

DARTMOUTH

WINTER 2009

# Engineer

THE MAGAZINE OF THAYER SCHOOL OF ENGINEERING

## THAYER IN THE LANDSCAPE

THE WORK OF ALUMNI  
IS IN PLAIN SIGHT, IF YOU  
KNOW WHERE TO LOOK.

> INVISIBLE HANDS OF SCIENCE > GUARDIAN OF NATURAL RESOURCES

## Strategies for Challenging Times

BY DEAN JOSEPH J. HELBLE

THE CURRENT FINANCIAL CRISIS AFFECTING ALL SECTORS of the economy is also having an impact on higher education. Falling endowment values, a challenging federal research climate, and a strong commitment to meeting increasing student financial need have placed unprecedented pressure on college finances. Dartmouth College is not immune from these challenges and is taking steps to reduce expenses while preserving student financial aid and faculty resources. Our commitment is to ensure that the outstanding academic experience of our students will not be compromised.

At the Thayer School, we are in a fortunate position relative to most academic institutions. Our research program has remained strong despite the increasingly competitive federal funding climate. For the first six months of the current fiscal year (through December 31, 2008), research grant awards to our faculty increased 26 percent over the same period one year ago. Funding continues to come from a broad range of sources, with 30 percent from the National Institutes of Health, 25 percent from non-federal sources, and nearly 30 percent from the National Science Foundation and Department of Defense combined, providing a buffer against budgetary challenges in any one particular area. Student interest in engineering also remains strong, with record enrollments noted in the Master of Engineering Management and Ph.D. programs this year, and enrollment in entry-level core engineering classes up significantly over the past several years. Although the value of Thayer's endowment has declined along with the stock market, the outstanding level of research funding, strong student interest in engineering, and continued careful management of discretionary expenditures place Thayer in a strong position to build for the future.

Over the course of the next academic year, while remaining flexible in our responses to this volatile economic environment, Thayer School will continue to build in strategic areas. We will conduct searches for new faculty in our energy and engineering-in-medicine focus areas, build our academic programs in these areas, continue to expand our unique Ph.D. Innovation Program [see page 2], and continue to explore new educational opportunities for our students. These are certainly challenging times for the academic community, but Thayer is well positioned, and we look forward to continuing to grow and strengthen our academic enterprise.

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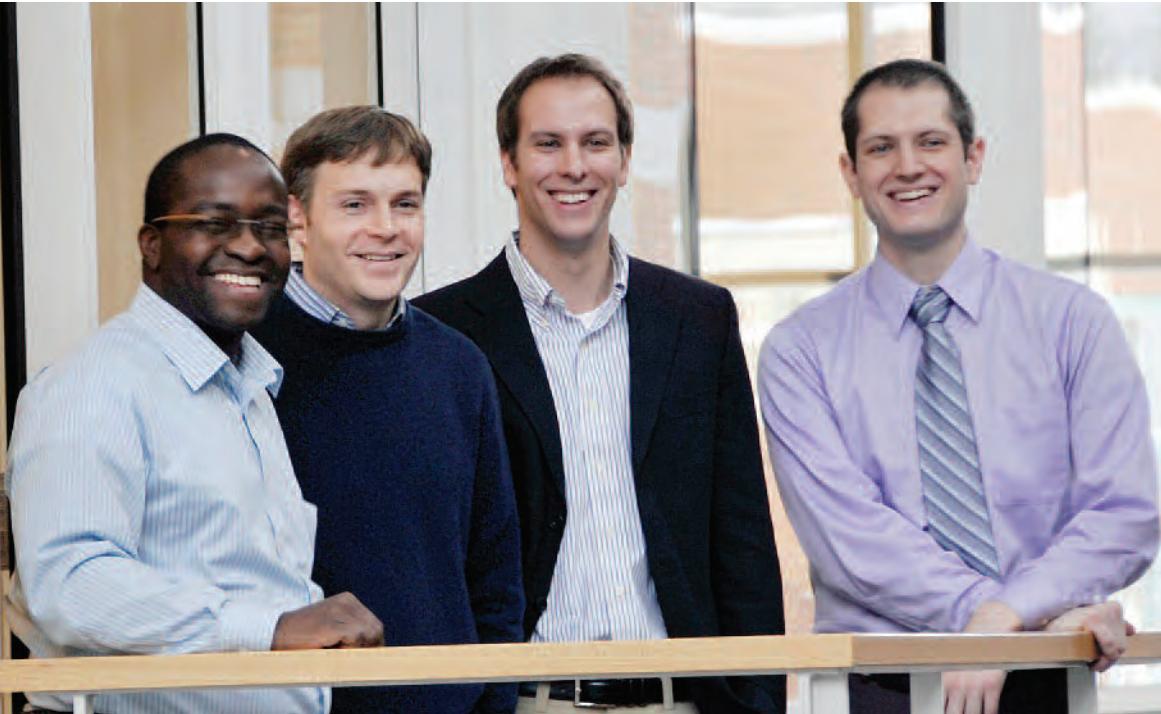
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Zakim Bridge, Boston, Mass.  
Photograph courtesy of Parsons Brinckerhoff Inc.

**BACK COVER**  
Aerial view of Thayer School and surroundings.  
Photograph by John Sherman

# THE Great Hall

>>NEWS FROM AROUND THAYER SCHOOL



## LEADING EDGE

### Nation's First Ph.D. Innovation Program

**FIRST CLASS**  
From left, Ph.D. students Ashifi Gogo, Preston Manwaring, Dax Kepshire Th'06, and M.D./Ph.D. candidate Andrew Giustini comprise the first cohort of Thayer's new doctoral-level Innovation Program.

**BREAKING NEW CURRICULAR GROUND**, THAYER School is training a new generation of technology leaders with the nation's first doctoral-level engineering Innovation Program. The program provides engineering Ph.D. candidates with entrepreneurial training for turning complex research discoveries into innovative applied technologies.

Students admitted to the program augment their doctoral studies with entrepreneurial-centered courses such as finance, accounting, patent law, marketing, and organizational behavior. Thayer School has developed two entirely new Innovation Program courses taught by former dean Charles Hutchinson, who co-founded the multi-million-dollar therapeutic protein company GlycoFi, and by John Collier, the Myron Tribus Professor in Innovation. The first of these courses is ENGS 300: New Venture Creation, a comprehensive overview of the commercialization of

emerging technologies. The second, ENGS 321: Introduction to Innovation, is a doctoral-level version of ENGS 21, Thayer's signature undergraduate course in creating new products. In addition, Innovation Program students will complete a three- to six-month internship at a start-up or other entrepreneurial enterprise.

The first Innovation Program students are pursuing a variety of research and entrepreneurial ventures. Ashifi Gogo is co-founder of the Ghana-based start-up mPedigree, a company that authenticates medicines in developing nations where drug counterfeiting is widespread. Dax Kepshire founded SustainX, a company that is developing compressed air energy storage technology for enhancing the value of renewables such as wind and

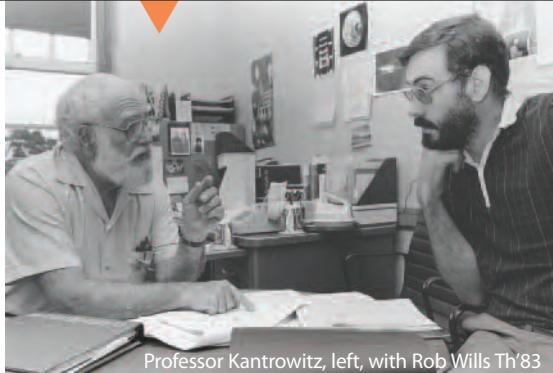
solar. Preston Manwaring anticipates that his future start-up will focus on traumatic brain injury assessment in hospital triage and intensive care, work that is related to his doctoral research. And Andrew Giustini, an M.D./Ph.D. candidate, plans to develop new medical technologies. "The only way to develop new therapeutics that will actually be used clinically is to work closely with industry and understand the business world," he says.

These four select students are at the start of a deliberate trajectory. "Our intention is to keep the program small and focused," says Dean Joseph J. Helble. "Admission is not automatic. Students admitted to the Ph.D. program prepare additional materials demonstrating their creativity and interest in innovation and entrepreneurship. Applicants then pass through an additional screening and review process. We expect to admit four to six Ph.D. students per year to the Innovation Program, building to a total enrollment of 20-25."

The program itself, says Helble, build on Thayer's "long history of innovation at the faculty level. We anticipate that the Innovation Program will increase the amount of patent activity from Ph.D. students at Thayer and the number of companies started by our Ph.D. graduates. We also expect to train a new generation of professors who are interested in putting their work to use by starting companies and developing products that benefit society. This program will help cement Thayer's reputation as a school focused on innovation."

—Kathryn LoConte

Kantrowitz was passionate about the roles of academia and the scientific community in the public perception of technology.



Professor Kantrowitz, left, with Rob Wills Th'83

#### IN MEMORIAM

## Professor Emeritus Arthur Kantrowitz

THAYER SCHOOL PROFESSOR OF ENGINEERING, Emeritus, Arthur Kantrowitz died of heart failure on Saturday, November 29, 2008, in New York City. He was 95.

Kantrowitz came to Thayer as professor and senior lecturer in 1978. Previously he taught aeronautical engineering and engineering physics at Cornell and founded Avco Everett Research Laboratory. He earned his Ph.D. in physics at Columbia; held 21 patents; served on advisory boards to the Ford White House, the Department of Commerce, NASA, the General Accounting Office, and the National Science Foundation; was a member of numerous scientific organizations; and was a recipient of the Roosevelt Medal of Honor for Distinguished Service in Science.

Kantrowitz's wide-ranging research included one of the first attempts at controlled nuclear fusion in 1938, magnetohydrodynamic generators, rocket nose cones able to withstand the heat of re-entry into the atmosphere, and the intra-aortic balloon pump that has been used in hundreds of thousands of patients.

He was passionate about the roles of academia and the scientific community in the public perception of technology. He advocated for a "science court" to provide reliable information about the scope and limitations of scientific knowledge.

An obituary in *The New York Times* noted that he "never lost his faith in science and in humanity's ability to solve its problems."

He is survived by his wife, Lee Stuart of Hanover; three daughters, Barbara, Lore, and Andrea; and six grandchildren.

#### FACULTY NEWS

## New Profs Arrive

>> **Ryan Halter**, assistant professor of engineering, brings expertise in the fields of engineering mechanics and biomedical engineering. His current research projects include electrical impedance imaging for breast cancer and prostate cancer screening. After completing his B.Sc. and M.Sc. in engineering mechanics at Pennsylvania State University, he earned his Ph.D. from Thayer School in 2006.

>> **Songbai Ji**, assistant professor of engineering, is currently working on image-guided neurosurgery. He completed his B.Sc. in materials science at Shanghai Jiaotong University and his M.S. in computer science and D.Sc. in mechanical engineering at Washington University in St. Louis. His interests include image analysis, finite element, and numerical methods.

>> **Frederic Leblond**, assistant professor of engineering, is currently focusing his research on fluorescence-guided neurosurgery and fluorescence imaging. He received his B.Eng. from École Polytechnique de Montréal, his M.Sc. in Physics from Université Laval, and his Ph.D. from McGill.

>> **Kofi Odame**, assistant professor of engineering, specializes in electrical and computer engineering. He joined the Thayer community in September 2008 after completing a Ph.D. in electrical and computer engineering at Georgia Institute of Technology, as well as M.S. and B.Sc. degrees from Cornell University. His research interests include biologically inspired cochlear implants and rain-computer-interface front-ends. Odame will also be teaching ENGS 32: Electronics: Introduction to Linear and Digital Circuits.

>> **Subhadra Srinivasan**, assistant professor of engineering, completed her bachelor's degree in technology, electronics and communication engineering at Pondicherry University in India. She earned her Ph.D. from Thayer School in 2005. She is focusing her research on near-infrared imaging, fluorescence imaging, and non-linear image reconstruction techniques.

## kudos

>> **Professor Brian Pogue**, internationally known for his research on biomedical optics and imaging of cancer, has been named the new dean of graduate studies at Dartmouth. In the lab, Pogue and his research team develop and refine new medical technologies that use near-infrared light and spectroscopy to characterize cancer pathophysiology and guide cancer therapy. He also serves as deputy editor of the journal *Optics Letters*, is on the editorial boards of *Medical Physics* and the *Journal of Biomedical Optics*, and holds adjunct appointments in the surgery department at Dartmouth Medical School and Massachusetts General Hospital.

>> In the August-September 2008 issue of *PE: The Magazine for Professional Engineers*, Thayer Dean Joseph J. Helble makes the case for the ability of colleges to prepare engineering students who are technically proficient and creative leaders who understand broader societal issues. "This call to a holistic approach is, in fact, a call to regain the true mission of the engineering profession," Helble and three co-authors write in "Dispelling the Myths of Holistic Engineering." "Engineers are eloquent in distinguishing themselves from other scientists as the science-based professionals who apply their creative and technical knowledge in service to humanity, specifically by designing and building to improve the quality of life for society in both the built and natural environments."

## STUDENT PROJECTS

### I Want One of Those!

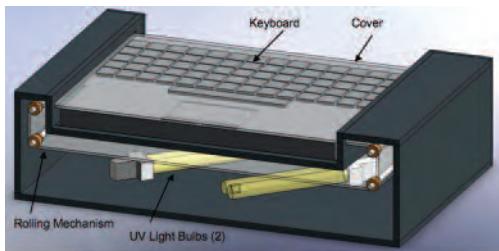
#### ▼ The Bike That Grows



Alden Adolph '11, Thomas Collier '11, Max McClorey '11, Kevin McGregor '11, and Chris Zentner '11 designed a bike that grows as a child grows. The bike uses only one set of 20-inch wheels but can be adjusted to mimic the geometries of a bike with 16-, 20-, and 24-inch wheels. The students won the Phillip R. Jackson Award for outstanding performance in ENGS 21: Introduction to Engineering. Their teaching assistant was M.E.M. student Eric Klem '08.

#### ▼ Self-Sanitizing Keyboard

Forget the Purell. ENGS 21 students Sean Currey '11, Elizabeth Kemp '11, Heather Kluk '11, and Yolanda Lin '11 built a self-sanitizing keyboard. Keyboard covers rotate after use for cleansing by ultraviolet light. The group's teaching assistant was B.E. student Scott Lananna '08.



## SERVICE TO HUMANITY

### Micro Hydro-Power

SEVEN STUDENTS WORKING AS part of Dartmouth Humanitarian Engineering Leadership Projects (HELP) Worldwide have successfully implemented a micro hydro-power system in the village of Banda, Rwanda.



#### POWER TO THE PEOPLE

From left, Giancarlo Nucci '07 Th'08, Zoe Acher '08, and Manaure Francisquez Rodriguez '11, work on a micro hydro-power system in Rwanda that is generating interest from several villages.

Using the area's natural water resources, Dartmouth engineers designed and built two hydro-powered turbines that can generate enough power to charge the batteries community members use for home lighting. The technology saves villagers from walking 27 miles each way to the nearest city on the electric grid to charge their batteries.

The project, started in 2008, made a point of using local materials and involving local residents in the work, according to Ben Koons '08 Th'09, president of HELP.

"Acquiring local materials was pretty interesting," he says. "There are these big scrap markets in the nearby city of Kigali, hundreds of tiny one-room

stores. We'd spend days trying to find specific parts, find bearings, an axel that fits. Then it would be hours haggling. One time I spent three hours finding a whole bunch of plumbing and electrical supplies, and then another three hours bartering. And I guess I went too low, because the guy just stormed off with all the wares. Then there was three hours of frantically running around the scrap yard all over again. It's pretty exciting, but tiring, too."

Another stipulation set by the students was to use local labor, which served to provide community members with employment as well as familiarize them with the technology.

"We were employing up to 35 people in the course of several months," says Koons. "And the ultimate goal of this project is to have these systems spread naturally without any foreign aid, to have trained local technicians, managers, and entrepreneurs who can run this as a small business with a local energy producer. Then it would just fit naturally into the economic framework."

Looking forward, HELP aims to have the Banda micro-hydro project act as a working model for future sites in surrounding communities. "With every successful project, I'd like there to be less and less involvement from us and more involvement from trained locals," says Koons.

That reality is not far off. Members of bordering communities have inquired about implementing the technology in their own villages.

—Kathryn LoConte

## Professor Oliver Goodenough: “You should manage lawyers, not be managed by them.”



**HEAD OF THE CLASS**  
Oliver Goodenough

### CLASSROOM

## Technology, Law, and Entrepreneurship

### PROFESSOR OLIVER GOODENOUGH GUIDES

Thayer School graduate students through the intricacies of the legal system that surrounds entrepreneurial enterprises. It's not enough for students to have an innovative idea to unleash onto the world, he says. They have to scale legal hurdles as well.

“Understanding the legal frameworks available for creating productive alliances of invention, capital, management, and labor is a critical skill for people who bring ideas to fruition,” says Goodenough, a Vermont Law School professor and Thayer adjunct professor who has taught ENGS 188: Technology, Law, and Entrepreneurship for five years.

During fall term, 22 students from Thayer and Tuck School of Business filled 202 Cummings Hall

to learn about the law of intellectual property, contractual transactions, business structures, debt and equity finance, and securities regulation in this country and abroad.

In leading students through these issues, Goodenough demystifies the way the legal world works. “My goal is to convince you that at least in certain domains, the law is your friend,” he told the class. “By having a core understanding of what lawyers are doing, you will understand the context, ask better questions, and make things better for yourself.”

Goodenough, who practiced business and property law earlier in his career, gives students a blunt look at his profession. “Lawyers are bossy people. They’re also often cautious people. That can be a very good thing. But there may be places in engineering and business where you want to take some risk. You should manage the lawyers, not be managed by them,” he told the class. “By the end of the term, I hope that you will not be intimidated by a 20-page contract. You may be bored, but you won’t be intimidated because you’ll have the tools to unpack it and manage it, not be managed by it.”

—Kathryn LoConte

>> The International Metallographic Society has awarded professor Ian Baker and three of his students honors in its International Metallographic Contest and Exhibit, held in conjunction with the society’s annual convention in August. The contest, which offers microstructural analysts the opportunity to display their work and communicate significant scientific information, covers all fields of optical and electron microscopy. Baker and Yifeng Liao Th’09 earned an honorable mention in the “Electron Microscopy —Transmission and Analytical” division for their work on “Microstructural Refinement of a Eutectoid Fe-Ni-Mn-Al Alloy.” Baker and Si Chen Th’10 received third-place honors in the “Electron Microscopy Scanning” division for their work on “Mechanisms of Sintering Ice Spheres.” And the professor and Rachel Lomonaco Th’09 received an honorable mention for the Dubose-Crouse Award for Unique, Unusual, and New Techniques in Microscopy for their research on “Classification of Firn Using Micro CT and SEM.” Baker is Thayer’s Sherman Fairchild Professor of Engineering Sciences and senior associate dean of academic affairs.

>> Dartmouth has been awarded nearly \$3 million to develop an interdisciplinary doctoral program in the polar sciences and engineering, with a focus on rapid environmental change. The five-year grant from the National Science Foundation “will allow us to train a desperately needed cohort of climate change scientists,” says environmental studies professor Ross Virginia, director of the Institute of Arctic Studies at Dartmouth. His co-investigators in the project include Thayer professors Ian Baker and Mary Albert Th’84.

# lab updates

## CELLULOUSIC ETHANOL BREAKTHROUGH

Lee Lynd, Thayer's Paul E. and Joan H. Queneau Distinguished Professor in Environmental Engineering Design, and his team have engineered a cellulose-dissolving bacterium that could lead to cheaper and more sustainable ethanol production. In this country, fuel ethanol is produced from corn. Producing ethanol from cellulosic feedstocks—such as wood, grass, and various residues—rather than food sources has obvious advantages. But a key constraint to the feasibility of ethanol production from cellulose is the cost of cellulase, the enzymes that convert fibrous biomass into sugars that can be fermented.

Currently, ethanol production also utilizes yeast, which grows at moderate temperatures of 30 to 35 degrees C. In a major breakthrough, Lynd's team has engineered a new bacterium, strain ALK2, that grows at 50 to 60 degrees C.—a temperature that speeds the breakdown of cellulose—and ferments all sugars in the biomass into ethanol. Under controlled conditions, Lynd reports, the amount of cellulase needed to break down cellulosic feedstocks is slashed in half when ALK2 is used in place of yeast.

"This work shows that a new class of potentially important organisms can be engineered to produce ethanol as the only fermentation product," says Lynd, who is chief scientific officer and co-founder of Mascoma Corp., a leading developer of cellulosic biofuel technology. "This opens up new and exciting possibilities

going forward," he adds, noting that Mascoma plans to test strain ALK2 in its pilot plant in Rome N.Y.

Lynd and his team published their findings on the ALK2 thermophilic bacteria online in the journal *Proceedings of the National Academy of Science* during the week of September 8, 2008.

—Elizabeth Kelsey

## THERAPY IN SPACE

Cramped quarters. Life-or-death decisions. Missions that last months or years. These are just some of the psychological stressors astronauts face. To help them cope, Thayer adjunct professor Dr. Jay Buckey Jr., a former astronaut, has teamed with Dr. James Cartreine of Harvard Medical School and other researchers with the National Space Biomedical Research Institute to develop an interactive, multimedia program called the Virtual Space Station. According to Buckey, the multimedia aspect of the program, which enters clinical trials this winter, provides an important emotional component. "Just like a good movie, it will draw you in and let you respond to the characters," he says.

While participating in NASA's Neurolab mission on the Space Shuttle *Columbia* in 1998, Buckey became interested in addressing potential barriers to flights to Mars or other long-duration missions. Psychological stressors, such as interpersonal conflict or depression, can destroy missions if they are not handled well, he says. With the Virtual Space Station, on-screen psychologists lead users through lectures, exercises, interactive



Former astronaut Jay Buckey

simulations, and programmed interventions. Astronauts can take diagnostic tests, work through simulations, and practice problem-solving strategies. The system, which runs on any laptop, will be accessible anytime, anywhere. Currently, space-based astronauts can only consult with therapists on the ground when communication links are available.

The Virtual Space Station also has practical applications here on earth. Doctors' offices, schools, oil rigs, and other remote locations would benefit from the portable therapy. Buckey hopes the program will enable more people to receive assistance for conditions that are sometimes stigmatized. "Often people are more comfortable working with a computer for these kinds of problems," he says. "With this program, we hope that people will seek help earlier, rather than letting the situation become worse."

—Elizabeth Kelsey

## FIGHTING DECOMPRESSION SICKNESS IN SPACE

Another space project of Buckey's that has earth-bound applications is his work with decompression sickness (DCS). Because current spacecraft and suit designs require astronauts to move through different pressure environments, the prevention of DCS is a priority for spacewalks. When humans move from areas of high pressure to low, nitrogen can be released in the body in the form of bubbles. Buckey and Creare Inc. are currently developing a dual-frequency instrument to detect and size nitrogen bubbles in body tissue. The instrument uses two

frequencies of ultrasound (similar to the frequencies clinical ultrasound machines use) to detect and size bubbles through the chest wall as they move through the heart. The instrument also can detect small, stationary bubbles in tissue—a unique capability. One potential benefit is the ability to detect the earliest stages of DCS and allow for preventative strategies like oxygen pre-breathing and the limiting physical activity at critical times. Further, the instrument can potentially be used in coronary bypass surgery to distinguish between solid and gaseous emboli and in industrial and aviation applications to determine the gas saturation in fluids.

—Elizabeth Kelsey

## POWER LINE DE-ICING

Russia and China are taking advantage of Professor Victor Petrenko's de-icing system for power lines. Both countries have placed orders with Petrenko's company, Ice Engineering LLC.

Petrenko's variable resistance cable (VRC) de-icing system switches the electrical resistance of a standard power line from low to high, automatically creating heat to melt ice build-up or keep it from forming in the first place. The system can be implemented for less than a ten percent increase in overall cost and can also be installed as part of regularly scheduled maintenance. "The beauty of the VRC system is that it's fully customizable and is an affordable addition to the current manufacturing and installation process," says Ice Engineering vice president Gabriel Martinez.

—Kathryn LoConte



## RESEARCH FOCUS AREAS

## Engineering in Medicine

ENGINEERING IN MEDICINE WAS THE FOCUS of several public lectures at Thayer School during Fall Term. One of three major research areas at Thayer—the other two are Energy Technologies and Complex Systems—the intersection of engineering and medicine was the theme of the school's weekly Jones Seminars. And in an intensive symposium on Engineering in Medicine, health-care professionals, faculty, and students gathered October 16–17 to discuss integrating engineering design, evidence-based medicine, and cost effectiveness.

Organized by Professor Brian Pogue, the symposium featured keynote speakers Roderic Pettigrew, M.D., Ph.D., director of the National Institute of Biomedical Imaging and Bioengineering; Ronald Newbower, Ph.D., co-founder, strategic director and chief technology officer at the Center for Integration of Medicine and Innovative Technology; and C. Everett Koop '37, M.D., former U.S. Surgeon General and current senior scholar at the C. Everett Koop Institute. They and a dozen other speakers discussed an array of research and clinical advances and concerns, including bioengineering in 21st century health care, translating and implementing technology in the medical field, and the issues behind the current American health-care crisis.

To listen to or view presentations online, visit <http://engineering.dartmouth.edu/news-events/lecture-series/impact-areas/engineering-in-medicine/program.html>.

## ENDOWED CHAIR

## Robert A. Pritzker Professorship

PROFESSOR KEITH PAULSEN HAS been appointed the first Robert A. Pritzker Professor of Biomedical Engineering. The professorship recognizes faculty scholarship at the intersection of engineering and medicine, one of Thayer School's main research focus areas.

Paulsen is a leading innovator of medical imaging technology and cancer therapeutics, primarily for the breast and brain. Along with an interdisciplinary team of colleagues, he has worked for more than 20 years to advance clinical science through the merging of engineering modeling methodology with an array of imaging techniques.

In addition to his appointment at Thayer School, Paulsen is also a professor of radiology at Dartmouth Medical School, director of the Dartmouth Advanced Imaging Center at Dartmouth-Hitchcock Medical Center, and co-director of the Cancer Imaging and Radiobiology Research Program at the Norris Cotton Cancer Center. He received his B.S. in biomedical engineering from Duke and his M.S. and Ph.D. from Thayer School in 1984 and 1986.

Tony Pritzker '82 and his wife, Jeanne, endowed the professorship in honor of Tony's uncle, Robert Pritzker, an industrial engineer who established The Marmon Group of companies. Tony is managing partner of The Pritzker Group private-equity firm.

## HONOREES

Jeanne and Tony '82 Pritzker, left and center, attended the inaugural lecture Keith Paulsen delivered during Fall Term when he became the first Robert A. Pritzker Professor of Biomedical Engineering.

>> Professor Ursula Gibson '76 spent the fall term at the VTT Technical Research Center of Finland in Espoo, Finland, under a Fulbright Scholarship. A nano-materials specialist, she is investigating the use of zinc oxide nanostructures as a way of imparting UV protection capabilities. "My collaborators in Finland are interested in improved protection for wood products," said Gibson, who hopes to connect this research to the timber industry in Vermont and New Hampshire. "Zinc oxide is a particularly attractive material to use as a UV blocker because it absorbs a wide range of UV light, and doesn't degrade as it does its job," Gibson returned in January to become the new director of Thayer's M.S./Ph.D. programs.

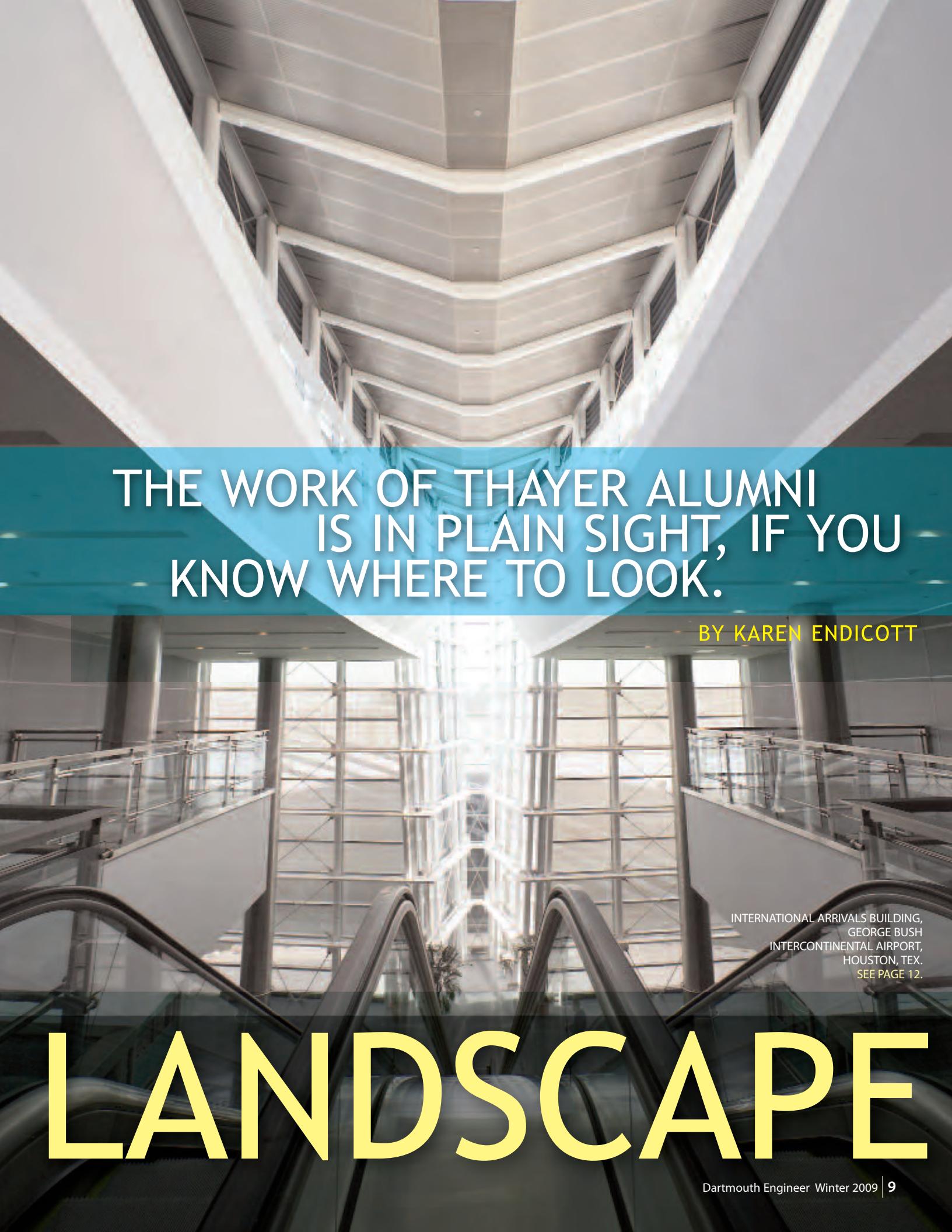
>> Adjunct professor Mary Albert Th'84 has been named director of the new Ice Drilling Program Office, part of National Science Foundation's Office of Polar Programs. The IDPO is responsible for drilling and obtaining ice core samples, which contain data about past climate conditions, levels of pollution, and even levels of atmospheric greenhouse gases over the last 800,000 years. Albert is a research engineer with the Cold Regions Research and Engineering Laboratory, part of the Army Corps of Engineers, and will head-up research at IDPO, which will be headquartered at Thayer School.

>> A group of Dartmouth researchers, including Thayer research associate and scientist Robert Savell Adv'05, has developed a mathematical tool that can be used to unscramble the underlying structure of time-dependent, interrelated, complex data—such as the career-long votes of legislators, second-by-second activity of the stock market, or levels of oxygenated blood flow in the brain. Their study was published in a December online issue of the *Proceedings of the National Academy of Science*. "We think this tool can be useful when applied in the financial realm, to portfolio and risk management," says study co-author and mathematics professor Dan Rockmore. "We expect similar results as it is applied to different complex systems like the brain, or even the collections of brains that are societies."



GLASS STAIRCASE,  
APPLE STORE, BOSTON, MASS.  
SEE PAGE 10.

# THAYER IN THE



THE WORK OF THAYER ALUMNI  
IS IN PLAIN SIGHT, IF YOU  
KNOW WHERE TO LOOK.

BY KAREN ENDICOTT

INTERNATIONAL ARRIVALS BUILDING,  
GEORGE BUSH  
INTERCONTINENTAL AIRPORT,  
HOUSTON, TEX.  
SEE PAGE 12.

LANDSCAPE

## Glass Staircase, Apple Store Boston, Mass.

(Pictured on page 8)

Elizabeth Hunneman '05 Th'06 designed the high-strength stainless steel alloy fittings for the glass stairs in Apple's flagship Boston store, located at 815 Boylston Street and completed in 2008. "Glass is very unforgiving. As a result, all connection hardware must be designed with precision to 1/1000th of an inch to transfer loads from one piece of glass to another or from glass to building structure," says Hunneman, a design engineer and project manager at TriPyramid Structures Inc. in Westford, Mass. "In any one of these stairs, there are dozens of very different connection fittings, and each has a very specific purpose. In some cases, fittings that look identical when installed have completely separate functions and, for that reason, unique internal details."

Photograph by Midge Eliassen.

## Voice of America Antenna Yamata, Japan

John W. Ballard '55 TT'56 co-founded TCI International in 1968 to develop and apply the Method of Moments to antenna design. Making it possible to calculate radio-frequency current distributions on arbitrary arrangements of metallic conductors, the technique eliminated the painstaking iterative experimentation of traditional antenna design and construction. "Today almost all antenna design is based on the Method of Moments," says Ballard, a Thayer overseer who is also co-founder, president, and CEO of Radio Propagation Services Inc. The Voice of America antenna in Yamata, he says, serves Japanese immigrants and their children in South America.

Photograph courtesy of John W. Ballard.



## Niagara Generating Facility Biomass Conversion Project Niagara Falls, N.Y.

The Niagara Generating Facility used to be a coal-fired power plant. In a two-year project completed in 2008, Scott Gardner '92, managing director of US Renewables Group, oversaw the plant's conversion from coal to biomass and tire-chip fuel. The transformation required retrofitting the boiler and building a "receiving, storage, and material handling system for up to 750 tons per day of wood chips on a site with only 5.5 acres, of which only 1 to 2 acres is available space," he says. Another challenge: "weatherizing the system to withstand an upstate New York winter while supplying wood chips and tire chips to the boiler round-the-clock."

Photograph courtesy of Scott Gardner.

## AEOS Telescope Mirror Support System Air Force Research Laboratory Maui, Hawaii

Dan Malwitz '77 designed most of the primary mirror support system for the AEOS 3.67-meter telescope atop Mount Haleakala in Maui. The system, he says, consists of a hollow steel weldment, 84 axial hydraulic actuators, 48 lateral hydraulic actuators and linkages, plus a number of counterweights to handle the pitch moment. "The point of this elaborate system is to support and control the 10,000-pound Zerodur (zero-CTE glass) meniscus without distorting it, regardless of elevation angle or telescope dynamics. It has to slew quite quickly—for a telescope—to track objects in low-earth orbit," he says. The telescope is part of the Air Force's Maui space surveillance system. Malwitz worked on the system while at Contraves USA, now L-3 Brashear. He is currently a staff design engineer at the space and defense group of Moog Inc.

Photograph courtesy of Dan Malwitz.

## First Commercial Cell Phone System

Randy Cooper Th'54 was a software engineer on the final test team for the central switch of the first commercial cellular telephone system in Chicago in 1984. "The main challenge was that it had never been done before by anyone," he says. Cell phones have changed not only how we communicate, but what we see. "Those ugly towers are everywhere!" says Cooper.

Photograph by Joseph White.

## Wahoo Dock Grand Lake, Colo.

Tim Osby '89 owns Wahoo Docks, a Gainesville, Ga., company that manufactures high-end environmentally friendly aluminum boat docks for residential and commercial sites throughout North America. "We have a multitude of designs and specs that the docks need to adhere to based on the location—snow loads, oxidation environments, wind and wave action," says Osby. To view the company's customizable options, visit [wahoodocks.com](http://wahoodocks.com).

Photograph courtesy of Tim Osby.

## Echo Mountain Park, Colo.

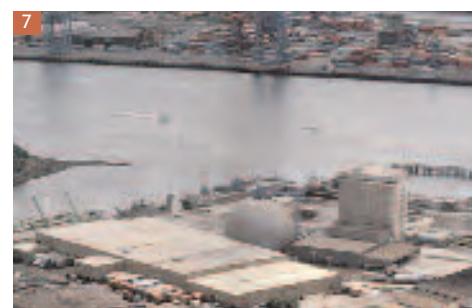
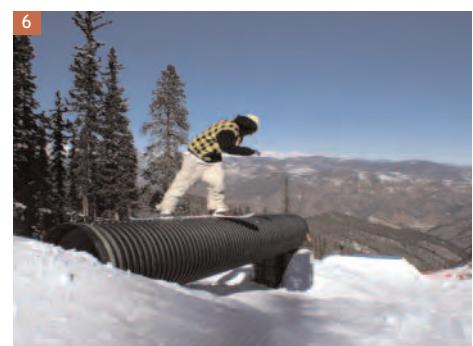
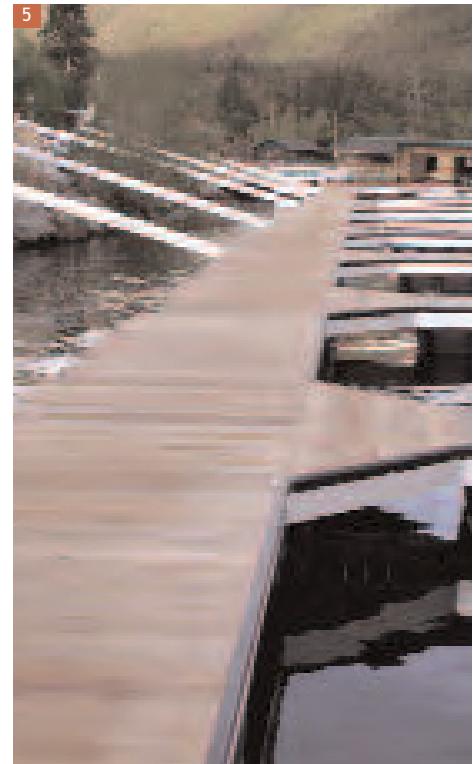
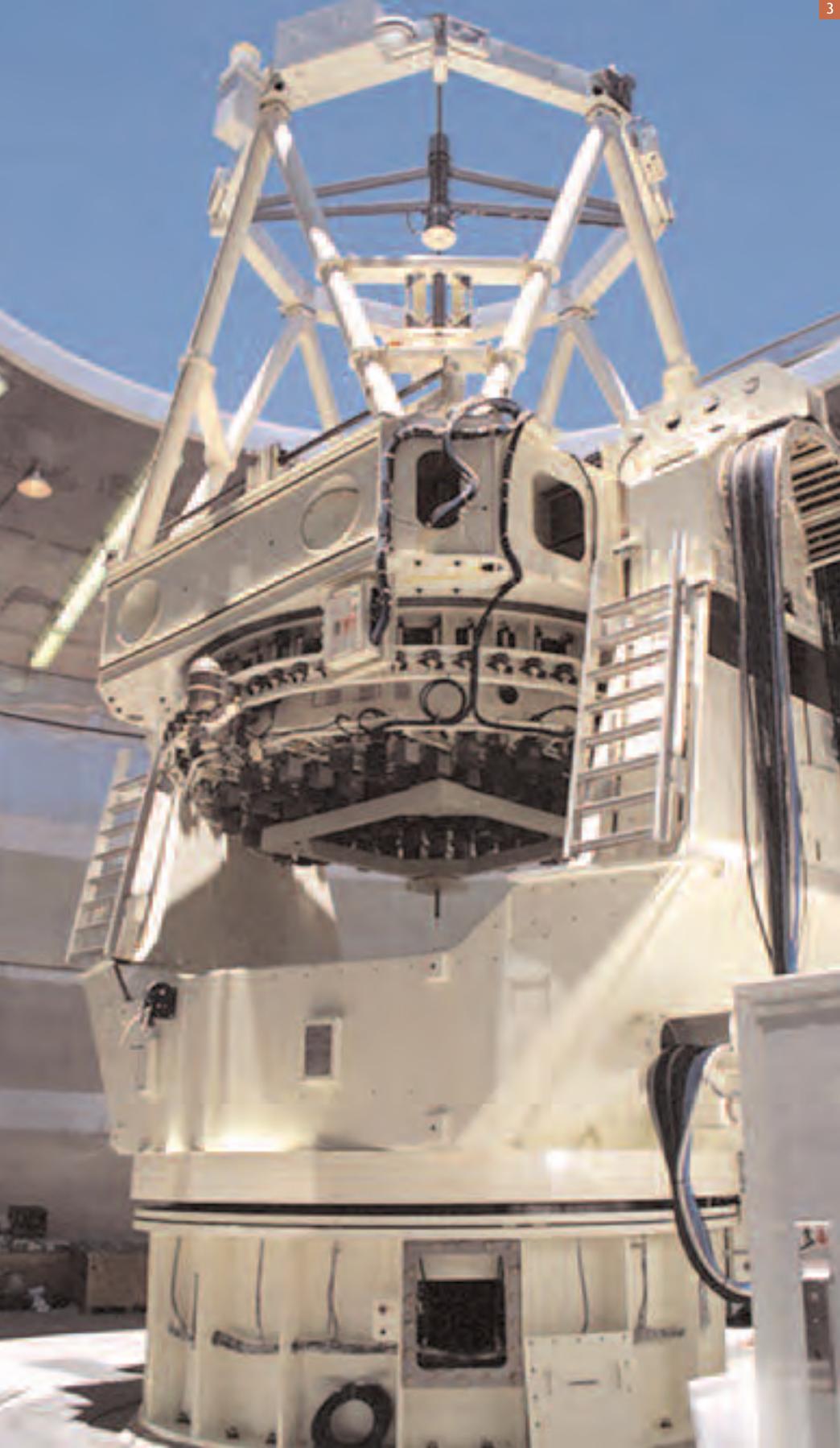
*The New York Times* calls Echo Mountain Park ski area, 30 miles from Denver, Colo., the "new Neverland of freestyle stunt pilots." Owned by avid skier Jerry Petitt '67 TT'69, Echo Mountain Park lures youthful snowboarders and freestyle skiers with inexpensive lift tickets and over-the-top terrain. "There are no gently groomed slopes, no wide cruiser runs, not even a single mogul field," raves the *Times*. "Echo is 100 percent terrain park—50 acres of jumps, rails, boxes, picnic tables, stairs, mailboxes and pipe. With a good-times agenda, Echo aims to be the X Games proving ground for the young and indestructible."

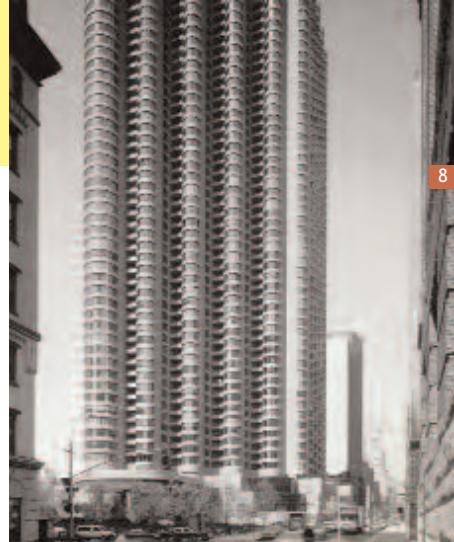
Photograph courtesy of Jerry Petitt.

## Deep-Water Marine Terminal and Frozen-Food Processing Plant Everett, Mass.

Thorsteinn Gislason Th'73 was a project manager and facility designer for a deep-water marine terminal and frozen-food processing plant that Coldwater Seafood Corp. constructed in Everett in the mid 1970s. The facility, seen in the lower center section of the photo, occupied some 150,000 square feet, with approximately 80,000 of that in the form of cold storage at -10 degrees F. "We were challenged by extremely poor soil conditions and the need to have very high load-bearing capability on the floors. After a geo-technical survey by experts it was decided to drill caissons to the level of bearing soil. Each caisson was individually designed, and they ranged in depth from 30 feet to less than 10 feet," says Gislason, now managing director of Tigertraders, a Salem, N.H., importer and marketer of frozen seafood. The Coldwater facility he worked on now belongs to Preferred Freezer Services.

Photograph courtesy of Thorsteinn Gislason.





### The Corinthian, New York, N.Y.

8

When the 55-story Corinthian opened in 1988, it was Manhattan's largest apartment building. With 1.1 million square feet containing 846 apartments plus commercial space and a garage, it occupies a full block between First and Second Avenues and 37th and 38th Streets. "The building towers over the Manhattan entrance to the Queens-Midtown Tunnel," says Sam Florman '46 Th'73, chairman of Kreisler Borg Florman, the general construction company that put the Corinthian on the map.

*Photograph courtesy of Sam Florman.*

### Cagayan De Oro Solar Photovoltaic Project Mindanao, Philippines

9

Edward C. Kern Jr. '67 Th'68 founded Irradiance Inc. to accelerate the worldwide deployment of photovoltaic systems. In 2004 he served as the technical advisor for Asia's first megawatt-plus photovoltaic system, the Cagayan De Oro Solar Photovoltaic Project in Mindanao. The project not only produced electricity, but achieved an extra goal, Kern says: making "clean solar power less expensive by using local materials and labor appropriate for developing countries." Kern holds a doctorate from MIT and lectures there on wind and solar energy.

*Photograph courtesy of Edward C. Kern Jr.*



9

### Arthur Ravenel Jr. Bridge Charleston, S.C.

10

With its tower diamond design, the Arthur Ravenel Jr. Bridge over the Cooper River in Charleston is the longest cable-stayed bridge in the Americas. Opened in July 2005, the span was designed to withstand ship collisions and Charleston's seismic and hurricane conditions. Parsons Brinckerhoff Inc. worked on the bridge's final design while Thomas O'Neill '73 Th'74 was the firm's chairman and CEO.

*Photograph courtesy of Parsons Brinckerhoff Inc.*

### Los Angeles Metro Red Line Los Angeles, Calif.

11

The Red Line is the heavy rail backbone of the Los Angeles public transit system. The two-track, steel-wheel subway serves the city's most densely populated areas, providing high-speed service from Union Station in downtown Los Angeles to North Hollywood via the mid-Wilshire district, Hollywood Boulevard and Universal City. Parsons Brinckerhoff Inc. worked on the project while Thomas O'Neill '73 Th'74 was the firm's chairman and CEO.

*Photograph courtesy of Parsons Brinckerhoff Inc.*

### International Arrivals Building George Bush Intercontinental Airport Houston, Tex.

(Pictured on page 9)

The International Arrivals Building of the George Bush Intercontinental Airport can process 4,500 passengers an hour. It is part of the Houston Airport System's International Services Program, which doubled the airport's capacity to 68 million passenger flights annually and streamlined customs and immigration processing. Parsons Brinckerhoff Inc. worked on the project while Thomas O'Neill '73 Th'74 was the firm's chairman and CEO.

*Photograph courtesy of Parsons Brinckerhoff Inc.*

### American Airlines Maintenance Hangar Dallas/Fort Worth Airport, Tex.

12

The Henry C. Beck Co., headed by Henry C. Beck Jr. '38 Th'39, provided general contractor services on the 781,000-square-foot aircraft maintenance hangar for American Airlines. The building can simultaneously service seven wide-body aircraft. Beck was awarded the Outstanding Construction Award by the Texas Association of General Contractors. The company is now known as The Beck Group.

*Photograph courtesy of Henry C. Beck Jr.*



### Cotton Bowl, Dallas, Tex.

13

The Henry C. Beck Co., headed by Henry C. Beck Jr. '38 Th'39, constructed this 68,000-seat sports facility in 1930 when it went by the name of Fair Park Stadium and Beck was known as Central Contracting Co. Throughout the years, Beck completed several renovation projects.

*Photograph courtesy of Henry C. Beck Jr.*

### Cape Canaveral Launch Complex 34 Cape Canaveral, Fla.

14

The Henry C. Beck Co., headed by Henry C. Beck Jr. '38 Th'39, completed the construction of the first launch facilities at Cape Canaveral in June of 1961 for the launch of the *Saturn* rocket. This \$6.5 million project included \$4.5 million of underground construction to strengthen the ground to withstand the tons of thrust initiated for a rocket launch.

*Photograph courtesy of Henry C. Beck Jr.*

### National Security Agency Building Fort George G. Meade, Md.

15

While a junior structural designer at Anderson Nichols & Co. Frederick T. Comstock '48 Th'48 worked on concrete slab and expansion details for the National Security Agency building. The original low, sprawling structure, situated to the right of the dramatic modern additions, was completed in the 1950s. "At the time," says Comstock, "it was thought to be second in size to the Pentagon."

*Photograph courtesy of the National Security Agency.*

### Leonard P. Zakim Bunker Hill Bridge Boston, Mass.

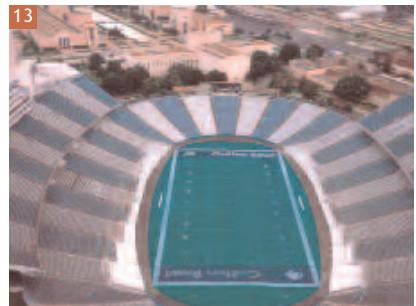
16

The signature element of Boston's Big Dig, the Zakim Bridge carries I-93 over the Charles River and provides a dramatic gateway to Boston from the north. The ten-lane bridge is the widest asymmetrical cable-stayed bridge in the world and the first hybrid cable-stayed steel and concrete bridge in the United States. Thomas O'Neill '73 Th'74 was chairman and CEO of Parsons Brinckerhoff Inc. when the firm served as management consultant for the construction of the bridge.

*Photograph courtesy of Parsons Brinckerhoff Inc.*



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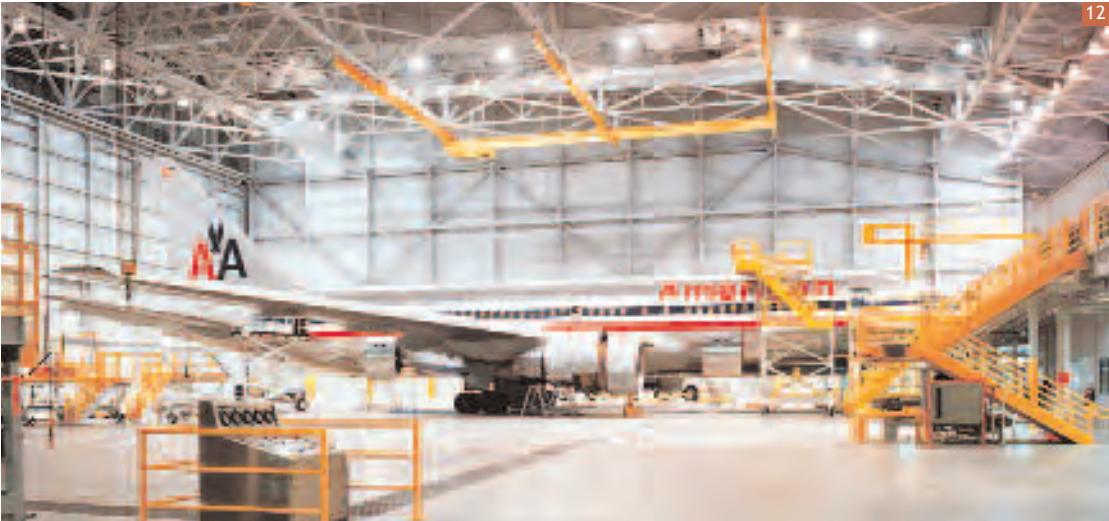
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Civic Plaza, Sandy, Ore. 17

As the engineering technician at the City of Sandy, Ore., Elizabeth French '99 Th'00, '01 was responsible for designing and managing the 2008 construction of the Sandy Civic Plaza. In addition to accommodating community gatherings, festivals, and farmers' markets, the plaza functions as a demonstration area for environmentally friendly construction. "Most of the surfaces are constructed from permeable pavers, with a 10-inch rock course underneath for storage of storm water," says French. "Based on this project, I have now developed the city's specifications for permeable pavers for pedestrian areas."

*Photograph courtesy of Elizabeth French.*

#### Water Tank for Solar Powered Water Distribution System, Ngelenge, Tanzania 18

Participating in Engineers Without Borders, Tia Hansen '05 Th'06 has been working as project manager and resident engineer overseeing construction of a water tank in a rural area of Tanzania. "The biggest problems that I faced in this project were the lack of construction knowledge, particularly in reinforced concrete construction, and materials acquisition and transportation," she says. "We ended up having to float 13 tons of materials across a river in small canoes and teaching local masons how to make concrete blocks and use them to build reinforced concrete structures."

*Photograph courtesy of Tia Hansen.*



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#### Wire Bridges, Nepal 19

Engineer and entrepreneur Edward "Skip" Stritter '68 is chairman of VillageTech Solutions, a nonprofit that provides energy and access for people in rural Nepal. One of VillageTech Solutions' projects is constructing wire bridges across the deep river canyons that isolate villages and make travel treacherous. Each wire bridge consists of a human-powered carriage that runs along a cable strung between anchor towers. Holding up to five or six people and their goods, the carriage is propelled by rope in the hands of passengers and bystanders. "These bridges are built at the request of a village—usually because they have a lot of school kids who need to cross the river. Costs range from \$15,000 to \$25,000," says Stritter's colleague David Sowerwine, who co-founded the organization with wife Haydi Sowerwine in 1996. "The villagers have no money, but can work hard. We raise the funds, we supervise, they build." Villagers are also getting construction help from Thayer students, including M.E.M. candidate David Drennan and Mike Wood '10. For more, see [villagetechsolutions.org](http://villagetechsolutions.org).

*Photograph courtesy of David Sowerwine.*

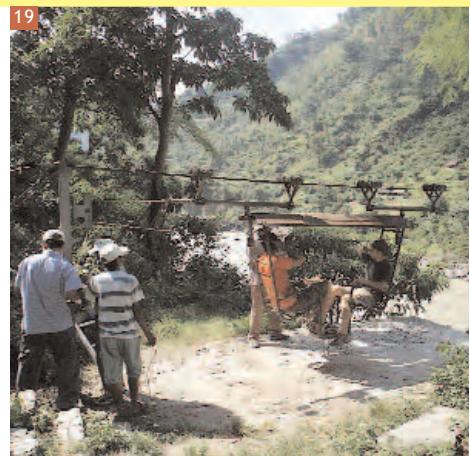
#### LEED-Certified Buildings at Grand Valley State University, Allendale, Mich. 20

As vice president for finance and administration at Grand Valley State University (GVSU) in Michigan, Tim Schad '70 Th'71 decided that all new construction would be LEED certified. "In 2001–2002 this was not as obvious as it is today—not everyone believed in global warming or the need to build energy efficient buildings," he says. "But this made us a leader. GVSU has built more LEED-certified buildings than any other college or university in the United States." Schad, who also owns Nucraft Furniture Co. in Comstock Park, Mich., notes that GVSU was started by Dartmouth alum William Seidman '71.

*Photograph courtesy of Tim Schad.*

#### Food Safety Laboratory Anchorage, Alaska 21

James M. Tanaka '81 of the Department of Transportation was project manager for the design and construction of the \$15.5 million, 20,000-square-foot laboratory for the Alaska Department of Environmental Conservation. Completed in 2006, the state-of-the-art facility enables researchers to provide surveillance of



seafood, food, water, air, soil, and zoonotic diseases from wild and domestic animals.

*Photograph courtesy of Livingston Sloane.*

#### Virology Laboratory, University of Alaska Fairbanks, Alaska 22

James M. Tanaka '81 is project manager for the design and construction of the Department of Health and Social Services Virology Laboratory, a public health research facility at the University of Alaska, Fairbanks. "The virology laboratory has been designed to function successfully in Fairbanks' sub-arctic climate—where summer temperatures reach 90 degrees F, and winter temperatures fall to 65 degrees F. below zero—to be highly durable and maintainable, and to provide for the intensive mechanical and electrical requirements for laboratory bio-containment in the most energy efficient means possible," says Tanaka. The project is scheduled for completion in early 2009.

*Photograph courtesy of Livingston Sloane.*

#### I-130 Mississippi River Bridge Luling, La. 23

William B. Conway '52 Th'54 was principal-in-charge for the construction of the I-130 crossing, the nation's longest cable-stayed bridge when it was completed in 1978. Conway retired in 2007 from the chairmanship of Modjeski and Masters Inc., a St. Louis, Mo., structural engineering firm specializing in bridge engineering. He is a recipient of the John A. Roebling Medal for lifetime achievement, an award sponsored by *Roads & Bridges* magazine.

*Photograph courtesy of William B. Conway.*

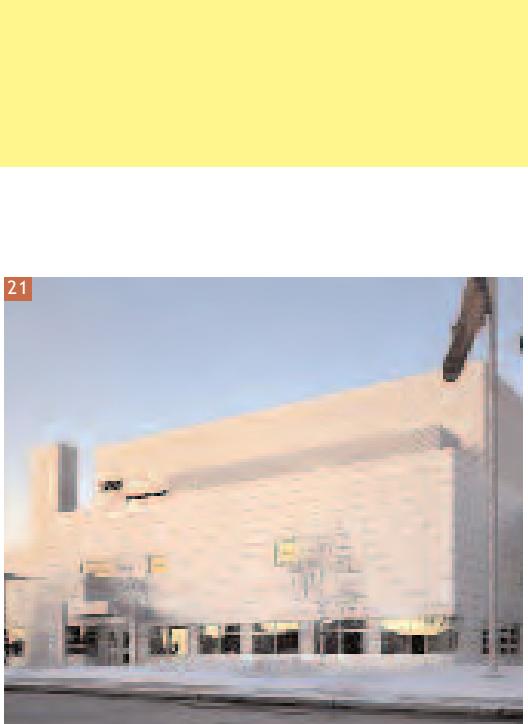
#### Trail Underpass Newbury, Vt. 24

Lucy Gibson Th'88 helped construct a hiking trail underpass below I-91 in Newbury to complete a section of the Cross Vermont Trail.

*Photograph courtesy of Lucy Gibson.* □



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# invis hands



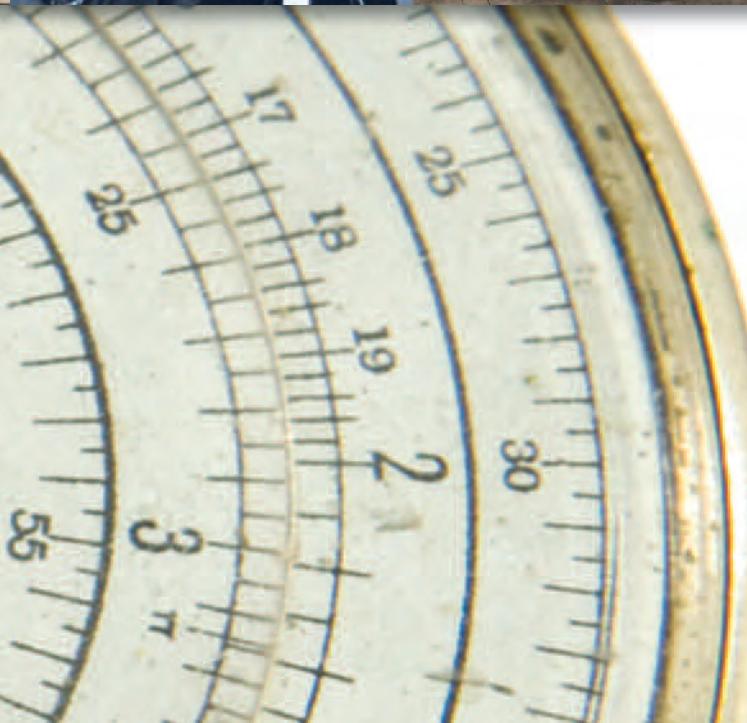
# Table of science

HISTORIC INSTRUMENTS BRING ENGINEERING'S PAST ALIVE.



## HALDEN CALCULEX

This circular slide rule, 3 inches in diameter, belonged to Professor Robert Fletcher, Thayer School's first director. It was made by J. Halden & Co. of Manchester, England, in the early 1900s.



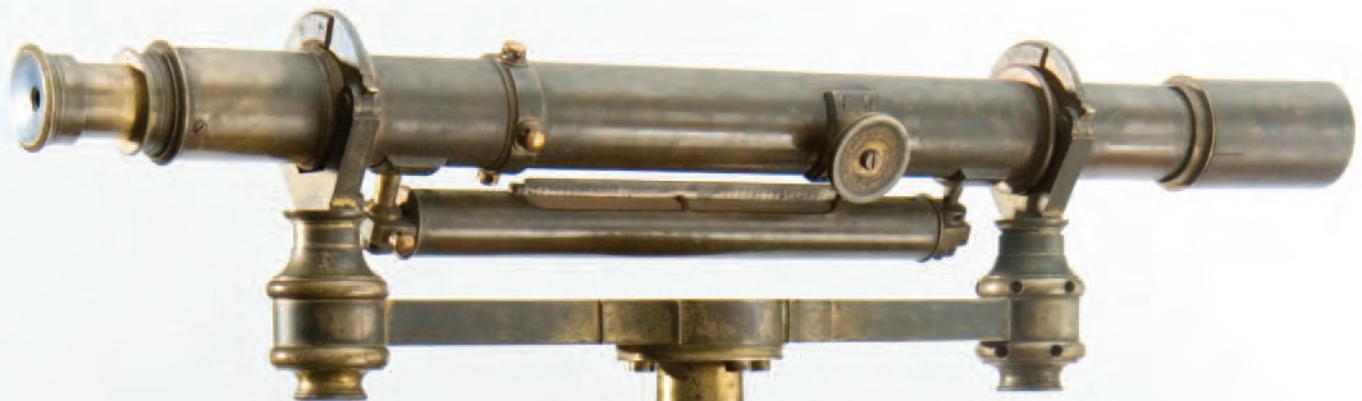
**W**hen Thayer School of Civil Engineering was founded in 1867, surveying was a key component of the skills Thayer students were required to master. In fact, surveying was so crucial to the establishment of property boundaries, the westward expansion of the nation, and the development of railroads, canals, bridges, and other infrastructures of commerce that until the 1880s all Dartmouth students—not just engineers—studied the subject. And though Thayer School broadened its focus beyond civil engineering—and dropped the term from its name in 1941—Thayer students continued to study surveying until 1962.

Many of the surveying instruments used by Thayer students during the 19th and early 20th centuries now reside in Dartmouth's Scientific Instruments Collection. Assembled by the late Dartmouth physics professor Allen King, the collection, housed in the physics department in Wilder Hall, is one of the largest in North America. It is now curated by history professor Richard Kremer, who regularly brings the instruments into his history of science classes for students to examine and research.

"Using the collection is a new way in the history of science to go beyond texts," he says. "Knowledge is being produced with these objects. They're the 'invisible hands of science.'"

The following is a close-up look at tools Thayer students used in the school's early decades.

BY MATTHEW FORMAN '11  
PHOTOGRAPHS BY JOHN SHERMAN



### WYE LEVEL

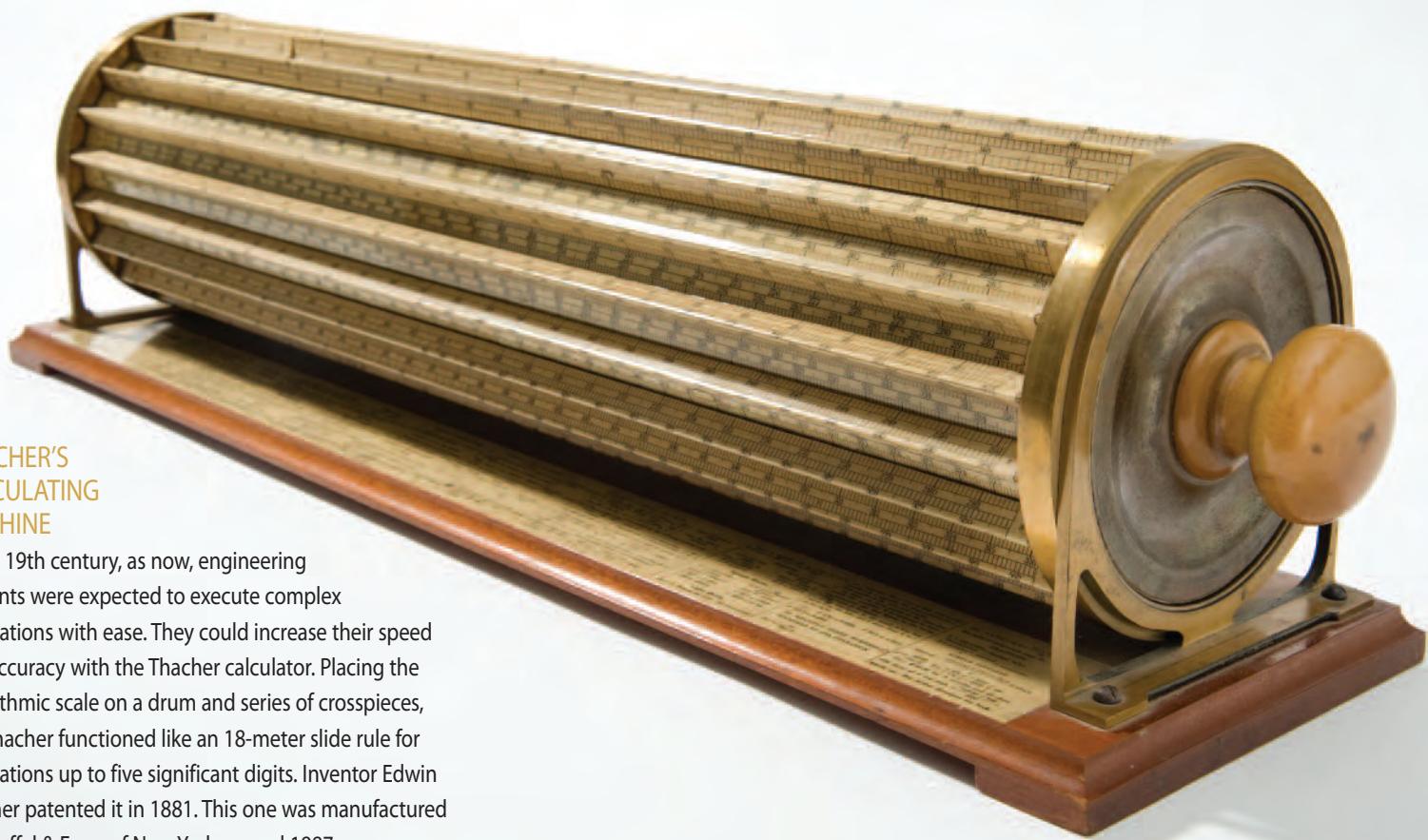
Consisting of a telescope and bubble level, the Wye level was a basic tool for measuring elevation. In an 1869 topography exercise, Thayer students used Wye levels to determine the contours of Bridge Street in West Lebanon. William J. Young of Philadelphia, Pa., one of the most prolific American instrument makers in the 19th century, constructed this level. It cost about \$150 in the 1860s.



### DIP CIRCLE

Dip circles, also known as dip needles or inclinometers, measure slope—*a.k.a.* “dip angle”—with respect to gravity. Used in surveying, mining, and prospecting, dip circles also served as demonstration instruments in physics classes. The Phelps & Gurley Co. of Troy, N.Y., manufactured this brass and glass dip circle around 1848. Dartmouth purchased it in 1862 for \$20.





### THACHER'S CALCULATING MACHINE

In the 19th century, as now, engineering students were expected to execute complex calculations with ease. They could increase their speed and accuracy with the Thacher calculator. Placing the logarithmic scale on a drum and series of crosspieces, the Thacher functioned like an 18-meter slide rule for calculations up to five significant digits. Inventor Edwin Thacher patented it in 1881. This one was manufactured by Keuffel & Esser of New York around 1887.



### OPTICAL SQUARE

Students used the optical square for sighting along two lines at right angles. This optical square was made around 1885 by a local instrument maker, J.N. Brown, whose shop was located just off Main Street in Hanover.



### SEXTANT

The sextant was designed to determine the angle between the moon and stars to calculate longitude at sea. On land, surveyors used sextants to determine angles between fixed locations. In an early class, Thayer students used sextants to measure angles for triangulating the height of a local church spire. This sextant, manufactured by Blunt & Nichols of New York, dates from between 1866 and 1868.

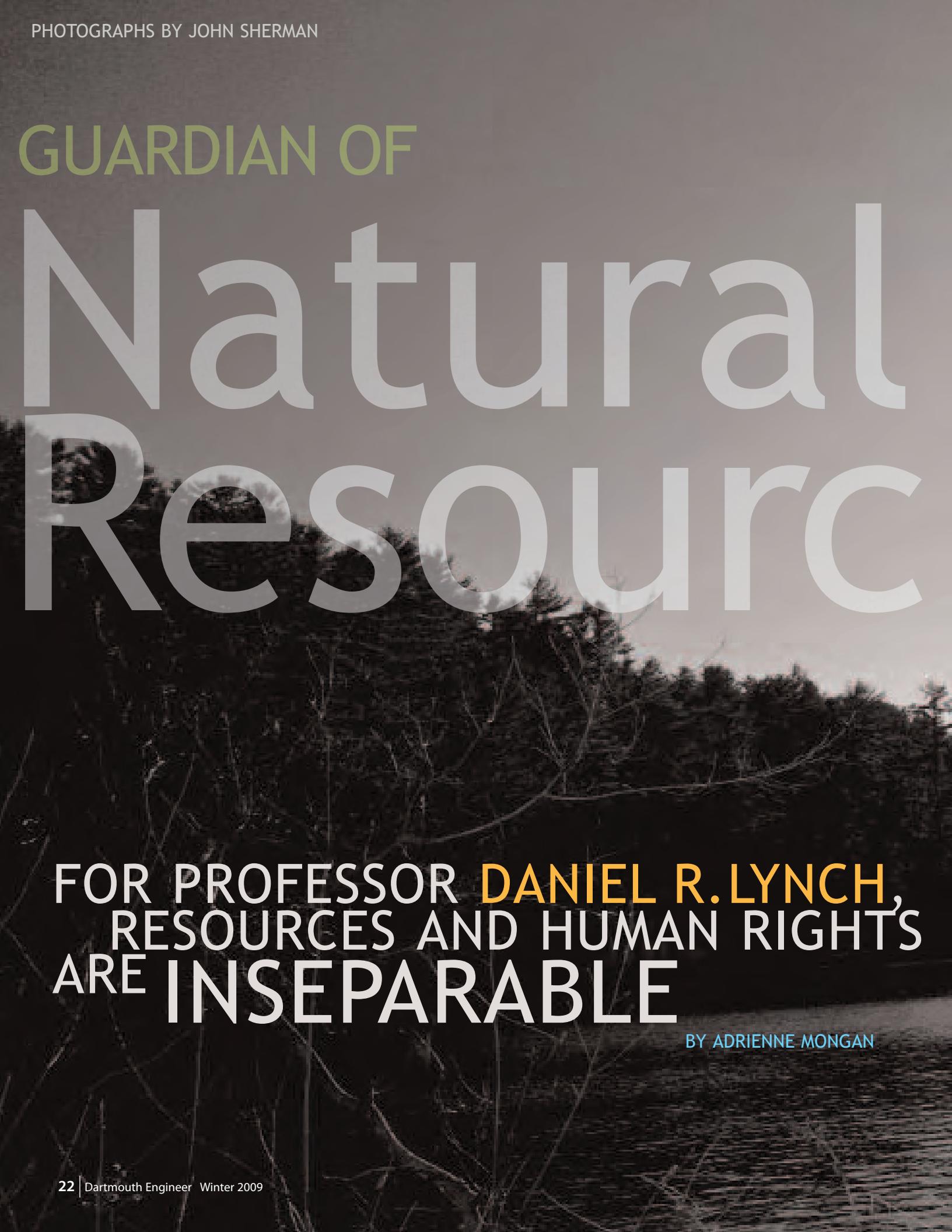


## TRANSIT

Measuring horizontal and vertical angles, transits were integral to surveying. As a culminating project in the September 1869 course on surveying and engineering, Thayer students had to use triangulation to calculate the distance from the Dartmouth Green to Mount Ascutney in Vermont. They used transits to obtain the angles they needed for the calculation. This transit was manufactured by William J. Young of Philadelphia, Pa., in the mid 19th century.

PHOTOGRAPHS BY JOHN SHERMAN

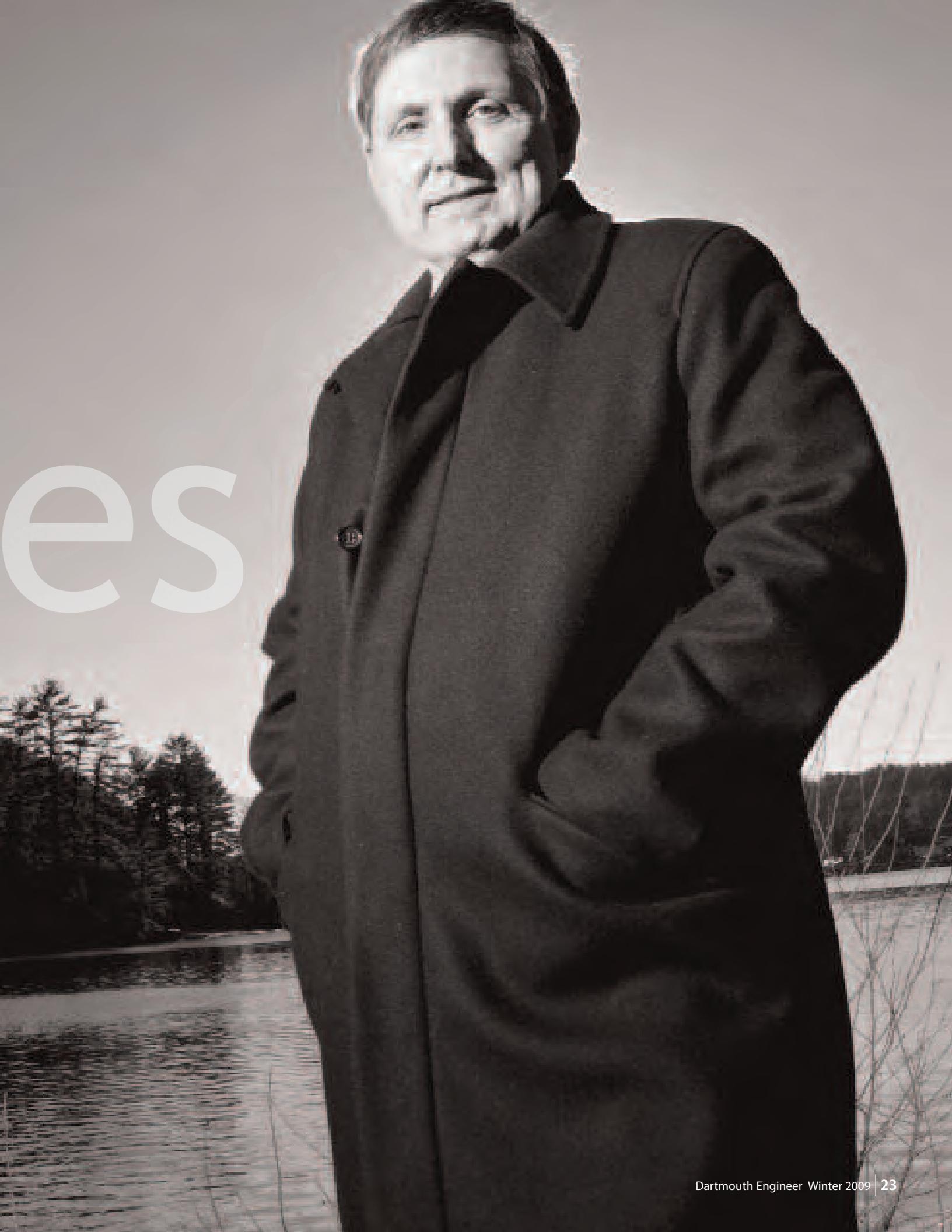
# GUARDIAN OF Natural Resource

A black and white photograph showing a dense forest. In the foreground, there's a dark, textured area that looks like a mix of low-lying plants and perhaps a small stream bed. Behind it, the forest rises with many tall, thin trees, their branches reaching upwards. The sky above the trees is bright and overexposed, creating a soft, hazy effect.

FOR PROFESSOR DANIEL R. LYNCH,  
RESOURCES AND HUMAN RIGHTS  
ARE INSEPARABLE

BY ADRIENNE MONGAN

es



## Daniel R. Lynch is an engineer with a mission.

He wants the world to adopt a Declaration of Stewardship Responsibility, akin to the landmark 1948 United Nation's Universal Declaration of Human Rights, which Lynch calls "the greatest document of the 20th century." Having drafted his own Declaration of Stewardship Responsibility (see sidebar for highlights), Lynch is taking his case to fellow engineers, including students in his classes on climate change and engineering and sustainability and natural resource management.

The MacLean Professor of Engineering at Thayer School and an adjunct scientist at Woods Hole Oceanographic Institution in Massachusetts, Lynch is an expert in computational techniques for simulating large-scale environments. His finite element mapping of continental shelf circulation in the Gulf of Maine and Georges Bank has led to greater understanding of those ecosystems, including factors affecting fish populations and patterns of toxic algae blooms.

Lynch spent the 2007-2008 academic year participating in the Program in Science, Technology and Environmental Policy at Princeton University's Woodrow Wilson School of Public and International Affairs. During that time he completed his latest book, *Sustainable Natural Resource Management for Scientists and Engineers*, due out from Cambridge University Press in 2009.

### Why are you working on a Declaration of Stewardship Responsibility?

Earlier in my engineering career, my focus was on water resources. As I advanced in the field, I felt a sense of responsibility to use my knowledge to help others have access to this essential natural resource, clean water. Now I'm working to encourage fellow professionals to use specialized knowledge for the global sustainability of natural resources in order to improve upon the common good.

### You link protection of natural resources to the idea of basic human rights. Why?

The Universal Declaration of Human Rights asserts that all people have the right to "an adequate standard of living." The two international covenants that implement the declaration in law articulate this in terms of housing, water, food, and health. These rights depend on the availability of essential natural resources—clean air, potable water, safe food—for people now and for future generations. To achieve the ultimate goal of sustaining human opportunity, the very essence of the declaration, we must protect natural resources.

### What role would a Declaration of Stewardship Responsibility play in promoting human rights and protecting natural resources?

Human rights can only be achieved if the world accepts responsibility for enacting them. The Universal Declaration of Human Rights asserts that everyone has "duties to the community" for the realization of rights. Similarly, natural resources will only be protected for perpetuity if people now develop a sense of universal responsibility for stewardship. By codifying the responsibility into a declaration, I hope to stimulate thinking about what individuals and institutions can do to protect the natural resources—and make them available to everyone.

### Why hasn't the world already done more to steward natural resources?

Much good has been achieved within specific nations. There is a vacuum in natural resource governance. Though resources are central to human flourishing, they are outside the bounds of present government and corporate institutions. In part this is because the occurrence of natural resources is seldom congruent—in space and time—with either corporate or governmental domains. The size, dynamics, and time frames of natural resource systems do not conform to human ideas of national boundaries, sovereignty, and rights of owner-

ship. Governance structures that do not match these will not succeed. For example, a trans-boundary resource cannot be managed by sovereign states alone. Or a slow-growing resource cannot be managed by governance that lacks accountability for long-term consequences. This is a simple dynamic error, well understood yet pervasive. The cumulative effects of overlapping markets, governments, corporations, cultures, and individual action compound the problem. Moreover, most people don't understand—and in some cases, they don't accept—the complexities of natural resources dynamics, making it harder to develop and enact safeguards against resource degradation or depletion. This is why it is critical for professionals to accept the twin obligations to develop specialized knowledge and to help people implement it.

### Where do engineers come in?

Engineers understand systems, so we're in an ideal position to analyze how natural dynamics, consumption patterns, and social, political, and economic factors affect resources—and explain it to others. I believe that engineers and other professionals have a responsibility to use our specialized knowledge for the collective good.

### What will it take to make natural resource stewardship a universal value?

We need professional, government, and corporate institutions to cooperate creatively to develop new means of collectively safeguarding natural resources. Agreeing that all of us—individuals and institutional entities alike—have stewardship responsibilities is a crucial first step. Each of us must accept this sense of responsibility so that we can pass precious, finite natural resources on to future generations to utilize. □

Adrienne Mongan is a contributing editor at *Dartmouth Engineer*.



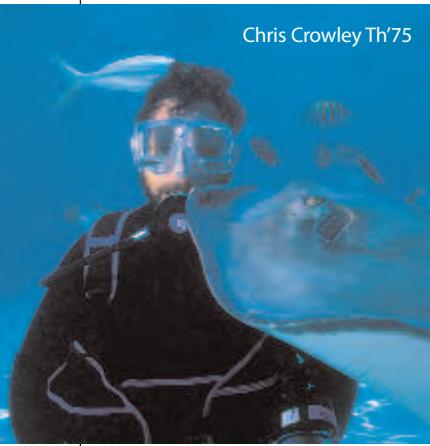
## TOWARD A DECLARATION OF STEWARDSHIP RESPONSIBILITY

Here are some of the key points Professor Lynch incorporates into his Declaration of Stewardship Responsibility. Read the full document at [dartmouthengineer.com](http://dartmouthengineer.com).

- ★ A sustainable relationship among people and natural resources shall be pursued in scientific, economic, and social communities. As natural resources sustain human productivity, so must humans sustain natural resource productivity and availability.
- ★ Everyone has a responsibility to reduce reliance on nonrenewable natural resources, use less, recycle more, and find efficient substitutes.
- ★ No one has a natural or intrinsic right to waste, harm, destroy, pollute, contaminate, or degrade a natural resource.
- ★ Property rights in natural resources shall be understood as obligations to stewardship.
- ★ Governments and public agencies have obligations to steward natural resources on behalf of citizens.
- ★ Natural resources have their own time and space scales that do not obey human political and economic constructs. All concerned with resource use, ownership, or governance shall recognize and respect these scales.
- ★ Natural resources cross political, legal, and economic boundaries, necessitating cooperative governance.
- ★ Cumulative effects of separate actions that have aggregate or synergistic effects on natural resources shall be recognized and accounted for collaboratively among owners, beneficiaries, and governance bodies.
- ★ Habitat for living resources shall be safeguarded against degradation or destruction from individual or collective action or inaction.
- ★ Natural conduits that distribute natural resources shall be safeguarded against degradation or destruction from individual or collective action or inaction.
- ★ Extinction of living resources by individual or collective action or inaction is to be avoided.
- ★ Uncertainty and error shall be treated conservatively, that is, with a preferential option for conserving future opportunity.
- ★ Everyone has a responsibility to seek ways of implementing the above.

# Alumni News

## spotlights



Chris Crowley Th'75

**Chris Crowley Th'75** is a research engineer by vocation and a wildlife photographer by avocation. During his 31 years managing research projects for Hanover-based Creare he also logged 1,000 scuba dives in locations such as Indonesia, the Galápagos Islands, Fiji, and the Caribbean. After earning his M.E. at Thayer, Crowley worked on nuclear reactor safety, gas and oil transport in pipelines, ocean mining, thermodynamic power cycles, and spacecraft system development projects. Recently retired from Creare, he sees connections between engineering and photography. "Wildlife photography is like running an engineering project. You have an objective: to photograph a certain animal or animals. You have to develop a work plan to get the shots. You have a limited budget. And the wildlife 'clients' are often only slightly less cooperative than business clients!" His images and articles have been published in magazines, textbooks, and a Nature Conservancy poster. View his photos at [cjclandandseaphoto.com](http://cjclandandseaphoto.com).

**Chris Yule '70** points to Thayer students' work as an example of how cars can solve the energy crisis in a

recent *Boston Globe* opinion piece ([boston.com/bostonglobe/editorial\\_opinion/oped/articles/2008/12/15/how\\_cars\\_can\\_solve\\_the\\_energy\\_crisis](http://boston.com/bostonglobe/editorial_opinion/oped/articles/2008/12/15/how_cars_can_solve_the_energy_crisis)). "Students in Dartmouth's Thayer School Formula Hybrid program are having a great time building hybrid race cars," he writes. "Imagine if the torpid design studios in Detroit suddenly came abuzz with exciting futuristic designs that treated the world's precious hydrocarbons like newspapers or beer cans. They would create exciting new jobs in a field that has worldwide appeal. And maybe, just maybe, we could save the planet while we're at it." Yule has been saving the planet one parcel at a time as president of Yule Development Co. ([yuledevelopment.com](http://yuledevelopment.com)), a real estate development firm in Newton Center, Mass., that specializes in designing energy-efficient solutions for "distressed" buildings and sites.

Veteran Wall Street analyst **Brian E. Wong Th'00** is the new director of research at AMI Research, a leading provider of issuer-paid research coverage and independent stock reports. Wong will direct the production of independent analyst research reports for AMI, based in Key Largo, Fla. Wong previously conducted sell-side equity research with Broadpoint Capital and First Albany Capital, where he was a member of the *Wall Street Journal's* Top Five Equity Analyst Team in 2002 and 2003. With a background in medical technology and health care, Wong provided investment research reports on companies in the diabetes, orthopedic, neurotechnology, plastics, and general surgery sectors.

There's a hot new install-it-yourself solar water-heating system on the market. Called Hot2O, it's a light-

weight polymer system developed by **Freeman Ford '63**, president and CEO of FAFCO, the nation's oldest and largest solar thermal panel manufacturer. A closed-loop design allows it to serve up hot water even during winter cold. The system is compact enough to be shipped in a small box to homeowners, who can easily add it to their existing water heaters. See [fafco.com](http://fafco.com) for more information.

For years **Tom Brady '66 Th'68**, founder of Plastic Technologies Inc., has been at the forefront of the polyethylene terephthalate (PET) bottle industry. Now he is developing and commercializing a PET recycling technology to deal with all the empties. The technology, he says, "will have huge implications for reducing waste and decreasing the carbon footprint for PET packaging." A pilot line is running in Bowling Green, Ohio, with installation of the first production line scheduled for early 2009. Brady plans to license



the system worldwide and expects to have 25 operations running within three years—for a total processing of some 200 million pounds of PET annually. "The breakthrough was our patent, which recognizes that reducing particle size allows the decontamination and purification to proceed exponentially faster as a function of particle size," he says. "One engineering challenge we faced was using a powder instead of a pellet, which is the industry standard. We solved that by agglomerating the powder into a pellet form that dries and heats like a powder but handles like a pellet for shipping and processing. A second engi-



Tom Brady '66 Th'68 is commercializing a new technique for recycling plastic bottles.

#### HOT PRODUCT

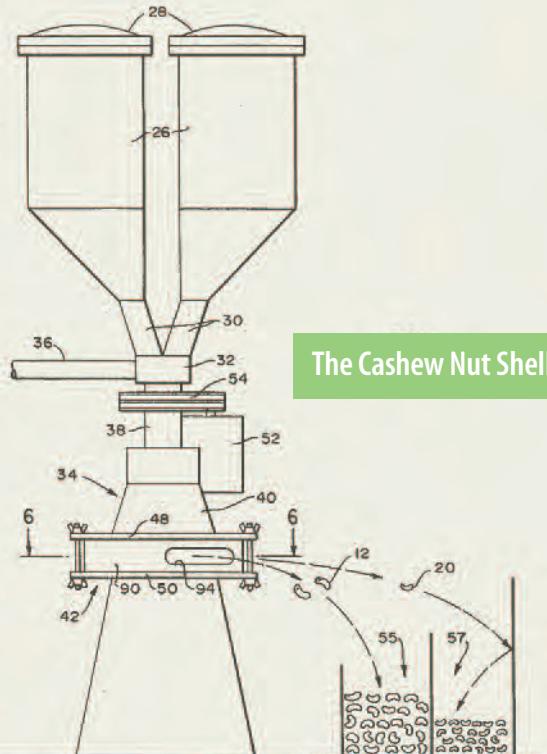
Freeman Ford '63 developed a DIY solar water system for his company, FAFCO.

neering challenge was that we no longer melt-filtered the plastic to remove solid contamination. We solved that by demonstrating that when hard contaminants are reduced in size, they no longer present an issue for secondary processing and reuse." For more information, visit [plastictechnologies.com](http://plastictechnologies.com).

Zoe Courville Th'03, '07 digs snow—specifically in Antarctica on a recent three-month expedition to drill through two miles of snow to collect atmospheric data from the past 140,000 years. "From the ice core you can actually tell a whole bunch about past climate and temperature," Courville recently told the New Hampshire *Union Leader*. The self-proclaimed "snow freak" earned her Thayer Ph.D. in materials science and engineering, doing research on the impact of snow accumulation in Greenland and East Antarctica. Now a research mechanical engineer at the U.S. Army Cold Regions Research and Engineering Laboratory in Hanover, she works with mentor and adjunct Thayer professor Mary Albert Th'84 on the effect of climate change on the polar ice caps.



Zoe Courville Th'03, '07



The Cashew Nut Sheller, 1971

#### BEST INVENTIONS

The first line of the abstract says it all: "A method and apparatus for removing explosively the kernel of a cashew or similar nut from its shell while isolating the kernel from contamination."

—Solomon G. Diamond '97 Th'98

## just one question

### Q. What invention or feat of engineering, from any time period, impresses you the most?

The computer is by far the most impressive invention that I have seen since graduation.

—Charlie Weinberg '42 Th'43

The spiral tunnels on the Canadian Pacific Railway near Lake Louise. To gain elevation, it makes two complete circles inside the mountain.

—Tom Streeter '44 TT'48

Fly ash from large coal-burning electric power plants has the same chemistry and uses as the volcanic ash the Romans used in their aqueducts. My company made a patented road base material from lime, fly ash, and various aggregates called Pozzolanic road base. It was a way to use products that otherwise would have ended up in landfills. The patent on lime-fly ash road base material impressed me and had an effect on my life in the 1960s.

—Craig J. Cain '45 Th'45

What excites me are investigations of electromagnetic principles that permit low-energy electrolysis of water

into its constituent parts, oxygen and hydrogen, and the controlling of the H<sub>2</sub> output to power or increase the efficiency of an engine or motor. There are some currently in operation. Then there is BlackLight Power's power source that extracts heat from the manipulation of the hydrogen atom to a fractional quantum state. Both 1- and 50-kilowatt units have been validated by an outside lab. The only input is water. Further, there's the employment of "negative energy." These new means of producing energy will power our world in the future.

—Ken Carpenter '48 TT'50

I'm nominating the open-dredged caissons under the piers of the Huey P. Long Bridge here in New Orleans. This construction innovation is now fairly widely used, but in 1930 most caisson piers were pneumatically sunk to their founding. I'm now involved with widening that bridge without increasing the foundations, and am basing my confidence on the fine geotechnical work done in the

1920s on the site by Karl Terzaghi. Bill Kimball, then an associate professor and eventually dean of the Thayer School, was involved in the analysis. He wrote a fine paper on the geotechnical aspects of the bridge.

—William B. Conway '52 Th'54

The greatest engineering achievement in my lifetime was Neil Armstrong's landing on the moon on July 20, 1969 and safe return to Earth. The Internet is another. My view is biased because of my 50-plus years in both the aviation and computers/communications fields.

—Pete Knoke '55 Th'56

The solid-state computer impresses me the most. When I was at Thayer, there was just one chapter in one book that discussed transistors. That invention made possible the integrated circuit, and that made programmable computers possible. Throughout my career with the Naval Research Laboratory and then NASA Goddard Space Flight Center, I used these developments to build

## BEST INVENTIONS

The steam engine in the 1800s. It was a power source that could be located anywhere and enabled society to move away from oceans and rivers.

—Don Baker '61 Th'62



ever more capable telemetry systems for launch vehicles and satellites.

—Ron Muller '55 Th'56

My late husband, Gene White '56, would agree with me that in all our years of living and working in developing countries, three inventions stand out: the radio, the bicycle, and the sewing machine. Never did we encounter a person who did not want a radio or yearn for a bicycle if all their travel was by foot, donkey, or bus. Likewise, no one needed to be convinced that a sewing machine was a practical item!

—Betsy White (Mrs. Gene White '56)

Velcro. Taking a look at nature and embodying the idea into a useful closure is quite exceptional.

—Charlie Schneider '57 TT'58

The steam engine in the 1800s. It was a power source that could be located anywhere and enabled society to move away from oceans and rivers.

—Don Baker '61 Th'62

GPS is my favorite. I have always loved maps, but GPS puts me into the map. It is a transformative invention.

—Bruce Johnson '61 Th'62

The most impressive engineering feat that I found during my engineering career was four-color offset lithographic printing. The idea that one can create a rainbow of color by putting dots on a page using just four colors is amazing. It is hard to believe that using a photographic plate where the desired patterns are hydrophobic and attract ink, but the rest of the plate is hydrophilic and kept wet with a slurry, lets one put ink on paper. Further, achieving registration with four separate rollers at paper speeds of more than 2,000 feet per minute is an accomplishment.

—Harris McKee '61 Th'63

The production of a practical heli-

copter by Igor Sikorsky in 1939 led to the multi-billion dollar industry serving societal and defense needs throughout the world.

—David O. Smith '61 Th'62

The Boeing 747. It's amazing it could get off the ground.

—Frank Barber '62

Has to be the Archimedes screw. Its impact on agriculture in the Eastern Mediterranean from 300 B.C. until the full development of Europe is only outweighed by the development of fasteners in the Industrial Age.

—Bill Reilly '67

My joint entry: airplanes and air conditioning. They allowed the full civilization of Florida and California. I guess you also have to tip your hat to the integrated circuit; most of its effects are invisible but also everywhere around us.

—Peter Fahey '68 Th'69

The hybrid-electric drive train for vehicles, because it allows for recycling of energy. This may save mankind from itself. If cold fusion ever works, I'll change my vote.

—Chris Yule '70

Underwater concrete pylons for bridges.

—Larry Lewis '71

The Great Pyramid of Giza.

—Stephen Flanders Th'73

The photographic camera. Photos preserve today's events as well as events of billions of years ago from the farthest reaches of the universe. Photos can evoke profound emotions, making the camera the greatest emotionally related invention, just ahead of the phonograph.

—Steve Arcone Th'77

Favorite of all time: Wright brothers. Newest favorite: Stanley Williams,

Hewlett Packard researcher leading the team that discovered the memristor, a fundamental physical component that interacts with electricity in a unique, non-linear way. If memristors can be developed, they may unlock a whole new generation of electronics.

—George Eger '77

There is no more important human occupation than farming. And nothing has done more to make agriculture possible than the humble hoe. Even the most modern and sophisticated of agricultural plows are nothing more than a large-scale hoe.

—Nelson Valverde '77

Watermills and windmills are simple and require little tech to deliver local power.

—Knud Eric Engelsted '78

A case can be made for the Brown & Sharpe universal milling machine. While you don't see them around anymore, the B&S universal performed an astounding array of work. It could make virtually any machine part or tool—and all motion was controlled mechanically.

—Steve Wyckoff '78 Th'79

In aviation, I'd have to say the SR-71 Blackbird. It had stealth in the early 1960s, and nothing has been done since that performs anywhere near it. Charles Babbage's calculating machine is another "ahead of the rest" invention. He couldn't get it to work because machining wasn't accurate enough in the day, but someone recently built one and it worked.

—Richard Akerboom '80 Th'82, '85

The Panama Canal was a huge project but brilliant in its simplicity. In its day, the lake that was created (Gatun) was the largest ever. The above-sea-level lake reduced the excavation from about 50 miles to only about 10. Many of the large earth-movers we

take for granted today were developed specifically for the Galliard cut. The controls managing the water and locks stand basically unchanged for almost a hundred years, and gravity basically powers the entire operation. I am biased, as I'm from the former U.S. Panama Canal Zone.

—William Hale '80 Th'93

While a graduate student at Thayer School during the early 1980s, I was given access to the ARPAnet, the beginning of the Internet.

—John Hoh '81 Th'82, '84

The Internet will be no less important than the invention of the printing press.

—Kim Quirk '82 Th'83

The Panama Canal—first use of mass-poured concrete among other firsts, and an incredible feat of construction logistics to implement an excellent engineering idea (don't build a sea-level canal, as the French tried to do, but build a lake and two sets of locks). It remains an engineering marvel for the ages.

—Mike A. Adams '83

The Wright brothers' airplane and first successful flight. I am biased, having gotten my commercial pilot license from the Lebanon airport while studying at Thayer. (Now as as president of Performance Motion Devices, in Lincoln, Mass., I'm too busy to get in much flying.)

—Greg Woods Th'83

The invention of semiconductors impresses me most. These are critical to computers, iPods, cell phones, and even today's automobiles.

—Mark Jones '84 Th'85

The gramophone.

—Alex Hartov Th'88

My favorite invention of all times is the cell phone. I remember my joy

### BEST INVENTIONS

My favorite invention of all times is the cell phone. I remember my joy when wireless phones came about. Freedom from the cord!

—Doris Martinez Th'91



when wireless phones came about. Freedom from the cord! Most important invention of all times, though—AC electricity: home-delivered and it powers everything (including my cell phone).

—Doris Martinez Th'91

The wheel.

—Duncan McElroy '91

The Toyota production system has inspired much of my work during the last 15 years. It is the most effective system of production devised in human history, and is being emulated by organizations worldwide. The concepts behind the system seem full of paradoxes, yet when they work in concert, they create a powerful, self-managing, ever-improving system.

—Durward K. Sobek II '91

I am impressed by the Thermos. If you put something hot in it, it keeps it hot. If you put something cold in it, it keeps it cold. How does it know?

—Erik Bliss '92

Cochlear implants let deaf kids grow up listening and talking, and gives adults who lose their hearing the ability to retain their relationships and productivity! I've devoted my career to this technology, first as an audiologist, then academic researcher, and now strategist for the leading manufacturer of implantable hearing solutions.

—Kevin Franck '92

Most of us could not do our jobs without our computer. It has become the most central tool of our lives.

—Annie Kaskade '92

While reading my 4-year-old son a book on the first moon landing, I was struck with how amazing it was to engineer the equipment that carried people to the surface of the moon and safely back to Earth for the first time. In addition to working

in uncharted territory, the engineers had a tight time frame and didn't have access to the computing power that exists today.

—Laura Iwan '93 Th'94

The Golden Gate Bridge.

—Keith Lenden '95 Th'95

Space travel was and still is an amazing feat. And the *Apollo* spacecraft had less computing power than my cell phone.

—Vic Almgren '94 Th'96

U.S. Patent No. 3,605,843 (1971): Cashew nut sheller. Inventors: Thayer adjunct professor Robert C. Dean Jr. and Richard W. Couch Jr. '64 Th'65. The first line of the abstract says it all: "A method and apparatus for removing explosively the kernel of a cashew or similar nut from its shell while isolating the kernel from contamination."

—Solomon G. Diamond '97 Th'98

Uniform screw threads that are easy to manufacture and validate. These didn't exist in the United States before 1864. I grew up taking the basic engineering infrastructure for granted, that we can all go to the hardware store and get nuts and bolts in order to fasten two objects together. No research required! How I wish we had such a technology base for biology!

—Drew Endy Th'98

The boat is the most important invention ever created. (I'm biased, because my Thayer M.S. thesis involved fluid simulation of an America's Cup yacht for Professor Horst Richter.) The boat allowed humans to reach Australia 40,000 years ago, spread down the coasts of North and South America 13,000 years ago, and colonize the Polynesian Islands 5,000 years ago. The shipping trade in the Mediterranean Sea supported the rise of the Greek and Roman Civilizations. The global economy start-

ed with European explorers in sailing ships. The bulk of trade goods are still carried in ships.

—Joe McInerney Th'99

The plow enabled man to start cultivation, which led to civilization.

—Holden Chi Hoon Lee '00 Th'01

My favorite invention is the personal computer. My second favorite is the jet airplane. The two together allow me to live, work, and play anywhere in the world I want.

—Will Schoen '00

The original Ferris wheel was designed and built in 1893. The size of the wheel impresses me—264 feet high, weighing more than 2 million pounds, and able to carry 2,160 people at one time. People marveled at how such a delicate-looking structure could be so strong and not waver in even gale force winds that tore apart the roofs of buildings and other structures during the fair.

—Lauren Scopaz '00

The total knee replacement.

—Derek R. Jenkins '02 DMS'06

As a feat of imaginative engineering: Tarski's undefinability theorem of 1936 on the limits of truth. For elegance and usefulness: solar water disinfection (SODIS), developed by Martin Wegelin in the early 1990s. My personal favorite: nature's evolutionary engineering of a tree. It is a masterpiece of simple thermodynamic efficiency, and energy degradation.

—Daniel Bilar Th'03

I am amazed at large structures like skyscrapers and huge planes. On a smaller note, the iPhone is pretty amazing, too.

—Brian Mason '03 Th'04, '05

Airplanes. Every time I am in a metal tube with wings I can't help but to look

out the window and marvel at how we ever managed to make this happen.

—Peter Rice '05 Th'06

I am glad Johannes Gutenberg invented the printing press. Paper, given to us by the Chinese, is one of the most important inventions.

—Subha Srinivasan Th'05

A windmill built by William Kamkwamba, when he was 14, to power two light bulbs and a radio for his family of 20 in the remote village of Malawi, Africa. He built it by reading a physics book! See [africanleader.shipacademy.org/site/about/students/studentprofiles/williamkamkwamba.html](http://africanleader.shipacademy.org/site/about/students/studentprofiles/williamkamkwamba.html).

—Afua Amoah Th'06

My favorite invention is air conditioning. Without it, there are a lot of places we couldn't comfortably live.

—Glenn T. Nofsinger Th'06

One recent invention caught my attention: Last week people broadcast a football game live, in 3-D.

—Trinell Ball Th'07

I'd go with the Internet. It has revolutionized how we communicate, work, shop, bank, learn, teach, etc.

—Thach Bui Th'07

*Apollo 11* and the Panama Canal.

—Juan Pablo Fernández Th'07

The bicycle. The design of modern bicycles is so simple that it is beautiful. Every part of a bike—the frame, crank, crank arms, brakes—has a function that is integral to its use. The simple mechanics allow for a robustness and reliability that very few other inventions can achieve. Bicycles made 30 years ago are still used daily with only minimal maintenance. Computers, cell phones, and even cars, become obsolete every five years.

—Calvin D. Krishen Th'07

# ►thayer notes

## 1950s

**Len Neely '56:** I retired from a career in mainframe data processing (programming, systems analysis and design) in 1995. I do not consider myself to be an engineer since I worked in related areas and may have used engineering approaches to work. And I did not complete my master's work at Thayer School. No work going on except to handle the health issues associated with being a senior citizen!

**Charlie Schneider '57 TT '58:** I have been retired 12 years now. I did not use my Tuck-Thayer skills in engineering directly. Started as a sales engineer and moved into management. Always appreciated engineering work/results and how they have been used to better our lives.

## 1960s

**Frank Barber '62:** I'm semi-retired to Golden, Colo., enjoying its mountains, now covered with snow.

**John Walkup '62 Th'63:** In 1998 I retired from my position on the faculty at Texas Tech University and my wife, Pat, and I returned to the San Francisco Bay Area in 1999. We had met and married out here when I was a graduate student at Stanford after I left Thayer in 1963. Since our return we have been directing a ministry to university professors at UC Berkeley, Stanford, UC Davis, and San Jose State University. It is called Faculty Commons and is the faculty ministry of Campus Crusade for Christ, International, an evangelical but nondenominational ministry. I organize fellowship groups for Christian professors at all of these universities. While it's true that many of the engineering professors I work with are engaged in energy research, my time is spent on encouraging them spiri-

tually and helping them integrate their faith and their academic discipline. The latter can be a challenge, as you might expect. Looking back on my Dartmouth/Thayer educations, my graduate work at Stanford, and my career at Texas Tech, I can only say how much I appreciate the broad liberal arts education I received at Dartmouth. As you might expect, I'm really a networker and people person. At Dartmouth I learned to think critically and take a big picture look at life as well as at engineering. This has been invaluable to me, both in my career and now in our ministry.

**Robert Dalrymple '67:** I'm with the department of civil engineering at Johns Hopkins University. Right now I am working on the U.S. Army Corps of Engineers' efforts on providing hurricane protection to south Louisiana, water waves propagating over mud, and numerical modeling of breaking waves.

## 1970s

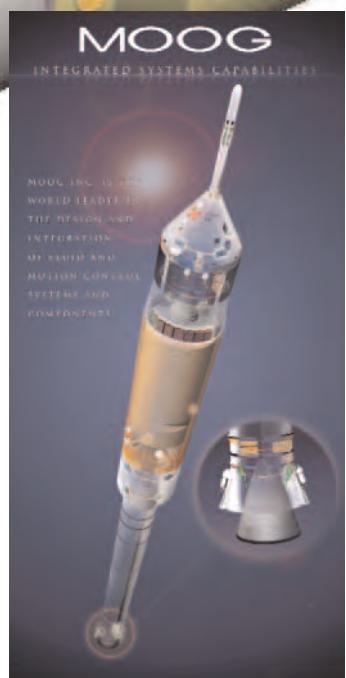
**Dan Malwitz '77:** I have worked at Moog Inc. near Buffalo, N.Y., for the past 15 years. Right now I am designing the upper-stage thrust vector control actuator for NASA's Ares I spacecraft. This is the crew launch vehicle that will replace the space shuttle. Moog is a fun place to work; seven hours from Hanover and two from Toronto. The space and defense group, where I work, currently has 25 openings for mechanical, electrical, project, and systems engineers at various experience levels. I have had a great engineering career since leaving Dartmouth: Five years at Split Ball-bearing in Lebanon, N.H., designing ball and roller bearings; two years at Lockheed Electronics in Plainfield, N.J., designing antenna structures; and eight years at Contraves in Pitts-

burgh, Pa., designing motion simulators and telescope structures. While at Contraves I designed the 50,000-pound payload crew station/turret motion base simulator for the U.S. Army Tank Automotive Command in Warren, Mich. I also designed the primary mirror support system for the AEOS 3.67-meter telescope that is now atop Mount Haleakala, Hawaii (see page 11). Here at Moog I designed the electric flight simulator actuators that Flight-Safety is now using. I have been fortunate to be able to apply my God-given design abilities that were awakened at Dartmouth. Andrea and I have been married for 29 years. We have two great children: Sarah, who with husband Scott has our first grandchild, Haley; and Daniel, who is a freshman at Gordon College.

**Nelson Valverde '77:** As my third successful career (after international finance and Internet service), I am currently enjoying bringing to the developed world the novelty and pleasure of Bolivian coffees. Visit my website, invalsa.com, for details.

## 1980s

**Jay Hole '81 Th'82:** At present I have two jobs. I'm helping another '81 engineering major, Toby Reiley, start a new company offering financial services to automotive dealers. The offering is an innovative way to allow a small segment of the deep sub-prime market to purchase used vehicles that is beneficial to the buyers and the dealers. My "day job" is with ChemPak International LLC, a very small chemical company that does specialty packaging of specialty chemicals, mostly polymerization inhibitors, catalysts, and pigments. I work across the spectrum but mostly on procurement/supply chain,



quality, operations, and strategy. Prior to ChemPak International LLC, I had an entrepreneurial "learning experience" with a company trying to make ethanol from waste liquids, primarily beverages. The start-up, management, and technical team grossly underestimated the complexity of the operation, particularly as related to fermentation and waste treatment/disposal.

**Greg Woods Th'83:** I am president of Performance Motion Devices (pmd corp.com). PMD has some very unique intellectual property that essentially puts a high-performance motion controller on a chip. The chips are marketed to high-volume original equipment manufacturers, primarily in the life sciences and other high-tech markets where the customer is looking to develop his own machine control, such as blood analyzers, semiconductor fabrication, energy technology, defense, etc. I'm proud to report that my son Chris was just admitted to the Dartmouth class of 2013! That will get me back up to the campus more frequently over the next four years.

## IN THE MOOG

Dan Malwitz '77 is designing the upper-stage thrust vector control actuator for NASA's Ares I spacecraft, the crew launch vehicle that will replace the space shuttle.

# Dartmouth Engineer is online!

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

**Sean Hogan '88:** I started my career in environmental and waste management, developing waste to energy facilities. During that time I spoke several times to Lee Lynd's environmental engineering classes, which I always enjoyed. Currently I work at IBM on health care-related topics and the transformation that needs to take place in our health system to make it more cost effective. We have been doing some groundbreaking work in these areas—from the Genographic Project with National Geographic to pandemic response—and in consumer activation as an important factor in improving the system and individual well-being.

## 2000s

**Lauren Scopaz '00:** I graduated from Harvard Business School in June 2007 (with fellow Dartmouth engineer **Brian Nickerson '00**), have worked at the Harlem Children's Zone, a nonprofit in N.Y.C. since then, and got married in September 2008.

**Erik Dambach '04 Th'05:** I just completed my M.S. from Purdue University in aeronautics and astronautics. I am now working on my fifth and final degree, my Ph.D. at Purdue. I have had a great time designing and testing rocket engines. This past summer I worked at Edwards Air Force Base testing advanced fuels in the high desert of southern California. And I look forward to playing with even more fire over the next two years as I work on my Ph.D., investigating new non-toxic (or at least less toxic) propellants.

**Daniel Hassouni '05 Th'05:** I completed my first marathon—the SunTrust National Marathon in Washington, D.C.—in 3:11:46 as a member of the Leukemia and Lymphoma Society's Team in Training. In the process I raised \$5,608 to help in the fight against blood cancers. The group of 53 runners that made up Team in Training's squad for this race surpassed \$150,000!

**Subha Srinivasan Th'05:** I love working at the interface of math and engineering. When I am not involved in implementing some numerical formulation or computing in 3-D for imaging, you will find me in a yoga class or my studio at home doing sun salutations or tai-chi or dancing to Middle Eastern music. Music, movement, and books are my passions.

**Afua Amoah Th'06:** A little about my life after Thayer: I moved to New York City and worked with BlackRock for two years. Currently, I am pursuing a Duke M.B.A. I have a long-term goal of using my engineering and M.B.A. experiences to establish a mechanized farming industry in Africa, which will allow people to get better access to food.

**Hannah Murnen '06:** I'm working with bio-inspired polymers (mimicking proteins) in the area of biomaterialization. I'm a graduate student at UC Berkeley in the chemical engineering department. My advisor is Dr. Rachel Segalman, and my project uses synthetic molecules to mimic the behavior of proteins. The end goal is to use these synthetic proteins to catalyze the growth of inorganic crystals into desired shapes and morphologies so that they can be utilized for optoelectronic applications (photovoltaics, semiconductors, etc). I'll be here for about four more years. Right now I'm thinking that I'd like to go into academia at the end of it, but that's a long ways off!

**Glenn T. Nofsinger Th'06:** This May I relocated to Honolulu, Hawaii, taking a position with BAE Systems as principle scientist. I'm helping the development of image processing algorithms. Life on the island is great, and I managed to find a Dartmouth alumni club in Honolulu.

**Peter Rice Th'06:** I am still working at Alarm.com with **Colin Murray '04 Th'05** and **Colin Ulen Th'05** from Thayer and am expecting to pick up a few more Thayer grads in the near future. In my personal life: **Betsy '06**, my wife,

and I welcomed our own little engineering project into the world on July 16, 2008: Samuel Bartlett. He loves spitting up on his Thayer School bib, which I picked up while on campus for recruiting, and has shown an interest lately in bridges.

**Rui "Anny" Zhang Th'07:** Both life and work are good here in upstate New York, though cold recently. Thayer's engineering educations, especially the practical skills I acquired in the M.E.M. program, greatly helped me in the real-life work. I am working in the marketing group with Indium Corp. of America in upstate New York ([indium.com](http://indium.com)). I like my job and the company a lot.

## OBITUARIES

**John Fondahl '47 Th'48**, 83, a world-renowned expert on the critical path method for construction management, died September 13, 2008. During World War II he joined the Marines, serving in the Pacific theater. After working for the American Bridge Co. in Pittsburgh, Pa., teaching civil engineering at the University of Hawaii, and working as project engineer on California's Nimbus Dam, he became a professor of civil engineering at Stanford in 1955. He taught there for 35 years, co-founded its construction management program, and served as the first Charles H. Leavell Professor of Civil Engineering. He taught construction management courses all over the world, founded the Project Management Institute, and served as president of the Construction Data Systems Corp. He received the Golden Beaver Award for Heavy Engineering Construction in 1975, was elected to the National Academy of Engineering in 1993, and to the National Academy of Construction in 2001. He is survived by his wife of 62 years, Doris; daughters Lauren, Gail, Meredith, and Dorian; and three grandchildren.

**Robert E. Koski '51**, 79, died October 11, 2008. After graduation, he moved to Sarasota, Fla., and in 1970 co-founded Sun Hydraulics, a leading designer and manufacturer of high-performance screw-in hydraulic cartridge valves and manifolds that control force, speed and motion as integral components in fluid power systems. The American Society of Mechanical Engineers, honored him when it inaugurated the Robert E. Koski Medal to "recognize individuals who have advanced the art and practice of fluid power motion and control through education and innovation." In 1992 he was awarded the Joseph Bramah Medal by the Institution of Mechanical Engineers for his "contribution to the resurgence of interest in fluid power in the U.S.A. and beyond." Case studies of his horizontal management approach at Sun Hydraulics led to his participation in programs at Tuck Business School and Harvard Business School. Survivors include his wife of 53 years, Beverly; children Christine, Robert and wife Tomeika, and Thomas and wife Sherry; six grandchildren; and five great-grandchildren.

**Gene F. White '56** died June 17, 2008 at his home in Berkeley, Calif., after battling leukemia. Having earned a B.S.C.E. from the University of Denver in 1957, he was a civil engineer specializing in water resources and irrigation in Asia and Africa. He served in the U.S. Army in 1957 and was a Peace Corps volunteer in Pakistan. He began skiing and climbing mountains as a teenager and had a lifetime list of 1,320 ascents, including several first ascents in Pakistan and Canada. His work and mountaineering took him to 60 countries. He spoke French, Indonesian, Punjabi, and Urdu. He is survived by Betsy, his wife of 48 years; children Eric, Greg, and Laura; and four grandchildren.

# inventions



## LIFESAVERS

The Kantrowitz brothers, Adrian, left, and Arthur, right, helped heart patients.

## INTRA-AORTIC BALLOON PUMP

>> INVENTORS:  
PROFESSOR ARTHUR  
KANTROWITZ AND  
DR. ADRIAN KANTROWITZ

A dynamic duo for solving problems of engineering in medicine, Thayer professor Arthur Kantrowitz and his brother Adrian learned early on that Arthur's passion for physics and Adrian's interest in medicine

could combine into a powerful force for innovation.

As kids they built an electrocardiograph machine out of old radio parts, and later—when Adrian became a doctor and Arthur a professor of engineering physics—they paved the way for open-heart surgery with their early version of a heart-lung machine. Their projects together continued from there. They developed a left ventricular assist device, introduced

electrical stimulation of paralyzed muscles, pioneered the implantable pacemaker, and invented the intra-aortic balloon pump (IABP).

The IABP is a small balloon that fits in the aorta and counter-pulsates with the heart. This action both decreases myocardial oxygen demand and increases myocardial oxygen supply. A computer controls the flow of helium into and out of the balloon. Helium is used because its

low viscosity allows it to travel quickly through the long connecting tubes and lowers the risk of rupturing the balloon and causing a harmful embolism.

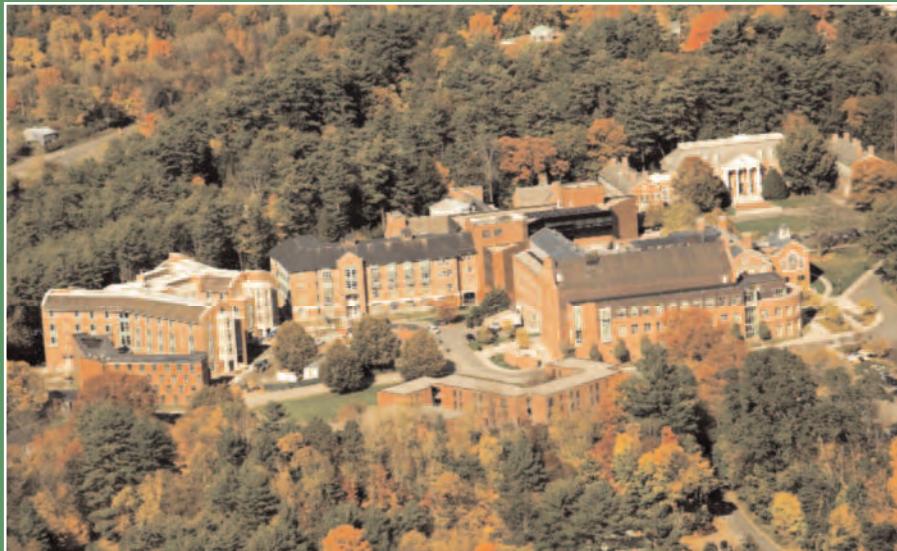
The IABP is credited with saving hundreds of thousands of lives. The device was used on Arthur himself to ease the effects of heart failure during his final hours. Both brothers died in November 2008, just 15 days apart.

—Catharine Lamm



## RANDOM WALK

Master of Engineering Management (M.E.M.) students gathered in Jackson Conference Room at the end of Fall Term for the annual M.E.M. Mugging Ceremony. A yearly ritual since 2005, the Mugging Ceremony marks the end of the 18-month degree program. Why mug? Because each graduate receives a special M.E.M. coffee mug. "They're going off into the workforce. They'll need a coffee mug," says Ross Gortner, assistant director of the M.E.M. program who earned his own Thayer M.E.M. degree in 2004. And since some grads won't make it back to campus in June for Commencement, "the party is a chance for everyone to get together and say goodbye," says Gortner, shown crouching in the photo. Despite the weak economy, 16 of the 40 class members are heading right into jobs at Boeing, Eaton, General Mills, McKinsey, Microsoft, and other corporations. The rest expect to find company desks for their coffee mugs within six months. The M.E.M. program is directed by Thayer Professor Robert Graves, pictured on the left, and Tuck Professor Kenneth Baker, right.



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