



NSF, NIH Reward Stevens Research Innovation Seven new awards recognize leading-edge research projects in cancer therapy, cybersecurity, privacy, STEM education, driver safety and collective design

Stevens has recently secured a series of high-profile National Institutes of Health (NIH) and National Science Foundation (NSF) awards to support innovation and initiative in diverse research areas stretching from the architectural to the virtual to the societal, training a national spotlight on the university's research program.

NIH will fund a collaborative Stevens project to study mechanisms, models, therapies and medication strategies related to multiple myeloma (MM), an incurable blood cancer. Stevens will team up with Hackensack University Medical Center (HUMC), New Jersey's top-ranked hospital, in the investigation to develop microfluidic technologies to reconstruct MM tumors in vitro from tumor cells harvested from patients.

This 'tumor engineering' approach could help researchers develop future diagnostic testing of personalized therapeutics for MM patients, evaluate new drugs and therapies, and study the mechanisms responsible for drug resistance and relapse associated with the disease, said Woo Lee, principal investigator for the project and a Stevens professor of chemical engineering and materials science.

NSF also recently granted support to six important Stevens research projects:

- Computer science professor Susanne Wetzel will serve as principal investigator for a cybersecurity project awarded more than \$3.2 million to continue Stevens' participation in the CyberCorps: Scholarship for Service (SFS) program that prepares cybersecurity professionals to enter the government workforce.

The award, granted to a four-member Stevens faculty team, will support 14 scholarships for undergraduate and graduate students pursuing cybersecurity-focused degree programs at Stevens. Recipients will be placed post-graduation in federal, state and local government organizations.

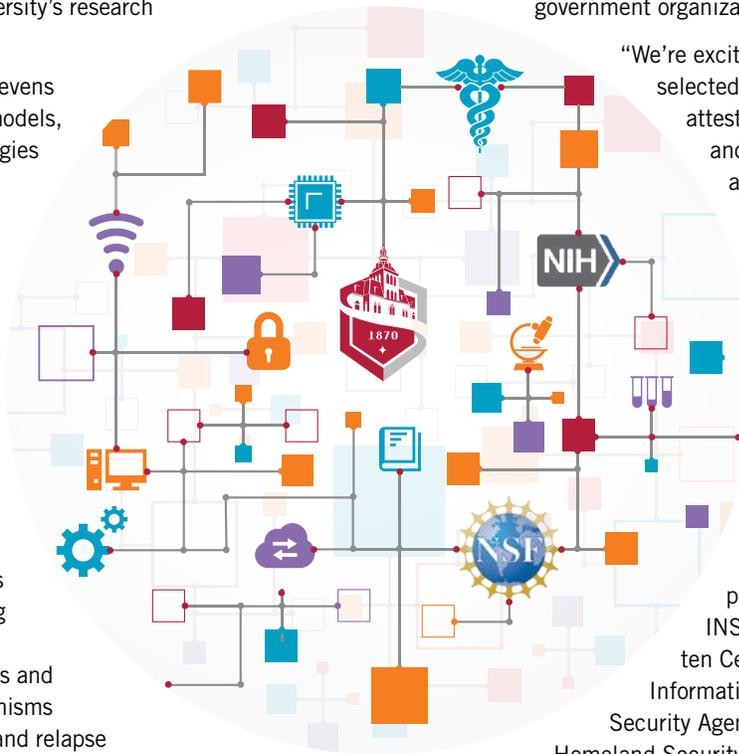
"We're excited that we have once again been selected as an SFS scholarship site, attesting to the quality of our students and programs," notes Wetzel. "Once again, this grant provides us with the opportunity to produce well-educated cybersecurity professionals who can help protect the nation's critical cyber-infrastructure."

Graduates from the program have previously joined government entities including the FBI, MITRE, the Federal Reserve and Sandia National Laboratories.

The grant also provides funding for Stevens faculty and students to participate in the NSF-funded project INSuRE, a research partnership among ten Centers of Academic Excellence in Information Assurance Research, the National Security Agency (NSA), the Department of Homeland Security (DHS) and other federal agencies.

- Stevens senior research associate and director of diversity and inclusion Susan Metz will serve as principal investigator on a three-year, \$825,000 project supported by NSF's Division of Undergraduate Education to incorporate mobile learning opportunities with a tested spatial skills curriculum to improve student retention in technical fields. The project will build upon work Metz has carried out under Engage Engineering, a six-year NSF grant-funded project to extend spatial visualization skills assessment and training, among other research-based retention strategies, into science, technology, engineering and mathematics (STEM) education.

continued inside



INSIDE HIGHLIGHTS:



Stevens logistics power Antarctic research



Port Authority agrees to fund Stevens storm, flood research



New wireless router technology unveiled



Mo Deghani, Ph.D.
Vice Provost of Research
Stevens Institute of Technology

One Year and Counting: Stevens Research Is On the Rise

It has now been slightly more than one year since I arrived at Stevens to help lead our research programs forward into the next decades, and I have now had time to gain a little perspective on both the remarkable historical legacy here and the challenge of taking our research program to new heights.

Having come from major research institutions, I recognized that Stevens possessed the talented faculty and tremendous potential to become one such major research institution — if we leveraged our resources carefully.

Well, it has been 15 months, and I can say for certain that my eyes have been opened. For a medium-sized university, there is an uncommon amount of quality research taking place at Stevens. As I write this message, I count 184 active research projects in motion, with dozens more currently in the ideation or proposal stage.

Stevens research has been recognized over the summer in a number of high-profile ways, including by both NIH and NSF (see the cover story for a description of recently received awards from these two institutions). The Department of Defense awarded Stevens \$60 million to extend the work of our Systems Engineering Research Center. The Department of Homeland Security has made a new \$10 million commitment for a Stevens-led project in maritime resilience with partners including MIT, Florida State, LSU, the University of Connecticut, the University of Puerto Rico-Mayagüez and Elizabeth City State University.

But it's not just the funding levels and our national recognition I am pleased about. As I look back upon the past 15 months, I also see

significant progress in lower-profile but critical support systems and structures. These systems and structures enable our talented (and time-challenged) faculty to turn great ideas into long-term research and commercial products that address pressing societal and global challenges.

During the past academic year, to take just a few examples, Stevens has:

- Hired 30 new faculty members, including a number of leading researchers in their fields.
- Convened an Award Capture Team, with representation from all four of Stevens' distinctive schools, specifically designed to identify funding opportunities relevant to our research community; enhance the proposal development process; and engage key members of funding agencies and organizations.
- Created a Faculty Support Center that provides critical front-end resources and assistance to faculty both at the pre-award stage and in the resolution of any issues post-granting of awards.
- Created a new series of Research Incentive Awards that support the vital work of our talented faculty members, as well as two new sets of 'ignition' grants to assist and encourage the process of securing major funding support for high-leverage research projects.

There is an outstanding convergence of valuable research being performed at Stevens. Please join us in this exciting journey by enjoying this and future issues of IMPACT and following us online at stevens.edu/research. And please feel free to contact my office at any time.

Enjoy the fall!

NSF, NIH RECOGNIZE STEVENS continued from cover



Strong spatial-visualization skills, particularly the ability to visualize in three dimensions, are linked to successful STEM careers. Significant disparities exist among women, underrepresented minorities and lower socioeconomic groups in spatial-skills test performance and are most evident in mental rotation, an important skill in engineering. Poor performance on spatial-visualization tasks can directly affect perceptions of self-efficacy and GPA in courses such as engineering graphics, calculus, chemistry and computer science.

Metz's award will enable greater access by students to a spatial skills training curriculum developed by collaborating researchers at Michigan Tech that can lead to marked improvements in retention of the skills.

- Stevens researchers Jeffrey Nickerson, a Stevens professor and director of the Center for Decision Technologies, and industry professor John Nastasi, director of the Product-Architecture and Engineering program, received a \$499,000 award to support their joint project proposal "Collective Design through Remixing."

The project is centered around three-dimensional online printing communities, and will enable 'makers' (expert amateur designers) to innovate, share, modify, combine and print designs or components that will be used to construct shelters after natural disasters. Nickerson and Nastasi will bring makers together with professional engineers, architects and fabricators through a forthcoming innovation competition, during which participants will design direct-print components that can rapidly deploy shelters and other temporary structures during emergencies.

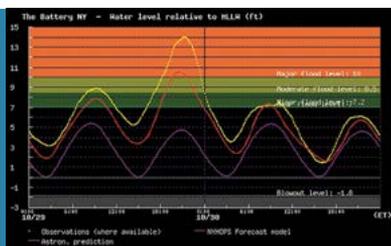


Stevens Research to Bolster Transportation Resiliency, Predict Storm Surges

\$6.6 Million Port Authority Grant Will Support Center for Coastal Resilience and Urban Xcellence (CRUX) Research

Stevens Institute of Technology has received a five-year, \$6.6 million grant from the Port Authority of New York/New Jersey (PANYNJ) to improve preparedness and resiliency at critical Port Authority infrastructure sites through an innovative observation and forecast system that provides accurate information on the potential risk and magnitude of overland flooding prior to and during significant storm events.

“We have envisioned a road map to more accurate flood forecasting by creating an ensemble of forecasts that, when brought together, provide unprecedented levels of accuracy and uncertainty quantification,” explained Stevens professor Alan Blumberg, director of the university’s Davidson Laboratory and principal investigator for the initiative. Key participants with Blumberg include Stevens professors Nickitas Georgas and Thomas Herrington.



The Stevens-developed Storm Surge Warning System records and depicts rising floodwaters at the southern tip of Manhattan during the height of Superstorm Sandy on October 29-30, 2012.

The resulting integrated flood observation and forecast system will extend the NY/NJ Harbor (NYHOPS) coastal monitoring system and Stevens Storm Surge Warning System, both previously developed at Stevens to better equip New York and New Jersey to forecast and prepare for storm impacts. The award also includes the purchase of a Hewlett-Packard scalable supercomputer that will reside in the new Hyperscale Supercomputer

Center, presently under construction, as well as the purchase and installation of 26 new sensors deployed in New York Harbor. The sensors will measure water levels, temperature and salinity every six minutes and transmit data in real time to the Stevens supercomputer.

Communication of forecasts to the public will be a key aspect of the research, said Blumberg. The new system will create dynamic, web-based informational materials that relate real-time and forecasted flood levels to local flood benchmarks.

“The forecasts must be communicated to the public in a way that they are easily understood. Decisions whether to shelter in place or evacuate, or even where to move your car, can be made with confidence once this system is fully deployed,” Blumberg noted.

“This contract represents a very meaningful partnership between the Port Authority and Stevens, a partnership built upon years of close collaboration in technology development to ensure navigation safety, maritime security and environmental stewardship,” said Michael Bruno, Dean of Stevens’ Schaefer School of Engineering and Science. “We are looking forward to the opportunity to develop and apply the leading-edge tools needed to assist the Port Authority in the protection of their critical infrastructure.”

The research will be conducted within Stevens’ newly-formed Center for Coastal Resilience and Urban Xcellence (CRUX). CRUX Director Alex Washburn will work closely with Blumberg and colleagues to better understand the interaction of the metropolitan New York City region with the environment and local populations in order to create better interventions that reduce environmental threats.

DHS Taps Stevens Expertise

Stevens selected to co-lead center for maritime research

Stevens has been selected as co-lead institution for a Center of Excellence for Maritime Research (CMR) in collaboration with the University of Alaska Anchorage after a lengthy review process conducted by the U.S. Department of Homeland Security (DHS).

The Center’s work will address challenges in the maritime domain, including those posed by the increased and increasingly diversified use of maritime spaces such as security, risk assessment and mitigation, and the potential for increased conflicts among maritime users, stakeholders and interests. Working closely with DHS, industrial partners and fellow Centers of Excellence nationwide, the CMR will develop new thinking and research to identify ways of protecting and creating transparency along coastal regions and inland waterways, integrating information and intelligence among stakeholders in the process.

Possible areas of inquiry could include enhanced communications and sensing networks, reduced response times and enhanced workforce capabilities during crisis situations.

“This award comes after a nearly year-long competition that challenged our researchers and education staff to demonstrate the impact of their present work, and to articulate their vision for the next five years,”

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explains Michael Bruno, Dean of the Schaefer School of Engineering and Science. “We are proud that the Department of Homeland Security has chosen our team to take on the serious technical and policy challenges faced on a daily basis by the Department and in particular by our primary customer, the U.S. Coast Guard.”

The CMR will facilitate collaboration with partner institutions including Massachusetts Institute of Technology, Florida State University, Louisiana State University, the University of Connecticut, the University of Puerto Rico-Mayagüez and Elizabeth City State University.

“The funding is a significant boost to Stevens’ R&D efforts in maritime security and ocean observations,” notes Bruno.

DHS Centers of Excellence were established by the Homeland Security Act of 2002 as a coordinated, university-based system to enhance the nation’s homeland security.



Center for Coastal Resilience and Urban Xcellence (CRUX) director Alex Washburn

NIMBLE NETWORKER

Stevens-developed SpiderRadio router technology could revolutionize communications in emergencies and developing nations



Emergency communications have long been a vexing problem, one thrown into sharp relief during the attacks of 9/11, Superstorm Sandy and the Boston Marathon bombings, when both emergency and personal communications were severely compromised.

Now Stevens researchers and students may have crafted an elegant yet practical solution.

SpiderRadio, a low-cost, cloud-based router, is currently being tested both in the U.S. and abroad with support from the National Science Foundation (NSF) and National Institute of Justice (NIJ) under the direction of Stevens researchers Rajarathnam ‘Mouli’ Chandramouli — Thomas Hattrick Chair Professor of Information Systems and recipient of a recent honorary degree from Stevens— and K.P. ‘Suba’ Subbalakshmi, a professor of electrical and computer engineering.

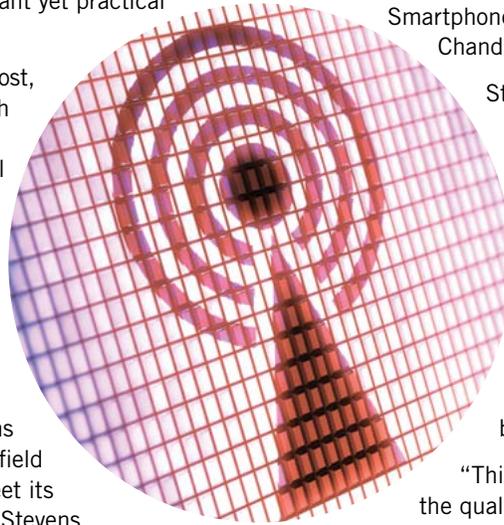
“SpiderRadio is another example of how Stevens faculty bring their research from the lab to the field to solve pressing problems and help society meet its technological needs at the global scale,” notes Stevens Provost and University Vice President George Korfiatis.

The wireless router uses two levels of ‘sensing’ mechanisms to intelligently predict potential losses of network connectivity and switch applications from one network to another. It also automatically grants priority access to first responders’ communications during

emergencies, and can sense and seamlessly switch among available networks and spectra to keep communications unbroken.

Crucially, SpiderRadio can operate on any available spectrum — including LTE, 3G, 4G, 5G and WiFi — in any given location, making the technology both portable and flexible. During disasters when cellular base stations are damaged (as happened during Superstorm Sandy), the router can even allow residents to share their home networks with emergency personnel if they so choose.

Smartphone applications are likely to follow, says Chandramouli.



Stevens recently donated a prototype router and server to the Brookline, Massachusetts police department for testing during crisis situations. Foreign nations are also taking notice. The government of South Africa, in collaboration with the University of Pretoria (UP) and Stevens, will fund a pilot test of SpiderRadio as a solution to that nation’s pressing need for low-cost, broadband Internet access in rural settings where conventional fiber or copper line-based Internet is not practical.

“This technology has great potential to improve the quality of life for millions of people living in rural areas, both in the U.S. and abroad,” notes Michael Bruno, Dean of the Schaefer School of Engineering and Science (SES). “Regions that rely solely on wireless communications are particularly vulnerable to degraded and disrupted service. SpiderRadio addresses this critical need in an elegant way, while also supporting applications that will improve emergency response.”

The competition will be juried by an advisory panel of makers, professional designers and emergency-aid organizations. The Stevens researchers aim to develop new technologies that aid the sharing and innovation process while also sparking fresh collaborations among professional designers, fabricators and makers — groups that rarely work side-by-side in online settings.

Nickerson also received a second \$399,000 NSF award for collaborative research to be performed with MIT Sloan School of Management. The MIT/Stevens team will focus on ways of organizing online communities to solve large-scale social problems. The organizational forms to be studied are examples of open innovation, a process through which crowds and members of online communities are encouraged to share, modify and combine each others’ ideas in the service of collective goals.

- Yingying Chen, a research expert in wireless networks and smartphone applications, received two new NSF awards to serve as principal investigator on projects in smartphone application privacy leakage and

driver safety while using mobile devices. The privacy project will address growing privacy concerns by detecting, modeling and visualizing the personal data that ‘leaks’ from smartphone apps in real time. It will also touch upon the personal, psychological and social factors and consequences related to privacy leakage.

Chen’s driver-safety research will expand upon and refine her previous work toward the development of a ‘guardian angel’ system in drivers’ smartphones that can intervene and prevent distracting texting and other behaviors that contribute to some of the nation’s 30,000 annual traffic fatalities. (For more on this technology, see the Summer 2014 issue of IMPACT.)

Chen will collaborate with Rutgers University’s Wireless Information Network Laboratory (WINLAB), Florida State University and Robert Wood Johnson Medical School, among other parties, during performance of the two research projects.



Noted Stevens Cellular Biologist Receives Jess Davis Research Award

Investigator describes cellular portals that may enable leukemia, HIV to infect humans

Joseph Glavy, an assistant professor of chemical biology and an investigator of key cellular structures and pathways that may enable pernicious diseases such as HIV and leukemia to invade the body, has been named the 2014 recipient of the Jess Davis Memorial Award for Research Excellence.

The award is named for Jess Harrison Davis, who served as the fourth president of Stevens from 1951 until 1972.

Glavy's special area of research focus is the nuclear pore complex (NPC) — fundamental, portal-like components of cell nuclei that may hold crucial insights into disease transmission and potential medication delivery. In December of 2013, Glavy co-authored a detailed study of the NPC's structure that landed on the cover of the prestigious research journal *Cell*.

"Once you know the structure of the nuclear pore, we can better understand the processes that it undertakes related to normal function and disease," explains Glavy. "The more we understand about its normal state, the more we can know about potential drug delivery and viral infections that use this system to infect the nucleus of cells."

Glavy joined Stevens in 2007.

"Joe's seminal work on cell nuclei is providing us with extremely promising new clues to disease pathways and mechanisms, and we are fortunate indeed to have him as a member of our Stevens faculty. He is extremely deserving of this recognition," says Mo Dehghani, Stevens Vice Provost of Research.

New Grant Initiatives To Support, Spark Pathbreaking Research

Two newly created research award initiatives will seed-fund and spark leading-edge, interdisciplinary Stevens faculty research for more than 20 faculty members over the course of the 2014-2015 academic year.

The inaugural Ignition Grant Initiative (IGI) awards, of \$20,000 each, will enable 19 faculty to better develop and acquire the resources necessary to support projects in five cornerstones of the Stevens Strategic Plan: healthcare and medicine, sustainable energy, financial systems, defense and security, and STEM education. Successful proposals included projects to price energy markets; image burn wounds; assess cyberthreats; detect financial fraud; create infection-resistant biomaterials; and enable quantum computing advances.

The IGI hopes to spark faculty members and teams to create new ideas and robust proposals targeting relevant funding opportunities of \$1 million or more.

"Faculty might choose to use ignition grant resources to author more fully developed research proposals, to take advantage of pre-award services or to obtain informal peer review of working proposal drafts from colleagues," explains Mo Dehghani, Stevens Vice Provost of Research. "We believe that any of these steps, alone or in combination, increases an investigator's chances of success in an increasingly competitive environment."

A second grant series created by Stevens Provost George Korfiatis, the Digital Learning Ignition Grant Program (DLIGP), will create and support a research community around the area of personalized digital learning (PDL) — a major new thrust area of research at Stevens. New tools and technologies could enable students to pursue lectures, readings or multimedia materials according to their individual learning styles, for instance; other potential applications might enable remote control of laboratory facilities and experiments at a distance.

Three DLIGP awards of \$60,000 each have been awarded to Stevens faculty for academic year 2014-15. These awards will support pilot projects to replace textbooks with a new data-driven engine forwarding rich mixtures of content individualized for students and to improve undergraduate calculus instruction through use of a new 'intelligent digital tutor' that automatically assesses students' homework and problem-solving in order to recommend tailored instruction.

"Our ultimate goal is the development of at least one collaborative, multi-disciplinary, multi-million dollar proposal for submission to a nationally recognized funding organization by next spring," noted Provost Korfiatis. "And we have every confidence that, given the tremendous quantity and quality of research being performed by Stevens faculty, we will achieve or exceed this goal."

ABOUT STEVENS

Stevens Institute of Technology, *The Innovation University*®, is a premier, private research university in Hoboken, N.J. Within the university's four schools, more than 6,300 undergraduate and graduate students collaborate with more than 350 faculty members to advance the frontiers of science and leverage technology to confront global challenges. Stevens is home to four national research centers of excellence, as well as joint research programs focused on critical industries such as healthcare, energy, finance, defense, maritime security, STEM education and coastal sustainability. The university is consistently ranked among the nation's elite for return on investment for students, career services programs and mid-career salaries of alumni.

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COLD COMFORT

Stevens provides key logistical support to Antarctic researchers

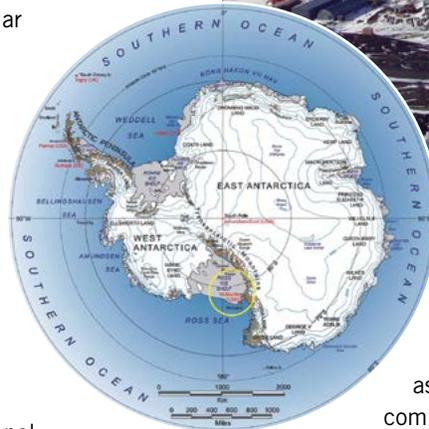
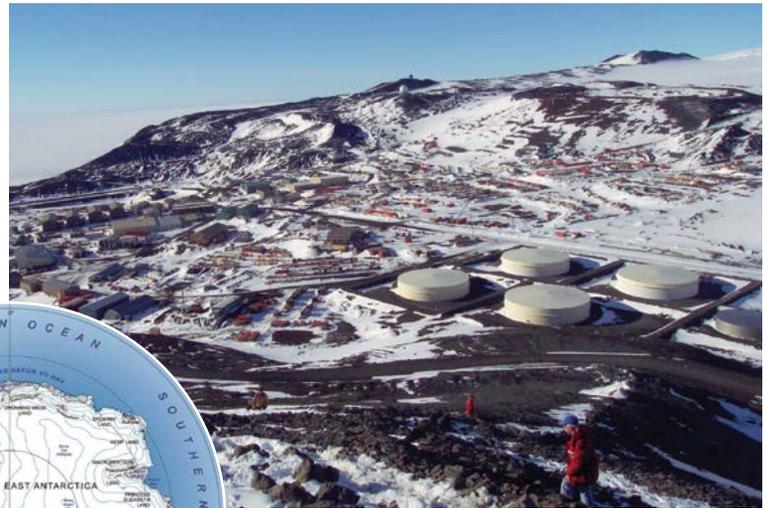
It's remote, icy, and inhospitable. For researchers, however, Antarctica is a natural laboratory providing a singular opportunity for investigation. Anywhere from 800 to 1,200 American researchers spend time on the continent each year, approximately 150 year-round, relying upon a long and complex supply chain of specialized ships, planes and other vehicles traveling long distances with the materials that enable research and sustain life.

Now Stevens is playing an important role in facilitating that research.



In conjunction with Lockheed Martin and the National Science Foundation (NSF), Stevens assists with the Virtual Antarctica project developing simulations of operational processes and activities at McMurdo Station, the Antarctic's largest research center and one of three permanent U.S. stations on that continent. Virtual Antarctica combines databases, models, simulations, sensors, crowdsourcing and other metrics to create dashboards, apps and other tools that enable researchers and their suppliers to make intelligent decisions in the harsh environment.

"Tackling the logistical challenges of supporting scientific research at the highest, driest, coldest, windiest and emptiest place on Earth is a Herculean task," says Mo Mansouri, an assistant professor in the School of Systems and Enterprises (SSE) and Stevens project lead for Virtual Antarctica. "Our goal at this stage of research is to test and evaluate scenarios in a virtual environment and create critical intelligence that will enable better decision making for logistics at McMurdo Station: medical facilities, communications, transportation, shipping, emergency response, housing, food services, science support, environmental protection, research vessels and much more.



"We want to create a system that gives us all the information that we need by collecting data."

A five-member engineering management Stevens student team assisted with logistical modeling as part of a Senior Design Project, deploying the computational power and other resources of SSE's Center for Complex Systems and Enterprises (CCSE).

The student team developed simulations that optimized the shuttle operations transporting passengers from Antarctica's Pegasus airstrip to the McMurdo base station.

"The project was a great opportunity to work on a small portion of a huge real-world problem, and to apply our systems knowledge to an important cause," said Dylan Feldman '14, a member of the team.

The project has wider implications, as well.

"Creating a detailed, multi-layered model for an isolated 'urban' environment, and testing the properties of such an interconnected network of activities, provides us plenty of opportunities to define new problems, test hypotheses and apply innovative solutions," Mansouri adds. "But environments such as McMurdo Station can also be used as a test bed for solutions that could one day be applied to other urban systems.

"In this way, the Virtual Antarctica project may become a gateway to many other research projects in the realm of 'smart' cities."