MECHANICAL & AEROSPACE Engineering Department 2011-12

UCLA ENGINEERING
Henry Samueli School of
Engineering and Applied Science

Birthplace of the Internet

Chair's Message



Dear Friends and Colleagues,

I am pleased to present to you the Annual Report of the Mechanical and Aerospace Engineering Department. The Report presents highlights of the accomplishments and news of the Department's alumni, students, faculty, and staff during the 2011-2012 Academic Year.

As a member of the global higher education and research communities we strive to make significant contributions to these communities and to positively impact society. From reading these pages, I hope you will sense the pulse of our highly intellectual and vibrant community.

Sincerely Yours,

Tsu-Chin Tsao

Tsu-Chin Tsao, Department Chair

ON THE COVER: From the UCLA Plasma and Space Propulsion Laboratory, discharge plasma from cathode tests in a cylindrical anode configuration. (Photo credit: Ryan Conversano, Wirz Research Group)

Mission Statement

Our mission is to educate the nation's future leaders in the science and art of mechanical and aerospace engineering. Further, we seek to expand the frontiers of engineering science and to encourage technological innovation while fostering academic excellence and scholarly learning in a collegial environment.

The Department gratefully acknowledges the UC Atkinson Archives and the UCLA Office of External Affairs for permission to use many of the images in this Report.

Design and layout by Alexander Duffy.

UCLA MAE Annual Report 2011-2012

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Adam Provinchain wins 1st place at the NSBE TRE	
Cesar Quinde Receives Research Award	
Jin Fang wins third place in the best poster award competition at the 2011 ASME IMECE	
Julie Nichols competed for London 2012 US Olympic Rowing Team	
Wei Yu wins von Liebig fellowship.	
Cynthia Yin awarded 1st place in 2012 VCSF Senior Division Biochemistry Category	
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AIAA Rocket Project	
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SAE Supermileage.	
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Faculty and Staff		Recognitions	
Ladder Faculty:	30	Society Fellows:	25
Joint Faculty:	3	CAREER or Young Investigator Awards:	10
Emeritus Faculty:	8	NAE members:	8
Adjunct Faculty:	6	Regular Faculty: 4	
Lecturers:	22	Affiliated Faculty: 2	
Administrative Staff:	24	Emeriti: 2	
Staff Research Associates	s: 8		
Development Engineers:	8	5.11	
Postdoctoral Scholars:	22	Publications	
Visiting Ph.D. Scholars:	9	Journal Articles: 92	
Visiting International		Conference Papers: 56	
non-degree Students:	19	Books & Book Chapters: 7	
GSRs total for the year:	226	Patents: 9	
TAs (3 quarters) total:	114		

Laboratories

Active Materials

Autonomous Vehicle Systems Instrumentation

Beam Control

Boiling Heat Transfer

Computational Fluid Dynamics

Design and Manufacturing

Energy & Propulsion Research Laboratory

Fluid Mechanics Research Fusion Research Center

Fusion Technology Center

Heat Transfer Laboratories

Materials Degradation Characterization

Mechatronics and Controls Laboratory

Micro-Manufacturing

Microsciences

Morrin-Gier-Martinelli Heat Transfer Memorial Laboratory

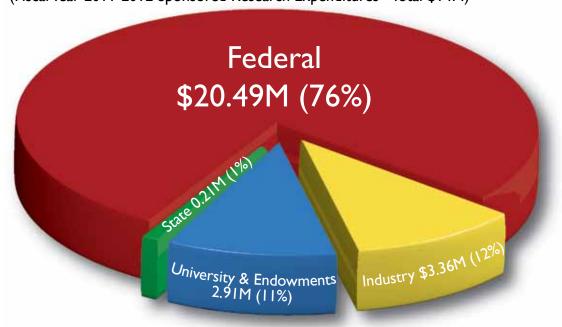
Multifunctional Composites

Nanoscale Heat Transfer & Thermoelectric Plasma and Beam Assisted Manufacturing

Thin Films, Interfaces, Composites, Characterization

Fiscal Year 2011-2012 Sponsored Research Budget - Total \$27M

(Fiscal Year 2011-2012 Sponsored Research Expenditures - Total \$14M)



Undergraduate Students

Enrolled / Aerospace: 198, Mechanical: 424, Total: 622

Applicants / Freshmen: Aerospace: 832, Mechanical: 1524, Total: 2356 Applicants / Transfers: Aerospace: 105, Mechanical: 367, Total: 472

Admitted / Aerospace: 131, Mechanical: 300, Total: 431

New Students Enrolled / Aerospace: 32, Mechanical: 92, Total: 124

Graduate Students

Students Enrolled / Aerospace: 67, Mechanical: 198, Total: 275

Applicants - MS/374 PhD / 233 Total: 607

Admitted / Aerospace: 70, Mechanical: 204, Total: 274

New Students Enrolled / Aerospace: 27, Mechanical: 86, Total: 113

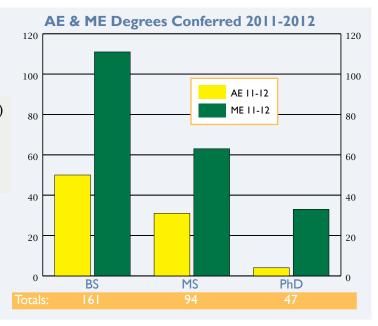
Average Undergraduate GPA: 3.56



Royce Hall and the Shapiro Fountain.

Number of AE & ME Degrees conferred 2011-2012 (BS, MS, PhD)

BS Aerospace: 50, Mechanical: 111, Total: 161 MS Aerospace: 31, Mechanical: 63, Total: 94 PhD Aerospace: 4, Mechanical: 33, Total: 47



Department Fellowships and Teaching Assistantships		
Graduate Division Allocation	\$ 737,644.00	
TA Funding	\$ 590,539.00	
Eugene Cota Robles Fellowship (4 Mechanical)	\$ 142,471.56	
Deans Matching NRT Funds	\$ 105,714.00	
Dissertation Year Program (3 Aerospace)	\$ 100,853.64	
Special GSR Funds	\$ 93,000.00	
GOFP Fellowship (3 Aerospace)	\$ 88,853.67	
Eugene Cota Robles Fellowship (2 Aerospace)	\$ 71,235.78	
Dissertation Year Program (I Mechanical)	\$ 33,617.88	
Camp Fellowship Funds	\$ 15,000.00	
Dean's Fellowship Funds	\$ 14,285.00	
Total	\$1,993,214.53	

Greg Carman to direct TANMS, the new UCLA engineering research center which will revolutionize nanoscale electromagnetic devices



The NSF-funded multimillion-dollar program, based on a new approach to electronics, could lead to tiny devices once considered fantasy

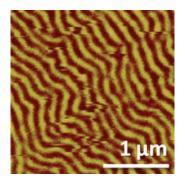
By Matthew Chin

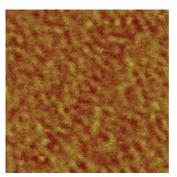


MULTIDISCIPLINARY TEAM OF researchers from UCLA and other universities is poised to help turn science fiction into reality — in the form of some of the world's tiniest electromagnetic devices — thanks to a major grant from the National Science Foundation's Engineering Research Center (ERC) program.

The grant, worth up to \$35 million over 10 years, will fund a new center headquartered at UCLA's Henry Samueli School of Engineering and Applied Science that will focus on research aimed at developing highly efficient and powerful electromagnetic systems roughly the size of a biological cell — systems that can power a range of devices, from miniaturized consumer electronics and technologies important for national security to as-yet unimagined machines, like nanoscale submarines that can navigate through the human blood stream.

Employing a fundamentally new approach to electromagnetic power at the nanoscale, researchers at the NSF-funded TANMS center (Translational Applications of Nanoscale Multiferroic Systems) are working





Electric field controls magnetic field

TANMS researchers have used an electric field to turn a magnetic field on (left) and off (right). They measured this effect in a ferromagnetic thin film on top of a piezoelectric substrate, using a magnetic force microscope. At left, the dark lines represent magnetic north poles emanating from the ferromagnetic thin film, and the light lines represent magnetic south poles. At right, an electric field is applied to the piezoelectric substrate, and the lines vanish, meaning that the magnetic field is no longer present. The researchers will expand on this ability to control magnetic fields in nanostructured ferromagnetic elements in the work of the TANMS Nanosystems Engineering Research Center. TANMS seeks to integrate newly discovered large effect multiferroic materials into electromagnetic devices, thereby enabling chip-scale generation of magnetic fields through the simple application of a voltage. Their research could lead to transformations in memory systems, antenna systems, and nanomotor systems.

Credit: Ray C. J. Hsu, Mechanical and Aerospace Engineering, UCLA

to replace traditional wire-based electronics with a revolutionary technique that couples electricity and magnetism by using multiferroic materials, which can be magnetically switched "on" and "off" by an electric field.

UCLA's partners in the new center include UC Berkeley, Cornell University, Switzerland's ETH Zurich and California State University, Northridge.

"At UCLA, we strive to conduct research that pushes the boundaries of knowledge and benefits society in practical ways, and this new center is a prime example of that pursuit," UCLA Chancellor Gene Block said. 'The National Science Foundation award for this major research center reflects the excellence and commitment of our renowned faculty and the quality of their collaborations with colleagues at other institutions."

"TANMS could spur a true paradigm shift for new devices that were once thought of as science fiction but now appear just over the horizon," said Vijay K. Dhir, dean of UCLA Engineering. "This new engineering research center's roster includes world-class faculty, and along with the best students in world, they will create and develop amazing new technologies that will certainly be exciting to see."

"We believe this is an opportunity for a truly revolutionary change in miniaturized electromagnetic devices," said Greg Carman, director of the new center and a UCLA professor of mechanical and aerospace engineering professor. "If you combine all three of our application areas — memory, antennas and motors— it really opens the possibilities of what new platforms may become possible. For example, it might be possible to build a remote submarine similar to the one described in the 1960s movie 'Fantastic Voyage.' Imagine a miniature submarine, at length-scales similar to red blood cells, that could be controlled and move through the blood stream.

"Present electromagnetic devices are based on concepts discovered nearly 200 years ago, and, while working well in large systems, they suffer from severe limitations in the small scale," he added. "TANMS overcomes this problem by developing a new, gamechanging approach to produce electromagnetic fields using nanoscale multiferroic materials with lengths as small as a few hundred atoms."

Electromagnetic devices are ubiquitous in today's world, from smart phones and computers to the

TANMS

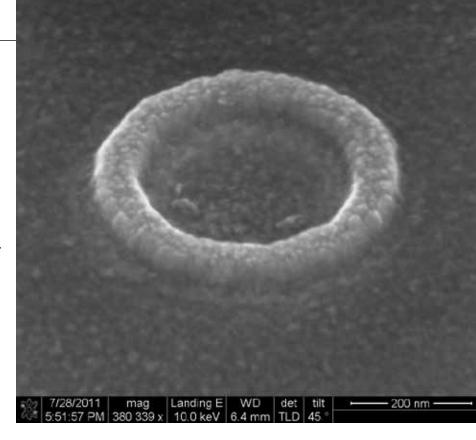
CENTER for TRANSLATIONAL APPLICATIONS of NANOSCALE MULTIFERROIC SYSTEMS

simple motors that automatically roll up car windows. All of these devices operate by passing an electric current through a wire, a concept first demonstrated in the early 1800s. And while this technology works extremely well in the large scale, it fails in the small scale and has been a roadblock to advancements in miniaturization. Much like water flowing through a pipe, as a wire's diameter decreases, so does the amount of current flowing through it, limiting the ability of this current—through-a-wire approach to create and control electromagnetic energy.

The new approach being developed by TANMS researchers seeks to solve this problem by taking advantage of multiferroic materials, which use electric fields to intrinsically switch the magnetic state of a material, similar to switching a light bulb on and off. Over the past decade, these researchers have led explorative efforts demonstrating the unique properties present in multiferroics at the nanoscale. These discoveries are leading to an entirely new method of controlling electromagnetic devices to revolutionize antennas, memory and motors at extremely small scales — an approach previously considered implausible.

"With platform technologies such as the ones we are developing, new, active devices that are more efficient, substantially smaller and more powerful will be available to engineers working on a wide class of problems, including the critical-care needs facing our nation," said Carman, who is a member of the California NanoSystems Institute at UCLA. "Of course, each individual focus application represents a significant advancement. For example, the ability to decrease the antenna size in a cell phone by an order of magnitude is an important step not only for consumers but also the military. I feel very fortunate to lead the world's best academic researchers in nanoscale multiferroics, and the whole team is truly excited about the unique opportunities and discoveries that await us during this 10-year NSF program."

While the new center's major focus is on research, it also aims to develop a unique ecosystem around the five-university alliance focused on both education and commercialization. TANMS faculty are already working closely with UCLA's Institute for Technology Advancement to help define and transition to market the intellectual property that will be developed under



the new program. And 21 companies, ranging from small businesses to large corporations, have sent letters of interest to help translate and commercialize TANMS discoveries.

On the educational front, TANMS has a unique "cradle-to-career" program that will introduce high school students to the center's facilities, as well as provide them with unique opportunities throughout their college careers. TANMS's educational philosophy focuses on teaching students about the important interactions between the engineering and business sectors that are necessary to advance new technologies that benefit society.

"The United States always led in technology development during the last century, and to continue this, our country needs to expand the pipeline of future engineers and scientists with more students from diverse backgrounds," Carman said. "At TANMS, we envision high school students, undergraduates and graduate students all taking part in both research and translational efforts associated with the research. We are trying to help our best and brightest students find their path toward being the next Henry Ford, Steve Jobs or Henry Samueli. I firmly believe that teaching our students that engineering is as much about business as it is about science will lead to a new wave of students interested in entering engineering school, and I expect our new paradigm to become a model program for other universities across the country."

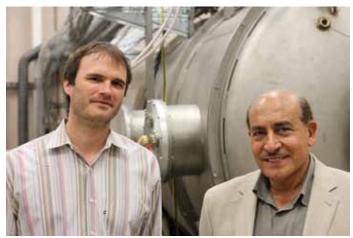
Ferromagnetic ring

This Scanning **Electron Micrograph** (SEM) shows a 500nm Nickel ring on a piezoelectric substrate. Such ferromagnetic rings may be used in the fabrication of nanoscale motors at the NSF Nanosystems **Engineering Research** Center (NERC) for Transformational Applications of Nanoscale Multiferroic Systems (TANMS).

Credit: Joshua Leon Hockel, Mechanical and Aerospace Engineering Department, University of California Los Angeles

THE SCIENCE OF SPACE

Through these efforts in plasma-materials and EP plasma physics, UCLA is poised to provide significant contributions to the future of electric propulsion and space travel.



Professors Wirz and Ghoniem in front of UCLA's new Plasma Interactions (Pi) Facility.

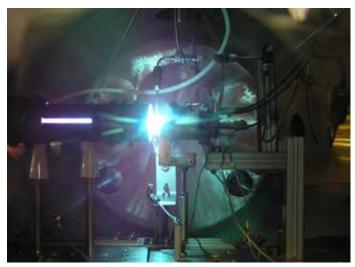
MULTI-MILLION DOLLAR PROGRAM funded by the Air Force lacksquare was launched at UCLA this year to develop the science base for a host of enabling technologies critical to the missions of the Air Force, NASA, and the U.S. Aerospace Industry. Nasr Ghoniem and Richard Wirz are collaborating on a unique scientific frontier at the interface between plasma and material science. Their ultimate goal is to develop new material architectures and electric propulsion concepts that promise to revolutionize space propulsion and pulsed power. UCLA has been awarded a five-year program led by Ghoniem to develop micro-architectured materials that are more resilient in the severe electric propulsion and pulsed power environments. The project is a collaboration between universities, national laboratories, and U.S. industries composed of: UCLA (lead institution), Princeton Plasma Physics Laboratory (PPPL), the Jet Propulsion Laboratory (JPL), Ultramet Inc., and Case Western University (CWU). These new materials are developed by Ghoniem's group at UCLA and examined in detail by the many collaborators for a wide range of plasma conditions. For example, Wirz' group uses a high energy Plasma Interactions (Pi) experiment to examine the behavior of materials in the presence of plasma conditions typical of electric propulsion and other high power plasma devices. In separate but related research efforts, Wirz has received multi-year awards from the Air Force and NASA to develop the science of plasmas to enable revolutionary electric propulsion thruster concepts.

Many space and Pulsed Power (PP) technologies, such as Electric Propulsion (EP) devices, high power gyrotrons, microwave sources, rail guns, etc., require materials that operate in extraordinary environments. Science-based development of materials for demanding space and pulsed power applications requires new modeling tools and experimental methods. While photons deposit their energy in shallow layers, energetic particles deposit their energy in the bulk, and this creates severe non-equilibrium

conditions forcing the material to adapt. Advances in electrode, chamber, and structural materials will enable breakthroughs in future generations of electric propulsion and pulsed power (EP & PP) technologies. The project is developing new refractory and ceramic material forms with micro-engineered surfaces, an area pioneered by Ghoniem's group that will enable revolutionary advances in EP & PP technologies. The research project focuses on two complementary areas: (1) the fundamental sciences of failure and degradation of micro- engineered materials operating in the harsh plasma, electromagnetic and ion environments of these technologies; and (2) the strong coupling between the material's surfaces and plasma performance.

The current research is a balanced approach combining multiscale modeling of materials and plasmas, experimental verifications of the models, and development of micro-engineered surfaces through fabrication with Chemical Vapor Deposition (CVD). Textured and foam-type plasma-resilient materials are manufactured by CVD, which is an extremely versatile and relatively inexpensive method of molecular forming of materials and structures that are difficult to create by conventional powder processing and machining. Metal deposits are formed on the substrate at the molecular level, while the gaseous reaction byproducts are exhausted from the system. Two unique UCLA experimental facilities are being developed by Ghoniem and Wirz to recreate the severe environments encountered in a wide-range of EE & PP technologies.

The High Energy Flux Experimental Facility (HEFTY) is an experimental facility dedicated to the testing of materials in pulsed high-energy flux environments. The effects of highly energetic plasmas on the surfaces of refractory metals, such as tungsten and molybdenum are of particular interest. The wide range of applications of such materials makes investigation



Side view of high power cathode plasma source with a liquid-cooled anode. Magnetic coils are used to confine the dense xenon plasma.

ELECTRIC PROPULSION

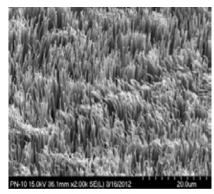
of their damage properties under various degrees of thermomechanical loading of paramount interest for facilitating the reliable design of next generation engineered structures. The mission of HEFTY is to provide a state of the art experimental facility for investigation of the damage mechanisms of refractory metals under high energy flux (extreme) conditions. Currently the lab is equipped with a Praxair model SG-100 plasma gun which is rated for up to 80 kW operation, of which about 30 kW actually reaches the target due to thermal losses. The system is capable of delivering heat fluxes in the range of 30-300 MW/m², with plasma arc temperatures on the order of 20,000 °C.

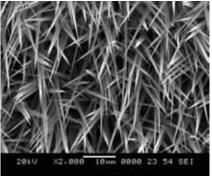
The Plasma Interactions (Pi) experiment is a new state-of-theart plasma surface interactions facility at UCLA. This facility is designed to provide well-characterized plasma indicative of the extreme conditions experienced in electric thrusters and other high power plasma devices. The plasma source for the Pi-facility utilizes a magnetically confined hollow-cathode discharge to produce high-density plasma for nearly any noble gas. The plasma is guided from the source to the target interaction region by a converging-diverging magnetic field produced by a series of coils installed inside the vacuum system. The target sample is inserted into the vacuum system on a cooled manipulator arm, exposed to the ion flux from the plasma source, and then biased to produce the desired incident energy. With this design, the Pi facility can provide plasma high power plasma conditions at the material surface with ion energies up to 300 eV and ion flux up to 1023 m⁻²s⁻¹. The plasma is carefully characterized by several

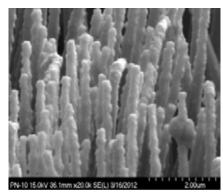
plasma diagnostic measurements, including spectroscopic and electromagnetic probes for determining the behavior of charged species (ions and electrons) and gas analyzers for measuring local composition and pressures of neutral atoms.

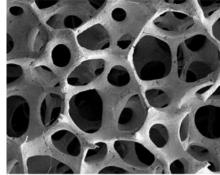
In addition to these efforts in plasma-materials interactions, Wirz' group is working directly on improving the understanding of electric propulsion (EP) plasma physics. One such effort is part of a 5 year, multi-university effort to use well-characterized experiments and models to make breakthroughs in the understanding of EP plasma physics. The models and understanding derived from these efforts are being applied to the development and performance/life characterization for a wide range of new electric propulsion concepts developed at UCLA, other universities, NASA, and the Air Force. For example, an area pioneered by Wirz is the use of magnetic cusp confinement for extremely high performance micro-scale noble gas plasma devices and electric thrusters. Researchers in Wirz' laboratory are using a combined experimental and computational approach to apply magnetic cusp confinement for plasma discharges as small 1 cm in diameter; such discharges are ideal for providing primary thrust for small interplanetary spacecraft or attitude control for precision formation flying missions that can directly observe planets in other solar systems.

Through these efforts in plasma-materials and EP plasma physics, UCLA is poised to provide significant contributions to the future of electric propulsion and space travel.









New micro-architectures materials developed by Ghoniem's group in collaboration with Ultramet using Chemical Vapor Deposition (CVD). Tungsten dendrites (top left); tungsten-Rhenium nano-pillars irradiated by low energy Argon (top right); rhenium microspears (bottom left); and tungsten micro-foam (bottom right).

UCLA Micro Systems Lab involved in UCLA discovery that migrating cells 'turn right' has implications for engineering tissues, organs

By Rachel Champeau (reprinted from UCLA Newsroom with minor edits)

HAT IF WE could engineer a liver or kidney from a patient's own stem cells? How about helping regenerate tissue damaged by diseases such as osteoporosis and arthritis? A new UCLA study, involving Ting-Hsuan Chen, Yi Huang, Margaret Wong, and Prof. Chih-Ming Ho, bring scientists a little closer to these possibilities by providing a better understanding how tissue is formed and organized in the body

A UCLA research team discovered that migrating cells prefer to turn right when encountering changes in their environment. The researchers were then able to translate what was happening in the cells to recreate this left–right asymmetry on a tissue level. Such asymmetry is important in creating differences between the right and left sides of structures like the brain and the hand.

The research, a collaboration between the David Geffen School of Medicine at UCLA and the Center for Cell Control at UCLA's Henry Samueli School of Engineering and Applied Science, appeared in the February 17, 2012 issue of the journal Circulation Research.

"Our findings suggest a mechanism and design principle for the engineering of tissue," said senior author Dr. Linda L. Demer, a professor of medicine, physiology and bioengineering and executive vice chair of the department of medicine at the Geffen School of Medicine. "Tissue and organs are not simply collections of cells but require careful architecture and design to function normally. Our findings help explain how cells can distinguish and develop highly specific left—right asymmetry, which is an important foundation in tissue and organ creation."

Using microtechnology, the team engineered a culture surface in the lab with alternating strips of protein substrates that were cell-adhesive or cell-repellent, analogous to a floor with narrow horizontal stripes of alternating carpet and tile. Cells may encounter such surface changes when they travel through the body.

The researchers observed that as the migrating

cells crossed the interface between "carpet" and "tile" sections, they exhibited a significant tendency to turn right by 20 degrees, and, like a marching band, lined up in long, parallel rows, producing diagonal stripes over the entire surface.

"We had been noticing how these vascular cells would spontaneously form structures in cultures and wanted to study the process," said first author Ting-Hsuan Chen, a graduate student researcher in the department of mechanical and aerospace engineering at UCLA Engineering. "We had no idea our substrates would trigger the left-right asymmetry that we observed in the cells. It was completely unexpected.

"We found that cells demonstrated the ability to distinguish right from left and to self-organize in response to mechanical changes in the surfaces that they encounter. This provides insight into how to communicate with cells in their language and how to begin to instruct them to produce tissue-like architecture."

According to the researchers, the cells can sense the substrates beneath them, and this influences the direction of their migration and what shapes they form in the body. Of most interest, the researchers said, was the fact that the cells responded to the horizontal stripes by reorganizing themselves into diagonal stripes.

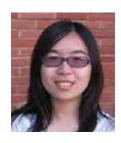
The team hopes to harness this phenomenon to use substrate interfaces to communicate with cells and instruct them to produce desired tissue structures for replacement. By adjusting the substrates, the researchers say, they have the potential to guide what structures the cells and tissue form.

The next stage of the research will be to control and guide cells to self-organize into two-dimensional and, eventually, three-dimensional patterns chosen by the researchers.

According to the research team, this is one of the first studies to demonstrate that encountering a change in substrate can trigger a cell's preference for

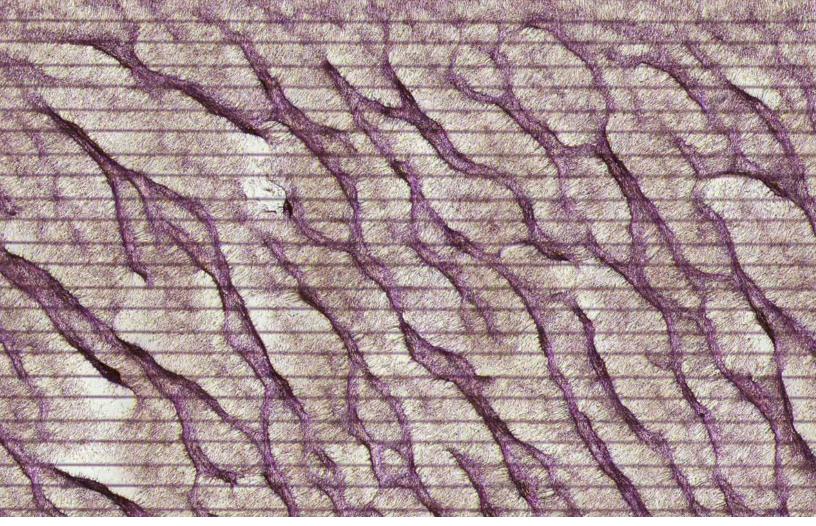








Ting-Hsuan Chen, Margaret Wong, Yi Huang, and Prof. Chih-Ming Ho



'Right turning' cells create diagonal pattern

turning left or right. It is also one of the first studies showing that cells can integrate left–right asymmetry into a patterned structure of parallel diagonal stripes resembling tissue architecture.

"Applications for this research may help in future engineering of organs from a patient's own stem cells," Demer said. "This would be especially important given the limited supply of donor organs for transplant and problems with immune rejection."

The study was funded by the National Science Foundation and National Institutes of Health.

Additional authors included Jeffrey J. Hsu, Alan Garfinkel and Yin Tintut from the UCLA Department of Medicine; Yi Huang and Chih-Ming Ho from the UCLA Department of Mechanical and Aerospace Engineering; Xin Zhao, Chunyan Guo and Zongwei Li from the Institute of Robotics and Automatic Information System at China's Nankai University; and Margaret Wong from the UCLA Department of Bioengineering.



Tsu-Chin Tsao's Mechatronics and Controls Laboratory conceives, designs, and builds dualcontrol robot that helps guide hands of novice surgeons



By Rachel Champeau / Photos by Matthew Chin (reprinted from UCLA Today)

A UCLA TEAM OF doctors and engineers has developed a new robot to help provide hands-on instruction to novice surgeons in minimally invasive surgical techniques — even if teacher and student are miles apart.

In one of the first tests with the robot, the team from UCLA connected remotely over the Internet to students more than 100 miles away at the Eisenhower Medical Center near Palm Springs.

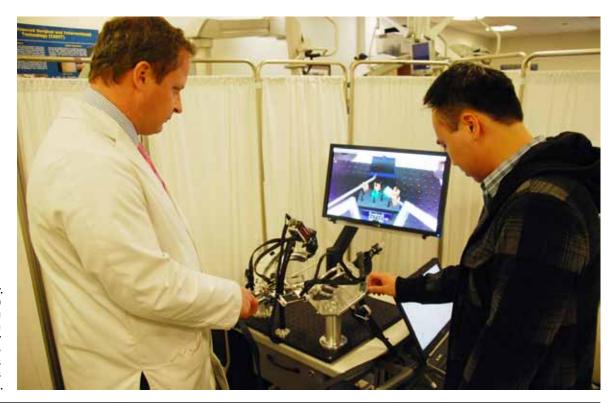
Using dual controls similar to those used in a driver's education car, Dr. Erik Dutson, a surgeon with UCLA's Center for Advanced Surgical and Interventional Technology (CASIT), manned a master console to guide novices over the Internet as they took turns using a duplicate set of surgical tools. The center is part of the David Geffen School of Medicine.

During exercises to help them develop dexterity with the tools, novices practiced picking up rubber beads, tying a knot similar to those used in suturing and cutting out a cloth circle to simulate snipping tissue. Successful execution of such tasks is part of the certification process for surgical training.

Rather than picking up a scalpel, surgeons are now doing many procedures by using joystick-like controls that manipulate surgical instruments inserted through tiny, keyhole-size incisions. These newer techniques are popular because they provide a shorter recovery time for the patient, reduced pain and trauma, and a greater range of motion and access for the surgeon.

But as the demand for these new techniques grows, so does the need for more effective ways to teach these skills.

The remote robotic teaching system is one of the first to be developed to help surgeons feel resistance to bone and tissue as if they were operating inside the body, Dutson said. Even though he was miles away, Dutson could take over the controls and increase or relax the resistance that the trainee encounterd while performing the tasks. The trainee and Dutson talked to each other via a Skype-like interface on a monitor



UCLA surgeon Dr. Erik Dutson (left) and engineering researcher Chris Lim adjust the master controls of the robot, which was developed at UCLA's engineering school. set up next to the robot platform. The robot also utilizes standard laparoscopic tools surgeons use in the operating room.

Called the LapaRobot, the new system was developed by a faculty member and researchers from the Department of Mechanical and Aerospace Engineering at the UCLA Henry Samueli School of Engineering and Applied Science in collaboration with the medical school. Professor and department chair Tsu-Chin Tsao conceived of the system, which was then designed and built by engineering researchers Stephen Prince and Chris Lim, with the help of colleagues Chris Kang and Kevin Chu. All are from UCLA's Mechatronics and Controls Laboratory.

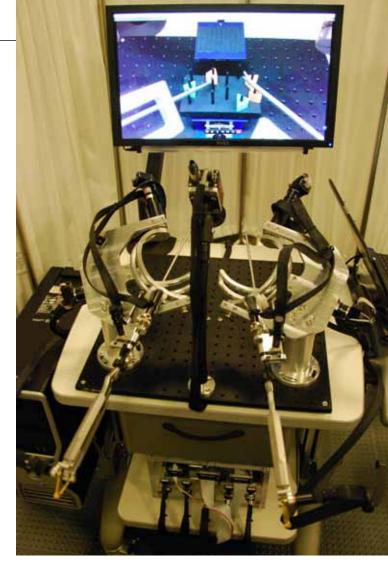
"These remote applications greatly broaden teaching and training capabilities," said Dutson, CASIT's executive medical director and associate clinical professor of surgery. Combat surgeons working on the battlefield as well as physicians in rural areas of the country or in third-world countries may someday be learning these skills remotely. "Telehealth is going to play a major role in the future of health care delivery," he said.

Created with this in mind, the robot is portable, ergonomically adjustable and requires just one AC power plug and two Internet connections. "The goal was to create a unit that was easy to set up and utilize in a variety of locations," Dutson said.

While the system is cost-effective, it has the reliability and stability required for tele-mentoring, said Tsao. "Such academic collaborations bring the latest engineering innovations and technologies into medicine to help advance the field, including developing new ways to train and educate."

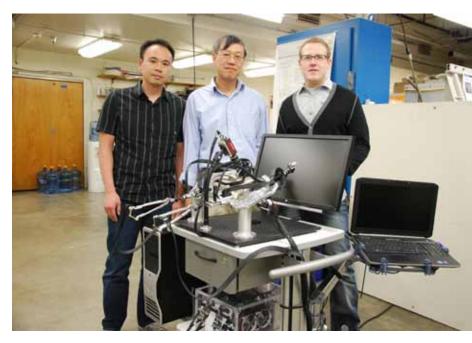
The teaching exercise with Eisenhower Medical Center is just one of a series of projects to assess the effectiveness of the robot in various training scenarios.

"It's very gratifying to see the robot in action," added Prince. "We're excited to be able to contribute to this growing field of telemedicine."



Top: The LapaRobot from the user's point of view.

Bottom: Chris Lim, Professor Tsu-Chin Tsao, and Stephen Prince.



SMART GRID

As the nation's power system ages and grows insufficient, Rajit Gadh, Director of UCLA SMERC (Smart Grid Energy Research Center), is building a smarter, greener electric grid for the future.

MERC, OR THE UCLA Smart Grid Energy Research Center, performs research, creates innovations, and, demonstrates advanced wireless/communications, Internet and sense-andcontrol technologies to enable the development of the next generation of the electric utility grid - The Smart Grid. SMERC also provides thought leadership via partnership between utilities, government, policy makers, technology providers, electric vehicle and electric appliance manufacturers, DOE research labs and universities, so as to collectively work on vision, planning and execution towards a smart grid of the future. The Smart Grid of the future would allow integration of renewable energy sources, reduce losses, improve efficiencies, increase grid flexibility, reduce power outages, allow for competitive electricity pricing, allow for integration of electric vehicles and overall become more responsive to market, consumer and societal needs. SMERC is currently working on the topics of Automated Demand Response, Electric Vehicle Integration (G2V and V2G), Microgrids, Distributed and renewable integration, and Cybersecurity.

Excerpts from the following three articles explore different facets of SMERC.

UCLA teams with Korea's energy research institute

By Wileen Wong Kromhout

MAGINE A HOME in which every appliance — computer, television, washing machine, refrigerator, air conditioner — can carry on a minute-by-minute "conversation" with the local power grid, allowing the devices to power down when the price of electricity is at a premium and to consume energy when it is cheapest.

Such smart-grid technologies can lead to increased energy efficiency, lower electricity costs and a significantly reduced carbon footprint. Now imagine an entire building outfitted with this technology — or an entire city — and the potential for savings and sustainable energy becomes clear.

Welcome to UCLA.

"UCLA is like a little city — Pasadena, Burbank and Glendale are not much bigger," said Rajit Gadh, director of UCLA's Smart Grid Energy Research Center (SMERC) and a professor of mechanical and aerospace engineering who specializes in wireless smart-grid technology. "With a city like UCLA, we can test our concepts very quickly, as well as conduct very interesting tests."

With major funding from the U.S. Department of Energy and the Los Angeles Department of Water and Power, Gadh and his colleagues from the UCLA Henry Samueli School of Engineering and Applied Science are leading the charge to build and test innovative smart-grid technologies that could lead to major breakthroughs for power infrastructure and reliability.

And now, UCLA Engineering has entered into a 10-year partner-ship with the government-supported Korea Institute of Energy Research (KIER) in South Korea to collaborate on smart-grid research and the development of new technologies with the aim of creating a robust smart grid on an international level.

As part of that effort, Gadh's team is using the campus — in particular, Boelter Hall and the Engineering IV and V buildings — as an experimental lab to observe how wireless sensing and control systems can help create the smart grid. They are retrofitting these structures with cutting-edge sensors and smart meters that can, for example, gauge and adjust the amount of power needed in a room at a particular time of day and control appliances, lights, and heating and air-conditioning systems depending on energy pricing or power availability on the grid.

Gadh's reputation for innovation in wireless smart-grid applications caught the attention of the Koreans, whose government is investing large sums to develop clean technology and renewable energy.

"KIER has a strong interest in energy-efficiency technology and R&D due to its importance in terms of energy savings and the reduction of carbon dioxide," said Tae Hyun Yang, KIER's principal researcher on the joint project with UCLA. "Dr. Gadh came to our attention via Dr. Jung-in Choi, a Korean professor who had worked with Dr. Gadh for a year. In addition, KIER is well aware of the growing reputation of UCLA Engineering in this area of work."

Choi, who has also been working on smart grid research since 2005, came to UCLA on sabbatical from Kyungwon University and learned about Gadh's research through several news articles.

"I think UCLA's Smart Grid Energy Research Center is one of the most active research institutes in the smart-grid field today," he said. "In particular I have been most interested in the open architecture platform for the smart grid — Dr. Gadh's WINSmartGridTM in particular. KIER needs an open architecture platform technology, and I thought a partnership between KIER and SMERC would be beneficial for both."

The UCLA WINSmartGridTM (Wireless Internet Smart Grid) is a network platform that allows electrically operated machines and appliances such as plug-in electric vehicles, washers, dryers and air conditioners to be wirelessly monitored, connected and controlled through a wireless communications framework.

The technology connects the machines and smart meters to the WINSmartGridTM web service, which receives real-time feeds from utilities and external sources on the price of power at any time of day and other information. Control signals can subsequently be sent via the WINSmartGridTM network, which in turn can dynamically control various appliances in real time.

Speeding transition to electric vehicles

By Judy Lin / UCLA Today

OR ENGINEERING PROFESSOR Rajit Gadh, knowledge is power. In particular, that's electric power and finding new ways to harness, store and deliver it as growing numbers of American drivers give up their gas-guzzlers for electric vehicles.

While the benefits of clean-energy, petroleum-free electric vehicles (EVs) like the Nissan Leaf and Chevy Volt are clear to a nation dependent on foreign oil, making this large-scale transition poses a whole new set of problems.

Take the seemingly simple matter of charging EV batteries, said Gadh, director of the UCLA Smart Grid Energy Research Center (SMERC) at the UCLA Henry Samueli School of Engineering and Applied Science.

Suppose you're a UCLA employee and proud owner of a new EV. You drive to campus, pull into a parking structure, plug into a charging station and leave your car for the several hours required for a complete recharge — about 5 kilowatts of power, enough to run a typical home.

Now fast-forward to the day when you're one of 50 EV owners who pull into the same parking lot at about the same time. Problem one is having enough charging stations for everyone, given that one station costs several thousand dollars to install and the rapidly advancing technology requires regular upgrades. Problem two is power capacity.

"That's 50 EVs consuming 5 kilowatts each," Gadh said, a huge load that could well blow a campus transformer, or, scaled up to citywide proportions, could blow out the whole power grid.

So Gadh and graduate student researchers at SMERC are exploring other possibilities. What if all the EVs could plug in at the same time and a software program could schedule the aggregate battery charges? What if EVs could not only draw power from the electric grid but feed it back in — helping stabilize our power supply?

Getting car and equipment manufacturers, utility companies and consumers onto the same grid — a 21st-century "smart" grid — could well change the entire ecosystem of technology. Underpinning SMERC's work is its UCLA-based parent organization, the Wireless Internet for Mobile Enterprise Consortium (WINMEC). Also under Gadh's direction, this university/industry/government collaboration is supported by funding from the U.S. Department of Energy and the L.A. Department of Water and Power. Both are racing to fulfill federal and state mandates requiring utilities to find ways to incorporate renewable energy into California's electric grid.



Smarter power

By Harry Mok / UC Research Explore Stories

OMEDAY MOST DRIVERS will power their cars by plugging in. Home appliances will be networked wirelessly and automated to maximize their efficiency. Solar, wind and other renewable energy sources will provide most of the country's power.

But it can't happen on the nation's current electrical grid. A renewable energy-based system will require new technology to facilitate the large-scale transmission and storage of solar and wind power. As more electric cars hit the road, a new system is needed to handle all the motorists trying to charge up at the same time.

Much of the nation's power system was designed more than 100 years ago and many of its parts are more than 50 years old.

The current grid was built for consistent, one-way transmission of power from large generation centers into homes and businesses. Renewable energy sources don't behave that way. They have variable loads that ebb and flow with the amount of sunshine or wind that generate them. The grid also can't handle the influx of electric cars that's expected in the near future.

"Now you have solar rooftops which essentially allow power to flow back to the grid," said Rajit Gadh, director of the UCLA Smart Grid Energy Research Center. "The grid operation is not used to getting information back from the consumer."

Gadh envisions homes in the future having appliances that can talk wirelessly to the electric grid and turn off during peak periods or draw from batteries that store excess power generated from the house's solar panels. In the garage, there would be an electric charging and power storage station for cars. Neighbors could form a collective to offer power back to a utility.

"All these ideas, we're exploring and one day I think they will happen," said Gadh, who cautions that it could still take up to 25 years to update the country's infrastructure to enable widespread use of these new technologies.

Gadh and other UC researchers are working to make this future come true. Among the numerous projects throughout the UC system, engineers and scientists at UCLA, UC San Diego and UC Irvine are utilizing their campuses as living labs for studies of smart grid technologies.

The UCLA Smart Grid Energy Research Center focuses on wireless communication technology and smart charging stations for electric cars. It is part of a smart grid demonstration project funded by the Department of Energy and the Los Angeles Water and Power Department and partnering with the Korea Institute of Energy Research to develop new technologies.

The center has outfitted several UCLA engineering school buildings with sensing and control systems to explore new smart grid technology. The devices can gauge and adjust the amount of power needed in a room; and control appliances, lights, and heating and air-conditioning systems, depending on occupancy and energy pricing or power availability on the grid. The smart car chargers operate similarly and can power down if grid conditions are not optimal.

Professor Rajit Gadh at Jeju Island in Korea.

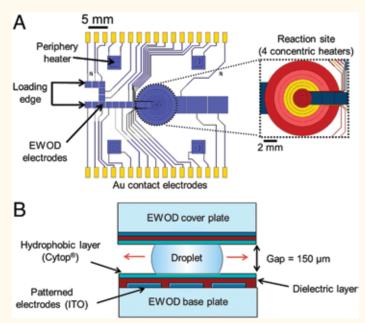
CJ Kim's electronic microfluidic device synthesizes biocompatible probes



ICROFLUIDIC CHEMISTRY IS fast gaining popularity – and for good reason: In addition to allowing highly-precise reaction control, micro-reactions often exhibit higher yield and proceed faster than their macroscale cousins. They also readily scale to production environments, and are far safer when synthesizing hazardous compounds because of the very small volumes of materials inside the devices.

Recently, scientists at the University of California, Los Angeles (UCLA) have advanced the field by developing and demonstrating an all-electronic digital microfluidic device for microscale chemical synthesis in organic solvents – and that is operated by electrowetting-on-dielectric, or EWOD. (Electrowetting modifies the wetting properties of a surface by applying an electric field; EWOD coats the electrode forming that surface with a dielectric insulating layer.) Their robust EWOD platform simultaneously resolves two limitations of previous technologies – namely, multistep reaction protocols and organic solvent compatibility.

The research team, led by Professors R. Michael van Dam and Pei Yuin Keng in UCLA's Crump Institute for Molecular Imaging and Professor CJ Kim in the Mechanical and Aerospace Engineering Department, faced a particularly challenging issue in developing their digital microfluidic device and applying it to microscale chemical synthesis. "When working with organic solvents at small volume scales – especially those that are volatile – evaporation is a significant problem in the relatively open configuration of EWOD chips," van Dam tells PhysOrg.com. "Unwanted evaporation can change concentrations, dry the sample, and so on, leading to imprecise control over the chemical process and low reproducibility of the chemistry. Our main challenge was in overcoming this effect."



(A) EWOD microchip with four concentric heaters (dashed circle) with a maximum volume of 17 μ L. Inset shows magnified area of the heater with four concentric individually controlled resistive heating rings. (B) Schematic side view of the EWOD chip sandwiching a reaction droplet between two plates coated with ITO electrodes, a dielectric layer, and a hydrophobic layer of Cytop (not to scale). Copyright © PNAS, doi: 10.1073/pnas.1117566109

Eric Chiou's laser-triggered high-speed cell

CLA MAE ASSOCIATE Professor Pei-Yu Chiou's recent work on a laser-triggered, high-speed cell sorter was highlighted in Nature Photonics 6, 269 (2012), in an article by James Baxter. From the article:

Pei-Yu Chiou and co-workers in the USA have now developed a high-speed, high-purity laser-triggered fluorescence-activated cell sorter. Their device is capable of sorting up to 20,000 mammalian cells per second with a purity of 37%, or 1,500 cells per second with a purity of more than 90%.

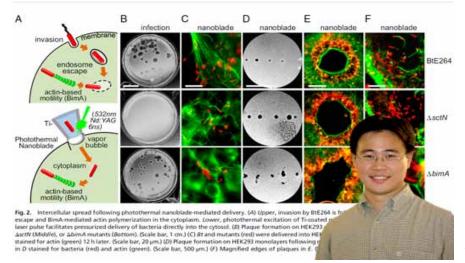
This research was originally published in Lab Chip 12, 1378–1383 (2012).

Abstract

We report a high speed and high purity pulsed laser triggered fluorescence activated cell sorter (PLACS) with a sorting throughput up to 20000 mammalian cells s⁻¹ with 37% sorting purity, 90% cell viability in enrichment mode, and >90% purity in high purity mode at 1500 cells s⁻¹ or 3000 beads s⁻¹. Fast switching (30 μ s) and a small perturbation volume (90 pL) is achieved by a unique sorting mechanism in which explosive vapor bubbles are generated using focused laser pulses in a single layer microfluidic PDMS channel.

Eric Chiou dissects the Burkholderia intracellular life cycle using a photothermal nanoblade

From pnas.org



RIC CHIOU'S OPTOELECTRONIC Biofluidics Laboratory, collaborating with a group of on-campus researchers, recently published a paper in the Proceedings of the National Academy of Sciences (PNAS) showing how their laser surgery tool helps deliver whole bacteria into live cells, with a high efficiency that was not possible before. Chiou is an associate professor with UCLA's Mechanical and Aerospace Engineering Department. The paper was the result of a wide on-campus collaboration between many departments and institutes.

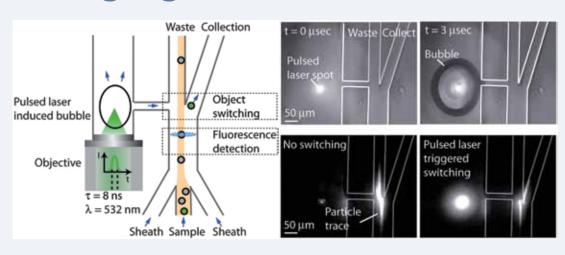
Abstract

Burkholderia pseudomallei and Burkholderia thailandensis are related pathogens that invade a variety of cell types, replicate in the cytoplasm, and spread to nearby cells. We have investigated temporal and spatial requirements for virulence determinants in the intracellular life cycle, using genetic dissection and photothermal nanoblade delivery, which allows efficient placement

of bacterium-sized cargo into the cytoplasm of mammalian cells. The conserved Bsa type III secretion system (T₃SSBsa) is dispensable for invasion, but is essential for escape from primary endosomes. By nanoblade delivery of B. thailandensis we demonstrate that all subsequent events in intercellular spread occur independently of T₃SSBsa activity. Although intracellular movement was essential for cellcell spread by B. pseudomallei and B. thailandensis, neither BimA-mediated actin polymerization nor the formation of membrane protrusions containing bacteria was required for B. thailandensis. Surprisingly, the cryptic (fla2) flagellar system encoded on chromosome 2 of B. thailandensis supported rapid intracellular motility and efficient cell-cell spread. Plaque

formation by both pathogens was dependent on the activity of a type VI secretion system (T6SS-1) that functions downstream from T₃SSBsa-mediated endosome escape. A remarkable feature of Burkholderia is their ability to induce the formation of multinucleate giant cells (MNGCs) in multiple cell types. By infection and nanoblade delivery, we observed complete correspondence between mutant phenotypes in assays for cell fusion and plaque formation, and time-course studies showed that plaque formation represents MNGC death. Our data suggest that the primary means for intercellular spread involves cell fusion, as opposed to pseudopod engulfment and bacterial escape from doublemembrane vacuoles.

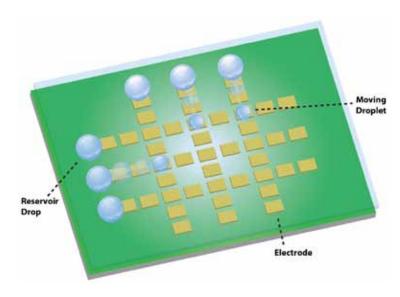
sorter highlighted in Nature Photonics





CHANG-JIN "CJ" KIM
has developed several
microelectromechanicalsystem
(MEMS) courses since joining the
UCLA faculty in 1993. He has also
established a MEMS Ph.D. major
in the Mechanical & Aerospace
Engineering Department.
Directing the Micro and Nano
Manufacturing Laboratory,
he is a founding member of
the California NanoSystems
Institute (CNSI) at UCLA.

CJ Kim's Start-Up Experience: Core Microsolutions



Water and other fluids, if broken down into small enough droplets, can be moved with the application of electrical signals. Consuming little power and requiring no pumps or valves, this microfluidic technology is attractive to many applications, ranging from biochemical analyzers to optical displays.

HE NOTION OF moving water and other fluids around without the use of pumps, pipes, valves and other familiar components might seem unimaginable to most of us. But if the fluids are broken down into small enough droplets—on the order of 1 millimeter in diameter—they can be moved or manipulated with the application of electrical signals.

Having discovered that this was possible in 1997, Kim, professor of mechanical and aerospace engineering and member of the California NanoSystems Institute at UCLA, has spent much of the last decade developing new technologies based on the phenomenon.

In 2002, Kim and one of his graduate students, Peter-Patrick de Guzman, applied for a Small Business Innovation Research (SBIR) grant and used the money to found Core Microsolutions. They planned first to develop a line of optical switches based on Kim's technology. These switches, intended for use in fiber-optic systems, used water droplets to replace the mirrors and mechanical assemblies that are ordinarily used to direct light pulses to their destination. Kim planned to use the revenue generated through the sale of these switches to finance the development of biomedical instruments.

"In the long run, I thought biomedical applications should be the major focus of the company," Kim recalls. "But at that time, optical applications were abundant, and optical applications were much easier to design and bring to market. So my strategy was to start the company with optical applications first, because the market was there."

But then the dot-com bust hit, and the market for optical switches collapsed. With the SBIR grant in hand and the company already formed, however, Kim had no choice but to move forward without the income stream he had anticipated. Fortunately, he

and his associates were successful in obtaining a succession of SBIR grants. The grant money, supplemented with personal funds, allowed the two researchers to "bootstrap" the company and sustain it while they developed the biomedical applications that had originally motivated them to found the company.

In 2009, the founders sold the company to North Carolinabased Advanced Liquid Logic. Kim looks back on the experience with mixed feelings.

"Having a company is exciting," he says. "It's all about taking the technology you have envisioned and developed, and eventually seeing it become a product. That's exciting. But as faculty members we may be very good at doing research, but we have never learned how to do business. There are a lot of human relationships involved, and human relationships are the source of the most frustration. I learned that people can be very different when there's money involved."

Still, Kim's groundbreaking research continues to attract the attention of colleagues and entrepreneurs from around the world, and he fully expects to start another company in one or two years. The lessons he learned at Core Microsystems, he believes, will serve him well as he contemplates the opportunities ahead.

Start-Up Experience articles reprinted from UCLA Invents. ©2011 The Regents of the University of California. Produced by UCLA Office of Intellectual Property and UCLA Communications and Public Outreach. Writer Dayton Fandray. Additional content Mary Daily and Michelle Azurin. Copyediting Keasha Dumas. Project coordinators Robin Faria and Kathy Lisiewicz. Illustrations and layout Roger Lee.

Greg Carman's Start-Up Experience: NSVascular Inc.



ITINOL—A MATERIAL WHOSE name is derived from an amalgamation of the words nickel, titanium and Naval Ordinance Laboratory—does not sound like the sort of substance you'd want to find anywhere near your body, let alone somewhere inside it. But as it turns out, Nitinol is strong, biologically inert, and it tends to "remember" its shape even after having been twisted or compressed. These properties make it a uniquely useful material in a variety of biomedical applications.

Greg Carman and his team of researchers at UCLA have dramatically increased the range of applications for Nitinol by developing a process that allows them to produce Nitinol in ultrathin sheets. At a thickness of only 5 to 6 microns—one-tenth the thickness of a normal human hair—these sheets are thin enough to cover medical devices that can reach virtually any location in the human vascular system.

To give some sense of what a breakthrough this is, Carman, a professor in UCLA's Mechanical & Aerospace Engineering Department and co-director of the Center of Advanced Surgical and Interventional Technologies (CASIT), uses the example of a brain aneurysm.

"To get to the aneurysm with a catheter, you have to go down a narrow, fairly tortuous highway in the neurovascular system," he explains. "What you would like to do is put a Band-Aid over that aneurysm to prevent blood from flowing into it. But the problem is getting a Band-Aid device that is sufficiently small to navigate that narrow, tortuous highway. This is challenging, if not impossible, with current technology. With the development of our new thin film Nitinol, however, we can produce a Band-Aid device small enough to traverse that highway and patch that brain aneurysm, sort of like patching a flat tire."

Carman's work was initially funded by the Air Force Office of Scientific Research and other Department of Defense research offices, and was focused on nonmedical applications such as large, space-based antenna arrays. These arrays had to be large—on the order of 50 meters in diameter. So in order to get them into orbit, Carman and his team proposed using their fabrication technology to produce an antenna that could be packaged in a tube, launched in a standard launch vehicle, then deployed once in space.

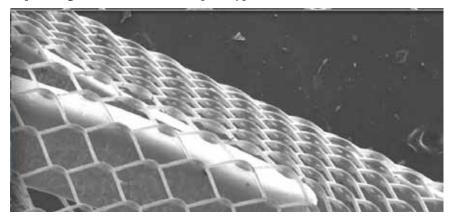
When a student told Dan Levi about Carman's work, Levi immediately recognized that this same principle could be applied in medical applications, specifically to brain aneurysms.

"As soon as I met Dr. Carman, I saw a lot of vascular implications for his technology," says Levi, who serves as co-director of the Diagnostic and Interventional Catheterization Program at the David Geffen School of Medicine at UCLA. We realized that probably the ideal application would be using it to treat brain aneurysms."

Levi and Carman called in Fernando Vinuela, professor of radiology at Ronald Reagan UCLA Medical Center and one of the world's acknowledged experts on treating brain aneurysms, and together they helped form a company now known as NSVascular Inc. The researchers have already completed a successful animal study and hope to begin work soon on a final prototype.



GREG CARMAN is a professor in the Mechanical and Aerospace **Engineering Department at** UCLA. His research focuses on developing and understanding the combined electro-magnetothermomechanical response of active material systems (smart structures), including biological applications. He was named fellow of the American Society of Mechanical Engineers (ASME) in 2003, and his awards include the Best Paper Award from the Adaptive Structures **Material Systems Committee of** the ASME Aerospace Division in 1996, 2001 and 2007 and the ASME Adaptive Structures and Material Systems Prize in 2004. He also was a member of the Boeing team that won the American Helicopter Society Howard Hughes Award in 2009.



A hyperelastic thin film Nitinol (HE-TFN) covered stent has been shown to promote aneurysm occlusion by helping to divert blood flow from a brain aneurysm.

Asking an Expert about Biofuels:PortTech LA's Q&A with Professor Laurent Pilon

From porttechla.org

PORTTECHLA, A PUBLIC/PRIVATE non-profit technology center and business incubator operated by a coalition consisting of the City of Los Angeles, Port of Los Angeles and the San Pedro and Wilmington Chambers of Commerce, recently talked to Laurent Pilon, professor of mechanical and aerospace engineering at the UCLA Henry Samueli School of Engineering and Applied Science, about the significance of biofuels. The below Q&A was highlighted on their Web site in their Featured Technology section. The mission of PortTechLA is to attract and mentor companies with technologies that will enable the Port of Los Angeles, and ports worldwide, to meet their immediate and future environmental, energy, security and logistics goals. The full Q&A has been reposted below:

Q. What are biofuels?

A. Biofuels are fuels that are made biologically from crops, bacteria or microalgae. An example is ethanol from corn; the corn is fed to microorganisms that convert the sugars contained in corn into ethanol during a fermentative process similar to making wine. Then ethanol can be purified and mixed with gasoline to power our cars. Similarly, biodiesel can be produced from soybeans as well as canola and palm oils. There are also microalgae that use photosynthesis to produce hydrogen gas or lipids. The hydrogen produced can be used in fuel cells and lipids can be converted into liquid biodiesel

Q. What is the importance of biofuels? A. Biofuels can be used as substitutes for petroleum-based fuels. Right now, the majority of oil produced in the world comes from the Middle East. Instabilities in this region could have major impacts on the price of oil and on the world and U.S. economies. To improve our energy independence, we can try to extract more oil at home, for example, in Alaska or in the golf of Mexico. In fact, advances in technology have allowed us to drill deeper in the ocean and reach oil that used to be impossible to obtain, but the risks are high and the process is expensive. With biofuels, you don't have the risks associated with oil spills and there are fewer concerns about energy security, international tensions and fluctuations in the price of oil.

Q. How do biofuels compare to fossil fuels as far as environmental impacts?

A. It really depends on the type of biofuel. Of course, fossil fuels can impact the environment during the extraction process with the risk of air, water and land pollution. Burning fossil fuels also emits large amounts of greenhouse gases into the atmosphere causing global warming. On the other hand, the environmental impacts of biofuels depend on the feedstock and the production process. For example, to grow some crops, we need to use fertilizers and pesticides, but fertilizers and pesticides wash off farmland into rivers causing algae blooms downstream in rivers and oceans. So water pollution is a potential problem. Also, certain types of biofuel production, such as ethanol from corn, are not very energy efficient. In addition, in some countries, deforestation takes place to make room for biofuel crops. Finally, burning biofuels in car or truck engines still emits carbon dioxide. On the positive side, biofuel production from plants or microalgae consumes carbon dioxide, which is a greenhouse gas. Nitrous oxide, another greenhouse gas and an air pollutant, can also be consumed by microalgae. Overall, biofuels are not a silver bullet solution to our energy challenges but, if produced properly, they could have a very positive environmental impact.

Q. What are the advantages to using biofuels?

A. There are many benefits to using biofuels. One advantage is energy security; we can reduce our dependence on foreign oil. Also, biofuels can be produced locally; many countries that don't have oil can still produce biofuels. Another advantage is that photosynthetic plants or microalgae consume carbon dioxide through the process of photosynthesis. With fossil fuels, you extract them, burn them, and that's it. Biofuel production from microalgae is sustainable and can be produced pretty much anywhere in the world, except deserts where there's no water.

Q. What type of research are you doing?

A. I'm studying photosynthetic microorganisms that use photosynthesis to produce biofuels. My students and I are paying particular attention to how microorganisms interact and use light so that we can design and control production processes to operate optimally. We are using microalgae and bacteria that can grow in fresh and ocean water. Some of them can produce hydrogen and others produce lipids.



Q. Why did you decide to research biofuels?

A. When I started my career in 2002 at UCLA, I was interested in energy and I wanted to find an innovative energy solution that would not only produce energy but also consume carbon dioxide. The microalgae I'm researching, that's what they do, they use carbon dioxide as their carbon source and sunlight as their energy source for photosynthesis. But they also produce useful things, like lipids or hydrogen. I became fascinated by some of these microorganisms. I felt that this was a potential solution to our energy problem.

Q. How far away are we from using microalgae as a biofuel?

A. Well, this is hard to predict, but there is more and more activity on this topic, both in research and on the part of small and large companies as well as venture capitalists. One of the issues is transitioning the technology from the lab to an industrial scale where the efficiency typically goes down. The biofuel production processes can also consume a lot of water, which could create problems in parts of the world where there is sun, but no water. That's why I'm interested in marine microalgae because then they don't compete for fresh water or even land use.

Q. Is there anything else you would like to add?

A. I think we also need to address the challenges for this technology. I already mentioned water supplies and production at an industrial scale. Price is also an obstacle: How do you compete with gasoline that's "only" four dollars per gallon? Can we produce biodiesel at that price or cheaper? Then there are other challenges in microbiology, can we improve or control their metabolism to get microalgae to produce what we want? We need to genetically engineer microalgae to try to improve their intrinsic performance, to get them to produce something we want, instead of spending their energy on something we don't want. All these challenges require a lot of fine-tuning to create a viable biofuel production system.

UCLA Aerospace Engineering ranked no. 8 by Microsoft Academic Search

HE UCLA HENRY Samueli School of Engineering and Applied Science is currently ranked highly in several research areas by Microsoft Academic Search. This includes a no. 1 ranking worldwide for electrical engineering by H-index over ten years. This dynamic worldwide ranking also places aerospace engineering at no. 8, and computer science at no. 9 and the school at no. 4 overall, throughout the same time period by H-index. H-index measures both the productivity and impact of published work.

"These rankings are a testament of the kind of impact being made by our faculty," said Vijay K. Dhir, dean of UCLA Engineering. "It is apparent based on these rankings and others, that our faculty's research is regularly disseminated and referenced on a global scale. I could not be more proud of what the school has accomplished over the last decade especially."

UCLA Engineering faculty, students and researchers all consistently publish papers on their research in top professional and scholarly journals, and are regularly invited to present their work worldwide at symposiums. They have authored numerous books, many of which have been translated to various languages and are regularly called upon to serve as experts to the media.



The Microsoft Academic Search, currently being beta tested, is a search engine developed by Microsoft Research Asia to help users quickly find information about academic researchers and their activities. With academic search, one can find top researchers, their papers, conferences and journals. It also contains visualization features like co-author graphs, co-author paths, paper citation graphs, domain trends, and organization comparison charts.

Mechanical and Aerospace Engineering Department's Research and Technology Review highlights innovation



Top: Heidi Shyu,
Acting Assistant
Secretary of the
U.S. Army for
Acquisition, Logistics
and Technology
[ASA(ALT)], and a
UCLA Engineering
alumna, gave
the plenary talk
entitled, "Evolving
Army Science and
Technology Needs".

Middle: Shyu shook the hands of about a dozen UCLA ROTC students who attended.

Bottom L to R: Tsu-Chin Tsao, UCLA MAE Chair; Heidi Shyu; Professor Ann R. Karagozian, UCLA MAE Vice Chair, Industrial Relations. CLA'S MECHANICAL AND Aerospace Engineering (MAE) Department held its Research and Technology Review (RTR) at the UCLA Faculty Center on April 27. More than 130 people were in attendance at the event, in which representatives from industry, government organizations, and national laboratories were able to see and hear the latest in MAE's innovations from faculty and students. The technical focus of the event was on the applications to which MAE research is most relevant, i.e., aerospace/defense, energy, and micro/nano scale systems. Professor Ann Karagozian, as MAE Vice Chair for Industrial Relations, organized the MAE RTR.

Both UCLA Chancellor Gene Block and UCLA Engineering Associate Dean Jane P. Chang welcomed the attendees at the start of the program.

Heidi Shyu, Acting Assistant Secretary of the U.S. Army for Acquisition, Logistics and Technology [ASA(ALT)], and a UCLA Engineering alumna, gave the plenary talk entitled, "Evolving Army Science and Technology Needs". Shyu emphasized that, above all else, the safety of soldiers is the number one priority to the Army. She told the attendees, who included a number of UCLA ROTC students, that over the

past ten years, innovations such as Mine Resistant Ambush Protected (MRAP) Vehicles and improved body armor have saved thousands of lives. Going forward, Shyu identified a number of technology areas that the Army is continuing to explore, including improved energy storage and vehicle fuel efficiency, light weight "wearable" power generation systems, and improved safety and performance of vertical lift vehicles, i.e., helicopters.

Natalie W. Crawford, Senior Fellow at RAND Corporation, and Wayne H. Goodman, Vice President of Space Program Operations at the Aerospace Corporation, provided their perspectives in a panel discussion on "Optimizing Government-Industry-University Partnering." Both Crawford and Goodman stressed the need for strong partnerships among government, industry, and universities such as UCLA, to enable the U.S. to continue to lead the world technologically. Their remarks stimulated a very interesting discussion among the attendees.



Following the panel discussion were oral technical presentations by faculty in two parallel sessions; Session I focused on research with aerospace and defense applications, and Session II focused on research relevant to energy systems and MEMS/nanotechnologies. In the afternoon, MAE undergraduate and graduate students presented technical posters . Forty-six posters covering every MAE discipline were on display.

"MAE faculty and students are pursuing high-impact research across a range of fields, and we were gratified that there was such a great turnout at the RTR," said Professor Ann R. Karagozian, MAE Vice Chair for Industrial Relations. "Our industrial and government partners were very engaged in research discussions with our faculty and students, and we are continuing to build on these relationships through follow-up meetings with these partners. It was especially

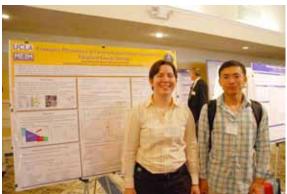
exciting to see so many of our graduate students engaged in technical discussions with future partners and employers. This was surely a very valuable experience for them."

The MAE RTR event concluded with tours of a few of the MAE experimental laboratories, including:

- Professor Bob M'Closkey's Microsensor Development Research Lab
- Professor T.C. Tsao's Mechatronics and Controls Lab
- Professor Steve Gibson's and Prof. T. C. Tsao's Beam Control Lab
- Professor C.J. Kim's Micro and Nano Manufacturing Lab
- Professor Richard Wirz' Plasma and Space Propulsion Lab and Energy Innovation Lab

UCLA's MAE Department has a broad range of ongoing research activities, and its recent RTR was an opportunity to showcase the faculty's many technical innovations for their very enthusiastic stakeholders.







Top: UCLA MAE Chair Tsu-Chin Tsao and Ph.D. student Sarah Warren discuss her poster, "Design of **Rotary Engines by** Apex Seal Profile (advised by Prof. Daniel Yang).

MIddle: "Transport Phenomena in Electrochemical Supercapacitors for **Electrical Energy** Storage." Poster by Anna d'Entremont and Hainan Wang (advised by Prof. Laurent Pilon).

Bottom: Professor Steve Gibson show attendees around the Beam Control Lab.

Ann Karagozian interviewed on SoCal Connected story "Military Goes Green"



On January 27, 2012, KCET's SoCal Connected aired a story on the U.S. Military exploring green energy for both economic and strategic benefits. UCLA MAE Professor Ann Karagozian was quoted in the story, which is available online. Prof. Karagozian's section runs from 1:50-2:27.

Vijay Gupta quoted in LA Times story about Oscar Pistorius





UCLA MAE Professor Vijay Gupta was quoted in the Los Angeles Times story "Oscar Pistorius runs into the Olympic spotlight" (by Bill Plaschke)regarding the use of prosthetic blades in Olympic running.

"My mind is racing, how is he doing that?" said Vijay Gupta, professor of mechanical and aerospace engineering, as he watched a Pistorius video.

After spending time studying Pistorius' motion, Gupta conceded he had a "very subtle advantage" in that the curvature of the blades allowed him to remain in longer contact with the track and thus propel himself slightly faster than someone with feet.

"Whoever designed those blades is very smart," Gupta said. "He can use them to generate more power from the ground."

Gupta added, however, that there are disadvantages in having an upper body that is attached to a mechanical lower leg.

"Watch his upper leg slightly move where the device is attached," Gupta said. "There is some instability in the biomechanics, which is something other runners don't deal with."

Prof. Gupta also discussed this issue on AirTalk with Larry Mantle on July 6, 2012

SMART GRID in the news



Rajit Gadh was interviewed by BBC News on how power outages spread.

"If you don't isolate the problem, it can move to other parts quickly, and lead to cascading failure," Mr Gadh said. As stressed connected power lines fail, it becomes increasingly likely the other local grids they are connected to fail as well.

It is an exponential effect, Mr Gadh said, unless systems can be isolated quickly - a tough task for an energy source that moves close to the speed of light.



Rajit Gadh was quoted in a recent Daily Bruin article regarding how two electric vehicle charging stations were recently installed in Parking Structure 9, in anticipation of increased demand for electric cars in the West Los Angeles area.

Rajit Gadh, a professor of engineering, has been driving an electric vehicle for a couple of weeks in conjunction with his research project, which will explore how electrical charging stations will affect the power grid.

"Having the stations is a necessary ingredient (of our research)," Gadh said. "It's like having a living lab." His team has also developed a mobile application to optimize use of the charging stations by letting users know the charge status of their vehicles, he said.



(Excerpted from 89.3 KPCC, Brian Watt, Business and Economics Reporter)

A massive power outage in India left more than 600 million people without electricity for several hours on Tuesday.

UCLA Professor Rajit Gadh grew up in India and says blackouts were fairly regular, especially in the summer. India's people and leaders took them in stride.

"One third of town loses the power," Gadh recalls. "Okay, fine, big deal, move on. Right? Half of town loses power: Okay, fine, big deal, move on, right?"

Not anymore. India wants to develop a thriving technology sector and needs a reliable grid. Gadh founded UCLA's Smart Grid Energy Research Center. He says India's first challenge is to make the vast grid easier to monitor, so that engineers can spot the cause of an outage quickly – even in advance.

"When you have less data coming in about the grid, there is less number of things you can do and you are often shooting in the dark," says Gadh.

Twenty of India's 28 states found themselves in the dark. Gadh says a black-out of this magnitude will get India's leaders focused on how to fix the power grid.

Faculty Awards and Honors



Vijay Dhir, HSSEAS Dean and professor of mechanical and aerospace engineering, has been awarded the following:

International Conference on Computational & Experimental Engineering and Sciences Lifetime Achievement Award, Crete Greece May 4, 2012.

University of Kentucky, Honorary Ph.D., May 2012.

He also delivered the Fowler Distinguished Lecture at Texas A&M on March 8, 2012.



Ann Karagozian was appointed as a Memberat-Large of the USNC/TAM (United States National Committee on Theoretical and Applied Mechanics). On behalf of the National Academy of Sciences and the National Research Council, USNC/TAM is the official U.S. representative to the International Union of Theoretical and Applied Mechanics.

Additionally, Karagozian was elected to the Board of Trustees of the Institute for Defense Analyses (IDA), which is headquartered in Washington D.C.



Rajit Gadh was elected a Fellow of the American Society of Mechanical Engineers (ASME).

Additionally, Gadh delivered the Keynote Presentation at the Distribution Technology & Innovation Summit, in Las Vegas, NV, and was the Keynote Speaker at the 17th Annual International Conference on Mobile Computing and Networking - MobiCom 2011, Las Vegas, NV.



CJ Kim was selected as one of "100 People Who Will Light Up Korea in Year 2020". "In celebration of their 90 years in service, Dong-A Newspaper has announced their selection of these 100 people, who will be leading Korea to a tomorrow that is better than yesterday. Dong-A Newspaper asked them about the Korean society they foresee and the self-portrait they dream about in Year 2020 as well as their heroes

and beliefs that influenced them most."



Chih-Ming Ho was appointed a Visiting Member of the Hong Kong University of Science and Technology's Institute of Advanced Study.

Additionally, Ho delivered the Yunchuan Aisinjioro-Soo Distinguished Lecture at the National Center for Supercomputing Applications at the University of Illinois at Urbana-Champaign (UCIC), on October 20, 2011.



Jason L. Speyer received the American Institute of Aeronautics and Astronautics Aerospace Guidance, Navigation, and Control Award for 2012. The award is "For significant contributions to deterministic and stochastic optimal control theory and their application to important aerospace engineering problems."



Tetsuya Iwasaki received the 2011-2012 Mechanical and Aerospace Engineering Department Teaching Award. This award recognizes contributions to the educational mission of the department, and is based on student evaluations of teaching, contributions to student welfare, and curriculum development.

Additionally, Iwasaki gave the keynote speech "Coordinated oscillations in biological systems" at the NSF/DSC Workshop on Frontiers of Dynamic Systems and Control, Arlington, VA, (11/03/2011).

Iwasaki also gave the plenary speech "Biological Control Mechanisms for Oscillation and Locomotion", at the Chinese Control Conference (07/26/2012).



Richard Wirz received the Faculty Career Development Award. The awards are given annually to assistant professors, providing research support at a critical time in the pretenure stage. Approximately 30 awards are granted annually. Professor Wirz will be using his award to forward his research in alternative energy, most notably wind and solar thermal energy.

NAE

National Academy of Engineering Members



Albert Carnesale Chancellor Emeritus

Albert Carnesale is Chancellor Emeritus and Professor at the University of California, Los Angeles (UCLA). He was Chancellor of the University from July 1, 1997 through June 30, 2006, and now serves as Professor

of Public Policy and of Mechanical and Aerospace Engineering. His research and teaching focus on public policy issues having substantial scientific and technological dimensions, and he is the author or co-author of six books and more than 100 articles.



Vijay Dhir

Vijay K. Dhir, Dean of the UCLA Henry Samueli School of Engineering and Applied Science and professor of mechanical and aerospace engineering, was elected into the National Academy of Engineering (NAE) in 2006, in honor of his work on boiling

heat transfer and nuclear reactor thermal hydraulics and safety. Dhir has been a faculty member at UCLA since 1974, and leads the Boiling Heat Transfer Lab, which conducts pioneering work in fundamental and applied research in phase change heat transfer.



Chih-Ming Ho
Ben Rich
Lockheed Martin Chair

Professor Chih-Ming Ho, director of the Center for Cell Control and holder of the Ben Rich Lockheed Martin Chair, was elected in 1997 for his contributions to the understanding

and control of turbulent flows. He joined UCLA to lead research in microelectromechanical system (MEMS) in 1991, and served as the founding director of the Center for Micro Systems. UCLA's MEMS program has been recognized as one of the top three programs worldwide.



John Kim Rockwell Collins Chair

Professor John Kim was elected into the National Academy of Engineering in 2009 for development of direct numerical simulation and seminal contributions to the understanding of the physics and control of turbulent flows.

Kim, who also holds the Rockwell Collins Chair in Engineering, revolutionized the way turbulent flows are studied and modeled. He has made outstanding contributions to the development of direct numerical simulations and large eddy simulations as reliable and respected tools for understanding the physics and control of turbulence.



Kuo-Nan Liou

Professor Kuo-Nan Liou, who holds a joint appointment in mechanical and aerospace engineering, was elected in 1999 for contributions in the theories of radiation transfer and light scattering, with applications to remote sensing technology and climate modeling.



Jason Speyer

Professor Jason Speyer was elected to the National Academy of Engineering in 2005 for "the development and application of advanced techniques for optimal navigation and control of a wide range of aerospace vehicles." He has pioneered new optimal determin-

istic and stochastic control, team and differential game strategies, estimation, and model-based fault detection.

NAE Professors Emeriti: David Okrent and Lucien Schmit (not pictured)



MAE Industrial Advisory Board Meeting, October, 2011

Left to right: Prof Dwight Streit (Materials Science & Engr and Director of the UCLA Institute for Technology Advancement), Jim Burns (Meggitt Safety Systems), Jim Hardy (Conoco-Phillips), Shawn Phillips (Air Force Research Laboratory), Prof Ann Karagozian (MAE VC for Industrial Relations), Pat Fitzgerald (Raytheon), Les Lackman (Associate Director of UCLA ITA), Jason Hatakeyama (Boeing), Prof. T-C Tsao (MAE Chair), Dan Goebel (NASA/JPL), Gareth Oskam (Solar Turbines), Wayne Goodman (Aerospace Corp and MAE IAB Chair), Ingo Foldvari (National Instruments), Geoff McKnight (HRL Labs), Roger Murry (Honeywell), Prof Adrienne Lavine (MAE VC for Undergraduate Studies), Milena Vujosevic (Intel), Munir Sindir (Pratt & Whitney/Rocketdyne).

MAE Industrial Advisory Board, 2011-2012

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Boeing Phantom Works Jason Hatakeyama Director, AM&ST Strategic Projects & SoCal Site Lead

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Pratt & Whitney Rocketdyne Inc. Munir M. Sindir Chief Engineer, California Operations

RAND Corporation Natalie W. Crawford Senior Fellow and former Director, Project AIR FORCE

Raytheon Space and Airborne Systems Pat Fitzgerald Department Manager, Thermal & Structural Design Dept. Mechanical & Optical Engineering Center

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NASA administrator names UCLA MAE alumnus Mason Peck agency's chief technologist

Prof. Mason Peck of Cornell, one of UCLA MAE Prof. Tino Mingori's former PhD students, has been selected to be the next Chief Technologist of NASA.



By David Weaver and Blaine Friedlander Reprinted from NASA Newsroom

ASHINGTON -- NASA Administrator Charles Bolden has named Cornell University Professor Mason Peck to be the agency's chief technologist, effective in January. Peck will serve as the agency's principal advisor and advocate on matters concerning technology policy and programs.

As the chief advocate, Peck will help communicate how NASA technologies benefit space missions and the day-to-day lives of Americans. The office coordinates, tracks and integrates technology investments across the agency and works to infuse innovative discoveries into future missions. The office also documents, demonstrates and communicates the societal impact of NASA's technology investments.

In addition, the chief technologist leads NASA technology transfer and technology commercialization efforts, facilitating internal creativity and innovation, and works directly with other government agencies, the commercial aerospace community and academia.

"Mason's lifelong commitment to learning and expertise in aerospace engineering makes him ideally suited to advise and help guide the agency toward the technologies and innovations that will enable our future missions," Bolden said. "His passion for education and his accomplishments in spacecraft design and robotics, along with his experience in the private sector, bring the skills I've come to depend on from my chief technologist."

Peck will serve as NASA's chief technologist through an

intergovernmental personnel agreement with Cornell University, where he is on the faculty as an associate professor in the School of Mechanical and Aerospace Engineering. He also teaches in Cornell's Systems Engineering Program. Peck succeeds Robert Braun, who returned to his teaching and research positions at the Georgia Institute of Technology in Atlanta.

Peck has a broad background in aerospace technology, which comes from nearly 20 years in industry and academia. He has worked with NASA as an engineer on a variety of technology programs, including the Tracking and Data Relay Satellite System and Geostationary Operational Environmental Satellites. The NASA Institute for Advanced Concepts sponsored his academic research in modular spacecraft architectures and propellant-less propulsion, and the International Space Station currently hosts his research group's flight experiment in microchip-size spacecraft.

As an engineer and consultant in the aerospace industry, he has worked with organizations including Boeing, Honeywell, Northrop Grumman, Goodrich and Lockheed Martin. He has authored 82 academic articles and holds 17 patents in the U.S. and European Union.

Peck spent some of his early career at Bell Helicopter, where he worked on the V-22 Osprey and a smaller tilt-rotor aircraft that later would become the BA609. He also has experience with commercial communications satellites and military spacecraft as a guidance and control engineer and in mission operations at Boeing Defense, Space and Security. He was a principal fellow at Honeywell Defense and Space Electronic Systems, where he led advanced-technology programs, helped direct patent and intellectual-property investments, and worked in business development.

At Cornell, Peck's work focuses on spacecraft dynamics, control and mission architectures. The Defense Advanced Research Projects Agency, the U.S. Air Force Office of Scientific Research, and aerospace contractors have funded his academic research. Some of this research includes microscale flight dynamics, gyroscopic robotics, and magnetically controlled spacecraft, most of which have been demonstrated on NASA microgravity flights.

He currently is the principal investigator on the CUSat in-orbit inspection technology demonstration, which is a pair of satellites built at Cornell. They are scheduled to launch in 2013 on a Falcon 9 rocket through the U.S. Air Force Research Laboratory's University Nanosatellite Program. CUSat technology represents a capability that will help enable commercial, government and human space missions envisioned for the coming decades.

Peck also is the principal investigator for the Violet experiment, another satellite built at Cornell. Violet will provide an orbiting test bed for investigations in technology that will enable more capable commercial earth-imaging satellites. Violet carries an ultraviolet spectrometer that will be used as a precursor to understanding exoplanet atmospheres.

Peck earned a doctorate in aerospace engineering from the University of California, Los Angeles as a Howard Hughes Fellow and a master's degree in English literature from the University of Chicago.

David Wirth and Joshua P. Kim receive the national Cadet Research Award from the U.S. Air Force

WO STUDENTS OF the UCLA Henry Samueli School of Engineering and Applied Science are recipients of the prestigious Cadet Research Award from the United States Air Force, making them the first UCLA students to receive such an award on a national level. David Wirth, a departmental scholar (combined masters and bachelors) in aerospace engineering, and Joshua P. Kim, a third year aerospace engineering student, won the award based on their research centered around the use of nanotechnology in solid and liquid rocket propulsion, which could advance the area of photoenergetic rocket fuels (rocket fuels ignited by light).

"We've known about chemical reactions that are affected or initated by light for quite a long time -photosynthesis is a good example. But in 2002, it was discovered that certain types of carbon nanotubes are not only affected by light, but they can be made to combust when flashed with intense light." said Wirth, who is specializing in MEMS and nanotechnology. "Our research is one of the first steps to engineer this effect to suit our needs, to ignite fuel without wires or sparks - using only light."

With this technology, fuels can be ignited "volumetrically," meaning with many ignition points spread out in two or three dimensions instead of just a single ignition point (such as a spark). Volumetric ignition creates a huge increase in pressure when fuel is combusted. The effect could potentially be used to increase the efficiency of gasoline, aircraft or rocket engines.

Wirth and Kim created a solid rocket engine which could be ignited, extinguished and restarted using only light as the ignition source. This year, the pair will focus on adapting the technology to be used in liquid fuels.

Wirth's work with Dr. Alireza Badakhshan and Dr. Stephen Danczyk at the Propulsion Directorate of the Air Force Research Laboratory (under the Vishal Parikh Memorial Scholarship) allowed for the discovery of new aerospace applications for nanotechnology. Dr. Badakhshan and Wirth later brought the project to UCLA under the supervision of Laurent Pilon, associate



professor of mechanical and aerospace engineering. It was here at UCLA Engineering where additional pathways for the technology were explored - branching into the areas of microencapsulation, solid rocket propulsion and controlled volumetric ignition of solid rockets.

Kim's part of the research centered around the creation of mini and microfluidics to support the core nanotechnology research of Professor Pilon and Wirth. His machining expertise and support of the project allowed for the rapid testing of prototypes instrumental to the success of the project.

"This award was instrumental in getting UCLA recognized on an Air-Force-wide level as a leader in this field of research, and potentially opening up new partnerships between UCLA and the U.S. Air Force or the Air Force Research Laboratory," said Wirth. "I am honored to be receiving this award with Joshua Kim after our work on the project last year."

"It feels great to be recognized for our work but I'm reminded of the people who weren't recognized," said Kim. "The staff that supported us and our efforts deserve every bit of recognition as well. Without them, this award wouldn't have been possible."

Louis Tse receives an NSF Graduate Research Fellowship



UCLA Mechanical and Aerospace Engineering Department graduate student Louis Tse was selected to receive a 2012 National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Fellowship. Tse's selection was based on his

outstanding abilities and accomplishments," as well as his "potential to contribute to strengthening the vitality of the US science and engineering enterprise."

Tse's research focuses on developing a new method of solar thermal energy storage. Currently, solar power plants store energy in tanks containing molten salt, to allow energy collected during the day to be dispatched at night. However, market penetration has yet to grow large enough to replace fossil fuels mainly due to high costs. Instead, Tse's research aims to replace expensive molten salts with readily available fluids operating at supercritical temperature and pressure, which takes advantage of latent heat, as well as sensible heat. This project has gained the attention of the Department of Energy, and obtained funding from the Advanced Research Projects Agency - Energy (ARPA-E), which focuses on "creative, out-of-the-box transformational energy research...where success would provide dramatic benefits for the nation."

Tse completed his B.S. in Mechanical Engineering from Arizona State University with Summa Cum Laude honors, and is the first in his family to pursue a graduate degree. Since moving here in 2011, he has quickly become involved at UCLA, serving as a board member for the UCLA Engineering Graduate Student Association (EGSA), Project Leader for the UCLA Volunteer Center, and regular donor at the UCLA Blood and Platelet Center.

UCLA SOLES takes top spots in SHPE 2011 conference



Lauren Quiroz, Matthew Barnes, and Andrew Reyes

UCLA's Society of Latino Engineers and Scientists (SOLES) won first place in the Academic Olympiad competition at the 2011 Society of Hispanic Professional Engineers (SHPE) conference. The student group also received the best outreach prize. In addition, mechanical engineering student Cesar Quinde

took 2nd place in the poster competition.

UCLA took 1st place in the academic decathlon. The team was led by Matt Barnes, Chapter President and 4th year AE student, and included Lauren Quiroz (Senior Chemical Engineering major), and Andrew (Andy) Reyes (Senior Computer Science major).

UCLA won the national award for best SHPE outreach. The effort was led by Cesar Quinde, ME student, and SINAM summer program participant.

In addition, Quinde won 2nd place for the SHPE National Undergraduate Technical Poster Competion. The selection criteria for the competition was based on originality, social impact, and completeness. Quinde competed against 44 other undergraduates from various institutions across the nation.



Powell Library

Cesar Quinde receives research award



On August 25, 2011, the UCLA Center for Excellence in Engineering and Diversity (CEED) held its 7th Annual Research Intensive Series in Engineering for Underrepresented Populations (RISE-UP) Undergraduate Research Poster Competition. In

the lobby of the California NanoSystems Institute (CNSI), seventeen researchers participated in the competition that was judged by: Dino Di Carlo, Assistant Professor of Bioengineering; Ann Karagozian, Academic Senate Chair and Professor of Mechanical & Aerospace Engineering; and Richard Wesel Associate Dean of Academic & Student Affairs and Professor of Electrical Engineering.

There was a tie for Second Place, with one award going to Cesar Quinde (who recently completed his 3rd year in Mechanical Engineering) for his work on A Parametric Study of a Barium Titanate/Epoxy Resin Nanocomposite sponsored by the NSF-funded Center for Scalable and Integrated NanoManufacturing (SINAM), under the direction of Professor Adrienne Lavine.

Adam Provinchain wins first place in the NSBE TRE



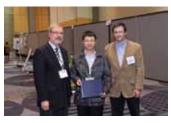
UCLA MAE Dept. 3rd year ME student Adam Provinchain won 1st place in the oral presentation category at the National Society of Black Engineers (NSBE) Fall Regional Conference's Technical Research Exhibition (T.R.E.). The conference was held November

18-20, 2011, in Denver, CO. UCLA is part of Region Six, which includes colleges from Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming. Competitors in the T.R.E. came from schools all across the region.

Adam Provinchain conducted research under the mentorship of Audrey Pool O'Neal in Professor Adrienne Lavine's research group, as a scholar in the NSF funded Center for Scalable and Integrated NanoManufacturing (SINAM) Summer Research Academy. His project is entitled "The Fabrication, Characterization and Analysis of a Barium Titanate/Epoxy Resin Nanocomposite". He will now compete at the 38th Annual NSBE National Convention that will be held March 28 - April 2, 2012, in Pittsburgh, PA.

The NSBE Mission Statement is "To increase the number of culturally responsible black engineers who succeed professionally, excel academically, and positively impact the community." Center for Excellence in Engineering and Diversity (CEED) Director Rick Ainsworth serves as adviser for the UCLA NSBE Chapter. The SINAM Summer Research Academy is directed by Professor Lavine and coordinated by KiMi Wilson, Education and Outreach Coordinator for UCLA/SINAM.

Jin Fang wins third place in the best poster award competition at the 2011 ASME IMECE



UCLA MAE Ph.D. student Jin Fang won third place at the Micro & Nano Technology Society-Wide poster competition, sponsored by the ASME NanoEngineering Council and the National Science Foundation, at the 2011 ASME International Mechanical Engi-

neering Congress and Exposition. The poster is titled "Thermal Conductivity of Ordered Nanoporous Silicon: Experiments and Molecular Dynamics Study." This study was performed in collaboration with Prof. Sarah Tolbert, and her Ph.D. student Chris Kang, from the UCLA Department of Chemistry and Biochemistry.

Fang is a member of UCLA MAE Associate Professor Laurent Pilon's Research Group. Fang investigates both experimentally and theoretically thermal transport in nano-structures for various energy applications.

Julie Nichols competed for London 2012 US Olympic Rowing Team



ORMER UCLA MAE student Julie Nichols, who received her Masters in Mechanical Engineering in Fall 2009 with a 4.0 GPA, competed for the London 2012 US Olympic Rowing Team! Here is a letter from Julie about her Olympic experience.

Mid-July we traveled to Eton Dorney, England (rowing venue) where we settled into the Rowing Olympic Village, a few hours west of the Olympic Village in downtown London.

Seventeen countries qualified in my event, the Lightweight Women's Double Sculls (LW2x). In the preliminary round, we finished 3rd in a tough field, with only two boats automatically

advancing to the semi-final round. Nevertheless, we advanced to the semi-final by winning the repechage. The semi-finals are always challenging; they determine if you will have an opportunity to race for the medals. Three of six boats in each semifinal

advance to the medal round. In a competitive race, we finished fourth. So we would be racing in the B-Final for places 7-12. In a close race, we were a little off pace and finished 5th for a final

placement of 11th overall.

After racing, we moved to the main village. There was still a week of the Olympics left. I wanted to enjoy some of the Olympics that were still going on around me. I was able to attend track cycling, handball, athletics, water polo, diving, and the closing ceremonies.

There are a series of Olympic Honor Ceremonies. Most recently we traveled to Washington D.C. for a White House visit. For the main event we all gathered on the South Lawn of the White House and were greeted by the First Lady, Vice-President Biden, and The President of the United States, Barack Obama. President Obama took the time to make us all feel very appreciated, welcomed and shook everyone's hand. It was truly an amazing day that I will remember for the rest of my life.

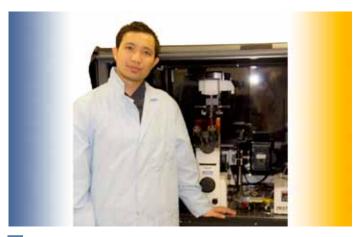
The Summer Olympics are really just on the radar every four years but the reality is that a lot of athletes are training year-in and year-out with little attention. Something about this makes the Olympics seem like a very pure pursuit to me. The daily accolades and recognition are not there for the majority of the journey. The true motivation is the passion for your sport and the pursuit of excellence. I am proud to be part of the Olympic movement and for all the hard work and effort I put towards this goal.

A very big thank you to the UCLA students, Alumni, Faculty and Staff for all the support and encouragement to pursue this dream!

Best Wishes, Julie Nichols



Wei Yu wins von Liebig fellowship



HE VON LIEBIG Center for Entrepreneurism and Technology Advancement at the University of California, San Diego Jacobs School of Engineering, has awarded four new graduate von Liebig fellowships to pursue the commercialization of research that will increase energy efficiency and the growth of renewable energy sources.

One of the von Liebig fellowships was awarded to Wei Yu, a Ph.D candidate in UCLA's Bioengineering Department, working in UCLA's Micro Systems Laboratories under the guidance of Prof. Chih Ming Ho. Yu has devised a novel strategy to increase the oil and protein production of Botryococcus Braunii, which could be subsequently converted into fuels and also used as feedstock. Furthermore, this approach could also shorten the growth cycle of B.braunii, which could possibly increase the harvest frequency, and save time and cost for cultivating cells. At present, microalgal biofuel is still rarely used in the energy refinery field due to its low yield, therefore to increase the biofuel production, along with shortening the growth cycle, is of great importance for microalgal to fuse into the current energy resource market.

During the past two years, Yu has been working on this robust protocol to confirm and improve the result. After more than 10

experimental demonstrations, a reliable protocol has showed its worthwhile position in biofuel study, and is approved by UCLA's OIP office. This strategy involved a well-defined culture condition, and now Yu (with a colleague) is testing the feasibility of this strategy in a large scale culture condition, in order to evaluate the commercial potential of this protocol.

B.braunii is regarded as a potential source of renewable fuel because of its ability to produce large amounts of hydrocarbons. Depending on the strain and growth conditions, up to 75% of algal dry mass can be hydrocarbons. The chemical nature of hydrocarbons varies with the producer strain. Compared to other green algae species, it has a relatively thick cell wall that is accumulated from previous cellular divisions, making extraction of cytoplasmic components rather difficult. Fortunately, much of the useful hydrocarbon oil is outside of the cell.

"We are developing a strategy that could increase the oil and protein production of B.braunii, since the current bottleneck of scale production on this species is its slow growth," said Yu. "Our lab has devised an optimized culture condition for B.braunii via a feedback system control strategy. And now we are focusing on some significant pathways in its metabolism route, aiming to tunnel the nutrients into the desired biosynthesis pathway."

The ideas of using metabolism regulating to maximize the biofuel production of B.braunii were initiated by Prof. Chih Ming Ho, Prof. James Liao, Prof. Laurent Pilon, and realized by Wei Yu, Yitong Zhao, who are both Ph.D students in the Bioengineering Department, working in Prof. Ho's Lab.

The invention named "A Feasible Biofuel Strategy To Achieve An Enhanced Oil And Protein Production Of Botryococcus Brauni" was approved by UCLA's OIP office. And the inventors included Wei Yu, Yitong Zhao, Dr. Chih Ming Ho, Dr. James Liao and Dr. Laurent Pilon.

Cynthia Yin awarded 1st place in 2012 VCSF Senior Division Biochemistry Category



Cynthia Yin, currently a Westlake High School 10th grader volunteering in UCLA MAE Professor Chih-Ming Ho's Micro Systems Laboratory, was awarded the 1st place in the 2012 Ventura County Science Fair's (VCSF) Senior Division Biochemistry Category. The awards ceremony was held 3/22/12. This advances Yin to compete in the California State Science Fair (CSSF) on 4/30/12 and 5/1/12. In addition, Yin was one of the two students qualified to represent Ventura County and compete in the Intel International Science & Engineering Fair (ISEF) in Pittsburgh, Pennsylvania from 5/13/12 to 5/18/12.

Yin has displayed a profound interest in science, technology, engineering, and mathematics since her childhood. This is evident through her avid participation and achievements in science fairs, ExploraVision, and math competitions. Yin strives to challenge herself beyond school curriculum by volunteering in Professor Ho's lab and exposing herself to emerging technologies. Her current research focuses on the structural integrity of the cytoskeleton and cell migration patterns in response to myosin inhibitors.

Henry A. Colorado wins 3rd Place -Best Paper Award in 35th ICACC



Henry A. Colorado, a former student of UCLA MAE Professor Emeritus Thomas Hahn, won the 3rd Place - Best Paper Award in the 35th International Conference on Advanced Ceramics & Composites (ICACC). The paper is Mechanical Properties of Chemical Bonded Phosphate Ceramics with Fly Ash as Filler, H. A. Colorado, University of California and Universidad de

Antioquia, Colombia; C. Daniel, University of California; C. Hiel, Composite Support and Solutions Inc., California, and University of Brussels, Belgium; H. T. Hahn and J. M. Yang, University of California. Prof. Hahn was the PI of the project, Prof. Yang is the current thesis advisor.

Colorado was informed of the award by Michael C. Halbig, 2011 ECD Awards Committee Chair of the Engineering Ceramics Division (ECD) of the American Ceramic Society. The award consists of a \$200 prize and a certificate. The award ceremonies will be held during the plenary session of the 36th ICACC, held in Daytona Beach, Florida, January 22 - 27, 2012.

Colorado has almost finished his PhD, and is now at Argonne National Laboratory.

Other alumni and students in the news

Cory Hendrickson and Dan Getsinger were awarded UCLA Dissertation Year Fellowships.

UCLA MAE Professor Xiaolin Zhong's Ph.D. student Clifton Mortensen won the DoD 2012 NDSEG Fellowship, which is DoD's equivalent three-year graduate fellowship to that of NSF.

UCLA MAE Professor Chih-Ming Ho's had three former students and one post-doc become faculty members.

Tak Sing Wong PhD 2009 Department of Mechanical and Nuclear Engineering The Pennsylvania State University

Peter Bjorn Lillehoj PhD 2011 Department of Mechanical Engineering Michigan State University

Ting-Hsuan Chen PhD 2012 Department of Mechanical and Biomedical Engineering City University of Hong Kong

Miuling Lam Post-doc 2012 Department of Creative Media City University of Hong Kong

Razmig Kandilian awarded the Chateaubriand Fellowship

UCLA MAE Associate Professor Laurent Pilon's PhD student Razmig Kandilian was awarded the Chateaubriand Fellowship in Science, Technology, Engineering, and Mathematics (STEM) by the Office for Science and Technology of the French Embassy in the United States. This program aims to give the opportunity to selected American



graduate students to benefit from an experience in the best research laboratories in France, and to develop scientific cooperation between France and the United States.

Kandilian received his BS in Mechanical Engineering at UCLA in 2010. He is the recipient of the 2009-2010 UCLA Outstanding Bachelor of Science Degree in Mechanical Engineering Award, and of the Clean Green IGERT Fellowship. He will be the first UCLA graduate student to participate in the Chateaubriand Fellowship STEM program. As part of this program Kandilian will spend 10 months at the University of Nantes in the GEPEA laboratory. This laboratory focuses on process engineering in the fields of food, environment, and marine bioressources valorisation. It is directed by Prof. Jack Legrand who will supervise Kandilian during his stay in France and serve a co-advisor of his PhD dissertation. Their research project will investigate the use of marine microalgae for producing liquid biofuels.

UCLA MAE 2012 Commencement Awards and Honors

2012 ENGINEERING ACHIEVEMENT AWARD FOR STUDENT WELFARE

Matthew Joseph Barnes, B.S., AE, Su12 Adam Gordon Brown, B.S., AE, Sp12 Steven James Diez, B.S., AE, Sp12 Cesar Eduardo Huerta, B.S., AE, Sp12 Iylene Marie Patino, M.S., AE, W12

DEPARTMENT AWARDS - Departmental Scholar David M. Wirth, B.S., AE, M.S., AE, Sp12

MECHANICAL AND AEROSPACE ENGINEERING DEPARTMENT Cesar Eduardo Huerta, B.S., AE, Sp12 Amanda Mei Keiko Fujii, B.S., ME, Sp12 Clifton Holden Mortensen, M.S., AE, Sp12 Kuan-Chou Chen, M.S., ME, F11

Jin Fang, Ph.D., ME, Sp12 Harsh Kumar Baid, Ph.D., ME, Sp12

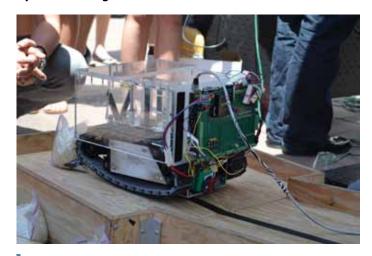
OASA RECOGNITION

Cesar Cervantes, M.S., AE

OUTSTANDING TA Levon Gevorkyan

May The Best Robot Win

By Wileen Wong Kromhout



N ONLY ITS second year, the rice rover robotics competition again brought excitement and joy to mechanical engineering (ME) seniors finishing up what has been described as one of the most challenging courses of their career at UCLA. In this newly redesigned two-term sequence, 126 students making up 22 teams, were asked once more to design and build an autonomous vehicle for the transportation of bulk material, this time with a much smaller budget.

"Although the design project was the same, a rice rover, this year we asked the students to complete their rover project with a fraction of last year's budget," said Robert Shaefer, professor of mechanical and aerospace engineering at the UCLA Henry Samueli School of Engineering and Applied Science. "This year each team had only \$330 as opposed to \$1,000 to design and build their rovers."

But despite the smaller budget, students embraced the challenge, using more ingenuity by recycling scrap material and finding used motors.

"Despite the much lower budget, the final design products this year were a great improvement from last year, which goes to show that more funds do not necessarily improve design and performance," said Shaefer. "From what I have seen, not only are the products better designed, but the performance and success rate has almost tripled."

The new capstone design sequence was unveiled during winter quarter of 2010 by the Mechanical and Aerospace Engineering (MAE) Department after two years of extensive preparations and refinement. The capstone sequence was created with the goal of providing students with a better design experience.

Instruction for the first term focuses on concepts with topics ranging from mechanical component design and mechatronics to thermo design and mechanical system design. Lab work includes CAD (computer-aided design), CAD analysis, mechatronics and conceptual design for individual projects. In the second term, students are then provided with opportunities for fabrication and testing, project demonstration and finally competition with their fellow classmates. Students work in groups of five to seven throughout the two course series.

"This year, a lot of organizational changes were made and many more details were ironed out," said Andrew Hauk, leader of the first place team in the competition. "This year a lot of the robots seemed to be performing pretty well. I think only two of the robots were able to finish the competition successfully last year because it was such a new program."

Though many have expressed the experience is intense, with many hours of commitment, they also admit the knowledge they've acquired is invaluable, especially for those about to start their careers in industry.

"The class is extremely hands on. There was instruction and guidance but definitely it was left up to us to figure things out," said Jonathan Salfity, Hauk's teammate. "The most challenging part for me was getting thrown into the programming and wiring of things that we've never seen before. It's a learning experience you struggle through but I also think you learn the best that way too."

The instructors of this year's sequence included Professors Christopher Lim, Kevin Chu and Robert Shaefer. Four Teaching Assistants and two MAE staff members also provided additional support.

"This was our one time to actually have a team project so it was really cool to have an opportunity to get to know new people and build a team," said Dana D'Amico. "Producing something like our rice rover is something we don't get to do normally."

"It was a huge learning curve for us all and I think it is great experience for the real world. You build a lot of confidence in yourself in that you can actually think up something, make it happen, get all the resources, plan it and then finance it. It was hard work but it was fun too," said D'Amico's teammate, Leslee Bell.

For the competition, the rover not only needed to follow a predesigned pathway but it had to be able to dump a payload of rice into a collection bin at the end of the path. Prior to the big day, students are provided with a detailed description of the pathway (three platforms and two ramps), along with other prerequisites like how the vehicle should be powered, its size, its movement along the pathway and of course, a budget.

Teams who placed in the top three this year were:

First place: "Team Cool Jazz" (Team 14)

Andrew Houck, Jason Bakhshi, Devon Leong, Jonathan Salfity, Ryan Kurt Allen, and David Ross

Second place: "15" (Team 15)

Susie Boyland, Aditya Chandramohan, Keith Katano, Ben Kolnowski, Sean Scott, and Daryl Wada

Third place: "Rice Knowing You" (Team 18)

Alex Baker, Amanda Fujii, Aaron Go, Matthew Jew, Daniel Nguyen, Daniel Yang, and Michael Young

AIAA-UCLA Rocket Project 2011-12

By Phuoc Hai N. Tran



Members with HyPE 1B2 aerobody at ESRA 7th IREC

The AIAA-UCLA Rocket Project is a student engineering organization, which provides students of all kinds the unique opportunity to engage in the field of aerospace through high-powered amateur rocketry. The endeavor encompasses many fields of engineering: Aerospace, Mechanical, Chemical, Materials Science, and Electrical to name a few. Each year with the help of generous industry sponsors and insight from advisors, this dedicated team averaging about 30 members designs, builds, and tests a complete rocket from the ground up for flight.

In the past year, the Rocket Project's objective was to design and build a rocket capable of reaching 25,000 feet to compete in the Experimental Sounding Rocket Association's 7th Annual Intercollegiate Rocket Engineering Competition (ESRA 7th IREC) advanced category. The team researched new propellant compositions with the Miniature Propulsion Experiment (MiPE) subscale test-bed as it continued development of its Hybrid Propulsion Experiment (HyPE) full-scale custom hybrid rocket engine, now into its third iteration: the HyPE 1C. Development

of the composite aerobody, avionics, and remote launch infrastructure were conducted in parallel to the engine.

Although the team saw improvements and innovations in all areas of the project, setbacks from machining of the HyPE 1C's parts meant that the engine would not be ready in time for competition. The Rocket Project moved to revise its previous HyPE 1B engine and legacy parts to meet necessary performance requirements. By consolidating components, reducing size, and employing a new propellant composition, the updated HyPE 1B2 and shortened aerobody were capable of reaching the target altitude.

In mid-June 2012, team members brought the completed HyPE 1B2 rocket to Green River, Utah for the ESRA 7th IREC. The judges were very impressed with the team's technical and procedural knowledge, design improvements, and safety-minded attitude. Although the rocket was ready to fly, there were major setbacks: first high winds, then physical damage to crucial electronic equipment. The team lacked the time and resources to repair these critical systems on the field. As a result, the rocket was grounded.

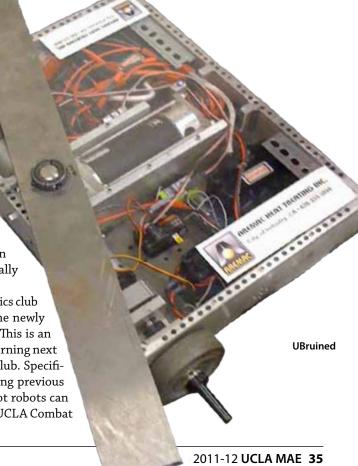
In the coming year, the Rocket Project hopes to maintain and fly the Hype 1B2 as a proof of concept while it expands its horizons by designing and building a new rocket capable of reaching altitudes in excess of 30,000 feet for use in future competitions and geologic and atmospheric research.

UCLA ASME BattleBots 2011-12

By Alex Browne

The 2011-2012 school year was marked by tremendous growth for the UCLA Combat Robotics team. The first portion of each project year is dedicated to getting incoming members up to speed. To that end, veteran members lead workshops on using Solidworks, fundamental machining, and effective robot design. New members then formed small groups, mentored by one of the veterans, for the new member project: designing and building 3lb combat robotics. Ultimately, five robots were constructed, armed with a variety of weapon types: drum-spinners, shell-spinners, and passive wedges. Two of these robots, along with a rebuild of a returning 6olb robot, UBruined, traveled to compete in RoboGames 2012, an international robotics competition held annually during spring quarter in San Mateo, CA.

Following the excitement surrounding Robogames, the Combat Robotics club finished the year with our first ever in-house competition, battling the newly built 3lb beetleweight class robots head to head in Boelter courtyard. This is an event we look forward to hosting annually. With so many members returning next year we are excited to have many new opportunities available to the club. Specifically, a large group of returning members allows us to work on refining previous designs and improving current designs until the most effective combot robots can be manufactured. Additionally, building off of last year's momentum, UCLA Combat Robotics will be attending Combots Cup in fall quarter 2012.



UCLA BEAM 2011-12

By Alexander Baker and Kymberly Alvarez



Second-year chemical engineering student Serena Shanbhag (left) and fourth-year mechanical engineering student Alex Baker (right) teach elementary school students at Aspire Firestone Academy in south robots made from LEGOs through UCLA student group BEAM.

Building Engineers and Mentors at UCLA (BEAM-UCLA) is a student run science and engineering outreach organization whose goal is to encourage students in K-12 to pursue STEM (science, technology, engineering, and math) disciplines. Six times a quarter, UCLA volunteers go to one of three partner schools in the greater Los Angeles community and perform a Los Angeles how to program fun, hands-on science activity with the students.

This past year, BEAM had three school partners -Young Oak Kim Academy (6-8), Aspire Junior Collegiate Academy (K-5), and Aspire Firestone Academy (K-5). Existing lesson plan favorites such as stomp rockets, ice cream heat transfer, and DNA extraction formed the core of the lessons taught at these sites.

However, BEAM volunteers were able to create six new and exciting lesson plans designed specifically for elementary and middle school students. "Bridge Building" had students working in teams to creatively build a bridge out of Popsicle sticks

that could withstand a large amount of weight. Two lessons involved material science; both "Slime" and "Bouncy Balls" had students creating new substances through chemical reactions. 'Squishy Circuits" had students using Play-Doh like substances to investigate conductors and insulators in electrical circuits. Students also built small generators with wire and magnets in the "Power Generation" activity. Lastly, the "Robots" lesson used LEGO Mindstorm robots to teach students basic programming.

The 2011-2012 academic year proved to be very successful for BEAM - laying groundwork for future years and setting BEAM up for a successful 2012-2013 year. This noteworthy year

would not have been possible if not for funding support from both the UCLA Mechanical and Aerospace Department and the **UCLA Community Activities** Commission.



Fourth-year mechanical engineering student Alex Baker (left) and second-year chemical engineering student Serena Shanbhag sit with a group of elementary school students as they work with a robot made from LEGO pieces.

UCLA SAE Baja 2011-12

By James Griswold

Fourth-year mechanical engineering student Anthony Tyson (left), second-year aerospace engineering student Dylan Aramburu and thirdyear mechanical engineering student Sam Neff assemble an off-road vehicle.



During the 2011-2012 Baja season, UCLA Racing implemented many new features and optimized existing designs that led to increased success at the Northwest competition in Washougal, Washington. Among these new designs was a locking differential, which allowed the vehicle to be optimized for each event: open differential for the maneuverability course, and locked differential for the rock crawl, hill climb, and acceleration events. The drivetrain was redesigned to be lighter and more efficient, with a 9:1 reduction achieved using only two shafts. Suspension was modified to give more travel and reduce the effect of bump steer

Members of the UCLA Racing Baja team built a 335-pound car that is mostly made of welded steel. The team used an mechanical engineering classroom as its workplace after the Engineering 1A building, where it had done its work in previous years, was demolished in August.



and the braking system was rebuilt from the ground up to allow all four wheels to be locked up with minimum force from the driver. General weight savings were made through Solidworks analysis in all subsystems, including a redesigned chassis. Using new Gaged Transmission, UCLA achieved 7th place overall in Dynamic events, and top 15 in sales and design presentations. Field testing was a large part of the 2011-2012 season, and our team is looking to further explore testing procedures using sensors and photogates for the 2012-2013 season.

This year, with top Baja leadership graduating, many new members were given a crash course in designing, fabricating, and racing the vehicle. Dedicated, hard-working new recruits eased the transition, and many lessons were learned during the assembly and fabrication process. Presentations and tutorials on Solidworks and design were open to all students and given throughout

Fall Quarter, and the team plans to continue offering these learn ing opportunities in the 2012-2013 school year.



UCLA SAE Supermileage 2011-12

By Chris B. Underhill

As the returning members of the team gathered in the fall of 2011, they realized they had a new challenge. They must not only rebuild a new vehicle, but they must rebuild a team. At the beginning of the school year, the team had only four returning team members, one of whom would soon dropout. Hence throughout the year, the team focused not only on producing a new vehicle, but on heavy recruitment and member retention. Now at the end of the year, the team has grown from a mere four involved members to nearly twenty, with eight returning as club officers for the 2012-2013 academic year.

The past year was one in which significant vehicle advancements were made, but little was actually shown for. For one, the team rebuilt its rear-steering style chassis using recycled aluminum tubes from the previous vehicle. The team redesigned the vehicle steering system to provide for much more reliable handling in addition to increased driver comfort in operating the vehicle. Lastly, but most significantly, the team successfully modified the stock Briggs and Stratton (lawn mower) engine to incorporate electronic fuel injection (EFI) as well as overhead valve (OHV) technology. The team successfully ran the engine with EFI before competition and at competition. However, success on the track was not meant to be. At the annual SAE (Society of Automotive Engineers) SuperMileage Competition at the Eaton Corporation test track in Marshall, MI, the team came prepared and excited for a successful event. However, at the beginning of the second day of the competition, when the vehicle was near ready to race, components of the EFI system began to break down. After failing to fix a leaky fuel injector and a faulty CPU, the team scrambled to replace the system with a carburetor. They did, but after successfully passing through technical inspection, the track had just closed for the day and the team was rendered unable to make a competition run.



L to R, Michael Tsai, Josh Chen, Chris Underhill, Stephen Chow, Joseph Lee, Eric Hsu

Despite failures at competition, the team is very excited for the coming year. With the technical advancements we've made, the next design nearly completed, and a much larger and more experienced team, the outlook for 2013 is positive in every aspect.

Photo info:

The first image (incar) has driver Crystal Nishioka in technical inspection. The second image (teamwithcar) has a portion of the team (from L to R, Michael Tsai, Josh Chen, Chris Underhill, Stephen Chow, Joseph Lee, Eric Hsu) with the car. The third image has Chris Underhill, Stephen Chow, and Eric Hsu troubleshooting the fuel injection system. The last photo (car) simply has the 2011-2012 vehicle.

UCLA Formula SAE 2011-12

By Alec Fredriksson

The end of the 2011-2012 school year marked the beginning of an era for UCLA's Formula SAE team. Despite being just a quarter old, after its founding in April 2012, UCLA Formula Racing has made great strides towards developing its first car. Preliminary design work for each system is already well underway.

This would not have been possible without the dedication of its club members. At meetings held twice a week, members worked to develop an understanding of not only Formula SAE cars, but engineering concepts in general. Whether it was researching vehicle dynamics or designing a prototype steering rack, these members were constantly working on our car.

While car development was an important part of this quarter, UCLA Formula Racing was created to be much more. Founders Matthew Shadish, Anthony Wong, and Alec Fredriksson also created it with the goal of educating members in the process.

One of the most noteworthy examples of our commitment to this philosophy was our Solidworks tutorial. This two-hour interactive lesson exposed the team to important computer-aided design concepts. By the end of the tutorial, members were able to create a variety of objects in Solidworks, including actual automotive components that they will be working with during the year, such as brake disks.

With a successful quarter behind us, UCLA Formula Racing is now setting its sights on the year ahead. While we will face countless challenges as we build our school's first Formula SAE car, the lessons learned will play a large part in the strengthening of not only ourselves, but also of the future of our team.

DYNAMICS



Oddvar O. Bendiksen

Classical and computational aeroelasticity, structural dynamics and unsteady aerodynamics.

Associate Fellow, AIAA, 1995



James S. Gibson

Control and identification of dynamical systems.
Optimal and adaptive control of distributed systems, including flexible structures and fluid flows. Adaptive filtering, identification, and noise cancellation.



Daniel C. H.Yang

Robotics and mechanisms; CAD/CAM systems, computer controlled machines.

Fellow, ASME, 2007

HEAT AND MASS TRANSFER



Mohamed A. Abdou

Fusion, nuclear, and mechanical engineering design, testing, and system analysis; thermomechanics; thermal hydraulics; neutronics, plasma-material interactions; blankets and high heat flux components; experiments, modeling and analysis.

Fellow, American Nuclear Society, 1990 Associate Fellow, TWAS, 1989



Ivan Catton

Heat transfer and fluid mechanics, transport phenomena in porous media, nucleonics heat transfer and thermal hydraulics, natural and forced convection, thermal/hydrodynamic stability, turbulence.

Fellow, ASME, 1989 Fellow, American Nuclear Society, 1999



Vijay K. Dhir

Two-phase heat transfer, boiling and condensation, thermal and hydrodynamic stability, thermal hydraulics of nuclear reactors, microgravity heat transfer, soil remediation.

Member, National Academy of Engineering, 2006 Fellow, ASME, 1989 Fellow, American Nuclear Society, 1997



Y. Sungtaek Ju

Micro- and nanoscale thermosciences, energy, bioMEMS/NEMS, nanofabrication.



H. Pirouz Kavehpour

Microfluidics and biofluidics, biofuel cells, cardiovascular flow, complex fluids, interfacial physics, micro-tribology, non-isothermal flows, drug delivery systems, and artificial organs.



Adrienne Lavine

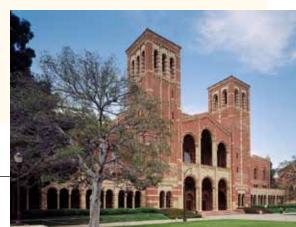
Solar thermal energy storage, thermal energy harvesting, thermal control of nanoscale manufacturing, thermomechanical behavior of shape memory alloys, thermal aspects of manufacturing processes including machining and plasma thermal spray.

Fellow, ASME, 1999



Laurent G. Pilon

Radiation transfer, biomedical optics, photobiological fuel production, sustainable energy, nanoscale thermoscience, foams.



FLUID MECHANICS



Jeff D. Eldredge

Bio-inspired locomotion in fluids; Numerical studies of high-speed flows; Development and application of computational tools for unsteady flow physics and flow-structure interaction; Generation and control and aerodynamic sound; Biomedical flows.



Ann R. Karagozian

Fluid mechanics and combustion, with applications to improved engine efficiency, reduced emissions, alternative fuels, and advanced high speed air breathing and rocket propulsion systems.

Fellow,AIAA, 2004
Fellow,American Physical



Xiaolin Zhong

Computational fluid dynamics, hypersonic flow, hypersonic boundary layer stability and transition, numerical simulation of transient hypersonic flow with nonequilibrium real gas effects, numerical simulation of micro two-phase flow, MHD control of hypersonic boundary layers, high-order numerical methods for flow simulation.

Associate Fellow, AIAA, 2004



John Kim

Numerical simulation of transitional and turbulent flows, turbulence and heat-transfer control, numerical algorithms for computational physics. Member, National Academy of Engineering, 2009 Fellow, American Physical Society, 1989



Richard Wirz

Society, 2004

Electric and micro propulsion, low temperature plasma and plasma discharges, spacecraft and space mission design, alternative energy generation and storage.

H. Pirouz Kavehpour

MANUFACTURING AND DESIGN



Nasr M. Ghoniem

Damage and failure of materials in mechanical design; mechanics and physics of material defects (point defects, dislocations, voids and cracks); material degradation in severe environments (e.g. nuclear, fusion, rocket engines, etc.); plasma and laser processing; materials non-equilibrium, pattern formation and instability phenomena; radiation interaction with materials (neutrons, electrons, particles, laser & photons).

Fellow, American Nuclear Society, 1994 Fellow, ASME, 2006 Fellow, American Academy of Mechanics, 2010



Gregory P. Carman

Electromagnetoelasticity models, piezoelectric ceramics, magnetostrictive composites, characterizing thin film shape memory alloys, fiber optic sensors, design of damage detection systems for structures.

Fellow, ASME, 2003

Tsu-Chin Tsao



Rajit Gadh

Smart Grid -Communication and control, Electric Vehicle aggregation for Smart Grid Integration, Vehicle to Grid and Grid to Vehicle. Automated Demand Response, Micro-grid modeling, Smart grid for renewable integration, Radio Frequency Identification (RFID), Wireless Internet of Artifacts, Reconfigurable Wireless Sensing and Networking Systems, Wireless Multimedia Architectures, CAD/CAM/ VR/Visualization.

Fellow, ASME, 2011

Modeling and control of dynamic systems with applications in mechanical systems, manufacturing processes, automotive systems, and energy systems, digital control; repetitive and learning control, adaptive and optimal control,

mechatronics. Fellow, ASME, 2011 Mohamed A. Abdou Daniel C. H. Yang

MEMS AND NANOTECHNOLOGY



Yong Chen

Nanofabrication, nanoscale electronic materials and devices, micro-nano electronic/optical/bio/ mechanical systems, ultrascale spatial and temporal characterization.



Pei-Yu Chiou

Biophotonics, nanophotonics, BioMEMS/ NEMS, electrokinetics. microfluidics and biofluidics, guided selfassembly, high throughput single cell analysis.



Vijay Gupta

Experimental mechanics, fracture of engineering solids, mechanics of thin films and interfaces, failure mechanisms and characterization of composite materials, ice mechanics.

Fellow, ASME, 2005

Gregory P. Carman Y. Sungtaek Ju H. Pirouz Kavehpour Laurent G. Pilon



Chih-Ming Ho

Molecular fluidic phenomena, nano/ micro-elector-mechanicalsystems, bio-molecular sensors, control of complex systems. Member, US National Academy of Engineering 1997

Academician, Academia Sinica, 1998 Fellow, American Physical

Society, 1989 Fellow AIAA, 1994



Chang-Jin "CJ" Kim

Microelectromechanical systems (MEMS), surface-tensionbased microactuation, nanotechnology for surface control, microdevices including microfluidic applications, full spectrum of micromachining technologies.

Fellow, ASME, 2011

SYSTEMS AND CONTROL



Tetsuya Iwasaki

Neuronal control mechanism of animal locomotion, nonlinear oscillators, and robust/ nonlinear control theory and its applications to mechanical, aerospace, and electrical systems.

Fellow, IEEE, 2009



Robert T. M'Closkey

Nonlinear control theory and design with application to mechanical and aerospace systems, real-time implementation.

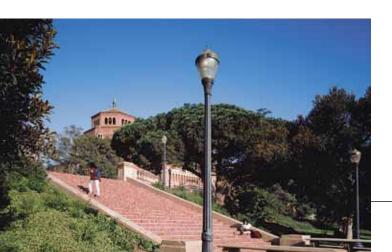


Jason Speyer

Stochastic and deterministic optimal control and estimation with application to aerospace systems; guidance, flight control, and flight mechanics.

Member, National Academy of Engineering, 2005 Life Fellow, IEEE, 2004 Fellow, AIAA, 1985

James S. Gibson Tsu-Chin Tsao



STRUCTURAL AND SOLID MECHANICS



Ajit K. Mal

Mechanics of solids, fractures and failure, wave propagation, nondestructive evaluation, composite materials, structural health monitoring, biomechanics. Fellow, ASME, 1994

Fellow, ASME, 1994
Fellow, American Academy of
Mechanics, 1994
Fellow, International Society
for Optical Engineering, 2005



William Klug

Computational structural and solid mechanics, computational biomechanics, and micro/nanomechanics of biological systems.



Christopher Lynch

Ferroelectric materials including experimental characterization of constitutive behavior under multiaxial loading.
Fellow, ASME, 2004

Oddvar O. Bendiksen Gregory P. Carman Nasr M. Ghoniem Vijay Gupta

PROFESSORS EMERITI

Charwat, Andrew Mills, Anthony
Friedmann, Peretz Mingori, D. Lewis
Hahn, H. Thomas Okrent, David
Kelly, Robert Smith, Owen

ADJUNCT PROFESSORS

Lackman, Les M. Sepulveda, Abdon Marner, Webb Shaefer, Robert Morley, Neil Szilard, Ronaldo H.

LECTURERS

Lih, Shyh-Shiuh

Amar, Ravnesh Lim, Christopher Chatterjee, Amiya Majlessi, Abdi Chu, Kevin Christopher Mathur, Atul Colonno, Michael Rahim, Faranak Deo, Ravindra B. Schwartz, David Goebel, Dan Shane, Judy Golub, Alex Swider, Jan Goyal, Vinay Tesch, Jonathan Jain, Sanjeev Toohey, Damian Kinsey, Robert Wang, Xiaowen Kipp, Kristina A.

JOINT APPOINTMENTS

Carnesale, Albert (Professor, Public Policy
Department)
Chen, Jiun-Shyan (Professor, Civil and
Environmental Engineering Department)
Liou, K. N. (Professor, Atmospheric and Oceanic
Sciences Department)

STAFE

Heejin Baik Faculty Support Staff **Faculty Support Staff** Samantha Becker Lili Bulhoes Staff Personnel/Payroll Angie Castillo Student Affairs Officer Coral Castro Fund Manager Management Services Officer Duy Dang Alexander Duffy Web and Publications Manager Lance Kono Facilities Manager Student Affairs Officer Abel Lebon Miguel Lozano Senior Laboratory Mechanician Mary Ann Macaso Business Office Manager Jennifer Ono Fund Manager **David Shatto Purchasing** Benjamin Tan Senior Development Engineer Marcia Terranova Academic Personnel/Payroll

Graduates 2011-2012

DOCTOR OF PHILOSOPHY

- Aggarwal, Ankush / Multi-Scale Mechanics Of Protein Assemblies / Klug
- Baid, Harsh Kumar / Detection Of Damage In A Composite Structure Using Guided Waves / Mal
- Bulgrin, Katherine Elizabeth / Magnetic Thermomechanical Devices Used For Waste Heat Energy Harvesting And Thermal Conductance Switching / Lavine
- Cha, Gilhwan / Liquid-Based Switchable Thermal Interfaces For Thermal Management Systems And Thermal Energy Harvesters / Ju
- Chen, Ting-Hsuan / Top-Down Engineering Of Self-Organizing Cell Pattern Formation For Regenerative Medicine / Ho
- Chu, Kevin Christopher / Stochastic And Deterministic Disturbance Cancellation For Nano-Precision Systems / Tsao
- Citron, Jason Keith / Biomechanical Impact Management Using Polyurea / Gupta
- Ding, Xianting / Identification Of Disease Mechanism Using An Engineering Top-Down Approach / Gupta
- Emmons, Michael Christian / Development Of Fiber Bragg Grating Strain, Thermal, And Magnetic Sensors For Smart Structure Applications / Carman
- Fang, Jin / Thermal Transport In Nanoporous Materials For Energy Applications / Pilon
- Ferrari, Marcello Do Areal Souto / Modeling Of Passive Acoustic Liners From High Fidelity Simulations / Elderdge
- Han, Seung Ryong / New Unified Machining Process Planning Using Morphing Technology / Yang
- Harb, Rani / Computational Modeling Of The Mechanical Response Of Open-Cell Foams: Finite Deformations And Ligament Plasticity / Ghoniem
- Hendrickson, Cory Scott / Identification And Control Of The Jet In Crossflow / M'Closkey
- Hunt, Ryan Matthew / Diffusion Bonding Beryllium To Reduced Activation Ferritic Martensitic Steel: Development Of Processes And Techniques / Abdou
- Juan, Tingting / A Computational Study Of Flow Through A Vitreous Cutter / Eldredge

- Kang, Jin Sung / Structural Integration Of Silicon Solar Cells And Lithium-Ion Batteries Using Printed Electronics / Hahn
- Lim, Christopher / Modeling And Analysis Of Cam-Based And Camless Air Hybrid Vehicles / Tsao
- Mal, Siddhartha Byron / Near Real-Time Push Middleware / Gadh Mandic, Milan / Decentralized Linear Observer And Estimator With Time-Varying Sensing And Communication Topologies / Speyer
- Michelin, Andre / Optimality Issues In The Free-Flight Merging Of Aircraft / Speyer
- Prakash, Akshay / Numerical Simulation Of Receptivity To Freestream Acoustic Disturbances For Hypersonic Boundary Layer Over A Blunt Body With Chemical And Thermal Nonequilibrium / Zhong
- Riendeau, Joseph / Self-Healing Polymer Composites/ Hahn Ryan, John Jens / A Method Of Extremum Seeking Control Based On A Time Varying Kalman Filter And Its Application To Formation Flight / Speyer
- Sasa, Leslie A / Neutron Reflectivity And Rheological Studies Of Grafted Polymers Under Shear / Lavine
- Sharif Kashani, Pooria / Biomechanics Of Vitreous Gel / Kavehpour
- Sharratt, Stephen Andrew / Optimized Structures For Low-Profile Phase Change Thermal Spreaders / Ju
- Tarzi, Zahi Bassem / Optimum Low Thrust Elliptic Orbit Transfer Using Numerical Averaging / Speyer
- Tesch, Jonathan Andrew / High-Performance Control And Prediction For Adaptive Optics / Gibson
- Teshome, Sophonias / Droplet Combustion And Non-Reactive Shear-Coaxial Jets With Transverse Acoustic Excitation / Karagozian
- Wilson, Jason Tomas / An Intraocular Robotic Interventional Surgical System – Iriss/ Tsao
- Wook, Choi / Miniature Stereo Imaging Devices And End-Effectors For Endoscopic Applications / Kim, C.-J
- Wu, Tao / Magnetoelectric Effect And Application In Layered Bulk Laminates, Thin Films And Nanostructures / Carman



Graduates 2011-2012

MASTER OF SCIENCE

Abdalla, Amira Hassan / MS Comprehensive Exam / Speyer Anders, Mark / MS Comprehensive Exam / Tsao Babb, Alexander / MS Comprehensive Exam / Bendiksen Bernal, Jose Luis / MS Comprehensive Exam / Eldredge Bousquet, Kenneth Ryan / MS Comprehensive Exam / Mal Carini, Gregory David / MS Comprehensive Exam / Bendiksen Chang, Yen-Chi / MS Comprehensive Exam / Tsao Chen, Kuan-Chou / MS Comprehensive Exam / Chiou Chin, Thomas K / MS Comprehensive Exam / Wirz Chiu, Phillip / MS Comprehensive Exam / Wirz Chu, Lauren Elizabeth / MS Comprehensive Exam / Wirz Clarey, Matthew / MS Comprehensive Exam / Bendiksen Co, Tony / MS Comprehensive Exam / Wirz Conversano, Ryan William / MS Comprehensive Exam / Wirz Curgus, Dita Brigitte / MS Comprehensive Exam / Gibson Dinh, Thai Quang / MS Comprehensive Exam / Ghoniem Dong, Wenda / MS Comprehensive Exam / Lynch Fong, Kahei Danny / MS Comprehensive Exam / Zhong Franceschi, Alex Quinton / MS Comprehensive Exam / Carman Gevorkyan, Levon / MS Comprehensive Exam / Karagozian Goljahi, Sam / MS Comprehensive Exam / Lynch He, Tao / MS Comprehensive Exam / Bendiksen Hernandez, Maximiliano III / MS Comprehensive Exam / Karagozian

Hu, Vincent En / MS Comprehensive Exam / Tsao
Iyer, Jaya / MS Comprehensive Exam / Mal
Johnson, Perry Moses Sablan / MS Comprehensive Exam / Zhong
Jonokuchi, Jeffrey Robert / MS Comprehensive Exam / Wirz
Jung, Yongwha / MS Comprehensive Exam / Carman
Kabachek, Sofya / MS Comprehensive Exam / Eldredge
Kandilian, Razmig / MS Comprehensive Exam / Pilon
Knaup, Brian / MS Comprehensive Exam / Mc'Closkey
Koo, Bonhye Thes/Diss Title: Long-Term Tests of EWOD:
Dielectric charging dependent on hydrophobic

material and voltage type / Kim, C.-J
Larsen, Bradley Robert / MS Comprehensive Exam / Bendiksen
Lau, Wai-Yin / MS Comprehensive Exam / Lavine
Leung, Kin Wai / MS Comprehensive Exam / Zhong
Li, Jing Xing / MS Comprehensive Exam / Ghoniem
Liew, Dennis Hungteh / MS Comprehensive Exam / Gibson
Lim, Alexander C / MS Comprehensive Exam / Zhong
Lin, Yuhua / MS Comprehensive Exam / Lavine
Liu, Sike / MS Comprehensive Exam / Lynch
Lomas, Gabriel Felipe / MS Comprehensive Exam / Wirz
Martinez, Brian Anthony / MS Comprehensive Exam / Karagozian
Menefee, Ryan Addison / MS Comprehensive Exam / Bendiksen
Miller, Benjamin Scott / MS Comprehensive Exam / Bendiksen
Mora, Paola / MS Comprehensive Exam / Ghoniem

Moreno, Raylene C / Thes/Diss Title: Numerical Simulations Versus Experimental Data For A Pyroelectric Energy Converter Harvesting Waste Heat / Pilon Mortensen, Clifton Holden / MS Comprehensive Exam / Zhong Murillo, Daniel / MS Comprehensive Exam / Bendiksen Namasondhi, Patrick / MS Comprehensive Exam / Eldredge Nguyen, Hoang-Yen / MS Comprehensive Exam / Lynch Nguyen, John Phu / MS Comprehensive Exam / Ghoniem Nguyen, Kevin Nhan / MS Comprehensive Exam / Eldredge Oey, Sunny / MS Comprehensive Exam / Kim, J. Ong, George K T / MS Comprehensive Exam / Mal Onorato, Michael / MS Comprehensive Exam / Carman Patino, Iylene Marie / MS Comprehensive Exam / Bendiksen Pham, Phillip Dao / MS Comprehensive Exam / Carman Pham, Thang Quoc / MS Comprehensive Exam / Eldredge Pillai, Sahil / MS Comprehensive Exam / Mal Quinonez, Christopher / MS Comprehensive Exam / Wirz Roizen, Brian Andrew / MS Comprehensive Exam / Kim, C.-J San, Alexander Tran / MS Comprehensive Exam / Yang Sbutega, Krsto / MS Comprehensive Exam / Catton Shea, Evan Naito / MS Comprehensive Exam / Catton Shen, Alex Ming / MS Comprehensive Exam / Chen Shepelev, Aleksey Vladimirovich / MS Comprehensive Exam /

Shifrin, Joseph Salvatore MS Comprehensive Exam / Karagozian Silva Vite, Aleidy Marlene / MS Comprehensive Exam / Ho Silva, Ryan Matthew / MS Comprehensive Exam / Eldredge Snyder, Kyle Robert / MS Comprehensive Exam / Eldredge Soukiassian, Hovhannes / MS Comprehensive Exam / Bendiksen Sun, Wei-Yang / MS Comprehensive Exam / Kim, C.-J Supowit, Jacob Adam / MS Comprehensive Exam / Catton Teng, Kuo-Tai / MS Comprehensive Exam / Tsao Thompson, Matthew John / MS Comprehensive Exam / Mc'Closkey

Truong, Paul Minh Thien / MS Comprehensive Exam / Mc'Closkey Vartanian, Ninel / MS Comprehensive Exam / Bendiksen Vu, Jane Mary / MS Comprehensive Exam / Lavine Vu, Nam Vy Quoc / MS Comprehensive Exam / Zhong Wasson, Christopher James / MS Comprehensive Exam / Yang Wilschke, Jeffrey Scott / MS Comprehensive Exam / Eldredge Wirth, David M / Thes/Diss Title: Experimental Study On The Aerospace Applications Of Photoreactive Nanomaterials / Pilon

Zhan, Yujia / Thes/Diss Title: Study Of Characteristics Of Liquid-Based Bridge Structure As Mechanical Elements / Ju

Zhang, Lin / MS Comprehensive Exam / Speyer



Graduates 2011-2012

BACHELOR OF SCIENCE

Ahn, Jeehoo

Akashian, Alexander Hagop Alcid, Eddson Eddson Alcid Alphonso, Mark Malcolm Antisdel, James Thomas Armstrong, Robin Christopher

Aroyan, Andre H

Aust, Brandon Christopher Bae, Ryan Sung Jun Baker, Alexander Banerjee, Kaustubh Barnes, Matthew Joseph Barrientos, Matthew Arane Bastomski, David Joseph Beach, Katherine R Bell, Leslee Katherine Berry, Matthew David

Blum, Merriman Thomas Bersch

Boyland, Susannah Rachel Boyle, Matthew Christopher

Bhateja, Sandeep Kumar

Biehler, Yoshiyuki

Brink, David William Brown, Adam Gordon Bui, Nhat Quang Chandramohan, Aditya Chang, Justin Wei-Young

Chavez, Broc Lucas Chen, Steve Sichi Chen, William Cho, Jaeyoon Cho, Jeong Shin Choi, Daniel Daseolhan Choi, David Seiji Kar Liang

Chun, Eugene Colon, Filiberto, Iii

Cowan, Thomas Christopher

Croshal, Gary Justin Crozier, Harris Ching Darakananda, Darwin Deleon, Marco Leija Diez, Steven James Dizon, Brandon Alexander

Fang, Vivien Yuan

Flores, Miguel Antonio Santos

Fracolli, Paul Taylor Fujii, Amanda Mei Keiko Gambardella, Anthony Lococo

Garcia, Gabriel Jj

Ge, Michael

Goodman, Taylor Schlaff Heigel, Jonathan Kenji

Hirschsohn, Ryan Malcolm

Ho, Jonathan Hsiao, Yu Hsiung, David Hsu, Mark Graham Huang, Timothy Huang, Yi

Huerta, Cesar Eduardo Hui, Ephraim Eli

Hutchinson, Sean Michael

Jang, Jun Bok Jirapong, Ryan

Johnson, Zachary Christopher

Kiang, Kevin Carl Kijatanath, Vathid Kim, Do-Hun Kim, Jong Hyun Ko, Jason Hyung In Kohli, Sunny

Kolnowski, Benjamin Michael

Kulkarni, Nikhil Anant Le, Ninh Nguyen Lee, Albert G Lee, Jae Hoon

Lee, Jason Jungseung Leung, Darius T

Li, Chin

Li, Vincent Yeou-Hua

Lim, Jason T Long, Justin Daniel Lu, Phillip Chao-Len Luong, David Ly, Matthew Ma, Jerome Ma, Steven

Maccani, Jason Lee

Manousiouthakis, Ioannis Vasilios

Marshall, Benjamin Wilson Mathew, Rohit Jackson Mayer, Nathanael Ross

Moreno-Magana, David Ernesto

Morgan, Patrick C Murray, Angela Marie Nakahara, Jeffrey Keane Nguyen, Daniel Tuan Nicholas, Frank Brady Nolta, Michael Lloyd O'Toole, Amanda Joanna

Park, Seung Ho Pasma, Keith W Patel, Nikesh

Peak, Alexander Kent

Pena, Carlos Augusto Phane, Denny Pineda, Francisco A

Plater, Nathanael Richard Ripley Ponnaluri, Aditya Venkatasati

Poon, Jessica Wai-Yin

Qian, Phillip

Quintero, Jose Alejandro Rackley, Paige Arlene Ridgeway, Sam Andrew Riggs, Alex James

Romano, Paul Joe-Dariush Roselli, Patrick Regan Ross, Nicholas Salvatore Saul, Kevin Robert Schurr, Andrew Hiroshi Setiawan, Riyan Hutomo

Sha, Yung-Hsien Sigler, Sean Collin Silva, William Anthony

Singer, Brian Singh, Amrit Kumar Smolke, Jennifer L Sotelo, Bruno Cesar Statom, Joseph Patrick Stochl, Mark Allan Robert

Suazo, Michael Suen, Hang Kit

Sulaiman, Sennan David

Sze, Conrad Tang, Sean

Tirumalareddy, Rajiv Reddy

Torres, Joshua Ryan Tseng, Kevin Andrew Tsou, Kevin Andrew Tung, Ho Him Tyson, Anthony Ryan

Ueki, Sho

Zaky, Zeyad

Valdes, Salvador Angelica Vogelaar, Adam Hiroki Wang, Adrien Phillips Wang, Hong Ru Webb, Timothy Hunter Weinberg, Ian Joseph Wirth, David M Wong, Nadine Alison Wooster, Collin Masaru Yee, Darrell Michael Yip, Alan William Young, Michael Leo Yu, Franklin Sol

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On the back cover: UCLA Racing: SAE Mini Baja at Northwest competition in Washougal Washington

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