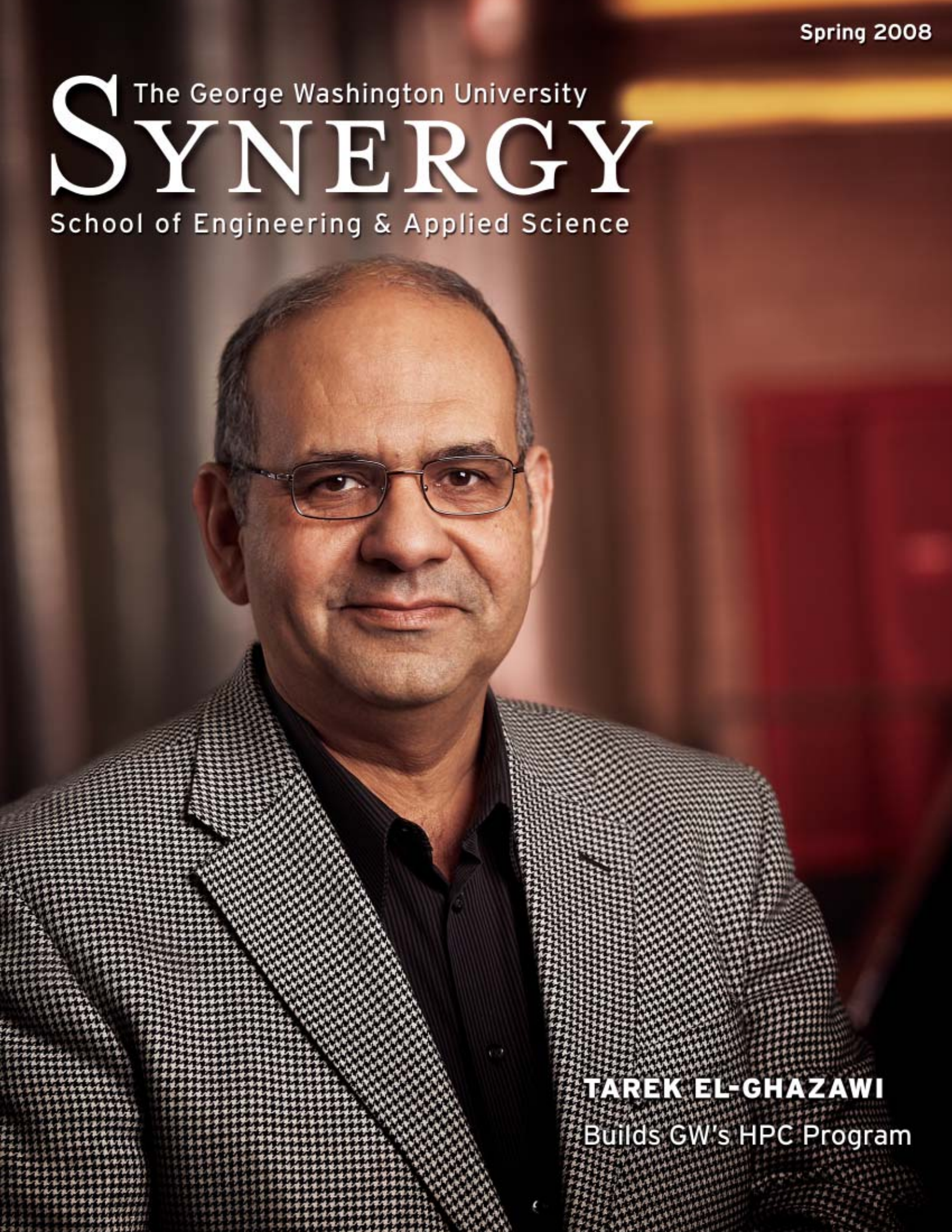
Spring 2008

The George Washington University

SYNERGY

School of Engineering & Applied Science



TAREK EL-GHAZAWI

Builds GW's HPC Program

First Words

"WE HAVE ESTABLISHED TWO NEW RESEARCH CENTERS, THE GW CENTER FOR BIOMIMETICS AND BIOINSPIRED ENGINEERING (COBRE) AND THE INSTITUTE FOR MASSIVELY PARALLEL APPLICATIONS AND COMPUTING TECHNOLOGIES (IMPACT)."

FROM THE DEAN:
Timothy W. Tong

Change is always afoot at SEAS, and each issue of *Synergy* gives me an opportunity to highlight a select number of these changes to share with you. I always look forward to being able to report on our advances, and I do so with pride, because we continue to grow not just in one or two areas, but across the board: in curriculum development, faculty research, student achievements, student services, and donor and partner relationships.

We continue to make great strides in two of our signature research areas, high-performance computing and biomimetics/bio-inspired engineering. In fact, SEAS won funding from the University for both in its latest round of competition for GW's areas of academic excellence. As a result, we have established two new research centers, the GW Center for Biomimetics and Bioinspired Engineering (COBRE) and the Institute for Massively Parallel Applications and Computing Technologies (IMPACT). The funding for these new centers brings us to a total of four GW awards for areas of academic excellence.

A natural correlate to our research activities is our effort to promote technology transfer and entrepreneurship. In the last issue of *Synergy*, we reported on our establishment of CET2C, the Council of Entrepreneurial Tech Transfer and Commercialization, and its various activities, such as seminars, brown-bag lecture series, and a national university start-ups conference. CET2C continues to generate strong interest among entrepreneurs, researchers, and investors within the GW community by holding events such as the very popular angel investing mini-workshops and the graduate student research and development showcases.

As we expand beyond our traditional role and provide more services—such as entrepreneurship training—to the GW community, we are also expanding the GW and SEAS community in other ways. One such way is in the growth of our off-campus programs. These programs have been growing steadily for five years, and SEAS now has a presence in several states with hundreds of students. This is a remarkable achievement and one that speaks very well of our programs and our reputation.

I end this message to you with some nostalgia, because these will be my last "First Words From the Dean." Effective June 30, 2008, I will be stepping down as dean of the School of Engineering and Applied Science. A search is underway for my replacement, and ten SEAS faculty members are working diligently to recruit the best possible candidate to lead the school in the next phase of its development. Let me say lastly only this: I am grateful to all the supporters and friends, faculty and staff, and students who have made SEAS stronger and better over the past several years, and I urge you to keep up your support.

Sincerely,

Timothy W. Tong, Ph.D.
Dean

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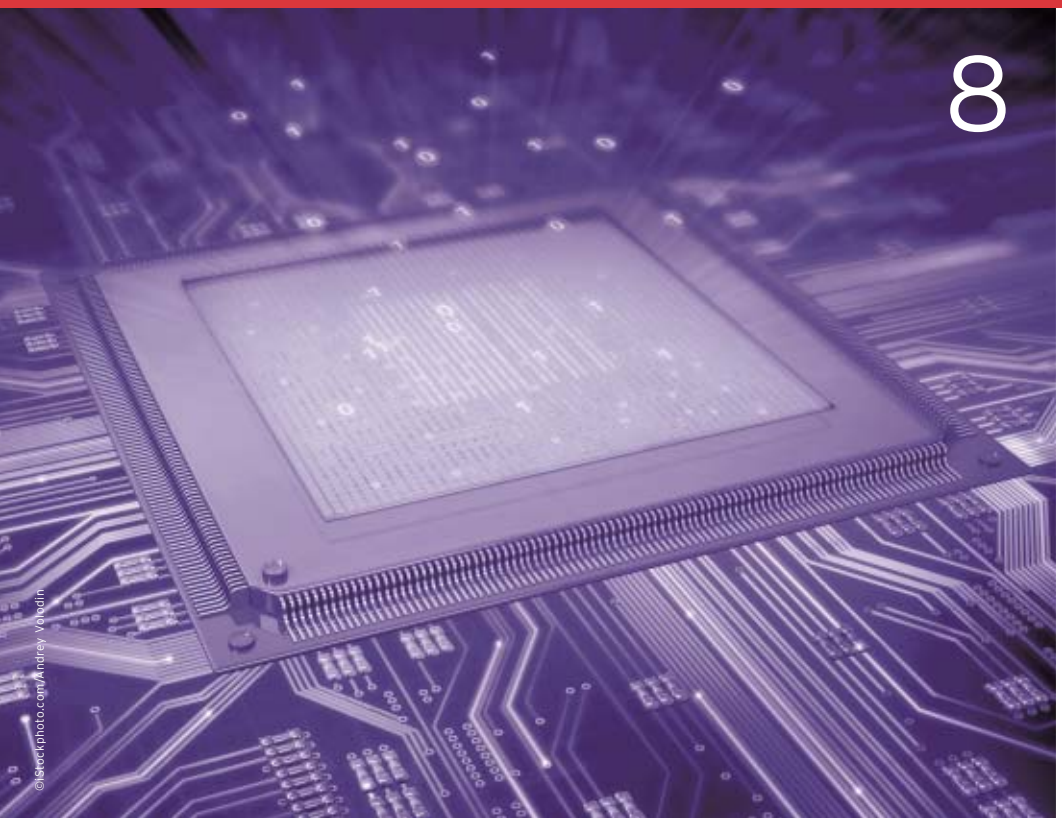

SYNERGY

SPRING 2008

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Civil & Environmental Engineering

PROFILE

Chair: Kim Roddis
202-994-4901
www.cee.seas.gwu.edu
Full-time faculty: 12
Undergraduate students: 59
Graduate students: 61
Annual research expenditures: $3.9 million

FACULTY

Sameh S. Badie, **ASSOCIATE PROFESSOR**
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Azim Eskandarian, **PROFESSOR**
Muhammad I. Haque, **PROFESSOR**
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Majid T. Manzari, **PROFESSOR**
Dhafer Marzougui, **ASSISTANT RESEARCH PROFESSOR**
Vahid Motevalli, **ASSOCIATE PROFESSOR**
Kim Roddis, **PROFESSOR**
Rumana Riffat, **ASSOCIATE PROFESSOR**
Pedro Silva, **ASSOCIATE PROFESSOR**

RESEARCH AREAS

ENVIRONMENTAL ENGINEERING
Riffat

GEOTECHNICAL ENGINEERING/EARTHQUAKE ENGINEERING
Badie, Manzari, Roddis, Silva

STRUCTURAL ENGINEERING
Badie, Manzari, Roddis, Silva

TRANSPORTATION SAFETY ENGINEERING
Digges, Eskandarian, Kan, Marzougui, Motevalli

INTELLIGENT TRANSPORTATION SYSTEMS
Eskandarian

Model Behavior

Professor Majid Manzari of the Department of Civil and Environmental Engineering has made his career studying and modeling soil behavior, and he is eager to let others know what is obvious to him. "It's important to know about soil behavior," Manzari says, "because all civil structures—bridges, buildings, tunnels—interact with soil. So, to design the structures properly, one needs to know what is happening in the soil and between the soil and the structure."

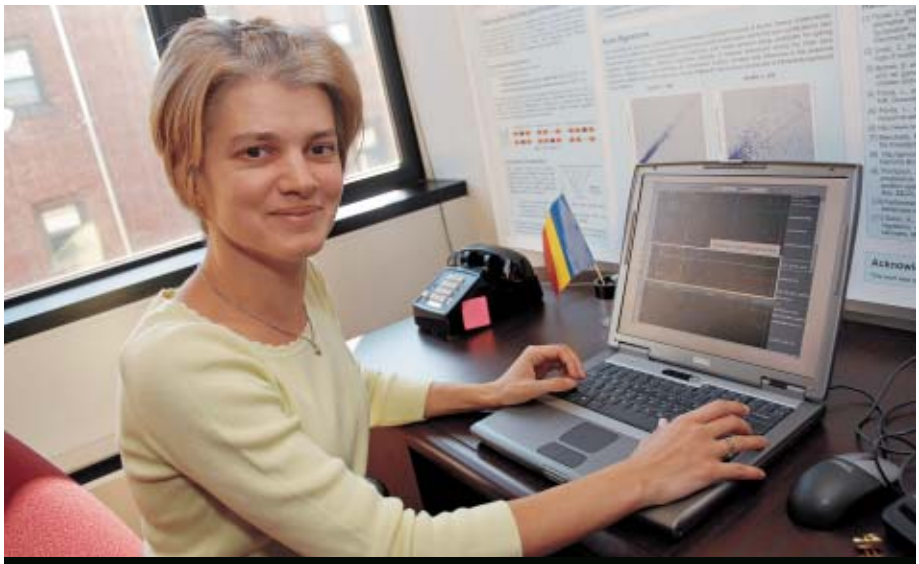
One area that Manzari studies is constitutive modeling of soil, trying to understand the mechanics of soil displacement during an earthquake, so that building designers can predict the effect of the displacement on their structures and develop counter-measures to it. "When structures are affected by earthquakes, most people assume the building or the bridge wasn't constructed correctly. Sometimes the problem isn't the structure but the soil underneath that cannot take the load from an earthquake," Manzari explains.

Manzari also studies what he calls the "post-failure response" of geo-materials to try to develop an understanding of this phenomenon. "If a small area in soil fails, the rest of the material will take the load," states Manzari, "but if this failure triggers failures in other locations, the triggering process could create a progressive failure that leads to a global collapse, such as a landslide. Whereas constitutive soil modeling looks at the soil condition at the local level, here we're addressing the bigger picture."

Another area of Manzari's research is his study of soil-pile-structure interaction. Structures whose loads are too heavy to put directly on the ground surface are constructed with piles that are driven below the surface to bring the load of the structure down to lower, stronger layers of soil. When an earthquake occurs, it can weaken the soil and the entire foundation. Manzari has been trying to apply his constitutive models to understand the soil-pile interaction and to come up with a predictive tool that engineers can use to develop design guidelines for the piles.

Although some aspects of soil behavior still remain a mystery, Manzari has had a good deal of success in developing models that explain some of the behavior. When asked about his successes, he replies, "Our key success is the model we have developed that is now one of the leading models in the world. This model is being used by major universities—including those that do research under the National Science Foundation's Network of Earthquake Engineering Systems grants—and by researchers in institutions like the world-famous Norwegian Geotechnical Institute. They are interested in having good soil models for their research, so they contact us to get the models."

DIGGING FOR CLUES: "My area of interest is what is underground; other colleagues worry about what is above the ground," says Professor Majid Manzari.



MAKING PREDICTIONS: Professor Liliana Florea has developed a scheme to better predict gene variations.

Cracking the Code

Nine years ago, scientists sequenced the human genome, the full set of our inheritable traits. They subsequently sequenced the genomes of several other species and at the same time began to discover variations within genes that were previously unknown. With this explosion of knowledge have come myriad new questions that create exciting challenges for researchers such as Professor Liliana Florea of the Department of Computer Science.

Florea creates computational modeling of biological problems, which she describes as the interface between computer science and biology. Her research spans the spectrum from trying to understand higher level concepts (such as what genes are and how diseases happen in genes) by looking at DNA and protein sequences that appear in cells, to trying to understand how bacteria relate to each other or how viruses and host cells interact with each other, to developing mathematical models that can be used to create software that identifies genes and their variations along large genomic sequences.

Florea has an impressive background in her field of research—and a modest way of describing her background. She was part of the group that sequenced the human genome, which she sees as "the privilege of being at the core of a group of scientists who solved a very important problem." She also has designed software programs, which she refers to as "tools," that very accurately and quickly help identify genes and their variations on genomic sequences. Florea says, "I sometimes call myself a toolmaker, because I design tools that other people use to do their research." In fact, she gets messages from around the world asking about these tools, or programs.

To better understand the usefulness of her programs, consider this explanation. "A lot of what we're doing computationally is making predictions about genes, and some of these turn out to be real and some don't. We have millions of variations in genes, but nobody can go into a lab and test all of these, so we have to have a way to narrow down which computational predictions are likely real. I came up with a scoring scheme to prioritize among different gene predictions to select those that most likely represented genes, and we suddenly went from millions of candidates to only about 40,000 or so. Others also have come up with scoring schemes and this is now how people identify genes, based on these methods."

For her past successes and in anticipation of future successes, the Sloan Foundation awarded Florea one of its prestigious research fellowships in 2006. Not resting in the past, Florea looks eagerly to current and future projects. "I think there is going to be a fusion between medicine the way we know it right now and computational medicine," Florea says, "and I think that that's where my group is going to go."

PROFILE

Chair: James K. Hahn
202-994-7181
www.cs.gwu.edu
Full-time faculty: 20
Undergraduate students: 118
Graduate students: 285
Annual research expenditures:
$2.1 million

FACULTY

Abdelghani Bellaachia, **ASSOCIATE PROFESSOR**
Simon Berkovich, **PROFESSOR**
Peter Bock, **PROFESSOR**
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Xiuchen "Susan" Cheng, **ASSISTANT PROFESSOR**
Hyeong-Ah Choi, **PROFESSOR**
Liliana Florea, **ASSISTANT PROFESSOR**
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Rachelle S. Heller, **PROFESSOR**
Lance J. Hoffman, **DISTINGUISHED RESEARCH PROFESSOR AND ACM FELLOW**
C. Dianne Martin, **PROFESSOR AND ACM FELLOW**
Sead Muftic, **RESEARCH PROFESSOR**
Bagharith Narahari, **PROFESSOR**
Rhys Price Jones, **PROFESSOR**
Shmuel Rotenstreich, **ASSOCIATE PROFESSOR**
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Rahul Simha, **PROFESSOR**
Jonathon R. Stanton, **ASSISTANT PROFESSOR**
Poorvi Vora, **ASSISTANT PROFESSOR**
Abdou S. Youssef, **PROFESSOR**

RESEARCH AREAS

ALGORITHMS AND THEORY
Bellaachia, Berkovich, Cheng, Price Jones, Youssef

BIOINFORMATICS AND BIOMEDICAL COMPUTING
Bellaachia, Berkovich, Cheng, Florea, Hahn, Price Jones, Rotenstreich, Simha

COMPUTER SECURITY AND INFORMATION ASSURANCE
Hoffman, Martin, Muftic, Simha, Stanton, Vora

DIGITAL MEDIA
Hahn, Heller, Martin, Sibert

MACHINE INTELLIGENCE AND COGNITION
Bock

NETWORKING AND MOBILE COMPUTING
Cheng, Choi, Narahari, Rotenstreich, Simha, Stanton

PERVASIVE COMPUTING AND EMBEDDED SYSTEMS
Cheng, Narahari, Simha

SOFTWARE ENGINEERING AND SYSTEMS
Narahari, Rotenstreich

Electrical & Computer Engineering

PROFILE

Chair: Can E. Korman
202-994-6083
www.ece.gwu.edu
Full-time faculty: 26
Undergraduate students: 186
Graduate students: 206
Annual research expenditures: $1.7 million

FACULTY

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Milos Doroslovacki, **ASSOCIATE PROFESSOR**
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Kie-Bum Eom, **PROFESSOR**
Robert J. Harrington, **PROFESSOR AND IEEE FELLOW**
Hermann J. Helgert, **PROFESSOR**
Walter K. Kahn, **PROFESSOR AND IEEE FELLOW**
Matthew Kay, **ASSISTANT PROFESSOR**
Can E. Korman, **PROFESSOR**
Nicholas Kyriakopoulos, **PROFESSOR**
Roger H. Lang, **PROFESSOR AND IEEE FELLOW**
Ting N. Lee, **PROFESSOR**
Murray H. Loew, **PROFESSOR, IEEE FELLOW AND AIMBE FELLOW**
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Martha Pardavi-Horvath, **PROFESSOR**
Joseph N. Pelton, **RESEARCH PROFESSOR**
Suresh Subramaniam, **ASSOCIATE PROFESSOR**
Branimir R. Vojcic, **PROFESSOR**
Wasyl Wasylkiwskyj, **PROFESSOR AND IEEE FELLOW**
Mona Zaghloul, **PROFESSOR AND IEEE FELLOW**
Jason M. Zara, **ASSISTANT PROFESSOR**
Vesna Zderic, **ASSISTANT PROFESSOR**

RESEARCH AREAS

BIOMEDICAL ENGINEERING
Kay, Loew, Manuccia, Zara, Zderic

COMMUNICATIONS AND NETWORKS
Doroslovacki, Helgert, Pelton, Subramaniam, Vojcic

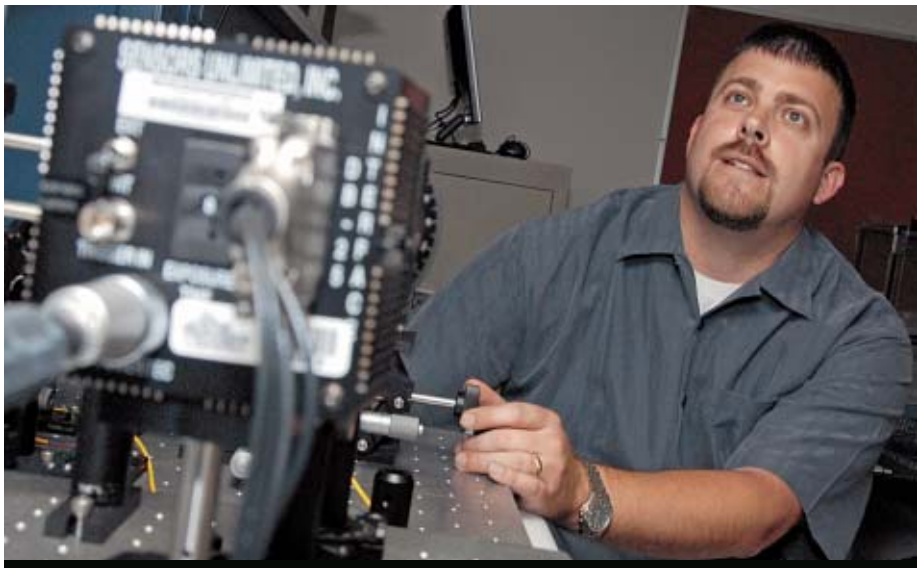
COMPUTER ARCHITECTURE AND NETWORKING
El-Ghazawi

ELECTROMAGNETICS
Bennett, Della Torre, Kahn, Korman, Lang, Pardavi-Horvath, Wasylkiwskyj

MICROELECTRONICS, VLSI SYSTEMS, AND MEMS
Ahmadi, Korman, Nagel, Zaghloul

MULTIMEDIA PROCESSING
Eom, Loew

SIGNAL PROCESSING, SYSTEMS, AND CONTROLS
Carroll, Doroslovacki, Eom, Harrington, Kyriakopoulos, Lee, Wasylkiwskyj



PROBING RESEARCH: "I never wanted to be a doctor, but I always liked medicine," says Professor Jason Zara.

Guiding Light

More than ninety percent of all cancers originate in the body's mucosal tissues, and the good news is that these cancers tend to be very treatable if found in their early stages. And thanks to Professor Jason Zara of the Department of Electrical and Computer Engineering and his team, surgeons may soon have another tool that significantly improves their ability to find these cancers early.

Zara conducts biomedical engineering research on the use of optical imaging, ultra-sound imaging, and micro-fabricated devices to improve early cancer detection, and he and his team have created a micro-fabricated imaging probe that they hope surgeons will be able to use with optical coherence tomography, or OCT, to find cancer in these tissues.

OCT is an imaging method that uses light to look at tissue and give high-resolution images of it, but it requires a probe to get inside the body and near the tissue to obtain images. OCT can be used to guide the tissue biopsy process and help the surgeon make better decisions regarding the state of the tissue. As Zara explains, "With a conventional biopsy, the surgeons often don't see anything visibly, so they just pick tissue from different locations and send it to the pathology lab. Those could all come back negative and they could have missed a spot of cancer. But, our imaging probes have the potential to help the surgeon see more tissue and see it faster, as opposed to just picking areas as they do now."

"Our contribution to this effort," Zara says, "is to develop the methods that someone else will use to build the probes." These tiny, micro-fabricated probes are currently built partially on a silicon wafer and partially by hand. The hand-built portions produce variations in the probes and cause their performance to vary, so the next step in the process is to be able to build the entire device on a silicon wafer in order to improve performance, increase reproducibility, and decrease production costs, making the probes a more mature technology.

In 2006, Zara and Dr. Michael Manyak, M.D., the former chair of urology at GW, won an important research grant from the Wallace H. Coulter Foundation for their team's work on the imaging probes. The Coulter Foundation funds biomedical technologies that it believes have the potential to be in hospitals within a few years, and Zara believes that they are getting close to this goal. "Our team has been able to demonstrate the effectiveness of its probes in prototype devices, and it has developed a partnership with the Army Research Labs to fabricate the devices based on their designs," says Zara.

In all of this, Zara is quick to point to the motivation for his work. "You have to focus on improving patient care. Otherwise the work has no relevance," he says.

The Right Decisions

Imagine that an earthquake occurs somewhere and emergency responders must decide how and where to send search and rescue teams, ambulances, or other scarce resources. Should they send them to sites A and B first, or C and D? How will they know which site should receive critical supplies first, and how should spatially dispersed groups collaborate and share crucial information?

What if they had a set of adequate tools at their disposal that could collect real-time information on the extent of the damage, optimize resource allocation decisions in real time, support information sharing and collaboration, and present maps and other visual information based on geographic information systems (GIS) to help them make better decisions about where to send their scarce resources?

A package that integrates these technologies in a useful way is not yet available to emergency responders, but thanks, in part, to the research of Professor Frank Fiedrich of the Department of Engineering Management and Systems Engineering (EMSE), it may one day be. Fiedrich recognizes that when lots of resources are involved—as they are in emergency response—making the right decisions can be very complicated. "If I can develop tools that have an impact on the way decision making is done and saves lives, I'm happy," he remarks. "That's really one of the main reasons I work in this field."

Fiedrich's research focuses on the use of information and communication technology for disaster management, and he uses a broad range of technologies, including distributed simulation systems, artificial intelligence, software agents, optimization, GIS, and web-based systems. However, he sees his unique contribution to disaster management as something more than technological solutions. "The design of information systems often doesn't take into consideration the human factor, but I try to look at both sides—the technology side and the human/organizational side—of information sharing, as well," says Fiedrich. "The focus of my research is really that we find proper ways to collect information and to share it so that the right information is at the right place at the right time, and technology can definitely help with that."

Fiedrich, who is affiliated with the EMSE's Institute for Crisis, Disaster, and Risk Management, works toward this goal through a number of projects. He is collaborating with SEAS Professor Joseph Barbera on a web-based volunteer management system to register, credential, and deploy medical and public health volunteers; he is working with SEAS Professors Theresa Jefferson and Jack Harrald for FEMA and the Mid-America Earthquake Center on catastrophic event planning for the New Madrid Seismic Zone; and he has begun to work with a colleague at the New Jersey Institute of Technology to design a decision support system that can help decision makers improvise as necessary. He loves his work and is glad to be where he is. "I'm especially glad to be in D.C., where all the real decision makers in this field are. That's one of the main reasons I came here," he says.

BOTH SIDES: Professor Frank Fiedrich studies both sides of information sharing—the technology side and the human/organizational side.

PROFILE

Chair: Thomas A. Mazzuchi
202-994-7541
www.emse.gwu.edu
Full-time faculty: 21
Undergraduate students: 41
Graduate students: 1,151
Annual research expenditures: $3.4 million

FACULTY

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Abiodun Bada, **ASSISTANT PROFESSOR**
Joseph A. Barbera, **ASSOCIATE PROFESSOR**
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E. Lile Murphree, **PROFESSOR**
Julie Ryan, **ASSISTANT PROFESSOR**
Shahram Sarkani, **PROFESSOR**
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Michael M. Stankosky, **ASSOCIATE PROFESSOR**
Rachuri Sudarsan, **RESEARCH PROFESSOR**
J. Rene van Dorp, **ASSOCIATE PROFESSOR**
Robert C. Waters, **PROFESSOR**

RESEARCH AREAS

CRISIS, EMERGENCY AND RISK MANAGEMENT
Barbera, Fiedrich, Harrald, Jefferson, Mazzuchi, Sarkani, van Dorp

ECONOMICS, FINANCE AND COST ENGINEERING
Duffey, van Dorp, Waters

ENGINEERING AND TECHNOLOGY MANAGEMENT
Deason, Duffey, Eisner, Hamner, Jefferson, Murphree, Waters

ENVIRONMENTAL AND ENERGY MANAGEMENT
Deason, Harrald

KNOWLEDGE AND INFORMATION MANAGEMENT
Bada, Frieder, Jefferson, Ryan, Stankosky

OPERATIONS RESEARCH
Abeledo, Campos-Nañez, Frieder, Mazzuchi, Soland

SYSTEMS ENGINEERING
Campos-Nañez, Duffey, Eisner, Mazzuchi, Sarkani, Stankosky, van Dorp

Mechanical & Aerospace Engineering

PROFILE

Chair: Michael K. Myers
202-994-9803
www.mae.seas.gwu.edu
Full-time faculty: 11
Undergraduate students: 96
Graduate students: 76
Annual research expenditures: $1.3 million

FACULTY

David F. Chichka, **ASSISTANT PROFESSOR**
Andrew D. Cutler, **PROFESSOR**
Charles A. Garris, **PROFESSOR AND ASME FELLOW**
Stephen M. Hsu, **RESEARCH PROFESSOR**
Roger E. Kaufman, **PROFESSOR**
Michael Keidar, **ASSISTANT PROFESSOR**
James D. Lee, **PROFESSOR AND ASME FELLOW**
Rajat Mittal, **PROFESSOR**
Michael K. Myers, **PROFESSOR**
Yin-Lin Shen, **PROFESSOR**
Timothy W. Tong, **PROFESSOR AND ASME FELLOW**
R. Ryan Vallance, **ASSOCIATE PROFESSOR**

RESEARCH AREAS

AEROSPACE ENGINEERING
Chichka, Cutler, Garris, Myers

BIOMEDICAL ENGINEERING
Chichka, Kaufman, Lee, Mittal

DESIGN AND MANUFACTURING OF MECHANICAL AND AEROSPACE SYSTEMS
Garris, Kaufman, Shen, Vallance

FLUID MECHANICS, THERMAL SCIENCE, AND ENERGY
Cutler, Garris, Mittal, Myers, Tong

SOLID MECHANICS AND MATERIALS SCIENCE
Hsu, Lee

TECHNOLOGICAL THRILLS: "Every year, we are thrilled with what we've been able to accomplish compared to the previous year," muses Professor Rajat Mittal.

A Powerful Set of Tools

What do you do when you find that the research tools you have developed have surpassed the applications for which you developed them? If you are Professor Rajat Mittal of the Department of Mechanical and Aerospace Engineering, you take on more complex research problems—in this case, computing biomedical and biological fluid flows.

Mittal specializes in computational fluid dynamics (CFD), which attempts to understand, model, and simulate air, water, or other fluid flows to better design machines that operate in these flows. During his six years here at GW, he and his students have developed CFD software tools that allow them to do simulations and modeling that are unique in their complexity and quality. The software and their applications of it have made the team leaders in the CFD field.

Mittal's Flow Simulation and Analysis Group began building its software earlier than most other CFD researchers, but it is not only the software that Mittal credits with their success. "I think what really sets us apart is our ability to find unique applications for our software," states Mittal. One example of this is their work with USA Swimming to try to model swimmers' strokes in order, ultimately, to improve the performance of the U.S. Olympic Swim Team. Another application is a study of fish swimming for the U.S. Navy, the idea being to develop better propulsors for small autonomous submarines by learning from these fish.

As the group's tools evolved, they turned their attention to the emerging discipline of biomimetics, which is simply the field of engineering looking for clues from nature for better machine design. Mittal explains that while humans have become quite good at designing large, powerful machines such as conventional aircraft, nature is a much better designer of the small than we are. This is the reason, for example, that Mittal studied swimming fish to look for clues that could improve submarine design.

To help catalyze the biomedical and biological fluid flow work that his group had already begun, Mittal recently proposed and received funding for the GW Center for Biomimetics and Bioinspired Engineering (COBRE), a new area of strategic academic excellence for GW. As director of the newly-created COBRE, Mittal has high hopes for its prospects but is also mindful of the funding from GW that has supported his group's work. "We've received support from GW from the signature programs as well as the graduate fellowship office at very critical junctures in our development," says Mittal. "This funding has helped us generate initial successes that have made additional funding possible, and that in turn helps us continue to produce the data for which we have become known."

SEAS Career Services Office: A Link from School to Job

Engineering students today understand that the global economy they will soon be entering is full of opportunities for well-prepared engineers, but also competitive. And, some of them are so serious about finding engineering experiences that will increase their competitiveness for jobs upon graduation that they are selecting their colleges based on how effectively the colleges locate internships and jobs and help place students in them.

Recognizing this challenge, Dean Timothy Tong asked Mr. Scott Amey (MS '75) to set up and direct the SEAS Career Services Office in the fall of 2004. Amey did so, on a completely voluntary basis, through last fall, when Ms. Emmy Rashid was hired and took the reins from Amey.

Headed first by Amey and now by Rashid, the SEAS Career Services Office works in conjunction with the GW Career Center and the various career centers in GW's other schools to provide a variety of services to both undergraduate and graduate students, and even to some alumni who have asked for assistance. Since the office opened in 2004, the number of students served has increased each year to its current total of more than 650.

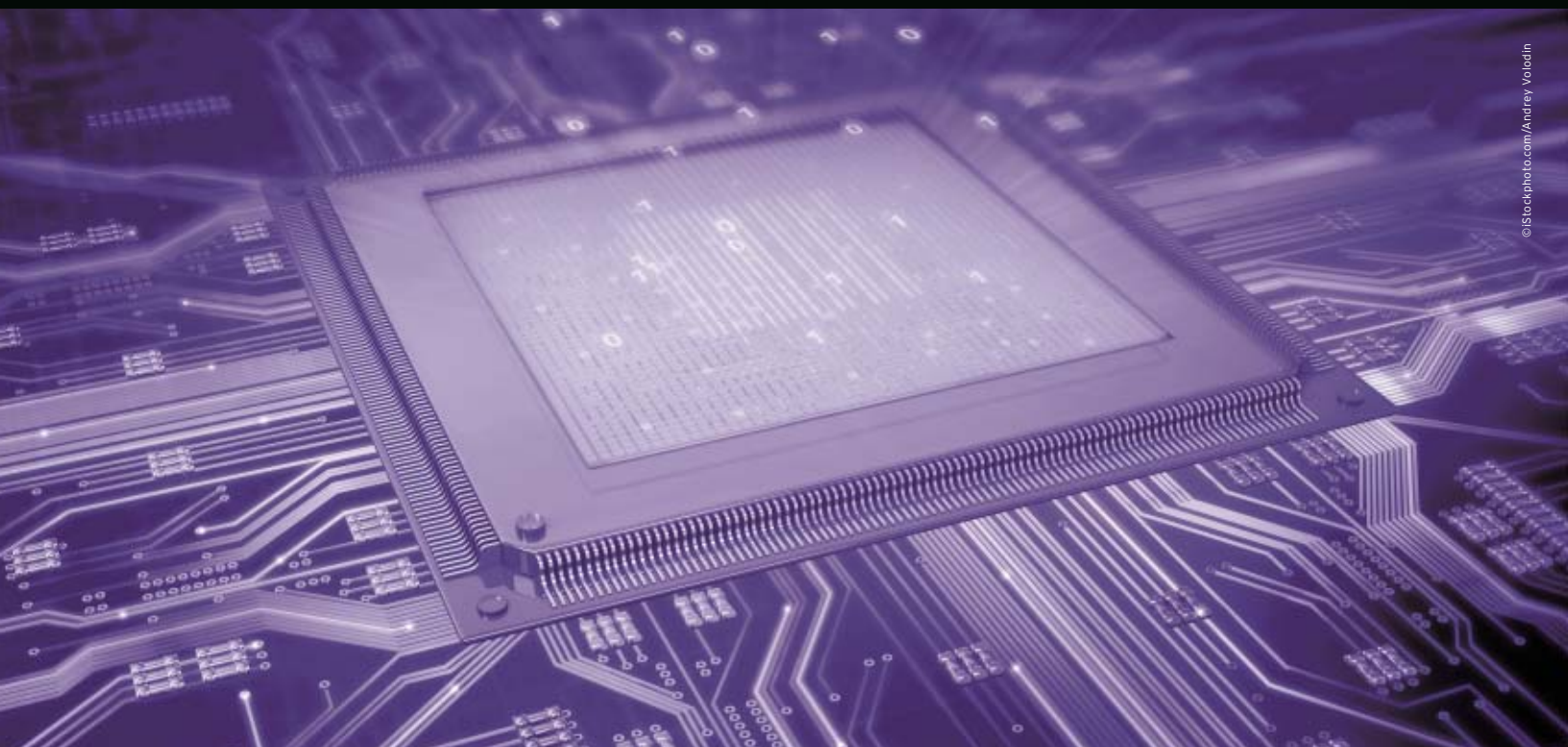
As directors of the SEAS Career Services Office, Amey and Rashid have arranged on-campus information sessions in which people employed at various companies or organizations speak to SEAS students about their jobs and employers. They also have worked with the GW Career Center to arrange for employers to attend the university's spring and fall career fairs, and have hosted resume critique and interviewing skills events to help prepare students for job or internship hunting. In addition to all of this, they have provided one-on-one career counseling for students who request it.

Individually, however, none of these services is the service that is most popular with SEAS students. The office's most popular service is its website, which posts summer internship and part- and full-time job opportunities. "While Scott directed the SEAS Career Service Office, he identified more than 200 summer internships and 200 full- or part-time job opportunities with companies and organizations like Accenture, AOL/Time Warner, AT&T Labs, IBM, Lockheed Martin, Northrup Grumman, and SAIC, and also with federal agencies such as the CIA, Department of Energy, National Institutes of Health, National Institute of Standards and Technology, NASA, Naval Research Laboratory, and many others," Rashid explains. "And we're continuing this effort and are committed to finding more of these important opportunities for our students."

Amey and Rashid understand the students' perspective on the importance of preparing themselves for the competition of the marketplace and they have been happy to lead the effort to help them. "The students know that internships will position them to get better job opportunities when they graduate," Amey states, "and I think that it's the duty of a school and a university to invest as much effort in helping students when they are finishing school as it is when we first recruit them to come to school."

CAREER SERVICES: Emmy Rashid, director of the SEAS Career Services Office, speaks with Farid Ahmed, a master's student in civil engineering.

The Ubiquity of Parallel Computing



COVER STORY:

The Need for Speed: High-Performance Computing

Tarek El-Ghazawi Builds **GW'S HPC PROGRAM**

In a world that continually strives to go faster and perform at higher standards, no one is surprised that those in the computer engineering field are trying to create computers that do the same. The surprise for many of us, however, comes in learning how fast these computers actually can process information and what kinds of information they are being tasked to process.

The field concerned with designing and applying such powerfully fast computers is called high-performance computing, or simply supercomputing. Professor Tarek El-Ghazawi of the Department of Electrical and Computer Engineering has spent a good part of his career investigating the challenges of high-performance computing and one of its niche areas—high-performance reconfigurable computing—and he is considered one of its pioneers. He knows the history of the field, and he has some pretty good guesses about its future, as well.

BUILDING THE DREAM: El-Ghazawi's HPC program grows steadily at GW.

High-performance computing (HPC) and high-performance reconfigurable computing (HPRC) present different challenges for computer engineers, but they share a common subset of issues and features, and El-Ghazawi tackles both. To understand the potential of both, one must first have a sense of what each is, and how they differ from standard computing.

A standard computing system, such as an ordinary desktop or laptop computer, uses a microprocessor and stores both a program and data in the computer memory. The program is the set of instructions that tell the computer how to perform its various tasks, and the data is the information that we give to the computer when we create documents or files that contain the data. When we task the computer to perform an operation—say, compute a student grade point average—the microprocessor reads the program instructions that are stored in its memory, and it processes the data based on these instructions. The processor simply "knows" how to perform this task algorithmically based on the instructions and using its fixed structure; no hardware changes take place inside the computer when we give the processor one of these commands. However, if we want the computer to perform a different type of task, such as computing the average number of years students spend on a particular degree, we have to change the software program; the computer hardware does not change to perform this new type of task for us.

Unlike standard computing, reconfigurable computing relies on changes to the computer hardware rather than on separate software programs to command the computer to perform a variety of different tasks. Reconfigurable computing differs from standard computing in that the changes happen in the hardware of the reconfigurable computer. Computer engineers create these reconfigurable computers by adding any number of reconfigurable co-processor chips to a main microprocessor. The main processor may still take a part in the computation, but in addition, it controls all of the reconfigurable co-processors and assigns specific time-consuming tasks to each of them. Configuring one of those co-processors amounts to customizing its hardware structure to perform the underlying task very efficiently. As soon as a co-processor completes its task, it can be reconfigured to perform a different type of task. In this way, the co-processors act as hardware accelerators that speed up the computing tasks. The idea behind reconfigurable computing is that a

hybrid computer structure that combines the speed provided by hardware customization with the flexibility of software will enhance computing.

Although a widely agreed upon definition of HPC is still hard to come by, one can think of it as many processors that are linked together into a single system to process information in a parallel or simultaneous fashion. Because the speed and the number of processors that are linked together changes dramatically from year to year, the definition of HPC is a moving target, and the supercomputers of today can be thought of as the desktops of tomorrow. For example, the fastest high-performance computer today is the IBM Blue Gene/L, which links more than 200,000 processors and performs at around 500 TeraFLOPS (or 10^{12} operations per second). However, many in the supercomputing field expect that computers performing at the PetaFLOPS range (10^{15} operations per second) will be deployed within the next one to two years.

SETTING GOALS: Professor El-Ghazawi confers with doctoral students Olivier Serres *(middle)* and Miaoqing Huang *(right)*.

So, why would a person need a computer that can perform at such speeds? The answer is that HPC and HPRC are used to run very advanced scientific and engineering applications that standard computers simply cannot handle. They have traditionally been used for very large simulations of everything from global climate modeling and the design of space shuttles and aircrafts to the simulation of car crashes and nuclear explosions. HPC simulations of nuclear explosions allow scientists to avoid underground testing. HPC can also cut the crash simulation of an automobile from days to hours and the production time for animation movies in the entertainment field from years to months. This significantly cuts down on costs and time-to-market in both industries.

On the down side, however, HPC systems have become very large in size and have developed a huge appetite for power. Their large size and the many parts included in them make them more prone to failures. HPRC, on the other hand, holds the promise of containing cost, power, and size. And while HPRC is not yet beneficial to all HPC applications areas, its application areas are growing. "Bioinformatics is one area in which HPRC technology shows great promise," says El-Ghazawi. "DNA matching and protein sequencing require the kind of computer power that high-performance reconfigurable computing can provide. Security is another area with lots of potential applications—for example, in things like breaking a cipher. We can also see applications in the area of remote sensing and image processing."

The HPRC technology is fairly new and is still maturing, he says, but as it continues to do so, it will be able to support more and more applications. Although much of the market for reconfigurable chips does not currently require number crunching capabilities, the market is nonetheless growing and reconfigurable chips will eventually become more computationally savvy. "Most of the high-performance computing these days is still within the realm of very specific, scientific research for highly technical uses, but there are so many non-highly-technical uses for supercomputers," says El-Ghazawi. "We expect to see more and more spin-offs of this technology as it matures. Eventually, supercomputers will be used more widely in day-to-day products and in the entertainment industry. We also expect to see more of them in financial markets, hospitals, and other businesses that require heavy transaction processing or that maintain massive data warehouses of complex formats and that require data mining. In fact there are already some working examples of all that."

Sensing that the need for high-performance and reconfigurable computing would increase dramatically as people recognized more applications for it, El-Ghazawi set out several years ago to make GW a center for HPC excellence. As he sees it, HPC is moving from being a niche area

to becoming a mainstream area in the information technology world, and over the last seven years, he has methodically built the necessary infrastructure for a thriving HPC research program, making a home for it here at GW.

It started with the High-Performance Computing Laboratory (HPCL). "HPCL began as our basement-like workshop," says El-Ghazawi. "We started with zero resources, and my students and I looked for sponsors who would be interested in our work and would help us with funding or by donating machines. The HPCL is very much self-built, and it's the platform we used to launch our newer endeavors, IMPACT and CHREC."

Over the years, the HPCL has provided an umbrella for the research projects that El-Ghazawi and his students have undertaken in HPC, HPRC, and the development of the supercomputing language UPC. Their successes eventually put GW and El-Ghazawi on the HPC map, and others began to show interest in partnering with them. El-Ghazawi became one of the co-authors of the UPC language standard, which is now delivered on top supercomputers from Cray, Hewlett-Packard, and others, and he authored a book on UPC. Under his direction, GW partnered in 2002 with Silicon Graphics, Inc., the Massachusetts Institute of Technology, and the Universities of Minnesota and Utah on a project funded by the Defense Advanced Research Programs Agency (DARPA) High-Productivity Computing Systems Program to create the first commercial petascale supercomputers, the SGI Ultraviolet. They and four other teams were selected from among forty teams for this DARPA research program.

Then, in 2004 the idea was born for CHREC, the Center for High-Performance Reconfigurable Computing. CHREC (pronounced "shreck") was formally instituted in late 2006 and is a national center and consortium for research in high-performance reconfigurable computing. It was created under the auspices of the National Science Foundation (NSF) Industry/University Centers program, and it is funded by an NSF grant that provides seed money, as well as by membership fees from participating governmental agencies and private companies.

The distinction between the HPCL and CHREC can be a little unclear for those becoming familiar with El-Ghazawi's research, so he explains the relationship. "HPCL is simply my students, myself, collaborating faculty, and my equipment. It is an informal, yet actual, physical structure, and a launching pad for new initiatives. However, CHREC research is limited to reconfigurable computing, while the HPCL mission goes beyond just reconfigurable computing to things like high-performance computing software technology such as UPC and new hardware processor technologies such as multi-core, many-core, and heterogeneous processors. CHREC research at GW is conducted at HPCL, but there are also other CHREC sites outside of GW. In fact, while CHREC was founded by GW and the University of Florida, the NSF has recently approved two new sites for the center, one at Brigham Young University and the other at Virginia Tech University, making CHREC a true national center."

BUILDING THE TEAM: Professor El-Ghazawi's HPCL scientists and students.

"The High-Performance Computing Laboratory began as our basement-like workshop. . . [It] is very much self-built, and **IT'S THE PLATFORM WE USED TO LAUNCH OUR NEWER ENDEAVORS, IMPACT AND CHREC."**

As for CHREC's research goal, El-Ghazawi describes it this way: "We're trying to conduct research that leads to creating high-performance reconfigurable computers that can be programmed efficiently by application users without any heroic efforts. It's not as simple as developing the right computer language. The problem needs to be approached from both sides, the language and the architecture. What matters for me as a computer engineer is that the architecture has to be working efficiently—not just working. It has to perform close to the maximum potential that it can perform, and take advantage of the fact that the hardware architecture itself can actually change. The software interface will also need to move toward the same meeting point where both can interact in the best possible harmony so that we can achieve performance and ease of use at the same time. That's really the research goal of CHREC."

The process for reaching this goal and determining CHREC's research projects is a very collaborative one that takes place at a semi-annual board meeting and CHREC workshop. Instead of GW and the other three university sites independently determining the projects to be pursued, they work with a unified industrial advisory board made up of CHREC's members, who guide the universities in selecting research projects. For example, last year, El-Ghazawi determined that his team would be able to undertake three projects; he defined a list of five potential projects; he and his team presented them to the industrial advisory board; and the board ranked the projects from one to five. The top three ranking projects were selected to be carried out. *(Note: See the side panel for a full list of the governmental and industrial organizations that comprise CHREC's membership).*

In addition to CHREC, El-Ghazawi founded and currently directs IMPACT, the Institute for Massively Parallel Applications and Computing Technologies. IMPACT is a new initiative, funded as one of GW's signature research programs under the strategic excellence initiative of the Office of the Executive Vice President for Academic Affairs. IMPACT was instituted to advance interdisciplinary research, education, and training in high-performance computing. According to El-Ghazawi, it is the *applications* of HPC, not HPC in itself, that really justify the technology and will advance its growth. He believes that useful technology advances cannot happen in isolation from their applications, so he conceived of IMPACT to help foster interdisciplinary work among faculty working in HPC technology and those in various other fields who were already using or could use the technology to advance their own work.

El-Ghazawi is understandably proud of his own and his students' research successes in high-performance and reconfigurable computing. For his part, he is a recognized leader in the HPC field. Since 2001, he has been selected to give tutorials on HPRC and on UPC to participants at the largest annual conference on HPC, one which gathers 7,000-10,000 participants each year. He is recognized for being a major contributor to the specifications for the UPC language used in HPC and for writing the first book on it. And, he gets numerous invitations to speak on HPC, including many from other governments and from academia in the U.S. and abroad. Beyond this, he cites the fact that many companies feature GW opinions and experiences in the

MONITORING SUCCESS: Post-doctoral scientist Proshanta Saha *(left)* and doctoral student Esam El-Araby *(right)* monitor systems in the HPCL.

"Parallel computing is moving from a niche area to become the backbone of mainstream computing. **THIS IS NOT DREAMING; IT IS ALREADY HAPPENING.**"

press releases they send out regarding their HPC activities.

He and his students have put together a unique, top-quality set of equipment in the HPCL, and because of this, the students have been able to study very important problems in the HPC field. El-Ghazawi believes that this creates a tremendous advantage for his students. Many of them have had internships at companies such as Silicon Graphics or at very prestigious government labs, so they have established important professional contacts that help them when they graduate. In fact, he says, "CHREC itself almost provides an in-house internship, if you will, for all of our students, where basically they interact on a daily basis with the top leaders in industry and government in these areas. In many cases, we've even had companies come and tell us, 'We need that particular student to come work for us.'"

As he looks out to the future of his field, El-Ghazawi wonders about the changes that he will see in HPC and how these will impact the way computing is studied and taught in academia. He muses, "We've already seen a revolution on the hardware side. We cannot just continue to build a single faster processor inside of the chip. It has become more feasible to build multiple processors on the chip, so this means that your laptop will end up being more-or-less a high-performance computer very soon. Given that your toys, such as the Sony Play Station PS 3, and your PCs will have many processors and will, therefore, be an HPC machine, I wonder if we're going to soon change the way we teach computer science and computer engineering—if we're going to see a change from assuming that we're dealing with sequential computers to an environment in which we teach the students about parallel programming and high-performance architecture. All of this is quite realistic now, and parallel computing is moving from a niche area to become the backbone of mainstream computing. This is not dreaming; it is already happening and the evidence is clear; and our curricula must change accordingly."

CHREC Membership

Air Force Research Lab (Eglin)
Altera
Arctic Region Supercomputing Center
Boeing
Cadence
GE Aviation Systems
Harris
Hewlett-Packard
Honeywell
IBM Research
Intel
L-3 Communications
Los Alamos National Laboratory
Luna Innovations
NASA Goddard
NASA Langley
NASA Marshall
National Instruments
National Reconnaissance Office
National Security Agency
Network Appliance
Oak Ridge National Laboratory
Office of Naval Research
Raytheon
Rincon Research Corporation
Rockwell Collins
Sandia National Laboratories
Sillicon Graphics, Inc.

PERSPECTIVE:

Engineering Education

A Conversation with **GW PRESIDENT STEVEN KNAPP**

On August 1, 2007, Steven Knapp took office as the 16th president of The George Washington University. Although President Knapp has already created several fora for GW students, faculty and staff, and alumni to learn more about his leadership and plans for the university, *Synergy* magazine recently proposed an interview with him to hear his views on a topic specifically tailored for SEAS alumni. In reply, President Knapp sat down last month with the editor of *Synergy* and talked about engineering education at GW and other American universities.

SYNERGY: *What role do you think an engineering school plays in an American university today?*

KNAPP: There are several ways to approach this question. Certainly it's important that all students, whether they're majoring in engineering fields or not, have some sense of the role of technology in our society, which I think is a really critical component of anyone's education. I also think it's important to have the presence of engineering on a comprehensive university campus, even for students who are not themselves engineers, because having the ability to interact with students who are studying the engineering fields gives all students an exposure to the kind of thinking that goes on in engineering. There is a unique way of approaching the world that is characteristic of engineering. It has to do with thinking in quantitative terms and applying that thinking to the solution of real-world problems.

In addition to that, we have a kind of obligation to have a presence in a field like engineering. Of course, the United States has a national competitiveness issue that has to do with the relatively small numbers of students nowadays who are going into science and technological fields. Part of our mission as a university is to serve the national need to be economically and technologically competitive in the increasingly competitive world market, and one of the ways in which we contribute directly to the strength of the nation is by educating students in science and technology.

Further, engineering—because of its focus on technology—is often at the crossroads of interdisciplinary efforts that combine scientific research and applications in a variety of different fields. Nowadays, some of the most important areas of research are at the interface between, for example, engineering and medicine. And of course, one of the growing fields at our university, as at many others, is biomedical engineering.

SYNERGY: *How well do you think American universities do today in preparing young people to be good engineers?*

KNAPP: Universities are doing a fine job of preparing people for engineering careers, but I think the problem is the difficulty in attracting students to engineering fields. I just heard Bill Gates on C-SPAN testifying about this before a congressional committee. He was saying that the decline in the number of students going into engineering fields is pretty widespread not just across America but across Western European countries as well. So there's a general decline in interest in both scientific and engineering fields, which I think has become a problem. That fact is creating a challenge for us when it comes to maintaining our competitiveness. The Unites States has achieved its prominence economically in large measure because of its innovations, and our leadership in innovation is threatened if we don't have strong engineering programs.

SYNERGY: *Are we doing anything differently today to prepare engineers than we did a generation or two ago?*

KNAPP: I think there has been a changing philosophy of engineering education, which is reflected in the ABET accreditation requirements that place a much greater focus on building teamwork and communication skills into an engineering curriculum. There's an increasing emphasis on introducing students early in their careers to real-world problems. It's important that students get an early exposure to the excitement of the field if you want to attract and retain their interest in engineering. They're not just taking a year or two of courses that are preparing them for engineering and not getting to do any real engineering before their junior or senior years.

SYNERGY: *What role does the engineering school here at GW play in the life of the university?*

KNAPP: We have opportunities to do things here at GW, both because of our plans to create a new science and engineering complex on the Foggy Bottom campus and because our Loudon County campus in Virginia creates opportunities to develop some larger-scale research programs that aren't easily accommodated on this

campus. The fact that the new science and engineering complex is going to be located directly across the street from the School of Medicine should help with synergies, and our proximity to the policy community here in Washington, D.C. will create synergies, as well.

We do have a unique opportunity in engineering, as in so many fields, because of our proximity to the policy community here in Washington, D.C. I'll give you one example. The National Crash Analysis Center at our Loudon County campus benefits from being located so close to the Department of Transportation, and it has immediate access to changes in the policy landscape that affect the application of technology to transportation safety issues. That's unique to GW.

SYNERGY: *In American academia today, there is quite an emphasis on interdisciplinary research. How would you like to see GW's engineering school incorporated into that paradigm?*

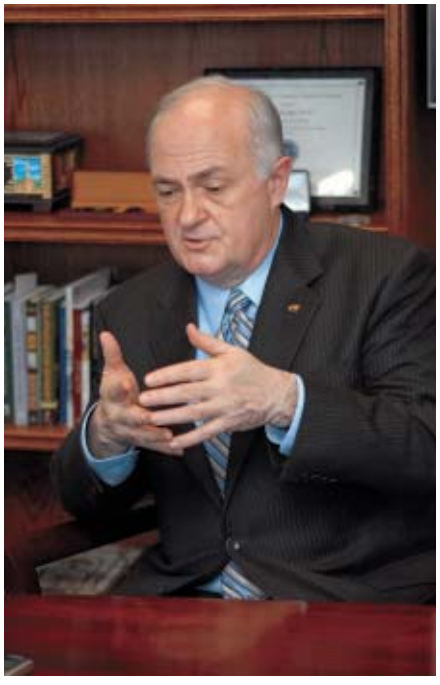
KNAPP: There are a number of opportunities for interdisciplinary research. In fact, we're doing some work that crosses over between departments in the Columbian College of Arts and Sciences and engineering in some of the biological areas, and I think we're going to see that continue to develop. I actually think that in some ways the boundaries between disciplines have been dissolving a bit, in ways that make it easier to put together interdisciplinary teams that cross the traditional boundaries between engineering disciplines and the basic sciences. It's also the case that increasingly the solutions to the kinds of problems we're confronting require the contributions of multiple disciplines. Biomedical engineering nowadays is probably the most obvious and striking example of that, but we can also see it in alternative fuels, high-performance computing, and other areas in which we have an interest. Computing, genetics, and also some of the nano-technological advances open rich fields for interaction across these disciplines.

Also, it's pretty much a green field out there in Loudon County, so as we're developing our facilities out there and we have a lot of space to expand, I think we can be very creative in how we think about these kinds of spaces—just as our faculty from SEAS and the Columbian College are being creative as they think through the programming of the proposed science and engineering complex on the Foggy Bottom campus.

The other thing we can do is work on faculty appointments in such a way that we keep in mind during the search process the kind of synergy that we want to create once the person arrives. In this way, we involve more than one department and, ideally, more than one school in thinking about the kinds of faculty we're trying to hire and the kinds of graduate programs that we're developing.

The final element of it, of course, is to attract more research funding, and to that end, we've created a position and are now doing a national search for a vice president for research, which is not a position that has existed across the institution. That is a position that will embrace the

"It's important that students get an early exposure to the excitement of the field if you want to **ATTRACT AND RETAIN THEIR INTEREST IN ENGINEERING."**



medical center and the rest of the university, and it will give us another opportunity to take a strategic look at how we develop collaboration across the disciplines.

SYNERGY: *If prospective engineering students were to approach you about studying at SEAS, what reasons would you give them to consider attending GW?*

KNAPP: First of all, Washington, D.C. is an exiting place to be no matter what field one is interested in. And although Washington is not sometimes thought of as a center for science and engineering, the reality is that in the Washington region, we're the home of the major federal institutions that support work in science and engineering, including the National Science Foundation. By being here in Washington, you have access to where a lot of the action is in new developments in the engineering fields.

I also think that there's some advantage to coming to an engineering school that's fairly small, but growing, within the context of a larger university. Students can expect a lot of attention from faculty at a school of our size. We also have an opportunity with this proposed new facility to think creatively about developing new fields, as opposed to a school that already has a lot of well-established, very large departments. We're looking for ways to be innovative as we think about the future of engineering here. I'm looking forward to seeing the engineering school become an increasingly vital part of a vibrant university with a strong research base and state-of-the-art laboratories, passionately engaged students, and effective faculty who are leaders in their fields.

"WE DO HAVE A UNIQUE OPPORTUNITY IN ENGINEERING, as in so many fields, because of our proximity to the policy community here in Washington, D.C."

Kachi Odoemene

Working Hard and **LOVING COLLEGE**

Junior Kachi Odoemene understands the importance of hard work and self-discipline. Spend a little time talking to him and you will notice that he returns to these values again and again, like the refrain of a song.

Kachi was born in the United States and spent much of his childhood in New Jersey, but he also lived in Nigeria for most of his middle school and high school years, returning to the U.S. for his senior year of high school. In Nigeria, he attended a Catholic boarding school with strict rules, a respect for tradition, and an emphasis on homework. Kachi does not complain about his time at the school; on the contrary, he credits it with teaching him about responsibility to oneself and others. In fact, he says that the habits he developed there have carried over into his college life.

Those habits seem to have stood him in good stead, because Kachi has had an unusually productive and successful undergraduate experience, particularly in his research endeavors. Kachi studies biomedical engineering and received both a Howard Hughes Medical Institute Undergraduate Summer Research Award in 2006 and a Gamow Fellowship during the 2006-2007 academic year.

As a summer research scholar, Kachi worked with his mentor, Professor Mark Reeves of the Department of Physics. After learning basic biology laboratory techniques, he assisted Reeves in working on a specific technique that uses gold nano-particle wires to separate proteins in order to better study them. This technique, which is a possible alternative to the more traditional use of gels to separate proteins, eliminates the impurities that the gel technique has.

In the fall, Kachi began his yearlong Gamow Fellowship and was able to continue working with Reeves and to begin work with SEAS Professor Jason Zara. In this research project, he studied the resistance of gold nano-particle wires under vibration. The final goal of this project is to make a device that can detect foreign analytes in the body and signal back its detection.

Kachi believes that his research opportunities have been a very important part of his education here at GW. "Being an engineering student, you have to learn different problem solving techniques. These experiences taught me to be patient and to troubleshoot, and I was able to overcome the challenges. They also helped me to apply a lot of what I had just learned in classes," says Kachi.

On top of his demanding engineering curriculum and his research projects, Kachi has also managed a very busy extra-curricular schedule. In addition to serving this year as the president of the GW chapter of the National Society of Black Engineers (NSBE), he has served on the boards of the Organization of African Students and Word Up Bible Study, and he has participated in the Catholic Charities off-campus tutoring program and the Black Men's Initiative, which mentors to freshmen black men.

Kachi says of his relationship with NSBE, "It's been very important to me. I kind of have a family there looking after me." As for his college experience in general and his avid participation in research projects and other activities, he sums it up by saying, "My cousin said it best: 'College is like a bowl of candy; you just have to pick your favorite one.'"

Greg Colevas

Delighted with the **CAREER THAT ENGINEERING MADE POSSIBLE**

In high school, Greg Colevas already had a career path in mind—and it did not include engineering, or even college. He intended to go into the contracting business after graduating from high school, but his father wanted him to go to college first and suggested that his son study engineering.

Colevas came to GW, studied civil engineering, and is now the president of the Major Projects Division at Clark Construction Group, one of the Washington, D.C. area's largest construction companies—and he is very happy with the path that his engineering education made possible for him. "My dad certainly supported me in going into the construction business, but he wanted me to have a college degree," Colevas says. "It was the best thing, because there's no way I would be able to do the things I'm doing today had I not gone to engineering school."

However, "Engineering was a secondary decision for me," Colevas explains. "I went to GW and very quickly in my freshman year I started to realize that this might not be the career for me if I have to do math and physics for my entire life," he laughs. "But the engineering school steered me toward the cooperative education program. I took a job with the Army Corps of Engineers and discovered there that engineers are the ones who run the major construction companies in the U.S., and it changed my whole focus."

Colevas joined Clark Construction Group in 1985 after graduating from GW and has been there ever since. During his career with the company he has worked in project management and field supervision on the World Bank Headquarters, the National Archives II project, and other projects. He also served as the senior project manager on FedEx Field, the home of the Washington Redskins, and on the Washington Convention Center. In his current role, Colevas is responsible for the successful delivery of several major projects, including the new Washington Nationals Stadium, a Major League ballpark.

Colevas talks about some of the factors that are important in making projects of this size succeed. "You have to look out way ahead on projects this large. These projects are like a big ocean-liner. Once that thing starts moving, it takes several miles to stop; you can't stop it on a dime, like a sports car. So, you want to make sure when you set the thing going, that it's moving in the right direction." Colevas adds, "Big projects like this typically have lots of stakeholders, and it's key at the beginning of the project to sit with the client and as many stakeholders as possible to establish what the project goals are. Certainly, it's budget and schedule, but there are always other things, like hiring goals, quality goals, and others."

Colevas sums up his career thus far saying, "When I step back and look over the whole career, it's been great. Here I am 23 years later, and I'm here because the projects have been fabulous, and it's been a very rewarding place to work." As for advice to undergraduates getting ready to start their careers, he says simply, "My first advice would be to go into the construction business."

Events

DR. MARIA KLAWE

Dr. Maria Klawe: Welling Professor and Keynote Speaker

Over the past year, SEAS has had the honor of hosting Dr. Maria Klawe, the president of Harvey Mudd College and a former dean of Princeton University's School of Engineering and Applied Science, three times. In April 2007 and February 2008, Klawe came to campus to deliver Welling Lectures, and during commencement weekend in May 2007, she delivered the keynote address at the SEAS Celebration.

Klawe's 2007 Welling Lecture was devoted to a research topic that is very important to her. In a talk entitled "Can Mobile Devices Improve the Quality of Life for People with Aphasia?" Klawe discussed a project that she and her colleagues and graduate students have worked on over several years to adapt mobile devices such as PDAs to assist communication in people with aphasia. Aphasia is a partial or total loss of the ability to articulate ideas or comprehend spoken or written language, and it most often happens as the result of a stroke or trauma to the head. According to Klawe, approximately one million Americans have aphasia.

In February 2008, Klawe returned to GW and delivered a Welling Lecture on leadership development in science and engineering education. She spoke of the necessity of developing leadership skills in all students to help them meet the requirements they will face later in their careers. Key to this is setting the expectation that students will be leaders and giving them opportunities to develop their leadership skills. She offered examples from Harvey Mudd College, where students participate in leadership workshops and teamwork projects, attend guest lectures on topics related to leadership, and attend a course on leadership.

Fittingly, when she addressed SEAS graduates as the keynote speaker at the SEAS Celebration in May 2007, Klawe challenged them to believe in themselves and their abilities. In a speech full of good sense and humility—with a dose of humorous anecdotes sprinkled in—Klawe told the graduates that she believes they must have "the six Cs" to succeed in their careers: competence, communication, confidence, caring, courage, and character. She focused on the importance of confidence, telling the graduates that "confidence acts like an exponential function on competence in terms of the results you achieve." Challenging them to be confident as they go forth, she laid out four reasons why confidence will help them succeed. Klawe said that: we set higher goals for ourselves when we are confident; others are less likely to oppose us and more likely to support us when we are confident; high expectations lead to high performance; and we are more likely to stick with something longer when we are confident.

GW and Hong Kong University of Science and Technology Establish Exchange Agreement

GW and SEAS have signed a Memorandum of Understanding (MOU) with the Hong Kong University of Science and Technology (HKUST) that paves the way for an exchange of undergraduate students between the two institutions.

Under the terms of the MOU, students from either institution will be able to study at the other for a semester or a full year. Students will then return home to receive their degrees from their home university.

"With this MOU, SEAS is able to provide another study abroad avenue for our students and another opportunity for them to broaden their education beyond the classroom. As the world gets smaller, these experiences become even more important to our students and make them even more sought after by employers, so we are really glad to be able to offer them. In addition, we're very pleased to be able to partner with an institution of the caliber of Hong Kong University of Science and Technology in this effort, and we also look forward to welcoming its students to SEAS," said Dean Timothy Tong.

The MOU also provides for SEAS and HKUST to exchange faculty for teaching or research, organize joint seminars and conferences, host visiting faculty from the other institution, develop joint research and publications, and exchange graduate students. The MOU is a four-year agreement.

Since 2005, SEAS has established MOUs with ten other institutions, including Bogazici University (Turkey), Georgetown University, Hohai University (China), Kuwait University, Northwest Frontier Province University of Engineering and Technology (Pakistan), Penza State University (Russia), Pontifical Lateran University (Vatican City), Shanghai Second Polytechnic University (China), Stuttgart University (Germany), and Yuhan College (Korea).

Philip Chan *(left)* of HKUST and SEAS Dean Timothy Tong sign an exchange agreement between GW/SEAS and HKUST.

SEAS Wins More GW Funding for Academic Excellence Proposals

Two SEAS initiatives have won funding from the University in the latest round of competition for GW's areas of academic excellence. Schools across the university submitted proposals for funding, and eight were selected last summer as new signature academic programs. The two SEAS programs that won funding are the GW Center for Biomimetics and Bioinspired Engineering (COBRE) and the Institute for Massively Parallel Applications and Computing Technologies (IMPACT). With this latest round of funding, SEAS has now won a total of four areas of academic excellence grants during GW's two rounds of competition.

The COBRE proposal aims to develop infrastructure for interdisciplinary research and education in the area of biomimetics and bioinspired engineering. Biomimetics is a field that attempts to create a paradigm to transfer nature's technologies, design principles, and solutions into our own designs to create small, multi-functional machines, technologies, and devices.

Professor Rajat Mittal of the Department of Mechanical and Aerospace Engineering (MAE) is the director of the center, and several faculty from his department and the Department of Electrical and Computer Engineering (ECE) currently are involved in the center. Faculty from other SEAS departments and various science-related disciplines are expected to participate, as well. The center initially is focusing on developing research in bioinspired/biomimetic locomotion, control algorithms, materials, and bio-metrology.

Currently, COBRE is involved in two new projects. The first project is the mechanical design of an exoskeleton for assisted human swimming. The project is supported by a grant from the Defense Advanced Research Programs Agency (DARPA). DARPA has an existing mechanism that uses a rigid hydrofoil, which cyclically heaves and pitches up and down under water and generates propulsive forces that help warfighters swim more efficiently. The COBRE team will try to further improve the efficiency of this mechanism by designing a biomimetic compliant hydrofoil. MAE Professor Ryan Vallance is the principle investigator on this grant, and two of his students, Mathieu Barraja and Tewodros Mengesha, are doing most of the mechanical design work. Professor Mittal is the co-principle investigator, and he and his student, Lingxiao Zheng, are analyzing the fluid-structure interaction of the compliant hydrofoil to assess how it produces propulsive forces.

The second COBRE project is an experimental measurement of paddle forces for the U.S. Olympic Kayaking Team. Peter Vint, the coach of the team, approached Professor Mittal and inquired about collaborating on this new project. Apparently, there is little correlation between the physical strength of a kayaker and his ability to win, and this means that there is some unique attribute to rowing style that gives the kayaker a competitive edge. Therefore, the COBRE team is developing a "smart" paddle, which will be instrumented so that they can measure the forces on the paddle while the kayaker is rowing. They are using a wireless transmitter that will beam the force signals to a remote laptop and record the forces for later analysis by the coach. This work is being done by Afzal Khan, a doctoral candidate, and Xiaolin Wang, a post-doctoral researcher.

The second proposal for academic excellence—the high-performance computing proposal—brings together an interdisciplinary faculty team from six departments across SEAS and the Columbian College of Arts and Sciences to form IMPACT. The team is led by the institute director, ECE Professor Tarek El-Ghazawi. Using the university investment, IMPACT will carry out research, educational, and outreach programs in high-performance computing (HPC). HPC refers to the application of supercomputers in various fields and to the exploration of new technologies to develop better supercomputers based on the needs of those applications. Supercomputers, or high-performance computers, are machines that are hundreds or thousands of times faster than a typical desktop computer and may have thousands of processors in one system.

In addition to its research activities, IMPACT has been focusing on continued efforts to enhance GW's stature in the HPC domain. These efforts include building both its advanced computing equipment infrastructure and local expertise and doing outreach to the HPC community. To build expertise and intellectual capacities, GW is establishing new graduate courses in HPC, and a new HPC graduate certificate is in the works. To shine the HPC light on GW, IMPACT is attracting major related scientific events to the university, such as the 3rd Conference on Partitioned Global Address Space Programming Models and the annual workshop for the National Science Foundation Center for High-Performance Reconfigurable Computing (CHREC). The CHREC conference was held in December 2007, with approximately 100 participants from thirty-five governments and industry and academic organizations. With support from the U.S. Department of Energy and the U.S. Department of Defense, IMPACT has also helped to secure two computer clusters totaling over 200 CPUs for the Departments of Physics and Electrical and Computer Engineering. The team jointly submitted and is working on proposals to bring the overall capacity of the IMPACT faculty to 1,000 CPUs over the next two years.

EDITOR'S NOTE:

For more information on Professor Mittal's research, please see page 6.
For more information on IMPACT and Professor El-Ghazawi's research, please see page 9.


BILL WESTENHOFER

SEAS Alumnus Bill Westenhofer Wins an Oscar

On February 24th, GW alumnus Bill Westenhofer (MS '95) was awarded the 2008 Achievement in Visual Effects by the Academy of Motion Pictures Arts and Sciences for his work on the film *The Golden Compass*. Westenhofer won the Oscar along with Michael Fink, Ben Morris, and Trevor Wood.

As visual effects supervisor for Rhythm & Hues Studios in Los Angeles, Westenhofer led a crew of 500 on two continents over eighteen months to produce nearly 400 shots featured in the film, which stars Nicole Kidman, Daniel Craig, and Dakota Blue Richards.

This was Westenhofer's second Oscar nomination. He previously was nominated in the same category in 2005 for *The Chronicles of Narnia: The Lion, the Witch and the Wardrobe*. He also was nominated for *The Golden Compass* in the Special Visual Effects category by the Orange British Academy Television Awards. *The Golden Compass* is one of the Visual Effects Society's (VES) nominees for Best Visual Effects in a Visual Effects Driven Motion Picture Category. VES recognizes visual effects practitioners in the entertainment industry.

In April of last year, Westenhofer returned to campus to deliver a lecture entitled "How Do I Become a Special Effects Expert?" More than seventy-five students, alumni, and friends showed up to hear Westenhofer talk about his experiences and his work as a special effects expert.

During the lecture, Westenhofer talked about how he got involved in his field and how his degree in computer science and his interest in art helped to bridge the gap in this interdisciplinary field. He also discussed the process of creating animation for the movie *The Chronicles of Narnia*. He showed before and after shots of adding computer-generated actors and talked about the technology used to create the main computer-generated characters in the movie and to have them interact with real characters and real scenes.

CET2C Expands Technology Transfer Support

Since launching CET2C, the Council of Entrepreneurial Tech Transfer and Commercialization, a year and a half ago, SEAS has busily been building its efforts to promote technology transfer.

SEAS established the council to help foster the school's entrepreneurial environment and to build opportunities for alumni to create and fund area start-ups based on SEAS and federal laboratory technologies. After hosting a number of seminars, workshops, and conferences during CET2C's first year, the school has continued its efforts with several mini-workshops and a Graduate Student Research and Development Showcase.

CET2C has hosted three mini-workshops since March 2007, the latest of which was held in February 2008. Approximately eighty to ninety people attended each workshop, representing venture capital firms, entrepreneurs, federal government agencies, economic development agencies, and area universities. The workshops are led by active angel investors, serial entrepreneurs, regional venture capitalists, and private equity experts. Each workshop also has included a trading floor, at which start-up companies—many of which have a GW connection—make presentations to the group. The workshops are co-hosted by SEAS, the GW School of Business, and Angel Investors of Greater Washington.

In April 2007, SEAS held its first annual Graduate Student Research and Development Showcase, which was arranged under the auspices of CET2C with planning and organizational support from SEAS alumnus Randy Graves (D.Sc. '86). The event provided highlights of the research activities at SEAS while fostering interaction among local and regional industry, governmental organizations, potential GW students, alumni, and SEAS faculty and graduate students. Graduate student principal investigators presented forty-seven research projects at the poster session. The posters were judged on the basis of presentation and content, and Dean Tong presented the top three projects with cash awards. The event was so successful that SEAS will host the second annual showcase on April 23rd of this year. For more information about the showcase, please visit: **www.seas.gwu.edu/RDshowcase**


Graduate Student Research and Development Showcase

ANDREW CUTLER

Cutler Receives NASA Grant for Laser Research

In February 2007, Professor Andrew Cutler of the Department of Mechanical and Aerospace Engineering received a three-year, $595,000 grant from NASA's Aeronautics Research Mission Directorate, Fundamental Aeronautics Program. The purpose of the grant is to further develop a laser technique for measuring flame qualities.

Cutler studies high-speed combustion and the fluid dynamics related to high-speed combustion, and he develops laser-method instrumentation to be able to measure gas qualities of flame. NASA is interested in Cutler's work in Coherent Anti-Stokes Raman Scattering (CARS)—a laser technique that makes remote measurements in the temperature and gas qualities of flame—because of its application to scramjets (supersonic combustion ramjets). Using the data that Cutler is able to generate from the laser instrumentation and techniques that he develops, other researchers can develop software code and models to test the scramjet technology. Ultimately, researchers hope to be able to build scramjets, which use air from the atmosphere and run at hypersonic speeds. Cutler has just started the second year of his three-year grant. Speaking to his progress thus far, Cutler says, "We have already successfully applied some of our techniques in tests in one of NASA's hypersonic test facilities, and we expect our data to be used by other university research groups developing codes and models."

SEAS Offers New Academic Programs

SEAS has recently initiated a number of new academic programs at both the graduate and undergraduate levels.

In cooperation with the GW School of Business, SEAS now offers any undergraduate who is pursuing a bachelor of arts or a bachelor of science in a SEAS degree program the opportunity to choose a new concentration in general business. This concentration is equivalent to a second major.

Students in the Department of Mechanical and Aerospace Engineering can avail themselves of the new patent law option, which teaches the fundamental principles of patent law and the influences of the U.S. patent system on modern engineering design. The option also aims to facilitate student internships at patent law firms, industry patent departments, and the U.S. Patent and Trademark Office.

The Departments of Engineering Management and Systems Engineering (EMSE), Civil and Environmental Engineering (CEE), and Electrical and Computer Engineering (ECE) have each developed new five-year programs. EMSE's five-year bachelor of science/master of science program allows students to obtain a bachelor of science in any SEAS program and a master of science in engineering management. The CEE program gives undergraduates the option of completing a five-year bachelor of science/master of science program in structures. Under the new ECE program, undergraduates may earn a combined bachelor of science/master of science degree in five years, with a bachelor's degree in biomedical engineering, computer engineering, or electrical engineering, and a master's degree in either computer engineering or electrical engineering.

Another new offering is the result of a partnership between GW and SEAS and the Integrated Justice Information Systems Institute, a non-profit corporation that comprises approximately 180 technology companies involved in the development and implementation of justice information systems. Through this partnership, SEAS has introduced a new graduate certificate and degree concentration that combines information technology with the needs of data sharing, interoperability, data management, and security in the field of law enforcement and justice.

SEAS has also expanded its cohort programs. The Department of Computer Science has started a new cohort program in partnership with Booz Allen Hamilton, which enrolled twenty-two of its employees as students in the program last year and another cohort of twenty-five students this spring. EMSE has expanded its off-campus cohort program with Lockheed-Martin Corporation and now provides instruction to Lockheed-Martin employees at fifteen sites across the U.S.

New Faculty

Dr. Michael Keidar

Michael Keidar is an assistant professor in the Department of Mechanical and Aerospace Engineering. Among his many research interests are advanced spacecraft propulsion, plasma-based nanotechnology, plasma-material interactions, and plasma processing. Before joining SEAS, Keidar worked as a research associate at Lawrence Berkeley National Laboratory, Cornell University, and as an assistant research scientist and adjunct professor at the University of Michigan. Keider earned his Ph.D. in plasma physics from Tel Aviv University in 1997.

Dr. Matthew Burke

Matthew Burke is an assistant professor in the Department of Computer Science. Among his many research interests are studying ubiquitous access to information and how it impacts education and research; using mathematical and computational techniques to study ecological problems, such as weed spread and the feeding behavior of whales; and exploring combinatorial game theory. Before joining SEAS, Burke was an assistant professor of computer science at St. Mary's College of Maryland. Burke earned his Ph.D. in mathematics from Washington State University in 1996.

Martin Named Interim Associate Dean

After a two-year leave of absence during which she served as dean of the College of Information Technology at Zayed University in Dubai, UAE, Professor Dianne Martin re-joined the SEAS administration in November 2007. Martin was appointed by Dean Timothy Tong to serve as the interim associate dean of student affairs for SEAS. Her appointment continues until June 2009.

Martin is a professor of engineering and applied science in the Department of Computer Science and has been a member of the SEAS faculty since 1983. She previously served as special assistant to Dean Tong from 2001 to 2002, and as the chair of the Department of Computer Science from 2002 to 2005.

As interim associate dean of student affairs, Martin is responsible for overseeing student recruitment, marketing, and admissions for both undergraduate and graduate programs. She plans to develop an integrated marketing strategy that will help SEAS achieve its goal of increasing the number of undergraduate students and on-campus graduate students, especially at the master's level.

When asked about the challenges of her position, Martin replies, "This is a very challenging job because there is so much to be done all at once! While we recruit for new students for next fall, we also are planning for an ongoing campaign over the next several years to raise the visibility of SEAS both in the Washington, D.C. area and internationally. Increasingly, we see a strong interest in GW and SEAS from students from the Middle East, China, and India who want to study in the U.S."

As part of the recruitment strategy, Martin hopes to highlight the opportunities available to students at SEAS. "Because SEAS is a small engineering school," she explains, "both undergraduate and graduate students have the opportunity to study directly with faculty who are doing very exciting research in areas such as homeland security, biomedical applications, computer graphics and modeling, mobile networks, environmental engineering, automobile safety, aerospace engineering, and crisis management."

Retiring Faculty

SEAS salutes our recently retired faculty member, **DOUGLAS WARD MAURER, PROFESSOR OF ENGINEERING AND APPLIED SCIENCE.**

Professor Maurer was a member of the GW faculty from 1973 to 2007 and a professor of engineering and applied science in the Department of Computer Science.

Maurer was a pioneer in the development of curriculum in the rapidly changing computer science field. He authored six published books—including the first textbook on "data structures"—and more than 180 journal publications and conference papers. He invented or co-invented numerous computer theorems and methodologies, and one of his methodologies reprinted as one of the twenty best papers of the first twenty-five years of the journal *Communications of the Association for Computing Machinery*. He received three National Science Foundation grants and served as a consultant to major corporations and institutes, such as IBM, Lockheed Aircraft Corporation, Lawrence Radiation Laboratory, and Krohn-Rhodes Research Institute.

DOUGLAS WARD MAURER

Faculty Honors

Professor Shahrokh Ahmadi, an assistant research professor in the Department of Electrical and Computer Engineering, received a 2007 Bender Teaching Award. The Bender Awards are presented annually to GW faculty who are selected by a committee of their peers in recognition of their efforts as teachers.

In August 2007, FOX 5 News channel interviewed **Professor Sameh Badie** of the Department of Civil and Environmental Engineering about the collapse of the I-35W bridge in Minneapolis, MN, and about the condition of Washington, D.C.-area bridges. Additionally, an abstract of a paper by Professor Badie was published in the second quarter 2007 issue of the American Institute of Steel Construction's *Engineering Journal*. The paper, entitled "Development and Application of Large-size Shear Studs to Steel Girder Bridges," was subsequently publicized in the July 2007 issue of *Modern Steel Construction*. Professor Badie also was published in the Transportation Research Board's *National Cooperative Highway Research Program* in February 2008. His report on "Full-Depth Precast Concrete Bridge Deck Panel Systems" examines recommended guidelines and American Association of State Highway and Transportation Officials load and resistance factor design specifications language for design, fabrication, and construction of full-depth precast concrete bridge deck panel systems. The Texas Department of Transportation and the Nebraska Department of Roads have started using some of these details on their highway bridges.

Professor Kennerly Digges of the Department of Civil and Environmental Engineering received the 2007 SAE Ralph H. Isbrandt Automotive Safety Engineering Award for Best Safety Engineering Paper. Professor Digges co-wrote the paper with Professors Clay Gabler, Brian Fildes, and Laurie Sparks.

Professor Howard Eisner of the Department of Engineering Management and Systems Engineering became a Fellow of INCOSE (the International Council on Systems Engineering) during its summer 2006 annual symposium.

In September 2007, **Professor W. M. Kim Roddis** of the Department of Civil and Environmental Engineering briefed U.S. House of Representatives and Senate staff on bridge and infrastructure safety in the U.S. Professor Roddis also was invited to serve as an expert panel member for the April 2008 *Popular Mechanics* and National Science Foundation "Bridges to the Future" webcast discussion, which explored the best ideas for improving American infrastructure and building a better, safer future.

Professor Mona Zaghloul of the Department of Electrical and Computer Engineering has been elected president of the IEEE (Institute of Electrical and Electronics Engineers) Sensors Council. Her term is for two years, 2008 and 2009. Professor Zaghloul was also awarded an honorary doctor of engineering degree—*honoris causa*—from the University of Waterloo, Canada, in June 2007. This honorary degree recognizes her academic career in the international circuit community. Professor Zaghloul is the first women to earn a Ph.D. in engineering from the University of Waterloo, one of the top engineering schools in Canada. In addition, Professor Zaghloul and her former doctoral student, Ioana Voiculescu, won the Best IEEE Journal Paper Award 2007 for their paper, entitled "Electrostatically Actuated Resonant Macrocantilever Neam in CMOS Technology for Detection of Chemical Weapons."

Achievement

SHIVKUMAR KAMBHAMPATI

Kambhampati Receives Goldwater Scholarship

Shivkumar Kambhampati, a senior and a biomedical engineering major, has received a Goldwater Scholarship for the 2007-2008 academic year. The Goldwater Scholarship is a very prestigious scholarship that was established by the Barry M. Goldwater Foundation to provide the U.S. with a continuing source of highly qualified scientists, mathematicians, and engineers. The award is based on academic achievement, recommendation letters, and the nominee's research proposal.

The proposal that Kambhampati submitted to the Goldwater Foundation was part of a project on which he worked, whose end goal was to develop gene therapy to treat neurological diseases. Kambhampati already had quite a bit of research experience under his belt by the time he applied for the scholarship, and he drew on this experience when he wrote his research proposal. For the previous three summers, he worked as a researcher at the National Institutes of Health, where his lab experiences included the National Institute of Neurological Disorders and Stroke, the National Institute of Allergy and Infectious Diseases, and the National Institute on Alcohol Abuse and Alcoholism.

Last summer, Kambhampati decided to complement his research experience with some knowledge of forensic medicine, so he spent several days shadowing a forensic radiologist at the University of Maryland. He finds the crime aspect of forensic work very interesting and says that he could see himself doing this type of work in the future. In the more immediate future, he plans to attend medical school and follow that with a either a master's of forensic science or a Ph.D.

When asked why he decided to apply for the Goldwater Scholarship, Kambhampati replied, "It's one of the few national scholarship competitions for science and engineering, and I just wanted to see how I would fare."

Taking a Different Perspective

Kimberly Turley, a sophomore double-major in computer engineering and international affairs, was awarded the highly competitive David L. Boren Scholarship by the National Security Education Program to study abroad last summer. Boren Scholarships are given to U.S. undergraduates to study languages and cultures that are currently under-represented in study abroad and are critical to U.S. national security.

Turley used her scholarship to study over the summer in China. She enjoyed the experience so much and did so well in her studies that she is hoping to arrange another study abroad in China next year, where she plans to take her engineering courses in Chinese.

KIMBERLY TURLEY

That seems like quite a challenge, but Turley loves learning languages and enjoys such challenges. She studied German in high school and then deferred her admission to GW for a year so that she could study in Germany as part of a joint U.S. Congress-Bundestag program that sends students from each country to the other to study and learn about the culture. In addition to German and Chinese, Turley also is learning Arabic on the side, but she says that her Arabic course is "just for fun."

Turley says that she chose to study Chinese last summer, in part, because she knew it would provide a very different perspective from that which she gained in Germany. Part of what shaped her perspective was having a Chinese roommate, which she described as the best aspect of her experience. "She really made an amazing amount of time for me," Turley says of her roommate. "After the first three to four days, we didn't speak any English, and after a couple of weeks I was able to have real conversations with people. It was amazing."

Turley hopes to dovetail her interest in engineering with her Chinese language skills in the future. "There are a million ways that I can combine them," she explains. "The one I'm most interested in is creating my own position in development, in those nations that are starting to become our regular trading partners and that work with high level technology. You need someone who can understand the technology and can work with people, too."

Cole Named a PAF

Each year, GW selects only a handful of graduating seniors to be Presidential Administrative Fellows (PAFs), and once again last year, the university selected a SEAS graduate to be among this select group. Kenan Cole, a 2007 graduate of SEAS, is one of the eight students who were selected from across GW for this fellowship.

The PAF program offers students the chance to work in a university office

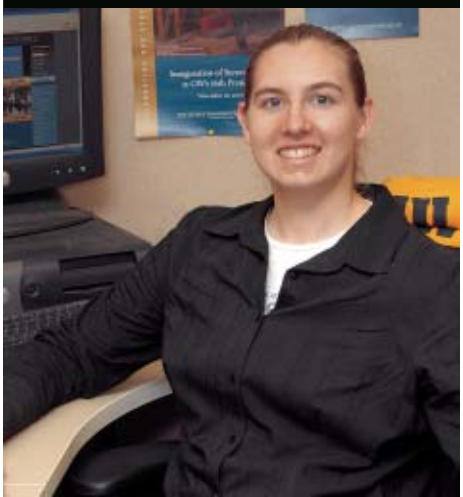
and represent GW at various events, and in return, the Fellows receive free tuition and a housing and monthly departmental stipend. Cole, who is continuing her studies in mechanical engineering, is working as a Fellow this year in the SEAS Office of Advising, Student Services and Records.

Cole works with Mr. Howard Davis, the director of undergraduate advising and student services, and Professor Dianne Martin, the interim associate dean for student services, and she assists them with high school recruitment and organizing recruitment-related events such as tours, engineering lab days, and others. Cole says that she is enjoying her time as a Fellow and is happy to be working with high school students. "It's been really fun to see high school students come in and to see how interested some of them are in engineering," she says.

Cole recognizes other benefits to the Fellowship, too, stating, "It has opened my eyes to some of the other things that the university does, and it allows me to meet so many other people within the university. It really opens up doors."

Despite the demands that the Fellowship puts on her time, Cole reports that she can manage her various responsibilities. As an undergraduate, she played on the GW women's basketball team and still managed to maintain a 3.9 grade point average, for which she was named an *ESPN The Magazine* First Team Academic All-American. As a graduate student now, she no longer plays for the team, but she compares the rigor of her undergraduate and graduate schedules, saying, "I'm also working on my thesis research, so now I'm just juggling three things instead of two."

KENAN COLE



The demands of her undergraduate career taught Cole great time management skills, which she has brought to her job as a Fellow. She says matter-of-factly, "I learned to always look ahead and see what's coming down the pike and to sort of follow the Nike slogan—'Just Do It.'"

Aslani Wins IEEE Scholarship

The Microwave Theory and Techniques Society of the IEEE (Institute of Electrical and Electronics Engineers) awards scholarships to a handful of undergraduates each year to attract them to the microwave and RF (radio frequency) discipline, and to encourage them to pursue graduate degrees in this field. This past summer Amir Aslani, a senior in the Department of Electrical and Computer Engineering, found out that he was one of only ten students across the nation to receive one of these scholarships for the 2007-2008 academic year.

"I was so happy when I found out," says Aslani. "This is the thing I've always wanted to do. I was in Professor Pardavi-Horvath's class last year, and she nominated me for this. I just want to thank her very much for doing that."

Aslani had started his three-semester senior design series when he was nominated for the scholarship, and he submitted a research proposal that dovetails with his senior design project. His project entails designing and building a wireless link using Bluetooth technology that allows a user to wirelessly send sensor data from one location to another location in the range of that transmission. "The research is going very well," reports Aslani. "Right now I'm in the middle of the project, and I'm trying to build what I already designed. I'm writing the programs and interfacing them with my Bluetooth transmitter, and so far, so good."

AMIR ASLANI

This is not the only radio frequency research on which Aslani has worked. Last summer, he held a research fellowship at the National Institute of Standards and Technology (NIST) in Boulder, Colorado. At NIST, he worked on a PASS (personal alarm safety system) devices project for firefighters and first-responders. The goal of the project is to develop a device that crew members carry on their bodies, which will send a signal back to the base station to alert a commander when a member has lost consciousness. Aslani is proud of the project and of the fact that he was nominated for having submitted the best report among his peer group at NIST last summer.

Aslani is very gracious in spreading credit for his successes. He specifically names Professors David Nagel and Thomas Manuccia for their help with his senior design project, and Dean Barbara Myklebust for assisting him with his NIST internship last summer. "I also thank the Department of Electrical and Computer Engineering, Professors Korman and Kyriakopoulos, and my family for helping me," he says, "and I hope someday to give back to the community."

Honor Roll of SEAS Donors

MESSAGE FROM THE DEAN

I am very grateful for the commitment and philanthropic support of the SEAS community. Gifts made by our alumni, corporate sponsors and other friends have a substantial impact on our ability to achieve greatness. This support has enabled SEAS to continually enhance an exceptional educational and research environment at The George Washington University. I would like to extend my deep gratitude to each of the donors listed below. Your gift to SEAS is what propels us forward, fulfills dreams, and impels us to lofty deeds. Thank you for your generosity.

Sincerely,

Timothy W. Tong
Dean

L'Enfant Society

The L'Enfant Society is named for the architect of the city of Washington, Pierre-Charles L'Enfant, whose vision guided its growth. The most prestigious of GW's gift societies, the L'Enfant Society recognizes donors whose generosity and foresight have a transformational and enduring impact on GW. Membership is extended to individuals, corporations, and foundations whose annual or cumulative giving totals are $5 million or more. L'Enfant Society members who have made contributions to the School of Engineering and Applied Science:

Science Applications International Corporation

1821 Benefactors

Established in 2004, this esteemed Society was named in honor of the year the University was founded, and embodies both the spirit of GW and the spirit of private philanthropy. Membership is extended to individuals, corporations, and foundations whose annual or cumulative giving totals are $1,000,000 to $4,999,999. 1821 Benefactors who have made contributions to the School of Engineering and Applied Science:

Nelson A. Carbonell Jr. and Michele Carbonell
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Asghar and Holly Mostafa
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The Alfred P. Sloan Foundation

George Wasington Society

Established in 1990, the George Washington Society was named to honor the forward-thinking spirit of the University's namesake, whose vision has guided GW's growth. Membership in the George Washington Society is extended to alumni and friends whose annual or cumulative giving totals are $500,000 to $999,999. The requirement for membership was changed for the first time in 2007. Donors who have given a total of $100,000 to $499,999 prior to September 1, 2007 have been granted membership in this Society. George Washington Society members who have made contributions to the School of Engineering and Applied Science:

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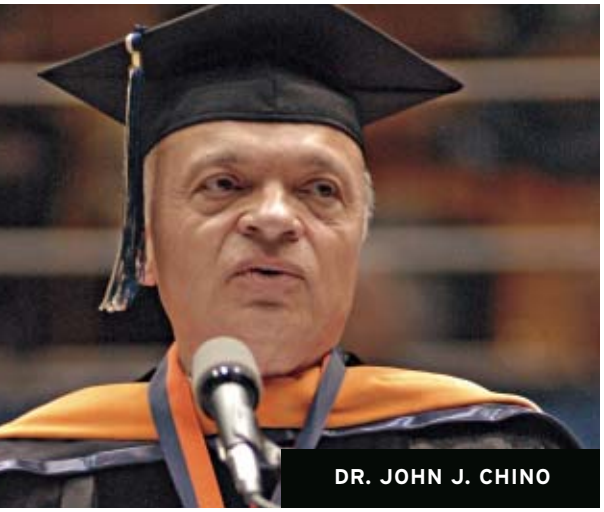
News



DR. JOHN J. CHINO

Chino and Martin Receive the Engineer Alumni Achievement Award

During the SEAS Celebration in May 2007, the Engineer Alumni Association (EAA) presented its Engineer Alumni Achievement Award to two SEAS alumni, Dr. John J. Chino (D.Sc. '86) and James L. Martin (B.S. '50).

Chino is deputy of electronic systems and sector vice president and general manager for Northrop Grumman Corporation and has executive responsibility for the Electronic Systems Sector's performance. In addition, he oversees the sector's capital resources and the program management homeroom.

Chino joined the company, formerly known as Westinghouse Electric Company, in 1971 and has held numerous positions in engineering, engineering management, program management and business area management. He has been responsible for all engineering and manufacturing operations and for the continuous improvement of processes, performance, systems, and facilities. In addition, Chino is a licensed professional engineer and holds thirty-eight patent disclosures and eight patents. He is also a member of the SEAS National Advisory Council.

Martin received his bachelor of science degree in civil engineering from SEAS in 1950 and is a registered professional engineer. During his career, Martin was the public works director for the City of Fresno, California. He was responsible for several areas of the city's public works department, including traffic engineering, wastewater treatment, sewer maintenance, and airports. He oversaw a staff of more than 530 people and a budget of $60 million annually.

Prior to his time in Fresno, Martin was the director of public works for the city of Berkeley, where he was responsible for the delivery of the city capital improvements program, including the design and initial construction of the city marina and coordination with design of the BART system facilities throughout the city.

Martin has served on several boards, including the American Public Works Association and League of California Cities. He has also published many books and periodicals and has received several honors and awards.

Chino accepted his award at the celebration, and then addressed the graduates. Martin was unable to attend the celebration, so J.P. Blackford, the president of the EAA, accepted the award on his behalf and then read remarks that Martin had prepared for the graduates.

SEAS congratulates these two men on their career achievements and on receiving the 2007 EAA Engineer Alumni Achievement Award.

Nelson Carbonell and Randy Graves Receive GWAA Service Award

SEAS congratulates Nelson A. Carbonell, Jr. and Randolph "Randy" Graves, Jr. for being selected as two of the six recipients of GW's 2007 Distinguished Alumni Service Award. Given each spring, the award has been conferred on a broad range of alumni who advance the mission of the university through dedicated volunteer efforts in support of its programs.

Nelson A. Carbonell, Jr. (BS '85) is the president, CEO, and founder of Snowbird Capital. A member of GW's Board of Trustees, Carbonell chairs the development committee and is vice chairman of the board. Last year, he led Leadership Weekend, an initiative that brought together all levels of university leadership to focus on the needs of the development and alumni relations division, as well as a series of university forums. Carbonell works directly with the vice president for development and alumni relations to recruit new trustees, and his efforts have resulted in the creation of a sub-committee to focus on this endeavor. In addition to his volunteer work, Carbonell has committed substantial financial support to the university and serves as a leader to his fellow board members and to alumni.

Randolph Graves, Jr. (D.S. '78) is the founder of Graves Technology, Inc., where he serves as an executive consultant. Having previously served as the chairman and CEO of Eurotech, LTD, and the director of the aerodynamics division of NASA, Graves has amassed decades of experience in technology management. Graves is an active volunteer for the university and SEAS.

NELSON CARBONELL & RANDY GRAVES

He has served as a member of the SEAS National Advisory Council for more than six years and has generously given of his time and resources to the university. Graves works closely with Dean Timothy Tong, offering insight on strategic planning and management. He helped to establish the Council on Entrepreneurial Tech Transfer and Commercialization, where he continues to assist faculty, student, and alumni entrepreneurs with education and training, technology commercialization, start-up formation, and enterprise funding.

William Ellenberger Turns 100!

In January of this year, SEAS alumnus and GW Engineering Hall of Famer, William Ellenberger (BS '30, BS '34), celebrated with family members a milestone that not many people achieve—his 100th birthday!

In February, Doug Honker, executive director of development for SEAS, visited Ellenberger in Escondido, CA, to bring him birthday greetings on behalf of the university and the school. Also on behalf of the university and Dean Timothy Tong, Honker presented Ellenberger with three new books and a replacement of his GW Engineering Hall of Fame Award from 2006, which unfortunately was lost in a devastating fire that Ellenberger survived in October of last year.

On October 22, 2007, firefighters awakened Ellenberger at 3:00 a.m. and told him that he would need to evacuate his home immediately, as one of the fires that devastated the San Diego area was approaching. By morning, Ellenberger's house and the adjacent home of his daughter and son-in-law had burned to the ground. Although almost all of his possessions were lost in the blaze, Ellenberger proved to be as resilient as ever, a trait that served him well during his long and distinguished career as an engineer. He relocated to a temporary apartment near his former home and immediately began to restock his personal library—at 100, Ellenberger is still a voracious reader and lover of history. He also acquired a new computer, and began corresponding with friends and family via e-mail.

SEAS congratulates William Ellenberger on his 100th birthday!

EDITOR'S NOTE:

As Synergy went to press, we learned of the death of William Ellenberger on March 26, 2008. Dean Timothy Tong and SEAS send our sincere condolences to Mr. Ellenberger's family.

DOUG HONKER & WILLIAM ELLENBERGER

ANNOUNCEMENTS

Order of the Engineer Induction Ceremony

Friday, May 9, 2008
8:00 pm
Alumni House
1918 F Street, N.W.
SEAS alumni with a bachelor of science degree from an ABET-accredited engineering program, from SEAS or elsewhere, are also eligible for induction. Please contact Professor Richard Soland at **202-994-7531** with any questions.

Angel Investing Mini-Workshop and Start-up Company Presentations

Thursday, May 22, 2008
Mini-workshop: 3:00 – 6:30 pm
Trading Floor: 6:30 – 9:00 pm
The George Washington University
1957 E Street, N.W. (7th Floor)
For more information, please contact Michael Veedock at **mfv@gwu.edu** or **202-994-6080.**

Commencement Legacy Reception

Friday, May 16, 2008
1:30 – 3:30 pm
The George Washington University
Media and Public Affairs Building
(2nd floor)
For more information, please contact Andy Hill at **ahill@gwu.edu.**

SEAS Celebration

Saturday, May 17, 2008
7:30 pm
Charles E. Smith Center
Corner of 22nd and G Streets, N.W.
For more information on this and other GW Commencement activities, please contact Sandra Little at **202-994-5411.**

Alumni Reunion Weekend

September 25-28, 2008
For information, please visit:
www.gwu.edu/~alumni/reunion/schedule.cfm

BARRY BLUMBERG, NICK PALEOLOGOS, BOB McCALLEY & FRANK KLISCH

These Guys Have "Hearts"

In 1959, four young men—all studying engineering—met at SEAS and have remained life-long friends. What has facilitated their staying in touch all these years? The answer, it turns out, is the card game "Hearts."

Barry Blumberg, Bob McCalley, Frank Klisch, and Nick Paleologos have been playing Hearts together since they started school at GW in 1959. According to Paleologos, "We played at Tompkins Hall in any empty classroom we could find." Blumberg, McCalley, and Klisch graduated together in 1963, and Paleologos, who got married and took time off to work, graduated in 1969.

Despite the years and the distances, the regular card games have never stopped. Paleologos still lives and works in the Washington, D.C. area, and he reports that Blumberg now lives in Atlanta, GA, but also works in the Washington, D.C. area; Klisch has retired to Tahoe, CA, and spends a great deal of time traveling to see his children, "but always makes it back here for our monthly card game;" and McCalley has retired to West Virginia "but won't miss a game."

When asked about the competition of the game, Paleologos surmises, "Because we have been playing together for so long, it's difficult for any of us to dominate, but I would suggest that we are probably the best Hearts players GW ever produced."

Richard Scott Receives GW Award for Distinguished Entrepreneurial Achievement

Members of the GW community and local entrepreneurs gathered on October 24, 2007 to honor Richard L. Scott with the inaugural GW Award for Distinguished Entrepreneurial Achievement.

Scott founded the Columbia Hospital Corporation in 1987 (later renamed HCA, Inc.) and by the time he left his role as chairman and CEO in 1997, Columbia/HCA had become the world's largest healthcare company with more than 340 hospitals, 130 surgery centers, and 550 home health locations in thirty-eight states and three foreign countries. With annual revenues of $20 billion, the company employed more than 285,000 individuals, making it the seventh largest U.S. employer and twelfth largest employer worldwide. Based on market capitalization, Columbia/HCA ranked in the top fifty companies in America and top 100 companies worldwide.

Since 1997, Scott has been CEO of Richard L. Scott Investments, LLC, focusing on public and private investments in strong cash flow generating companies. He was recognized by *TIME* magazine as one of America's 25 Most Influential People in 1995. Also in 1995, he was named CEO of the Year by *Financial World* magazine and was cited as one of the Top 25 Performers of 1995 by *U.S. News and World Report* magazine.

GW PRESIDENT STEVEN KNAPP & RICHARD L. SCOTT *(right)*

Photo courtesy of Dave Scavone

The celebration of Scott's achievements included a keynote address from Scott; an address from GW President Steven Knapp on entrepreneurship and research at GW; and two panels of GW entrepreneurs who spoke about their experiences as entrepreneurs. President Knapp opened the morning's events with remarks on the environment that GW hopes to create to foster entrepreneurial activities, and he spoke about the challenge of developing the speed and agility that a university needs to be successful in building entrepreneurial enterprises.

The cornerstone of the event was President Knapp's presentation of the award and Scott's keynote address. Scott thanked GW for his award and began his address by noting how appreciative he is to live in the United States, where opportunities are available to those with drive. Scott said that he did nothing the conventional way upon entering the healthcare industry, but he always followed the same principles: look for a simple business model; hire an honest management team that holds people accountable; and measure people to make sure that they are achieving what you need them to achieve. He said that these principles hold true whether one is doing a $2 million business or a $24 billion business.

The GW Award for Distinguished Entrepreneurial Achievement was sponsored by Blank Rome LLP, SEAS, GW School of Business, GW Alumni Association, GW Cancer Institute, GW Entrepreneurs Roundtable, GW Office of the Chief Research Officer, Peter Weissman (JD '96), and Sharon Worthington.

Happenings

Talal Al-Mazrooei, BS (electrical engineering) '03, MS (telecommunications and computers) '04, works as a project manager for the Emirates Dubai National Bank. He recently received the Sheikh Rashid Award for Academic Excellence. Sheikh Mohammed bin Rashid Al Maktoum, vice-president and prime minister of the United Arab Emirates and ruler of Dubai, presents the annual awards to UAE students who have achieved outstanding results at their respective academic levels.

Ahmad Abdoh Alhattan Alaseeri, MS (engineering management) '98, proudly announces his firstborn child, Nuha.

Gregory R. Allen, MEA '89, has joined Vangent as director of business development for enterprise solutions.

Peter Cavallo, MS (aeronautics) '95, was recently named an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA). Since graduating from the JIAFS program at NASA Langley he has been with CRAFT Tech of Pipersville, PA, a small aerospace and defense contractor specializing in computational fluid dynamics methods development, where he is currently a senior scientist. Last year he completed his Ph.D. in mechanical engineering at Drexel University. Peter and his wife have three children.

Simon Cheong, BS (civil engineering) '81, has been named the president of the Real Estate Developers Association of Singapore (Redas).

Terry Collins, D.Sc. (computer science) '76, was honored at the Greater Washington Government Contractor of the Year program in October 2007. Collins, the CEO of Argon ST, received the Executive of theYear Award ($75 million to $300 million) based on his contribution and work in the community, with the government contracting industry, and for his respective companies.

David Dastvar, BS (electrical engineering) '81, is the managing partner of InnoVest Group, a technology investment and management consultant group based in Washington, D.C. InnoVest Group recently established technology business incubators for small technology enterprises in the Middle East and Eurasia.

Amr ElSawy, MS (electrical engineering) '80, was named president and CEO of Noblis (formerly Mitretek Systems) in 2007 and is responsible for the general management and direction of the company's overall technical, financial, and administrative activities.

Yusuf Emre Erdi, D.Sc. (medical engineering) '95, is a medical physicist who is internationally known for his expertise in positron-emission tomography (PET). He is an associate attending physicist at Memorial Sloan Kettering Cancer Center in New York City. He is the section head in diagnostic medical physics, currently overseeing about 150 X-ray units, such as computed tomography, mammography, and fluoroscopy. Dr. Erdi is married to **Alev Erdi, D.Sc. (medical eengineering) '96.** They have two sons and live in Montclair, NJ.

Zhone Technologies has named **Steven Glapa, BS (mechanical engineering) '89,** to lead Zhone's global marketing initiatives.

Dawn Hayes, D.Sc. (systems engineering) '05, received the Civilian of the Year Award from the Naval Facilities Engineering Command (NAVFAC) in February 2007.

Akhlesh Kaushiva, MS (computer science) '86, has joined Avineon, Inc. as vice president of the company's commercial IT services division.

Matthew F. Koff, BS (mechanical engineering) '97, and **Sasha R. Pailet Koff, BS (mechanical engineering) '97,** are happy to announce the arrival of their daughter Leah Beatrice Koff, who was born on April 18, 2007.

Robert Kramer, BS (mechanical engineering) '60, MEA '72, retired in 1997 after a career spent primarily with the federal government at NASA, the Department of the Navy, and the Department of Energy. Among the programs that Kramer worked on during his career were the Apollo rocket launching, war ship maintenance, and the Trident submarine and missile systems development.

Kelly Latimer, MS '89, has joined the flight crew branch at NASA's Dryden Flight Research Center at Edwards Air Force Base, California.

At a White House reception and dinner in September 2007, **Simon Lee, MS (systems engineering) '05,** president and CEO of STG, Inc., received a Lifetime Achievement Award for his ongoing dedication to the advancement of minority business. The award, presented by the U.S. Department of Commerce, Minority Business Development Agency (MBDA) and U.S. Small Business Administration, was given as part of the MBDA's Minority Enterprise Development Week conference.

Arthur V Lopes, D.Sc. (computer science) '93, lives with his family in San Diego, CA, and works for Teradata, a division of NCR Corporation, doing software research end development.

Marie Luby, MS (electrical engineering) '98, had a baby girl, Lily Sue, on October 31, 2006. She also received her Ph.D. in biomedical engineering from the University of Connecticut in May 2007.

Robert L. Maier, BS (computer engineering) '98, attended Fordham Law School and now is practicing as a patent lawyer specializing in high-technology patent litigation with Baker Botts, LLP in New York.

Kristy McDonnell Ortiz, BS (civil engineering) '99, MS (engineering management) '01, received her MBA from the Harvard Business School in June 2007 and began work for the Boston Consulting Group, a management consulting firm, in August.

Kenneth W. Meeks, P.E., D.Sc. (civil engineering) '97, is the chair of the Department of Civil and Environmental Engineering at Tri-State University in Angola, Indiana. He plans to retire at the end of the 2007-2008 academic year. Prior to receiving his doctoral degree, Meeks spent 29 years as a Navy Civil Engineer Corps officer.

Rachel Miller, BS '03, MS '07 (civil engineering), married Jordan Usdan on October 7, 2007 in Washington, D.C. They met their freshman year at GW. She is a structural engineer at the Washington office of the URS Corporation, an engineering design firm, and is currently the secretary on the executive committee of the Engineer Alumni Association for SEAS.

Sameh Muhtadi, MEA '83, has been appointed CEO of Emaar Misr for Development S.A.E, the wholly owned subsidiary of a Dubai-based property developer.

Arthur Pantelides, MEM '02, is currently working on his dissertation at GW for a doctoral degree in engineering management and is an engineering manager at Sumitomo Drive Technologies in Chesapeake, VA.

Mark Prahl, MS (engineering administration) '88, has been named associate director for operations for the Voice of America.

Ruby Roy, BS (computer engineering) '98, MS (computer science) '03, married Toby Chaudhuri on January 13, 2007.

David A. Saperstein, M.D., BS (electrical engineering) '83, has joined QLT, a biopharmaceutical company, as a consultant and interim chief medical officer.

Gerald Seelman, MEA '66, has joined Psomas as group leader of transportation and public works.

Rita Sinha, BS (mechanical engineering) '06, is a patent examiner at the U.S. Patent and Trademark Office and a J.D. candidate at GW's School of Law. She was crowned Miss District of Columbia International 2007 and has spent her year's reign promoting the platform of "HIV/AIDS Prevention: Abstinence Education" in the nation's capitol.

Jeffrey M. Skrysak, BS (computer science) '00, worked for various companies in Chicago, including Philips Lighting North America (N.A.), after graduating. He married in 2003 and now lives in a South American country with his wife. They own their own business, and Jeffrey is currently attending medical school.

John Sporidis, BS '74, MS '80 (electrical engineering), is senior vice president and managing director at Syska Hennesssy Group's Washington, D.C. Office. He has been with the firm nearly 15 years and has led a team of over 35 professionals in creating the design of several prestigious projects around the world, including the U.S. Patent and Trademark Office headquarters in Alexandria, VA, which was recently awarded an engineering technology design excellence citation by the U.S. General Services Administration. John is an active participant in the ACE Mentor Program. He has two boys in college, Taso and John, and he resides in Bethesda, MD.

Northrop Grumman Corp. has named **Patrick K. Talty, MS (telecomunications & computers) '96,** vice president of information superiority for its information technology sector.

Josep (Jep) Tarradas, MS (computer science) '86, lives in Barcelona, Spain, and works for Hewlett-Packard Co. as the director of research and development for large format printing business. He and his wife, Rosa Maria, have two children, Anna and Josep.

Khalid M. Umerani, BS (civil engineering) '86, owns a top-producing Allstate Insurance Agency business in Chantilly, VA.

NetWitness has named **Amit Yoran, MS (computer science) '96,** as its new chief executive.

John Young, MEA '89, has recently moved to Atlanta, GA, where he is employed with the law firm of Cantor Colburn, LLP as a patent attorney.

In Memoriam

James C. Aller, D.Sc. '68
Banji Babalola, MS (operations research) '77
Mark Bensinger, BS (mechanical engineering) '35
Edgar Berdahl, BS (mechanical engineering) '45
Thomas J. Bunt, MEA '75
Daniel John Crawford, MS (electrical engineering) '75
Wilbur H. Eskite, Jr., BS (civil engineering) '53
Barry Vance Gibbens, MEA '90
Gordon Gifford, MS (computer science) '76
William Hayward Dix, BS (electrical engineering) '34
Francis Hermach, BS (electrical engineering) '43
Raymond Carl Houghton, MS (computer science) '75
Jeffrey Krull, MEA '82
Edward Mackie MacCutcheon, MEA '58
Paul Eugene Milbrodt, MS (electrical engineering) '69
John B. Mildenberg, MS '80
Irwin B. Nathanson, BS '41
Sherwin Rubin, BS (electrical engineering) '48
Dominick R. Traina, BS (mechanical engineering) '58, MEA '62
Albert Van Metre, BS '51
William N. Yehle, MEA '64
Ahmed Mahmoud Youssef, MS (mechanical engineering) '59

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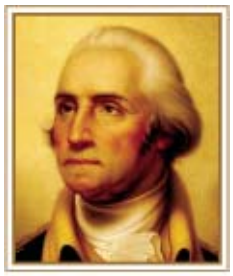

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