



# ENGINEERING NEWS

## The latest on the Light Sport Aircraft

by Don Pratt

The Messiah College Flying Club (MCFC) has been very busy working on our Light Sport Aircraft project this year. After dreaming up the idea of a new plane for use in medical missions some two and half years ago, the design has progressed through a series of phases including drawing up specifications, brainstorming various configurations, learning the basics of aircraft design, researching airfoils, building models of the fuselage, building a prototype wing section, and considering possible engines. While the MCFC is the overall sponsor of the project, it has generated a good deal of interest outside the club, including several senior projects focused on such things as engine testing, design of the wing folding mechanism, and construction of a belt reduction drive. In spring 2006, the Collaboratory Transportation Group was asked to partner with the Flying Club to finish the development of the powertrain, including the engine testing, reduction drive, and engine integration, tasks which have generated a great deal of enthusiastic work in the new IPC classes, including Group Orientation and Project 1. Over the past year, students have worked tirelessly to refine the design of the fuselage using a combination of scale models, Finite Element Analysis (FEA), and a full-scale mockup. The overall design was nearing completion in spring 2007, and construction of the tail surfaces had begun. Engine testing was nearly complete, and the results were very encouraging, with measured thrust of over 400 lbs. at maximum throttle while still maintaining reasonable fuel consumption at cruise settings of around 3 gallons per hour. Over the summer, the major structural compo-



LSA project team including students (left to right) Tim Burgeois '09, David Smith '10, Tyler Miller '08, Jon Shenk '08, Paul Gustafson '09, and Joshua Joyce '08

nents of the fuselage were fabricated and welded together, using the new TIG welder recently acquired by the engineering model shop. During the fall semester, the president of Rotamax Engines visited campus and added his support to the project by presenting us with a Rotamax Gen II aircraft engine, including electronic fuel injection, dual ignition, and gear drive reduction unit. This new engine will be integrated into the fuselage by a senior design project team, including the design

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## Chair's corner



Our department's theme for the year is "Success is in the Journey". The main point of this theme is to enjoy the journey of your education while at Messiah. Being successful God's way on this journey is the highest priority. II Chronicles 26:5b (NIV) states, "As long as he [Uzziah] sought the Lord, God gave him success." Some may think getting the BSE degree is the final destination of success in your education. In actuality, it is only the beginning of a new phase of your journey of life as a Christian engineer. Using the talents and skills that God has given you and that you have learned here at Messiah is what is important. The real, final destination is when God says, "Well done, thou good and faithful servant."

This year marks the second of a three-year transition for the department, to full implementation of the Integrated Projects Curriculum (IPC). Last spring semester's first Group Orientation class, with 17 students, was very successful, with the five IPC groups being active in many projects. This 2007–2008 academic year will bring Project I, Project II, and Seminar I on board. Projects III and IV will be initiated fall 2008.

I want to especially welcome the Class of 2011 as they begin their studies here at Messiah College and also welcome back our sophomores, juniors, and seniors from a summer of work, mission trips, and rest. May the Lord's blessings be upon each of our students, faculty, and staff as the new academic year begins. Enjoy the journey!

*Professor Erikson  
Chair, Department of Engineering*

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of the engine mounting, cooling, exhaust, controls, and instrumentation systems. A second senior project is finishing the development of the folding wing mechanism and flight controls, as well as the landing gear design. During the fall semester 2007, Flying Club members also began construction of the aluminum wings. This involved building the spars (made of aluminum angles rivets to a thin aluminum web) and ribs (made of 1" strips of 0.020" thick aluminum bent into angle sections and riveted together). By the time you read this, the major pieces will be taking shape, and it should be starting to look like a real airplane. If all goes according to schedule, we hope to be ready for the initial test flights some time in the summer of 2008.



*Barak Gohn '07 and Mike Hoffman '07 with the LSA engine and propeller*

## Why did you come to Messiah?

Results of 2007 first year student survey

A survey of over 50 newly enrolled first year students in the Department of Engineering asked them to rate the top three reasons why they came to Messiah College. Twenty-one students reported "Has a Christian World View" as their number 1 reason, while another 13 students had that as their 2nd or 3rd most important reason. Twelve students indicated "Strength of Engineering Major/Curriculum" as their number 1 reason, while another 13 had that as their 2nd and 7 as their 3rd most important reason. Other reasons rated relatively highly on the survey include "Location of the College," "Reputation of the College," "Like Professors We Talked With," "Financial Aid Package," "Engineers Day Participant," "Friends or Siblings Come Here," "Facilities—Labs and Equipment," "Family/Relatives Encouraged Coming Here," and "Hands-On Service Projects." The engineering department wishes to thank all the first year students who participated in this survey for contributing their input and providing valuable feedback!

# Senior Projects 2006–2007

The following is a summary of the projects presented by their teams during Scholarship Day on Friday April 27, 2007, in Frey Hall at Messiah College. Several of these projects are ongoing and have found a place in the Integrated Projects Curriculum with support from the Collaboratory for Strategic Partnerships and Applied Research. For more detailed information on individual projects and their reports, please refer to: [www.messiah.edu/departments/engineering/activities/senior\\_design/index.html](http://www.messiah.edu/departments/engineering/activities/senior_design/index.html)



Well drilling in Sub Saharan Africa Team (left to right): Brian Syvertson '07, Erik Blosser '07, and Thomas Betteridge '07

## Well Drilling in Sub Saharan Africa

**Team Members:** Thomas Betteridge, Erik Blosser, and Brian Syvertson

**Abstract:** In many developing countries, water is a scarce resource. Often, limited water sources result in hours of daily travel or difficulty growing crops during the dry season. The design of an inexpensive well-drilling system could alleviate this problem. To be sustainable, the system must be easily reproducible, and in this application, use materials available in rural West Africa. Continuing work begun by a previous senior project on a percussion well-drilling system, this project focused on manufacturability of well-drilling components, reducing the cost, and using appropriate materials in the rig construction.



Biodiesel Team (left to right): Daniel Geeslin '07, Joel Travis '07, David Enders '07, and Charles Brenner '07

## Biodiesel

**Team Members:** Charles Brenner, David Enders, Daniel Geeslin, and Joel Travis

**Abstract:** This team sought to establish a sustainable biodiesel production system on the Messiah College campus using waste vegetable oil (WVO) from Lottie Nelson Dining Hall. Sustainability necessitates proficient documentation of procedures, quality testing, and fuel usage. The team built a successful system in a trailer behind Frey academic building, using inherited and purchased components. They proceeded to successfully burn fuel in their Volkswagen and in a home heating system.

## International Medical Aspirator

**Team Members:** Mary Constantine, Melissa Jamison, and Kelly Smith

**Abstract:** Engineering World Health (EWH) is a non-profit organization that creates technology for developing countries. EWH asked students to design an aspirator useful in hospitals of developing countries. An aspirator is a medical suction device employed during surgery to remove fluids



◀ (Left to right) Melissa Jamison '07, Mary Constantine '07, and Kelly Smith '07, of the International Medical Aspirator Team, display their aspirator.

from the body. This device was designed from locally available materials, in order to facilitate assembly and repair at the international locations. To operate on electrical power, this aspirator includes a refrigerator compressor, collection jar, and associated tubing; for the hand-powered alternative, it utilizes PVC piping, a rubber stopper, and the barb of a pipe connector.

## Water Purification System

**Team Members:** Nathan Martin, Stuart Oberg, and Adam Yoder

**Abstract:** This project continued Living Water, begun two years ago. Originally, the idea was to produce a marketable water filtration and purification system for a SUV or RV. A previous team demonstrated proof-of-concept, but ended up with a system too costly, bulky, and heavy to have commercial value. This team achieved a marketable water purification system powered by a DC battery. The system meets market standards of purification, filtration, and safety, and aesthetically pleases potential customers.

## Continuing Alternate Aviation Solutions

**Team Members:** John Bryson, Tim Stello, and Rich Stoner

**Abstract:** This team created an economical satellite-based flight-tracking system for United Indian Mission (UIM), an organization establishing churches among Native Americans in the southwestern U.S. and Mexico. UIM employs missionary pilots to visit and replenish supplies of their established churches, located in remote areas. As a non-profit organization, UIM requires an inexpensive system for tracking their aircraft. The system in use transmits GPS data via satellite and downlinks the real time flight data to an Internet site. This team designed a pilot interface module (PIM) that enables the pilot to send an additional emergency message code. Once the message code and flight data reaches the website, it is accessed and displayed by Google Earth, in real time.

### Ozone Water Purification

*Team Members:* Jennifer Clay and Stephanie Koplak

**Abstract:** This water purification system uses ozone to disinfect and was designed as a demonstration model. The system overcomes water quality problems (mainly bacteria) that a site team encountered in rural areas of Honduras (WFTW Honduras 2006 trip report). Besides producing clean drinking water, this system also addresses investment costs, maintenance costs, and ease of use, among other factors. This project was done in cooperation with the Natural Science and Central America teams of Water for the World within The Collaboratory for Strategic Partnership and Applied Research.



Stephanie Koplak '07 (left) and Jennifer Clay '07 display their ozone water purification system.

### Automatic Water-Level Detecting Bilge Pump for a Whitewater Canoe

*Team Members:* Michael Bauer, Ian McGray, and Paul Roman

**Abstract:** This team addressed a canoeing problem: what to do when the craft is taking in water. Water can often splash into a canoe, from paddle-strokes, rapids, or waves. Excess water in the canoe reduces its performance, and wets vital gear. This team developed the design and prototype of an automatic water-level detection bilge pump, to monitor water level and sustain a minimal depth within a canoe.



(Left to right) Ian McGray '07, Michael Bauer '07, and Paul Roman '07 display their bilge pump.

### The Cellulosic Ethanol Group

*Team Members:* Jeff Bennet, David Irvin, and Vaughn Moser

**Abstract:** Corn stover, one of the largest untapped natural resources in the United States, is both renewable and more environmentally friendly than fossil fuels. This team attempted to harvest corn stover with a small scale production system capable of converting it to ethanol. The team built a relatively inexpensive functioning production system, and showed its feasibility of producing ethanol from corn stover. However, the team determined that the system would not be profitable on such a small scale. Future teams should complete the process and greatly improve its efficiency, by testing different enzymes, pretreatments, and ratios of enzyme to solid, etc.

### Light Sport Aircraft Control System and Wing-Folding Design

*Team Members:* Christopher King, David Roncin, and Nathan Swanger

**Abstract:** This team developed designs for the folding mechanism and control system of the Messiah College Flying Club's light sport aircraft. The systems meet club specifications, with the desire for integration in mind. The folding mechanism reduces space the plane requires for storage. The control system facilitates the folding movement and provides a reliable means to control the plane in flight conditions. A cartridge style tail system allows the elevator of the aircraft to detach for storage and maintenance purposes.

### Renewable Energy Sensor Package

*Team Members:* Cameron N. Hess, Justin Kelly, and Jon Shambada

**Abstract:** This project continued the 2004–2005 fourteen channel Renewable Energy Data-logger (RED14) senior project. Renewable energy sensors were designed according to the objectives and specifications required by RED14. This team designed the sensors with state-of-the-art accuracy and quality, yet low-cost components. The project also required establishing communication between the sensors and the RED14 data-logger.



Justin Kelly '07 (center) and Jon Shambada '07 (right) answer questions about the renewable energy sensor package.

### Light Sport Aircraft Instrumentation Team

*Team Members:* Jeff Delcamp, Barak Gohn, Mike Hoffman, and Dawn Verlander

**Abstract:** The flying club is developing an inexpensive Light Sport Aircraft (LSA) for the mission field. Commercially available instrumentation products cost thousands of dollars, potentially increasing the total cost of the aircraft. The LSA instrumentation team provided a state-of-the-art, low-cost alternative to expensive avionics.

# Engineering Alumni News

## Wendell Witter '96

After working in the field of engineering for two years, Wendell attended Wheaton College (Ill.) where he earned a Certificate in Leadership and Camp Ministry in 1999, and a Master of Arts in Educational Ministries in 2000. For the past seven years, he has served as the intern and adventure ministries director at Three Springs Ministries, Morris, Pa. In 2007, he returned to his undergraduate alma mater, Messiah College, to reach out to students through outdoor ministry opportunities as director of Issachar's Loft. He enjoys connecting with students through adventure programming. Wendell and his wife, Teri, have three children, Jeremiah, Hannah, and Joel, and they are excited to offer hospitality to students at their house. Issachar's Loft advances the mission of Messiah College and the Coalition for Christian Outreach by fostering leadership, discipleship, wilderness and educational programs conducive to academic success, spiritual formation, and social engagement. This is done through Bible studies, group facilitations, wilderness trips, development of student leaders, and a weekly fellowship called Who's Zooming Who?

## David Owen '97

David has returned to Messiah College as a professor in computer science, nearly seven years after studying as an engineering student and then serving as a library employee. In the meantime, he worked part-time for ProLogic, Inc., a software company headquartered in Fairmont, West Virginia, studied linguistics at the University of North Dakota through the Summer Institute of Linguistics, and studied computer science at West Virginia University, where he finished his Ph.D. this summer. David moved with his wife Gretta to Dillsburg, Pa., in July. He is grateful for the hospitality shown by old friends at Messiah and for the chance to be closer to his siblings Jonathan and Megan, both Messiah graduates, who live in the Harrisburg area. Coming back to Messiah has reminded David how much he appreciates the

professors he knew as an engineering student. He is grateful to be part of a community of Christians who want each student to succeed and who are willing to invest themselves in making that possible. Having been away, studying and working, where that level of commitment and teaching and mentoring was the exception rather than the rule, David is excited to be back. In his new role, he is praying that his students will sense the same kind of support and encouragement from him that he received from his professors here.

## Mike Foster '02

After graduating from Messiah College with a B.S. in engineering, Mike attended Drexel University and earned his masters in 2006 and Ph.D. in 2007, both in mechanical engineering. His thesis was entitled "Low-Temperature Reactions and Cool Flames in an Unstirred, Static Reactor at Terrestrial and Reduced-Gravity." Mike and his wife, Luann (Engel) '02, moved from Willow Grove, Pa., to Newberg, Ore. so that he could begin teaching at George Fox University. The university is a Christian liberal arts college with a Quaker heritage. As an assistant professor of mechanical engineering, his course load this fall includes Fluid Mechanics and Applications of Thermodynamics and managing the Senior Seminar. In addition to the move and Mike's new job, he and Luann welcomed their first child, Noah Bradley, on August 29!

## Earl Swope '03

Earl was recently an exhibitor with Sigma Electronics, of East Petersburg, Pa., at the annual National Association of Broadcasters convention in Las Vegas. Sigma's featured products were the Arbalest and Sabre system. The Arbalest system provides flawless recovery from lip-sync errors created by multiple video and audio transmission paths. It automatically detects and compensates for any delay in a transmission up to +/- 5 seconds between a video signal and a corresponding audio. The process is totally transparent to viewers, and uses a patent-

pending processing system that accurately identifies the time relationship between video and audio signals. The result is perfectly synchronized television over the air, on cable, or anywhere else that flawless synchronization is required. The Arbalest system is compatible with all television broadcast systems and other transmission avenues including streaming applications. As for Sigma's Sabre Series frames, they are extremely versatile, supporting a broad range of signal and function requirements. Each frame can house any combination of available modules and are available in sizes ranging from 1RU to 4RU as required. Earl is in his third year as electronics design engineer at Sigma. His primary responsibilities are printed circuit board (PCB) design and development.

## Joel Foster '06

*Mechanical engineer with DuPont*  
"My completion of Messiah College's engineering program is the fundamental reason why I am working today as a mechanical reliability engineer for DuPont. My responsibilities as an engineer include developing a mechanical integrity program which is an important part of process safety management in the chemical industry. Messiah's engineering program imparted me with a valuable skill-set which was easily integrated into my current position. The engineering program also equipped me with a broad knowledge base in the field of mechanical engineering which allowed me to allocate transferable skills to this new work environment. As a result, I am confident in, and comfortable with, the type and quality of work I am doing. Additionally, Messiah's engineering program helped me to not only understand the scope of the field, but also how to set and achieve personal and professional goals. One of the most important aspects of my education at Messiah was the opportunity to be part of the organization, Dokimoi Ergatai (D.E.). My three years of volunteering with D.E. taught me concepts such as sustainability and reliability, which are characteristic concepts that most engineering companies value. Above all,

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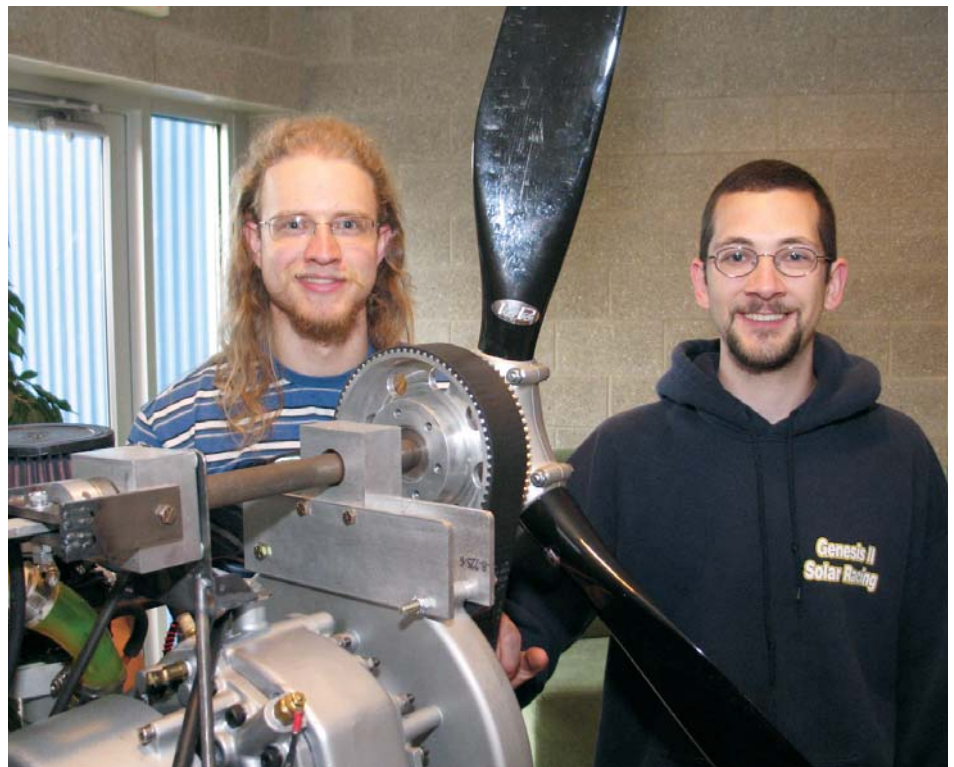
## OUR MISSION

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.

*“Alumni” continued from page 5*

Messiah’s professors gave me something to aspire to. I respect everyone in the program and know that my philosophy of engineering was derived from the program’s passion for developing Christian engineers. I was taught to think about engineering with a ‘Kingdom perspective’ that I will carry for the rest of life.

**Thank you, Messiah Engineering!**



*J. Paul Gustafson '09 (left) and Jeff Delcamp '07 with LSA engine and propeller*