Center for the Environment

CLARKSON UNIVERSITY

ANNUAL REPORT 2003 - 2004

MESSAGE FROM THE CO-DIRECTORS

AN INTERDISCIPLINARY ADVANTAGE

Philip Hopke and Thomas Holsen, Co-Directors

The Clarkson Center for the Environment has enjoyed another exciting year of growth and development, and its achievements have been recognized at the national level. In its latest graduate program rankings, *U.S. News and World Report* placed Clarkson's graduate programs in Environmental Engineering/Environmental Health 23rd in the United States. We are ahead of schedule in achieving our goal of a top-20 ranking by 2007. We have continued to add high-quality junior faculty of outstanding promise and are expanding our capabilities in environmental management with a new M.B.A. program in "green supply chain management," an initiative that exemplifies the kind of interdisciplinary collaboration in both research and teaching that is our hallmark strength.

Center faculty members have completed a productive year in terms of scholarship, having published more than 200 articles, and having obtained more than $4 million in external grants and contracts. Numerous faculty have received individual recognition, as noted on the following pages. For example, Prof. Susan Powers received the National Science Foundation's Director's Award for Distinguished Teaching Scholars for her pioneering use of project-based learning at middle schools through doctoral levels. Prof. Philip Hopke has ascended to the presidency of the American Association for Aerosol Research, the world's largest society devoted to aerosol science technology. Broadly, we have continued to strengthen our programs and campus components, including most notably Clarkson's interdisciplinary Center for Air Resources Engineering and Science (CARES).

In preparation for a sabbatical leave during the past year, Prof. Powers stepped down from her role as Director of the Center for the Environment, and our search for a new permanent director is underway. We thank Sue for her past leadership of the Center. Her vision and energy has made the Center a nationally recognized leader in the environmental area. We look forward to working with her and the rest of the Center faculty in the coming months as the evolution of the Center continues.

Philip K. Hopke
Co-Director, Clarkson Center for the Environment
Director, Center for Air Resources Engineering and Science
Bayard D. Clarkson Distinguished Professor
Chemical Engineering and Chemistry

Thomas M. Holsen
Co-Director, Clarkson Center for the Environment
Professor, Civil and Environmental Engineering

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Front cover: **(Center)** Undergraduate researchers Stacey Crawford and Jason Woodruff monitor traffic and air sampling equipment near the Peace Bridge in Buffalo, N.Y. **(Top)** Joseph Osso Jr., a graduate student in the Environmental Science and Engineering Program, processes a water sample from Upper Cascade Lake to measure dissolved oxygen as part of a study on the impact of road salt on Adirondack Lakes.

Left: **(Top)** Andrea Ferro in the mobile air-quality laboratory. **(Left)** Stefan Grimberg and students sampling soil at Huntington. **(Right)** Tom Young monitoring the discharge from Lower Cascade Lake on an Adirondack spring day.

Air Resources Engineering and Science

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

Center for Air Resources Engineering and Science

CARES researchers are using advanced technology in laboratories and in the field to develop new methods for determining human exposure and susceptibility to potentially harmful airborne substances. Their research promises to improve human health and inform policy decisions.

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

Developing better ways to address the health and ecological effects of air pollution is the mission behind Clarkson's Center for Air Resources Engineering and Science (CARES), a major U.S. center for air-quality research.

CARES is a founding member of the New York Environmental Quality Systems Center, a network of 12 research institutions, which received a $15 million grant from New York's Office of Science, Technology and Academic Research (NYSTAR) to study air quality.

"The presence of contaminants in the atmosphere can produce a wide variety of adverse effects including increased mortality and morbidity in the public, deterioration of buildings and monuments, acidification of lakes and rivers, and forest and crop damage," says Philip K. Hopke, Bayard D. Clarkson Distinguished Professor of Chemical Engineering and Chemistry and CARES Director.

"Although we have substantially improved the ambient air quality over the past 30 years, there are still a number of problems that are attributed to air pollution," adds Hopke. "Recent studies have found strong correlations between changes in particle concentrations and increased mortality. There has been a sharp rise in childhood asthma, which has been linked with air pollution, but its causes are as yet unknown."

At CARES, an essential part of estimating the risk to human health from environmental agents is determining the *exposure* of individuals or a population to a potentially harmful substance in the air.

The Center has been actively developing its capabilities to do exposure assessment to airborne pollutants by attracting significant financial support for related research, acquiring state-of-the-art instruments, and attracting promising young scientists to its team of top-notch researchers.

In the past year, two new faculty members, Andrea Ferro and Peter Jaques, with research interests in this area, have joined Hopke in the development of exposure assessment tools. The scientists are working with other chemical and environmental researchers and occupational and environmental health specialists to bring an interdisciplinary approach to a complex problem.

"Part of our interest in exposure assessment research is to support the goal of the NYSTAR Environmental Quality Systems Center to improve health care and performance through the development and application of advanced technology to improve environmental quality," says CARES Director Philip Hopke.

Personal Cloud

"The Environmental Protection Agency regulates the quality of outdoor (or ambient) air, but people spend the vast majority of their time indoors at home or work," says Hopke. "Thus, exposure assessment must include understanding the concentrations of pollutants in indoor and outdoor air and the time individuals spend in each of these environments."

Research studies have shown that personal exposure as measured on particular individuals

is typically higher than would be estimated from the indoor and outdoor air concentrations. According to Hopke, this "personal cloud" effect is still not well understood. However, recent work by Prof. Ferro published earlier this year in *Environmental Science and Technology* has suggested that resuspension of dust through the simple act of walking may lead in part to this increased exposure to particles.

Ferro and her co-researchers used particle detectors to monitor a base rate of undisturbed air and then measured the concentration caused by different activities. They applied a mathematical model to estimate contributions from various sources.

"We looked at the effects of resuspended dust particles on human exposure and the length of time pollutants remain in the indoor environment by measuring emission rates from human activities, including walking and vacuuming," she explains.

Further experimental work to test and refine the model will be done over the next several years with support from the EPA.

Exposure and Dose

Understanding the complex relationship between *exposure* and *dose* is central to the research currently underway in Prof. Peter Jaques' laboratory.

"Exposure is the product of the concentration of a substance with which a person has contact multiplied by the time (duration) of that contact," explains Jaques. "The amount of material deposited in the nose, throat and lungs and, thus, the potential for inducing adverse health effects depends on the characteristics of the pollutant, such as particle size, and personal characteristics, for example, breathing rates and individual lung geometry. So what we find is that two people exposed to the same concentration may not receive the same dose of pollutant."

Jaques is working to develop a system to measure the deposition of ambient particles in people's airways in order to understand how personal characteristics affect dose and why some individuals have greater susceptibilities to pollutants.

Professors Peter Jaques and Andrea Ferro discuss their sampling efforts in Buffalo, NY, in front of the Clarkson mobile laboratory.

Pilot Study

Jaques and Ferro are also collaborating on an initial study of exposure of the population in the vicinity of the Peace Bridge in Buffalo, N.Y., a major trucking route between the U.S. and Canada. [See sidebar.]

As past research has linked certain types of respiratory illnesses to air pollution, the team is looking at a possible cause-and-effect relationship between the high concentration of diesel emissions released into the air by commercial vehicles to an increase in asthma and respiratory illnesses in the adjacent population.

"We expect that more field, laboratory and modeling studies will be conducted at CARES in the future as we continue to develop our exposure assessment capabilities," says Hopke. "From such studies and the development of mathematical models of how pollutants get suspended and transported, it will be possible to estimate exposures in a larger population. This information, in the end, is critical to state and federal regulatory agencies developing strategies and policies to improve air quality and protect human health."

Measuring Exposure to Air Pollution Near the Peace Bridge in Western New York State

Researchers at Clarkson are looking at an urban population located near a major international trucking route to determine whether high levels of diesel emissions released in the air may be linked to recently reported increased rates of asthma in an adjacent community.

Situated at the inlet to the Niagara River in Buffalo, the Peace Bridge annually carries more than 6.6 million passenger vehicles and almost 1.4 million commercial vehicles between the U.S. and Canada.

Past research has linked certain types of respiratory illness to air pollution. In addition to polycyclic aromatic hydrocarbons, suspected carcinogens, diesel exhaust contains high levels of soot in the form of fine particle matter less than 2.5 micrometers in diameter ($PM_{2.5}$), which may have an adverse effect on human health.

According to Clarkson Assistant Professor of Environmental and Occupational Hygiene Peter Jaques, "This pilot study is our first step in determining whether a cause-and-effect relationship between diesel fumes and respiratory illness exist within this community."

Jaques and his colleague, Assistant Professor of Civil and Environmental Engineering Andrea Ferro, are working on a one-year pilot study funded by the Health Effects Institute to investigate the community's exposures to potentially harmful air particles related to diesel emissions.

The researchers are measuring particulate matter pollution at fixed sites, up- and downwind of the bridge and throughout the community, by using a mobile laboratory equipped with sophisticated instrumentation for collecting and measuring air samples and analyzing data.

Prof. Ferro also outfitted three volunteer residents with personal monitoring devices. The volunteers, who live approximately one-half mile northeast of the Peace Bridge Plaza Complex, wore the devices for 72 hours and recorded their activities in and out of the home every half-hour. The monitors collected time-integrated filter samples that will be analyzed in the CARES laboratory for mass, metals and elemental carbon/organic carbon.

The team is collaborating with investigators from the Harvard University School of Public Health who are conducting a related study. "We are working together to enhance overall efforts for the mutual benefit of both universities and in the public interest," Jaques says.

After completion of the one-year study, Jaques and Ferro will apply for additional funds to expand their air-quality research in Buffalo.

"Ultimately," says Jaques, "one of our goals is to assist public health officials and policy makers by providing scientific data that may be useful in their decisions that affect transportation, air quality, and our communities."

Joseph Osso Jr. processes a water sample used to measure dissolved oxygen as part of a study to examine the effects of road salt on Adirondack lakes.

Complex Environmental Systems

Clarkson is using an integrated systems-based approach

Understanding and Analyzing Interconnections

Interdisciplinary research teams at Clarkson apply a systems approach to understand and solve complex environmental problems.

A central challenge of environmental research is understanding how the physical, chemical, geological and biological processes of the Earth's natural systems are interconnected.

One of the most useful techniques to study these interconnections is with a *systems* approach, wherein the environment is seen and analyzed as a set of complex systems that function together and form integrated wholes or units.

"In a systems approach, plants, animals, soil, bodies of water, and the atmosphere are not studied separately, but as components of the complex environments they make up," says Thomas Holsen, Professor of Civil and Environmental Engineering. "It is the integrated approach, and the emphasis on relationships and linkages, that distinguishes the systems approach."

This interconnectedness among people, eco-systems and the biosphere requires analogous collaborations among environmental scientists and engineers, biologists, medical professionals, economists and chemical engineers to understand and resolve environmental problems.

At Clarkson, interdisciplinary research teams are working together and with scientists at other universities to preserve, manage and enhance the environment, as well as promote human health and well being.

Transport and fate of mercury in air, soil and water and its effects on aquatic health

Mercury is a toxic trace metal and its presence in the environment has been linked to human illness and ecological damage.

A 1997 Congressional report, which provided a quantitative human health risk assessment of mercury, estimated that between one and three percent of women of childbearing age in the United States eat sufficient amounts of fish for their fetuses to be at risk from mercury exposure.

"Over the last two decades, industrial activities have resulted in substantial emissions of mercury into the atmosphere," says Holsen. "The long-distance transport of these emissions appears to have caused widespread contamination of aquatic environments, and dangerously high levels of mercury in biota. But the link between atmospheric deposition of mercury and contamination of aquatic biota is, as of now, not well understood."

Improving our understanding of the transport, fate and bioavailability of mercury in atmospheric, terrestrial and aquatic environments is the goal of a joint research project among Clarkson University researchers and investigators from Syracuse University, Rutgers University, and the University of Massachusetts, Lowell. Clarkson's team includes Holsen; Stefan Grimberg, Associate Professor of Civil and Environmental Engineering; and Michael Twiss, Assistant Professor of Biology.

The research team is conducting the $2

(L-R) Honors student Chase Gerbig, graduate student Matthew Fox, and their advisor Professor Stefan Grimberg collect water and soil samples at Sunday Lake as part of a multiuniversity research project funded by the National Science Foundation (NSF) on the transport, fate and bioavailability of mercury in atmospheric, terrestrial and aquatic environments.

Sonia Mae Johns '06, collects a Hester-Dendy macroinvertebrate sampler in Upper Cascade Lake, as part of a study on the impact of road salt on Adirondack lakes.

million, National Science Foundation-funded study over the next five years in Clarkson's own backyard: the Adirondack region of New York, an acid-sensitive forested area with high concentrations of mercury in fish relative to other lake districts in eastern North America.

"We know that mercury enters an area primarily as atmospheric deposition," explains Twiss, "and that once the mercury is carried to the soil or lakes by the hydrologic cycle, it can enter into anoxic, or oxygen-poor, environments where it is transformed into methyl mercury by the action of microbes. The methyl mercury form is very toxic and lipophilic (fat loving) so that it accumulates in organisms and can magnify up the food chain."

Existing research supports the scientists' hypothesis that the forest canopy strongly affects the magnitude and pathways of mercury depositions to forest eco-systems. Although mobilization and transport of mercury in forests seem to be closely coupled with organic carbon dynamics, little is known of the residence time and ultimate fate of mercury in terrestrial environments.

"While microbiological transformations clearly control the accumulation of mercury in aquatic biota, interconnections with major element cycles, including sulfur and carbon, and variable redox (reduction-oxidation) conditions make it difficult to develop predictive relationships," says Holsen. "Our research is an important step to developing a quantitative understanding of the inputs and pathways of atmospheric mercury deposition, the factors regulating the transport and transformation of mercury as it cycles through the terrestrial environment and the bioavailability of mercury in downstream aquatic ecosystems."

Holsen and Grimberg will conduct field studies at Huntington Forest and laboratory studies on soil binding and microbial controls on methylation/demethylation. Holsen will also work with Twiss and Syracuse University researchers on regional field studies of mercury deposition, accumulation in soil, and presence in water and biota of lakes.

The Cascade Lakes Project

In northern regions of the globe, road upkeep can be a major source of contamination of surrounding soils and water bodies as a consequence of spreading road salt, sand and other materials for winter road maintenance.

"Deicing roads is necessary to maintain safe travel conditions for motorists and travelers in cold regions during the winter months," says Clarkson Assistant Professor of Biology Tom Langen. "But road salt (sodium chloride) is readily transported through soil and into water bodies. Although non-toxic in low concentrations, at high concentrations it stresses plants and animals, ultimately eliminating native salt-intolerant species and promoting the growth of salt tolerant ones, including non-native invasive species."

Langen and fellow researchers associated with the Clarkson Center for the Environment and Paul Smith's College have formed a multidisciplinary team to assess the long-term environmental consequences of current winter road maintenance practices on soils and lakes in the Adirondack Park of New York State, and to identify alternatives that may be less environmentally harmful. Their research is focused on three lakes along New York State Highway 73, a heavily traveled mountain roadway and the main route to Lake Placid, a year-round tourist destination. The project is largely funded by the New York State Department of Transportation; the New York State Department of Environmental Conservation and the Adirondack Park Agency are also sponsors.

Joseph Osso Jr., a graduate student in the Environmental Science and Engineering Program, collects a water sample from Chapel Pond in the Adirondack Park, while CCE affiliate Tom Langen handles the boat.

The two lakes that are the primary focus of the study, Upper Cascade Lake and Lower Cascade Lake. These lakes also maintain the state's largest populations of round whitefish, a species that is classified as endangered in New York. In sampling the Cascade Lakes recently, the scientists have found concentrations of chloride that are 40 times higher than expected in Adirondack lakes, and the concentrations appear to be increasing.

"There has long been concern about environmental implications of heavy road salt and sand applications in the Cascade Lakes watershed," says Langen. "Environmental advocacy groups have pressured state agencies to alter road management activities. However, winter weather is exceptionally severe along this stretch of highway, and local residents and other road users are justifiably concerned that any changes in winter road management not reduce road safety."

"Our road salt study has led to a collaboration among researchers from two universities – whose expertise include limnology, ecology, and civil and environmental engineering – and policymakers from three state agencies," says Langen. Most importantly, the project should yield some definitive results and recommendations that will help keep the roads safe for motorists and protect the waterways and forests in the surrounding environment."

Greening Business
Curricula and Research

BUSINESS

An Environmental Bottom Line

Interdisciplinary courses and research projects in the Clarkson University School of Business consider business theory and practices in light of environmental management and sustainability.

Professor Vachon and environmental-track M.B.A. candidate Kelly Griffith discuss the facts of a case in OM671 - Supply Chain Environmental Management.

Educating future business leaders who will think beyond the bottom line is an important goal at the Clarkson University School of Business.

"With the planet's population expected to exceed eight billion people by 2020, it is imperative that business leaders around the world begin to adjust production processes and products to help reduce the strain on the natural environment," says Clarkson School of Business Dean Timothy Sugrue. "That's why we have decided to enhance our curricula by adding a new course that considers business operations and marketing in light of social responsibility and corporate citizenship."

Building on its nationwide reputation in supply chain management, the School of Business this spring introduced "Supply Chain Environmental Management," a new course offered to both undergraduate and M.B.A. students. The main purpose of the course is to teach future business leaders how to incorporate environmental considerations into business decision-making.

According to Stephan Vachon, Assistant Professor of Operations Management and the architect of the new course, students are asked to integrate an environmental management perspective into several aspects of business management including corporate strategy, technological investments, and marketing planning.

"The students examine more than 16 international cases in different industrial settings, each with a distinctive set of circumstances," explains Vachon. "By looking at actual managerial challenges of integrating different stakeholders' interests, students are required to balance the financial, environmental and social aspects of the business operations."

This new course, along with an environmental economics class taught by Professor of Economics Fredric Menz, are the building blocks of a new concentration offered within the one-year M.B.A. degree at the School of Business.

"We want to attract students with an undergraduate degree in environmental science or environmental engineering who would like to gain valuable managerial skills," says Peter Diplock, Director of the M.B.A. program.

In addition to the "greening" of the curriculum at the School of Business, Clarkson faculty are also involved in interdisciplinary research projects in the area of environmental management and technology.

One study currently underway at Clarkson's Center for Global Competitiveness looks at the relationship between quality practices and investment in environmental technologies. Researchers have collected data that will be used to analyze correlations among various quality management practices and the spending patterns in environmental technology.

"We are trying to assess, for example, whether an organization emphasizing failure prevention in their quality practices would be more inclined to invest in pollution prevention technologies, which imply product or process modification, rather than end-of-pipe and other control technologies," says Vachon.

This project emerged from a larger research program on the impact of supply chain management activities on environmental technologies investment that was initiated a couple of years ago by Vachon and Robert Klassen, Associate Professor and Hydro One Faculty Fellow in Environmental Management at the University of Western Ontario's Richard Ivey School of Business.

An article arising from this research program published in *Production and Operations Management* indicated that strategic interaction between a plant and its major customers was associated with greater investment in pollution prevention technologies.

K-12 Project-Based Learning Partnership Program

Joseph Tari '04, MS ECE, works with students on the design of a water-powered turbine. (Left) Brian Lowes, MS Engineering Science, works with students in an 8th grade technology class on the design and optimization of a wind turbine.

National Recognition for an Innovative Approach

Educating the next generation through problem-solving initiatives that promote an understanding of energy sources and management.

The next two decades will see dramatic changes in how we supply and use energy. Whether its drilling for oil in the Alaska National Wildlife Refuge or developing a hydrogen fuel cell car by 2010, engineers, scientists, managers, politicians and the general public are increasingly being called on to assess and make decisions about our energy needs and their environmental impacts.

"Educating children today about these issues is one way to ensure that tomorrow's generations are prepared for important policy decisions involving energy that will have far-reaching consequences," says Susan E. Powers, Professor in the Department of Civil and Environmental Engineering. "And how we teach young people has a significant impact on the depth of their learning and their retention of knowledge and understanding."

Promoting technical and environmental literacy and an understanding of the processes used to make rational energy decisions from a *systems perspective* are key features of the Center's K-12 Project-Based Learning Partnership Program. For the past four years, college students have been trained through this program to develop and teach environmental problem-solving curricula to students in area middle schools.

Clarkson students present middle school pupils with an open-ended problem. They must research all the facets of the problem, brainstorm possible solutions, and then test the most promising, cost-effective ones.

Led by Dr. Powers and supported by the National Science Foundation (NSF) and the GE Foundation, the program has received national recognition.

In February, the NSF announced their renewal of this project with nearly $2 million in funding to carry it forward for another five years. The renewal expansions include more math concepts under the direction of Department of Mathematics Chair Peter Turner, and a partnership with St. Lawrence University's Department of Education.

This June, Dr. Powers was recognized by the NSF for her pioneering use of project-based learning at middle schools through doctoral education levels with the Director's Award for Distinguished Teaching Scholars (DTS), the foundation's highest award for teaching and research excellence.

Research completed with the DTS award over the next four years will address the question: *What do we need to know about our energy future and how should we best teach this?* Middle school classrooms and interdisciplinary college classes will be the test beds to determine the energy-related learning objectives necessary to improve the energy and environmental literacy of our future workforce.

So what does the average person know about energy and its impacts on the environment?

Not much, according to widely cited survey on energy sources and management conducted by the National Environmental Education and Training Foundation (NEETF) in 2001. Of the 1,500 Americans surveyed, only 12 percent were found to have a "passing" knowledge about energy.

And, according to Dr. Powers, studies such as these often do not address more important questions related to energy systems and their impact on the environment.

"Instead of asking the public how many workers are employed each year in the coal industry, we might ask them to articulate what they understand of the relationship between the use of fossil fuels and increased carbon dioxide concentrations in the atmosphere," says Powers. "We want to identify what critical knowledge and decision support tools Americans will need to make informed choices regarding energy systems."

Take these quizzes to test your own environmental literacy:
NEETF: http://www.neetf.org/roper/Roper2002.pdf
DOE: http://www.eia.doe.gov/quiz/quiz.htm

Faculty and Student News and Achievements

Hopke completes term as chair of EPA committee and named AAAR president

Philip K. Hopke, Bayard D. Clarkson Distinguished Professor of Chemical Engineering and Chemistry, has become President of the American Association for Aerosol Research, the world's largest society devoted to aerosol science and technology. Hopke is also completing his fourth year term as chair of the Clean Air Scientific Advisory Committee (CASAC) of the Environmental Protection Agency. 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).

Young and Ahmadi named associate deans

Goodarz Ahmadi, Robert R. Hill '48 Professor of Engineering, was appointed Associate Dean for Research and Graduate Studies in the Wallace H. Coulter School of Engineering, effective April 1. As Associate Dean for Research and Graduate studies, he coordinates research and graduate study efforts and assists in faculty mentoring. Ahmadi is the Co-Director of the Clarkson Center for Air Resources Engineering and Science and a board member of the Center for Advanced Materials Processing (CAMP).

Thomas C. Young, Chair of the Department of Civil and Environmental Engineering, was appointed Associate Dean for Academic Programs in the Wallace H. Coulter School of Engineering, effective February 1. As Associate Dean, Young is coordinator and liaison for all academic programs in the School of Engineering, including engineering undergraduate and graduate programs. He also assists with the management of facilities utilization. Young joined the faculty of Clarkson in 1977 and was named Chair of the CEE Department in 1999.

Clarkson's CURE students Kevin Hickey '05, Deanna St. Onge '04, and Michael Cooper '04, compete at the 14th Annual Environmental Design Contest of New Mexico State University.

Second-place finish for Clarkson student remediation team at national competition

The Clarkson University Remediation Engineers (CURE) earned second place and a cash prize at the 14th Annual Environmental Design Contest sponsored by WERC: A Consortium for Environmental Education and Technology Development and held on the campus of New Mexico State University. The students developed a cost-effective treatment technology to remove perchlorate from small water delivery and domestic water systems. The Clarkson team was one of 20 collegiate teams from the U.S., Canada and Mexico that competed this year.

Clarkson students receive awards

Andrea Bellinger, a senior chemical engineering major, and Ryann Fisher, a junior interdisciplinary engineering and management major, each received a $750 scholarship award from the Central New York Chapter of the American Society of Safety Engineers. The students received the awards for academic achievement, in particular, work related to environmental safety and health.

Peter Olesheski, a senior environmental science and policy major, was honored with a citation of appreciation by the St. Lawrence Aquarium and Ecological Center for his contributions caring for fish and aquatic animals in his role as "volunteer animal curator."

Students pedal human-powered vehicle to third place in national competition

Clarkson University's Human-Powered Vehicle Team pedaled their uniquely designed three-wheel vehicle to a third-place finish at the 2004 American Society of Mechanical Engineers' Human-Powered Vehicle Challenge Eastern competition. Assistant Professor of Mechanical and Aeronautical Engineering Jeffrey A. Taylor was the team's faculty advisor. The vehicle featured a "reverse tricycle" design with two front wheels for steering and a single rear wheel that provided propulsion for the vehicle. The driver of the vehicle sat in a reclined seat and used a drive train driven by bicycle pedals for power along with 35 gearing choices to give the vehicle an average cruising speed of around 35 miles per hour, with top speeds near 50 miles per hour.

Adam Farver '05 demonstrates the human-powered vehicle's capabilities during initial testing.

Promotions and tenure

Brenton D. Faber of the Department of Technical Communications, **Kenneth D. Visser** of the Department of Mechanical and Aeronautical Engineering, and **Rick Welsh** of the Division of Liberal Arts have each been promoted to associate professor and granted tenure.

Faber's research interests are in the areas of discourse analysis related to social and technological change and workplace communication, with a special interest in organizational issues related to nonprofits.

Visser's research interests include aerodynamics, vortex dynamics, aircraft design, and renewable energy extraction. Major research projects include improving the efficiency of small horizontal-axis wind turbines, aircraft wing design optimization, aerial refueling implications for commercial transports, and drag reduction of tractor-trailers.

Welsh's research focuses on economic and social change and development with emphases on agriculture and food systems,

the sociology of science and technology, environmental sociology, and social movements and collective action.

Company to commercialize fine particle counting instrument developed in Clarkson lab

Rupprecht & Patashnick Co., which designs, manufactures and markets technologically advanced instrumentation in the areas of ambient air quality, diesel particulate exhaust, power plant emissions, and catalyst research received a $50,000 grant to commercialize measurement instrumentation originally developed in a Clarkson laboratory.

The Ultrafine Particle Counter, an instrument that is capable of measuring the concentrations of aerosol particles down to two nanometers in size, was developed in the Clarkson laboratory of Philip K. Hopke, Bayard D. Clarkson Distinguished Professor of Chemical Engineering and Chemistry. Hopke and his research team spent about four years developing a prototype in the laboratory with the more recent work done in collaboration with Rupprecht & Patashnick and with support and assistance from NYSERDA and Clarkson's Center for Advanced Materials Processing. The grant was offered through the New York Indoor Environmental Quality Center Inc.'s Commercialization Assistance Program (CAP).

Menz in residence at CICERO

Fredric Menz, Professor of Economics, was in residence at the Center for International Climate and Environment Research – Oslo (CICERO) during May and June working on green electricity and climate change research. Menz's research interests are in international pollution problems, environmental economics, and Canada-U.S. trade.

Twiss named interim director of Great Rivers Center

Michael Twiss, Assistant Professor of Biology, has been named Interim Director of Clarkson's Great Rivers Center. The Center was established by Clarkson in 1999 in partnership with the St. Lawrence Aquarium and Ecological Center (St. Lawrence University, Canton, N.Y.) and three SUNY campuses.

GRC Director Twiss working with summer intern Sonia Mae Johns '06 on toxic cyanobacteria.

The mission of the Center is to promote and support research related to environmental issues affecting the lower Great Lakes and St. Lawrence River, including eutrophication, toxic chemical pollution, and water resources management**.** The Center is an affliliate of the Great Lakes Research Consortium.

Clarkson to co-host AEESP Conference in 2005

Clarkson and Syracuse Universities will host the 2005 Association of Environmental Engineering and Science Professors (AEESP) Conference. The conference will be held on the Clarkson campus in Potsdam, N.Y., from July 23-27, with an optional pre-conference field trip scheduled in Syracuse.

The theme of the 2005 conference is *Pushing the Boundaries: Making research and education in environmental engineering and science count*. Some 250 people are expected to attend. The goal of the conference will be to increase each participant's awareness of the wide range of opportunities for environmental engineering and science professors especially in light of the recent multimedia and interdisciplinary research initiatives by federal funding agencies. Conference articles will be published in the journal *Environmental Engineering Science*.

Powers on sabbatical at DOE's Renewable Energy Lab

Susan E. Powers, Professor of Civil and Environmental Engineering, spent a six-month sabbatical leave appointment at the U.S. Department of Energy's National Renewable Energy Laboratory located at the National Bioenergy Center in Golden, Co.

Powers was also appointed to the U.S. EPA Science Advisory Board, Environmental Engineering Committee for a three-year term (2004-07).

Shen receives award from Canadian Geophysical Union

Hung Tao Shen, Professor of Civil and Environmental Engineering, received the R. Larry Gerard Medal from the Canadian Geophysical Union. Shen's research interests include river hydraulics and transport processes, river and sea ice processes, and mathematical modeling of surface water flow and transport processes. He is a past recipient of the Harold R. Peyton Cold Regions Engineering Award and the CAN-AM Civil Engineering Amity Award of ASCE. He is also Interim Chair of the CEE Department.

Center for Environment's $5,000 scholarship supports graduate student's research

Clarkson environmental engineering graduate student Ryan LeBouf was awarded the ExxonMobil Scholarship by the Center for the Environment to support his research into environmental and occupational exposure assessment of trace levels of chemicals in microenvironments.

Annual Environmental Geochemistry Meeting

CCE sponsored the annual Gananoque Environmental Geochemistry meeting held February 6-8, 2004, in Gananoque, ON. The conference was attended by students and faculty from Clarkson and several universities in Ontario and Quebec.

Powers receives NSF's highest award for teaching and research excellence; appointed to EPA advisory board

Susan E. Powers

Susan E. Powers, Professor of Civil and Environment Engineering, was recognized by the NSF for her leadership in energy-related education with the Director's Award for Distinguished Teaching Scholars, the foundation's highest award for teaching and research excellence. Powers received the award for her pioneering use of project-based learning at middle schools through doctoral education levels.

(Right) Jan DeWaters, Curriculum Development Coordinator for the K-12 Project-Based Learning Partnership Programs, illustrates the compressive force used to break concrete samples made with waste aggregate to 8th grade students from Parishville-Hopkinton Central School.

(Above) Clarkson Jean Newell Distinguished Professor of Electrical and Computer Engineering Pragasen Pillay and Professor of Anthropology Daniel Bradburd and four electrical engineering students participated in a 10-week summer research program in South Africa sponsored by the National Science Foundation. The students, under the direction of Prof. Pillay, were involved in renewable energy research, including determining the feasibility of integrating wind and solar systems to communities that cannot afford conventional electricity. Prof. Bradburd conducted research on changes in the students' attitudes based on their experiences. (back, L-R) Daniel Bradburd, graduating senior Luke Dosiek, rising senior Michael Snow, and Pragasen Pillay; (front, L-R) doctoral candidate Lotten Mthombeni, and rising senior Corey Simpson.

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, 47 buildings
Enrollment — 2,700 undergraduates, 350 graduate students from 40 states, 44 countries
Faculty — 170 full time
Schools — Arts and Sciences, Business, Engineering

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