MichiganTech

Civil and Environmental Engineering Department

International Sustainable Engineering Initiative

Mission: In the upcoming decades, engineers will play a critical role in the eradication of poverty and hunger and facilitation of sustainable development, appropriate technology, beneficial infrastructure, and social change. Our mission is to promote international sustainable development engineering by creating knowledge through research and nurturing and educating young people to value and implement this vision of a better world.

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GLOBAL FACTS:

- More than two billion people live on less than $2 per day.
- Every 10 seconds, 3 children die from preventable causes.
- More than one billion people lack access to safe drinking water.
- More than two billion people are without adequate sanitation.
- As many as 113 million children do not attend school.

INSIDE THIS ISSUE:

Our Students Around the World	2
Master's International Update	2
Master's International Students	3
Water for Mali	4
How to Help Engineer a Better World	5
International Senior Design Update	5
International Experiences are an Asset in the Workplace	6
Solar Pump in the Dominican Republic	6
From the International Senior Design Students	7
International Senior Design Mentors	7
Our Contributions to Sustainable Development	8

Engineering a Better World

Imagine a better world—a world where all have access to sanitation and potable water, where all children are able to learn in well built classrooms, where families no longer suffer from disease, starvation and poverty. Now make it happen. That's what civil and environmental engineering students are doing at Michigan Tech. The Master's International Program and the International Senior Design class are providing real opportunities for students to put their knowledge to use and create a better world.

Unique to Michigan Tech, the department's International Sustainable Engineering Initiative trains engineers to value community service and be prepared for the international marketplace. Also unique to our programs, students are conducting research and creating knowledge in the area of international sustainable engineering by publishing the results of their research.

International Senior Design students working with locals to build a water storage tank in the Dominican Republic.

Sustainable development is defined as the design of human and industrial systems to ensure that humankind's use of natural resources and cycles do not lead to diminished quality of life due either to losses in future economic opportunities or to adverse impacts on social conditions, human health, and the environment (Mihelcic et al., *Environ. Sci & Technol.* 2003).

Motivation for Change: At the 2002 World Summit on Sustainable Development (Johannesburg), world leaders reaffirmed the principles of sustainable development adopted at the Earth Summit ten years earlier. One outcome was de-

(Continued on page 4)

Michigan Tech Students Recognized Around the World

Helen Muga and Dan Nover by their award-winning poster for the Mondialogo Award.

Mondialogo Worldwide Engineering Award :
Awarded to civil & environmental engineering students for their research on sustainable construction materials in the developing world. Mondialogo is a partnership between Daimler Chrysler and UNESCO.
See http://www.sfi.mtu.edu/news-6-06-05.htm.

EPA People, Prosperity and Planet (P3) Competition:
The same team received honorable mention from the National Academy of Sciences at the P3 awards competition in Washington, DC.
See http://www.sfi.mtu.edu/news-6-06-05.htm.

Parsons Brinckerhoff Environmental and Water Resource Student Design Competition:
A 2004 International Senior Design team won 3rd place in this competition, coordinated by the ASCE Environmental & Water Resources Institute. Team members presented at the ASCE-EWRI Conference in May. http://www.admin.mtu.edu/urel/news/media_relations/382/.

Our Students Around the World

John Simpson served as a water and sanitation engineer in Honduras from 2001 to 2003.

Through the Master's International and International Senior Design Programs, Civil and Environmental Engineering seniors and graduate students have worked in 17 countries: Belize, Bolivia, Cameroon, Dominican Republic, East Timor, Ghana, Honduras, Jamaica, Kenya, Macedonia, Madagascar, Mauritania, Mali, Panama, Philippines, Uzbekistan, and Vanuatu.

"The concept of sustainable development would be impossible without the full input of engineers"
- Maurice Strong, Secretary General, United Nations Conference on Environment and Development, 1992

Master's International Update

Michigan Tech's Master's International Program in Civil & Environmental Engineering combines a graduate degree in civil or environmental engineering with 2+ years of training and engineering service with the U.S. Peace Corps.

The program is the only one of its kind in the United States and has attracted students from all over the country. This fall, the 14th student will graduate from the program. Over 24 students are enrolled and serving overseas; 12 additional students arrived on campus this year to complete coursework and begin their research prior to their Peace Corps experience. Students have served in 16 countries and have worked on a variety of projects related to water supply and treatment, wastewater treatment, solid waste management, public health training, construction, and water resource management.

A unique aspect of the program is the language and cultural training that Peace Corps provides. So far, 31% of students have become fluent in French, 42% have become fluent in Spanish, and 27% have learned another language.

A second unique aspect of the program is that the degree is research based. Besides making their research projects available on the Internet, students are now publishing their research studies in professional journals.

Graduates of the program have taken employment in several sectors that include: engineering consulting firms, U.S. federal government (Environmental Protection Agency and Indian Health Service), and overseas work with non-governmental aid organizations.

For more information, see www.cee.mtu.edu/peacecorps or contact the program director, Dr. James Mihelcic, 906-487-2324.

Ed Stewart served in Jamaica and defended his research on subsurface flow wetland sewage treatment systems this September.

Master's International Students in the Field and Beyond

In April 2005, **Milagros JeanCharles** swore in as a water and sanitation volunteer in Togou, Mali. She works with the town's Pilot Committee, and she plans on focusing her work on rainwater catchment projects.

Milagros came to the program with a BS in electrical engineering . Her decision to enroll in the Master's International program was simple: "I was attracted to this program because Michigan Tech is the only school in the country that offers [the Master's International Program] with an emphasis in engineering... I wanted to do the Peace Corps, I wanted to obtain my graduate degree, and I wanted to stay in engineering… I would say to those out there who don't know what to be- be flexible, be an engineer."

Milagros JeanCharles in her graduate Aquatic Ecology class

From 2002-2004, **Kelly Stanforth** worked as an engineer for the Ministry of Health of Jamaica, where she participated in policy discussions on medical waste treatment, wrote an onsite wastewater treatment manual, and helped a local fishermen's village develop a sanitation plan for a beach.

Kelly is now an engineer for Wetland Studies and Solutions, Inc. in Northern Virginia. Kelly draws on her Jamaican experience to help her in her work at WSSI. "We rarely had money to solve the environmental health issues across the island, so we had to be resourceful and efficient. At WSSI, I use that same creative thinking when I approach a stream restoration project."

Kelly now engineers projects similar to this natural w-weir.

Andrea Telmo was the first Master's International student to graduate from the program in August 2002. Her assignment was in the village of Gouansolo, Mali, where she served as a water/ sanitation engineer from 1999-2001. In Mali, her projects were focused on improving the village's water supply.

The Master's International experience influenced Andrea's career decisions: "When I returned, I wanted to work on rural water supply and sanitation in my own country—even in one of the most developed nations in the world, there are still people without safe and adequate water supply and sanitation." She went to work as an engineer for the Indian Health Service on the Navajo Reservation in Arizona. Now she is an engineer for Souder, Miller & Associates in Albuquerque, where she works on projects on the Navajo Reservation, Pueblos, and other small rural communities throughout New Mexico.

Andrea works in the area of small, rural water supply and sanitation.

"I would say to those out there who don't know what to be—be flexible, be an engineer."

Danny Hurtado was a Peace Corps volunteer in Panama, where he worked with small communities on projects such as composting latrines and water supply. He earned his Master's degree in March 2005, and he now works for CDM in the DC Metro Area.

"Although the differences in technology, work load and "corporate-ness" are vast, my time in Peace Corps has definitely given me an edge for work with a large consulting firm. In Panama, I was in charge of supplying water to a village. The project was small, but my responsibility to the villagers was huge. This type of project management can't be taught in school, and is usually not encountered fresh out of college. When you enter Peace Corps, everything is new: language, culture, projects, attitudes. This prepares you to thrive in situations where others may be intimidated by the unfamiliar, and makes you eager to succeed."

Danny is an engineer with CDM in Northern Virginia

Churches at Home Provide Water to Thousands in Mali

Brooke standing by the well and pump she helped install with the contributions of two U.S. churches

In May 2004, after eight months of planning, needs assessment, and organization with the residents of Sirakorobougou, Mali, Master's International student Brooke Ahrens and her husband, Jeff, began work on a well and pump project financed by their home churches. Oconee Associate Reformed Presbyterian Church in Seneca, SC and Red Rock Presbyterian Church in Hockessin, DE gave $13,000 total. The project included a geophysical study, drilling of a borehole, hardware installation, concrete work, and pump repair training for 2 residents. Before installation of the well and pump, the town's 500 residents had access to only one well, which dried up every year in the dry season, forcing residents to find water at a small stream 3 kilometers away. People washed, bathed, and watered their cattle in the same river, resulting in 15-20 fatalities due to cholera each year.

After a lot of sweat and hope to find water, the drilling was complete at 93 meters. Two weeks later, the project was complete with a concrete cover and a hand pump. Residents now draw their water from a protected, reliable source every day. This gives more time for farming and other activities, and saves money otherwise spent on medicine for cholera or diarrhoel sicknesses. Water quality affects every aspect of a person's life, from economics to health.

When the work was complete, Brooke and Jeff met with the elders of Sirakorobougou to make sure the community was satisfied. At the meeting, they learned that residents from the surrounding villages had been using the pump too…that's about 7,000 people with clean water!

This ventilated Improved double pit latrine is an example of an appropriate technology that can improve lives.

Engineering a Better World

(Continued from page 1)

velopment of Millennium Development Goals, an ambitious agenda for reducing poverty and improving lives. For each goal, one or more ambitious targets have been set, most for 2015, using 1990 as a benchmark. The Millennium Development Goals are clear and well defined motivators for changing the way we educate engineers. In fact, careful analysis of the Millennium Development Goals clearly indicates they are a call to the engineering profession to participate in creating sustainable solutions for the many problems facing the world.

Engineers need to be educated so they not only transform society to one that is more socially just, but also ensure that society learns to live within the carrying capacity of natural systems. In support of this idea, The World Federation of Engineering Organizations has stated that "engineers play a crucial role in improving living standards throughout the world. As a result, engineers can have a significant impact on progress towards sustainable development."

The solution to the world's many environmental and societal problems will require that engineers design and construct ecologically and socially just systems within the carrying capacity of nature without compromising future generations. These engineers of the future will have the opportunity to play a critical role in the eradication of global poverty and hunger and facilitation of sustainable development, appropriate technology, beneficial infrastructure, and promotion of change that is environmentally and socially just—our vision of a better world.

How to Help Engineer a Better World

As we continue to work toward our mission of nurturing and educating students to engineer a better world, we need your support. Students contribute significantly through tuition, travel (in the case of International Senior Design students) and course fees. However, more is needed to implement our mission. Please consider making a gift to the "International Sustainable Engineering Initiative." Your contribution will help the department achieve its mission and will qualify for a federal tax deduction (if you itemize). Michigan residents receive a bonus through the Michigan Tax Credit. Your gift qualifies for a 50 percent tax credit in the state of Michigan up to a $200 credit for a joint return or a $100 credit for a single return.

Send your gift to:

Michigan Tech Fund
P.O. Box 390
Hancock, MI 49930

Make your gift payable to the Michigan Tech fund and Be sure to earmark your gift for the "International Sustainable Engineering Initiative" in civil and environmental engineering.

If you have questions, contact Dale Kero, (906) 487-2937, Email at djkero@mtu.edu

See our website at http://www.cee.mtu.edu/sustainable_engineering.

International Senior Design Update

Two International Senior Design (ISD) classes each spent a total of 4 weeks in barrio Los Pinos on the outskirts of Santa Cruz Bolivia this summer. A total of 105 CEE students have now participated in the ISD program since its inception in 2001.

International Senior Design students constructing a two story classroom building in Santa Cruz, Bolivia this summer.

This year, the 23 students worked with locals to build 4 classrooms at Colegio Walter Henry. When the students weren't constructing, they were gathering essential data for their design projects. As a result, eight design teams will propose design solutions for two city storm drainage projects, a swamp land reclamation study, septic waste projects for 4 overcrowded governmental schools, and a structural analysis for a proposed building.

Students will produce an engineering study evaluating feasible solutions and prepare contract documents for their recommended option. Local government and school parent groups are eager to receive student reports to incorporate them in next year's budgets and plans. Students sincerely hope to see their designs realized, contributing to the improvement of the lives of those they now call "friends". Three former ISD Students returned as mentors: Marc Plotkin (2001), Tim Elmore (2002), and Tim Martin (2003). MTU ChE Alum Nancy Bach (1976) also joined us.

International Senior Design students laying bricks for the construction of classrooms in Santa Cruz, Bolivia

For more information, see: www.cee.mtu.edu/projects/ or contact program director, Linda Philips, (906) 487-3073 .

International Experiences are an Asset in the Workplace

ISD Mentor Nancy Bach and Bolivian Joselo Hierbas at the going away party for the International Senior Design trip to Bolivia this summer.

"students construct a personal foundation of … success!"

If I were hiring someone for an engineering job, I'd expect to see good technical skills. That's a given. If the candidate also has *proven* non-technical skills, he or she has a big advantage.

Business today is global. Clients and coworkers are diverse in language, in culture, in how they *really* do things – not how they're supposed to do things as taught in the classroom. If you've already shown that you embrace diversity and thrive in a dynamic not-fully-defined international environment, you have the advantage.

Communication is critical. Ideas and plans are shared in multiple languages, across many time zones, via electronic files or snail mail. If you've completed a project where you effectively listened to a client (in Spanish!) and converted his needs to appropriate engineering language and plans, you have the advantage.

In the real-world, things don't often go as planned. If you've already shown that you can be adaptable and develop better solutions under changing conditions, if you've demonstrated project management and time management, if you've taken your engineering skills out into the field and worked "hands on," you have the advantage.

Being an engineer is much more than knowing how to use a calculator (a slide rule in my early days!) If you've already worked with clients, professional peers, government officials; if you've experienced the fulfilling realization that this work you do as an engineer *really* helps *real* people, you have the advantage.

The International Senior Design students have these advantages. In their short but intense immersion helping the people of Santa Cruz, they build these non-textbook skills. They construct something material, yes. Even more important, students construct a personal foundation of passion and commitment, of constant discovery and excitement, of rewarding relationships, and of *success*!

I'd hire them!

- Nancy Bach graduated from Michigan Tech as a chemical engineer (1976) and has an MS in marketing from the University of Rochester (1985). She worked for Kodak for 28 years and is now a private management and training consultant. She accompanied an International Senior Design class as a mentor in Bolivia this summer.

Solar Panels Make ISD Project Possible in the Dominican Republic

Solar Panel donation was coordinated by MTU Alumnus Howard Barikmo, Photovoltaic Testing Laboratory at Arizona State University.

In May 2003, 12 International Senior Design students traveled to the Dominican Republic to design a pump assisted gravity system that would supply water to the people of a village called Rancho Viejo.

The following year, students in the 2004 ISD class returned to Rancho Viejo to construct the system. Their work was made possible through their own contributions of class fees, but also through the donation of tested solar panels from the Photovoltaic Testing Laboratory of Arizona State University.

This project provided water to 52 households, or 275 people in the community. Matthew Niskanen of Turner Construction, and current Master's International student, Lyle Stone assisted as mentors.

From the Students: Lessons Learned in the 2005 Bolivia ISD

Julie McNamara:

Julie is a senior from Swartz Creek, Michigan. After she graduates, she hopes to work in the area of building or bridge design and analysis.

"Though I am trying to keep the emotions of this project separate from the learned experiences, I feel that they go hand in hand... Someone said to me, 'look into the eyes of the children and there is your factor of safety.' It was then that I realized the true definition. I now understand the great responsibility that goes into the designing of a plan and I feel that that may be the most important lesson to learn... I feel that the next time I am given a project..., perhaps at my job, I will be more prepared for that feeling of total confusion and I will be able to look back on this experience and know how to move forward."

Parker Sovey:

Parker is a senior from Geneva, IL. He hopes to work in the area of water resources or geotechnical engineering.

"This trip was the most incredible and educational experience of my life... It prepared me to be a better engineer than a normal senior design would have... My communications skills and my ability to work in a team have greatly improved, and I am definitely more comfortable with designing and creating for engineering applications... With enough time I could tackle any problem in my field."

ISD Mentors: Bringing Real-World Experience to ISD

Matthew Niskanen *graduated from Michigan Tech in 2000, where he was involved in department activities such as the concrete canoe competition. He is a graduate of the Master's International Program (2003). Now, he works as a civil engineer with Turner Construction in New York. He has volunteered as a mentor for two International Senior Design classes in the Dominican Republic over the last three years.*

"After two years of Peace Corps service in the Dominican Republic, I experienced first hand the importance of sustainable development… and what an amazing effect it has on the student, professor and local people. ISD opens up a brand new world to students, that they otherwise might not get the opportunity to see. In a ten day period, it is incredible to see students adapt to a new environment, learn a new culture, and embrace the local way of life. At the end of the project the most gratifying moment is when you see the first smiles, indicating a job well done. The students realize how much they are appreciated and the incredible feeling that goes with it.

The opportunity to learn about a different culture, while learning together with fellow engineering students about sustainable development is a priceless opportunity for the rest of one's life. Graduates of the ISD program leave with a new perspective on life, technology and 'the right way to do things!'"

"Graduates of the ISD program leave with a new perspective on life, technology, and the 'right way to do things!'"

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Our Contributions to Sustainable Development:

One thing that makes the International Sustainable Engineering Initiative at Michigan Tech unique is that it has been successful in creating knowledge and contributing to the field of international development. Technical briefs, publications, student reports, and presentations are all available on our website at www.cee.mtu.edu/peacecorps/resources.html. These documents cover topics such as:

- Engineering designs for the developing world
- Appropriate construction materials
- Rural water supply
- Improvement of natural springs
- Education
- Community involvement and organization
- Wastewater treatment and solid waste management
- Public health

If you would prefer to receive this newsletter electronically, let us know by email at lmfry@mtu.edu.