CEDARVILLE UNIVERSITY ENGINEERING NEWS

Cedarville University Wins Record-Breaking Fifth World Championship in Solar Boating

Cedarville University's solar boat team held off a strong entry from the University of New Orleans (UNO) School of Naval Architecture to take a third-straight world championship title and the fifth title in the past six years. Cedarville now has more Solar Splash championships than any other school; Kanazawa Institute of Technology (Japan) has four titles, while the University of South Carolina has three. In the Qualifying and Slalom events, Cedarville was able to build a commanding lead, allowing them to hold on against a strong comeback performance by UNO in the Endurance and Sprint events.

A team of 13 senior mechanical engineers and four underclassmen continued the winning tradition by building on the strong foundation provided by previous teams and by pursuing competitive advantages in many areas. A drive train team composed of seniors Stephen Smith '09, Ryan Reep '09, Ryan Samuelsen '09, Tim Vincent '09, and Brad Absher '09 designed and manufactured a contra-rotating propeller system to provide more efficient propulsion. Another group of students, including Mordecai Veldt '09, Toby Dewhurst '09, Jordan Winter '09, John McClure '09, and Peter Cahilly '09, furthered the team's understanding of hydrofoils and also worked with a local company to develop ways to create a lighter hull by reinforcing resin with carbon-nanofibers. The electronics team of Tim George '09, Ben Hill '09, and Mike Steele '09 developed a totally new wiring system for the boat that incorporated cruise control. Ben Hill also worked with researchers at Wright-Patterson Air Force Base to develop a prototype buck-boost converter to significantly reduce losses in the Sprint event. An underclassman team of Jill Conway '11, Krista Kroninger '11, Hanna Bowes '11, and Bill Rabenstein '12 worked on electrical issues and upgraded the solar panels to produce more power during the races.

Winning efforts of this caliber are not possible without a strong supporting cast of sponsors. Key to this year's victory were sponsorships by national companies such as MAS Epoxies, Enersys, Dantona Industries, and Blue Sea Systems, as well as local manufacturers Trojon Gear, Sure Tool, G&F Tool, Quality Black Oxide of Dayton, Airplane Plastics of Tipp City, and Spradlin Brothers Welding of Springfield.

A major focus of the 2009 team was to develop a contra-rotating propeller drivetrain to increase efficiency, acceleration, and top speed. A second propeller captures some of the energy that the lead propeller loses in swirl by straightening the flow leaving the system, thus improving performance. The design and manufacture of the lower (Stephen Smith) and upper (Ryan Samuelsen) gear units for this drive train was a tremendous feat. The use of a contra-rotating propeller drive required a totally new approach to propeller design. Tim Vincent adapted a program available from MIT that he and Ryan Reep used to design propellers for the Sprint and Endurance events. This unit was used in the Maneuverability and Endurance events and received the award for Outstanding Drive Train Design.

In an effort to win in future years, the Cedarville team is continuing its effort to optimize self-regulating hydrofoils. Using research papers from several sources, Toby Dewhurst designed a computer code that predicted the interaction of the front and rear foils at various boat speeds. This work provided significant understanding as to how the angle-of-attack of the water on the rear foil fluctuates as the boat comes up to speed. Mordecai Veldt made substantial progress in modeling the hydrofoils using Fluent, a three-dimensional computational fluid dynamics program. Mordecai was able to model the "free surface" between the water and air matching experimental results. Jordan Winter worked with Applied Sciences Inc. (ASI) of Cedarville to investigate the feasibility of integrating carbon nanofibers with epoxy resin in the construction of a new hull. Jordan made numerous sample specimens and then tested them for strength in the materials lab. A full report of these studies was prepared for both ASI and MAS Epoxies. John McClure and Peter Cahilly also worked on hydrofoils.

The Cedarville team has mastered the art of managing battery energy during the two-hour Endurance races. Proper control of battery current is the key to maximizing performance in this event. However, boat skipper Tim George found that keeping the battery current constant requires continuously changing the boat's speed. So, he set out this year to design a control system that automatically regulates battery current to the motors to ensure that the maximum amount of energy stored in the batteries is used. To minimize losses in the high speed Sprint race where battery current can exceed 900 amps, Ben Hill worked on a boost converter that would double the battery voltage, therefore cutting the motor current in half, which would then cut the energy lost in the motor by 75%. Ben worked with researchers from Wright-Patterson Air Force Base to develop this converter. Mike Steele developed a completely new wiring system for the boat, while Tim George and Bill Rabenstein worked to implement this system.

An underclassman team of Jill Conway, Krista Kroninger, and Hanna Bowes worked on characterizing the existing solar panels and constructed an additional solar panel to increase the amount of solar energy available during the Endurance event.

During the competition, Cedarville built an early lead by placing first in the Slalom and Qualifying events, while also earning first place for Visual Display. Entering the two big events — the Endurance (400 points) and Sprint (250 points) — Cedarville had more than a 100-point lead over UNO. In both of these events, UNO was dominant. But Cedarville hung close in both events, earning a second-place finish in each. While a strong performance by UNO allowed them to diminish the point gap on Cedarville, the final tally had Cedarville in first place with 922 points to UNO's second-place score of 879 points. Third place went to the University of Northern Iowa with 802 points.

For complete results and numerous photos, go to **www.solarsplash.com** or check out the team website at **http://people.cedarville.edu/stuorg/solsplsh**.

Left to right: Tim Dewhurst, Krista Kroninger '11, Jill Conway '11, Ben Hill '09, Tim Vincent '09, Mordecai Veldt '09, Tim George '09, Toby Dewhurst '09, Ryan Samuelsen '09, Stephen Smith '09, Jordan Winter '09, and Ryan Reep '09

Student Organizations

Growing and Winning With SWE

Cedarville's student chapter of the Society of Women Engineers (SWE) welcomed eight new girls to the department of engineering and computer science this year. The addition brings the total number of girls in the department to 23. To celebrate with the new members, they held a "Sweet Welcome Party" at Young's Dairy to kick off the year.

Left to right: Devin Wicker '12, Stephanie Russell '12, Alissa Johnson '11, Sarah Norris '12, Kirsten Nicolaisen '12, and Dr. Vicky Fang

A highlight for SWE this past year was its participation in the Games 4 Girls Competition, sponsored by the University of Illinois. Under the direction of Dr. Vicky Fang, chapter advisor and assistant professor of computer engineering, five SWE members (pictured above) entered the computer programming competition to design a computer game geared toward middle school and high school girls. Altogether, 19 teams from 14 schools participated in the event, including Cornell, USC, the University of Virginia, and the first-place winner Arizona State. After four months of hard work, Cedarville's entry, "Hott Lead," earned second place, an excellent finish for a first-time endeavor.

SWE could not succeed without the support of all the department's professors. Mr. Jay Kinsinger offered helpful advice when the team built a picnic table in 2007. Dr. Clint Kohl's family once again hosted the SWE Dessert Night for all the members. To show their appreciation, SWE had a baking night and baked cookies for all the professors and staff of the engineering and computer science department, saying, "It was a small way for us to show our appreciation."

Striving for Scholarly Success

This year, Cedarville's Ohio Nu Chapter of Tau Beta Pi (TBP) consisted of nine seniors and seven juniors who represent computer, electrical, and mechanical engineering majors. TBP is the national engineering honor society, which recognizes engineering students with high academic achievement and honorable character. At last fall's initiation dinner, Michael Loosa '10 and Ryan Hokuf '10 received the $300 Secretary's Commendation Scholarship and the matching Dean's Scholarship. In May, team members learned that graduates Scott Van Dyke '08 and Joseph Miller '06 had received prestigious National Science Foundation Fellowships for graduate studies in the 2009–10 academic year. For the fifth year in a row, a junior student was awarded a TBP $2,000 undergraduate scholarship for his senior year. This year's winner was Noah Van Zandt '10, an electrical engineering student. Cedarville's TBP chapter continues to demonstrate its commitment to academic excellence and community service.

Winning Big at ASME Regional Event

Three mechanical engineering students participated in the American Society of Mechanical Engineers (ASME) District B Regional Student Conference held at Wright State University in March 2009. Schools from Michigan, Pennsylvania, West Virginia, Ohio, and Ontario were represented at the conference. Mordecai Veldt '09, past-chair of the Cedarville ASME student chapter, received a first-place award for his webpage design called "Lights Without Borders," which described the solar lights developed by Cedarville's Society of Engineers Aiding Missions for use by pastors in Liberia.

Matt Hollis '09 also received a first-place award for his Old Guard oral presentation describing his senior design team's re-engineering of a fracture fixation device requested by missionary physicians in Kenya. The intramedullary nail currently in use will no longer be manufactured by its patent-holder. Matt's team worked through the complications of intellectual property rights and reverse-engineered the existing nail. The team contacted the nail's patent-holder who approved an agreement to market the re-engineered nail only in Third World countries. A business plan was developed for a not-for-profit enterprise that would be able to manufacture and distribute the nails. Matt's win at the regional event earned him a spot at the international congress in Orlando, Florida, where he again received the first-place award.

Ryan Samuelsen '09 received a second-place award for his Old Guard oral presentation describing his design team's development of a contra-rotating propeller drive for their Solar Splash boat. Rather than swapping out drive systems for the two major events at the Solar Splash competition, Ryan's team designed and manufactured a unique compact drive train that spins two unique propellers in opposite directions using a single shaft to minimize drag.

Shedding Light in Liberia

During the 2008–09 school year, Cedarville's Society of Engineers Aiding Missions (SEAM) designed and fabricated nearly 50 solar-rechargeable reading lamps for village pastors in Liberia. In May 2009, SEAM vice president Elizabeth Flow '09, along with Dr. Tom Thompson, pictured below, delivered the lights to an assembly of church leaders in Liberia.

The purpose of SEAM is to educate, equip, and engage engineering students in the cause of world evangelization through service projects and to learn about and pray for cross-cultural engineers and missionaries.

Student Design Team Develops Tracking Software

For their senior design project, a group of computer science majors developed software that now serves Cedarville's postal services department. Drake Angle '09, David Benson '09, Kyle Linden '09, and Michael McCoy '09 comprised the team, under the advisement of Bob Schumacher, assistant professor of mathematics, and Dr. Keith Shomper, associate professor of computer science. Working closely with the computer services department, the team developed Package Tracker, the University's first-ever automated tracking system.

Under the previous process, packages were recorded on a handwritten log as they were received. Names were then hand printed on the package in large letters for ease of location, and recipients who were not on the delivery route were individually notified by e-mail. Cards were written by hand for those on the delivery route so that signatures could be obtained for tracking purposes. At the beginning of a semester, this could involve hand processing over 1,000 packages in a single day.

The team took this entire process and created a tailored system that uses a searchable database to find the correct recipient, captures tracking and insurance information, automatically notifies non-delivery route recipients of a package receipt, creates labels with the click of a mouse, scans and captures student IDs as they pick up packages, and incorporates a wireless handheld computer system for the delivery driver to capture signatures. In addition, because all of this information is being captured electronically, package questions can be answered quickly through computer query, and benchmarking data is recorded without labor-intensive processes.

This project was a wonderful opportunity for the students to work in a real-world environment and apply their skills to develop a much-needed system. A tailored software system like this one would have otherwise cost the University upwards of $30,000.

Another Year of Blessing

Sam L. SanGregory, Ph.D.
Chair, Elmer W. Engstrom Department of Engineering and Computer Science

Greetings! I am excited to present you with an update on another year's events in the Elmer W. Engstrom Department of Engineering and Computer Science at Cedarville University. As I compiled the stories from our faculty to produce this year's newsletter, I was once again humbled by how the Lord has blessed our efforts. For example, He led two new faculty members to join us, three of our faculty received awards for research, and one was promoted to senior professor.

Our students also continue to shine for the Lord. For the first time in our history, we had an all-female team enter a competition. This team not only competed in but also took second place in a national computer programming contest. Another programming team finished seventh of 123 teams in a regional competition, beating out teams from larger schools like The Ohio State University and the University of Cincinnati. Several other teams that fared well and whose stories are included in this newsletter include our Solar Splash boat team, which won the world championship for the fifth time in six years; our Supermileage team, which set another team record; our ASEE robot team, which finished second at competition; and our Formula SAE team, which again competed in two events.

Competitions are fun, but their real purpose is to provide real-world experience to our students. Taking engineering education out of the classroom and into the world offers our students opportunities to apply classroom theory to open-ended problems.

Another way in which we try to broaden their engineering education is through missions work. I hope you will be encouraged by the report from one of our engineering mission teams about their travels to Liberia to apply their skills to the work of the Lord.

Thank you in advance for taking the time to read through the highlights of our 2008–09 academic year. These stories are just a few of those we could tell, but they represent the overall quality of the faculty, students, and programs here at Cedarville University.

Sincerely,

Samuel L. SanGregory, Ph.D.
Chair, Elmer W. Engstrom Department of
Engineering and Computer Science

Contributors

Publication Editor
Sam SanGregory

Graphic Designer
Kaitlin Start

Photographers
Kim Dewhurst
Nate Dolan
Sabrina Elgersma
Scott L. Huck
Sam SanGregory
Tom Thompson
Larry Zavodney

Writers
Bob Chasnov
Tim Dewhurst
Vicky Fang
David Gallagher
Hardy Hegna
Jay Kinsinger
Clint Kohl
Tim Norman
Sam SanGregory
Catherine Shanks
Tom Thompson
Larry Zavodney

Competition Challenges Both FSAE Car and Team

When a wrench gets thrown in the works and things get complicated, some people have an overwhelming urge to give up. But Cedarville's 2009 Formula Society of Automotive Engineers (FSAE) team showed just what hard work can accomplish. Cedarville recently competed in two FSAE competitions — one in Virginia and one in Michigan. Although their rankings slipped in both competitions compared to the previous year, they successfully built a car that was 50 pounds lighter and was more powerful than the previous year's.

Considered the major leagues of collegiate design engineering competitions, FSAE draws student engineers from all around the globe to design prototype race cars that are then evaluated for production potential. Not only do the teams make a new car each year, but they also develop business plans and marketing scenarios that are judged by business professionals. The designs are then judged before the cars are tested for acceleration, turning capability, handling, endurance, and fuel economy in four dynamic events.

New rules made the already rigorous competition even harder, but that didn't stop Cedarville's team. They completed the car in time for the Virginia event but couldn't participate in the dynamic events because the air intake manifold exploded early in the competition. As a result, the team finished 19th out of 39.

The team fixed the problem in time for the Michigan event. Placing 45th overall in Michigan, Cedarville was one of only 33 teams to finish all the events, an accomplishment that earned them a certificate of completion. They competed against 119 other teams from some of the world's best engineering schools, including Purdue University, Cornell University, The Ohio State University, Universidad Simon Bolivar (Venezuela), Graz University of Technology (Austria), and the National University of Singapore.

Student Perspective: Catherine Shanks, 2009 Mechanical Engineering Graduate

Building a car in eight months with just 13 busy college seniors was daunting, but the thrill of seeing our team compete got me hooked. The project was a whirlwind from start to finish. Though we certainly hit lows when completion seemed impossible, adrenaline fueled our ambition and team spirit the whole way.

The most beneficial aspect to the project was being able to witness a condensed version of the entire engineering process. We began with thoughts that soon became drawings. We designed some of the parts, purchased others, and manufactured a few in-house. We also conducted research, testing, and analysis.

Possibly our least favorite activity was the marketing and business presentation, which, unfortunately for us, is also an integral part of engineering. We held meetings, wrote reports, gave presentations, and did just about everything else that actually occurs in industry. I gained tremendous knowledge about composites, which was my specialty on the team, and about cars in general. However, the most valuable lesson was seeing what is involved in producing a product and learning how to accomplish a goal of this magnitude with a group of people.

As much work as it was, we had a ton of fun. My fondest memories are the many late nights we spent working in the lab. A dozen sleep-deprived engineers working with metal and machinery resulted in plenty of laughs. We began as classmates and grew into a team of friends.

Flawless Run Earns Second Place

Back row: Jordan Oakes '12, Jeff Oakley '11, Jimmy Myers '12, Daniel Shaffer, Dr. Clint Kohl (advisor). Front row: Matthew Emery '11, Adam Downs '11, Matthew D'Anna '11, Joe James '12. Not pictured: Tyler Chan '12, Adam Taylor '12

Once again, students designed a robot for the American Society of Engineering Education (ASEE) Autonomous Robot Competition, held in June 2009 in Austin, Texas. Focusing their efforts on speed and reliability, the team named their robot the Jitterbug after its tendency to jitter its back gates. The team worked hard to accomplish the challenging task of collecting four red and five blue golf balls placed around an 8-by-6-foot track while sorting them so that the red balls could be deposited in a bin at one end of the track and the blue balls at the other end.

The team devised several innovative designs, including a sensing method for ball detection on the entire front area of the robot, an area almost 8 inches wide. They accomplished this by using a bright white LED on one side and a light detector on the other. When the robot encountered a golf ball, it detected the ball's shadow, and a scoop was then activated to bring the golf ball into the robot, where it was sorted into one of two bins. The color of the ball was determined by its location on the course in accordance with the competition rules. The team designed several custom-printed circuit boards to house the needed electronics and provide the connections and sensors, logic, and the robot's drive motors.

Because the overall team score was the sum of four independent runs, reliability was a high priority. The Jitterbug performed well in competition, correctly scoring all nine balls in each round. The team from Rochester, New York, was the only other of the 14 teams able to score all the balls correctly. They did so in a shorter time than Cedarville's team, giving CU a second-place finish.

Supermileage Team Breaks Record — Again

Cedarville's Supermileage Team participated in two Supermileage competitions this year. At the Shell Eco Marathon Americas (SEM) held at the California Speedway in April 2009, Frank Roney '10 drove GL-IV to a new school record of 1,257.5 mpg, earning Cedarville fifth place. In June at the SAE/ Briggs & Stratton Supermileage Competition (SAE SM) held at the EATON Proving Grounds Test Track in Michigan, Cedarville took fourth and seventh place by achieving 1,077 mpg with GL-IV and 1,038 mpg with Slipstream.

The team worked long hours during the academic year on two vehicles: the red car dubbed Gold Lightning (GL-IV) and the newer blue car called Slipstream-IV. Team leader Dustin Winchester '09 made major structural changes to the front chassis in GL-IV, to comply with the vehicle wheel track width-to-height ratio required by SEM.

At competition, teams must average a minimum of 15 mph. To help the drivers, the instrumentation team, headed by John Hagen '10 and Nate Wade '10, developed and installed a new computer and a flat-panel touch-screen monitor to give the car a "glass cockpit" feel. With the software they developed, the screen displayed their track position, speed, average speed, elapsed time, lap count, relative wind speed, and other useful data. A Pitot tube and differential pressure transducer generated the relative windspeed signal. The team also installed a GPS system in the car.

To measure track position, the students mounted 24 magnets on a plastic disk on the rear drive wheel. A sensor detected the passing of each magnet and sent the pulses into the counter on the Data Acquisition Unit, which was connected to the computer. Using these pulses, the students calculated and displayed all of the critical information for the driver, using Measurement Studio display software.

The engine team, headed by Ryan Hokuf '10, worked hard to get the new 50-cc Honda overhead cam and valve head married to the Briggs & Stratton crankcase and to get the electronic fuel injection system working. They had to make a new intake manifold/throttle body and mount the air intake temperature sensor, manifold air pressure sensor tap, throttle position sensor, and throttle position actuator for eventual computer control of the engine. Given that the team members' participation on the team was extracurricular (i.e., voluntary), they were not able to complete everything to get it working in time for competition. Next year's team is already working to finish the task.

The team had to make additional upgrades such as new and improved chain guards for both cars. They also worked on completing the second-generation Slipstream vehicle. The unique design changes included a major upgrade to the chassis front end: bringing the kingpins, steering linkage, and brake calipers and rotors inside the vehicle to reduce aerodynamic drag. The design required rather complex mathematical analysis to design the kinematic linkages to provide zero-scrub Ackerman steering motion. The team was unable to complete this major project this year, so they raced Slipstream again. They made repairs to Slipstream and prepared it for the competition in June.

At competition, getting the cars through inspection is never without issues, and this year was no exception. Little things needed to be adjusted, or just plain fixed. The SAE SM competition uses a checklist that has over 100 inspection items! For two years, the brake light on Slipstream passed inspection. But last year it did not, so it had to be modified. This year the team had to install a positive crankcase ventilation valve and a fuse on the battery line. These fixes required a visit to a local auto supply store to get parts. To make the brake light brighter, team members went to a grocery store to buy aluminum foil to help reflect the light out the back, which solved the problem.

Sometimes problems show up for the first time at competition. For example, extra spikes generated false counts on the track position counter. Every time the engine was started, it generated extra pulses, which introduced large errors in the track position and speed indications. The reason this is so critical is that the driver must start and stop the engine about 18 times during a typical 10-mile race, requiring the vehicle to burn and coast to get the very high mileages and average 15 mph. The students worked into the early morning to fix this problem.

During the races, Cedarville's team — as well as teams from other schools — always encounter additional problems, such as flat tires, overheated engines, and dead batteries, which prevent them from restarting the engine during a run. Little things that go wrong can terminate what otherwise would have been a successful run.

When it is all said and done, Cedarville made a very positive impression — on the other teams and the race officials, who noticed the team's behavior. Congratulations to a wonderful team of students for another successful year — and setting another Cedarville mileage record!

Faculty in Focus

Engineering Professor Receives Dean's Service Award

Dr. Bob Chasnov, professor of mechanical engineering, recently received the Cedarville University Dean's Service Award. This award, selected by the University's Deans Council, honors faculty members for their contributions on departmental, school, and University committees and task teams. Also considered are the individuals' service to the higher education community, work with student groups and organizations, and civic service and leadership roles in church or para-church organizations. Dr. Chasnov has served tirelessly on several University and departmental committees. For six years, he has also served as the assistant to the chair in his department. In addition to assisting in the day-to-day operations in the department of engineering and computer science, Dr. Chasnov is the curriculum coordinator for the mechanical engineering program.

Outside of Cedarville, Dr. Chasnov is actively involved with the Gideons and an active member of Southgate Baptist Church where he has served on the deacon board and is a leader in the Awana program.

Dr. Chasnov earned his B.S. in physics from Rensselaer Polytechnic Institute. His M.S. in physics and Ph.D. in materials engineering are from the University of Illinois at Champaign-Urbana. He is a registered professional engineer and has provided expert witness in several court cases involving material science. Dr. Chasnov has served as a consultant for an Air Force project to replace Ni-Cd batteries with Ni-MH on the F-16. His research interests include materials testing and characterization, failure analysis, hydrogen-metal alloys, and fuel cells. He is married to Sue, and they have three daughters and one son.

Welcoming New Faculty

Dr. Nan Jiang joined the department as assistant professor of computer science. She received her M.S. and Ph.D. in computer science from the University of Oklahoma. Prior to joining Cedarville's faculty, she worked as a software developer for the State of Oklahoma Department on the State Immunization Information System Project. She has also worked as a lab instructor, teaching assistant, and research assistant in the department of computer science at the University of Oklahoma. Her research included web-based applications, data mining, secure sensor networks, and research for the Center for Economic and Management Research on multiple projects of intelligent business decision systems and web applications. Dr. Jiang's recent dissertation was in the areas of data mining and wireless sensor networks. Her major research interests include database information systems, data mining and information retrieval, data warehousing and online analytic processing, information security, privacy and confidentiality, stream data processing and management, automatic data management, and multimedia and web databases.

Faculty Advisor Award Given to Engineering Professor

In 2009, Dr. Hardy Hegna, professor of mechanical engineering, received the Cedarville University Faculty Advisor Award for the influence he has had on students as an academic and student organization advisor. Since joining the department in 1992, Dr. Hegna has consistently been one of the University's top academic advisors. It is not uncommon to see students in his office receiving advice on everything from course-related questions to godly council. Students see him as a trusted friend in whom they can confide, as evidenced by the fact that he and his wife have served as mentors in the Fit To Be Tied premarital program.

In addition to individual student advising, Dr. Hegna advised the SAE Aero Design Competition team for several years. He is also the moving force behind the Cedarville University chapter of Tau Beta Pi, the national engineering honor society. Dr. Hegna began his efforts to form a chapter several years before Cedarville's chapter was officially received into the national organization. Under his leadership, many engineering students and alumni have received scholarships and fellowships from Tau Beta Pi. Cedarville's chapter has also earned several instances of the Secretary's Commendation Award for its timely and accurate operations.

Dr. Hegna holds B.S. and M.S. degrees in aero engineering, an M.S. in mechanical engineering, and a Ph.D. from the Air Force Institute of Technology in aero engineering. He came to Cedarville in 1992 after a full career in the United States Air Force. He held faculty positions at the United States Air Force Academy and the Air Force Institute of Technology and has had assignments in both Air Force Systems and Logistics Commands, including the Flight Dynamics Laboratory at Wright-Patterson Air Force Base. His areas of expertise include fluid mechanics, heat transfer, numerical methods, and applied mathematics.

Dr. Hegna enjoys involvement in his church's adult choir and Vacation Bible School program. He and his wife, Helen, have been married for more than 27 years and have three children. He loves traveling and seeing God's marvelously created world with his family. Recently, they hiked across the Grand Canyon and white-water rafted down the Arkansas River in Colorado.

Also joining the department is Dr. Timothy Yao, associate professor of electrical engineering. He earned his B.S. from National Chiao-Tung University, M.S. from National Taiwan University, and M.S. and Ph.D. in electrical engineering from the University of Maryland at College Park. Dr. Yao came to Cedarville after holding faculty positions at the University of Texas and San Jose State University. He also served as consultant to technical and management staff for various companies in the semiconductor industry where he participated in designing several wired and wireless communication chips. His areas of expertise include RF/microwave integrated circuit design, wireless transceiver design, and error correction coding.

University Names Its First Senior Professor of Engineering

Cedarville University named Dr. Lawrence Zavodney as senior professor of mechanical engineering, the first professor to achieve this rank in the department of engineering and computer science. Dr. Zavodney came to Cedarville in 1992 from The Ohio State University to serve as chair of the new engineering department, a position he held for 14 years. Prior to his tenure at Ohio State, he was on the faculty at Virginia Polytechnic Institute and State University and Yarmouk University, where he was instrumental in helping start a new engineering program in the country of Jordan. He worked as an engineer at Goodyear Tire and Rubber Company, Babcock and Wilcox Research and Development Division, NASA Langley, and Wright-Patterson Air Force Base. He received a commission in the Air Force in 1974 and served as a civil engineer.

Dr. Zavodney received his B.S.M.E. and M.S.M.E. degrees from the University of Akron and his Ph.D. in engineering mechanics from Virginia Tech. He also attended Moody Bible Institute and taught a course there. He is a member of the American Society of Mechanical Engineers, Society of Automotive Engineers, Creation Research Society, and Tau Beta Pi Engineering Honor Society. He is a registered professional engineer in the state of Ohio.

He has published one book and 34 journal papers, research reports, and conference papers. He was honored as the Outstanding Faculty Scholar of the Year at Cedarville in 1998 and was inducted into his high school's Alumni Hall of Fame in 2002. A paper he presented at the American Society for Engineering Education regional conference, co-authored with Dr. Thomas Thompson, received the Best Paper Award in 2008. The paper summarized the new initiative they have begun that involves engineering students using their skills to help a Christian ministry in Liberia recover from a devastating civil war, which includes taking students on short-term missions trips to Liberia during the summer.

At Cedarville, Dr. Zavodney was instrumental in developing the new engineering program and strongly supported student participation in national and international collegiate competitions. He helped lead the new department through two successful six-year ABET Accreditation cycles. In 1993, he began advising the Supermileage team that has won several awards, and in 1994 he started an annual cardboard canoe challenge held annually on campus during homecoming weekend.

He and his wife, Debbie, have been married since 1976. They have homeschooled their seven children and have two granddaughters (one is in heaven). Although he is seen at Cedarville many hours during the week, he enjoys traveling, flying airplanes, scuba diving, sailing, wind surfing, photography, designing and building things, and restoring old vehicles.

Back row (from left to right): Nan Jiang, Tim Yao, Keith Shomper, Tom Thompson, Tim Tuinstra, Jay Kinsinger, Tim Norman, Jeff Shortt, Tim Dewhurst, Gerry Brown, Vicky Fang. Front row (from left to right): Clint Kohl, Larry Zavodney, Dave Gallagher, Sam SanGregory, Bob Chasnov, Hardy Hegna, and Stan Baczek

The faculty of the Elmer W. Enstrom Department of Engineering and Computer Science

ME Professor Wins Scholar of the Year

Dr. Timothy Norman, professor of mechanical engineering, was named the 2009 Faculty Scholar of the Year at Cedarville. He was recognized for his outstanding track record of scholarly work, including 44 refereed journal publications, 92 conference papers, two book chapters, and over $2 million in funded research as Principal Investigator. While much of this work was done before coming to Cedarville, Dr. Norman has been able to continue his strong scholarly work since joining the Cedarville faculty. This year, for example, he published the following articles:

> Norman, T.L., Little, T.M., Yeni, Y.N. "Age-related changes in porosity and mineralization and in-service damage accumulation," *Journal of Biomechanics*, Vol. 41, pp. 2868–2873, 2008.
>
> Norman, T.L., Carter, J., Yeni, Y.N. "Diffuse damage accumulation with age is cortex and gender-dependent in human cortical bone," 55th Annual Meeting, Orthopaedic Research Society, Feb. 22–25, 2009, Las Vegas, NV pg. 628.

While at Cedarville, Dr. Norman has included senior students in his research and publications, advised Cedarville teams to first-place awards in interscholastic competitions, helped to develop the minor in biomedical engineering, developed new courses, and continued to advise graduate students as an adjunct professor at another university. Dr. Norman has successfully incorporated research with undergraduate teaching by advising teams of senior students that focus on the development of biomechanical devices for handicapped or injured people. His senior projects have included the development of a prosthetic ankle, a prosthetic swim-foot for below-knee amputees, a walker for children with cerebral palsy, and the design of an intramedullary nail for use by missionary doctors in Kenya. These projects necessitated the development of a "gait lab" where the effect of the prostheses can be recorded when used by amputees. In spring 2009, the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) named Cedarville's walker design — along with the MIT, Duke, Stanford, and University of Wisconsin designs — as the best in its annual design competition. The walker will be featured on the cover of an upcoming issue of *Ohio Engineer Magazine*.

While for some in academia research is cited as a distraction to undergraduate teaching, it has proved to enhance and augment Dr. Norman's teaching. He not only pursues his scholarly work and teaching with a passion, but he has also been of great service to the University. He is a member of numerous committees on campus, including the Graduate Program Committee and the Graduate Task Force. He is working diligently to take Cedarville to the next level of scholarly activity.

Engineering Team Serves in Liberia

For the third straight year, Cedarville's department of engineering and computer science sent a team of students and faculty to Liberia through the University's Missions Involvement Services, in cooperation with Serving In Mission (SIM). The team's work focused on rebuilding the infrastructure of the Everlasting Love Winning Africa (ELWA) radio ministry near Monrovia and facilitating the work of village pastors.

The team was led by Dr. Tom Thompson, associate professor of mechanical engineering, and Paul Mitchell, supervisor of water systems at Cedarville, with liaison Ray Hutchison of SIM.

Team member Trenton Smith takes a break from working on the pressure tank restoration to engage children of ELWA Academy.

Through God's provision and many prayers, the team persevered and completed several projects including many specified by a 2007–08 CU senior design team who studied the potential performance improvements to ELWA's water system. Under the direction of Paul Mitchell, they installed an additional pump, new pump controls, new filters, and new flow meters.

The team also completed the restoration of a 5,000-gallon pressure tank that was begun by the 2008 team who repaired holes in the tank. This year, the interior of the tank was wire-brushed, cleaned, and coated with special epoxy paint. The outside was also prepped, primed, and painted. Those working in the tank wore activated carbon masks and were limited to 10-minute shifts due to the extreme heat.

Dr. Rick Sacra, deputy director of SIM Liberia, expressed appreciation for their work: "Thank you for taking the time to get down into our pressure tank and refurbish it — inside and out! It reminds me of Jesus' remarks about the cup: what good would that tank be all scraped and repainted on the outside if you all had not done so much work on the inside! … We here at ELWA will have many reminders over the coming months of the impact your team has made."

In 2007, the Cedarville team had designed and installed a fountain spray system to cool ELWA's electric generators. This year's team performed some routine maintenance by clearing algae from and repositioning the spray nozzles, clearing muck from the pond, installing intake filters, and beginning a chlorination regimen to control the future growth of algae.

In 2009, the Society of Engineers Aiding Missions at Cedarville again built solar-rechargeable reading lights for Liberian pastors who typically farm by day and have no electricity at night. In addition to delivering almost 50 of the lights to a conference of the pastor's association, team members met with pastors who had received lights in previous years to learn how to improve their design.

In the ELWA Academy, last year's team had installed a few stations of a computer laboratory built by graduate Jonathan Elchison '06. This system is low-cost because it uses an open-source Ubuntu operating system and requires mostly low-resource computers. This year, two of our team members spent many hours fixing and upgrading the operating system over the Internet with Jonathan's help.

Conducting a "What Is Engineering" workshop for aspiring Liberian engineers, Dr. Tom Thompson explains the cooling system for the diesel generators powering the ELWA campus.

This year, there were some special opportunities for the team. On two different occasions, team members were interviewed on Radio ELWA about the projects and career choices for young people. The team also presented a "What Is Engineering?" workshop for Liberian high school students. A two-day trip to a village featured a mango feast and a hike to a beautiful rain-forest river. More importantly, the team encountered Liberian Christians living out their faith in a very difficult way of life and heard Mr. Hutchison deliver some important spiritual truths in the local parlance.

Back row (from left to right): Paul Mitchell, Ray Hutchison (SIM), Mark Hiteshew '11, James Elgersma '09, Trenton Smith '09, and Dr. Tom Thompson. Front row (from left to right): Elizabeth Flow '09, Patrick Brady '11, Nate Dolan '11, Will Humphrey '09, and Nathanael Barham '09

CEDARVILLE UNIVERSITY

Elmer W. Engstrom Department of Engineering and Computer Science
251 N. Main St.
Cedarville, OH 45314
www.cedarville.edu/engineering

Nonprofit Org.
U.S. Postage
PAID
CEDARVILLE, OH
Permit No. 1