



WINTER 2010 - 2011

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MISSOURI
S&T

SDELIC Gets New Director



Dr. Roger A. LaBoube, Curators Teaching Professor Emeritus of Civil Engineering, has been named Director of the Student Design and Experiential Learning Center.

Dr. LaBoube holds B.S., M.S., and Ph.D. degrees in Civil Engineering from the University of Missouri-Rolla and has received numerous faculty and teaching awards. He serves as Director of Wei-Wen Yu Center for Cold-Formed Steel Structures at the Missouri S&T, remains

active in professional organizations and societies, is a Registered Professional Engineer in Missouri and served as faculty advisor for the S&T Steel Bridge Team from 1991 until 2010. Dr. LaBoube's goals as SDELIC director include increasing student participation in competition teams and experiential learning activities, strengthening the center's corporate funding support, encourage more faculty participation as team advisors, and ensure that student team members learn, succeed, and have fun.

New Student Design Center

The Kummer Student Design Center will soon be a reality. Renovation of the old Holsum Bakery building started in August and by Thanksgiving new concrete floors, upgraded electric lines, interior framing walls, and the classy-looking new brick exterior were complete. Brinkmann Constructors should have the new facility ready for occupancy in late January.



Solar Car

2011 is déjà vu for the Solar Miners. The annual Formula Sun Grand Prix (FSGP) relocates to the Indianapolis Motor Speedway as part of the famed track's centennial celebration. The "Brickyard", was the start point for the SunRayce '97 cross-country solar car race to Denver. The Miners will run Solar Miner VII at Indy, and they'll make major changes to the car's chassis, including moving SMVII's center of gravity and redesigning the rear swing arm to accommodate a third-wheel braking system.

Big changes are in store for the '12 American Solar Challenge. University solar racers will have to use



silicon solar cells instead of mounting the far-more-expensive gallium-arsenide arrays. The lower costs should expand the racing field as more schools will be able to afford the project, and silicon's lower efficiency will require teams to concentrate more on design and strategy rather than simply spending money on sheer power.

In the meantime the Miners are working hard to enlist and train new team members, and they'll use the FSGP to do just that. The track race helps keep teams sharp, serves as a test bed for new designs and systems, and gives new drivers and support crews valuable solar racing experience.

Student Profile

Miriah Anderson's engineering journey started in her high school's FIRST Robotics Team. She says "through FIRST (For Inspiration and Recognition of Science and Technology) I learned that engineering



was much more than sitting behind a desk. I worked closely with engineers, business professionals, and my teachers, all of whom

became my role models. Robotics became my educational heart and those mentors, along with my FIRST experience, helped me see my future in engineering. When I learned about the Miner Robotics Team, that made my college decision so easy that S&T was the only school to which I applied."

"I quickly got involved with the S&T robotics team, using my FIRST expe-

rience to assume the team's public relations duties. Soon I became the group's vice president, and now my peers have chosen me to lead the team. Throughout this process I've strengthened my leadership skills, created friendships, and networked with many engineering professionals at competition. Our team members come from different backgrounds and all have unique personalities, but we work very well together to create a fully functioning robot, and that is what I find most rewarding."

"I also began to better understand the impact that the Student Design and Experiential Learning Center (SDEL) has on our student design teams. The SDEL is one of the driving forces behind S&T's most-visible student teams. Without the center our teams wouldn't have been as successful. The center staff helps us develop the technical, business and interpersonal skills necessary for us to succeed in our careers."

Solar Village

Responsibility for S&T's Solar Village, which consists of four solar-powered homes designed and built by the Miner Solar House Team, has been transferred to S&T's Institute for Environmental Excellence effective Nov 1st. Inquiries regarding student housing opportunities, public tours, and research should be directed to <http://iee.mst.edu/>.



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Alumni Highlight

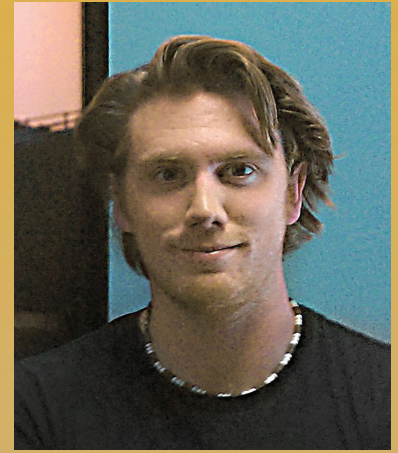
Mike Eckert, ME '09 Engineer, Tesla Motor Works Advanced Engineering team,

"My story is a bit unusual because I didn't apply to Tesla. They came looking for me simply because I was chief engineer on Missouri S&T's highly-ranked FSAE team. During a phone call with Tesla executives I was given an immediate offer based solely on my FSAE knowledge and experience, and just two days after completing my last FSAE race I was in Los Angeles ready to start an exciting career."

"I am part of a small group of highly specialized engineers comprising the Vehicle Engineering and Design team. My work at Tesla highly parallels the Formula SAE experience at Missouri S&T. Quick, informed decision making, high-level knowledge of every facet of the vehicle, the ability to learn and apply new things very quickly, and extensive knowledge and reliance upon computer-aided design software are all part of my daily tasks."

"I work with former Formula 1, IndyCar, LeMans, and other race-industry engineers and even solar car veterans. There are at least five former FSAE chief engineers working at Tesla, attesting to the value of such a program. The long hours and fast-paced environment are nothing new to a Formula SAE graduate, and some of my Detroit-honed coworkers were very impressed with my ability to wear so many hats. Few of them had ever seen someone who could both TIG weld and run a finite element structural analysis!"

"My S&T design team experience, often hard, tiring times mixed with the good, has really paid off. I often think about it when I pull up to my apartment each night, located just across the street from the sandy shores of Hermosa Beach, CA. I have my S&T Formula SAE design team experience to thank for it."



Advanced Aero Vehicle Group

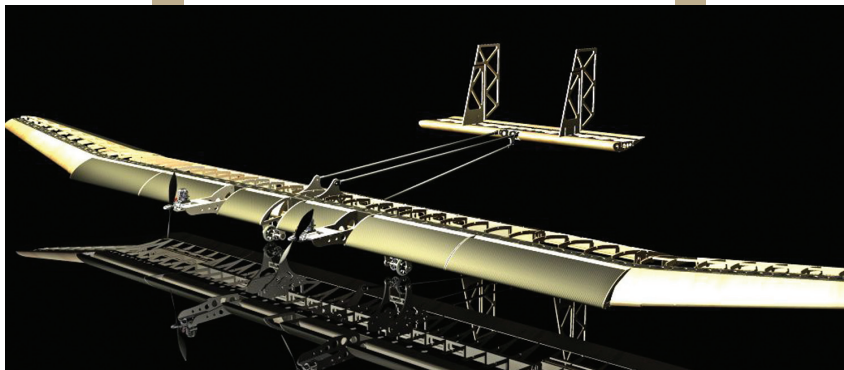
Every year SAE Aero officials throw new autonomous design requirements into the heavy-lift competition's flight manifest. For 2011 the Miners must build a durable aircraft that does more than just carry heavy cargo; the plane has to measure its own take-off and landing distances, fly well with a payload and utilize on-board braking systems to bring the landing roll to a controlled stop. Dave Althuis says "Last year we didn't get the recording of the take-off distance working so we have some catching up to do. We'll also use two engines, mount a twin vertical stabilizer/rudder system for better performance, and get away from the blended wing design."

Airplane team member Anan Takroori says "AAVG has helped me understand the concept of propulsion and aerodynamics better than just formulas and lectures. This is the first step to my future and I am hoping this will help me fulfill my dream of becoming the first scientist to land on Mars."

separates on descent, takes photos, measures temperature, barometric pressure, relative humidity, UV radiation, and solar irradiance even after landing. The photos must remain in a specific orientation relative to the sky and ground, and we've built some simple prototypes to determine the best way to keep the instruments in the correct orientation during descent and landing."

USLI offers both a challenge and an opportunity for the AAVG rocket team. The top-five USLI teams must advance to larger Level II rockets in 2012 and launch at the

NASA's Goddard Space Flight Center Wallops Island (Virginia). Those projectiles must attain a 10,000-ft altitude and might "land" in the nearby Atlantic Ocean, so teams must plan for a water recovery if they hope to bring their projects home.



The NASA-sponsored 2011 University Student Launch Initiative (USLI) project will operate very differently than before. Chief USLI engineer Jason Brown reports "This year NASA's Space Mission Directorate provides a deployable payload that

Engineers Without Borders

David Malawey, Team Leader for the Nahualate clean water project, explains that the Miners “don’t impose a U.S.-based engineering solution to problems in developing countries. S&T’s EWB chapter works closely with religious, non-governmental, and professional engineering organizations to determine indigenous communities in special need. The team’s assessment trips are carefully coordinated with the national EWB office, which ensures that proposed projects are feasible, affordable and sustainable.” David says “I wish I could do everything, but EWB has challenged me to weigh all things I devote time to during school--what will matter, say, two or ten years from now? This is the one I stuck with.”

Nahualate, Guatemala

EWB spends most of their time talking to their “customers” in the southern hemisphere. Each community best knows its own economic, political and agricultural needs so dropping in with a ‘we are engineers,

we know what’s best for you’ attitude could doom any project, because without community buy-in, the project won’t succeed. The

Miners developed a two tank solution, one at the well and the second for residents a short distance away. They’ll still have to determine if the community wants communal water spigots, is prepared to pay the monthly electrical costs, and is committed to hiring a water system manager to handle ongoing man-



agement and maintenance tasks. S&T’s EWB students are even writing a Spanish-language operation and maintenance manual to leave behind in their partner villages.

Tacachia, Bolivia

EWB teams aren’t afraid to pull out of a project if they determine it’s more than they can responsibly handle. In the case of Tacachia,



which needed a river footbridge to reduce the town’s isolation, the Miners determined it would have been too expensive, didn’t provide a year-round benefit, and there were other ways to reach the town. More importantly, the community expressed a greater concern for solving the town’s erosion problems. The erosion problem will be a very large-scale project so the students decided that with limited

finances and time they’d only take on one project at a time.

Erquis Sud, Bolivia

S&T students have been working on water distri-

bution systems in Erquis Sud since 2008. The area, in the foothills of the Andes Mountains, is normally arid but riverbank erosion is threatening the water tank the Miners built two years ago. Surface water floods some of the houses, the town still lacks electrical service and

the community doesn’t have the knowledge or resources to fix these issues. The Miners will return to tackle those problems using gabions, stone-filled baskets to stabilize soil and prevent erosion, and develop a plan to divert the surface water away from the homes. Project Leader Tiffany Werckmann says “The community is a huge part of our projects. The people take real ownership of the projects, work side-by-side with us, provide a lot of quality labor and treat us wonderfully.”

Santiago, Honduras

S&T’s EWB team will return to Honduras after a nearly three-year absence to focus on clean water supplies. Santiago, a tropical area known for huge banana farms where much of the population works, is where the Miners will repair the town’s water distribution system and design a water storage facility with a capacity of as much as 100,000 gallons.

A Special Thank You!

In September Bob (CE’71) and Kim Brinkmann hosted the 7th annual fundraising event for the S&T design teams and other student programs.

Over one hundred guests enjoyed a wonderful French-style picnic at the Brinkmann home overlooking the Missouri River, and the occasion raised nearly \$100,000 for pre-college programs, Hit The Ground Running, and the SDELIC.

Bob has long been a strong believer in learning by doing. He has worked hard to promote S&T’s experiential learning programs.

The SDELIC design teams thank Bob and Kim for being such steadfast supporters of the student design teams.

Robotics

The S&T Robotics Team spent the fall semester outdoors practicing and testing for the 2011 Intelligent Ground Vehicle Competition (IGVC). The team revamped their design approach last year, and it paid off with their best-ever IGVC finish. Even though their event takes place after spring semester they are already focused on their AI/ME plat-



form and have worked out some interface issues. The Miners have finally retired *Aluminator*, and its replacement, the four-wheel-drive *JomegaTRON*, due to be rolling by year's end, will sport a one-piece firewire camera and a separate stereo imaging system for obstacle identification, and some of the key work involves aligning the cameras on the machine's mast to provide its "brain" with a larger viewing area. Frank Fitzpatrick says "in the meantime our late-summer tests identified a new 'bug' we need to fix, but we got 1gb of pictures that we can analyze without having to go outside every day."

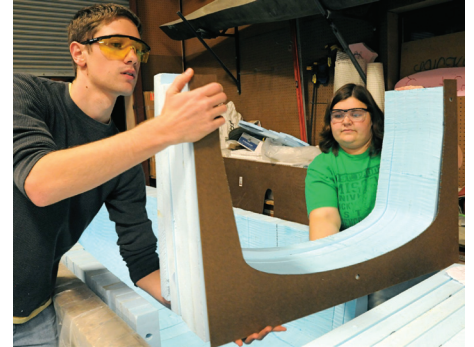
Solar House

S&T's Solar House Team will sit out the 2011 competition and use the time to write their '13 entry proposal. They'll re-evaluate their design approach, refine their home automation systems, get involved with research projects and expand the team and start introducing younger students to the scale, cost and complexity of the project.

Concrete Canoe

Concrete Canoe has already expanded their paddling program that brought S&T such good results at the 2010 ASCE Midwest regional conference. The team held regular outdoor practice sessions through most of the fall semester before moving to the S&T indoor pool when the weather turned cold. That's helped them keep their coordination, muscle tone and focus through the winter months, especially important because the concrete canoe competition is one of the first projects out of the gate in April.

The canoe squad isn't faced with any major new design requirements this year so they're concentrating on two major issues, writing code for the five-axis water jet system to cut the mold cross sections, and pouring the boat nearly a month earlier than usual. The water jet will save countless hours of mold preparation and sanding time. The advanced schedule will let them spend more time on aesthetics and paddling practice. The Miners return only two veteran racers, but they've recruited plenty of excited newcomers with paddling experience.



Look for the Miners to qualify for the concrete canoe nationals for the first time in many years.

Steel Bridge Team

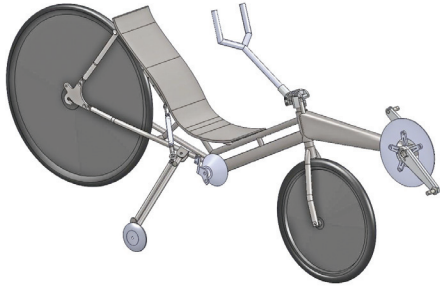
The Steel Bridge Team salutes faculty advisor Dr. Roger LaBoube who assumed the directorship of the SDELC. Their new team advisor, Dr. Timothy Philpot, has already given the builders great advice and helped the team work through a few issues that came up this fall. New for 2011 is the requirement to build a cantilever deck bridge, so the team answered the call with an intra-team design contest in which four student groups presented their ideas for a new competition bridge. The winning concept is simple, elegant, strong and requires only a minimum number of members to assemble during competition, so the now-unified design group will work out their calculations and modeling through the fall semester in SolidWorks and AutoCad. At the same time the Miners have been teaching their newer team members to weld, and have established their own public relations working group that focuses on fundraising, campus recruiting activities, team social events, and publications and outreach within the SDELC programs.

Project Administrator Carolyn Wood says "Steel Bridge has helped me see the 'engineering process' as a whole. There is fundraising, design, fabrication, and the competition to win over the 'customer' who is looking for the design which best fits their needs. It was clear to me after one year on the team that engineering is just not sitting at a desk doing calculations all day."



Human Powered Vehicle

The pedal-powered Miners have dominated speed events, taking national championships on 2007 and 2010. This year ASME competition rules call for more practical vehicle designs. Former team leader Trent Lauer says "the Missouri S&T Human Powered Team will be chang-



ing things this year. No more will our rider need assistance in getting in and out of the vehicle and staying upright. We've got landing gear, new canopy designs, a safer and more rigid fairing, and more innovative ideas than a third grader with a box of Legos. This year we are moving to the unrestricted category from the speed class, bringing new challenges in designing for practicality."

Chief Engineer Adam Jankowski says "our challenge is to devise a fast and maneuverable bike that doesn't need a pit crew to help the rider start and stop. We've designed retractable 'landing gear' the rider can deploy to get in and out of the vehicle easily. We are even looking at using some donated titanium for our crank arms and maybe even the frame. That'll make the chassis 35% lighter and 150% stronger than last year's frame. Riders will be from a strong pool yet to be determined, although all prospective riders are training hard.

New member Dashiell Moore hopes ".....to gain a greater knowledge of team building fundamentals as

well as enhance my knowledge of mechanical engineering principals by being active on the Human Powered Vehicle Team."

Formula SAE

FSAE's "Win or Die" mentality means go great distances to prove themselves. S&T Racing, as they like to call themselves, has chosen a truly international strategy for 2011. They'll pass up the annual Michigan race for events in California, Toronto, and, in August, the famed Hochenheimring Formula 1 course near Mannheim, Germany. They must raise extra funds to cover travel expenses, but race rules mean they can also use that same late-season car for the next racing season, so it could be economical in the long run.

Team Leader Zach Lagrone says "there are a lot of people doing an amazing job. Several solid freshmen are already running Finite Element Analysis (FEA) and making complex parts. I wish I could be on the team in three years. If all these guys stay on I think S&T will be a real SAE powerhouse."



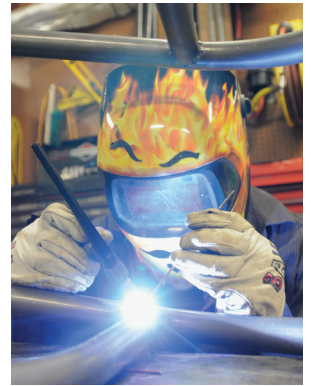
Zach adds "aero rules allow us to mount larger devices and our suspension changes are focused on reliability."

They put in huge hours in the shop when they aren't out practicing late at night, testing new designs, proving durability and developing razor-sharp driver reflexes, all of which add up to a powerful team.

Baja

In April S&T's Baja SAE off-road team heads to Birmingham, Alabama for a grueling test of student innovation, engineering and machine against water, mud and rocks. This event brings back the amphibious challenge, where, in addition to all the tech inspections, static tests, engineering reports and hill climbs, the cars must drive through a water obstacle on every lap of the four-hour endurance race.

The Miners redesigned the chassis geometry to include a



three-link rear suspension for a larger range of motion and improved drive-wheel travel. These changes required the Miners to recalculate their geometry and frame angles to accommodate the improvements. Done well, the car will be able to take on harder terrain while simultaneously handling more smoothly, a combination that will make car and driver last longer. Mounted incorrectly the suspension would decrease performance and cause extreme axle travel bad enough that our drive shafts might even separate from the transmission.

The team is ahead of last year's production schedule, have already tested two different transmission designs in hope of solving last year's shifter problems, and will even install the optional reverse gear.

PR officer Karl Hansen says - "It's fun to be on a relatively young design team that, despite being only five years old, is finally beginning to compete at the upper level of SAE's collegiate design programs."

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Comments: _____

Please list any specific instructions or identify which teams(s) you would like your donation to support.

Competition Dates

Advanced Aero Vehicle Group

SAE Aero Design East, April 29 - May 1, 2011
Marietta, Georgia

NASA University Student Launch Initiative
April 13 - 17, 2011 - Huntsville, Alabama

Baja SAE

April 14 - 17, 2011 - Birmingham, Alabama

Human Powered Vehicle

East Coast April 29 - May 1, 2011
Indianapolis Motor Speedway - Indianapolis, Indiana

West Coast date TBA - Bozeman, Montana

Steel Bridge and Concrete Canoe Teams

ASCE Mid-Continent Conference April 28-30, 2011
Kansas State University, Manhattan Kansas

Solar Car

Formula Sun Grand Prix, May 2-7, 2011 - Indianapolis
Motor Speedway, Indianapolis, Indiana

Formula SAE

California, June 15-18, 2011 - Auto Club Speedway,
Fontana, California

Robotics

Intelligent Ground Vehicle Competition
June 3 -6, 2011 - Oakland University, Rochester,
Michigan

Engineers Without Borders

Nahualate, Guatemala - January, 2011
Erquis Sud, Bolivia - May, 2011
Tacachia, Bolivia - May/June, 2011
Santiago, Honduras - August, 2011

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SDELC Staff

Director	Dr. Roger LaBoube
Assistant Director	Dr. Paul Hirtz
Outreach Manager	Bob Phelan
Safety/Shop Ops. Manager	Richard Dalton
Administrative Assistant	Susan Robison

Main Advisors

AAVG	Dr. Fathi Finaish
Baja SAE	Mr. Randall Lewis
Concrete Canoe	Dr. John Meyers
EWB	Dr. Richard Stephenson
Formula SAE	Dr. Hank Pernicka
HPV	Dr. Keith Nisbett
Robotics	Dr. Donald Wunsch
Solar Car	Dr. C. H. Wu
Solar House	Mr. Heath Pickerill
Steel Bridge	Dr. Timothy Philpot

Annual Phonathon

The annual SDELC Phonathon, when design team members reconnect with their supporters, is scheduled for January 27, 30, 31, and February 1, 2, 3, 7, and 8.

Your financial support helps our students finish their projects, and above all, provides the funds necessary for teams to compete against peer institutions at events all over the U.S. and abroad. When the students call, take time to learn more about them and their learning experiences, and please be generous with your support.