativity!

—Benjamin Cunkelman, MS Candidate

## ON THE RAILROAD

Left to right, Nicholas Willey '06 Th'08, Russell Primeau '13, and Alan Talbot '83 discuss upgrades to the rail corridor from Boston to Montreal with New England Central Railroad's Malcolm Blue at a rail/highway grade crossing in Cornish, N.H.



## thayer notes

### 1940s

**Foxy Parker '48 Th'49:** I've been retired for many years, am in reasonably good health, and got out to Colorado as usual this winter with Helen, my bride of 61 years, to see our two daughters and one granddaughter and do some skiing.

### 1950s

**W. Patrick Gramm '52:** Duplicate bridge, golf, and family take up most of my time. I am lucky to still be alive.

**Bart Lombardi '52 Th'54:** After 35 years with IBM, I retired in 1989. I started out as a computer engineer and later found that I could manage IBM's business activities well with my engineering background. After retiring, I became an independent consultant with Bell Atlantic Mobile (now Verizon). I developed business partnerships with software companies to develop wireless data applications to run on Bell Atlantic's wireless network. This was in the mid-1990s, when people were wondering if wireless data apps had a future. After several years in this mode, I then become an adjunct professor of computer science at Gateway Community College and Southern Connecticut University in New Haven. I am now fully retired with my wife, Ursula, in Guilford, Conn. We travel a fair amount and enjoy our 11 grandchildren.

### 1960s

**Bruce Clark '60 Tu'61 Th'61:** We just completed a \$350,000 water treatment upgrade for Danbury, Conn. I am a director and past president on our Lake Waubeeka Association board of directors. I have had responsibility for our water system for about seven years. We were required by the Connecticut Department of Public Health to test our raw-water quality for signs of surface water contamination. That groundwater under the influence of surface water, or GWUDI, study showed signs

of contamination, and we agreed to correct the problem with a new filtration system. As a part of that upgrade, we examined our whole system and upgraded many elements, including electrical, pumps, septic, backup power, and piping. This has been the most significant and expensive project in our community's 62-year history.

### 1970s

**William Holekamp '70:** I continue to be involved in commercializing innovative technologies, including a recent purchase of S-RAM Dynamics (s-ram.com). S-RAM, an early-stage energy technology development company, is commercializing a heat engine that converts biomass heat to power, a high-performance heat pump that uses environmental friendly air as the refrigerant, and natural-refrigerant oil-free, variable compressors. These high-performance energy applications use S-RAM's breakthrough variable compressor and expander technology.

**Peter Areson '72 Th'73:** I have spent the last several years working as a locum tenens surgeon in Gisborne, New Zealand. My wife, Cyndy, and I have settled back in the United States in Weston, Vt. I am working a long weekend in small Vermont hospitals once a month or so, filling in for general surgeons to give them a weekend off. It keeps me somewhat active without having to commit myself to full-time work and gives me a look at other small hospitals in the area. I have not been doing any engineering, but follow my colleagues at Thayer School with great interest.

**Steve Askey '76 Th'77:** I retired from Schlumberger in July 2010 after almost 33 years in various positions, both domestic and international. Retirement lasted for about three weeks. After much encouragement (read: an ultimatum) from wife, Yenni, I returned to the workforce as a consulting quality-assurance engineer for BHP Billiton in Houston, Texas, in November 2010.

The good news is that this current job is more enjoyable with less stress and better compensation. The bad news is that I've been unsuccessful in retiring again. I hope to remedy that in 2014.

**Wayne Ballantyne '77 Th'78:** I am still in engineering, as fellow of technical staff for Motorola Mobility LLC (a Google company), based in Plantation, Fla. I've been with Motorola for 34 years and it's been a wild ride, with the 2011 separation from Motorola Solutions, the Google acquisition, force reductions, etc. I earned my M.S.E.E. from Florida Atlantic University in 1985, and am trying to finish a Ph.D. there next year. I still remember **Kelly Carter '77 Th'78**, **David Voss '77**, and **Radu Tenenbaum '75 Th'77** from my class, but haven't talked to them since graduation. **John "Jack" Maney '77** was also in my class. He was working at Harris in Melbourne/Palm Bay, Fla., for many years, and I communicated with him occasionally, but I'm not sure if he is still there. One thing I always remember is the machine shop class where we built the Stirling cycle engine. I was able to parlay that into a summer job at a printed circuit board fab house in Fort Lauderdale, Fla., back in the late 1970s.

**William Fraizer '78:** I have been shuttling back and forth between the United States and Western Australia this year in my role to manage the technical support for the construction of the Wheatstone Liquefied Natural Gas (LNG) Project. We are building a Greenfield, two-train, LNG plant just west of the small town of Onslow on the far northwest coast of Western Australia. I work at the construction site office, supervising a team of discipline engineers and interface coordinators and providing oversight and technical assurance to the construction work, which has been under way since our formal groundbreaking in December 2011. The site preparation work is making good progress; we are moving more than 10 million cubic meters of material to

elevate and contour the plant site. We are now pouring the massive concrete foundations for the refrigeration compressors, which will form the heart of the LNG production trains. We are also building a material offloading facility, which is an artificial harbor, to allow us to receive all the heavy equipment and preassembled modules that will be installed in the LNG and domestic gas processing units. It is enjoyable to be involved in managing the construction of a multibillion-dollar world-scale energy project that will benefit both Australia and our customers in Japan, particularly after spending the preceding three years in a senior engineering role overseeing the front-end engineering and detailed design of the LNG plant facilities. The far northwest Pilbara region of Australia is a challenging work environment with its heat, red dust, flies, and risk of a tropical cyclone during the summer months. It is far from any large city so we have to construct all our own supporting infrastructure. We spent the first year building the access roads, accommodations facilities, and water supply systems needed to support construction. I live for four weeks at a time in the construction village complex we built to house the 3,500-plus workforce and work seven days a week. Balancing that is the opportunity to have an equal number of weeks off. Last June I was able to return to Hanover for my class reunion and participate in the Thayer School reception for returning alums hosted by Dean Helble.

**Michael Geilich '79 Th'82:** I am the senior director of software engineering for Resource Systems Group in White River Junction, Vt. RSG is an employee-owned consulting company specializing in modeling, simulation, and data. RSG was founded by former Dartmouth professors Dennis Meadows, Tom Adler, and Colin High.

### 1980s

**Michael A. Komara '81 Th'83:** For the past



#### VAT CHECK

Lauren Busby '07 Th'08 inspects a 90,000-liter wine tank in the Blenheim region of New Zealand for earthquake damage.



30 years, whenever I receive anything from Thayer School, I think about how fortunate I was to be able to go there. Then I immediately think about the single professor who had a major effect on my thinking, creativeness, inventive nature, and eventual success. I attribute my 17 U.S. patents (in cellular) to an old curmudgeon I had for Engineering 21, **Professor Frederick J. Hooven**. When our group of five sophomore “future engineers” were assigned to him, we all thought, “Who is this old grumpy guy?” Over time, we grew to love and respect him for all of his wisdom. Eventually, I became quite amazed by all of the things that he had invented. I did get him back when I scrambled his mind riding my unicycle to Thayer School—he was just laughing as if he could not believe it. It felt good to be a 20-year-old student making a 70-year-old genius laugh so much—and just one wheel was needed to do it.

While chief scientist at AirNet Communications, I received 17 U.S. patents, including the AirSite product, which won the 1998 Global System for Mobile Communications Association global award. I wrote nearly every hardware specification for the AirNet products for 12 years—from systems to subcomponents. Since 2006, I have been consulting to the wireless industry in intellectual property and radio frequency systems engineering, primarily to LiveTV as the systems engineer to offer super-high-speed WiFi-based connectivity of 12 megabits per second to each passenger of JetBlue and United/Continental using the ViaSat Ka-band satellite-to-aircraft data communications system. You can read more and see a video at [engadget.com/2013/09/24/inside-jetblue-fly-fi](http://engadget.com/2013/09/24/inside-jetblue-fly-fi).

**Peter G. Lambert '82:** I am the senior vice president of Nordson Corp., a multinational company with direct operations in 30 countries. I lead the company's polymer processing systems product lines, which includes Nordson's extrusion dies and feedblocks through its extrusion

dies industries division. I joined the company in 1993 as product development manager in the powder systems group and in 1997 was appointed to the position of managing director of Nordson Australia. I was named director of corporate development and global business information in 2001, VP of packaging and product assembly in 2003, and VP of Nordson's EFD Inc. in 2005. I headed Nordson's adhesive dispensing systems segment from 2010 to 2013. I hold a master's in aeronautical engineering from the Air Force Institute of Technology and an M.B.A. from Case Western Reserve University's Weatherhead School of Management.

**J.D. Lindeberg '82:** I run an environmental consulting firm that focuses on sustainability and zero waste solutions. We are based in Ann Arbor, Mich., and are called Resource Recycling Systems (RRS, at [recycle.com](http://recycle.com)). RRS employs 37 folks who are located from the outer banks of North Carolina to Half Moon Bay, Calif. We work on a variety of projects, including development of recycling programs for municipalities, life-cycle assessments for packaging developers, raw material supply plans for biomass power plants, and other projects related to preventing and reutilizing wastes in our industrial ecosystem. In business for more than 25 years, we pride ourselves on delivering superior solutions to our customers, providing excellent work for our employees, and making a difference in the world. To prepare myself for this job after Dartmouth, I attended Stanford for a civil engineering master's and Princeton's Woodrow Wilson School for a public policy degree. That, together with the Peace Corps, created an excellent basis for being a leader in my work and

the marketplace.

**Bill Lipfert '82:** I'm the manager of the operations planning and simulation practice at LTK Engineering Services, a firm that specializes in railroads and rail transit. Many of our projects involve real design (preliminary engineering, final engineering, and construction phase services). LTK is working on improving passenger rail service in the Northeast. We are involved in a study for Vermont, with the participation of Massachusetts and Connecticut, to identify upgrades and improvements along the Boston-to-Montreal corridor, via Springfield, Mass., and White River Junction, Vt. I work with three Thayer alums at our Lebanon, N.H.-based office. **Alan Talbot '83** is director of software engineering, leading the team that develops and improves our TrainOps simulation software. **Nicholas Willey '06 Th'08** is a rail operations analyst for projects in New York, California, Illinois, Pennsylvania, and Australia. **Russell Primeau '13** was our summer intern in 2013.

**Jim Pedrick Th'82:** I regret not having utilized Thayer's machine shop, but I work with metal now in my blacksmith shop. My latest project was to make two fireplace sets for our church sale, and I have the materials for a dinner bell (triangle). My shop is in my garage in Douds, Iowa. It's unheated, but I stay warm by the heat of the forge and the exertion of pumping the blower handle.

**Mike Adams '83:** For the past 24 years I have worked for Bechtel, the largest engineering and construction company in the United States (and one of the top 10 in the world). I spent 10 years based in London running the global civil infrastructure (roads, rail, airports, hydro) business for Bechtel. For the past year, I have been the CFO

(based in Virginia and San Francisco). My responsibilities include Bechtel's global sustainability work. I have a vacation house in Vermont and so pass through Hanover several times a year with my family (four boys—all still in school).

#### 2000s

**Andy Thompson '00:** I am an assistant professor of environmental science and engineering at Caltech. I research ocean circulation around the margins of Antarctica and how it might impact Antarctica's ice sheets. Our first glider deployment was carried out in the Weddell Sea in January 2012 as part of the GENTOO (Glanders: Excellent New Tools for Observing the Ocean) project. The project title emphasizes the compelling prospect of using ocean gliders to continuously monitor remote but influential regions of the ocean. Data collected by our gliders will provide us with an exciting new view of the variability and interdependence of ocean physics, chemistry, and biology at the boundary between the Antarctic margins and the global ocean. Our group's second glider deployment took place in the Atlantic last summer. A link to the cruise blog is at [www2.physics.ox.ac.uk/blog/osmosis-research-cruise-2012](http://www2.physics.ox.ac.uk/blog/osmosis-research-cruise-2012).

**Charles Augello '03:** I spent the last many years working as a software developer and financial analyst for AllianceBernstein in New York City, using some of the skills I learned in ENGS 20 (Intro to Scientific Computing) and ENGS 65 (Engineering Software Design) and a whole lot of MATLAB. Last summer I took off from work for a bit of a life reboot. I spent much time reading and traveling though South America and the western United States, got engaged, and moved to Seattle. I am

considering the possibility of returning to school to further my engineering education, rueing somewhat that I did not go beyond my A.B. at Thayer.

**Alex Streeter '03 Th'05:** For more than four years I have been a systems engineer at DEKA Research and Development Corp. in Manchester, N.H., nearly all of that time working on our Defense Advanced Research Projects Agency-sponsored prosthetic arm. Now in its third-generation design, the Luke Arm has been used by several dozen amputees in clinical trials. In addition to modest design contributions, I've been performing large amounts of testing: Beating the snot out of the design to demonstrate that it will hold up for its design life. We are negotiating with the FDA for clearance to bring it to market.

**Matthew Guernsey '05 Th'07:** In May I married fellow Thayer engineer **Dana Haffner '06 Th'08** in New Marlborough, Mass. We met in the fall of 2006 in the basement halls of Cummings while I was covered in engine grease working on the ethanol-powered Dartmouth Formula Racing (DFR) car and Dana was working on the hybrid DFR car. We had three other Thayer engineers in our wedding party: **Mike Madson '05 Th'07** and his wife, **Liz (Hunneman) Madson '05 Th'06**, who got married in June 2012, and **Daniel Hassouni '05 Th'05**, who is engaged to another Dartmouth alum. Also in attendance were **Cliff Orvedal '05 Th'07**, **Matt Hodgson Th'06**, **Colin Ulen Th'05 Th'06**, and **Julie Lisi '05 Th'06**.

**Erik Johnson '06 Th'11:** I am president of Synticos LLC, a company that I started with Dartmouth **Professor Emeritus Robert Dean Jr.** Synticos is based out of a garage bay in Burlington, Vt., and is trying to achieve proof of concept for the world's first commercially viable abrasive slurry jet cutter (ASJC). An ASJC improves on the current state-of-the-art abrasive water jet cutter (AWJ) and is theorized to have up to five times the cutting speed. My wife, Marie, and I celebrated our one-year anniversary on September 15 with a camping trip to Maine. Also, we got a dog named Ellie



that is the best hiker you've ever seen.

**Lauren Busby '07 Th'08:** I've worked for Thornton Tomasetti for the past three and a half years following grad school at Stanford. For the past six months, I've been in Christchurch, New Zealand, working on the engineering evaluations for insurance claims related to the Canterbury earthquakes of 2010 and 2011. I have evaluated many large buildings in Christchurch and also some wine tanks in the Blenheim wine region for damage from additional earthquakes.

**Peng Wang Th'09:** I have married **Yihan Hao '08**. We are both working in Beijing and are natives of the city. We spent a happy mini-honeymoon in Paris and Copenhagen last summer and are planning a more formal one somewhere in the Pacific. I am an investment manager for a Danish state-owned investment fund for emerging markets. As a representative of the fund, I've recently joined the board of a portfolio company in China as an alternate board director. My wife's major was economics, but she is now an architect (with a master's from Columbia University).

## 2010s

**Matthew Cohen '10:** I'm in the Siemens Graduate Program (SGP), a rotational development program within Siemens. I just got back from six months in Shanghai, China, working on the design and manufacture of equipment for the steel industry. The SGP consists of three eight-month rotations, one of which is completed abroad. I'm in Boston for the immediate future. In Shanghai, my major projects were cost-reduction work in response to new, low-cost competitors and a market-entry business case and project plan for a new product. The most important experience was gaining an understanding of how manufacturing and

business as a whole work in China. The Thayer M.E.M. set me up exceptionally well for engineering management in a program like the SGP and at a company like Siemens.

**Ben Hemani '10:** In September I left my job as an energy specialist for an economics consultancy for a job as an analyst at a Boston venture capital firm, Braemar Energy Ventures, a fund that specializes in energy tech. I primarily vet companies' potential for investment (i.e., seeing if they'd make good investments for us) and help our existing portfolio companies grow toward an acquisition or IPO. It's a very different role than I was in as an energy market consultant. Now I think about the business world much more strategically and about how a specific company can find success, instead of how macroeconomic conditions are driving changes in the energy sector. The background I built as an M.E.M. at the intersection of the business world and emerging technology is critical to being a successful analyst at a venture fund. With my focus on energy, I benefit from the background I built in classes with **Lecturer Mark Laser** and **Professors Charlie Sullivan** and **Benoit Cushman-Roisin** paired with the core Tuck classes required for the M.E.M.

**Brandon Cohen '11:** I work as a project engineer for an environmental engineering firm near Philadelphia called CSL Services (cslservices.com).

**Matthew Dahlhausen '11:** I am an M.S. candidate in the building science group at Penn State University. I research and develop simulation tools for energy retrofit of existing buildings through the U.S. Department of Energy-sponsored Energy Efficient Buildings Hub. Prior to this graduate program, I served with AmeriCorps as an energy auditor in a residential weatherization program in Philadelphia. I spend my free time reading, writing, and thinking about

## THE KNOT

Peng Wang Th'09 and Yihan Hao '08 were married at the Imperial Ancestral Temple in front of the Forbidden City in Beijing, China.

what ecological limits mean for the future.

**Benjamin Meigs '10 Th'11:** I am still with Zodiac Aerospace, designing commercial aircraft interiors in Huntington Beach, Calif. In January, I headed to São Paulo, Brazil, with a team of Zodiac engineers for the joint development phase (JDP) on the Embraer E2 commercial jet program. The JDP involves defining technical requirements, interface points, and envelopes for the floor-to-ceiling interior that Zodiac will design and manufacture on the E2.

**Ashie Bhandiwad Th'11:** I am at a job that uses my skills from my entire educational background: bachelor's in chemical engineering, master's in biotech, and Ph.D. in engineering sciences at Thayer focusing on biofuel production. I work as an associate specialist at the Energy Biosciences Institute at UC Berkeley doing process modeling for predicting different feasibility scenarios for biofuel production on a large scale.

**Alison Stace-Naughton '11 Th'13:** I've always been interested in the startup world and different products that solve real-world needs. While at Dartmouth, I cofounded a medical device startup, Spiral-E Solutions LLC (spiral-e.com). I was the project lead on an ENGS 21: Introduction to Engineering team that invented an endoscopic vacuum tissue stabilizer. I worked for two years to finalize the design and conduct extensive product testing on tissue. I won the \$25,000 first prize in the Dartmouth Ventures competition in 2012, and that June Spiral-E Solutions filed a utility patent on the tissue stabilizer. Since graduation, entrepreneurship in conjunction with engineering has been my main focus. I worked at Thayer last fall as the Cook Engineering Design Center (CEDC) Fellow, working closely with **Professors Ron Lasky**, **William Lotko**, and **Ryan Halter Th'06** to hone the next year's capstone projects for 100-plus Dartmouth engineering students. I received the CEDC fellowship for work done on my engineering senior capstone project on fecal transplantation. This project—in which I helped





#### TIME OUT

Natalie Burkhard '12 got in some hiking during a trip to Norway for research on robotic oil drilling.

develop a novel filtration and isolation system for fecal transplantation—won first prize in the 2013 National Bio-medical Engineering Society's BME-Start Innovation Competition and first prize in the 2012 National Institutes of Health Innovation Competition. I've also been working at Adimab; the CEO, **Professor Tillman Gerngross** and COO **Erik Anderson '00 Tu'07** hired me to figure out how to collaborate with academic labs to empower academic investors to develop the antibody engineering space. Working there has been a fantastic experience in which I not only learn more about the biotechnology startup world but am also being advised by two very successful entrepreneurs. This mentorship will help me in my future entrepreneurship endeavors.

**Jorge A. Bahena '12 Th'13:** I started working at BP Biofuels last fall as a process development associate, working in fermentation, maintaining bacterial cultures intended for the conversion of cellulose into biodiesel.

**Natalie Burkhard '12:** I'm a second-year master's student in mechanical engineering at Stanford and doing research in its Biomimetics and Dexterous Manipulation Laboratory. Recently I went to Norway for research related to robotic oil drilling with Robotic Drilling Systems in Sandnes. Our job was to find a way to detect slip between a robotic gripper and pipes, ensuring safe and reliable operation in an automated oil drilling system. We developed and tested a slip-detection algorithm at the Biomimetics and Dexterous Manipulation Laboratory at Stanford and then tested it onsite in Norway. My Thayer engineering education influences the way I think and the projects I'm able to work on. Although as an undergrad I studied mostly structural and civil engineering

and did mostly biomedical research, I feel comfortable working with sensors and robotics because Thayer's engineering program encourages us to be well-rounded engineers.

**Alex Engler '12 Th'13:** I'm pleased to say that I've remained in engineering! Following my completion of the B.E. requirements last fall, I began work at Harvard's Wyss Institute for Biologically Inspired Engineering as a postgraduate research fellow. I have been designing medical devices to treat esophageal atresia, a congenital anomaly consisting of an interruption of the continuity of the esophageal wall. I have been in and out of the operating room, working with surgeons and neonatologists as well as mechanical and electrical engineers to design a device and corresponding system to non-surgically grow esophageal tissue.

In esophageal atresia, which affects one in approximately every 4,000 live births, the esophagus consists of two blind pouches instead of a continuous connection between mouth and stomach. The current standard of care involves putting the infant in a multi-week coma and putting the two esophageal pouches under traction using sutures that come out through the infant's back and are tightened daily; while this stretching is effective in growing esophageal tissue, the surgery is incredibly destructive and costly. The device we are designing involves the principles of hydrostatic pressure to induce tissue growth in a non-surgical and minimally invasive manner. We insert the device into the esophagus and, through an embedded attachment method, it affixes itself to the esophageal walls. We then inflate the device with fluid, and its design causes it to expand longitudinally with very little radial growth, applying internal pressure to the inside end

of each pouch. We then control the device through pressure feedback, inflating it as the tissue grows in order to maintain a constant pressure that is just below the tissue perfusion pressure for the esophagus. We are finishing up bench-top characterization of the device and are preparing for animal studies at Boston Children's Hospital to validate that the control limits we impose on our system are able to safely grow esophageal tissue. The design skills I acquired through Dartmouth's biomedical engineering program have been extremely relevant to my current work—and have definitely given me a leg up on my coworkers!

**Scott Lacy '13 Th'13:** I graduated last June with the B.E. and an A.B. in earth sciences. I had planned on continuing to ski after graduation, but a variety of factors influenced my decision to change directions. I spent the summer taking classes at Tuck and spent some time back in Colorado and building (timber framing) a new bunkhouse at Moosilauke. I also cold-called a small product development company in Seattle. They asked me to design my own internship and said they would love to have me join the company. ClaroWorks Product Development specializes in underwater and waterproof products and spends a lot of time testing prototypes via SCUBA diving, skiing, or canoeing. I am their first intern and had the opportunity to design the internship myself (the work, timeframe, pay, vacations, client interactions, daily schedule). It is a bunch of cool engineers who love being outside engineering things to be adventure-proof. I will be spending my time designing and brainstorming, prototyping and manufacturing (they do in-house manufacturing, too), and testing, so pretty much everything. I don't think I could be with a better company for me. My goal is to use my engineering skills, gain some capital, explore the Pacific Northwest, and even keep up with ski training a little. Skiing is a hard part of my life to leave behind and I have come to realize I will never be done with it.

## OBITUARY

**George Ehinger Jr. '45 Th'45** passed away on April 21, 2013, in Wilton, Conn., at the age of 91. He was an engineer and vice president of Dorr-Oliver for 40 years. He joined Dorr-Oliver straight from Thayer and rose to group vice president, responsible for sales exceeding \$100 million and more than 1,000 employees. Upon his retirement, coworkers recognized him with the following passage: "He set high ethical standards. He gave the company class. He led imaginatively. He challenged all to excel." He became owner/president of Winslow Manufacturing in Wallingford, Conn., for 20 years. He was predeceased by his wife, Marilyn, in 1993 and by his companion Beth Fuller in 2011. He is survived by daughter Ruth and son-in-law Bill, son George III and daughter-in-law Tamie, son Richard, two grandchildren, and brothers Robert '43, Paul, and Nelson '52.

### Dartmouth Society of Engineers ELECTION RESULTS

#### President

Richard K. Akerboom '80 Th'82 '85

#### Vice President

Jolin M. Salazar-Kish '88 Th'91

#### Treasurer

John H. Kennedy '53 Th'54

#### Secretary

Harlan W. Fair '53 Th'54

#### Members at Large

E. Kristina Brock '01 Th'02  
Jason R. Duty '95 Th'96

#### Alumni Council Representatives

Richard K. Akerboom  
Jolin M. Salazar-Kish

[engineering.dartmouth.edu/for/alumni/dse](http://engineering.dartmouth.edu/for/alumni/dse)

# inventions

## SWEET DESIGN

### >> INVENTOR:

HENRY C. KECK '43 Th'44 Tu'44

It isn't unusual for Thayer grads to innovate, invent, and design. However, Henry C. Keck '43 Th'44 Tu'44 is unique in the community of Thayer alumni. Among the 1,500 items produced by Keck-Craig, the industrial design firm Keck started in 1951, are a sugar shaker and a barricade light that are now considered works of art.

Design historian Bill Stern described Keck's 1955 sugar shaker to a reporter from the *L.A. Times* as "the essence of modernism, a perfect meld of function and form. There's not a whit of unnecessary decoration. It's made inexpensively but responsibly, so it won't prematurely break or wear out. Viewed at a distance, it is an extremely elegant object."

In designing the shaker, displayed at the Los Angeles County Museum of Art in a 2012 special exhibit on mid-century modern life, Keck considered the needs of the coffee shops and lunch counters that would eventually purchase 25 million of them. "We engineered it to be completely smooth all around, so there's nowhere for sugar or dirt to hide," Keck explained.

In 1967 a second Keck-Craig product catapulted into the realm of art—the widely used yellow flashing roadside barricade light. Keck's design is featured on the Museum of California Design's home page, along with work by such paragons of design as Frank Gehry and Ray Eames. And winners of the museum's annual design award are given a transpar-



ent replica of the barricade light.

How does Keck design products that are artistic, practical, and profitable? The artistic part might be genetic. "My heart has always been in two worlds: art and engineering. My father was a famous sculptor; my cousin was a famous bridge designer. For these reasons, I always had a passion for creating new designs and innovative products," he says. He also draws from a solid education. Keck graduated from Dartmouth, Thayer, and Tuck, joined the Navy's Advanced Electronics Program, and earned another graduate degree at Caltech.

In his book, *How Design Changed America*, Keck described what set Keck-Craig apart from the competition. "Our approach was to make things work, to function properly, and to be capable of being produced at a reasonable cost. Only when these hurdles were handled did we indulge in the industrial design in the sense of making the products attractive, easily used, and marketable."

Keck's sugar shaker was immensely profitable, but not for Keck-Craig. The firm worked for a prearranged fee. "Sales exploded," Keck told the *L.A. Times*. "Our client was able to retire on the profits from that one thing."

—Lee Michaelides







## RANDOM WALK

On a stormy winter day in February, neither snow nor rain stayed 43 companies and 124 students from the swift completion of their appointed rounds at Thayer School's Virtual Career Fair. Using Skype for online face-to-face interviews, employers and students got together for 393 tightly scheduled eight-minute meetings between 10 a.m. and 6:30 p.m. Run by Thayer's Office of Career Services, the fair provided employers with students' resumes in advance. The Virtual Career Fair had other virtues, too, according to employers. As one interviewer put it, "It is an efficient medium for meeting quickly with many candidates without having to spend time traveling or setting up a booth." Students could sign up for as many interviews as they could manage. The most interviews by a single well-prepared student: an enterprising 11.

*Photograph by Karen Endicott*

THAYER SCHOOL OF ENGINEERING AT DARTMOUTH  
14 ENGINEERING DRIVE  
HANOVER, NH 03755

NON-PROFIT  
U.S. POSTAGE  
PAID  
DARTMOUTH COLLEGE

