

EXPERTS DISCUSS HOW NEW TECHNOLOGIES CAN IMPROVE NATION'S INFRASTRUCTURE



James H. Garrett
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Estimates project that within the next five years, the U.S. must invest 2.2 trillion dollars into its infrastructure to keep it safe and efficient. In fact, the American Society of Civil Engineers' 2009 Report Card for America gives the nation's infrastructure a cumulative grade of D. The dilapidated state of our infrastructure begs many questions, for example: What technologies and approaches for improvement would provide the best use of our time and money? This quandary and related matters were the focus of a panel discussion, titled "Smart Technologies," that was held at Carnegie Mellon on September 9, 2009.

James H. Garrett Jr., co-director of the Center for Sensed Critical Infrastructure Research and head of Civil and Environmental Engineering moderated the panel, which included: Jurij Paraszcak, director of Emerging Business Research and Smarter

Planet Initiative, IBM; Benson Gabler, Corporate Sustainability Manager, the PNC Financial Services Group; Guy Costa, former Public Works director, City of Pittsburgh; Piervincenzo Rizzo, professor of Civil Engineering, University of Pittsburgh; and Carnegie Mellon's Burcu Akinci, professor of Civil and Environmental Engineering.

"By bringing together experts from academic, industry and government, we were able to call attention to important issues related to our infrastructure, such as the need for more cost-effective ways to monitor, sustainably maintain and operate our aging infrastructure, and raise

awareness of new technologies and approaches that can help us address these issues," says Garrett.

During the 90-minute discourse, panel members offered perspectives on a range of topics, including:

- the need for cyber-physical systems in infrastructure;
- the application of leading-edge technologies in old, urban infrastructures;
- how companies can adopt new technologies and policies to make themselves greener; and
- the use of sensors to gather data that leads to more efficient use of resources and smart business decisions.



MAKING OUR PRESENCE KNOWN: THE WASHINGTON SPEAKER SERIES



Sharon Grant

Bringing business, government and research leaders together to explore issues residing at the intersection of policy, technology and innovation – this is the purpose of Carnegie Mellon University's Washington Speaker Series.

Sponsored by the College of Engineering, the Speaker Series, which is held in Washington, D.C., is a public forum that enables experts to talk about important issues that align with the College's research thrusts – like innovation, cybersecurity and energy. Since the event's inception in 2008, hundreds of alumni, corporate and government figures have attended the biannual panel discussions that take place at the Cosmos Club. The most recent gathering, which was held on September 10, was titled "Inspiring Innovation: Reinventing the Theory, Practice and Policy of Transformational Change." Dean Pradeep Khosla moderated the panel which consisted of Robert Atkinson,

founder and president of Information Technology and Innovation Foundation; Erica Fuchs, assistant professor of Engineering and Public Policy, Carnegie Mellon; Robert Gardner, founder of New World Technology Partners; Egils Milbergs, executive director of Washington Economic Development Commission; and Congressman David Wu, chairman of the House Committee on Science and Technology's Subcommittee on Technology and Innovation. Jack Goldman, the creator of Xerox PARC and former Carnegie Mellon professor of physics, was the guest speaker.

"The Washington Speaker Series helps to create new relationships, strengthen existing ones and provide interesting professional experiences for our faculty and alumni. The series also keeps the public aware of the College's leading-edge research," says Sharon Grant, the College's senior director of external relations. "By listening or asking the panel

questions, people walk away more informed, more sensitized to the pressing issues at hand," explains Grant.

In addition to providing valuable networking opportunities, the Speaker Series raises Carnegie Mellon's profile in Washington. This is achieved in part by the caliber of the panel members. "We seek people who are more than technical experts. We want people on these panels who are actively engaged in an issue and can make things happen. They are influential and have a respected track record," says Grant.

The discourse that takes place is "open, robust and productive," she says. She arranges an interesting mix of panel members who at times vary widely in their opinions. The goal of the series is not to foster controversy but instead to bring different perspectives to the table. Panel members are selected based on their dedication to finding solutions to difficult problems and not their political persuasions. By presenting alternative views, problems can be approached from different angles.

"In D.C., I have seen so many issues that are informed and shaped by the research that the College is working on. What we work on is of vital interest to all. And I think people turn to institutions like the College of Engineering for solutions to tough problems because we look at issues in a comprehensive fashion. A great example of this is our Engineering and Public Policy Department, where we have a melding of policy and technology," says Grant, adding, "We contribute to sound public policy."

To join us for future events, visit our Web site at www.cit.cmu.edu and search for Washington Speaker Series. For additional information, contact Sharon Grant, Senior Director of External Relations at 202-478-7842 or sharongr@andrew.cmu.edu.



NEW FACULTY MEMBER FOCUSES ON OPTIMIZING ENERGY NETWORKS



"Power systems are probably the biggest systems we have and that's why it is important to coordinate control of these systems," says Gabriela Hug, an assistant

professor in ECE. Hug, who is from Switzerland, teaches a special course for graduate students called Optimization in Energy Networks, which is a topic of vital public concern, perhaps more so than most people realize.

Power systems are constructed in a manner that allows different entities responsibility for various parts of the system. "If you want to optimize the system, you have to get the entities to coordinate, and often

they aren't willing to exchange data," says Hug. Further, if a Pennsylvania utility company does something in its system, say increase or decrease a load, it will influence neighboring systems in Ohio or Virginia. Hug is using optimization theory to formulate hypothetical problems for each entity and solutions that benefit all involved parties.

The ability to coordinate and control different parts of the power grid is important with regards to distributed generation and renewable forms of energy. "Wind generators and solar cells are connected all over the power grid and this is difficult to coordinate," says Hug. A formidable problem is that energy can only be stored to a limited degree, and wind generation is intermittent. "You need

environmentally unfriendly backup if the wind is not blowing. You don't want the system to go down." Like an orchestra, renewables and traditionally generated electricity must work in sync and this comes about through expert coordination.

Hug says that her research delves into "two levels of coordination. You have coordination between large power systems and then within these systems you have to coordinate equipment." She explains there are limitations as to what systems can handle. If a piece of equipment falters, causing a line to overload and fail, the power will flow elsewhere and overload another line. This pattern continues, creating a cascading power failure.

Another area that Hug's research could impact is the developing concept of demand control. "This means that the prices you pay for

electricity for your home will vary at different times of the day," she says. For example, consumers may run their washing machines at night because it would be cheaper and would reduce the peak load on the system during the day. (Midday is when the most electricity is used.) Again, coordinating the amount of power in the grid at specific times is a key task.

Because Hug's work involves very large systems, her research is being tested via simulations. "This is one of the most difficult things in power systems research. You can't just try something out. Utility companies are afraid that their systems would go down if something went wrong," she says. Yet Hug is confident her work will come to light. Government regulation is forcing change in the power industry and "old equipment and blackouts make utility companies more receptive to testing new ideas."

Newsmaker

MCGAUGHEY EARNS AIR FORCE GRANT

Alan J. H. McGaughey, an assistant professor in Mechanical Engineering, received a grant from the Air Force's Young Investigator Research Program (YIP).

McGaughey was one of 38 engineers and scientists, selected from a pool of 202 applicants, who are to receive a total of \$14.6 million in grants over a 3- to 5-year period. YIP grants are awarded to researchers who have received their Ph.D. within the last five years and demonstrate exceptional ability and promise in their work.

For his award-winning project, McGaughey will investigate how quantum mechanics can be used to predict the thermal conductivity of nanostructures. "I want to look at the tools used in physics, materials science and chemistry and apply them to solve engineering problems," he says.

He explains that when new materials are created in the lab, it is often a trial-and-error process. McGaughey's goal is to reduce the guesswork and use theory and simulations to develop nanomaterials with tailored heat transfer properties. He is concentrating on superlattices, which are made of two semiconductor materials that are alternately "layered like a cake." Depending on their design, superlattices may be good conductors of heat or be insulators. "We want to use nanomaterials and make them behave differently than what you'd expect," says McGaughey. This research could have applications for thermal management in light-emitting diodes and lasers and in thermoelectric energy conversion, where waste heat can be used to generate electricity.

