



Jacobs School of Engineering News
Winter 2012/2013

Pulse

Structural and Materials Engineering Building Creating a 21st Century Bauhaus



Structural and Materials Engineering Building

On Sept. 14, we celebrated the opening of our Structural and Materials Engineering building. The research laboratories, teaching facilities, and office spaces could not have come at a better time—we hired 15 new faculty members this academic year and our student enrollment is at record levels. With 5,638 undergraduates and 1,548 graduate students in Fall 2012, our enrollment is more than 1,300 students higher than it was two years ago, and more than 800 students higher than last year.

We focus on some of the great work taking place in our new building in this issue of Pulse—which will be my last issue as Dean. As you may know, I have decided to retire from UC San Diego in April 2013, after 30 years of service to the campus, including the last 10 as Dean of the Jacobs School of Engineering. I will be moving to Melbourne, Australia to take an exciting position as Vice President–Academic and Dean of Engineering at Monash University. While I'll be on the other side of the Pacific Ocean, I'm not leaving the Jacobs School entirely. I will remain active as Professor and Dean Emeritus, and I believe there are a number of ways the two universities can collaborate in the future.

I would like to offer my most sincere thanks to all who have contributed their time, energy, expertise and resources to ensure the continued success of the Jacobs School. It is because of your hard work and dedication that the Jacobs School is stronger and better positioned to fulfill our mission than ever before. For example, this new building we are celebrating likely would not have come to fruition—and certainly not in this timeframe—without the hard work and support of a list of dedicated individuals that is too long to name here.

The Structural and Materials Engineering building represents the exciting interdisciplinary future the Jacobs School is embarking upon. The building provides the first permanent home for the Departments of Structural Engineering and NanoEngineering. The new building also houses medical device researchers from the Institute of Engineering in Medicine.

These engineers and medical researchers share each floor with artists from the Department of Visual Arts, which occupies 20 percent of the new building. The most exciting engineering research is taking place at the interface of our traditional disciplines, and I am excited to see what will emerge when structural engineers, nanoengineers, medical device researchers and visual artists—all working at completely different scales but with the same materials—come together.

It is my hope that the next Dean of the Jacobs School will have the opportunity to dedicate a new wing of this new building (already in the master plan)—a facility that will provide space for even more extensive collaborations between engineers, physicians and other medical researchers.

FRIEDER SEIBLE, DEAN



Jacobs School of Engineering

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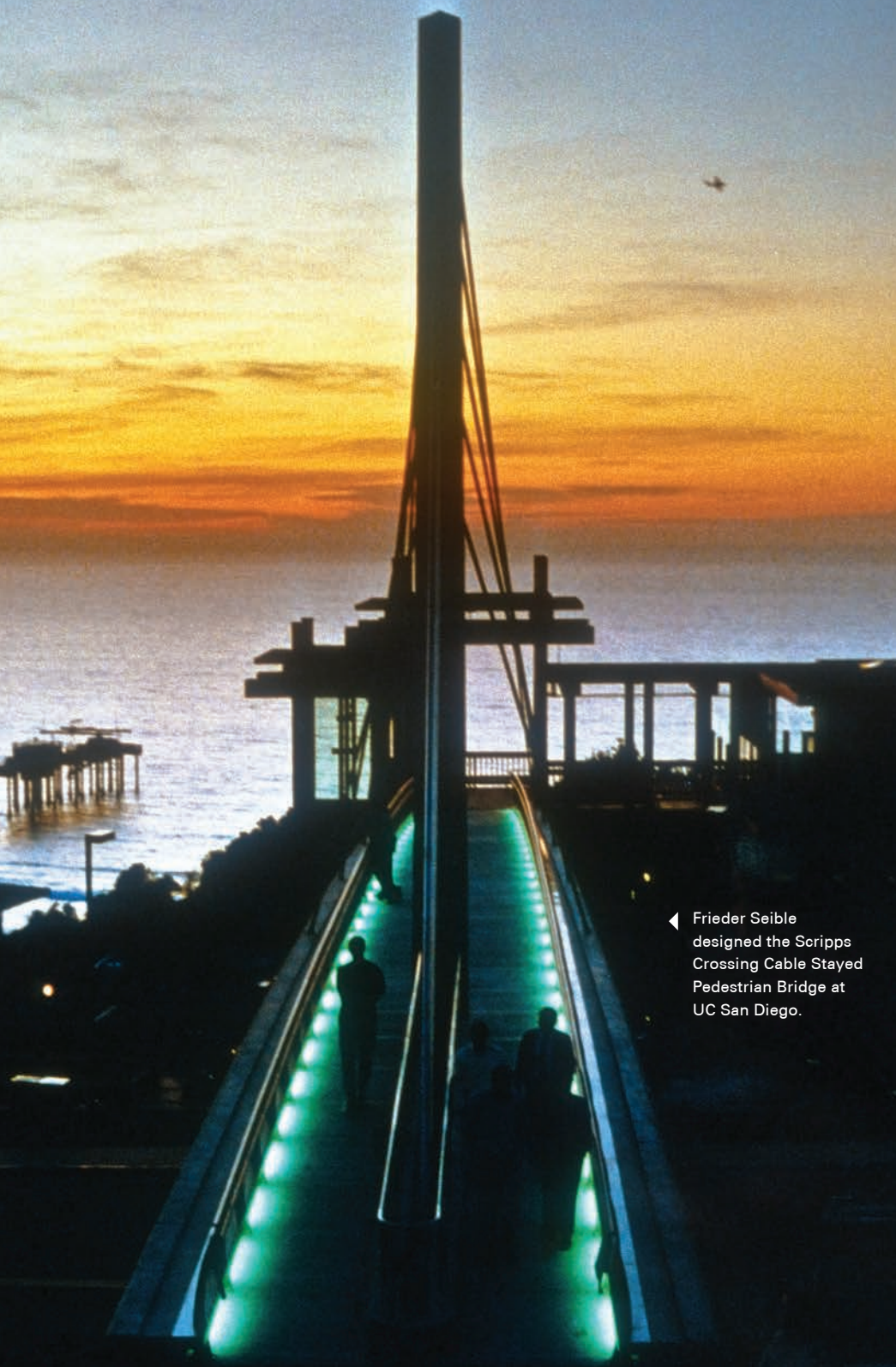
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FRIEDER SEIBLE TO RETIRE

AFTER 30 YEARS ON CAMPUS, 10 YEARS AS DEAN



◀ Frieder Seible designed the Scripps Crossing Cable Stayed Pedestrian Bridge at UC San Diego.

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JUAN C. LASHERAS NAMED INTERIM DEAN

Professor Juan C. Lasheras will serve as the Interim Dean during the nationwide search for the fourth Dean of the Jacobs School of Engineering. UC San Diego Chancellor Pradeep K. Khosla and Executive Vice Chancellor Suresh Subramani are leading the search.

Professor Lasheras is the Stanford S. and Beverly P. Penner Professor of Engineering and Applied Sciences at the Jacobs School, an elected member of the National Academy of Engineering of the USA, and the Royal Academy of Engineering of Spain. He is a distinguished professor in the Departments of Mechanical and Aerospace Engineering and Bioengineering, a dedicated and celebrated teacher, the Founding Director of the Center for Medical Device and Instrumentation at the Institute of Engineering in Medicine, and a Co-Director of the Master of Advanced Study program in Medical Device Engineering.

Professor Lasheras works at the intersection of biology, medicine and engineering and is a world-leading expert on fluid mechanics, turbulent flows, two-phase flows and mechanobiology. Dr. Lasheras served as Chairman of the Department of Mechanical and Aerospace Engineering from 1999–2004 and led the department's faculty hiring and growth in the fields of medical and biological applications, environmental engineering, and nanomaterials. Lasheras has received *Doctor Honoris Causa* degrees from Universidad Carlos III de Madrid and Universidad Politécnica de Madrid, Spain.

Frieder Seible: Forever Building

As Dean of the Jacobs School (2003–12), Frieder Seible built new departments and cross-disciplinary research organizations, focused on industry partnerships, and created an “engineering talent pipeline” that gives Jacobs School students opportunities to develop into engineering leaders.



Engineering Talent Pipeline

A dedicated teacher, Seible changed the culture of the Jacobs School by founding and championing a variety of programs and initiatives for students including:

IDEA Student Center

IDEA = Inclusion, Diversity, Excellence and Advancement

Team Internship Program (TIP)

A program of the Jacobs School’s Corporate Affiliates Program

Gordon Engineering Leadership Center

Global Teams in Engineering Service (Global TIES)

Student Organizations / Engineering Teams

Von Liebig Entrepreneurism Center

Moxie Center for Undergraduate Entrepreneurship

Master of Advanced Study programs

Technical executive education for engineering professionals

Frieder Seible’s Footprint

Faculty Growth: 87 Hires

The Jacobs School hired 87 faculty members, an average of nearly nine hires per year during Seible’s term as Dean.

Faculty Diversity: 26 of 87

Women and other traditionally underrepresented minorities in engineering made up 26 of the new faculty hires.

Partnerships: \$26.1M to \$66.2M

Research expenditures from industry and private funding more than doubled from \$26.1M in 2003 to \$66.2M in 2012.

New Buildings at the Jacobs School

2002 Powell-Focht Bioengineering Hall	109,000 ft ²
2005 Atkinson Hall (Calit2)	215,000 ft ²
2005 Computer Science and Engineering	148,000 ft ²
2012 Structural and Materials Engineering	183,000 ft ²

Departments and Research Centers

Structural Engineering Department

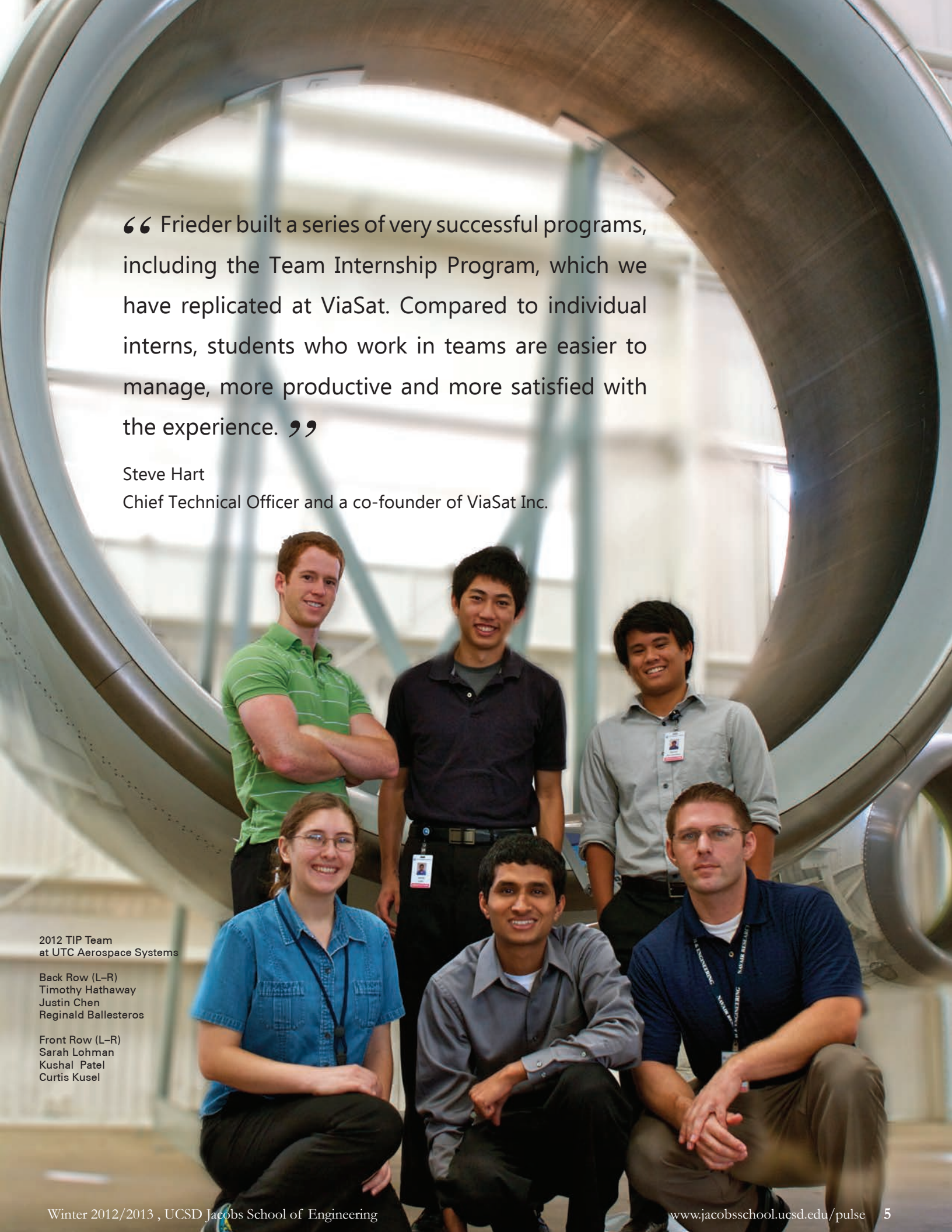
Frieder Seible was a key player in the formation of the first and only structural engineering department in the nation. He served as founding chair from 1995 to 2001. Structural Engineering emerged from the Department of Applied Mechanics and Engineering Sciences (AMES).

NanoEngineering Department

In 2007, the Jacobs School established the first Department of NanoEngineering in the nation with a full undergraduate and graduate student curriculum.

Institute of Engineering in Medicine

Created in 2008, the IEM brings academic and industry research teams together to leverage the latest engineering breakthroughs in order to improve human health.



“ Frieder built a series of very successful programs, including the Team Internship Program, which we have replicated at ViaSat. Compared to individual interns, students who work in teams are easier to manage, more productive and more satisfied with the experience. ”

Steve Hart

Chief Technical Officer and a co-founder of ViaSat Inc.

2012 TIP Team
at UTC Aerospace Systems

Back Row (L-R)
Timothy Hathaway
Justin Chen
Reginald Ballesteros

Front Row (L-R)
Sarah Lohman
Kushal Patel
Curtis Kusel

Safer Bridges and Buildings

Frieder Seible is a key member of the teams that envisioned, designed and created a collection of large-scale and full-scale UCSD testing facilities that exist nowhere else in the world. These structural engineering labs give academic teams and their industry partners the opportunity to pursue research that leads to safer and smarter new designs and retrofits for bridges, buildings and other structures—advances that make California and the world safer in the face of earthquakes, blasts and other hazards.



Powell Labs

Full-scale seismic tests on a five story building (left) in the Charles Lee Powell Structural Research Laboratories in 1986 were some of the first performed in the facility. The tests performed by Seible, Gil Hegemier, Nigel Priestly and colleagues led to a better understanding of how concrete masonry buildings fail. The engineers later wrapped the first two floors with fiber reinforced composite materials and subjected the building to additional seismic forces. The results eventually led to the widespread use of fiber reinforced composite materials for seismic retrofits as well as for repair strategies for quake-

damaged buildings. The Powell Labs also include the Caltrans Seismic Response Modification Device (SRMD) Test Facility. Seible led the design team for this unique facility. It tests the full-scale bearings, isolators and dampers used in the seismic retrofits of many long-span bridges, including the San Diego-Coronado Bridge.



Englekirk Structural Engineering Center

In 2005 Jacobs School engineers shook a seven-story building on the world's largest outdoor shake table. This was the first big shake table test at the UC San Diego Englekirk Structural Engineering Center—a one-of-a-kind facility that would have not been realized without Seible's vision and leadership. The Englekirk Center also includes the blast simulator facility that Seible developed with structural engineering professor Gil Hegemier, and the nation's largest facility for testing soil-structure reactions to earthquakes and other natural disasters, such as hurricanes.



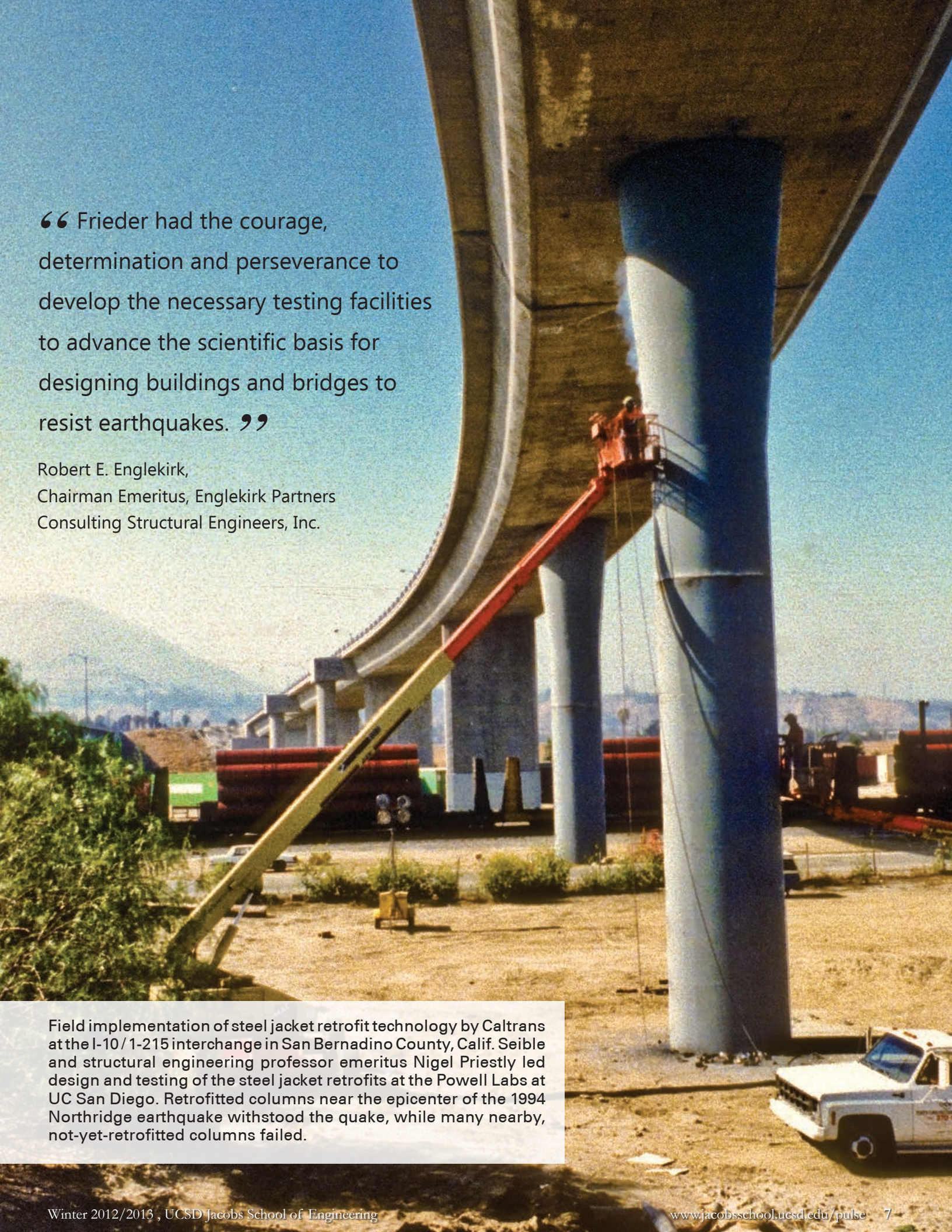
Bridge Safety and Beyond

Frieder Seible served as founding director of the Powell Labs, which provide a worldwide resource for full-scale testing and analysis of bridges and many other structures. For example, Jacobs School engineers tested new structural systems for the seismic safety of the new East Span of the San Francisco-Oakland Bay Bridge. Seible (pictured left on this new East Span) is called upon to provide seismic design and retrofit expertise in many major bridge and transportation infrastructure projects worldwide.

Frieder Seible

- Distinguished Professor of Structural Engineering at UCSD
- Walter J. Zable Professor of Engineering
- Eric and Johanna Reissner Professor of Applied Mechanics and Structural Engineering

- Author of more than 600 publications and technical reports
- Member of the National Academy of Engineering
- Foreign Member of the Chinese Academy of Engineering
- Recipient of many awards and honors including the 1996 CERF Charles Pankow Award for Innovation



“ Frieder had the courage, determination and perseverance to develop the necessary testing facilities to advance the scientific basis for designing buildings and bridges to resist earthquakes. ”

Robert E. Englekirk,
Chairman Emeritus, Englekirk Partners
Consulting Structural Engineers, Inc.

Field implementation of steel jacket retrofit technology by Caltrans at the I-10/1-215 interchange in San Bernadino County, Calif. Seible and structural engineering professor emeritus Nigel Priestly led design and testing of the steel jacket retrofits at the Powell Labs at UC San Diego. Retrofitted columns near the epicenter of the 1994 Northridge earthquake withstood the quake, while many nearby, not-yet-retrofitted columns failed.

Structural and Materials Engineering Building

Creating a 21st Century Bauhaus

At NanoMacroMega, the first official event in the new Structural and Materials Engineering building, researchers presented on nanosensors, sustainable sculptures, cutting edge simulation techniques, experimental video projects and more. Speakers and attendees (see below) brainstormed about ways that collaborations between researchers in vastly different fields might occur. The workshop offered a glimpse into the possibilities for interdisciplinary and multi-scale interactions in the new building—the possibilities of a 21st Century Bauhaus.

This state-funded, 183,000 square foot facility provides the first permanent home for the Departments of Structural Engineering and NanoEngineering at the Jacobs School. These engineers share space with visual artists, and with medical device researchers from the Institute of Engineering in Medicine.

Research laboratories, visual arts studios, and visualization facilities in the new building are shared resources—by design—that encourage people working at different scales and in different fields to interact.

“As I look at where UCSD is headed, I think this building signifies the beginning of what we should be doing more and more of, which is combining sciences, engineering, technology, arts and humanities, all in a single hall to solve problems of societal significance,” said UC San Diego Chancellor Pradeep K. Khosla at the formal building dedication.

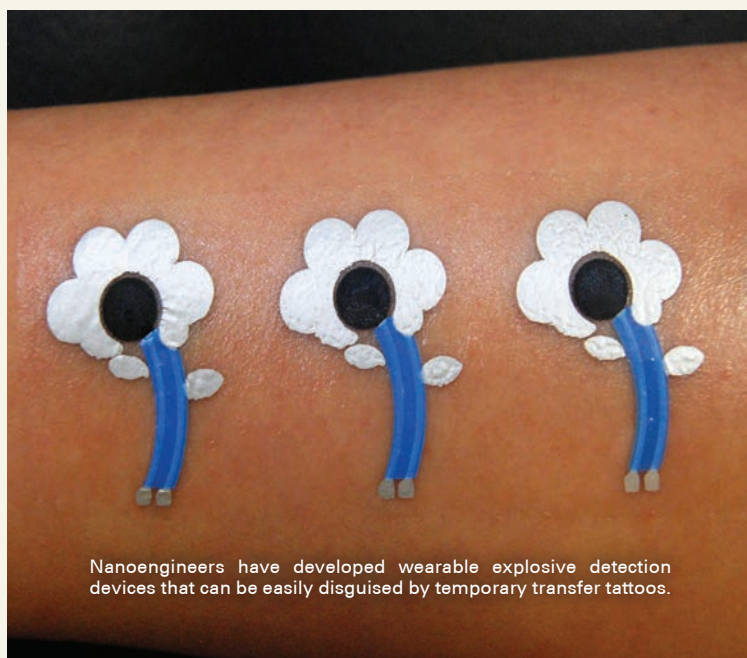
As the engineers, medical device researchers and visual artists make the new building their home, these interactions and collaborations now have the opportunity to take root and grow.

“Behind any brilliant idea always has to be an implementer and nothing would have been possible without Frieder Seible. He is truly the heart, the soul and the inspiration of this new building. We all have witnessed how hard he has worked for this project, internally with the university, and with the state of California despite difficulties with the budget. The successful completion of this building is truly a testament to his values, his personality, and his strength,” said Juan C. Lasheras, Interim Dean of the Jacobs School.

Hi-Tech Tattoos: When Artists and Engineers Work Together

Joshua Windmiller (BS '07, MS '09, Ph.D. '12, Electrical Engineering) has developed inexpensive, non-invasive and easily disguisable sensors that can accurately detect the vapors generated by the common chemical constituents found in improvised explosive devices. The sensors can also be used for healthcare, fitness and environmental monitoring. The device integrates temporary transfer tattoos with electrochemical sensors that can be applied directly to the skin or sewn into clothing.

Windmiller, who worked with visual artists on designs for the sensors, discussed the potential of this kind of ubiquitous sensing at the recent NanoMacroMega workshop in the new Structural and Materials Engineering building. The workshop brought together artists, engineers, architects and medical device researchers from UC San Diego and Bauhaus University Weimar—home of the Bauhaus movement, which integrated art, technology and craftsmanship and created modern architecture.




Nanoengineers have developed wearable explosive detection devices that can be easily disguised by temporary transfer tattoos.

The nanoengineered tattoos, combined with high-fidelity electrochemical detection, have resulted in fast, rugged, highly sensitive devices that can detect targeted chemical compounds while tuning out noise. In the healthcare domain, the chemical information collected by the temporary-transfer tattoo biosensors offers the possibility of a more complete assessment of metabolic health than is possible with just physical parameters such as vital signs.

During NanoMacroMega, Teddy Cruz, a professor of visual arts at UC San Diego, said it's important to examine new technology in the context of society as a whole.

“Let's not forget that modernity is about more than the onward march of technology,” said Cruz, director of the Center for Urban Ecologies in the Visual Arts Department. “I think modernity also represents the possibility to rethink and to reform our institutions today based on these possibilities of interface between the large and the small, the formal and the informal, the micro and the macro.”



“ Frieder’s greatest contribution as Dean has been raising the quality of education and research in the Jacobs School while increasing the number of well-qualified students.

He has attracted and retained great faculty, introduced interdisciplinary programs, and orchestrated expanded facilities such as the new Structural and Materials Engineering building.

Within this new building, Frieder’s achievement of intermingling engineering and visual arts throughout all of the floors is a perceptive use of space. He recognized the great importance of design to engineering and set the stage, I suspect, for many novel and exciting ideas. ”

Irwin Mark Jacobs

Founding Chairman and CEO Emeritus, Qualcomm

Frieder
Seible

Structural Engineering. Unique in the Nation.

It's not just the large-scale and full-scale testing facilities that make the Department of Structural Engineering unique. If you look beyond the Jacobs School, you won't find another structural engineering department in the United States. Most faculty and students pursuing structural engineering research belong to broader civil engineering departments.

Jacobs School structural engineers are leaders in large-scale and full-scale testing research. Facilities include the world's largest outdoor shake table at the Englekirk Structural Engineering Center and the Powell Structural Research Laboratories on the Jacobs School campus. Programs cover multihazard mitigation, including earthquake and blast; earthquake engineering and infrastructural renewal; structural health monitoring; risk engineering and composite and nano-materials and lightweight structural systems.



Undergraduate structural engineering teaching laboratory in the new Structural and Materials Engineering building.



Testing Metal-Frame Buildings

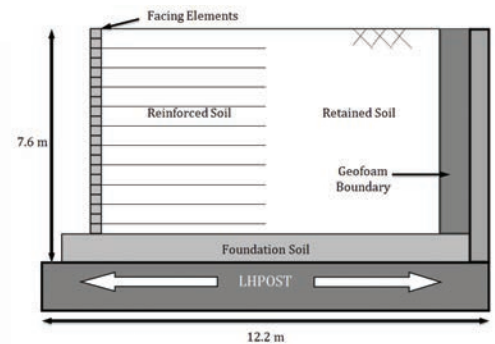
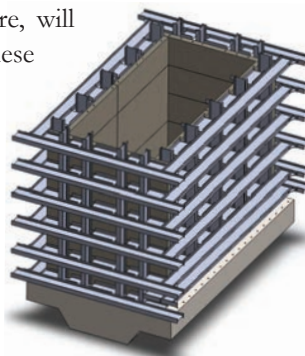
Metal-frame buildings, also known as Metal Building Systems, constitute a large portion of low-rise buildings in the United States. Two new seismic safety systems for these structures are under development as a result of a series of tests on the world's largest outdoor shake table and at the Powell Labs. The tests were led by Chia-Ming Uang, a structural engineering professor.

Three full-scale frames were tested on the shake table. Ten beam-column assemblies also were cyclically tested at the Powell Labs to provide data about the strength and cyclic performance of lateral buckling of tapered I-beams. The data will be used to validate inelastic finite elements used to model the cyclic behavior of metal building frames.

Metal frames are typically composed of steel moment frames with slender tapered beam sections. Conventional steel moment frames rely on the formation of ductile plastic hinges to prevent collapse. The slender members are unable to deform in a traditionally inelastic model, and that raises questions about frame behavior during large seismic events. The tests aimed to answer these questions. The research program was sponsored by the Metal Building Manufacturers Association, the American Iron and Steel Institute and the NSF's George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES).

Gauging the Seismic Safety of Retaining Walls

Researchers at the Jacobs School will be testing a full-scale, 7-meter-tall retaining structure on the world's largest outdoor shake table in spring 2013. The tests, conducted on a scale never achieved before, will collect high-quality data on the overall seismic response of these structures, which constitute an integral and ever-growing component of our nation's infrastructure. The data will be used to enhance design guidelines for mechanically stabilized earth walls in seismic regions and to help validate previous research and numerical models. The tests, led by structural engineering professors Patrick Fox and Ahmed Elgamal and graduate student Andrew Sander, are sponsored by the NSF's George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES).



A diagram of the components to be tested in the retaining structure.

Cradle-to-Grave Safety Testing of Aircraft Composites

Detecting damage to the outer skin and primary structural components of aircraft is becoming increasingly difficult as manufacturers switch from aluminum alloy to composite materials, which can undergo damage that is not visible to the naked eye.

Because a single hit is unlikely to have significant consequences, researchers at the Jacobs School are working to better understand how repeated and widespread impacts, as well as other kinds of severe events affect the aircraft's composite materials over their lifespan.

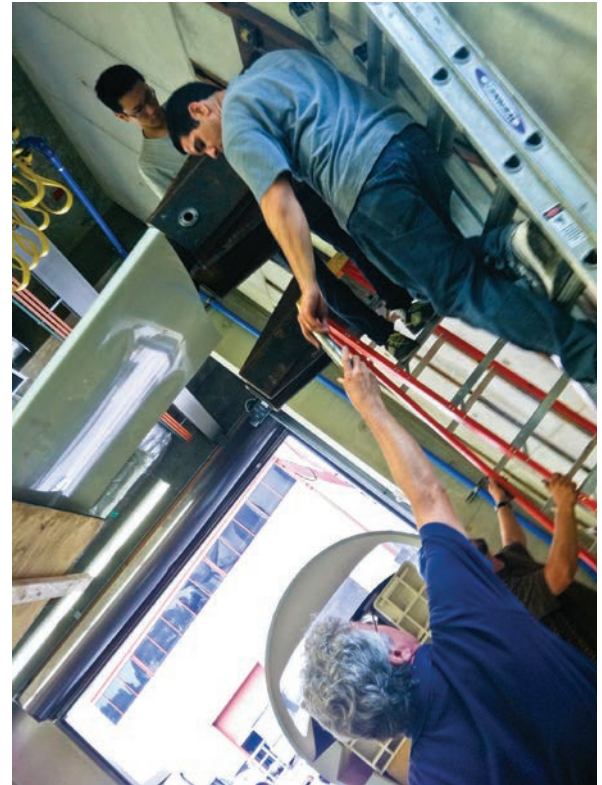
A major facility in the new Structural and Materials Engineering building is dedicated to studying all aspects of full-scale composite material aircraft structures. In the Composite Aviation Safety Center, researchers build and test specimens representing aircraft parts made from composite materials. They outfit these specimens with sensors and use the data they collect to build computational models to predict damage—all in an effort to make composite structures safer and more efficient.

“What makes us unique is that we will be researching the entire product development process,” said John Kosmatka, a professor of aerospace and structural engineering and one of the lead researchers for the new facility.

Kosmatka and colleagues Hyonny Kim and Chiara Bisagni, in the Department of Structural Engineering, focus on manufacturing and testing. One of Kosmatka's projects investigates how carbon nanotubes could reinforce the composite's resin matrix. The ultimate goal is to develop a custom-tailored nanoparticle to reinforce the resin matrix as well as a procedure to place these high-performance particles in critical stress regions.

Meanwhile, Kim's lab subjects components to a wide range of tests to simulate impacts and dynamic loading, including everything from hail to cargo loaders. Prior to testing, structures can be outfitted with embedded sensors and damage detection strategies developed in the lab of Michael Todd, a professor of structural engineering. The sensors use ultrasonic waves to detect damage, from cracks, to voids, to corrosion. Damage also can be detected by special instruments placed on the outside of the structures and developed in the lab of structural engineering professor Francesco Lanza di Scalea. His team is using ultrasonic waves to detect and quantify damage, both during and after testing, or after an actual event, such as a crash.

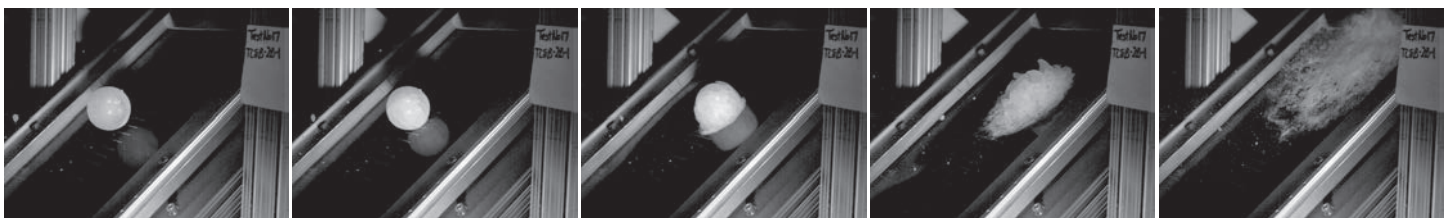
Finally, the data collected during the tests comes back to Kosmatka's lab, where he and structural engineering professor Joel Conte are developing probabilistic-based computational models to predict the type and growth rate of damage in composite aircraft parts. These computational models, along with an extensive experimental database, aim to predict the remaining life of in-service aircraft components, as a result making it easier to schedule maintenance, or provide a critical warning to the flight crew.



Professor John Kosmatka works with his graduate students to install a Predator wing in the new Composite Aviation Safety Center.



Researchers will be working on two Predator wings.



The lab of Professor Hyonny Kim simulated the impact of hail on composite materials used in modern jets. Researchers launched ice spheres of about 2.4 inches in diameter at 108 meters per second using a gas gun built for testing ice impacts on aircraft structures. Their target was a 12" by 24" composite panel

made of the same composite material used in the Boeing Dreamliner. The panel is about 12 times thicker than an aluminum soda can (0.064 inches). The research was funded by the Federal Aviation Administration. Learn more Feb. 28, 2013 at an alumni event with Kim at Boeing in Seal Beach, Calif. (See page 16 for details.)



NanoEngineering Department Opens Materials Research Center

NanoEngineering graduate student Scott Olson is working on a new iron-based super elastic alloy that can stretch out like a slinky without getting those frustrating twists and kinks that slinkies always get. The solution, like much of the work of developing new materials, involves exploring the material's chemistry and crystalline structure at the nanoscale, a measure thousands of times smaller than the width of a human hair. A little bit more or less of a particular metal or compound makes the difference in what the researcher is trying to achieve, whether it's strength, elasticity, holding up under extreme temperatures, or all of the above. For this purpose, Kenneth Vecchio, Professor and Chair of the Department of NanoEngineering, recently built a sprawling suite of new laboratories dedicated to the design, development and testing of new materials.

Here, large samples of metals are cut, ground, melted and mixed with other metals and compounds, and then forged into smaller samples of new alloys for study under special microscopes and a broad range of other analytical tools.

The NanoEngineering Department's Materials Research Center provides faculty and students—drawn from the fields of chemical engineering, materials engineering and materials science—with a shared core laboratory. It's a setup that recognizes that today's engineering and science challenges—with applications in energy technologies, medicine and information technology—will be solved through collaboration among researchers from diverse disciplines.

“ The NanoEngineering Department is focused on understanding nanomaterials and nanoscale interactions. We explore mechanical and physical properties at the nanoscale, and then exploit them to do things that we consider paradigm changing. ”

Kenneth Vecchio
Professor and Chair, Department of NanoEngineering



PerkinElmer Representatives (L-R) Saleem Abdo and Otto Rose and Kenneth Vecchio at the opening of NanoEngineering's Materials Research Center.

NanoEngineering Laboratories

Spread over 9,000 square feet in the basement of the new Structural and Materials Engineering building, the NanoEngineering Department's Materials Research Center was made possible with the support of corporate partners PerkinElmer, Instron and Struers, and complements the Nano3 Lab in the UC San Diego Division of Calit2. In addition to supporting faculty and graduate student research, the new space will support undergraduate laboratories for students pursuing degrees in nanoengineering and materials engineering.

ElectronOptics and Micronanalysis Suite Electron microscopy instruments optimized for materials research, from scanning electron microscopes to a scanning transmission electron microscope (see right).

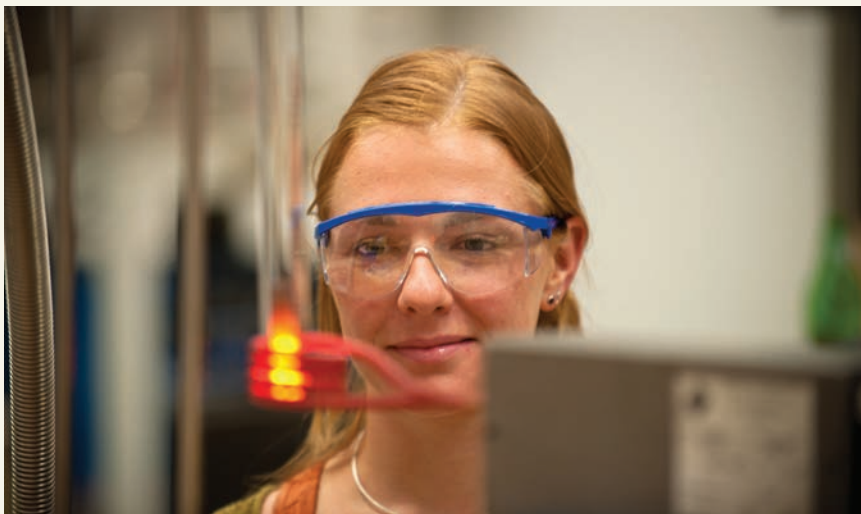
PerkinElmer Analytical Instrumentation Suite This lab provides a mixture of analytical tools to measure the function of new materials. For example, researchers use this lab to test how a material's unique properties, such as microstructure and stiffness, shift in response to changes in temperature.

Optical Microscope Suite For samples that require much lower magnification than electron microscopy. The highlight of this suite is an Atomic Force Microscope that works like an old record player skipping over the sample's surface to image and measure samples at very high resolution.

Material Preparation Lab Large samples can be cut or ground into smaller samples, polished to a high sheen or chemically etched in preparation for analysis under electron microscopes or optical microscopes.

Material Synthesis Lab This is where metallic materials are melted and forged into new material specimens, or pushed and deformed through rolling mills into sheet materials. Instruments range from an induction heater for metals that melt at lower temperatures, such as copper or aluminum, to the Arc Melter for metals that require heat like a "lightning bolt."

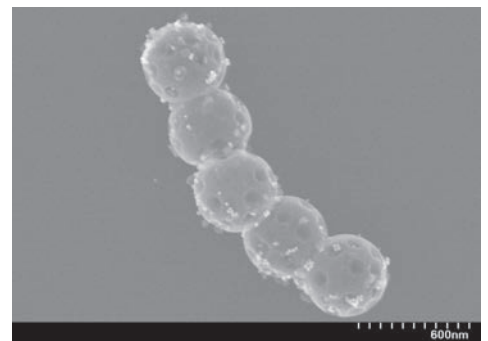
Mechanical Behavior Lab A graduate research facility and undergraduate teaching lab outfitted by Instron to test the mechanical properties of new materials, from the nanoscale to very large material samples. The instruments bend, stretch, break and deform new materials to see how well they perform under stress.



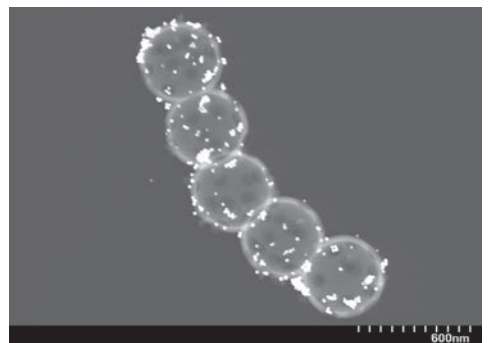
Laura Anderson, a Ph.D. candidate in materials science, demonstrates the use of induction heating to melt a novel metallic glass alloy.

Scanning transmission electron microscopy (STEM) enables researchers to determine the chemistry, microstructure and crystal structure of nanoparticles at much finer spatial resolution than scanning electron microscopy (SEM). Thanks to a tightly focused electron beam less than a few nanometers in size and the thin samples used, researchers can take 1,000 chemical measurements over the same distance as a single measurement taken through SEM. The capability is enormous in a field where slight changes in the composition of a few particles could significantly change the properties of the material itself. "We can couple real chemistry to the sample image so you know exactly where all the elements are and in what percentages they are in different parts of the sample," said Kenneth Vecchio.

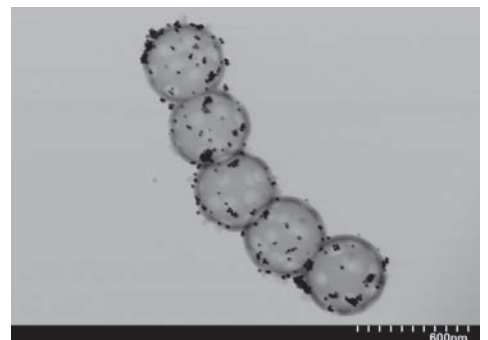
The three images of gold nanoparticles below show the resolution and contrast provided by the STEM.



STEM secondary electron image of silica nano-wiffle balls shows its overall topography.



STEM dark-field image of nano-wiffle balls shows gold nanoparticles (white specks) in stark contrast.



STEM transmitted electron image reveals pores (light grey circles) in the nano-wiffle balls. The wiffle balls are hollow shells with pores created through a nanomasking method developed at UC San Diego.



An ultrasound image of blood flow in the left ventricle of a patient implanted with a biventricular pacemaker.

relies on a handheld transducer positioned over the skin, is already used to measure blood flow in heart patients but provides limited one-directional blood flow velocity. In a study recently presented to the American Heart Association, Del Álamo's team applied their new multi-dimensional imaging modality to study the spatio-temporal evolution of the blood flow patterns within the heart, and how these dynamic patterns are modified in each specific patient by the programming of the pacemaker.

Complex Matters of the Heart

Juan Carlos del Álamo, a professor of mechanical and aerospace engineering and one of the medical device researchers whose lab moved into the new SME building, has combined Doppler ultrasound with the principles of fluid mechanics to develop a new method of studying the complex, multidimensional blood flow patterns within the heart. The ultimate goal is to synchronize blood flow with ventricle wall motion in heart patients with pacemakers. Del Álamo's focus is to optimize the programming of biventricular pacemakers, which are designed to not only control heart rate, but also the timing of specific events in the heartbeat such as the length of time between the contraction of the atrium and the contraction of the ventricle, or the length of time between the contraction of the right ventricle and the left ventricle. Blood flow imaging in patients with implanted pacemakers has been complicated thus far because these patients cannot undergo cardiac magnetic resonance safely. Doppler ultrasound, which

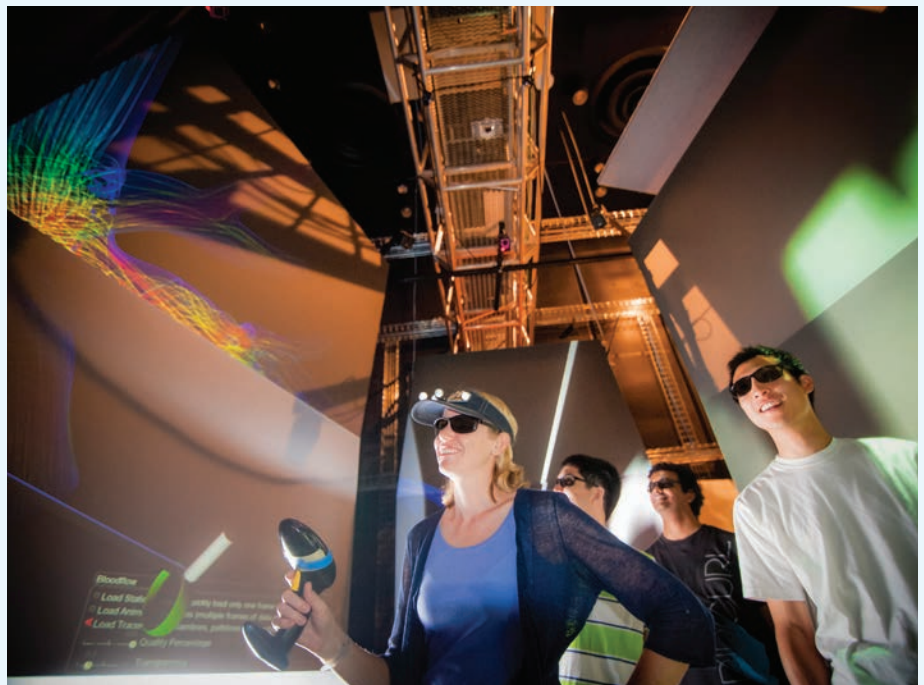
A Better Cardiac Pump for Children with Heart Defects

Structural and mechanical engineers at the Jacobs School are working together to create blood flow simulations that could lead to improvements in the design of a cardiac pump for children born with heart defects. They hope that the design changes will improve young patients' outcomes.

The Berlin Heart is currently the only FDA-approved cardiac pump for young children who can't be outfitted with an adult-sized pump. The device is used to extend a patient's life until a transplant becomes available. Accurate simulations of the way blood flows inside the pump are important because the device is associated with as much as a 40 percent risk of developing blood clots, which can lead to strokes or embolisms. This in turn can have devastating consequences on the children using the pump, who can be anywhere from just a few months old to about 9 years of age.

Two researchers have combined their strengths to solve this problem. Alison Marsden, a mechanical and aerospace engineering professor, focuses on the development of blood flow simulation tools that can be used to test and optimize new heart surgery designs on the computer before trying them on patients. Yuri Bazilevs, a structural engineering professor, focuses on computational science and engineering to develop methods for large-scale, high-performance computing applications.

Marsden, Bazilevs and their teams have successfully simulated blood flow within the device. They are now trying to understand how blood clots form inside the pump. The next step is to figure out, through simulations, what design changes are needed to reduce that risk.



Alison Marsden, a professor of mechanical and aerospace engineering, and her students examine some of the simulations her research group developed in the StarCAVE imaging space on the UC San Diego campus.

Visual Artists as Materials Engineers



Two visitors in the new art gallery at the Structural and Materials Engineering building interact playfully with art work by Jennifer Pastor during the building's dedication.

Photographic prints made by using an electron microscope to scan nano and micro particles. “Digital clay” sensitive to human touch. A 3D model of a dying tree and its ghost version, cast in polished, mirrored stainless steel.

These are just some of the projects that the visual artists who have taken residence in the Structural and Materials Engineering building are working on. The new building houses 12 Visual Arts studios distributed across the building's four floors, as well as exhibition and performance spaces.

“By bringing together members of the Visual Arts faculty with researchers and teachers in engineering, we call attention to the ways our creative artists are working with both traditional and innovative materials,” said Seth

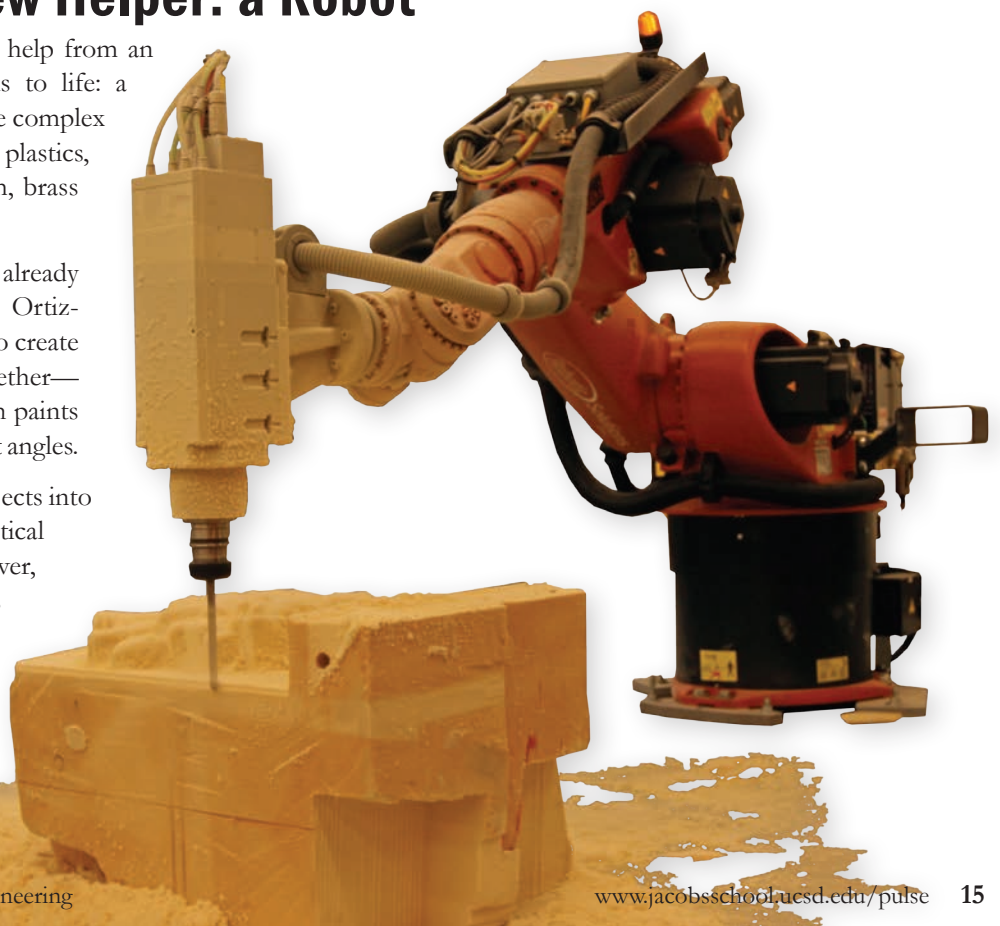
Lerer, dean of the Division of Arts and Humanities at UC San Diego. “In many ways, our Visual Arts department is a group of materials engineers. Our sculptors, our painters, our digital artists and our social theorists all work together to understand the place of engineered materials in culture and the imagination.”

Meet the Artists' New Helper: a Robot

Visual artists in the new building will get help from an unusual assistant to bring their creations to life: a robot—well, a robotic mill—that can carve complex forms from composite materials, foams, plastics, fiberglass, hard and soft woods, aluminum, brass and bronze.

The machine, made by KUKA Systems, is already being used for several projects. Rubén Ortiz-Torres, a Visual Arts professor, is using it to create diptychs—pairs of panels hinged together—milled with surface shapes and coated with paints that change color as light strikes at different angles.

“I transform tools and other functional objects into means of expression and cultural and political commentaries,” Ortiz-Torres said. “However, we will be collaborating with the engineers who might have additional ideas about the eventual function and purpose of our work.”



Cymer Conference Center Opens

The Structural and Materials Engineering building is a much better spot for conferences, meetings and workshops thanks to Cymer, a San Diego company co-founded by UC San Diego alumni Bob Akins ('74, '77, '83) and Richard Sandstrom ('72, '76, '79).

Cymer's generous gift was used to outfit the building, including the three-story Cymer Conference Center, which will serve as a venue for industry collaboration and innovation.

"We hope the new Cymer Conference Center will help foster the success of the next generation of talented leaders, while supporting the San Diego-based technology community," said Ed Brown, President and Chief Operating Officer of Cymer.

Enabling the commercialization of today's advanced consumer electronics devices, Cymer is a leading developer of light sources used by chipmakers worldwide.

“ With our own history rooted in the local community, and more specifically, UC San Diego, we remain advocates of how the right educational opportunities and resources can springboard careers. ”

Ed Brown
President and Chief Operating Officer
Cymer



Building Dedication Celebration (L-R)
Ed Brown, Cymer President and Chief Operating Officer
Richard Sandstrom ('72, '76, '79), Cymer Co-Founder
Bob Akins ('74, '77, '83), Cymer Co-Founder
Frieder Seible, Dean of the Jacobs School of Engineering

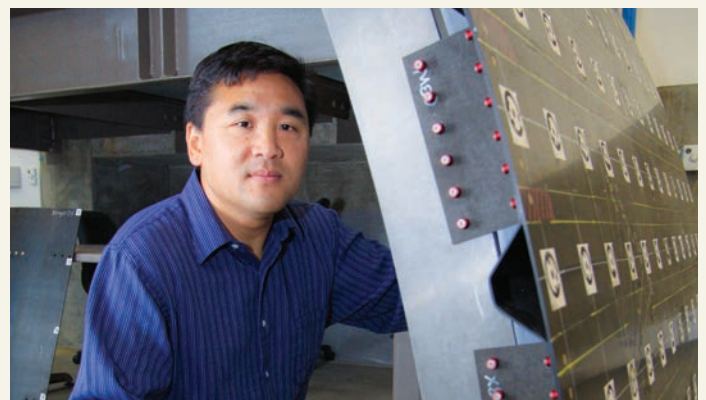
CYMER
Conference Center



A Vision of the Future

When best-selling science fiction author David Brin tried to imagine the future of the Structural and Materials Engineering building, he saw a malleable and adaptable structure whose cells are leaky—deliberately almost biological. "Problem solvers within these walls will send robots into the bloodstream and mysterious nonlinear realms within the cell," Brin said. "New work in fluidics, materials and battery storage will help us tackle vexing energy problems." He spoke at the building's dedication Sept. 14.

Watch his talk on YouTube: <http://bit.ly/XztXHU>



Composites Expert to Speak at Alumni Event

The new generation of commercial jets constructed with high-strength carbon fiber composite materials are light-weight and fuel-efficient. But blunt impacts from baggage and cargo loaders and hail stones can result in damage nearly invisible to the naked eye. Prof. Hyonny Kim will describe research to detect, predict and avoid damage to modern composite airframes.

Feb. 28, 2013 at 6 p.m. at The Boeing Company in Seal Beach, Calif. More info: alumni.ucsd.edu/inspiringminds

Pradeep K. Khosla

UC San Diego Hires First Engineer to Chancellor Post



On his first day as UC San Diego Chancellor, Pradeep K. Khosla met with incoming engineering freshmen taking part in the Jacobs School's Summer Pre-Engineering Program (PrEP). Khosla is an internationally renowned electrical and computer engineer and the first engineer to serve as UC San Diego Chancellor. Most recently, he served as Dean of the College of Engineering at Carnegie Mellon University. <http://chancellor.ucsd.edu>

Chancellor Khosla Speaks at Gordon Leadership Center

On Oct. 30, UC San Diego Chancellor Pradeep K. Khosla spoke at a forum organized by the Gordon Engineering Leadership Center at the Jacobs School. Khosla described his journey from an undergraduate student in India to the eighth UC San Diego Chancellor, and offered insights on leadership, careers and more.

On Career Choices "I chose to do what I love. And once I made that choice, I absolutely loved what I did," said Khosla. "I think that is something that has been extremely helpful in my own success."

On Leadership "As a project manager at DARPA, I realized I enjoyed putting big ideas together, building and leading organizations, motivating people and seeing the fruits of their labor. I took pride in enabling our researchers to succeed," Khosla explained.

On Organization Building "If you want to enable people to succeed, you have to understand each person's mindset," Khosla said. "Two human beings are never the same. How do you motivate people? How do you enable people? In terms of leadership, you never become a great leader by telling people what the answer is. I think when people are enabled and empowered to discover on their own, they do a much better job... at that point... they are doing what they love and hopefully they are loving what they do."



Pradeep K. Khosla, UC San Diego's 8th Chancellor

The Gordon Engineering Leadership Center hosts a forum every quarter for Gordon Scholars, as well as members of the larger Jacobs School community. The Gordon Center invites alumni to share their own engineering leadership story with our Scholars. Contact the Gordon Center at gordoncenter@ucsd.edu to learn how.

Jacobs School Hires Fifteen New Faculty



CHIARA BISAGNI

Professor, Structural Engineering

Aerospace composite structures, in particular buckling and post-buckling, crashworthiness, fatigue, damage propagation, optimization.

Ph.D. 1997 Politecnico di Milano

Most recently: Associate Professor in aerospace structures in the Department of Aerospace Engineering at Politecnico di Milano in Italy

Email: cbisagni@ucsd.edu



SHENGQIANG CAI

Assistant Professor, Mechanical and Aerospace Engineering

Mechanics of soft materials; energy harvesting and storage; micro/nano-fabrication techniques of polymeric structures and soft/stiff hybrid structures; and deformable acoustics and optical metamaterials.

Ph.D. 2011 Harvard University

Most recently: Postdoctoral fellow at the Massachusetts Institute of Technology



SHADI DAYEH

Assistant Professor, Electrical and Computer Engineering

Neuroprosthetic devices, growth and devices of compound semiconductors and silicon/germanium materials, monolithic and hybrid hetero-integration technologies, in-situ microscopy on advanced III-V device architectures.

Ph.D. 2008 UC San Diego

Most recently: Distinguished JR Oppenheimer Fellow, Center for Integrated Nanotechnologies, Los Alamos National Laboratory

Email: sdayeh@ucsd.edu



OLIVIA A. GRAEVE

Associate Professor, Mechanical and Aerospace Engineering

Solution-based processing of nanopowders; spark plasma sintering of materials; powder particle size distribution control and characterization; behavior of colloidal systems; morphological control of non-oxide ceramic powders; composite manufacturing; special emphasis on electromagnetic materials for sensors and energy applications.

Ph.D. 2001 UC Davis

Most recently: Associate Professor of Materials Science and Engineering at Alfred University

Email: ograeve@ucsd.edu

Website: <http://graeve.ucsd.edu/>



DREW HALL

Assistant Professor, Electrical and Computer Engineering

Analog and mixed-signal CMOS integrated circuits to address applications in bioelectronics, biosensors, lab-on-a-chip devices, point-of-care (POC) testing, and other biomedical devices and systems.

Ph.D. 2012 Stanford University

Most recently: Research scientist in the Integrated Biosensors Laboratory, Intel Corporation

Email: drewhall@ucsd.edu



PRADEEP K. KHOSLA

UC San Diego Chancellor

Internet-enabled collaborative design, collaborating autonomous systems, agent-based architectures for distributed design and embedded control, software composition and reconfigurable software for real-time embedded systems, reconfigurable and distributed robotic systems, integrated design-assembly planning systems and distributed information systems.

Ph.D. 1986 Carnegie Mellon University

Most recently: Dean of the College of Engineering and Philip and Marsha Dowd University Professor at Carnegie Mellon University

Email: chancellor@ucsd.edu

Website: <http://chancellor.ucsd.edu>



DARREN LIPOMI

Assistant Professor, NanoEngineering

Mechanically compliant organic electronic materials and devices, including stretchable polymer-based solar cells and skin-like sensors, and unconventional, green approaches to nanomanufacturing.

Ph.D. 2010 Harvard University

Most recently: U.S. Intelligence Community Postdoctoral Fellow, Stanford University, Department of Chemical Engineering

Email: dlipomi@ucsd.edu

Website: <http://darrenlipomi.com/>



SHACHAR LOVETT

Assistant Professor, Computer Science and Engineering

Algorithms, computational complexity, coding theory, randomness in computation, additive combinatorics.

Ph.D. 2010 The Weizmann Institute, Rehovot, Israel

Most recently: Postdoctoral researcher at The Institute for Advanced Study in Princeton, N.J.

Email: slovett@ucsd.edu



JIAN LUO

Professor, NanoEngineering

Utilizing nanoscale interfacial phenomena to design and tailor materials for energy-related applications, including lithium-ion battery materials, high-temperature materials, ionic conductors, photocatalyst and photovoltaic materials, and materials for applications in nuclear power generation systems and clean coal technologies.

Ph.D. 2001 Massachusetts Institute of Technology

Most recently: Professor, Materials Science and Engineering, Clemson University



JASON MARS

Assistant Professor, Computer Science and Engineering

Online adaptive systems in both software and hardware, datacenter and warehouse-scale computer architecture, and software / hardware co-design.

Ph.D. 2012 University of Virginia

Most recently: Ph.D. student at the University of Virginia

Email: jmars@ucsd.edu

Website: <http://clarity-lab.org/>



PATRICK MERCIER

Assistant Professor, Electrical and Computer Engineering

Energy-efficient circuit and system design, with emphasis on miniaturized devices for biomedical electronics that employ novel RF, analog, digital, power management, and energy harvesting architectures.

Ph.D. 2012 Massachusetts Institute of Technology

Most recently: Ph.D. student at the the Massachusetts Institute of Technology

Email: pmercier@ucsd.edu

Website: <http://efficiency.ucsd.edu/>



MARK MERCOLA

Professor, Bioengineering

Developing novel pharmacological therapies for heart regeneration, protection and maintenance of function after injury. Approaches include high throughput screening, animal and human stem cell models of disease, and systems biology.

Ph.D. 1985 University of California, Los Angeles

Most recently: Professor, Sanford-Burnham Medical Research Institute; Director, Muscle Development and Regeneration Program

Email: mmercola@ucsd.edu



JUSTIN OPATKIEWICZ

Lecturer, NanoEngineering

Opatkiewicz joined the NanoEngineering Department to teach a variety of the core courses in the Chemical Engineering curriculum. He created and taught courses related to mathematical techniques for chemical engineers while a student at UC Berkeley and Stanford University.

Ph.D. 2012 Stanford University

Most recently: Research staff, Stanford University, Department of Chemical Engineering

Email: jopatkiewicz@ucsd.edu



PETER YINGXIAO WANG

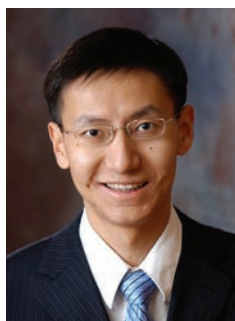
Associate Professor, Bioengineering

Interdisciplinary approaches involving molecular engineering, fluorescence resonance energy transfer (FRET), live cell imaging, and bio-nanotechnology to visualize and elucidate the molecular mechanisms by which live cells perceive the environment and to engineer machinery molecules for the reprogramming of cellular functions.

Ph.D. 2002 UC San Diego

Most recently: Associate Professor, University of Illinois, Urbana-Champaign

Email: yiw015@ucsd.edu



SHENG ZHONG

Associate Professor, Bioengineering

Computational genomics, epigenomics, stem cells and developmental biology, single-cell nano-technology. His lab discovered genetic differences between humans and other mammals in early embryonic development, and contributed to introducing the field of "comparative epigenomics".

Ph.D. 2005 Harvard University

Most recently: Associate Professor and Bliss Faculty Scholar, University of Illinois, Urbana-Champaign, Department of Bioengineering

Email: szhong@ucsd.edu

FACULTY HIRING FOR 2012–2013

The Jacobs School of Engineering is recruiting for 12 open faculty positions in the 2012–13 academic year. The positions fall within three strategic research focus areas: energy, sustainability and environment; engineering in medicine; and information technology and applications. Several of the positions are part of a three-year recruitment plan in the area of advanced energy research. Learn more: <http://bit.ly/Y6qMZi>



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UCSD | School of
Jacobs | Engineering

RESEARCH EXPO

April 18, 2013

jacobsschool.ucsd.edu/re/

Walking Tours of Campus

Welcome to the UC San Diego Visitors Tour Program
Public Tours Highlight Campus History, Art and Architecture
<http://admissions.ucsd.edu/tours/index.html>

Visit Fallen Star

Tuesdays and Thursdays
11A.M.–2 P.M.
Jacobs Hall 7th floor
<http://bit.ly/VhfeAN>

