University of Minnesota

A magazine for alumni of the College of Science and Engineering | Fall/Winter 2012-13

INVENTING TOMORROW

A SLAM DUNK FOR SCIENCE AND ENGINEERING

University students mentor *FIRST* Robotics teams

ALSO INSIDE:

Faculty are transforming the college classroom >>

The "Greatest Generation" share tales of WWII >>

INVENTING TOMORROW

Fall 2012
Vol. 37, No. 1

Inventing Tomorrow is published by the College of Science and Engineering communications team twice a year for alumni and friends of the college. This publication is available in alternate formats for those with visual impairments by calling 612-626-7959.

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Inventing Tomorrow welcomes readers' comments and story ideas for future issues.

Email
csemagazine@umn.edu

U.S. Mail
Inventing Tomorrow
College of Science and Engineering
105 Walter Library
117 Pleasant Street SE
Minneapolis, MN 55455

Twitter: @umn.cse
Facebook: facebook.com/umn.cse

Phone: 612-624-8257
Fax: 612-624-2841
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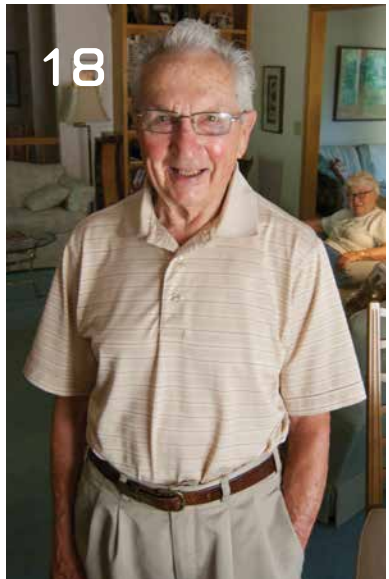

fall **2012**

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Danny Blau (center), CSE student and GOFIRST team member, helps out the *FIRST* Robotics team from Breck High School in Golden Valley, Minn., as they prepare to compete during the 10,000 Lakes Regional *FIRST* Robotics Competition at the University of Minnesota. • 12

PHOTO BY RICHARD G. ANDERSON

FROM THE Dean

Steven L. Crouch

CSE serves students throughout the generations

WHEN TALKING WITH ALUMNI AND STUDENTS this fall at our many events, including Homecoming and the Grand Opening of Lind Hall, one thing stands out—the stories I hear about how the University of Minnesota College of Science and Engineering continues to make a positive impact on students and their futures, as it has done for generations. In this issue of *Inventing Tomorrow*, we read stories of our students helping high schoolers build a love for science and engineering, we discover how classes are being taught in new and innovative ways to develop critical thinkers, and we reminisce about the past with a few of our older alumni who lived through World War II.

> "The College of Science and Engineering continues to make a positive impact on students and their futures as it has done for generations."
>
> —DEAN CROUCH

In the cover story "A Slam Dunk for Science and Engineering," we take a peek into the future. Our current University of Minnesota students show their commitment to the next generation by mentoring high school *FIRST* Robotics teams. They are helping these teens to learn important skills such as problem-solving, time management, communication, cooperation, and budgeting. In addition, many of these high school students are now considering careers in science and engineering. In 2008, 12 incoming CSE freshman had participated in *FIRST* Robotics in high school. This fall, the number of incoming freshmen with *FIRST* experience has grown to 76.

Faculty in the College of Science and Engineering are showing their commitment to the present by developing and using innovative teaching methods to meet the needs of today's students. In the story "Head of the Class," we see how the tradition of rigor remains, but faculty are using new techniques and technology to spark the flame of curiosity. Chemistry labs focus more on problem-solving, engineering lectures are taught online so more time can be spent on in-class discussions, and physics classes are taught using cooperative learning methods. Engaging students as active participants in their learning makes them better prepared for their careers after graduation.

In this issue, we also take a look back at the past in one of my favorite articles featuring our alumni. In "Tales from the Greatest Generation," we read four stories from World War II and how the University of Minnesota played a role in their lives before, during, and after the war.

As we look to the future, we need to continue to focus on innovation. In the "Alumni Report" section of this magazine, University President Kaler outlines his vision focusing on four key areas in his MnDRIVE legislative budget request. These four areas include: 1) robotics, sensors, and advanced manufacturing; 2) securing the global food supply; 3) addressing water quality and environmental issues; and 4) brain research. The College of Science and Engineering will play a key role in all of these areas and will lead the robotics efforts.

With continued support from the State, our alumni, and our entire community, I am confident that our college and the University can have an impact for many generations to come. ■

Lind Hall renovation provides home base for undergraduates

The 2012 renovation of the first floor of Lind Hall was completed this fall providing a dynamic home base for College of Science and Engineering current and future undergraduates. The space integrates CSE Student Services, provides study and meeting space, and includes a CSE Computer Lab. To read more and see a slideshow, visit **z.umn.edu/lindhall**

RECOMMENDED Extras | *on the Web*

To see these videos and more featuring College of Science and Engineering faculty, students, and alumni, visit our page on YouTube at **www.youtube.com/umncse**.

Bin He discusses new epilepsy research

Bin He, University professor of Biomedical Engineering, discusses his research on a new type of non-invasive brain scan that gives additional insight into possible causes and treatments for epilepsy patients.

Target Field balloon launch

The University of Minnesota High Altitude Ballooning Team kicked off Minnesota Aerospace and Aviation week this fall, with a balloon launch from Target Field before a Minnesota Twins baseball game.

Spider-Man and the decay rate algorithm

Jim Kakalios, University professor of physics, served as the science consultant on Sony's film, *The Amazing Spider-Man*, by developing an important equation used throughout the film.

Inside the University's Nanofabrication Center

Take a look inside the University of Minnesota's Nanofabrication Center, a state-of-the-art facility dedicated to the design, fabrication, and testing of small-scale devices.

Big Question: Can we make plastics sustainable?

The University of Minnesota's Institute on the Environment and the Center for Sustainable Polymers explores how we can enjoy the benefits of plastics and keep our planet healthy, too.

Driven to Discover: Degrees of light

View the University of Minnesota's new Driven to Discover advertising campaign which launched this fall.

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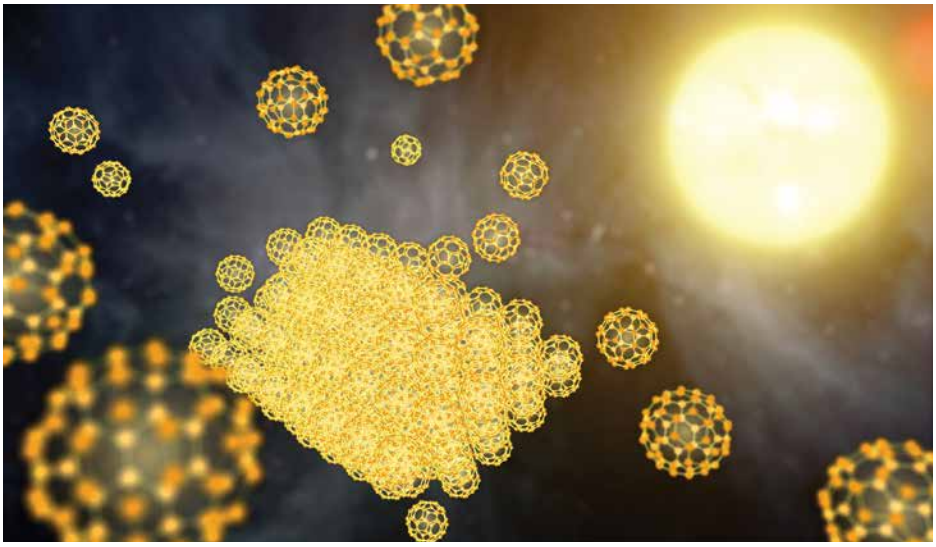
About 2,500 students, alumni, and friends have joined us on the College of Science and Engineering *Facebook* page at facebook.com/umn.cse. Also follow us on Twitter.com/umncse for the latest news about the college.

Inventing Tomorrow available online

To view an interactive online version of the current *Inventing Tomorrow* or to see past issues, visit our archives at: **cse.umn.edu/inventingtomorrow**

U astronomers help to discover solid buckyballs in space



NASA/JPL-CALTECH

Illustrated in the artist's concept above is the beginning process of buckyballs in space stacking together to form a solid particle. Robert Gehrz and Charles Woodward, both University professors in the School of Physics and Astronomy, are part of a research team that detected the solid form of buckyballs in space using data from NASA's Spitzer Space Telescope.

USING DATA FROM NASA's Spitzer Space Telescope, an international team of scientists, including University professors of astronomy Robert Gehrz and Charles Woodward, say they have discovered buckyballs in a solid form in space for the first time. Prior to this discovery, the microscopic carbon spheres had been found only in gas form in the cosmos.

Buckyballs, formally named buckminsterfullerene, are made up of 60 carbon atoms arranged into a hollow sphere of hexagons and pentagons, similar to a soccer ball. They are named after their resemblance to the late architect Buckminster Fuller's geodesic domes. Their unusual structure makes them ideal candidates for electrical and chemical applications on Earth, including superconducting materials, medicines, water purification and armor.

In the most recent discovery, scientists using the Spitzer telescope detected tiny specks of matter consisting of stacked buckyballs. They found the particles around a pair of stars called XX Ophiuchi or XX Oph, 6,500 light-years from Earth, and detected enough to fill the equivalent in volume of 10,000 Mount Everests.

Buckyballs were detected definitively in space for the first time by Spitzer in 2010. Spitzer later identified the molecules in a host of different cosmic environments. It even found them in staggering quantities, the equivalent in mass to 15 Earth moons, in a nearby galaxy called the Small Magellanic Cloud.

In all of those cases, the molecules were in the form of gas. The recent discovery of buckyballs particles means that large quantities of these molecules must be present in some stellar environments in order to link up and form solid particles.

The research team was able to identify the solid form of buckyballs in the Spitzer data because they emit light in a unique way that differs from the gaseous form.

Gehrz and Woodward were involved in designing the program of infrared spectroscopic observations using Spitzer to determine the mineral content of the grains being produced in the XX Oph system. They were also involved in analyzing and interpreting the data. Such formation helps scientists determine the essential building blocks of our Universe.

Researchers find new way to pinpoint epileptic seizures

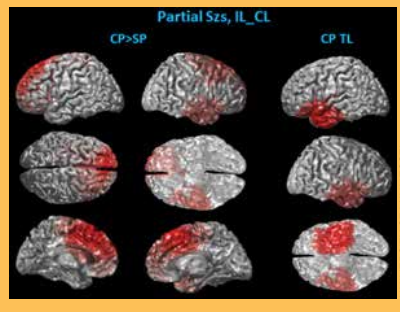
RESEARCHERS FROM THE University of Minnesota and Mayo Clinic say that a scan taken immediately after an epileptic attack can provide additional information about the causes and treatment of epilepsy. The study was recently published in *Brain*, a leading international journal of neurology.

"This is the first-ever study where new non-invasive methods were used to study patients after a seizure instead of during a seizure," said Bin He, University professor of biomedical engineering and senior author of the study. "It's really a paradigm shift for research in epilepsy."

For decades, medical researchers have focused on locating the part of the brain responsible for the seizures to determine possible treatments. The research has focused on studying patients while they were having a seizure, or what is technically known as the "ictal" phase of a seizure. Some of these studies involved invasive methods such as surgery.

In the new study, the researchers used a novel approach by studying the brains of 28 patients immediately after seizures, or what is technically known as the "postictal" phase of a seizure. They used a specialized type of non-invasive EEG with 76 electrodes attached to the scalp to gather data.

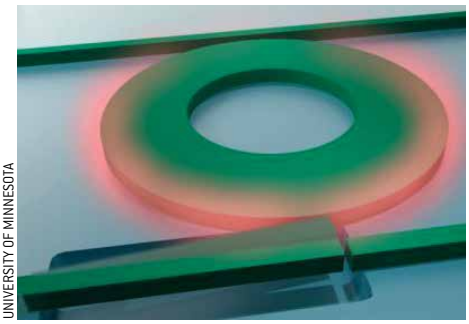
The study found that the frontal lobe of the brain is most involved in severe epilepsy. The findings may lead to new ways of locating the brain regions responsible for seizures in individual patients.



UNIVERSITY OF MINNESOTA

Researchers invent device that could speed online downloads

UNIVERSITY RESEARCHERS have invented a unique microscale optical device that could greatly increase the speed of downloading information online and reduce the cost of Internet transmission. The research results were published recently in the online journal *Nature Communications.*



UNIVERSITY OF MINNESOTA

Researchers have invented a microscale mechanical switch of light on a silicon chip. Light in the resonating ring can be amplified enough to set the left-hand waveguide moving without needing electricity.

The device uses the force generated by light to flop a mechanical switch of light on and off at a very high speed. This development could lead to advances in computation and signal processing using light instead of electrical current with higher performance and lower power consumption.

"This device is similar to electromechanical relays but operates completely with light," said Mo Li, an assistant professor of electrical and computer engineering in the College of Science and Engineering.

Li and collaborators discovered in 2008 that nanoscale light conduits can be used to generate optical forces strong enough to mechanically move an optical waveguide. With their new device, they found that its mechanical properties can be completely dominated by the optical force.

"This is the first time that this novel optomechanical effect is used to amplify optical signals without converting them into electrical ones," Li said.

Glass optical fibers carry many communication channels using different colors of light assigned to different channels so they don't interfere with each other. This noninterference characteristic ensures the efficiency of a single optical fiber to transmit more information over very long distances. But this advantage also harbors a disadvantage: When considering computation and signal processing, optical devices could not allow the various channels of information to control each other easily—until now.

The device uses a donut-shaped component called an optical resonator, which is placed between two rod-like components, called waveguides. As light travels through one waveguide, it is circulated through the optical resonator hundreds of times, increasing the intensity of the signal. The amplified force generated by the optical resonator guides a free-moving piece of the second waveguide like a tuning fork, thus signaling the light transmission in a useable, amplified form.

Medical Devices Center receives grant to expand

THE COLLEGE OF SCIENCE AND ENGINEERING has been awarded $1.08 million from the Minnesota Department of Employment and Economic Development (DEED) to convert 8,000 square feet of space into an expanded facility for the Medical Devices Center on the Minneapolis campus.

Construction on the Medical Devices Center will begin this fall, converting part of the Mayo Parking Garage into a new, larger facility for the center, which has outgrown its current 5,000-square-foot space in the Shepherd Labs building on the University's East Bank. The new facility will be located in the heart of the University's medical facilities.

The College of Science and Engineering will contribute the remaining funds for the $2.2 million project using money from facilities and administrative charges on external research grants. In-kind donations from medical devices companies are expected to fund needed equipment. To date, the Medical Devices Center has received more than $1 million in equipment donations for its current facilities.

"The medical devices sector is a vital industry in Minnesota, employing more than 29,000 people, the highest number per capita in the U.S.," said DEED Commissioner Mark Phillips. "The Medical Devices Center is critical to the state's infrastructure, serving as an integral partner to industry and an incubator for innovative new devices."

Established in 2008, the Medical Devices Center includes laboratories, equipment, support facilities, training programs, and expert personnel. The center is a world-renowned model for turning research and development ideas into marketable products. Over the last four years, the center's research fellows have filed 109 invention disclosures to the University of Minnesota Office of Technology Commercialization (OTC), of which 52 were filed just this year. Based on these invention disclosures, the University has filed 37 patent applications and four additional applications are currently under preparation.

"The Medical Devices Center is a great example of how a partnership among the University of Minnesota, State of Minnesota, and industry can strengthen the state's economy," said Steven L. Crouch, dean of the College of Science and Engineering. "With more than 100 invention disclosures in just the last four years, our Medical Devices Center has a proven track record of success that we hope to expand even further with additional space."

President Obama appoints Foufoula-Georgiou to board

PRESIDENT BARACK OBAMA appointed Efi Foufoula-Georgiou, a professor of civil engineering, to the U.S. Nuclear Waste Technical Review Board. She is one of only eight individuals nationwide who were appointed to the board.

An independent agency of the U.S., the sole purpose of the Nuclear Waste Technical Review Board is to provide independent scientific and technical oversight of the Department of Energy's program for managing and disposing high-level radioactive waste and spent nuclear fuel.

Foufoula-Georgiou has served as the director of the National Center for Earth-Surface Dynamics at the University of Minnesota since 2008. She has also served on the National Center for Atmospheric Research's Science Advisory Board since 2005 and is a member of the American Geophysical Union, American Society of Civil Engineers, and the Society of Women Engineers.

University of Minnesota teams up with Google to offer polar expeditions from the comfort of a chair

THE UNIVERSITY OF MINNESOTA'S Polar Geospatial Center has teamed up with Google to offer new interactive, 360-degree images of early polar explorer Ernest Shackleton's hut, a penguin colony, and the Antarctic landscape, all from the comfort of a home or office computer.

Between October 2011 and January 2012, Brad Herried, a research fellow in the Polar Geospatial Center, took more than a dozen images of the historical huts, research stations, and other places on Antarctica. Using a lightweight tripod camera with a fisheye lens that could withstand the harsh conditions, he took the photos manually. Google's real-life mapping service typically collects images using panoramic cameras mounted on cars, trikes or snowmobiles.

Google used the images to expand its 360-degree imagery of Antarctica giving the public an opportunity to view in breathtaking detail the South Pole Telescope, Shackleton's hut, the Cape Royds Adélie Penguin Rookery, the McMurdo Research Station, and many other sites.

The huts are literal time capsules of the early Antarctic explorers. After abandonment by their original inhabitants, the huts became buried in snow and were preserved in the frigid temperatures. Still present today and visible in the images are original cans of food from a century ago, photos on the walls, and the explorers' socks.

"When I visited the historical huts of the early explorers, it gave me a new appreciation for what they endured to provide generations of scientists with important Antarctic information. I don't know how they did it back then," Herried said. "To just visit a place like that is so interesting. Now I am able to share it with the world. It makes me feel like I am part of their enduring legacy."

Because many of the sites are in very remote locations, Herried said getting to them required some interesting forms of transportation. Some sites were accessible by snowmobile, while others, such as the Amundsen-Scott South Pole Station required traveling by U.S. Air Force LC-130 Hercules aircraft.

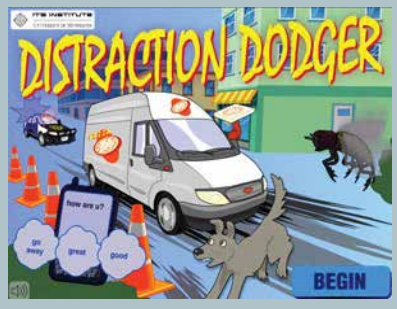
"This is the ultimate public outreach," said Paul Morin, director of the National Science Foundation-funded Polar Geospatial Center. "These are places that nobody can visit without tremendous effort and cost. This puts the glory of Antarctica at people's fingertips around the world so everyone can be an 'armchair' polar explorer."

Images of Scott's hut and other sites of Antarctica can be found at Google's World Wonders Project at **z.umn.edu/scotthut**

BRAD HERRIED

The interior of Robert Falcon Scott's Hut on Cape Evans can be viewed in amazing detail. Frozen in time since 1912, the small wooden building was built to withstand the harsh conditions only for the few short years that it was inhabited, but remarkably, the structure is still intact after more than a century.

U researchers develop video game to curb distracted teen driving



A VIDEO GAME developed by mechanical engineering researchers in the Intelligent Transportation System (ITS) Institute at the University of Minnesota is teaching teens the consequences of distracted driving.

The Internet-based game called "Distraction Dodger" was designed to help teens and young adults understand the importance of concentrating on driving.

"This is a video game, but the choices presented in the game are true to life," said ITS Director Max Donath.

In the video game, players drive a pizza delivery car in the city of Little Moots. As they deliver pizza, they're encouraged to use a smart phone, social media, and a GPS to build their business and get points.

At the same time, they need to avoid obstacles such as traffic tickets, damage to the car, and pedestrians.

As the player progresses through the game's levels, feedback is offered about driving performance and the level of distraction, which can be an eye opener.

"For young drivers who believe they can do it all and not negatively affect driving, the game offers a reality check," said Michael Manser, director of the HumanFIRST Program at the ITS Institute within the University's Department of Mechanical Engineering. The HumanFIRST program, which helped develop the game, studies how drivers interact with in-vehicle technologies on a psychological, perceptual, and behavioral level and how those technologies may then support or detract from driving.

Visit **its.umn.edu/DistractionDodger** for more information or to play the game.

Haynes named to "Brilliant 10" list

UNIVERSITY ASSOCIATE PROFESSOR of Chemistry Christy Haynes was named one of *Popular Science* magazine's "Brilliant 10," an elite group of young scientists whose research is expected to dramatically impact their fields.

Haynes and her research group have been studying blood platelets. They are the only researchers in the world who have been able to measure chemicals being released by individual platelets in real time. They were the first to successfully isolate an individual platelet under a microscope, place a minuscule electrode onto it, and measure the messenger molecules released.

Understanding how platelets communicate with each other gives researchers fundamental knowledge they never had before. This could lead to new treatments for patients who have difficulty with blood clotting or developing medications to help patients avoid dangerous blood clots.

STEVE NIEDORF

Haynes is already collaborating with renowned platelet specialists nationwide to look at platelet samples and conduct initial lab testing for possible anti-clotting medicines.

U-led program doubles number of underrepresented minority students receiving degrees in STEM fields

THE NATIONAL SCIENCE FOUNDATION (NSF) through the Louis Stokes Alliance for Minority Participation (LSAMP) program has awarded the North Star STEM Alliance an additional five years of funding totaling $2.5 million. The group is led by the University of Minnesota-Twin Cities, and includes 13 higher education institutions and three community partners.

The additional funding was awarded as the Alliance approaches its initial five-year goal of doubling the number of underrepresented minority students receiving bachelor's degrees in the science, technology, engineering, and mathematics (STEM) fields from 2007-12.

RICHARD G. ANDERSON

The University of Minnesota-Twin Cities and its 13 higher education partners recently celebrated the kick-off of the North Star STEM Alliance activities for the 2012-13 academic year.

In addition, the University of Minnesota-Twin Cities has been named one of four recipients of a two-year Minority Male STEM Initiative (MMSI) grant from the Association of Public and Land-Grant Universities (APLU). Funded by a major grant from The Kresge Foundation, the MMSI grant supports a partnership between the U of M and Minneapolis Technical and Community College (MCTC) to increase recruitment, retention, and success of minority males in STEM majors.

The North Star STEM Alliance began June 1, 2007, as a partnership among Minnesota colleges and universities and two community organizations.

"Minnesota has one of the nation's largest educational achievement gaps. The state's universities and colleges must be proactive to address this problem and help close that gap," said University of Minnesota President Eric Kaler.

"As more and more jobs are created in STEM-related industries, it is imperative to provide a top-notch education in these fields that is accessible to all students from all backgrounds. The successful statewide partnerships forged by the North Star STEM Alliance and the Minority Male STEM initiative are addressing these challenges head-on," he added.

CSE research fuels startup companies

DISCOVERIES BY RESEARCHERS at the University of Minnesota led to a record 12 startup companies in fiscal 2012, which ended June 30. The previous record was set last year, when nine companies were launched. Of the total, five companies were fueled by research conducted in the College of Science and Engineering.

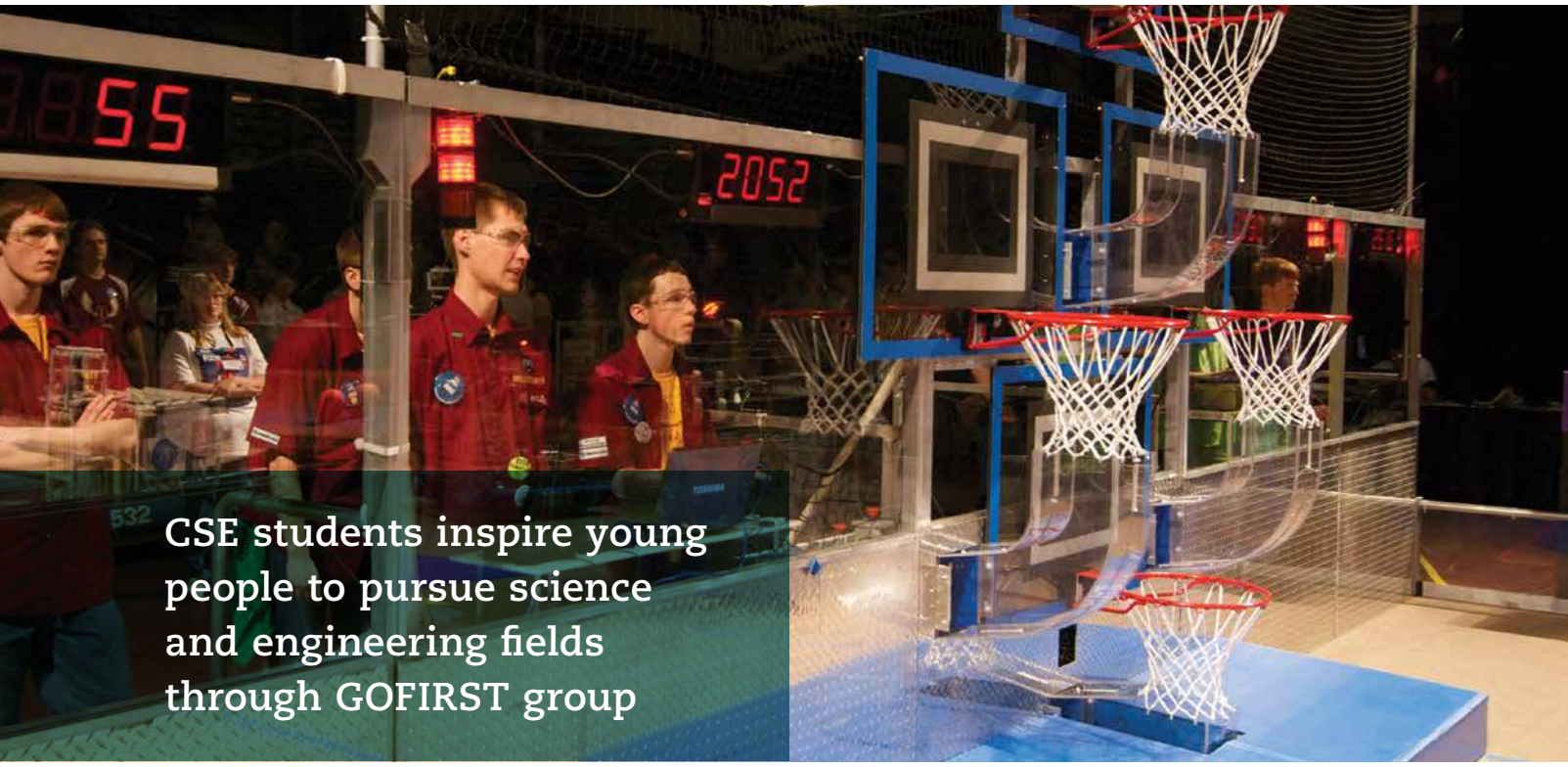
Since 2006, a total of 38 startup companies have been launched by the University. Listed below are companies launched by discoveries made in the College of Science and Engineering:

- **Argilex Technologies:** Membrane technology for separation processes such as those in the petroleum refining, chemicals and biofuels industries (Michael Tsapatsis, professor of chemical engineering and materials science)
- **cycleWood Solutions:** Low-cost biodegradable and compostable bags (Simo Sarkanen, professor of bioproducts and biosystems engineering)
- **Drive Power:** Web- and smartphone-based products that leverage emerging measurement technologies and predictive analytics to enable people to make more informed driving decisions (Max Donath, professor; Craig Shankwitz, program director; and Alec Gorjestani, research fellow; all in the department of mechanical engineering)
- **Heat Mining Company:** Process uses sequestered carbon dioxide to extract geothermal energy from the earth in order to generate electricity (Martin Saar, assistant professor of earth sciences)
- **SMART Signal Technologies:** Hardware and software solutions that can be used to reduce traffic congestion on major signalized arterial highways (Henry Liu, associate professor of civil engineering)

WRITTEN BY SILVA YOUNG

PHOTOS BY RICHARD G. ANDERSON

A slam dunk for Science and Engineering



CSE students inspire young people to pursue science and engineering fields through GOFIRST group

The "Knight Krawlers," FIRST Robotics team from Irondale High School manipulate their robot into shooting position from the sidelines. The team is mentored by Bryan Herbst, College of Science and Engineering computer science student and president of the GOFIRST student group.

At first glance, it could be a rock concert—an arena filled with young people in costumes, loud music, and hundreds of cheering fans. Look closer at center stage, and you see robots of various shapes and sizes hurling basketballs trying to score points. From the sidelines, teams of high school students, dressed in wacky costumes—some as mad scientists—use computers and joysticks to manipulate and operate the robots.

It's all part of the Minnesota Regional *FIRST* Robotics Competitions held every spring at the University of Minnesota Mariucci and Williams Arenas. The annual event—a sort of "varsity sport for the mind" if you will—was conceived by *FIRST* Robotics Competition founder Dean Kamen, an inventor, entrepreneur, and tireless advocate for science and technology.

Through *FIRST* (which stands for "For Inspiration and Recognition of Science and Technology")—now a worldwide organization—Kamen is determined to help young people discover the excitement and rewards of science and technology. He believes he can reprioritize society to value inventors the way it values sports heroes.

Helping to put that mission into action is the University of Minnesota's GOFIRST (Group Organization for FIRST) student group, which was founded in December 2009 with six students and four high school robotics teams. Last year, the group's 30 members mentored 11 Minnesota high school teams.

Dedicated to the fields we love

The members of GOFIRST support Kamen's vision by primarily helping high school teams develop a successful robot for the annual *FIRST* Robotics Competition. They also volunteer at regional events and conduct outreach activities for students in Minneso-

ta. They are passionate about science and technology, and they want to encourage and inspire high school students to pursue education and careers in the STEM (science, technology, engineering, and mathematics) subjects.

"We're helping young people discover science and engineering is not just for nerds. It can be fun, exciting, and a cool thing," said Bryan Herbst, current president of the group and College of Science and Engineering student majoring in computer science.

Although GOFIRST is open to any University of Minnesota student, most of its members are students in the College of Science and Engineering, who participated in *FIRST* as high school students. Now as college students, they have a dedication to the program nearly impossible to match.

"I got involved with *FIRST* after attending the 2005 Championship *FIRST* Event as an eighth grader. That's where I met my future high school robotics team. My involvement in the program caused my parents to become volunteers. Through the organization, I gained so many skills—confidence, communication, and leadership," said Renee Becker, a recent College of Liberal Arts graduate in scientific and technical communications who served in a leadership role last year and was heavily involved as a student.

Becker, who says she was never much interested in robot design and operation, is an enthusiastic supporter of the program and mentored several teams on the competition's written requirements and team management aspects. She also spent a lot of time leading *FIRST* workshops, including one session where Girl Scouts could earn a merit badge.

"There is no mandatory amount of time required to participate in GOFIRST. It has a tendency to take on a life of its own," Becker said.

"Typically, you figure how much you plan to get involved, and then double that amount. It draws you in, and I've become pretty passionate about it," she added.

Herbst advised at least two high school teams this past spring, one of which was from Irondale High School in Mounds View, Minn. With his computer science knowledge, he was able to help with the team's website and robot programming.

"Volunteering can take up a lot of time, but school always comes first. We're able to do quite a bit of advising by phone and through email. We also use Skype a lot," Herbst said.

Collaborative teamwork

In addition to the robotics, each high school team is responsible for designing its own website and creating an optional animation film. There is also a fundraising component to the competition. Students must raise close to $12,000 before a high school team can even think of competing. The kit of parts alone costs $6,000.

At its core, the *FIRST* Robotics Competition is an annual engineering contest, with a different objec-

(Above right) Renee Becker, a 2012 CLA graduate and mentor, provides last-minute competition tips to the "Robettes." The team from Convent of the Visitation School in Mendota Heights, Minn., is the only all-girl FIRST Robotics team to participate in Minnesota.

(Left) FIRST Robotics participant displays his costume creativity.

tive every year. Each year, student teams design and build a 120-pound robot from a kit of parts made up of motors, batteries, a control system, and a mix of automation components, but no instructions. The teams are given only six weeks to complete the task, which begins in January,

During the process, the students learn about engineering, budgeting, time management, cooperation, and other life skills. "It's a little like running a small business if you look at all the components involved. Yet, the kids have a lot of fun as they build a robot, learn how to operate it, and get involved in so many ways, all as a team," Herbst said. "For me, I was able to come to the University as a freshman with a lot of technical knowledge that helped me in several classes."

"This is real-world engineering for students, and the kids get totally absorbed in the project," said Stephanie Hornung, director of programs for GO-FIRST and College of Science and Engineering student majoring in mechanical engineering. "It's also a great opportunity to reach out to kids on a much larger scale."

This past year's robotics challenge was called "Rebound Rumble," and it pitted two alliances of three teams each in a game that resembled basketball. The goal was to score as many baskets—arranged at varying heights—in two minutes and 15 seconds. The higher the hoop in which the basketball is scored, the more points the group receives. Groups were awarded bonus points if they balanced on bridges at the end of the match.

The competition isn't just about smashing robots into each other, even though there is a significant amount of "vigorous interaction" involved. Rather it is about such things as "gracious professionalism," communications, cooperation, and the acquisition, use, and sharing of knowledge.

FIRST COMPETITION TAKES A VILLAGE OF VOLUNTEERS

It takes a large and diverse group of volunteers to make the *FIRST* Robotics Competition successful; mentors and coaches guide the kids on their teams, event volunteers make the hundreds of seasonal events possible, and field volunteers continue to help the organization grow.

Among those dedicated volunteers is Gil Huie, a machinist for the Department of Civil Engineering. For the past five years, he has spent countless hours helping *FIRST* prepare for the annual competition.

"I enjoy helping the kids. It's fun to see the interesting robot designs they create," Huie said. In a very literal way, Huie's work with *FIRST* demonstrates his drive to give his best to tool and die making, volunteering, and education.

Huie became involved with *FIRST* in 2007 when Steven Crouch, Dean of the College of Science and Engineering, asked him to help the college host a regional edition of the national *FIRST* Robotics Competition. "He asked if I would handle some of the technical aspects by building prototypes of the scoring device, in addition to serving as the machine shop liaison for the local teams," Huie said.

The machinist happily accepted the challenge. He has helped every year since, except in 2009, when a battle with cancer forced him to sit out the competition.

Huie's contributions have not gone unrecognized. During the 2010 *FIRST* Robotics Competition, Dean Crouch asked Huie to attend an "impromptu meeting" at Williams Arena. Upon arrival, he heard the announcer saying, "we have someone who has been here since our program began. Here to present the award to Gil Huie for 'volunteer of the year' is Dean Kamen!"

Stunned by the news, he walked out onto the court, received a handshake of thanks and the award from Kamen, the founder of *FIRST*. "I was so surprised. I knew there were a lot of other people who deserved it just as much as I did," Huie said.

In addition, his volunteerism has drawn attention from the University's highest leaders. In 2008, Huie received the President's Award for Outstanding Service, the highest award given to a staff or faculty member.

Huie credits his love of precision engineering, dedication to helping others, and earnest interest in sharing his knowledge and skills with others. "You don't have to be the best, but be diligent, do your job, and be the person people can count on. Then you'll receive your rewards," Huie said.

Providing a helping hand to the Willmar High School robotics team, "WARPSPEED," is Gil Huie, a machinist in the Department of Civil Engineering. For the past five years, Huie has served as the machine shop liaison for the teams and helps with the technical aspects of the FIRST Robotics Competition held every March.

Inspiring the next generation

"At the heart of the competition is a collaborative approach—it's a community and there are no trade secrets," Herbst said. "We learn from each other and help each other. As a former *FIRST* high school participant, I'm able to share what I know and be a role model to the kids I mentor. It's empowering to know I'm possibly helping to motivate the next generation of scientists."

According to a survey conducted by Brandeis University in Waltham, Mass., students who participated in the program are more than three times as likely to major in engineering, and more than twice as likely to pursue a career in science and technology.

Similarly, as the *FIRST* Robotics program has grown, so have the number of CSE students who participated in the program as high school students. In 2008, 12 CSE freshman students had participated in *FIRST* when they were in high school and this fall, that number had grown to 76.

In addition, PTC (Parametric Technology Corporation) sponsors two annual scholarships of $5,000 per year available to two students enrolled in the College of Science and Engineering. The scholarships are renewable for a total of $20,000 over four years. CSE students who participated for at least one full season on a *FIRST* Robotics Competition team in high school are eligible to apply for the scholarship.

"*FIRST* is the reason I decided to major in mechanical engineering," said Hornung. "I was always good at math and science as a high school student in Edina, Minn., but I didn't have a clear career path in mind. Participating in *FIRST* showed me the mechanical side of things. I love what I'm studying and knowing that engineering is a viable career choice for me is exciting."

"Building robots is not the only thing we're doing. We are inspiring the future roboticists, engineers, educators, and entrepreneurs. Even if we've inspired only a few, we've done our job," Herbst added. ■

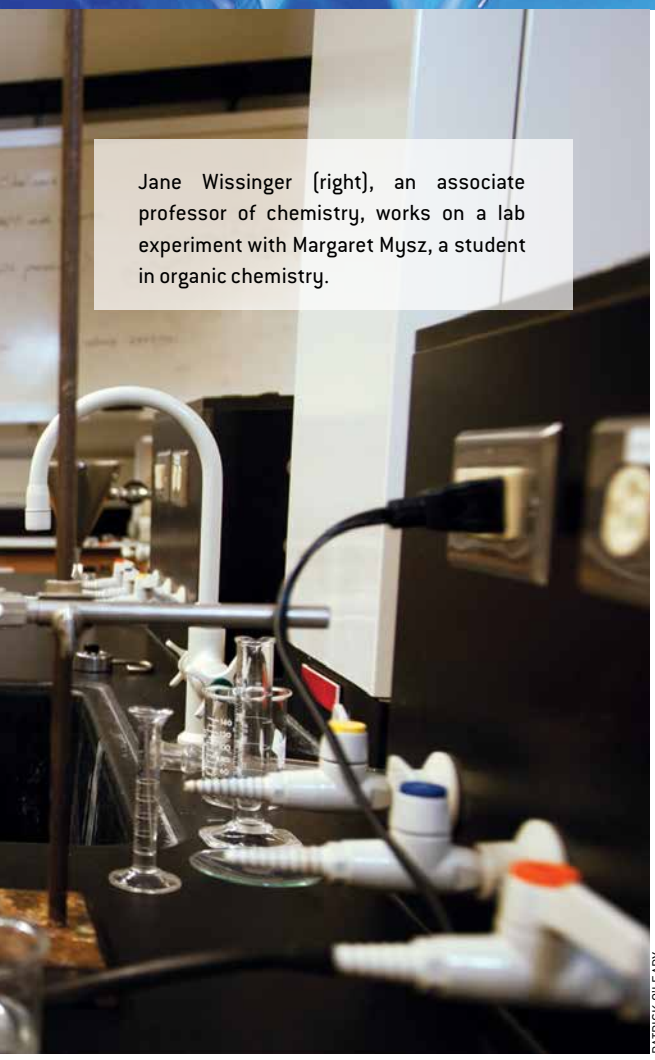
For three days last spring, nearly 160 teams participated in the FIRST Robotics Competition held in Mariucci Arena and Williams Arena.

University of Minnesota GOFIRST team members mentored "The Blizzard" a FIRST team based at the Courage Center in Golden Valley, Minn. The organization offers services to people with disabilites or complex health conditions. Team members include students with and without disabilities in grades 9-12.

Head of the CLASS

WRITTEN BY **RICHARD BRODERICK**

College of Science and Engineering faculty are changing the traditional approach to teaching students



Jane Wissinger (right), an associate professor of chemistry, works on a lab experiment with Margaret Mysz, a student in organic chemistry.

PATRICK O'LEARY

In the traditional approach to college teaching, most class time is spent as the professor lectures and the students watch and listen, but several University of Minnesota faculty are changing this tradition.

A much better way to teach—particularly courses in science and engineering—is focused less on textbooks and lectures and more on engaging students as active participants in the learning process. By getting them to use their hands and brains to design something or work cooperatively, suddenly the material begins to make sense.

College of Science and Engineering faculty members are in constant pursuit of better ways to impart knowledge and spark the flame of curiosity in their students. CSE professors—world-renowned for groundbreaking research—are as dedicated to the science of learning as they are to the science of their chosen discipline. Ultimately, the one quality that may characterize the best and most innovative teachers is that they themselves are forever students, not just in their respective fields but also of teaching itself.

Three CSE faculty members—Michelle Driessen, Ned Mohan, Ken Heller, and many others in the college as well—are forever on a quest to find the tools, the methods, and the concepts that will improve the teaching process. They make improvements by recognizing that the knowledge students need for real-world, problem-solving situations includes not just facts and techniques but also ways of knowing, thinking, and seeing the world.

Michelle Driessen: A recipe for success

Changing the way chemistry labs are taught began in a moment of despair for Michelle Driessen, assistant professor of chemistry.

"I was beginning work to create new experiments for a verification chemistry lab, often referred to as a "cookbook" lab, and I was depressed because I was making sure nothing unexpected might happen," confesses Driessen. "It just took all the fun of chemistry out of the work."

Taking the fun out of labs has long been standard practice where experiments are all laid out in advance. Most chemistry professors would agree that laboratory instruction goes hand in hand with learning chemistry. However, many have grown increasingly concerned that the conventional lab-

> "What I overheard from students was great. They were brainstorming, bantering back and forth, and really working at a high level of analysis."
>
> –MICHELLE DRIESSEN

JAYME HALBRITTER

Michelle Driessen, assistant professor of chemisty, has led an overhaul of general chemistry laboratory classes at the University of Minnesota by challenging students to figure out how to solve problems instead of simply answering questions.

> "What makes him such a great teacher is that he's really passionate about teaching. He is always looking for a better way to present the materials."
>
> —ETHAN TORREY, TEACHING ASSISTANT

oratory format is functioning as a kind of kitchen where students follow recipes with little thought or understanding.

Driessen set out to ensure that students learn more from their freshman chemistry labs than just how to follow directions. She sent an email to other department faculty announcing her intent to overhaul the way chemistry labs are taught.

The feedback she received led her to a literature search of lab manuals for general chemistry. That's how Driessen happened on a professor at Clemson whose lab manual was one of a very few designed to engage students' higher-order thinking skills.

"Well, I thought conducting that kind of lab would be easy in a school where there were only 24 students in a class, as opposed to the 4,000 students who take labs here at the University every year," she said. Driessen's concern vanished when she learned that Clemson similarly has thousands of students participating in general chemistry labs each year. In fall 2010, Driessen visited the school.

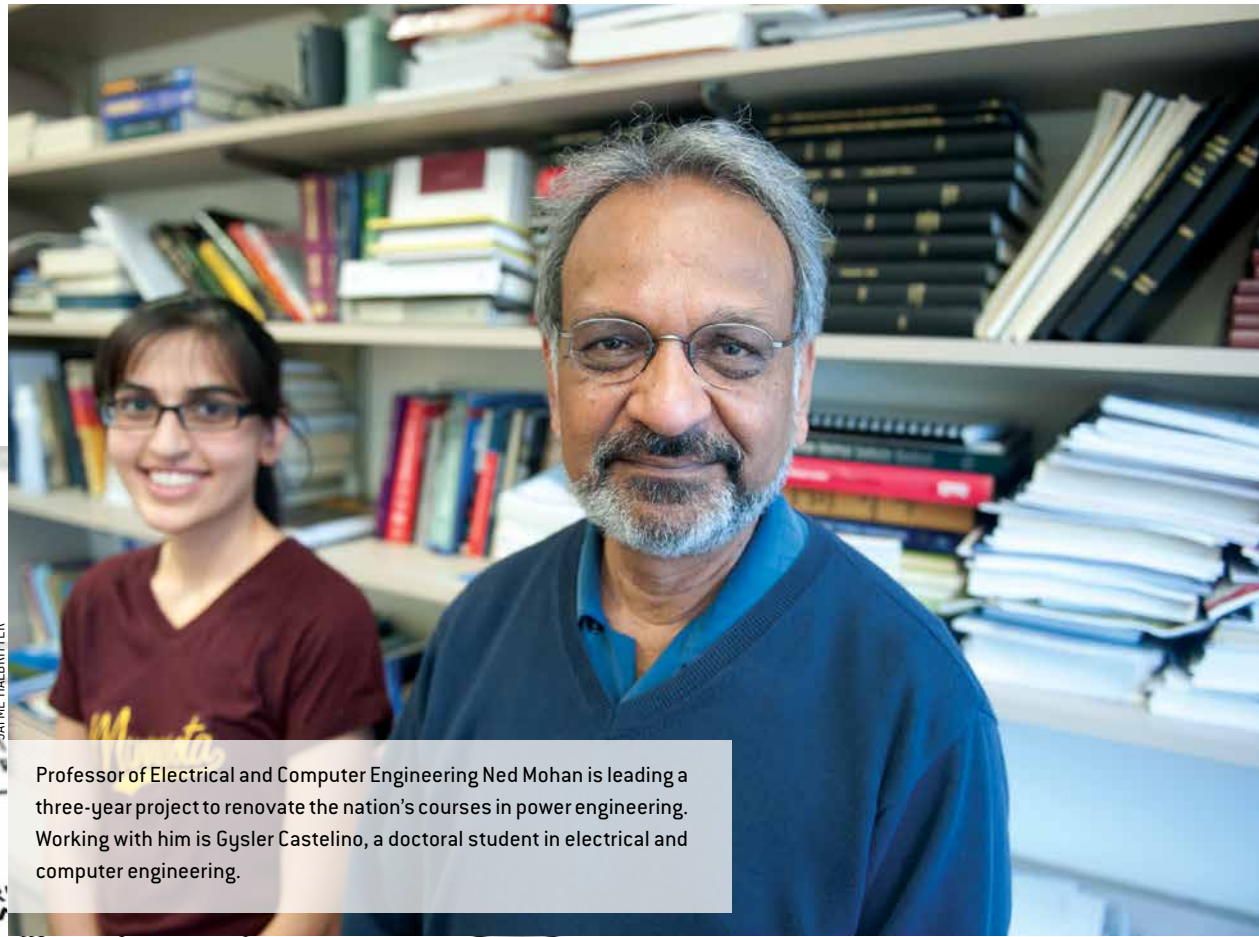
"I spent a few days there, just sort of lurking in general chemistry labs. What I overheard from students was great," she said. "They were brainstorming, bantering back and forth, and really working at a high level of analysis."

She returned to the University with a plan to create "problem-based" labs. Students are given an experimental problem to solve, materials they will need, and then hints at approaches they might take to find a solution. Rather than acting as the expert at the center of the lab, teaching assistants now serve as coaches and on-site resources.

In the summer of 2011, Driessen "test-piloted" general chemistry's first problem-based lab with 112 students, giving a roster of four experienced teaching assistants the opportunity to make the transition with a very small class. That fall, the department rolled out the new style labs for all students enrolled in Chemical Principles I, followed by Chemical Principles II in the spring. As of the end of spring semester 2012, nearly 3,000 students completed the courses.

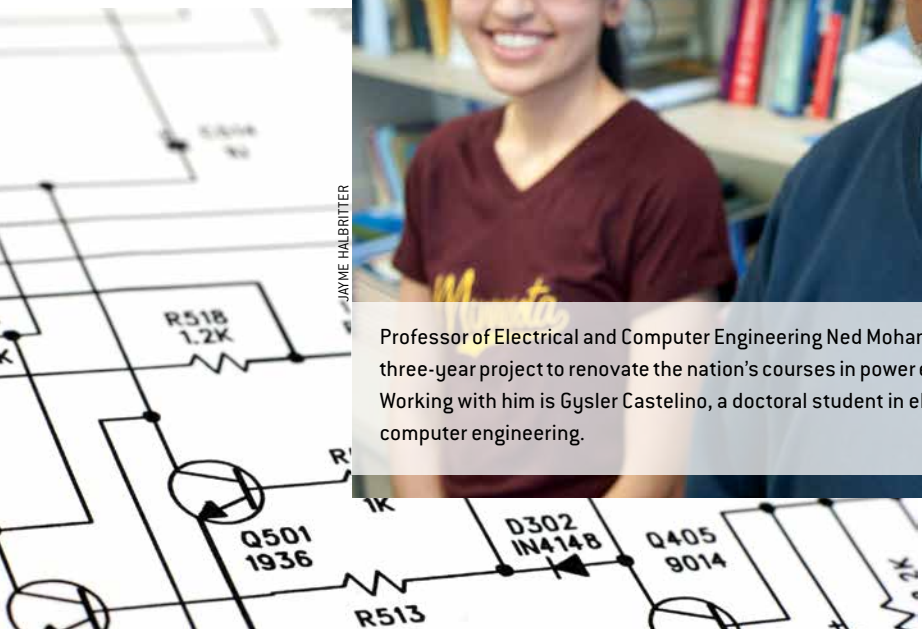
Not only are the problem-based labs a new challenge for students—many of them fresh from structured labs in high school—they also represent a new challenge for teaching assistants.

"For us, the old labs were easy because there was a right and wrong answer. You knew the concepts to be taught, the outcomes to be achieved and all the procedures were standard," explained Amanda Maxwell, a teaching assistant who worked the first



JAYME HALBRITTER

Professor of Electrical and Computer Engineering Ned Mohan is leading a three-year project to renovate the nation's courses in power engineering. Working with him is Gysler Castelino, a doctoral student in electrical and computer engineering.



new lab in summer 2011 and now serves as both a teaching assistant in general chemistry and as a teaching assistant mentor.

"That's not the case anymore," she said.

Whatever the challenges may be, Driessen says the transition is paying off, making students more effective learners as they emerge from the new labs with a better understanding not just of chemistry but also of problem solving itself.

"When I've asked students to compare our problem-based labs with old-style verification labs," Driessen said, "they tell me the big difference is because they are now involved in designing the experiments in our labs, they will never forget how they did it."

Ned Mohan: Powering Change

When it comes to leading the charge in reforming the way electric and power energy systems are taught and their curriculum written, it's hard to keep up with Ned Mohan.

A professor in the Department of Electrical and Computer Engineering, he's written five textbooks, each reflecting his objective of engaging students in a field—power electronics—that, until recent times, had been languishing in an enrollment backwater. He's the principal investigator of a three-year nationwide project seeking to revitalize the country's power engineering programs.

He's also the driving force behind the Consortium of Universities for Sustainable Power, or CUSP, 145 universities that use, offer feedback on, and promote curriculum developed at the University of Minnesota. At the moment, that curriculum consists of three undergraduate courses—Power Electronics, Electric Machines and Drives, and Electric Power Systems all written by Mohan.

"We need to add five graduate-level courses by the end of the year, which is no easy task. To accomplish that deadline, we should be even busier than we are," he said about CUSP with a sarcastic smile. "It appears that we will be able to reach that goal."

And if all of the above were not enough, Mohan is highly regarded by students as well. A Morse-Alumni Distinguished Teaching Professor, he's received the Distinguished Teaching Award from the College of Science and Engineering, the Outstanding Educator Award from the Power Engineering Society of the IEEE in 2008 and that organization's 2010 Undergraduate Teaching Award.

"The pedagogy we've developed is sometimes called a mixed or blended mode of teaching," he explains. For his own lecture classes—which averages 100 students each—his research and exploration have provided him with a novel way to deliver lectures. He records them on videos that are about 10 to 15 minutes long. "Because there are no interruptions as there would be in an actual class," Mohan explains, "they are the equivalent of a 45 or 50 minute in-class lecture.

He then posts the video lectures on Moodle, an online instruction program, where students review them and take a concept quiz that essentially tests whether they have, in fact, reviewed the video. Before showing up for class himself, Mohan reviews questions and comments posted on the Google account he creates for each course. He shapes the day's lessons in part around the questions posted by students.

"So what do we do in the class? We crack a few jokes and go home," he quips. "In reality, the approach allows us to engage in lots of real world open-ended discussions—discussions in which students use clickers assigned to their University ID to respond to questions, which is a real incentive for class participation. Over the past few years, the attendance in my classes has reached 90 percent," he said.

"What makes him such a great teacher is that he's really passionate about teaching," observes Ethan Torrey, who has been a teaching assistant in several of Mohan's courses. "He is always looking for a better way to present the materials."

"There are lots of teachers who are good lecturers, but he engages students and makes his classes feel fresh in a way that's unique," said David Orser, a doctoral student in power electronics who completed Mohan's course in advanced drives.

"My goal is to teach someday," Orser said. "It's easy to see how I could apply some of his techniques to my own career."

Ken Heller: Cooperative Learning

In a sense, it was self-interest that got physics professor Ken Heller into reforming the way physics is taught at the University.

It was in the early 1980s and he was a junior faculty member. The department chair asked him to teach the algebra-based introduction to physics class—a course that was about as unpopular among faculty as it was among the students consigned to taking it as a requirement of one of several majors. Heller told the chair he would take on the noisome chore—but only if he could make changes to it. "Go ahead," was his response.

"If I was going to teach it, I was going to know why," explains Heller. Working with colleagues in physics as well as the College of Education, he devised a questionnaire for faculty in the dozens of departments that require students to take Introduction to Physics to find out what their goals and expectations were for the course.

Since then, Heller and his colleagues in the Physics Education Research Group have helped to bring

"And what's the next step in learning something? You need coaching. You need to try it yourself with someone giving you feedback in real time."

–KEN HELLER

Ken Heller, professor of physics, and his colleagues in the School of Physics and Astronomy are changing the way physics courses are taught by introducing students to cooperative problem solving.

JAYME HALBRITTER

about innovation in the teaching not just of Introduction to Physics, but many of the courses in the department.

In structuring his own lectures for Introduction to Physics, Heller draws upon a theory of learning called Cognitive Apprenticeship. It is premised on the notion that part of teaching is a matter of a master teaching apprentices through the use of modeling behavior; by making the implicit processes involved in carrying out a complex task visible, students can observe and then practice those skills under the coaching guidance of a teacher or teaching assistant.

He likens this approach to the steps you would take to teach someone how to play baseball.

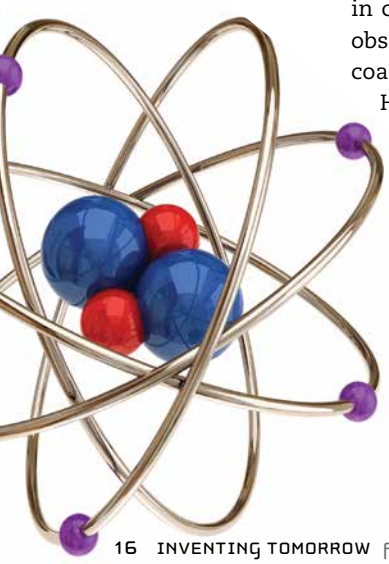
"What's the first thing you do? You take the person to a baseball game," he said. "You don't start with an explanation of the aerodynamics of a spheroid."

"And what's the next step in learning something?" he asks. "You need coaching. You need to try it yourself with someone giving you feedback in real time." In different forms, coaching is built into all three components of his Introduction to Physics classes—lectures, discussion groups, and labs—all with the use of a group to provide mutual coaching to solve a problem.

"In both the discussion groups and the labs, the emphasis is on cooperative problem solving," explains Evan Frodermann, a teaching assistant in Heller's Introduction to Physics class geared specifically toward pre-medical students. "There is a tendency for people to solve problems on their own and then compare their answers with other people in the team rather than solving the problem cooperatively—which is actually a much more efficient way to solve problems."

And making that conceptual leap is an invaluable lesson explains Anne Doering, a post-baccalaureate student who has returned to school in order to apply to medical school.

"The approach to problem solving I've acquired in Introduction to Physics has changed the way I think about and approach problems," she said. "As professor Heller has said, a problem is a question you have no idea how to solve. Today, because of him, I find myself much better equipped to deal with such unfathomable questions." ■



The Virtual Classroom

IN THE PAST, there was only one way to go to class—physically show up in person. Now students can view and listen to lectures from the comfort of their dorm room or elsewhere on campus just by flipping open a laptop. One such course, offered through the Department of Bioproducts and Biosystems Engineering, is BBE 2201: *Renewable Energy and the Environment.*

Originally offered in the traditional classroom format, the three-credit, broad-based introductory course was created about five years ago by Shri Ramaswamy, Department of Bioproducts and Biosystems Engineering Professor and Head, and Richard Huelskamp, an instructor in the department. Student interest became so great that there was a wait list to enroll. In summer 2011, David Schmidt, a research engineer and instructor in the Department of Bioproducts and Biosystems Engineering, redesigned the course and made it available completely online to accommodate the growing demand.

Since then, more than 1,000 students have taken the course that provides an overview of renewable energy technologies and industries, and fulfills the liberal education requirement for "Technology and Society." More than 600 students enrolled for spring semester 2012.

As the online course has evolved, Schmidt has pushed the boundaries of available technology. Lectures from expert faculty, agency staff, industry, and non-profits are pre-recorded using a video camera, microphone, and Smart Podium, which allows lecturers to write directly on PowerPoint presentations. This combination makes the lectures more interesting than narrated PowerPoint presentations.

Schmidt uses Moodle, (Modular Object-Oriented Dynamic Learning Environment) a free source e-learning software platform, to post the course syllabus, all the lessons, and grades. He also uses the Moodle technology for class discussions, written paper submissions, and quizzes, which get graded and provide feedback immediately online.

"To help students assimilate what they learned in the lesson, they are required to write a short reflection on the lesson topic. From what I have heard from the students, I believe that online education can be a very effective means of educating students and I can support that claim with the positive feedback from the students on the course." he said.

Schmidt has structured the class to help procrastinators because there are strict due dates on the lesson quizzes and reflections. "Once you miss the deadline, you don't have the option to go back. It's similar to real world project deadlines," he said. "The course provides a lot of flexibility, but still quite a bit of structure."

Lessons are posted a couple weeks prior to their due date giving students the opportunity to work ahead, which about one-third do. "The course really benefits those students who are organized, and for those who set goals and stay on track," said Schmidt. "Whether organized or not, most students are able to do well in the class."

The course culminates in a final project called "Do Something and Report It." Students must "do something" related to one of the topics presented in class and effectively present to their peers what they did by creating a fact sheet, a PowerPoint presentation or a video, and posting it on the course website. Many students prepare videos and post their work to YouTube. Students receive feedback on these projects from their peers. "The presentation topics have current relevancy and are very diverse," said Schmidt. "Most students are extremely creative and have fun with the project, but also learn quite a bit because of the practical nature of the assignment."

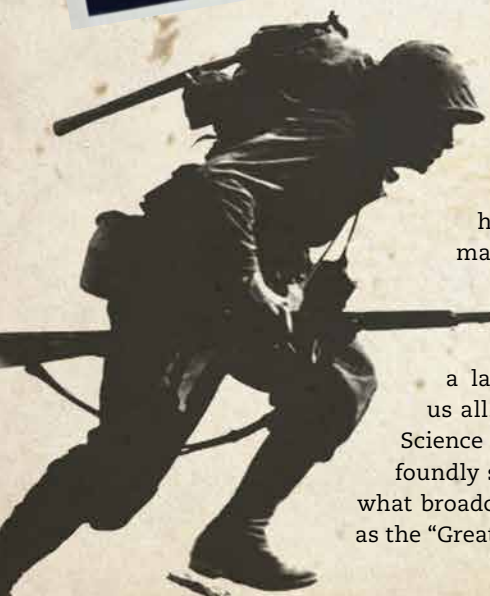
According to Ramaswamy, there seems to be a definite paradigm shift in education, and technology is breaking down the barriers. "In the future, we may see more students listening to lectures online, followed up with smaller, in-person discussion classes. This way, students and faculty can use time more efficiently," he said.

"This method of teaching is very effective," Schmidt added. "Students can listen to the lecture over and over again, and pick up anything they may have missed the first time."

> "The course provides a lot of flexibility, but still quite a bit of structure."
>
> —DAVID SCHMIDT

BBE 2201: Renewable Energy and the Environment is an online course that gives an overview of renewable energy technologies and industries; the environmental, technical, social, and economic challenges and opportunities. To view student projects, visit YouTube and enter "DSaRi project" [Do Something and Report It] in the search bar.

Tales from the "Greatest Generation"



During the second world war, college of science and engineering alumni enlisted in military service with a sense of purpose.

WRITTEN BY **KERMIT PATTISON**

PHOTOS BY **RICHARD G. ANDERSON**

We all know of people who lived during World War II—parents, grandparents, and College of Science and Engineering alumni. Yet, we may have never heard their stories. These remarkable people—who grew up during the Depression, came of age during this time of unrest and participated in the post-war boom—created a lasting legacy that continues to shape us all. In this story, we meet four College of Science and Engineering alumni who were profoundly shaped by World War II and exemplify what broadcast journalist Tom Brokaw has hailed as the "Greatest Generation."

One infantryman-turned-engineer came back from the war and pioneered sensor technology for jet aircraft. Another overcame the indignity of being interned in a relocation camp for Japanese-Americans and rose to become one of the government's most trusted Cold War scientists.

Another civil engineer helped rebuild battle-ravaged Okinawa and went on to found a leading civil engineering firm. Yet another served as a Navy aircraft mechanic in the Pacific and came home determined to finish his education, allowing him to launch a successful company that helped lay public infrastructure in the post-war boom.

All their educations were interrupted, or accelerated, by the war. They grew up fast, came home with a sense of purpose, finished their education, and leveraged their degrees into successful post-war careers in engineering and technology. Here are just a few of their stories.

Dick DeLeo: From Infantry to Aerospace

Dick DeLeo (Aero '46, M.S. '48) used his ingenuity to help the aeronautics industry reach supersonic speeds.

Growing up in St. Paul, Minn., DeLeo became fascinated in the then-burgeoning field of aviation. As a boy, he built model planes and flew them in his backyard. By the time he entered the University in 1940, he knew he wanted to study aeronautical engineering.

He landed in the right place. Founded in 1929, the department was one of the first accredited aeronautical engineering programs in the United States. By 1940, Minnesota enrolled about one out of every seven aeronautical engineering students in the country.

Then the war intervened. DeLeo enlisted in the Army reserve and was called to active duty in 1943. Later, with the 84th Infantry Division, his unit served in Belgium and Germany and took part in the Battle of the Bulge.

"I was attached to regimental headquarters, which was a fairly good job," he said. "We did mainly sentry duty, guarding the command post and collecting German POWs. It was a cushy job."

The war stamped DeLeo with a sense of discipline and purpose. Within 10 days of returning home, he re-enrolled in the University and graduated in August 1946. "It matured you," he said. "You came back and settled down pretty fast."

DeLeo went to work at Rosemount Aeronautics Lab, a major research hub in the post-war years as the industry transitioned to jets and supersonic flight. The lab, located at the old Gopher Ordinance Works, had a number of wind tunnels where researchers could run experiments at high speeds.

"In those days, they were switching from propeller airplanes to jet airplanes," DeLeo said. "The measurement of altitude and airspeed became a lot more complex. The old techniques that worked with propellers weren't satisfactory. There were some good opportunities to come up with novel ideas."

Meanwhile, DeLeo continued his studies, earning a master's degree in aeronautical engineering in 1948. One of his greatest influences was Professor John D. Akerman, director of the Rosemount Lab and founder of the aeronautical engineering department.

Akerman was a memorable figure. Born in Latvia, Akerman served as a pilot with the Russian Imperial Air Service in World War I; after the Bolshevik revolution, he joined the French Air Force. He became one of the founding fathers of the early aeronautics industry in the Twin Cities. He designed a tailless airplane known as the "flying wing" (now at the Smithsonian Institution), served on the team that designed the wing of the B-29 bomber, did groundbreaking research into high altitude flight and developed early gas pressure suit and oxygen systems. DeLeo recalls him as a major influence—and stern taskmaster.

"His method of teaching was called the sink or swim method," DeLeo recalled with a chuckle. "He gave you a job and if you made a success, that was good and if you didn't, you flunked. He didn't really help you either way. Now, a lot of people didn't like that, but he created a lot of independence. He was mainly a creator of possibilities."

Dick DeLeo

> "In those days, they were switching from propeller airplanes to jet airplanes."
>
> —DICK DeLEO

DeLeo took advantage of those possibilities. He spent 10 years at the Rosemount lab. In 1956, a group of engineers from the lab spun off a company called Rosemount Engineering. DeLeo joined them the following year and spent the remainder of his career at the company designing instruments for measuring altitude and speed.

Dick DeLeo (Aero '46, M.S. '48), who served in the Army, was called to active duty in 1943. His unit took part in the Battle of the Bulge.

We regret to inform you that Dick DeLeo passed away as this magazine went to press. We send our deepest sympathy to his family.


WESTERN DEFENSE COMMAND AND FOURTH ARMY
WARTIME CIVIL CONTROL ADMINISTRATION
Presidio of San Francisco, California
May 23, 1942

INSTRUCTIONS TO ALL PERSONS OF
JAPANESE
ANCESTRY
Living in the Following Area:

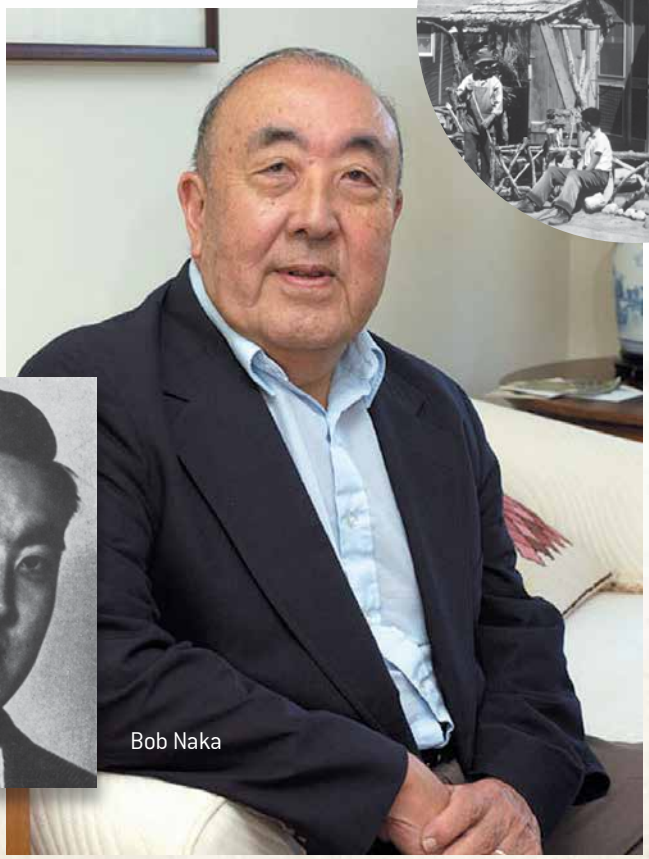
DeLeo rose to vice president of aeronautical research, a position he held 10 years until he retired in 1988. He developed technologies for 19 patents, about five of which became valuable products for Rosemount Engineering (now part of United Technologies). His inventions included a pressure pick-up tube mounted on the outside of the aircraft that measured speed, airflow, and altitude while compensating for air motion disturbances.

Eventually Rosemount sensors were flying on virtually every aircraft manufactured outside the Soviet block. They even went into space on the Space Shuttle.

All that was made possible by his education at the University. "It created my whole capability really," said DeLeo, now a 90-year-old retiree who splits his time between St. Louis Park and Florida. "I'm forever grateful for my education."

Bob Naka: From Internee to Top Secret Scientist

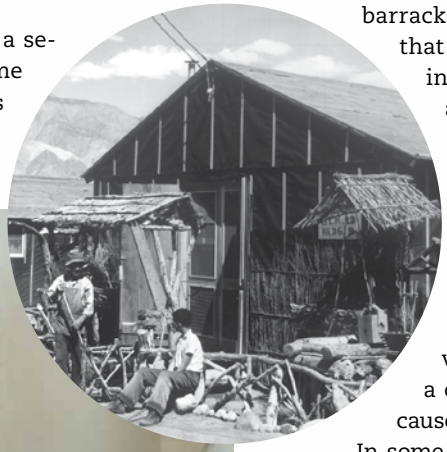
First Bob Naka was labeled a security threat. Then he became one of the U.S. government's most trusted scientists of the Cold War.


Bob Naka

Bob Naka (EE M.S. '47) was an engineering student at UCLA when Pearl Harbor was attacked. By early 1942, his family was ordered to move into the Manzanar internment camp (center circle) forcing him to leave school.

Naka (EE M.S. '47) was an engineering student at UCLA when the Japanese attacked Pearl Harbor. Two months later, President Franklin Roosevelt signed an executive order allowing the government to remove people of Japanese descent from the western United States. About 110,000 people were uprooted from their homes, jobs, and schools and sent to internment camps.

In the spring of 1942, the Naka family was ordered to report to the Manzanar internment camp in Owens Valley, Calif. Naka was forced to leave UCLA three quarters of the way through his sophomore year.



Naka recalls Manzanar as a dismal place. The barracks were built from uncured wood that shrank in the summer heat, opening gaps in the floors and walls and allowing sand and dust to blow inside. They shared a small room with another family and strung up sheets to separate living from sleeping areas.

"My parents were very stoic about the whole thing," he said. "Although it was unspoken, they were quite worried about me. I was a citizen of the United States, and because of that, I was not welcome in Japan. In some respects, I was a person without a country."

Naka spent nine months in the camp. Education proved to be his salvation. The National Japanese American Student Relocation Council (a coalition that included college administrators, government officials and religious groups, particularly the Quakers), helped 4,000 Japanese Americans attend colleges in the interior United States.

In the summer of 1942, Naka was told to start packing his bags: he was headed to Ohio State. Soon afterwards, however, students there protested and organizers decided it was unwise to send students there.

Naka remained in the camp until the following February when he was offered a place at the University of Missouri. On the eve of his departure his parents quarreled. "My father said 'I don't want him to go. He's our only child and it's dangerous out there,'" recalled Naka. "My mother got very irritated, and

said, 'I say he goes. If he stays here, he's as good as dead. If someone gets angry and kills him, at least he tried.'"

The exchange left Naka frightened—and his apprehensions only increased when he boarded a train full of soldiers the following day. Fortunately, he arrived in Missouri without incident and was warmly welcomed on campus. One electrical engineering professor urged Naka to continue his education by pursuing a master's degree at Minnesota and helped arrange a teaching position.

In 1945, Naka arrived in Minneapolis. Again, his department and fellow students welcomed him. "There was absolutely no harassment," he said. "The veterans were very friendly, and I got to know quite a number of them."

Naka excelled at Minnesota and did his master's thesis on high voltage engineering. His professors encouraged him to stay for his Ph.D. and pursue a career in teaching. Ultimately, he decided to go to Harvard for his Ph.D.

But Minnesota did provide Naka with one lasting gift. There he met his future wife, Patricia Ann Neilon, then a graduate student in child development. They married and had four children.

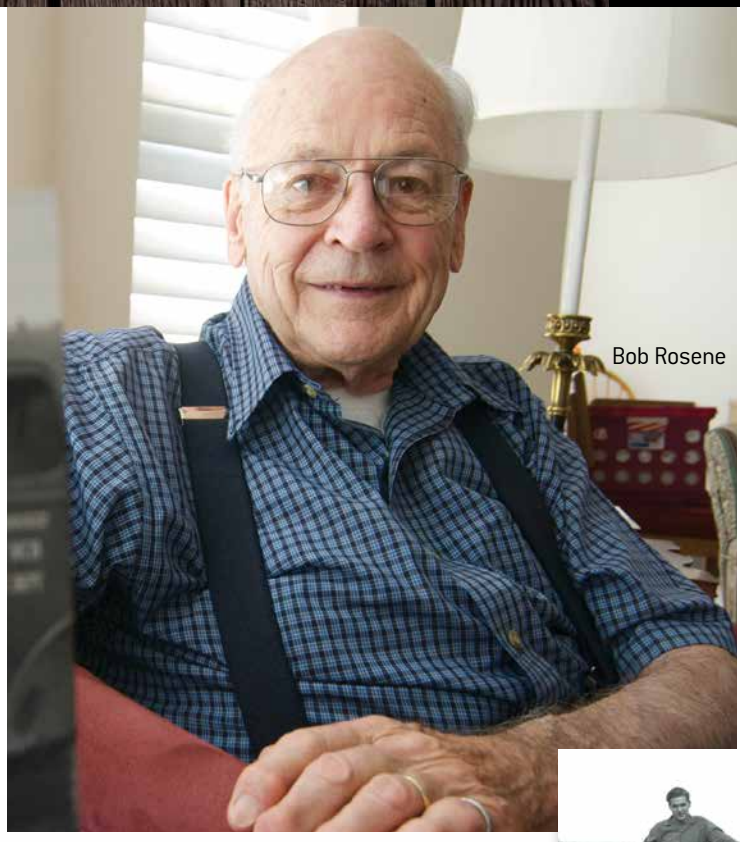
After earning his Ph.D. in electron optics from Harvard, Naka went to work at the nearby MIT Lincoln Laboratory, which was building the nation's first air defense system known as the Distant Early Warning, or DEW line. Given his wartime internment, he wondered if he would be cleared to work on classified projects. "With some trepidation, I filled out all the forms," he recalled. "Much to my surprise, I was given secret clearance."

That was just the beginning. Over the next several decades, the government increasingly would trust him with some of its most sensitive defense projects.

In 1956, the Director of Lincoln Laboratory asked Naka to step outside to talk privately. Sitting in a car outside, he was informed about his next assignment: a high-flying spy plane that could penetrate Soviet airspace. Until then, Naka had worked on radar technology; now he would switch hats and devise technology to *evade* radar—the beginning of what became known as Stealth Technology.

Naka was among a small group of people who knew details of what would become the U-2 spy plane. In 1960, the plane was revealed to the rest of the world when a U-2 piloted by Francis Gary Powers was shot down over the Soviet Union.

Meanwhile, Naka's career kept flying. From 1969 to 1972, he served as Deputy Director of the National Reconnaissance Office (NRO), a spy satellite organization. He spent three years as Chief Scientist of the U.S. Air Force and about 10 years as Vice President of engineering and planning of GTE Government Systems Corporation. He also served on the NASA Space Program Advisory Council, Trustee of the Aerospace Corp., as a member of the Board of Directors of Simmonds Precision Products, Inc. and Hercules Aerospace Corp., the U.S. Air Force Scientific Advisory Board, and as a private consultant.



Bob Rosene

Toward the end of the Cold War, Naka's boss asked him whether he had been interned. His boss, John L. McLucas, had an impressive resume: secretary of the Air Force and head of the NRO and administrator of the FAA. Yet even McLucas marveled at Naka's biography—the man who once had been interned for security reasons was now sending classified memoranda to the White House and running the U.S. government's super secret satellite agency.

"He remarked on the irony of it all," recalls Naka, now 88 and living in Concord, Mass. "He said 'only in America could such a sequence of events have occurred.'"

Bob Rosene: Out of the Rubble, a Career of Building

The Battle of Okinawa was the largest amphibious invasion of all time. Known as the "typhoon of steel," it raged for three months until the last pockets of Japanese resistance were wiped out in July of 1945.

Three months later, Bob Rosene (CivE '45, M.S. '48) a civil engineer from the University of Minnesota and newly commissioned ensign with the Navy Sea-

As a young officer trainee in the U.S. Naval Reserve, Bob Rosene (CivE '45, M.S. '48) was training for combat when Japan surrendered to the United States in 1945. Shortly thereafter, he was shipped to Okinawa to help rebuild the country.

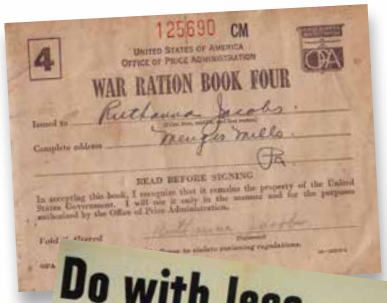
> "It was tough, but there was a war on. You did what you were told."
>
> —BOB ROSENE

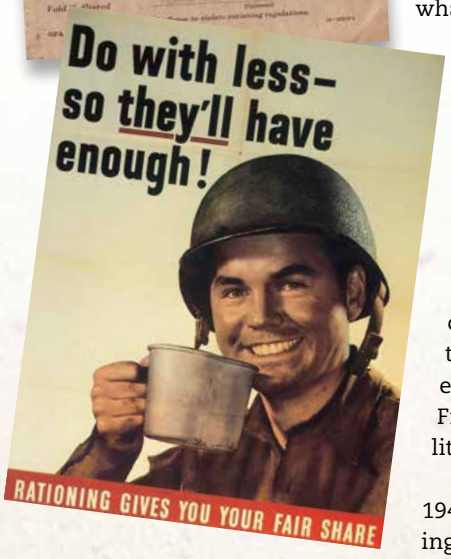
bees, stepped ashore and witnessed an island ravaged by war, which was occupied by many U.S. military units in the process of being deactivated.

"In the south end of Okinawa, there wasn't a single building left standing after the war," recalled Rosene, now retired in northeast Minneapolis. "Either it had been blown to pieces in the war or it had been bulldozed out of the way to make room for bases."

His path to Okinawa began two years before when he arrived at the University of Minnesota as an officer trainee in the U.S. Naval Reserve. The V-12 Navy College Training Program was established at colleges and universities around the United States to quickly train officers for the Navy and Marine Corps. Pioneer Hall was converted to a Navy barracks.

The program would leave most modern students in awe. The program packed three years of college into two with a military regimen that included uniforms, restriction to barracks, and daily physical fitness training. Trainees were expected to work 55 hours per week and took not only engineering classes but also military ones.





By the time Rosene graduated in 1945, half his fellow civil engineering students had dropped out. "We went around the clock, three semesters a year," he said. "It was tough, but there was a war on. You did what you were told."

Rosene graduated from the University with a civil engineering degree in June of 1945 and was sent to midshipmen's school. He was in combat training when the Japanese surrendered. The training ceased and he was commissioned as an ensign in the Navy Civil Engineer Corps to serve with the 36th Naval Construction Battalion or Seabees in Okinawa. One year earlier, the construction battalions had been celebrated by the John Wayne movie "The Fighting Seabees," which Rosene calls "a little more dramatic" than reality.

Rosene arrived in Okinawa in October 1945, about three months after the fighting ended. The island had seen the worst carnage of the Pacific and the death toll included about 150,000 Okinawans (one third of the population), from 75,000 to 100,000 Japanese Military and 14,000 Americans.

Almost no trees or buildings were left standing. Rosene's photo album bears testimony to the scene: Forests leveled by artillery barrage, blackened caves where Japanese soldiers had been burned out with flame throwers, crashed airplanes, and a landscape covered by construction sites, airfields, and military camps.

Rosene served as an officer with the Seabees until the battalion was deactivated. He was then transferred to the Navy Military Government. His duties in the battalion included security, overseeing the brig (mostly used as a drunk tank) and other administrative duties. The Military Government duties included helping to construct temporary housing for Okinawans whose villages had been leveled. They also helped them replant rice and sweet potato fields, rebuild village office buildings, and set up freezers for the local fishing industry. It was all to help the Okinawan citizens return to their normal lives.

Rosene left the island in the summer of 1946 when the U.S. Army took over all of the military government activities. He returned to the University of Minnesota for a master's degree in civil engineering and worked for private industry. In 1959, he teamed up with another University alumnus, Otto Bonestroo (CivE '49, M.S. '50) who was starting a new engineering firm. Later, Joseph Anderlik joined them. Bonestroo, Rosene, Anderlik and Associates, Inc. became one of the region's largest civil engineering consulting firms. By the time Rosene stepped down from the board of directors in 2002, it had grown to 400 employees with five offices.

In retirement, Rosene has remained active in several professional societies and has supported his alma mater. Bonestroo, Rosene, and Anderlik established a scholarship fund for civil engineering undergraduates and an award that recognized excellence in teaching. They established another fund for graduate study in civil engineering. Rosene also served on the advisory committee of the civil engineering department where he advocated greater emphasis on undergraduate teaching.

In 2004, he returned to Okinawa for the first time since the war and found it transformed from the place that he remembers. "It's the Miami of Japan now with big hotels and beautiful beaches," he said. "You couldn't recognize it at all from what it was before."

Keith Caswell: GI Bill Helps Launch a Successful Career

The aviators of the U.S. Navy and Marines played a storied role in winning the war in the "Pacific Theater." Keith Caswell helped keep them in the air.

When the war broke out, Caswell (CivE '50) was a student at the University and working part time on campus for the Minnesota Department of Highways. On January 10, 1942, he and two friends walked into a recruiting office and volunteered for the Navy Seabees.

"Two of the guys ended up with the Seabees," he

Keith Caswell

During World War II, Keith Caswell (CivE '50) helped to keep aircraft flying as a mechanic for F4U Corsairs and F6F Hellcats.

said, "and I wound up in aviation. I don't know why—I never asked!"

Caswell was stationed at the Naval Air Station at Wold-Chamberlain Field (now the Minneapolis-St. Paul International Airport) as an aircraft mechanic on the Boeing Stearman model 75, an open cockpit, single-engine plane used to train Navy pilots and nicknamed "The Yellow Peril."

The planes flew through the winter—a fact that Caswell remembers well because he occasionally had to fly in the open cockpit without the warm gear issued to pilots. "They wouldn't have to fly if it was 25 below zero," he said. "We had to fly with them too a certain amount of time. It was cold!"

In May 1943, Caswell was sent to Chicago to train in high performance engines. Shortly after, he was sent to Hawaii where he served as a mechanic for F4U Corsairs and F6F Hellcats, the top gun fighters of the "Pacific Theater." He also was trained as a rear-seat gunner for torpedo planes and dive-bombers and was slated to embark on the aircraft carrier USS Hornet for the invasion of Japan. Then the atomic bomb was dropped, Japan surrendered and Caswell was sent home.

He reclaimed his job in the highway department lab and picked away at his degree at night school. The war left Caswell convinced that he needed to complete his education. He quickly realized that most of the officers had one thing in common—they were college graduates.

"The G.I. bill was a real break to finishing," he said. "I had a couple of children. It allowed me to go to the University full time and supplemented the wages enough so that I could support my family too."

After a stint as an engineer for a housing contractor, he founded his own civil engineering and land surveying company. He found ample work in the booming suburbs of post-war America on projects such as water and sewer lines, sewage treatment plants, highways, bridges, gas pipelines, airports, and subdivisions.

Caswell Engineering Company (later renamed Consulting Engineers Diversified when he took on partners) grew to more than 100 employees.

During the war, Caswell vowed he would never fly on an airplane again; eventually his business grew so busy that he got a pilot's license and bought a plane so he could fly to project sites and clients.

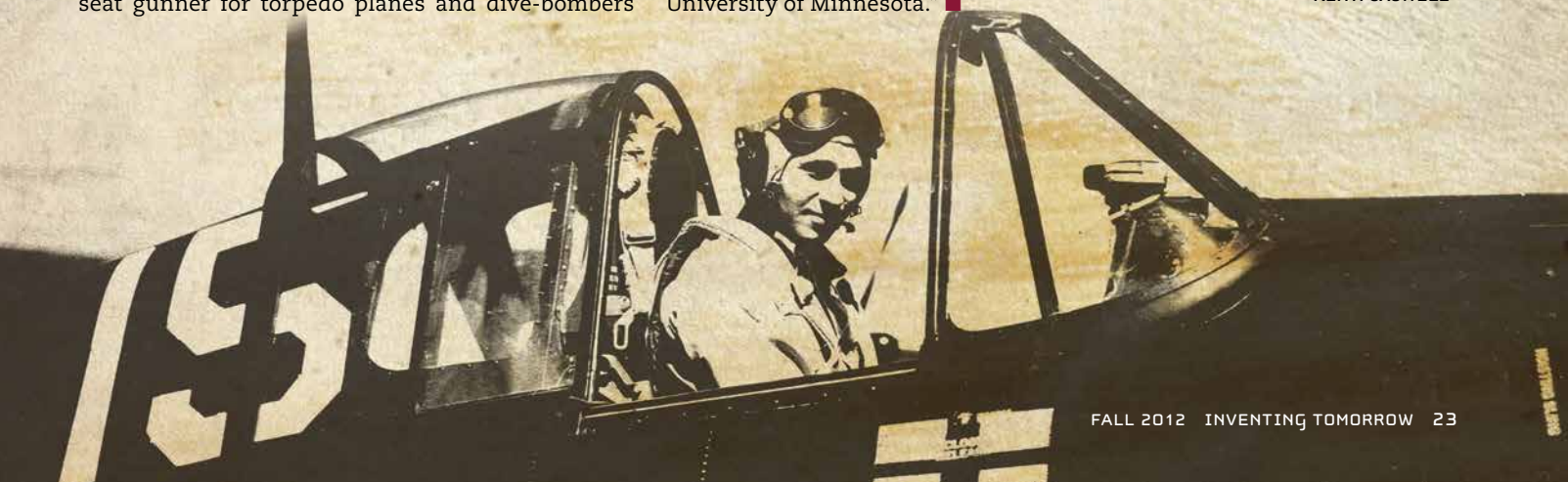
Caswell, now a 92-year-old great grandfather, still lives in Maple Grove with his wife Dona, who he married 10 days before he enlisted. As he drives through the suburbs today, he constantly passes sites where he helped lay out the infrastructure decades ago. And that, he adds, was made possible by his education at the University.

"We got an excellent background in the basic training for engineering," Caswell said. "We had some wonderful professors. It was always a good addition to your portfolio that you had studied at the University of Minnesota." ■

SHARE YOUR STORY

Whether you were involved in WWII, Korea, Vietnam, Gulf War, Iraq, or Afghanistan, we want to hear your stories and see your photos. Tell us how your U of M education helped you before, during, or after the war. Email your photos and stories to **csemagazine@umn.edu.** Read other people's stories at **cse.umn.edu/warstories.**

> "Two of the guys ended up in the Seabees, and I wound up in aviation. I don't know why—I never asked!"
>
> –KEITH CASWELL



A conversation with University of Minnesota President Eric Kaler

University of Minnesota President Eric Kaler (ChemE Ph.D '82) talks about the student experience, research, and how alumni can support the University.

Q. ***How did your education in the College of Science and Engineering impact your life?***

I was 22 years old when I arrived at the University in the fall of 1978 as a brand new graduate student. I was able to come to graduate school because of the fellowship the U provided for me. I found myself a graduate student in the world's best chemical engineering program. It was pretty daunting, but that major league research environment helped to mold me, not only as a scientist and teacher but also as a leader. I had great mentors and role models in Skip Scriven and Ted Davis. I've been forever grateful to them and the University of Minnesota for those four years of growing up.

My own story touches on what I believe is the key to Minnesota's future: We as a state must commit ourselves to maintaining a world-class research university, and to giving bright and eager students access to it, be they from Minnesota or around the world. This will help to drive Minnesota's economic and cultural prosperity.

Q. ***You emphasize the student experience. What does that mean for CSE students?***

One of my top priorities is to make sure our students have the resources and classroom experiences to help them earn their degrees in four years and be prepared for the workforce, and not just for jobs for today, but for jobs and technologies for the future. Of course, with all of our extracurricular activities, study abroad opportunities and thriving campus life, I'd also love for them to have a fun and fulfilling college experience.

CSE students have amazing opportunities to work side-by-side with world-renowned faculty to solve big problems. A renovated Lind Hall now gives them a great home base, and innovative teaching and guaranteed access to courses are reducing class sizes and improving graduation rates.

We're working to up the numbers of students of color in STEM fields. That will create a richer cultural experience for everyone. We're working to increase student financial support from our University of Minnesota Foundation. And my first biennial budget request to the state of Minnesota proposes a tuition freeze for resident Minnesota undergrads. Students come first on my agenda.

Q. ***What impact does CSE research have on Minnesota?***

We see our research enterprise as directly spurring economic growth in Minnesota and in tackling the state's most pressing problems.

There's a great tradition of CSE research, from the historic development of the pacemaker and airplane black box to today's innovations in medical devices, biomedical applications of nanotechnology, data mining techniques, smart grid technology, and clean energy innovations.

Today, intellectual property reforms at the U have made it easier for companies to license new technology developed in CSE. That fuels the economy.

In our legislative budget request, we've proposed a new program to focus research that supports key Minnesota industries. We're calling the initiative MnDRIVE, for Minnesota Discovery, Research and InnoVation Economy program. We're seeking $18 million from the state to fund research to develop robotics, sensors, and advanced manufacturing techniques; to secure the global food system; to address water quality issues around agriculture, mining and natural gas exploration, and to speed treatments for brain disorders, from Parkinson's to schizophrenia. CSE will be a central part of MnDRIVE's work. To learn more, visit:

www.umn.edu/president/speeches-and-writing

Q. ***How can CSE alumni support your goals for the University?***

First, you should know and be proud that the University is working to be the best steward of taxpayer money. What I call "Operational Excellence" is a long-term commitment to work smarter, reduce costs, and improve service. We are already producing success stories. Visit **excellence.umn.edu** to learn more.

Second, please remember that your gift, of any size, makes a difference. CSE raised $38 million last year. That money goes to student scholarships, it helped renovate Lind Hall, and it will help build an addition to Amundson Hall. These are great outcomes from dollars donated to CSE.

Third, consider volunteering. You can mentor a student or serve on an alumni board. You can provide students with professional networking opportunities that become jobs and careers, helping our placement office, which already does an outstanding job.

Finally, engaged alumni form a powerful army of advocates. I encourage you to go to our website—**SupportTheU.umn.edu**—for more information and to keep in touch as we seek to renew and revive our partnership with the state, to keep tuition low and our research enterprise world class. We need your support. Your voice matters and I hope you will have it be heard. ■

Two alumni receive service awards


Pat McGuire


John Mendesh

COLLEGE OF SCIENCE AND ENGINEERING alumni, Padraic (Pat) McGuire (ME '81) and John Mendesh (ChemE '79, MBA '84) have been awarded the University of Minnesota Alumni Association's Alumni Service Award. The award is given to University of Minnesota alumni by the Board of Regents in recognition of their service to the University or its school, colleges, or departments; or service to the University of Minnesota Alumni Association.

McGuire is a passionate and dedicated volunteer who has made significant contributions to the College of Science and Engineering. He currently serves on the college's Alumni Society Board, where he championed efforts to increase departmental engagement with industry and promote its science and engineering education outreach program to K-12 audiences.

For the past several years, McGuire has volunteered with the CSE Mentor Program, helping CSE students transition from academic to workplace life. He is well connected to the Department of Mechanical Engineering, presently chairing the Mechanical Engineering Advisory Council and previously as an advisor on the Strategic Planning Task Force on Undergraduate Education. He continually supports student experiential learning activities, which include the Solar Vehicle Project, student design projects, and co-op and internship programs at 3M.

Mendesh, a long-time advocate for the College of Science and Engineering, is a dedicated volunteer who demonstrates his commitment and enthusiastic support for the college and the University of Minnesota. He has provided outstanding leadership through his service as a member of the Dean's Advisory Board. He provides strong advocacy and is a passionate ambassador for the college as a member of the External Relations Committee, and has championed the college's strategic initiatives.

A lifetime member of the University of Minnesota Alumni Association, Mendesh also serves as a Board of Governors Member for the Evans Scholars Foundation and active supporter of alumni and Gopher Athletics events.

CSE celebrates "Legendary U"

Nearly 500 alumni attended the annual College of Science and Engineering Homecoming event at the University's Recreation Center on Oct. 12. This year's theme "Legendary U," celebrated the University's legendary aspects from academics to athletics, and research to alumni. The CSE event, which featured a casual barbecue, demonstrations by various CSE student groups, and a welcome from Dean Steven Crouch, was followed by the University-wide Homecoming Parade on University Avenue. Pictured above are Thomas Gasser (AeroE '86) and Jennifer Pischke (top center); Jennifer Diffley Benjamin (CivE '95) and her two daughters (bottom left); and Kaitlin Thell, current CSE student, and Andrew Ouverson (CSci '10) (bottom right).

Save the date: 50-year Reunion and Golden Medallion Society

RECONNECT WITH FELLOW classmates on May 9-10, 2013 when the College of Science and Engineering (formerly the Institute of Technology) Class of 1963 celebrates its 50-year reunion.

A reception on Thursday evening, May 9, will feature an induction into the College of Science and Engineering's Golden Medallion Society. The Golden Medallion Society honors those alumni who have reached the 50th anniversary of their graduation. Those who were previously inducted into the Golden Medallion Society, which includes the Class of 1963 and earlier classes, are invited to attend the reunion on Friday, May 10.

Events will include department tours, presentations by department heads and students, and more. Attendees will have an opportunity to learn about current research in the college and have free time to explore campus. Members of the Class of 1963 will be invited to join the academic procession during the 2013 College of Science and Engineering commencement ceremony on May 10.

Invitations, which will include details about the day's schedule, hotel and parking information, and registration information will be sent in March. In the meantime, please feel free to contact csealumni@umn.edu or 612-626-1802 with any questions.

ALUMNI RELATIONS TEAM

Ann Terry
Alumni Relations Coordinator
612-626-1802
asterry@umn.edu

Becky Kiefer
Alumni Relations Assistant
612-624-5537
kiefe069@umn.edu

CSE Alumni Relations
105 Walter Library
117 Pleasant Street SE
Minneapolis, MN 55455

csealumni@umn.edu
cse.umn.edu
612-626-1802
800-587-3884

INVESTING IN Tomorrow

BY KIM DOCKTER
DIRECTOR OF EXTERNAL RELATIONS

Affordable, quality education depends on your support

THIS FALL HAS BROUGHT even more of the best and brightest students to the College of Science and Engineering (CSE). Our 2012 freshman class has once again broken records in the total number of students enrolled (969), average comprehensive ACT score (30.6), and number of women (28.2 percent). In addition to seeing the quality of our students improve each year, we also get closer to fulfilling Dean Crouch's vision of increasing the number of science and engineering graduates by 30 percent by 2014.

To achieve this, we have worked to improve and expand our facilities to accommodate larger class sizes. The newly renovated Lind Hall, opened at the beginning of the semester, provides a home for CSE students for the first time. The first floor now houses our undergraduate advising, career center, student programs, and student organizations, and has become a great gathering place for CSE students. A new Physics and Nanotechnology building is under construction and set to open at the end of 2013. We will also soon begin construction for an addition to Amundson Hall, which houses our top-ranked Chemical Engineering and Materials Science Program.

As we all know, it takes more than just increased space and staff to support our students—we need to ensure that they are able to afford the high quality education they receive here and graduate without the pressures of overwhelming student debt—something President Kaler is also very committed to eliminating.

It is with that goal in mind that the University has created the Fast Start 4 Impact program. With Fast Start, you have a unique opportunity to:

- Create a new, named endowed scholarship supporting students.
- See the results of your giving right away.
- Continue your legacy with a scholarship or fellowship in your name.

For each new endowment fund of $50,000 or greater, Fast Start will pay four years of annual scholarship awards to students in an amount that is roughly equivalent to what the payout of the fully endowed fund will be at the end of the four-year pledge period. It is designed to build a permanent revenue source for student support and provide funds when they are needed most—right now. The program which was launched on September 1 of this year will continue through December 2014 or until all incentive funds are committed, whichever is first.

We are thrilled to help donors see an immediate impact from their scholarship or fellowship donation and to have more students helped right away. I would like to especially thank Dr. Tu Chen (Metallurgical Engineering Ph.D. '67) and his wife Pi-Fang for establishing our college's first Fast Start 4 Impact fellowship.

All of these objectives, though different in their size and scope, have the same goal—to better serve our students and ensure they receive the highest quality education. This would not be possible without your generous and loyal support of CSE. Thank you for being part of our continued success.

To learn more about Fast Start 4 Impact or any other giving opportunities, please contact Kim Dockter at dockter@umn.edu or 612-626-9385. ■

Donor profile

Alumnus believes in value of education

ROBERT HARTMANN (EE '65) spent his freshman year of college playing football for Hamline University in St. Paul, Minn. He loved football, but soon realized balancing practices, games, and his course load was difficult. Plus, the expensive private liberal arts college didn't offer a true engineering degree at the time. He transferred to what was then the University's Institute of Technology, where he decided to major in electrical engineering.

"I originally thought about civil engineering, but I remember feeling comfortable in a course I took on electrical circuits. I kept thinking, I understand this. I can do this. It's interesting and intellectually satisfying," Hartmann said.

After he completed his bachelor's degree in 1965, Hartmann began his career as a design engineer and design manager at several leading computer chip manufacturers, including North American Rockwell and Fairchild Semiconductor.

Hartmann went on to pioneer the world's first programmable logic circuit device, providing the technology industry with fast, efficient, high-density applications. He co-founded Altera Corporation, in San Jose, Calif., and holds seven U.S. patents.

"The timing for my degree couldn't have been better," said Hartmann. "I feel like I got the right degree at the right time."

Acknowledging that his college education served him better than he could have ever imagined, Hartmann now gives back to the college that helped to launch his success by creating the Robert F. Hartmann Scholarship Fund and the Robert F. Hartmann Chair in Electrical and Computer Engineering.

"My degree in electrical engineering was life changing, and I wanted to provide an opportunity for others to experience the value of a college education," Hartmann said. "When I was at the University, tuition was $125 a quarter. I worked my way through college, and I was able to graduate without any debt. That's impossible today."

He said funding the scholarship can compensate for some of the tremendous financial burden students experience today.

"Putting money into education is one of the few places where it can have a long-term, perpetual effect," said Hartmann. "It's similiar to that quote, 'teach someone to fish, and you feed him for a lifetime.' This is the best way I can contribute to society and where it has the most impact."

Amundson Hall expansion and renovation to begin

Construction begins on Gore Annex in early 2013. The building, featuring a cantilevered extension, is expected to be completed in mid-2014.

CONSTRUCTION WILL BEGIN in early 2013 on a renovation and expansion of Amundson Hall, home to one of the top-ranked Chemical Engineering and Materials Science departments in the world.

The expansion will be named the Gore Annex. Robert (ChemE Ph.D. '63) and Jane Gore provided a $10 million leadership gift for the project. Gore is the inventor of Gore-Tex.

The expansion will add 40,000 square feet including a new state-of-the-art materials lab. The six-floor addition includes two floors below ground and four floors above ground with connections to the existing building on each floor.

The project is driven by growing demand from highly qualified students at both the graduate and undergraduate levels seeking admission into the chemical engineering and materials science degree programs.

"We are setting all-time records for quality and demand, with roughly 10 times the number of applicants we expect to matriculate in the college," said Frank Bates, head of the Department of Chemical Engineering and Materials Science.

"This addition, which reflects our commitment to provide the best instruction nationwide, will give us a new undergraduate materials laboratory, and a bevy of instructional rooms dedicated to serving students," he said.

Perkins+Will was chosen as architect and Kraus-Anderson Construction Company has been selected as the general contractor for the project.

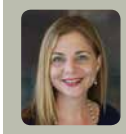
CSE dedicates renovated Lind Hall and unveils donor wall

Dedication ceremonies were held for the newly renovated Lind Hall on Oct. 12. Considered a home base for CSE students, Lind Hall's first floor now features the Career Center for Science and Engineering, CSE Academic Advising and Collegiate Life, the CSE Undergraduate Dean's Office, a Starbuck's Coffee, and student computer lab and study space in the renovated Taylor center. Funded primarily through private support, more than 135 individuals, companies, and foundations donated more than $4 million toward the project. The College of Science and Engineering is grateful to its generous donors including: (above left) with Dean Steven Crouch are Nancy and Clifford Anderson (Business '62); (above right) Carl Kuhrmeyer (ME '49), Vern Rylander (ChemE '60) and Paul Pankow (ME '56); and (left) Randy Schiestl (ME '77, MBA '84), VP of Research and Development, Boston Scientific. For more information and photos, visit: **z.umn.edu/lindhall.**

DEVELOPMENT TEAM

Let us help you determine your best options for supporting the college.

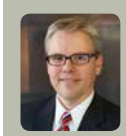
Kim Dockter
External Relations Director
612-626-9385
dockter@umn.edu



Joslyn Biever
Corporate Relations Director
612-625-6798
biever@umn.edu

Jennifer Clarke
Senior Development Officer
612-626-9354
jclarke@umn.edu

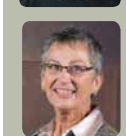
Anastacia Quinn Davis
Senior Development Officer
612-625-4509
aqdavis@umn.edu



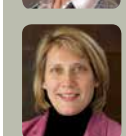
Paul DeGeest
Development Officer
612-285-4276
dege0106@umn.edu

Sally Euson
Senior Development Officer
612-625-6035
euson@umn.edu

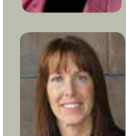
Shannon Birge Laudon
Associate Development Officer
612-626-8822
birge006@umn.edu



Mary Mahto
External Relations Assistant
612-626-7637
mahto005@umn.edu



Kathy Peters-Martell
Senior Development Officer
612-626-8282
kpeters@umn.edu



Jennifer Pogatchnik
Senior Development Officer
612-626-9501
pogat005@umn.edu

Office of Development
College of Science and Engineering
105 Walter Library
117 Pleasant Street SE
Minneapolis, MN 55455

csedevelopment@umn.edu
cse.umn.edu
612-624-5537
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Retrospect

BOB BEATTIE

IMA brings math to life for 30 years

Celebrating 30 years, the IMA connects scientists, engineers, and mathematicians to develop transformative, new mathematics.

In response to the National Science Foundation's (NSF) request for proposals to establish "a mathematical sciences research institute," the Institute for Mathematics and its Applications (IMA) opened its doors in the fall of 1982.

At the time, its founders Hans Weinberger, now professor emeritus in the School of Mathematics, Willard Miller, then School of Mathematics head and former IMA director, and George Sell, professor of mathematics and IMA associate director, envisioned a bold mathematics institute that would run counter to the prevailing trends in mathematical research.

They proposed a visitors' institute where mathematics focused on problems arising from other disciplines and from industry. Arguing that such an effort would lead not only to increasing the impact of mathematics on other fields, but also to an enrichment of mathematical research. This initial vision was realized and continues to this day.

Breaking down "silos" and crossing disciplines

Sell recalls that "the proposal resonated with the mathematical sciences community who felt mathematics, as an academic discipline, was becoming 'siloed' into sub-areas that did not talk to each other, let alone to the world outside."

Since the institute's creation—a direct result of the NSF competition—the IMA has successfully renewed its funding numerous times. The IMA's current award, which runs through 2015, stands among the highest funded math projects in NSF's history.

As a visitors' institute, researchers with common interests from across disciplines gather at the IMA to collaborate on topics related to an annual theme. Each year's focus is always on an important area of applied research where mathematics is poised to make a difference or in a subarea of mathematics and its diverse applications. As a result, many thriving research communities are launched by these innovative annual programs.

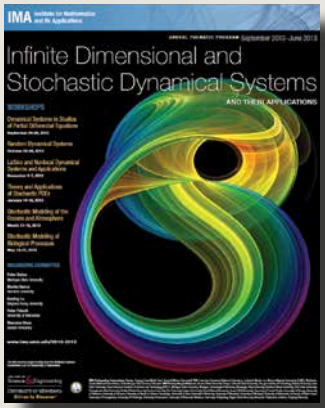
The IMA's 1982 thematic program was the first of several to focus on the mathematics of materials science. Today, the IMA is widely credited for its major role in helping to develop this field.

"The IMA's activity in the mathematics of materials, has had a huge impact, by nucleating then nurturing what has become a vibrant scientific community," said Robert Kohn, professor of Mathematics at New York University.

Transforming the world through mathematics

The IMA has held 31 annual thematic programs since 1982, and attracts nearly 1,200 visitors each year. "Thanks to the visionary leadership of Avner Friedman (1988–1998), Miller (1998–2001), and Doug Arnold (2001–2008), the IMA has become one of the most influential mathematical sciences institutes in the world," said Fadil Santosa, current IMA director.

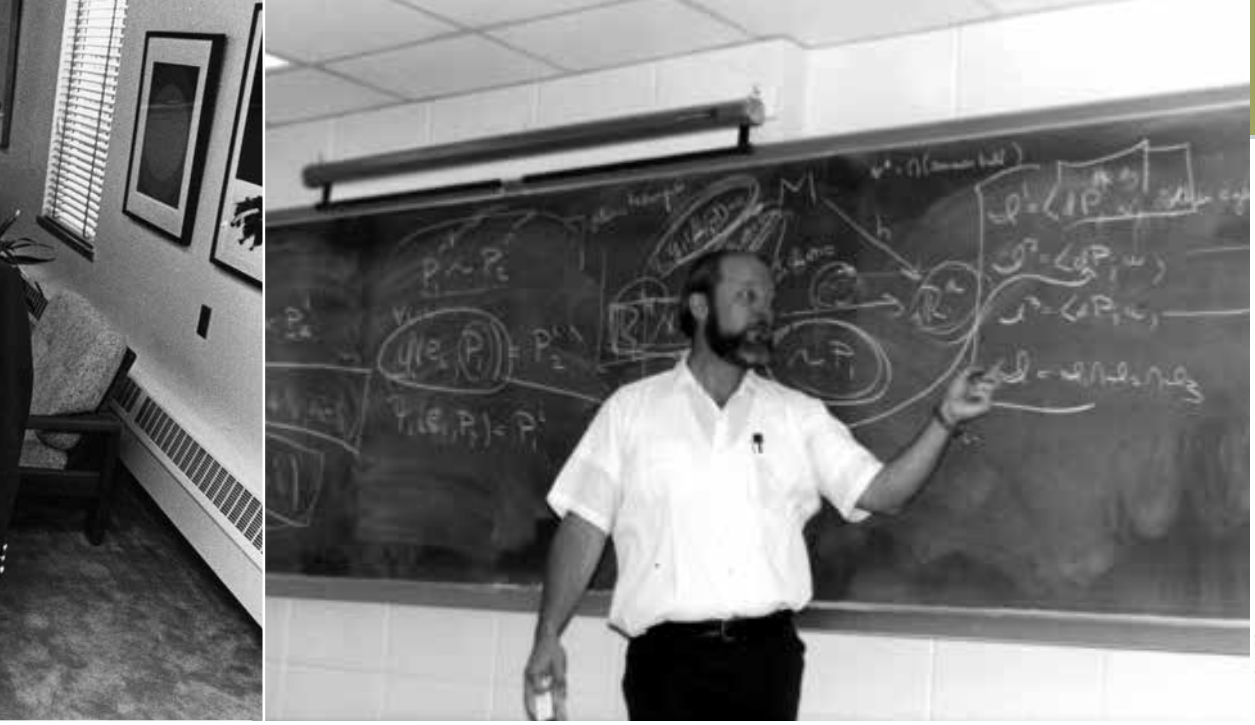
"The IMA impacts mathematicians from undergraduate to 'grave,' and researchers from computer science to environmental science, from social sciences to engineering fields, and from biology to informatics," Arnold said. The annual Public Lecture series, given by prominent mathematical scientists, now reaches



IMA POSTER FOR 2012-13

Variations on a theme

From September to June each year, the IMA focuses its programs and activities on a central theme. Involving more than 1,000 participants, the IMA draws a large and diverse community of visitors from academia, industry, and government. The themes are broad and timely and aim to advance mathematical research, generate new opportunities, and create lasting impacts on various application areas.



IMA ARCHIVES

THEN

(Far left) George Sell, and Hans Weinberger, along with Willard Miller, founded the Institute for Mathematics and its Applications in 1982. (Left) Donald Saari, Professor of Mathematics and Economics at the University of California–Irvine, participates in a 1983 IMA workshop on Price Adjustment, Quantity Adjustment and Business Cycles.

middle- and high-school students, and reveals the importance of mathematics in people's everyday lives.

With its far-reaching and long-lasting impact, the IMA's innovative annual programs have helped to launch many thriving research communities. Partner corporations, including locally based companies Medtronic and Honeywell, and multinational partners like Schlumberger and Siemens, all tout the benefits of their connections with the IMA.

Of the nearly 300 postdoctoral fellows who have trained at the IMA, many have gone on to become research leaders in both education and industry. Many have made important contributions to the health of science and technology in the United States.

Former postdocs David Gobson and Gang Bao wrote computer codes to design a special type of optical glass in the 1990s. Nathan Kutz and Lei Wang assisted Honeywell with the design of laser and optical fiber communications, helping the company to acquire several patents and create new product designs. Douglas Huntley worked on blood gas monitors used during surgery that included coronary bypass. This list only begins to scratch the surface.

Closer to home, the IMA serves as a resource to the University's research community—faculty and students from the College of Science and Engineering regularly participate in many of its programs.

Building a mathematical community

The IMA's Industrial Postdoctorate Program was created in 1988 by former Director Avner Friedman, who felt mathematics was undervalued in industry. The program pairs postdocs with companies who can use their expertise to help improve their products. Postdocs devote half of their efforts to industry projects, working under the mentorship of industry scientists. The program was so successful that it was used as a model to create the NSF's Grant Opportunities for Academic Liaison and Industry (GOALI) Program, which emphasizes improving industry-university research linkages in designing and implementating products and processes.

Postdocs often return to the IMA as established researchers, offering their guidance and expertise to a new generation of postdocs. For members of the IMA community, returning to the IMA to organize a program or a workshop is not uncommon. The ties that are created at the IMA are long-lasting and significant, bringing former visitors back to the institute year after year.

"Even after 30 years, there seems to be no end to the new challenges that lie ahead. We look forward to the future, where opportunities for interdisciplinary collaboration abound," Santosa said. ■

BY AMANDA ARANOWSKI

FOR MORE INFORMATION, visit **www.ima.umn.edu**

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During the IMA's Mathematical Modeling in Industry Workshop, graduate students work in teams under the guidance of an industry mentor who helps the student model, analyze, and perform computational work associated with a real-world industrial problem.

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DISCOVERING THE STARS. Seeking the outer limits of space is this student's passion.

Grant Remmen has a passion to learn and a curiosity to discover. Black holes, time warps, and the Milky Way captured his imagination from an early age. Through the College of Science and Engineering's Undergraduate Research Opportunities Program, he conducted original research on dark matter and cosmic rays since his freshman year and is now published in the Journal of Undergraduate Research in Physics. For that work, plus research ranging from studying massive stars with the Hubble Space Telescope to Einstein's General Relativity, as well as an impressive academic career, Remmen was awarded a prestigious national Hertz Fellowship for graduate study. The fellowship is worth $250,000, which will fund further discoveries to illuminate the final frontier. Now there's a student on a mission.

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