

Center for the Environment



C L A R K S O N U N I V E R S I T Y

A N N U A L R E P O R T - 2002 - 2003

AN INTERDISCIPLINARY ADVANTAGE



Susan E. Powers

Clarkson University recently celebrated the inauguration of its sixteenth President Dr. Anthony G. Collins. Tony is the individual most responsible for the creation and evolution of our Center for the Environment. He began his academic career at Clarkson in 1982 in the Department of Civil and Environmental Engineering, where he joined a handful of faculty members with active research programs in water quality and treatment. Subsequently, he became a driving force in development of the collaborative interdisciplinary activities in research and learning that are now a defining feature of the Center.

On a personal note, through my own undergraduate and master's-level research under his direction, I developed a keen awareness of the unique and special attributes of Clarkson's environmental research programs.

The Center retains many hallmark qualities that I initially experienced in the environmental engineering program: high professional standards; collaboration among faculty that results in world-class research and helps attract top-notch new colleagues; mentoring of graduate students that leads to national recognition of their work; and fostering of undergraduate research and projects to stimulate and inspire younger students.

However, the Center has grown beyond its early environmental engineering roots. We have redirected activities to involve colleagues from a range of disciplines aimed at preserving and restoring environmental quality over many scales. Continued growth in our M.S. and Ph.D. programs in Environmental Science and Engineering will help this evolution towards truly interdisciplinary graduate opportunities.

Meanwhile, our scholarship is achieving notable recognition. During the past year, faculty members affiliated with the Center brought in over \$5 million in external funding and published six book chapters and 65 journal papers.

Significantly, we are still energized by the academic team spirit I first encountered while working with Tony Collins. Using that collaborative model, we strive to maximize the quality and impact of our work in accordance with the theme that now guides Clarkson's Wallace H. Coulter School of Engineering: "Technology Serving Humanity."

A handwritten signature in black ink, appearing to read "Susan E. Powers". The signature is fluid and cursive.

Susan E. Powers
Director, Clarkson Center for the Environment
Professor, Civil and Environmental Engineering

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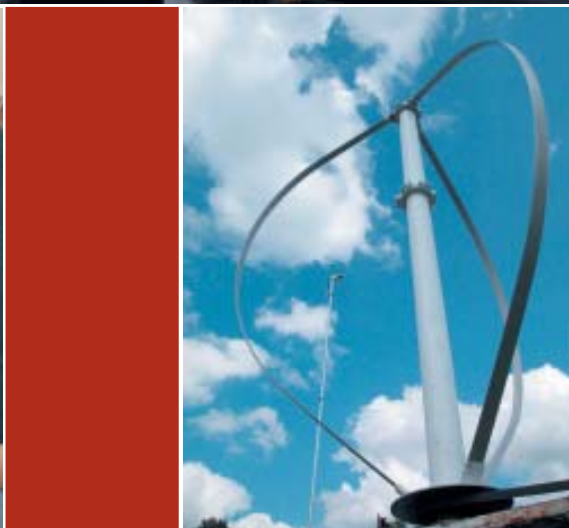
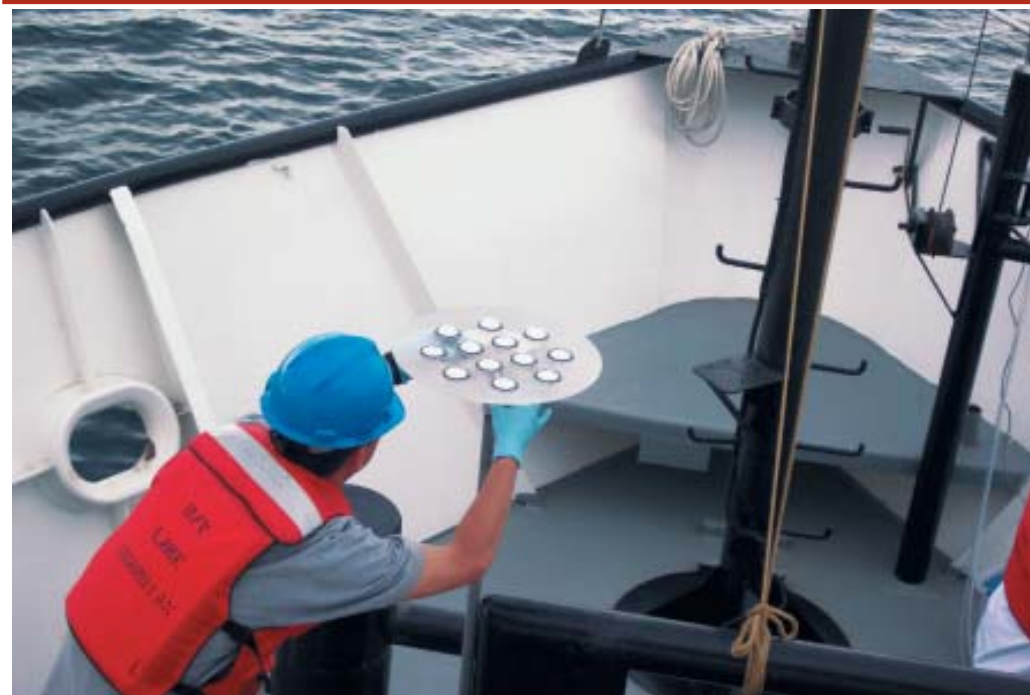
Clarkson Center for the Environment

Director, Susan E. Powers

Associate Director, William Vitek

Front cover: (Center) Clarkson University undergraduates Marilyn Gonzalez (CSTEP program, Environmental Science & Policy) and Kim Ogden (McNair Program, Biology) capture a snapping turtle while participating in a summer research internship with Dr. Tom Langen.

(Top) Prof. Phil Hopke, Director of Clarkson's Center for Air Resources Engineering and Science (CARES) is developing better ways to address the health and ecological effects of air pollution.



Air Resources Engineering and Science

CARES is applying expertise in air sampling,
chemical analysis, and fluid dynamics



CARES Director Hopke aims to create one of the most technologically advanced and complete centers of air quality research in the world.

Center for Air Resources Engineering and Science

One year after its creation, CARES has established itself as a major center for air quality research, attracting significant financial support, acquiring state-of-the-art instruments and assembling an international team of top-notch scientists and researchers.

complex and with so many variables as air pollution, is through a multifaceted approach,” explains Philip Hopke, internationally renowned air quality researcher who is the director of CARES and the Bayard D. Clarkson Distinguished Professor of Chemical Engineering and Chemistry.

“There are thousands of chemical species in the air, and not all airborne particles are toxic or have the same levels of toxicity,” Hopke observes. “The dispersion and concentration of pollutants in the air is affected by wind and weather patterns. Our challenge as engineers and scientists is to determine which particles are toxic and to track down the sources of the pollution. The conclusions we draw will profoundly affect environmental policy and government regulations.”

To meet the challenge, CARES has assembled an interdisciplinary team of chemical, environmental, and mechanical engineering researchers and occupational and environmental health specialists.

“Our goal is to create one of the most technologically advanced and complete centers of air-quality research in the world,” says Hopke.

State-of-the-art instruments and innovative techniques

Construction has been completed on a 6,000-square-foot facility that includes offices and climate-controlled laboratories. Additional space is used to house an aerosol wind tunnel to study the aerodynamic characteristics of air particles, and new analytical instruments and specialized computer systems to enhance capabilities for experimental and computational fluid dynamics.

The Center may already be the best known in receptor modeling, a data analysis method designed to identify pollution sources and their contributions to measured environmental concentrations.

The CARES computational facilities will include a Beowolf cluster of 64 CPUs with a primary emphasis on computational fluid dynamics. The system is designed to calculate fluid motion in complex geometries such as

the human respiratory system and the dispersion patterns of particles to understand their transport and deposition.

The Center is also acquiring analytical equipment to provide significantly enhanced capabilities for chemical analysis of environmental samples, with a primary emphasis on atmospheric particle samples.

“When you collect airborne particles, you have this complex mixture coming from different sources and they all have patterns of chemical species,” says Hopke. “We take

CARES Co-Director Ahmadi uses computational fluid dynamics to study wind patterns.



those samples and use advanced instrumentation and chemometric techniques to pull them apart into their likely profiles, determining how much of these sources contributed to the mass of particles.”

A multifaceted approach to problem solving

These techniques and instruments provide CARES scientists with the necessary tools to identify what proportion of the airborne particles comes from sources of given types, such as diesel trucks or coal-burning power plants.

Hopke and CARES Co-Director, Goodarz Ahmadi, the Robert R. Hill Professor of Mechanical Engineering, have applied these methods to air-quality research near the Peace Bridge, a major trucking route between the U.S. and Canada.

Situated at the mouth of the Niagara River, the Peace Bridge carries more than 6.6 million passenger vehicles and almost 1.4 million commercial vehicles annually. Traffic congestion at the border causes even more fumes from idling diesel trucks to escape into the air.

While Ahmadi has used computational fluid dynamic tools to study the wind patterns that distribute air pollution in nearby neighborhoods, Hopke has been collecting data to determine the composition of the samples in an area located about 100 meters to the northwest of the border plaza, where an increase in childhood asthma has been reported by pulmonary physicians and health officials.

“Certain types of respiratory illnesses have been linked to air pollution. We are hoping to examine the relationship between the exposure to particles and incidence of asthma,” explains Hopke. “It is much too early to determine whether a cause-and-effect relationship exists, but the initial evidence is compelling.”

Interdisciplinary team of experts and researchers

Assembling a team of top-notch researchers is also a major priority for the Center. CARES draws on the expertise of more than 15 Clarkson faculty members and specialists in

aerosols, particle deposition, aerodynamics, chemistry, and environmental and occupational health.

Joining the Center as laboratory director is Kaisheng Jiao, Ph.D., an analytical chemist and an expert in liquid chromatography/mass spectrometry. Jiao served in the research department of U.S. Smokeless Tobacco in Nashville, Tenn., and was a postdoctoral associate at Massachusetts Institute of Technology. As laboratory director, Jiao will lead the development of the analytical facilities at CARES.

Over the past year, CARES faculty has received \$3.5 million in external funding and has published some 48 original research papers in professional and peer-reviewed journals.

Making public policy

The data collected and analyzed by CARES scientists will likely affect how air pollutants are classified, as well as how environmental regulations are developed at the federal, state and local levels. This focus on research that could directly influence public policy and human health is one of the most striking features of CARES.

“There is no question that the research we are involved in today will help build a better scientific framework for policymakers to make informed regulatory decisions,” says Hopke.

“Sophisticated air pollution monitoring facilities, like CARES, that incorporate the latest technology provide more complete and useful data on which to base critical decisions in the future,” says Hopke.

“The more specifics we can gather on what’s causing the air pollution, its components and how it effects human health, the better we can target and regulate the problem sources,” adds Hopke.



Prof. Holsen aboard the Lake Guardian pursuing collaborative international air pollution research.

Measuring the Effects of Air Contaminants On Great Lakes Pollution

Decades ago, several of the Great Lakes were considered “dead” owing to massive industrial pollution. Years of environmental regulation have revived the lakes, but various pollutants, including heavy metals and PCBs, remain too high for lake fish to be consumed in unlimited quantities or by pregnant women. The goal now is to identify more precisely the current sources of Great Lake pollutants so as to bring their levels down to acceptably safe levels.

“The thinking now is that for many pollutants the deposition of chemicals from the atmosphere may actually be the primary source of pollution in the Great Lakes,” says Thomas Holsen, professor of civil and environmental engineering at Clarkson.

Over the last two years, investigators from Clarkson have made three 10-day trips aboard the 180-foot research ship, the *Lake Guardian*, as part of an international effort to measure air pollution over Lake Ontario, the furthest downstream of the Great Lakes.

Holsen and fellow researchers from Clarkson, SUNY Oswego, SUNY Fredonia, and Canada are participating in The Lake Ontario Air Deposition Study (LOADS), a joint U.S.-Canadian air-monitoring project.

The scientists collect air, rain, and water samples. The samples are then taken back to laboratories such as the ultra-modern CARES facility at Clarkson, and analyzed to determine the amount of air pollutants entering the lake environment.

Acquiring these data pose a special challenge because the quantity of pollutants drifting down from the sky at any one location is quite small. In order to overcome this difficulty, the *Lake Guardian* lies at anchor for up to 24 hours at a time while taking in large quantities of air through specially designed sampling devices. This process allows pollutants to be collected in sufficient quantities to allow scientists to make a thorough and accurate analysis. A land-based site in Sterling, New York, has also been collecting rain, snow and air samples for the last year.

“We are looking for specific contaminants, including mercury, PCBs, dioxins, and certain pesticides,” says Holsen. “Once we have identified the contaminants and examined the region’s wind and weather patterns, we will create a numerical model that we can use to determine how much pollution is entering the water and track down the sources of the pollution. This information is needed to continue cleaning up the Great Lakes, the largest fresh water reservoir on the planet.”

LOADS is sponsored by the U.S. EPA and Environment Canada.

Sustainable Energy

ENERGY

Clarkson is using an integrated systems-based approach



REU student Jessica Swanson conducts tests of multi-blade wind turbine designs in the Clarkson Subsonic Wind Tunnel.

- ◆ International collaboration by Clarkson faculty on research projects from green electricity in Norway to energy efficiency in South Africa, affect energy policy in the U.S. and abroad.
- ◆ Graduate student Jonathan Otter's work on wind power earns him a top prize at IEEE's student research competition.
- ◆ Undergraduate Nadeeka Yapa to receive the prestigious Goldwater Scholarship based on her research in improving the efficiency of motors.



Undergraduate Goldwater Scholar Nadeeka Yapa '05 (EE) with research mentor Prof. Pragasen Pillay, who guided her research project in ways to improve motor efficiency using algorithms.

Across the Clarkson campus, faculty and students are engaged in interdisciplinary research and education initiatives designed to address one of our nation's greatest challenges today: How to provide cleaner, affordable and renewable sources of

energy while preserving our natural world and encouraging economic development.

Clarkson scientists, engineers and economists are seeking practical answers by applying a *systems-based* approach to renewable energy research.

"Evaluating energy alternatives for our nation's future requires a comprehensive analysis that integrates patterns of energy consumption, economics, costs to consumers, regulatory requirements, environmental impacts, and reliability of the energy sources," says Susan Powers, Director of the Clarkson Center for the Environment.

Integrated systems-based research initiatives

Clarkson scientists and engineers are applying this systems-based approach to state-of-the-art research in power and transportation. (See sidebars.)

And they are collaborating with experts

in government policy and economics and partnering with private sector firms and governmental and nongovernmental organizations. The relationships with industry and government are vital to ensure that research conducted today in laboratories and in the field will result in innovative technology and new approaches that are cost effective, support environmental regulations, and have commercial potential.

"One of the problems right now is that 'green' energy tends to be more expensive to produce than conventional forms of energy," explains Frederic Menz, Professor of Economics and an expert in energy policies. "But the relative economic cost of renewable energy becomes more equivalent if environmental destruction and the depletion of natural resources are counted in the cost of conventional electricity."

Menz spent 2002 as a Fulbright Scholar in Norway working on a four-country study of renewable energy policies funded by the government of Norway. He has investigated green electricity market developments in the Netherlands, Germany, Sweden and the United States to assist in the formulation of policies to promote increased use of green electricity in Norway to meet that country's objectives for reducing greenhouse gas emissions and to ensure sustainable and secure energy supplies for the future.

For Clarkson researchers, that commitment extends beyond the laboratories and into the classrooms.

Education initiatives

Project-based learning opportunities provide Clarkson students and outreach partners a chance to explore sustainable energy options.

Recently, students in a senior Integrated Design course developed an experimental fuel saving concept into a viable device that reduces tractor-trailer drag and could revolutionize the trucking industry. Their work led to graduate research and efforts to commercialize this innovation. Early road tests indicate that the attached cavity saved approximately one-half-mile-per-gallon, an increase in fuel efficiency of about 10 percent.

Clarkson is also involved with area public schools in a K-12 project-based learning partnership program that brings together engineering college mentors and middle school students in team-based, hands-on learning projects focused on environmentally related problems.

One partnership provides an exciting curriculum that addresses energy-related issues and demonstrates the systems approach to energy problems.

With funding from the GE Foundation, Clarkson students have been working with local teachers to develop a 10-week integrated science, math and technology curriculum entitled *Energy and the Environment*. The curriculum will be considered for national distribution through Project Lead the Way.

Middle school students are challenged to recommend a source of electric power for a new house on a property not served by the power grid. They must consider environmental, economic and social constraints and reflect these in their final recommendations. This project emphasizes that an engineering career really can have a positive outcome on our world, a message that is particularly important for attracting young students from under-represented populations into engineering.

Wind Power Increasing the efficiency of small horizontal axis wind turbines

Full scale wind turbine tests are conducted at the Clarkson Wind Turbine Test Facility near the Potsdam airport. Meteorological and wind turbine performance data is recorded every second.



Researchers in Clarkson's Departments of Mechanical & Aeronautical Engineering and Electrical & Computer Engineering are engaged in a multidisciplinary effort to explore ways to increase the energy production and efficiency of small, homeowner-sized wind turbines through innovative multi-bladed rotor designs.

The goal is to help farmers in rural areas cut energy costs by using renewable resource technologies, such as wind power, to become less dependent on the grid for electricity.

"We are conducting experimental and numerical studies to evaluate the impact of solidity and blade number on the aerodynamic performance of horizontal axis wind turbines," explains Ken Visser, Assistant Professor of Mechanical & Aeronautical Engineering.

Visser, along with his colleague Pragasen Pillay, the Jean Smith Newell Distinguished Professor of Electrical and Computer Engineering, is heading up the research team.

"Small wind turbines have largely adopted the three-blade, low solidity design philosophy of large utility-scale machines. But research has shown that aerodynamic performance can be improved by

increasing the solidity and blade number beyond current configurations," adds Visser. "Our research looks at ways to increase the potential to extract more energy at lower wind speeds, reduce rotor noise and lessen blade erosion."

A wind research facility originally created some 30 years ago to explore the feasibility of farm silo-mounted Darrius vertical-axis turbines has been recently refurbished for use in the project.



The AETEG Project team: Prof. Marc Compeau (Bus.), Prof. Brian Helenbrook (ME/MS), graduate Research Assistant Madhov Karri, and Prof. Eric Thacher (MAE).

Thermoelectric energy recovery from light trucks

recovers energy in the exhaust from light trucks and passenger cars.

"Automobile waste recovery could improve the fuel efficiency of combustion engines," explains Eric Thacher, Associate Professor of Mechanical and Aeronautical Engineering (MAE). "The system we are developing uses a thermoelectric generator (TEG) installed in the exhaust pipe to convert up to about five percent of the energy in the exhaust into electric energy and feed it to the vehicle's electric load." Thacher and his team have subcontracted with Hi-Z Technology Inc., to build the TEG. Hi-Z Technology is independently developing thermoelectric technology that could increase the TEG's conversion efficiency up to about 20 percent.

"The most attractive market for this technology is the fleet vehicle operators such as UPS," adds Thacher. "Vehicles in such fleets generally drive about 65,000 miles per year. The money saved per vehicle per year we estimate as \$335 for the current technology and \$1,172 for the improved technology, not to mention the environmental damage avoided by burning less fuel."

Thacher and his team have completed the design phase and are preparing to install and test the prototype AETEG using a 1999 Sierra pick-up truck on loan from General Motors. Delphi Automotive Systems is donating use of its wind tunnels and services for the test runs.

Funded by a grant from NYSERDA, a team from Clarkson's engineering and business schools is engaged in a project to design, build, and produce a commercialization plan for an automobile exhaust thermoelectric generator (AETEG) system that

Undergraduate Research

Clarkson mentors guide students in
NSF-funded research projects



Undergraduate Belinda Clarke, a double major in Environmental Health and Biology at Iowa Wesleyan College, measures exposure to atmospheric pollutants in an indoor environment.

Research Experience for Undergraduates Programs

Highly competitive, intensive and challenging, Clarkson's Research Experience for Undergraduates (REU) programs provide select groups of ambitious undergraduates from across the country the chance to spend 10 summer weeks working closely with engineers, scientists and graduate-student mentors on high-level research projects.

Funded by the National Science Foundation (NSF), Clarkson operates two REU program sites; one on the Clarkson campus that focuses on environmental science and engineering, the other in China, where students work on projects linked to marine science and engineering. Both programs have recently been renewed by the NSF, attesting to their success and the exceptional quality of the students' completed research.

REU - environmental science and engineering

Established in 1998, Clarkson's REU program in environmental science and engineering provides opportunities for participants to work on independent projects related to the sustainable management of environmental systems.

More than 90 students applied for 10 slots in the highly competitive program in summer 2003. Students who did participate came to the Clarkson campus from as far afield as Virginia Polytechnic Institute, Michigan Technological University, University of Colorado, and the University of California at Berkeley.

"I applied for the Clarkson REU program because I eventually plan on going to graduate school and was looking for an opportunity to get some real laboratory experience," says Michael Beaver, a chemical engineering junior from Lehigh University in Pennsylvania.

Michael worked under faculty adviser Ruth Baltus, Professor of Chemical Engineering,

on a "green chemistry" project that looked at the solubility of organic solvents in room temperature ionic liquids.

"My favorite part of the research is that it was pretty revolutionary. No one really knows much about the ionic liquids I was working with. I felt like I was involved in something that could actually make a difference in society someday,"

Michael adds.

Other 2003 projects included measuring human exposure to pesticides, examining levels of toxic chemicals in Great Lakes fish, and improving efficiency of small wind turbines.

At Clarkson, REU participants are assigned faculty mentors under whom they must complete an independent research project. The student researchers work in the field and in state-of-the-art laboratories. They must write and submit a research report and

participate in group research meetings. In addition, the University hosts a symposium during which students make oral and poster presentations. Faculty advisers also encourage the participants to publish their original research in peer-reviewed journals.

The Clarkson program also includes two seminar series. A sustainability series provides students with broader perspectives on the social and economic aspects of sustainability. Another series focuses on research methodologies, presentation skills, and graduate school opportunities.

Most of the more than 56 students who have participated in the Clarkson REU program over the last five years have continued their education at top-ranked graduate schools. They point to their experiences in the REU program as playing a pivotal role in their decision to pursue a career in engineering and the sciences.

REU - marine science and engineering in China

Learning to communicate effectively is a special challenge for the 15 highly qualified

REU students from Clarkson visit a market in China. Clarkson's REU-China program has completed three successful years.



students who are selected each summer to spend 10 weeks in China conducting research projects related to marine science and engineering.

Clarkson Professors of Civil and Environmental Engineering Hung Tao Shen and Hayley Shen direct the program in cooperation with Dalian University of Technology and Ocean University of China.

Initially funded in 2000, the Clarkson REU program in Marine Science and Engineering was the first undergraduate research site program in China to be sponsored by the NSF.

Forty-five students representing 30 American universities participated in the program over three summers. Their research projects included both physical and environmental aspects of marine science and engineering. To date the students have published over a dozen journal and conference papers based on their research. The majority of the participants are continuing their education at top-ranked graduate schools. Some are pursuing their graduate studies abroad.

"The students have a unique opportunity to work on valuable, advanced-research topics with distinguished scientists within a culture and educational system very different from their own," explains Hayley Shen. "Our participants must be highly motivated and open to new ideas, new challenges, and new ways of solving problems."

Gayle Willis, an REU-China participant in 2001, was subsequently awarded an NSF Graduate Fellowship to support her graduate work in environmental engineering at Georgia Tech.

"It was an amazing experience," Gayle continues. "I grew to greatly appreciate the kindness and patience of my Chinese colleagues and to understand the cultural differences between Chinese and American research environments."

Willis worked with a scientist from Dalian University of Technology on research

that focused on the effects of sandbars on ocean waves. Her experiences in China provided her with the confidence to return to Asia last summer for five months to work on air pollution research in Hong Kong and the adjacent Chinese province of Guangdong.

"Having lived and worked in China, I felt comfortable going back to Asia and traveling on my own and setting up equipment at seven monitoring sites," she explains. "I would never have been able to do this without my REU experience."

Indeed, an important feature of the program is experiencing Chinese culture and life outside of the laboratory. Students participate in social activities, visit historical and cultural sites, and learn to adjust their pace to the rhythms of daily life in China.

"Overall, the program provides a crash course in acculturation and the experience of doing research with international researchers. And there are benefits for the Chinese researchers, too," Shen points out. "Working with American students provides them with a better understanding of the differences in education and training between U.S. and Chinese students."

University officials in China would seem to agree. In 2002 Chinese administrators developed a reciprocal program that will send their students to the United States to conduct research for two months.

"This new initiative makes our REU program a truly bilateral exchange," adds Shen.

Turtle Tracking



Mary Wright locates a snapping turtle by radiotelemetry while participating in the summer Research Experience for Undergraduates (REU) Programs in Environmental Science and Engineering at Clarkson University.

"I loved working in the field everyday and working with the turtles in the lab," says Mary Wright, a junior biology major from Bowdoin College in Maine and REU summer 2003 participant.

Wright worked with Clarkson Assistant Professor of Biology Tom Lengen and several Clarkson undergraduates on a Turtle Demography Study. The research team spent six weeks tagging and tracking turtles, as part of a larger three-year research project that will assess the impact of roads on the demography of turtles.

"I was looking for a summer internship that combined biological fieldwork and environmental studies," explains Wright. The Clarkson program, and Professor Lengen's project in particular, presented the perfect opportunity to get some firsthand experience."

Wright spent much of her time collecting roadkill, poking around roadside ditches, and wandering waist-deep through marshes holding an antenna over her head in an effort to collect data that will help researchers assess the area's total turtle population and determine what percentage of that population is being killed on roads.

There are three species of turtles in the marshes under study by Lengen and his students: snapping, painted and the threatened Blanding's turtles. Turtles lay their eggs on land, preferably in dry, sandy areas near marshes. As it turns out, roadside berms make attractive nesting sites.

"Turtles are actually drawn to the roads. More roads and more traffic mean more turtles get killed. If young adult turtles are killed before they have a chance to reproduce, there will be a noticeable decline in the turtle populations in the area," explains Tom Lengen.

While Wright genuinely appreciated working on a project that focused on a real local environmental problem, she was particularly excited by learning firsthand the challenges involved in orchestrating a biological study.

"I liked working in the wetlands and learning to radio track," she says. "Working with the larger snapping turtles was especially exciting. At times they were difficult to handle, but it was very rewarding to track and locate them in the swamps because of all the hard work that went into tagging them. I also had a few valuable lessons in problem solving, such as what to do when a 35-pound snapping turtle got loose in the back of my car!"

For Wright, the summer research experience also clarified her professional aspirations. "The experience reinforced how much I love studying biology," says Wright. "I plan to attend graduate school and pursue an advanced degree in aquatic or marine ecology."

"I learned so much this summer and worked with so many wonderful people," adds Wright. "Witnessing Prof. Lengen's dedication as a field biologist was profoundly important. It was an experience I would not trade for the world!"

Faculty and Student News and Achievements

New faculty contribute to interdisciplinary research



Andrea Ferro

Andrea Ferro has joined the Department of Civil and Environmental Engineering as an Assistant Professor. Ferro received her Ph.D. from Stanford University in 2002. Her research interests include indoor air quality, resuspension

of particulate matter, human exposure to pollutants, environmental justice, VOC and odor-control technologies.

Kathleen Fowler has been appointed an Assistant Professor in the Department of Mathematics and Computer Science. Fowler earned her Ph.D. from North Carolina State University. Her areas of expertise include nonlinear equations, temporal integration, numerical analysis, and optimization centering around applications in hydrology: flow in unsaturated porous media, optimal design for remediation and water supply, and multiphase simulation.



Kathleen Fowler

Peter Jaques has been appointed an Assistant Professor in the Department of Biology. He earned a Ph.D. in Environmental and Occupational Hygiene from New York University. His areas of expertise include the measurement of environmental and industrial exposures to particulate matter, and associated gases, in healthy and compromised individuals.

Stephan Vachon is Assistant Professor of Operations and Information Systems in the Clarkson School of Business. He received his Ph.D. from the University of Western Ontario. His research interests include the linkages between supply chain management and environmental management, environmental management in the service industry, and quality management.



Stephan Vachon

Grimberg spends year at EAWAG

Stefan Grimberg, Associate Professor of Civil and Environmental Engineering, spent the 2002-03 academic year at the EAWAG (the Swiss Federal Institute for Environmental Science and Technology) in Switzerland through a grant from the National Science Foundation.

Grimberg and EAWAG collaborator Jan Roloef van der Meer worked on the development of a biosensor to test for the biodegradation of polycyclic aromatic hydrocarbons (PAHs).

Clarkson students receive awards

Cory McDowell, a graduate student in environmental engineering, received the second-place award in the Association for Environmental Engineering and Science Professors (AEESP) Annual Master's Thesis Award Competition for his master's thesis: "Effects of Ethanol on the Migration and Distribution of Gasoline in the Vadose Zone."

Civil & Environmental Engineering seniors Laura Bertrand and Will Stradling each received a \$2000 scholarship award from the New York Section of the American Water Works Association at their annual banquet in May 2003. Bertrand was presented with the John C. Robbins Scholarship and Stradling received the Walter B. Sinnott Scholarship.

Electrical & Computer Engineering graduate student Jonathan Otter received first place in the Master's Category at the IEEE Power Society's 2003 Student Poster-Paper Contest for his poster "Improving Efficiency in Small Wind Turbine Systems."



Jonathan Otter



Will Stradling and Laura Bertrand, both senior Civil & Environmental Engineering students, each received a \$2,000 scholarship award from the New York Section of the American Water Works Association.

Environmental Science and Engineering Ph.D. students Amanda Lavigne and Ryan LeBouf, were both awarded ExxonMobil Scholarships by the Clarkson Center for the Environment for their research in the area of Strategic Environmental Management.

Senior Nicole Berney, an environmental and occupational health major, was awarded the Karen Olmstead '84 Memorial Scholarship established by the Halson Corporation in memory of Olmstead's 11 years of service as an industrial hygienist. Berney was chosen based on her high academic achievement and her dedication and enthusiasm for the profession of industrial hygiene.

Clarkson students drive alternative-fueled vehicle to top-place finishes at national Tour de Sol

The Clarkson University Solar Knights drove their alternative fueled vehicle to top-place finishes at the 2003 Tour de Sol: The Great American Green Transportation Festival held during National Transportation Week (May 10-14).

Organized by the Northeast Sustainable Energy Association, the annual three-day road-rally competition took place in New Jersey, Pennsylvania and Washington, D.C. The Clarkson team received three awards, including first place in the Electric Vehicle with Advanced Battery Prototype Division category and third place in the Most Efficient Light-Duty Vehicle category. Their vehicle was also one of three cars named in the Most Innovative Vehicles category. The Clarkson students' vehicle, which featured a rechargeable battery complemented by a solar array, can travel approximately 55 miles on local roads and up to 70 miles on highways before recharging is necessary.

Clarkson receives environmental monitoring equipment

Quest Technologies Inc. of Oconomowoc, Wis., donated over \$30,000 worth of gas, vibration, heat stress and noise monitors that are currently used in the environmental and occupational health laboratories at Clarkson. The gift was facilitated by Clarkson alumnus Daniel Webster '69, President of Quest Technologies.

Center for the Environment grants support three research projects

The Center for the Environment awarded three grants totaling more than \$12,000 to Clarkson faculty in support of research that advances environmental programs and the mission of the Center.

Grant recipients and projects included: Assistant Professor of Biology and Director of Environmental and Occupational Health Program Alan Rossner and Assistant Professor of Physics David Wick's "A quantitative assessment of the sampling bias associated with a capillary-canister flow sampler;" Assistant Professor of Physics Igor Sokolov, Associate Professor of Civil and Environmental Engineering Stefan Grimberg, and Assistant Professor of Chemistry Anja Mueller's "Nanoscale Force Measurements for Studying Bacteria/NAPL Interactions;" and Professor of Chemical Engineering Ruth Baltus' "Solubility of Organic Solvents in Room Temperature Ionic Liquids."

Hopke reappointed chair of EPA Committee

Philip K. Hopke, Bayard D. Clarkson Distinguished Professor of Chemical Engineering and Chemistry has been reappointed Chair of the Clean Air Scientific Advisory Committee (CASAC) of the Environmental Protection Agency (EPA) until 2004.

CASAC is responsible for reviewing the scientific basis for air-quality standards covering the major pollutants (particles, ozone, carbon monoxide, sulfur dioxide, nitrogen oxides, and lead). The committee is reviewing the problem of airborne particulate matter, the basis for ozone regulations and the overall EPA air-quality management strategy.

Zander receives American Society of Civil Engineers Award

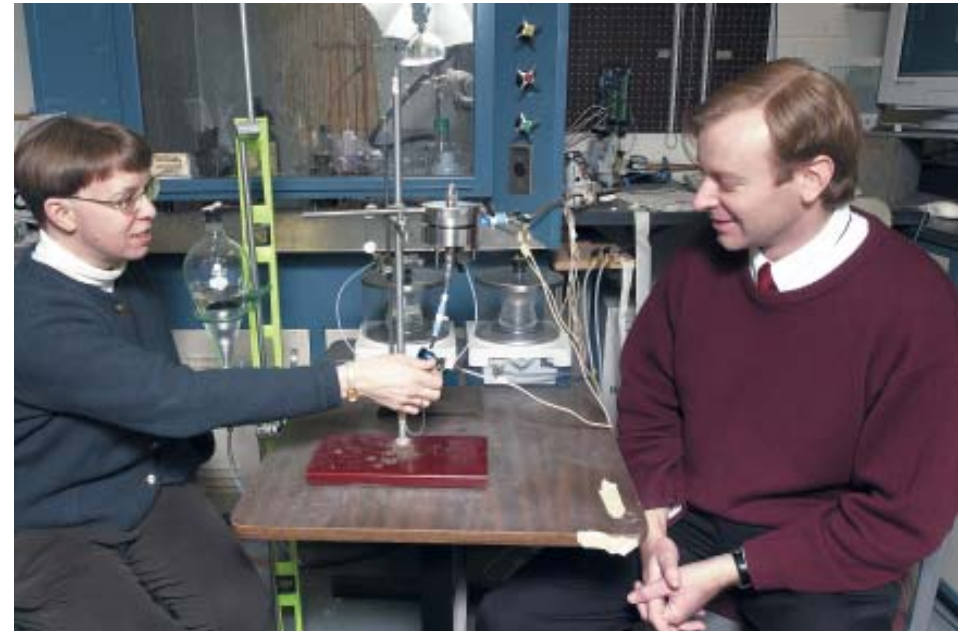
Amy K. Zander, Professor of Civil and Environmental Engineering, has received the 2003 Samuel Arnold Greeley Award from the Environmental and Water Resources Institute, a division of the American Society of Civil Engineers. The annual award is given for the article that makes the most valuable contribution to the environmental engineering profession.

Zander's article, "Standardized Membrane Pore Size Characterization by Polyethylene Glycol Rejection," was published in the May 2002 issue of the Journal of Environmental Engineering. Zander makes an argument and presents a method for standardizing the classification of pore sizes in drinking water treatment membranes. Two former Clarkson graduate students, Christopher T. Cleveland '99 and Thomas F. Seacord '98, are co-authors.

Fulbright Scholar visits Clarkson laboratory

Robert Niven, a Fulbright Scholar from the University of New South Wales, Canberra, Australia, was a guest in the laboratory of Susan Powers, Professor of Civil and Environmental Engineering and Director of the Clarkson Center for the Environment, from January through February 2003. Niven is developing a new approach to understanding the flow of oil contaminants in natural soils that he believes will be more accurate than existing mathematical models. The two researchers shared their different approaches to studying oil-contaminated soils. Niven described the collaboration as a marvelous opportunity and identified Powers as "a pioneer in the study of oil contaminated soils."

Susan E. Powers and Robert Niven discuss experimental apparatus in her laboratory for measurement of relative permeability and capillary pressure of oil and water in a porous medium.



(Right) Ryan Chafin, a summer intern working in the research lab of Dr. Twiss (Biology), commences an experiment designed to refine water-quality criteria for the metal thallium, a pollutant of emerging concern. Chafin's work-study at Clarkson was supported by the NSF-Research Experience for Undergraduates programs, a grant received from the NSF by Drs. Grimberg (Civil and Environmental Engineering) and Langen (Biology).



(Above) Instructor Dr. Twiss demonstrates the operation of a submersible "rosette" water sampler to students participating in the Lake Ontario Great Lakes Science Practicum, September 2003. During the eight-day field course, students were instructed in advanced methods of limnological analysis focusing on microbial ecology, sampling methods, and ornithological surveys. Students cruised Lake Ontario onboard the R/V *The Lake Guardian*, the primary environmental research vessel of the U.S. Environmental Protection Agency Great Lakes National Program Office.

CLARKSON QUICK FACTS

- Location** — Potsdam, New York, in the foothills of the Adirondack Mountains near the St. Lawrence River
- History** — Founded in 1896 as a memorial to Thomas S. Clarkson, a pioneering businessman
- President** — Anthony G. Collins
- Campus** — 640 acres, 49 buildings
- Enrollment** — 2,700 undergraduates, 350 graduate students from 40 states, 49 countries
- Faculty** — 170 full time
- Schools** — Arts and Sciences, Business, Engineering

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