



# ENGINEERING NEWS

## Mobility project improves Tricycle Design for differently-abled

This past summer, a group of three Engineering students—Alex Brubaker '11, Charlie Kimpel '12 and Justin Stevenson '12—were part of a Collaboratory site team that traveled to the village of Mahadaga, Burkina Faso, West Africa. Their objective was to continue a decade-long partnership with SIM missionaries and Burkinabe staff at the Center for the Advancement of the Handicapped (CAH) to provide simple, appropriate mobility devices for persons with physical disabilities living in Mahadaga and surrounding areas. Specifically, the work focused on the implementation of a new design for the tricycle/wheelchairs used by many of the center's clients.

Prior to 2008, most of the tricycle work involved improving an existing hand-powered tricycle design and adapting that design for use with an electric motor to accommodate persons with limited upper body strength. While a great deal of progress was made toward improving tricycle performance, the limitations of working within the framework of the original

design became apparent. In consultation with CAH staff, a decision was made to develop a new tricycle design that would address existing manufacturing issues and allow tricycle seating to be easily adapted/customized to fit individual users. Thus the Uniform Frame Tricycle project was initiated. Developed by '09 alums Andrew Betteridge, Brant Copen and Jon Hollinger, this new design provides a single platform for both hand- and electric-powered tricycles with a removable seat that can be customized to the user. Building off the work of a 2005 engineering senior project team, the uniform frame design makes extensive use of the tube-bending process to decrease part count and the number of welded joints needed per frame.

While the site visit itself lasted only a month, the foundation for this summer's trip was the culmination of hundreds of hours of volunteer (Collaboratory) and for credit (IPC) work completed by current and former engineering students who are part of what is known as the Disability



Sixteen-year-old Diabidi enjoys traveling to her home from the handicap center.

Resources Group. Following on the original uniform frame design, several student groups worked at improving tricycle component areas, such as wheel strength and integrity, braking system performance and wheel axle design. Other groups focused on various manufacturing aspects, such as developing welding fixtures and procedures appropriate for use in the fabrication shop at the CAH. Most recently, '10 alums David Bedillion and Steven Ritter worked on optimizing the sizing of the motor and battery pack for the electric tricycle while Mason Rhine and Alex Wardenberg looked at improving tricycle stability and handling.

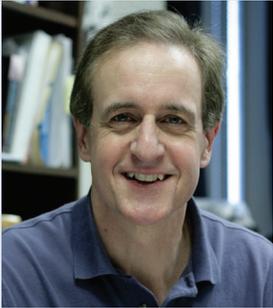
These are real-world opportunities for students to use their chosen profession to serve others in the name of Jesus Christ; or in the words of 1 Peter 4:10-11:

"Each one should use whatever gift he has received to serve others, faithfully administering God's grace in its various forms. If anyone speaks, he should do it as one speaking the very words of God. If anyone serves, he should do it with the



Yembabou tries out the new electric tricycle. Watching from left to right, Mindieba, Diergou, Matt Walsh '01, John Meyer, mechanical engineering technician, Alex Brubaker '11, Justin Stevenson '12, Charlie Kimpel '12 and village youth.

## Chair's corner



Another September, another school year. Saying it like that makes it sound like drudgery; not for me. I really enjoyed my summer but have been looking forward to the start of the school year.

But, before I look forward, let me look back. This summer was once again a time of activity for the engineering department. Over the summer months, students and faculty traveled to Mali, Nicaragua, Burkina Faso and Zambia. These site team visits allowed us to deliver prototype systems, collect data for product improvements, lay the foundation for new initiatives and strengthen ties with our in-country partners.

The summer also found many of our students expanding their knowledge and the reputation of Messiah engineering through internships. One particularly interesting case involved a company who received applications for two openings from hundreds of students, some from “big name” institutions. It was only after making their final selection that they realized that both of the slots were going to engineering students from Messiah; quality always wins out.

Looking back over such a robust and exciting summer is why I'm excited to start another year. We have added a biomedical group to the Integrated Project Curriculum; 62 new students are building edible scales in Intro, and Dr. Pratt is a grandfather. Another September, another school year—God is good!

Dr. Randy Fish  
Chair, Department of Engineering

## Update on the Wireless Enabled Remote Co-presence (WERC) Project

by Harold Underwood

Asperger Syndrome (AS), classified among neurodevelopmental disabilities better known as autism spectrum disorders, now affects one in every 110 children in the United States. Adults with AS, though gifted with average to above-average intellect, may experience impaired social interactions with tendency toward restricted and repetitive patterns of behavior. While social coaching may be locally available for job training and developing self-sufficient living skills, the idea of this project is to enhance such social coaching by wireless communications technology to achieve more independence. A prototype for such an assistive technology, known as Wireless Enabled Remote Co-presence™ (WERC), has been developed by students and faculty at the Messiah College Collaboratory, in partnership with The SymBionyx Foundation2 (TSF), over the past few years. WERC enables a coach to talk to a selected AS client, such as on a job site, and receive audio-visual feedback via a micro-camera device worn by the client. Spring 2010 Engineering graduates Jason Shortall and Ade Osunsakin, along with many other Collaboratory members, worked on this project since its inception in May 2008. As a result, the WERC team has developed an improved prototype, addressing issues identified during testing of the original.



*Lifecam mounted on modified headset of enhanced WERC prototype*

During the 2009-2010 academic year, collaboratory and IPC students focused on enhancing the original prototype of the client device based on feedback obtained from testing at Hilltop Academy in spring 2009. Students researched and tested means to improve the camera/picture quality, attachment of the camera to the client and client mobility. Various cameras were evaluated, resulting in the selection of the Microsoft Lifecam USB webcam as an upgrade. Instead of using a lapel mount, this camera was mounted on a modified headset so as to improve the viewing area of the coach. To increase client mobility, various devices were researched including the beagle board and FitPC. The FitPC, with its Wi-Fi capability, was selected for

its range and programmability. A battery pack was also selected. Thus, the new prototype has the Lifecam mounted on a headset interfaced to the Fit PC, powered by a lithium ion battery pack.

Software and Humanities teams have also been active on this project through the Collaboratory. Since hardware changed, a new operating system and application software was needed. Students researched several lightweight operating systems and video-streaming applications before settling on Ubuntu Netbook remix and Skype. To be more compact and portable, the FitPC operates without keyboard, mouse or screen attached to it. Thus, students explored methods to automate the process of powering up the FitPC, connecting to the internet, starting Skype and calling the coach. A Python script was developed to execute the steps of this procedure and to run automatically as soon as the FitPC was turned on. Meanwhile, the humanities team worked on a coaching manual and submitted several grant proposals for the project.

Future development will include developing a system to monitor the battery life and status. Audio notifications will notify the client of issues such as Internet connectivity, battery life, calling status, etc.

The new software client interface will

*WERC, continued on page 3*

# Kilo-Watt-hour Project Update

By Randy Fish

“It’s been rainy for two days and the batteries have not fully charged, so take it easy on your power usage for today.” Those were the instructions given to the 10 of us who traveled to Mahadaga, Burkina Faso, this summer by our missionary contact Matt Walsh ’01.

But, what does that mean? Should I not use my fan tonight — its 95°? I bet Dr. Vader will use his. What does that mean for those at the clinic working off a different solar power station, also installed by Messiah? If the waiting room uses too much power, will nurses not be able to do their job?

What about students at the Center for the Advancement of the Handicapped (CAH) down the road using yet another Messiah installed solar power station?

If only there were a way to assign an amount of power to each room or each building and let the users figure out how

to ration themselves. Of course, you would want to be able to tell them how much power was left and shut them off if they went over their rationed amount. If only...

Well, we’ve just described the function of the KWhr project being designed by D. Allen ’12, A. Dowling ’13, leader K. Manieri ’12, J. Martin ’12 and N. Nichols ’11. Along with students and faculty working on projects for disability resources (trike), energy (biodiesel) and education (summer enrichment program for CAH), Jon Martin and I delivered the first “working” prototype of the KWhr meter to our partners in Mahadaga.

Having the system in hand allowed us to iron out functional details for the expected first release in 2011. We were also able to plan out upgrades for the next generation.

After leaving Matt in Mahadaga, I visited with a missionary in Ouagadougou,



Burkina Faso, planning to start construction on a new Bible college outside the city. It turns out that they are also looking to run on solar power. Can Messiah engineering help? This new contact in Burkina Faso had also heard about the KWhr meter. “Will that be ready for us to use, as well?” he asked.

We are still writing code, and it looks like we are going to need to go into production already. Welcome to Messiah engineering.

*Mobility, continued from page 1*

strength God provides, so that in all things God may be praised through Jesus Christ. To him be the glory and the power forever and ever. Amen.”

This year students we were able to help provide mobility for a 16 year old girl who had never traveled on her own before in her life, a tricycle for a man injured in a motorcycle accident and continued freedom for a 19 year old young man with cerebral palsy who is now running his own business thanks to the staff at the CAH and his tricycle. To God be the Glory. . . .

*WERC, continued from page 2*

need testing to obtain further feedback. A “real workplace” test is planned for early in this school year. Procedures for this test are under development, including survey and feedback questions. The coaching manual will also be further revised. The current slate of students and faculty on this project appear on the Collab Comm Group wiki page at [thecollaboratoryonline.org/wiki/Communications\\_Group](http://thecollaboratoryonline.org/wiki/Communications_Group).

## Messiah Engineering Students Educating the Community about Biodiesel

by Mike Zummo



*Junior mechanical engineering student Michael Hahn at the 2010 PA Farm Show*

Producing, testing and using biodiesel have become common activities for the students, faculty and staff involved in the Biodiesel Research Project at Messiah College. Over the course of the last seven years, student project teams have worked to develop a

successful small-scale production system able to produce consistently high-quality biodiesel.

Through a grant received in 2008 from the U.S. Department of Energy, the project team was able to develop a cutting-edge biodiesel quality testing lab which has greatly increased the capacity for research and development in the area of small-scale production. Just this summer, student interns produced more than 500 gallons of high-quality biodiesel from waste vegetable oil collected from campus dining facilities. However, through all of this work, the team has discovered that biodiesel is not as commonly understood by most people as it is by team members, and the team wants to change that.

Educating the campus and local community about biodiesel, including what it is, how it is made and why it is important,

*Biodiesel, continued on page 4*

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## ENGINEERING NEWS • FALL 2010 OUR MISSION

The mission of Messiah College is to educate men and women toward maturity of intellect, character and Christian faith in preparation for lives of service, leadership and reconciliation in church and society. Graduates of the engineering program will therefore be technically competent and broadly educated, prepared for interdisciplinary work in the global workplace. The character and conduct of Messiah engineering graduates will be consistent with Christian faith commitments. We accomplish this mission through engineering instruction and experiences, an education in the liberal arts tradition and mentoring relationships with students.

*Biodiesel, continued from page 3*



*Senior Mechanical Engineering Students Jordan Beckler and Jeremy Miller guide a student in hands on biodiesel workshop.)*

has become one of the key components of the work that the team is doing. This work has been going on for several years through team members attending different festivals and events to present their work with biodiesel.

The Pennsylvania Farm Show has been one of the most successful events

where the team has presented. At the 2009 Farm Show, the team displayed their mobile biodiesel processor and samples of waste vegetable oil, biodiesel, glycerin and many others materials associated with biodiesel production in the Renewable Energies Harvest Exhibit. They also distributed information about the biodiesel program, The Collaboratory for Strategic Partnerships and Applied Research, the Department of Engineering and Messiah College in general.

During the 10-day show, the team connected with more than 600 people about biodiesel and the work being done at Messiah College. A local cable news station filmed and aired a tour of the mobile biodiesel processor and a podcast was recorded about the importance of biodiesel by a Pennsylvania-based non-profit group promoting alternative energy.

Based on its past success, the team also attended this year's 2010 Pennsylvania Farm Show with a new and improved exhibit. They displayed a newly developed 5-gallon biodiesel process specifically

designed for educational demonstrations. Another addition was a multimedia presentation displaying the biodiesel production process and highlighting the testing capabilities of the quality lab.

The exhibit at the 2010 Farm Show was also extremely successful, and the team is currently preparing an exhibit for the 2011 Farm Show this coming January.



*Senior Mechanical Engineer Student Jordan Beckler explains elements of titration to a student at a biodiesel workshop.)*