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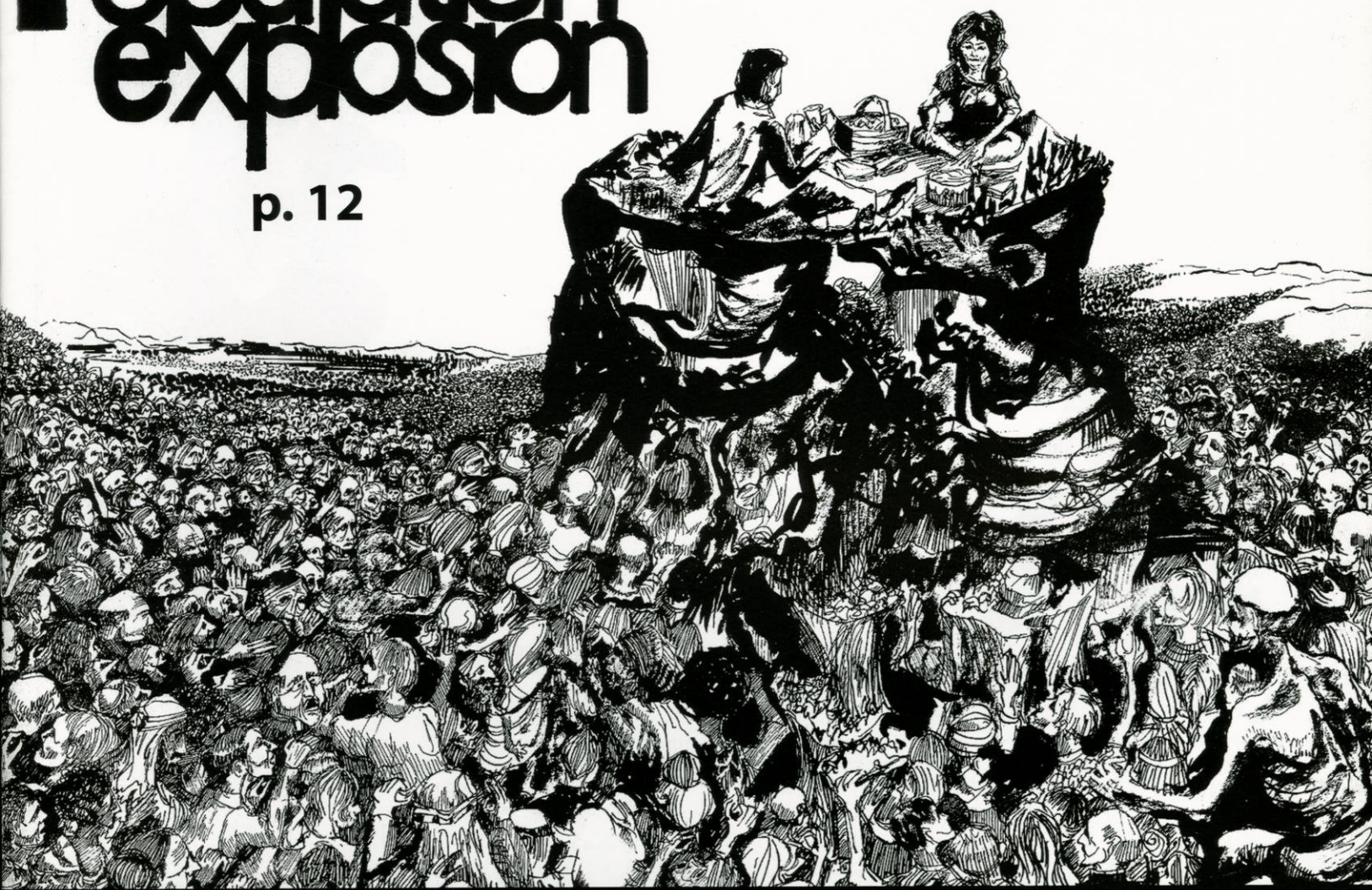
NOVEMBER 2011 VOLUME 116, NUMBER 1

wisconsin engineer

the Population explosion

p. 12



wisconsin engineer

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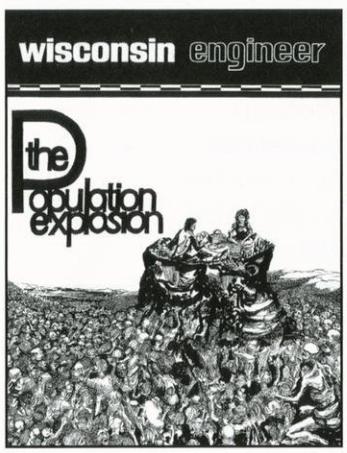
Feature

General



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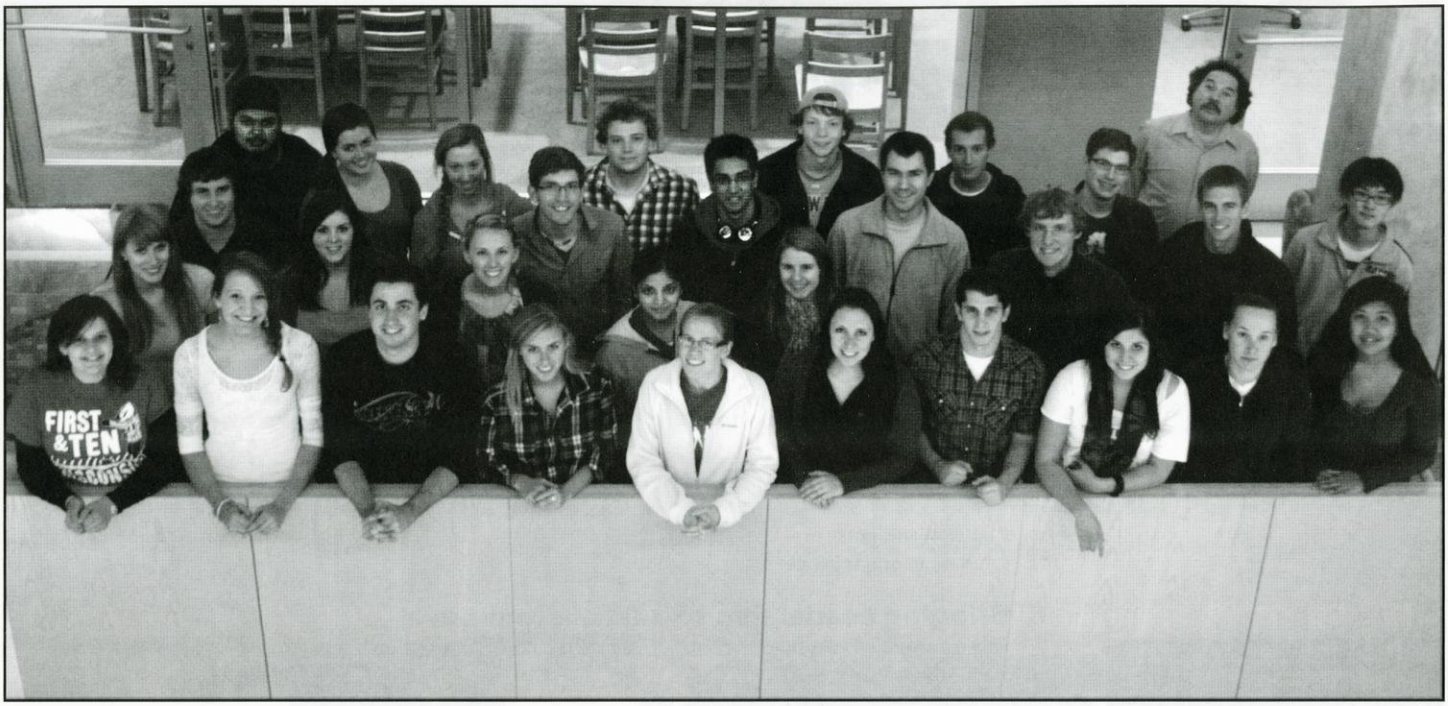
Professor Profile

Editorial

Wisconsin Engineer Staff



COLLEGE OF ENGINEERING
UNIVERSITY OF WISCONSIN-MADISON

THE UNIVERSITY of WISCONSIN MADISON

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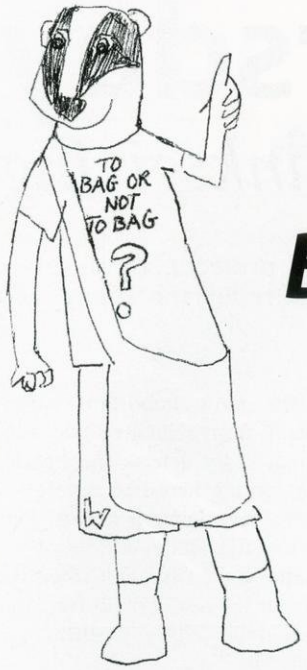


Banning the Use of Plastic Bags

Editorial and Graphic by Alex Beletic

The banning of plastic bags in Madison, or anywhere for that matter, may sound like a near impossible undertaking. A task as challenging as, perhaps, banishing cigarettes from bars? Although the idea of completely eliminating plastic bags may sound impossible, it should be undertaken. Banning plastic bags would be a tremendous step in reducing waste pollution and lowering the human impact on our environment.

Plastic has an extremely slow rate of decomposition. Other than a small amount that has been incinerated, every piece of plastic ever created still exists. Plastic contamination is particularly dangerous for marine life and, sadly, 75-80% of floating ocean refuse is plastic.

According to Science 2.0. researchers, every year over 500 billion plastic bags are produced which is approximately 40% of global plastic toxicity. Plastic bags are spewed out in huge numbers due to their convenience for everyday life. Because of their volatility, they easily and in big quantities become dispersed in the environment. Plastic bags are the least-recycled plastic packaging waste. They have low individual weight and provide a minimal amount of raw material. They, therefore, have too small of a monetary value for companies to recycle. Also, they are often rejected in the sorting process in the recycling plants as they are dirty and not worth cleaning.

Biodegradable polymers are a viable substitute; these polymers are nearly harmless to the environment. Other than the difficulty of changing people's habits, the reason plastic hasn't been switched is due to the cost: these polymers are nearly twice the cost of plastic. Additionally, the plastic bag industries have strong lobbyists that are trying to prevent this switch.

I think in Madison we should aim to eliminate not replace; but, where this is totally impossible we could use biodegradable bags. The stores could charge customers approximately five cents per bag to fray the additional manufacturing cost, which is already common practice in many countries. Moreover, in these countries the bags seem to be of higher heavier quality and so do get reused. This practice greatly decreases the number of bags consumed. Due to my Air Force father, I frequently lived abroad when I was younger and so experienced this first-hand. We would nearly always brought our own bags when grocery shopping or, otherwise, used as few as possible. We also never consumed garbage bags or trash bin liners, but instead used our shopping bags.

Recently, Italy banned the use of plastic bags completely. As of January 1st, 2011 supermarkets were restricted from using "non biodegradable single-use shopping bags". This major accomplishment proves that this feat is really possible!

Here in Madison, the mental switch of conserving shopping bags is already underway. At supermarkets, the cashiers habitually ask you if you need a bag before they begin bagging. Trader Joe's on Monroe lets you enter a raffle for free groceries when you don't use one of their bags.

I live with three environmentally conscious roommates. They insist on bringing their reusable bags when we go grocery shopping. We have had more than one delayed departure due to scrambling for their bags. They, along with the green movement on campus as a whole, have opened my eyes to the ease at which we can prevent waste.

Between the optimistic young college crowd and the already citywide attempts to increase sustainability, I strongly believe that Madison is one of the best cities to bag the bag. Until then, make an effort, use less. We

"Thank You" Thursday

The International Perspective of Thanksgiving

The table is set for a Thanksgiving feast.

In the midst of midterms and projects, Thanksgiving break comes as a cherished relief for many UW-Madison students

For an international student, the most important part of Thanksgiving is probably the break from school or the chance to catch up on homework, which sadly defeats the holiday's purpose. I am from India and before coming here had never really heard of Thanksgiving. I certainly have never experienced it. Many international students attempt to delve into the holiday and they do not regret it; it is a memorable time, something they can talk about back home, and something they'll remember for the rest of their lives. Some students travel and explore America geographically, and others spend Thanksgiving with local families and friends.

Given the diversity of people at UW–Madison, celebrating holidays together is one of the best ways to get to know each other. Sushmit, a third year student from India, always has a thanksgiving dinner with his lab mate. It is in the form of a pot-luck picnic with a typical Thanksgiving feast of turkey and roasted potatoes. Though international students may be surprised, there is much more to American food than burgers and fries. Sushmit slyly reveals that since there is a Canadian in their group, and Americans and Canadians celebrate Thanksgiving on different days they end up celebrating it twice a year. Canadians harvest their crops earlier due to the colder climate, so they celebrate the holiday almost a whole month earlier. Sushmit enjoys double the celebration and, moreover, double the food!

Every year Judy Tang, Director of the International Friendship Centre, hosts a huge Thanksgiving dinner the Sunday before the actual day which is geared towards international students. The food is donated by churches and local people and includes eight turkeys and at least 60 pounds of mashed potatoes! Tang attempts to create a "family feeling" between the students and attendees so the international students can see what this day is supposed to be like. The best part of this day is the warmth and love and togetherness seen everywhere, and even the international students begin to feel at home with the locals. According to Tang, "the stores are closed and everyone stays home. Moreover this is the one time when everybody visits their family and a lot of this feeling radiates to international students – just knowing and talking and all these conversations and people waiting anxiously to go to their parents or grandparents – they make you think of your family and friends, here and in your country and the big IFC family comprising of international students and volunteers and everyone involved in making it happen – all of this builds up to the feeling of inclusiveness." Many colleges in the U.S have a program that assigns a host family to international students. They are your pseudo-mom and dad with whom with you celebrate the holidays. This arrangement allows international students to have memorable experiences and an insight to the cultural values of America. Every country has some unique traditions and when you visit a new country, if you do not explore them, it is equivalent to not going there at all.

Many people around the country will spend hours in their kitchens on Thanksgiving day preparing meals for their loved ones.

Rahul, who is spending his sixth year in the U.S, had a great chance to experience all of this with his host family. Rahul says of his experience, "They call you every week and are always there for you to guide you and help you with any issue. They are very open and accepting and make your stay here worth it." He believes that only the international students who have met and interacted with local people will become familiar with the culture. Having spent Thanksgiving with his host family, Rahul is of the view that Madison lacks this concept and that people here are missing something. Thanksgiving is the one time when the whole family comes together. The feeling of togetherness is so strong on this day that Rahul's host parents even drove from Texas to North Dakota to pick up their son as he didn't have any other way to get home for the holiday.

Lilly Cao, a senior in Industrial Engineering, has also had a similar experience and can remember clearly how much the 'amount of food' and the 'size of the turkey' struck her! Coming from Italy, she believes that the biggest difference between social gatherings here and back home is the lack of alcohol. "In Italy, champagne or some other form of alcohol is always present", she says. She adds that unlike Italy, "In the US it's a big deal to have the family get together, as they are all so independent – kids leave there parents and work in other places and thanksgiving is the one time when everyone comes together to celebrate and enjoy and have fun as a family."

Another aspect of Thanksgiving is Black Friday, an adventurous, exciting and somewhat hectic day according to Rahul and Lilly. Rahul in his first year here went to the store with some friends at midnight and was stunned at the manic rush that ensued! So the next year, he prepared: he left at 8 PM fully equipped with food, water, and a sleeping bag, "We came back at eight the next morning and it was a lot of fun," he says. Lilly went to Black Friday sales with her host mom who loves the sales that day. "We discussed our strategy on the Thanksgiving Day – we planned which store to go to first, as they open at different times, and how much time we had in each of them as some of the stuff, the costly ones, are limited and we wanted to get the worth of it. We had an early dinner and slept early so that we could wake up at four in the morning," she says. On the flipside, there are people who find the whole "strategising and waking up early" thing ridiculous. Sushmit refuses to wake up at such an absurd time and says that amazon.com still exists!

It is the responsibility of international students to embrace the culture and traditions that we are a part of now. It is important for international students to mix with people and, moreso, to celebrate with them. Judy recalls the time when she visited Thailand and witnessed the King's birthday, "There was such a huge crowd cheering for the king and enjoying and celebrating and they had so much energy and I can't tell you how much fun I had getting involved with them."

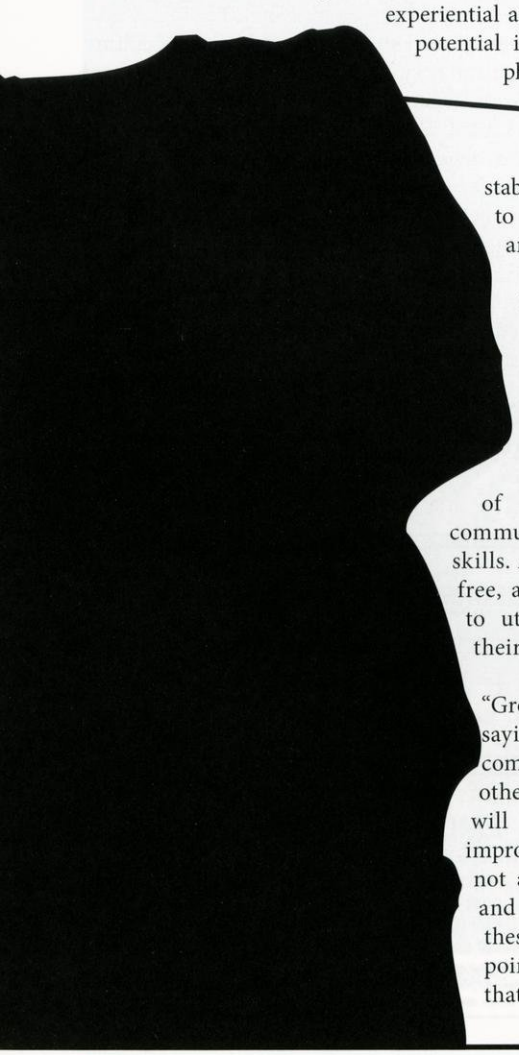
There is a Thanksgiving opportunity here at UW-Madison and all it takes is for you to come out of your shell and see what is happening around you. Participate, get involved and have fun because Thanksgiving is a great time of the year to get a flavor of this amazing country. We

Article by: Yaman Singh Sangar
Photography by: Sara Karraker
Design by: Marita Thou

Bringing Leadership to a Whole New Level

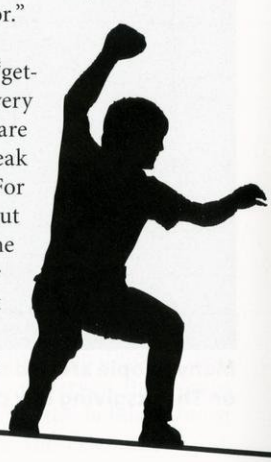
Engineers are expected to be leaders. They are leaders in science and technology, leaders in innovation and creation; leaders in change. But how does an engineer uncertain in his or her leadership skills find a way to become a better leader? Here are some unconventional programs available through UW-Madison to do just that.

In 1995, the Adventure Learning Programs (ALPs) was founded by a group of students who decided that there was a need for experiential education on campus – that is, the idea that people learn more effectively by doing. Abby Dare, student co-coordinator for ALPs and a senior in Physical and Health Education, gives their mission statement, "ALPs facilitates experiential activities that explore group potential in an environment that is physically and emotionally stable, challenging and relevant to individuals, their groups and the human experience."



Nowadays, ALPs hosts leadership workshops, and takes people to both high and low ropes courses in order to help teams, student orgs, and even just groups of friends improve their communication and teamwork skills. All of these workshops are free, and any student is eligible to utilize ALPs's services for their program or organization.

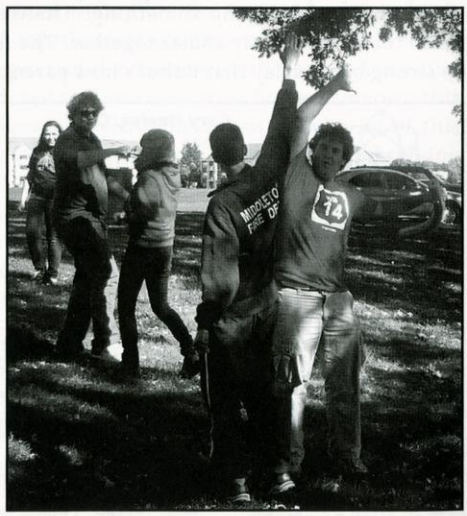
"Groups will come to us saying, 'We have a hard time communicating with each other,'" Dare says – so ALPs will tailor a workshop to improve communication. "It's not all about breaking the ice and going crazy and playing these dumb games – there is a point to it," she says, and says that ALPs is there to create a safe and honest working space for these groups to dig deeper into their problems as opposed to just skating the surface. Dare says, "It's hard to do, but it's definitely something that we strive for."



The workshops ALPs offers run from simple "get-to-know-you" activities to "very intense, very time-consuming, very frustrating" activities, Dare says, they are meant to get groups to really break themselves down and show their true colors. For example, the low ropes course has a wall without ladders or ropes that a team needs to cross. The team has to figure out how to help each other across the wall, which can get very intense, but really helps the team grow as a group.

There are also silly ice-breakers, where the point is simply to laugh and set a positive tone for the day. The workshops run all year, although groups generally don't go on the ropes courses when there is snow on the ground, in which case ALPs runs plenty of ground workshops. ALPs owns its own low ropes course on the west side of town, and rents a high ropes course on the east side of town, and will conduct ground workshops wherever a group wants to be. ALPs doesn't have a facility of its own, so often facilitators will bring the props necessary for ground workshops to a chosen location, like sorority houses, Bascom Hill and dorm halls.

Like any student organization, ALPs is more than what students see in public. It also has several committees, such as external relations, internal relations, program development and staff training. Everyone works together in teams, whether it be on marketing, hiring, or staff training. Every team has a team



Two students celebrate their victory during an ALPs workshop.

leader, and these leaders meet to discuss how ALPs as a group is doing and how to make it a better organization. There are also two coordinators, including Dare, who work to keep communication between the groups and make sure everything is running smoothly. There are also trained facilitators who run the workshops that students are familiar with. ALPs is not an open membership; you would have to apply to join the group, but no worries, as ALPs hires 15-20 new people every fall.

Members of the Young Progressives participate in a low ropes course put on by ALPs, which offers its services to all registered student organizations.

Another group on campus offering leadership opportunities is the Accenture Leadership Center. The ALC was founded 25 years ago to give students a place to work together toward better leadership. With the motto, "Learn. Practice. Lead." their goal is to help students become better leaders, and the ALC has a variety of ways to do just that. The biggest program they support is LeaderShape, the leadership boot camp, from the Leadership Institute. At Leadershape, every day has a very strict theme, and all the activities build off of those themes. Sometimes students do these activities as large groups, sometimes they split off into "family clusters" to go more in depth on how to improve their leadership skills. On the idea of family clusters, "That's kind of your private time,"

The workshops are meant to get groups to really break themselves down and show their true colors.

Allie Putterman, junior in Marketing and International Business and long-time ALC worker says, "when you're in those communities it's really a way for you to open up, to explore your thoughts, to talk with everyone else, sometimes it gets emotional, you don't necessarily know what's going to come out of it." But there are also fun, down-time activities, and attendees will spend one day at a ropes course. "As the time goes on, you get more and more focused … It's a great way to collaborate and find interests with other people," Putterman says.

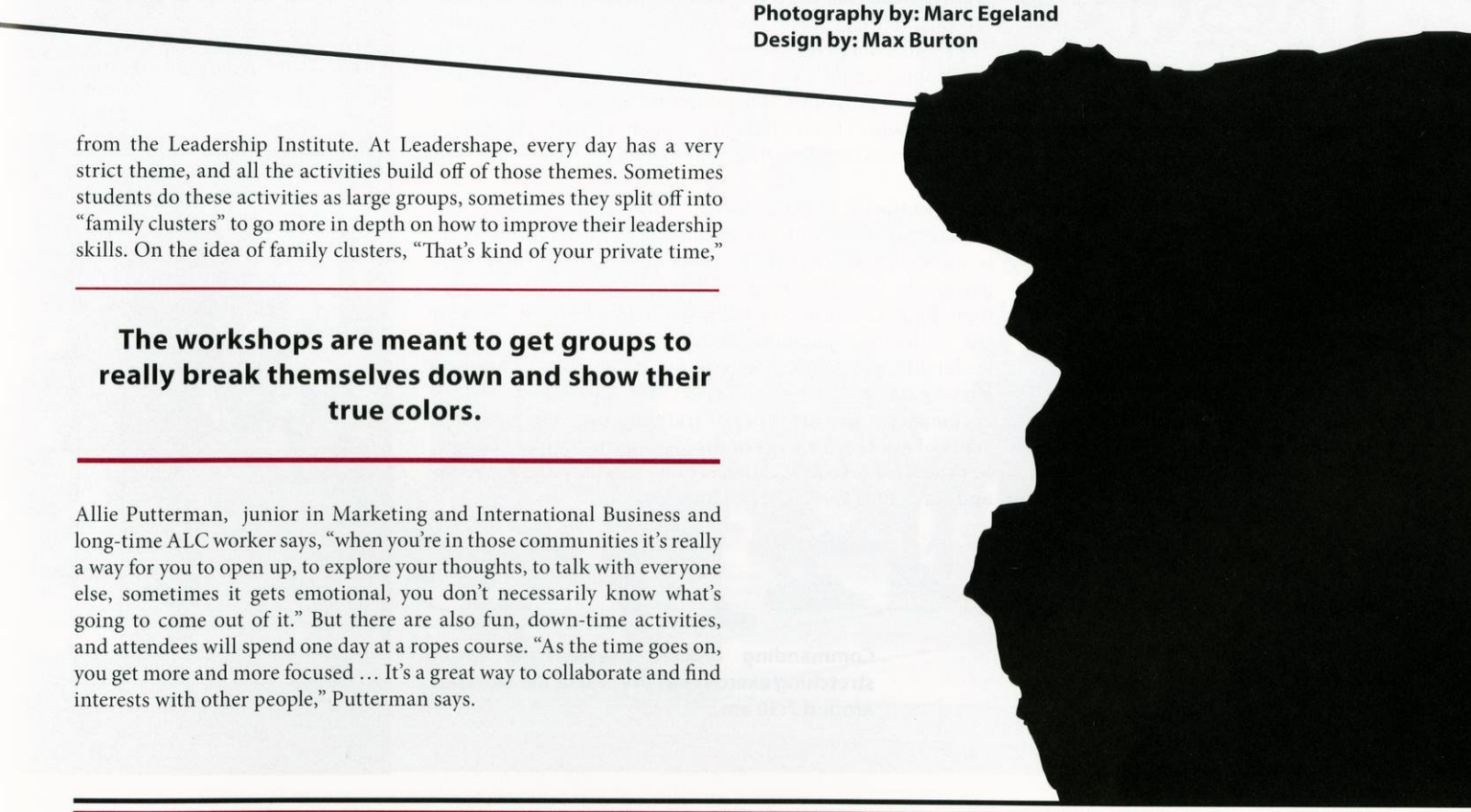
The ALC mirrors LeaderShape's six ALC themes: Leadership Styles and Personal Effectiveness, Creating a Vision and Bringing it to Reality, The Dynamics of Power and Influence, Building High Performance Teams, Living and Leading with Integrity and Managing Change. These themes are a continuation of what students learned from LeaderShape, and the ALC has a speaker come in to address one theme a month, which means three speakers come each semester. Some past speakers have been retired Accenture partners, the new Dean of the Business School and Bo Ryan. The ALC tries to bring in a lot of different speakers and outside business people so students can really get a scope of what it is to be a leader in an actual organization.

The ALC also does Leadership Case Competitions. For these competitions, a company will give the teams an issue or a problem scenario going on within the company, and the team has to come up with a case of how they as leaders would solve this problem. The ALC hosts one in the first week of December every year (this year it will be December 3rd), where 12 teams of only UW-Madison students participate, and the winner of the UW-Madison competition goes on to the Big Ten Case Competition.

Students can also get a Leadership Certificate through the ALC. It goes on leadership and involvement records, and is the same as getting the campus-wide Leadership Certificate. To earn a Leadership Certificate, attendance LeaderShape is a requirement, along with an MHR Leadership Development Class, which is a follow-up of LeaderShape where students come up with a vision as a group and make their vision a reality. Volunteer hours are also required, as well as four workshop events or two workshops and a Case Competition.

So if engineering students need a little boost to get their inner leaders out, want to meet other leaders on campus, or just have a good time, any of these programs would be happy to bring their leadership to a whole new level. WE

Article by: Sophie Weinsheim
Photography by: Marc Egeland
Design by: Max Burton



Dustin Spencer knew he wanted to attend UW-Madison for engineering, however, he faced the question so many students do: how to pay for it? One day his father said to him, "I have enough money to send you to college for one year. After that it's up to you." Dustin found not only funding but also leadership, training, a job after graduation and abundant opportunities: he found Air Force ROTC.

Real Opportunities, Tools and Challenges

Reserve Officer Training Corps

Reserve Officer Training Corps (ROTC) is a program that combines a college education and military training. The Morrill Act of 1862 established military training at land-grant colleges including UW-Madison. The National Defense Act of 1916 initiated the ROTC program.

UW-Madison's Air Force ROTC is led by Lieutenant Colonel Todd Berge, UW-Madison '93. The headquarters are located at 1433 Monroe Street, across from Camp Randall. The program comprises of about 80 students from UW-Madison, UW-Whitewater, Edgewood, and Maranatha Bible Baptist College. Each military branch has its own program, all of which include physical training, special classes and scholarship opportunities. The goal of the program is to recruit, educate, and commission officers. For the individual, this means a commitment to military service after graduation, entering as an officer (2nd lieutenant). Anyone interested can take ROTC courses such as military history or navigation without seeking a commission.

To join the program as a freshman or sophomore, a prospective candidate must be enrolled in a college with an accredited ROTC program, maintain at least a 2.0 GPA, and be in good physical condition . With two years remaining in school, a candidate signs a contract and enrolls in the Professional Officer Course (POC). The requirements for the POC include passing the Air Force Physical Fitness Test, the Air Force Officer Qualifying Test, and completing a Field Training course. For most, the commitment is a total of eight years of service. Specialized programs, like pilot training, require a ten year commitment. That's what Dustin Spencer, fifth-year senior in mechanical engineering, plans to do.

A day in the life of the cadet is similar to that of the average engineer: classes and lots of homework. In addition there is physical training in the mornings, two to three days per week. Cadets attend additional classes that vary in topic by year. Freshmen learn the basics like how to wear the uniform, sophomores study history, juniors practice leadership and seniors prepare for active duty. They also participate in a weekly "Leadership Laboratory," which encompasses various types of training, marching practice, study of military strategy or discussions on national budget. For the Air Force ROTC this is every Tuesday and for Army and Navy ROTC it is every Thursday.

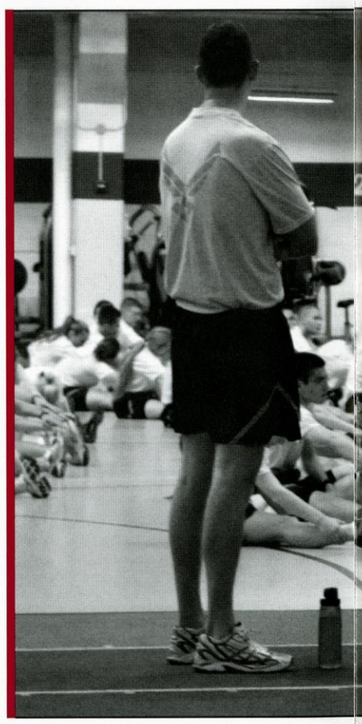
Dustin knows his college experience is stricter than most; no staying out late and sleeping in, and his free time is limited to "a few hours on Saturday to go to a football game, then [he] has to go home and keep studying."

To Dustin the rewards are well worth the sacrifices. Being able to pay for college became the least important benefit. "In fact as time went on it became an inverse relationship, that the longer I've been in ROTC the less important the money became," he says. ROTC provided leadership experience and other opportunities he had never expected.

Now, there's something you can bank on. WE

Article By: Lori Bierman
Photography By: Joe Powell
Design By: Tom Bernath

ROTC



Commanding officers oversee the group stretching exercises at the end of the workout, around 7:30 am.

Badger B.O.T.S.
Robotics Program

Giving Future Badgers a Glimpse into Science and Engineering

At what point did current UW – Madison College of Engineering students decide they wanted to major in engineering in college? What convinced them to take on the challenging course of study? From as young as nine to as old as eighteen years of age, Madison area youth are getting a taste of what being a real engineer is like through the BadgerB.O.T.S (Building on Talented Students) program.

BadgerB.O.T.S was founded in 2003 on the principles of promoting science, technology and entrepreneurship to students by Ben Senson, a Madison School District science and technology faculty member. First competing in the 2004 season, the program has come a long way in its seven years.

The BadgerB.O.T.S program competes with numerous teams at the state, regional and world levels each season through the FIRST® organization. FIRST® is a not-for-profit organization founded in 1992 by the inventor of the Segway, Dean Kamen. Since its creation about 20 years ago, FIRST® has grown from just 28 teams, to over 250,000 participants and 90,000 mentors in 56 different countries.

Beginning with only the FIRST® Robotics Challenge (FRC) team for students in grades nine through twelve, BadgerB.O.T.S has grown to provide programs for kids from as young as second grad all the way to the high school level. Many of the FRC team members enjoy mentoring the younger age groups such as the Minor League Teams for students in grades two and three, the FIRST® LEGO League (FLL) for students in grades four through eight and the FIRST® Tech Challenge for students ages 14 to 18. "Many of the members on the FRC team came in through the LEGO league and they enjoy giving back to the program since it meant so much to them," the director of BadgerB.O.T.S, Ben Senson, says.

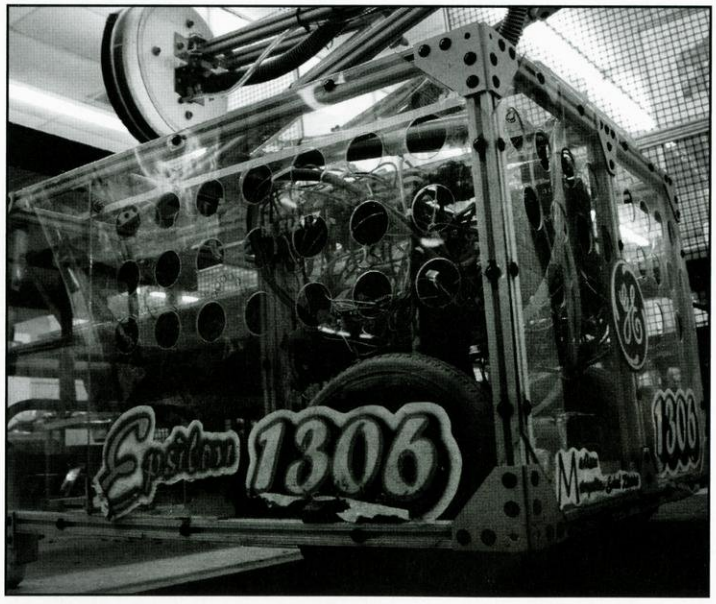
In addition to high school FRC team members mentoring the younger LEGO League members, many UW-Madison students lend a helping hand to the program as well. Within BadgerB.O.T.S, "college students mentor the participants and act as connections to the next level," Senson says. Whether you have technical expertise in programming, graphic arts, web design, mechanical design, logistics, etc., you will come in handy on any of the BadgerB.O.T.S. teams. "We need every talent one would need to run a successful small business, in one shape or form," Senson says.

Having many connections to large corporations including General Electric (GE), Plexus, Oshkosh Corp., Rockwell and Microsoft, involving yourself as a mentor with the BadgerB.O.T.S. program and so being able to mention the world-respected FIRST® organization during an interview may be the best way to land your dream job.

The Wisconsin Regional Director of FIRST®, Maggie Rossiter Peterman, emphasizes how wonderful and beneficial involvement with the FIRST® program can be. "When corporations see the FIRST® on a college students resume, that resume goes to the top of the pile. Mentoring with our program shows long term persistence, diligence and passion for what you do" says Rossiter Peterman. Originally becoming involved with FIRST® by writing an article on the organization, the free-lance writer fell in love with it, became involved, and is now the Regional Director for Wisconsin.

During the course of the season, students involved with BadgerB.O.T.S achieve many difficult goals. For example, each year members of the Lego League are given a new project in which they must brainstorm, design and create an automated Lego robot. Similar to the assignments, projects and personal ambitions of many UW-Madison College of Engineering students, members of the BadgerB.O.T.S Lego League are looking for solutions to real world issues. The LEGO League kids have to research the international problem assigned to them and present it back to the group. "The kids realize they are doing the same exact thing their college mentors have to do at the University level for school and research, and that is fun for them," Senson says.

For this year's competition, members of FIRST® LEGO League were assigned to a challenge called 'Food Factor' which consists of finding solutions to the issue of quality food affecting many parts of the world. Taking problems like exposure to insects and creatures, unsterile processing and transportation, and unsanitary preparation and storage into account, the task given to the fourth through eighth grade



Epsilon is a BadgerB.O.T.S robot designed from 2004. Each season, the robot designs must perform different tasks in competition.

members of the Lego League has involved great amounts of in-depth brainstorming and research.

After the team is finished brainstorming and researching, they design, build and test their Lego robot to complete the given missions. While the children's favorite part of the Lego League program is having fun and building cool robots, they start to develop skills needed to be a successful engineer at the same time. Building the Lego robots encourages Madison's youngest Badgers to think analytically by experimentally finding solutions to complex problems, just like real engineers and scientists. In addition, the personal satisfaction after creating a successful final robot helps the young LEGO League members gain self-esteem and confidence in themselves and their ability to positively contribute to society.

A bit more strenuous than the FIRST® LEGO League, the FIRST® Robotics Challenge (FRC) gives high school students a larger glimpse into whether or not a career in engineering is for them. Meeting once a week in the fall for company tours and safety lessons, the team really goes into high gear around January after NASA announces the challenge for the upcoming season. The FRC members pile into a bus, drive to Milwaukee and watch the announcement of the challenge for the upcoming season on big screen televisions with hundreds of other people from many different teams in the room. "As an engineering person, your mind will be thinking 'are you kidding me?' because the challenges given to these high school students are always off the charts," Ben Senson says.

"As an engineering person, your mind will be thinking 'are you kidding me?' because the challenges given to these high school students are always off the charts."

-Ben Senson

Whether it is putting gym balls through hoops, throwing racket balls at targets, or sending bowling balls down ramps in order to complete the challenges, the team of high school students amaze many by designing, building, testing and shipping their final robots in just six short weeks. "Sometimes the kids meet four, five, or even six times a week to get the projects done," Donna Bambrough says. Donna is a dedicated volunteer of the FRC team and is also a large advocate of involving more college students in mentoring opportunities with the BadgerB.O.T.S program.

Come competition time, the students once again voyage to Milwaukee for the regional tournament. Junior FRC member Ryan remembers his first experience at regionals, "walking into the Cellular Center was absolutely amazing. Seeing all the different teams set up, looking at how they made their robots, the designs we hadn't thought of that we could have built-it was amazing," Ryan says.

Ryan is considering majoring in mechanical engineering and is having a blast making designs on the CAD program Inventor and working on the 3-axis mill the BadgerB.O.T.S recently purchased. Maddi, who loves FRC as much as the next team member, has come to realize a major in engineering is not for her. "A common misperception is that we really push science and technology, but we celebrate just as much when a kid decides that is not what they want to do and decides to go a different track. That is a great thing for them to realize before they go to college," Ben Senson says.

Although some team members enjoy the engineering aspect of BadgerB.O.T.S more than others, there are plenty of tasks not as directly linked to the robot which are just as important for a successful FRC competition season. "I mostly work with marketing and PR. I don't touch the robot, I am afraid I would ruin it," Maddi says, while laughing.

Whether it is with technology or business, the FRC team members are becoming prepared for college through all the designing, machining, programming, team work, financial balancing and marketing experience they are gaining. In addition to all the academic benefits, it is evident the BadgerB.O.T.S program truly prepares the young adults for college as 11th grade FRC member, Maddi, comments on her experience. "It gets to be a huge adrenaline rush preparing for regionals. Everyone is running on very little sleep, a lot of stress and a lot of sugar, but the energy on the team is amazing," Maddi says.

BadgerB.O.T.S. director Ben Senson is very optimistic this season, whether it is with the second and third graders who present their robots to their parents at an end of the season celebration, or the LEGO League and high school FRC teams who both have good shots of going to the world championships.

Despite the positive outlook for all the BadgerB.O.T.S teams in the upcoming competitions, the season does not always run as smoothly as the students, mentors, and volunteers would like. Some of the major hurdles the teams face every season include finances and location. The BadgerB.O.T.S are continuously seeking corporate sponsors to help make it over these hurdles.

For starters, the cost of just the FRC season ranges from $13,000 to as high as $25,000 if the team qualifies for the world championship. The BadgerB.O.T.S receive a very tiny portion of their financial support from school districts since it is a Dane County organization and not affiliated with any school. In addition, a major goal of BadgerB.O.T.S is to allow any Dane County student to participate, even if they cannot afford to pay the dues required of regular members. "About eight to ten percent of our team is on fee waivers at any given time. This ranges from partial to complete financial support. We don't want the financial part to be a barrier for anyone's participation," Senson says.

An even more difficult challenge for BadgerB.O.T.S has been finding a home. "One season we literally moved 5 times, we didn't get a whole lot accomplished that season" Donna Bambrough says. In early October, BadgerB.O.T.S found out their current corporate sponsored building location will no longer be available come April. This means Ben Senson and his dedicated volunteers are once again looking for a new corporation who will be able to lend a bit of unused space for the BadgerB.O.T.S teams to build their robots. The group is really hoping not only for a new home, but a new home which is more permanent than previous ones.

Despite the challenges facing BadgerB.O.T.S, the team always has great fun whether it is wearing their N.E.R.D (Never Ending Research and Design) shirts, eating snacks provided at meetings, machining on the new CNC mill or helping the younger students build robots. Students likeRyan and Maddi may even be joining some of FRC alumni at universities such as UW-Madison, MIT and Cornell some day. "These kids are so bright it's ridiculous. Come out and see our competitions, we'll have you as a mentor any time," Ben Senson says. WE

Article By: Ellyn Underwood
Photography By: Adam Dircz
Design By: Elizabeth Jurgens

population: 7 BILLION

An article from the Wisconsin Engineer Archives written in 1969 discusses the world problem of overpopulation. As the population of the world hit seven billion on October 31 this year, we take a look at what has changed since 1969 and what the future holds for human kind.

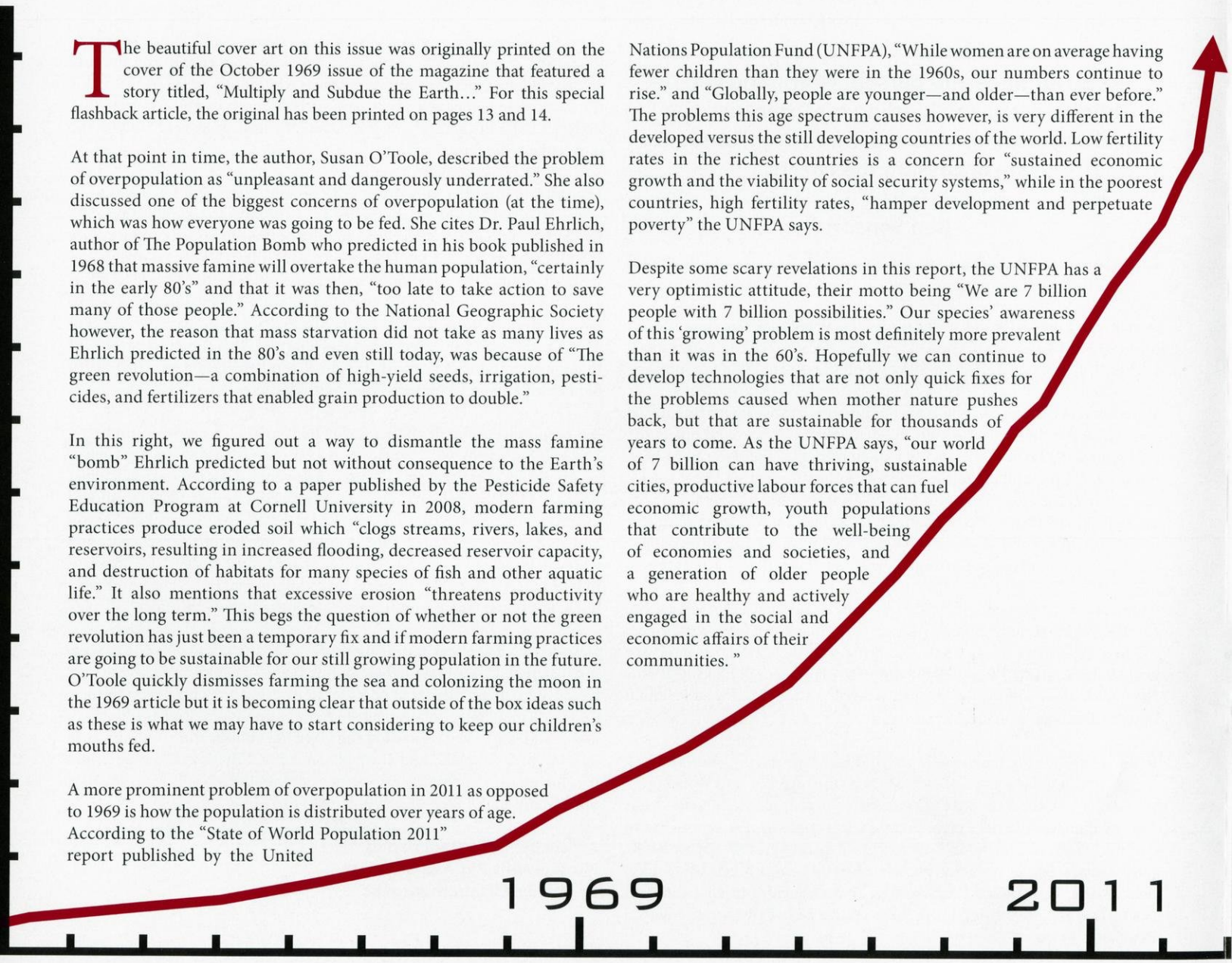
The beautiful cover art on this issue was originally printed on the cover of the October 1969 issue of the magazine that featured a story titled, "Multiply and Subdue the Earth…" For this special flashback article, the original has been printed on pages 13 and 14.

At that point in time, the author, Susan O'Toole, described the problem of overpopulation as "unpleasant and dangerously underrated." She also discussed one of the biggest concerns of overpopulation (at the time), which was how everyone was going to be fed. She cites Dr. Paul Ehrlich, author of The Population Bomb who predicted in his book published in 1968 that massive famine will overtake the human population, "certainly in the early 80's" and that it was then, "too late to take action to save many of those people." According to the National Geographic Society however, the reason that mass starvation did not take as many lives as Ehrlich predicted in the 80's and even still today, was because of "The green revolution—a combination of high-yield seeds, irrigation, pesticides, and fertilizers that enabled grain production to double."

In this right, we figured out a way to dismantle the mass famine "bomb" Ehrlich predicted but not without consequence to the Earth's environment. According to a paper published by the Pesticide Safety Education Program at Cornell University in 2008, modern farming practices produce eroded soil which "clogs streams, rivers, lakes, and reservoirs, resulting in increased flooding, decreased reservoir capacity, and destruction of habitats for many species of fish and other aquatic life." It also mentions that excessive erosion "threatens productivity over the long term." This begs the question of whether or not the green revolution has just been a temporary fix and if modern farming practices are going to be sustainable for our still growing population in the future. O'Toole quickly dismisses farming the sea and colonizing the moon in the 1969 article but it is becoming clear that outside of the box ideas such as these is what we may have to start considering to keep our children's mouths fed.

A more prominent problem of overpopulation in 2011 as opposed to 1969 is how the population is distributed over years of age. According to the "State of World Population 2011" report published by the United Nations Population Fund (UNFPA), "While women are on average having fewer children than they were in the 1960s, our numbers continue to rise." and "Globally, people are younger—and older—than ever before." The problems this age spectrum causes however, is very different in the developed versus the still developing countries of the world. Low fertility rates in the richest countries is a concern for "sustained economic growth and the viability of social security systems," while in the poorest countries, high fertility rates, "hamper development and perpetuate poverty" the UNFPA says.

Despite some scary revelations in this report, the UNFPA has a very optimistic attitude, their motto being "We are 7 billion people with 7 billion possibilities." Our species' awareness of this 'growing' problem is most definitely more prevalent than it was in the 60's. Hopefully we can continue to develop technologies that are not only quick fixes for the problems caused when mother nature pushes back, but that are sustainable for thousands of years to come. As the UNFPA says, "our world of 7 billion can have thriving, sustainable cities, productive labour forces that can fuel economic growth, youth populations that contribute to the well-being of economies and societies, and a generation of older people who are healthy and actively engaged in the social and economic affairs of their communities. "



>> Excerpt from Wisconsin Engineer Magazine
Volume 74, Number 1, October 1969

"Multiply and Subdue the Earth . . ."

by Susan O'Toole

The undeveloped countries of the world, most of them already overcrowded and horribly underfed, are presently working toward a future infinitely more terrifying than their present unbearable conditions. Every year there are more people and less food to keep them alive. The logical end is mass starvation. Dr. Paul Ehrlich, in his book *The Population Bomb*, predicts that this massive famine will overtake us "probably in the early 70's, certainly in the early 80's." This year alone, a minimum of three and one-half million will starve to death, mostly children. Dr. Ehrlich assures us that "this is a mere handful compared to the numbers that will be starving in a decade or so. And it is now too late to take action to save many of those people."

The facts of overpopulation are surprising, unpleasant, and dangerously underrated. However, they are becoming the matter of more and more concern for biologists and ecologists. In an interview with Dr. Warren Porter of the Zoology Department, I asked him if he agreed with Dr. Ehrlich's prediction. His answer: "It's the prediction of almost any ecologist you talk to anywhere in the world. Primarily this whole business of the population explosion is a numbers game. There are equations which describe the increase in numbers of the population. We know what the population is now, we have a pretty good idea of how fast it is increasing, and from that we can predict quite accurately in many cases, how the population is going to increase."

An interesting but fatal fact of the numbers game is the phenomenon of "doubling time." As the number of people inhabiting this planet increases, the number of years that it takes that population to double decreases. It took the population of 6000 B.C. (5 million people) eight thousand years to reach 500 million people – a doubling time of roughtly 1,000 years. From 1,000 years, the doubling time reduced to 200 years, then 80 years, and the current estimate for our world population is a doubling time of 37 years. However, the doubling times vary in individual countries. While they may be as high as 63 years for the United States or 140 years for the United Kingdom, most of the doubling times for undeveloped countries are below the average of 37 years. Examples are 24 years for Kenya, 20 years for Costa Rica, and 19 for El Salvador.

The living conditions in the undeveloped countries are, of course, far from adequate. Yet to simply maintain the same impoverished level, the food supply, transportation facilities, industrial output, imports, doctors, teachers, and everything else that is necessary for maintaining life must also double at the same rate. Improving the conditions of a country is not simply a

matter of importing more food than a country consumed in one previous year. The surplus will quickly be consumed by the new surplus of people. To effectively raise the standard of living, the new supply of food and products must not only keep up with the increasing numbers of people, but must surpass it. It is not likely that this will happen in most undeveloped countries or even that increase in food and products will keep up with population growth, and the undeveloped countries will sink deeper and deeper in poverty. Obviously what is called for is not the impossible dream of pouring more and more food supplies into these countries, but an effective means of population control.

One factor of the overpopulation issue that is little known is that roughly 40% of the population of the undeveloped countries is under 15 years of age. In one decade this tremendous number of people will reach their reproductive years and there will be a baby boom that is unparalleled in the history of this planet. And all these people must be fed. The optimists among us will say that more people will provide more manpower for growing and distributing food, but the facts give support to a gloomier position. In 1966, while the population of the world increased by some 70 million people, there was *no* compensatory increase in food production. The result of these impersonal facts and figures is, for instance, that 100 infants die *per day* in Colombia from malnutrition.

Providing food for these countries, in the case that anyone cared to or was able to undertake such a project, could only postpone the inevitable, not solve the problem. What is needed is a stable population. A population that remains the same in numbers over a period of time is one in which the birth rate and the death rate are approximately equal. With increasing sanitation and medical advances in many undeveloped countries, disease is claiming fewer victims and the infant mortality rate has often been substantially reduced. While the birth rate continues to soar, medical advances keep more and more people alive, increasing even more the active and dependent members of a population. The implication is not that we need to let more people die, but that we need a means of effectively reducing the birth rate to balance it with our increasingly sophisticated knowledge in reducing the death rate.

This emphasis on the undeveloped countries should not leave the impression that the situation is under control in the industrially developed countries such as the United States. There is no longer any doubt that a great many people are literally starving to death in this country and a walk through the slums of any one of our major cities will give ample evidence of the effects of overpopulation.

The whole issue of population control boils down to a choice that we must make. Either the people of this world must exert a control over nature in the form of maintaining a population that is balanced with our limited

••• to read the entire article from 1969, visit our website at www.wisconsinengineer.com WE

Article by: Melody Pierson with excerpt written by Susan O'Toole
Design by: Evan Owens

Lecture in the cloud

Lecture Capture Technology is a new pilot technology being introduced to the College of Engineering this semester. This technology has been implemented in courses that rely heavily on lecture material such as ISYE 315 and ISYE 575.

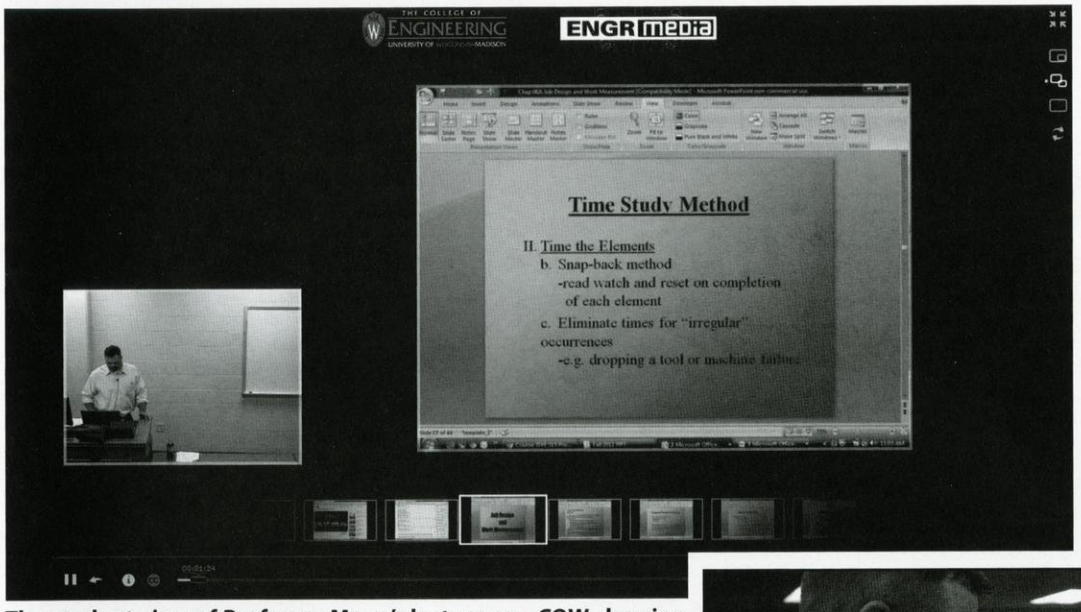
This technology allows the professor turns on his microphone at the beginning of the lecture and hits a record button at the podium. There is a video camera mounted in the ceiling to record the professor and the computer simultaneously records the PowerPoint slides being discussed. The footage is then streamed over the Internet, displayed as a split screen of the professor and the slides, and can either be viewed real time or at a later date.

There are many benefits of implementing this new technology including ease of access to the material, especially with regards to making up missed lectures. Students can watch the entire lecture as if they were in the lecture from the comfort of their own home. Also, students no longer have to stress about missing class for interviews or exams because they can easily watch the lecture at another time. Both of these features have definitely benefitted students throughout the semester so far and will continue to benefit them as student's schedules get more and more hectic.

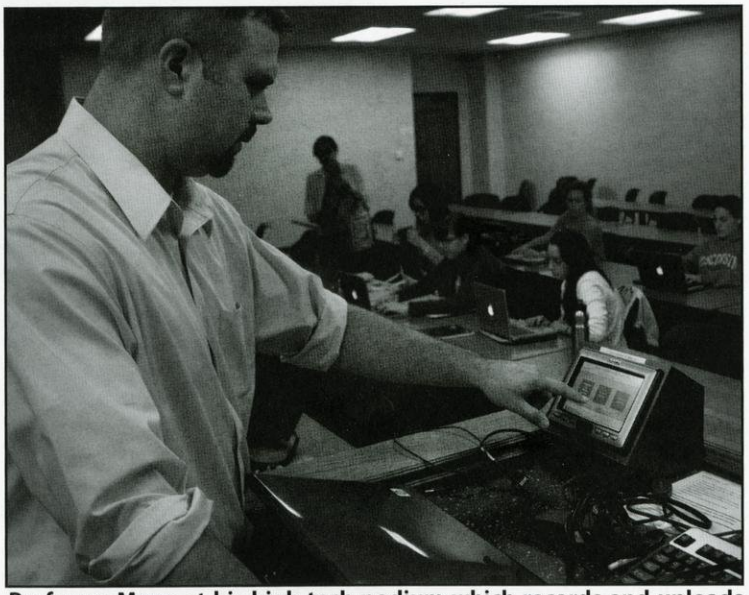
With this technology there are some concerns about attendance because you essentially would never have to go to class. However, in ISYE 315 and 575 the professors and the students haven't noticed a dramatic decrease in attendees. However, there are people who do miss class occasionally and they recognize the benefits of having access to the lectures online.

Depending on the success of this technology this semester, there will be plans to implement it into more and more classrooms in the future. Check out our next issue for more details about how the technology is changing, the effects it's had throughout the fall semester, and what professors have to say about it.

Article By: Christina Wallhausser
Photography By: Chris Ross
Design By: Evan Owens



The student view of Professor Mann's lecture on eCOW showing both the professor lecturing and his PowerPoint.



Professor Mann at his high tech podium which records and uploads his lectures to his eCOW website.

power WALKING

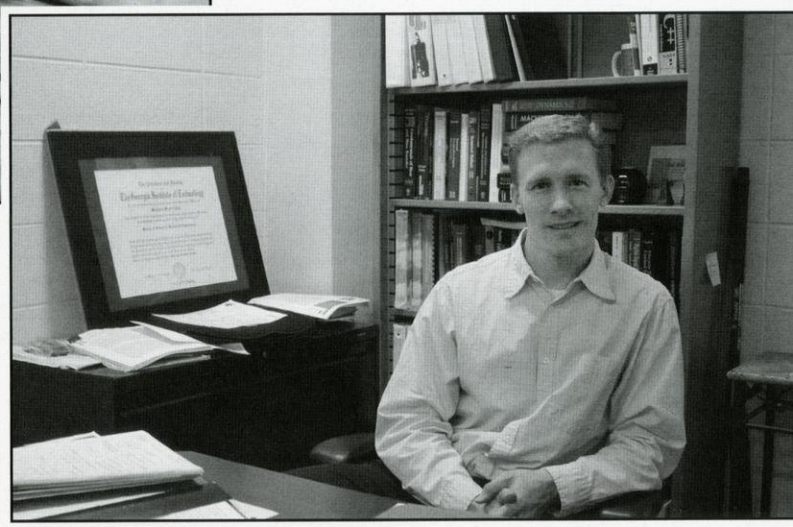
Energy harvesting, sometimes termed power harvesting or energy scavenging, refers to any process that captures and stores energy from external sources. Some of these processes are quite common already, such as photovoltaic panels or wind turbines. There are many methods, however, that have been largely overlooked until now. According to the Department of Energy, more than 50 percent of energy generated annually in the United States is lost as waste heat. Thermoelectric generators can be used to cool computers components and industrial equipment while simultaneously generating electricity by taking advantage of the thermal gradients that are created. Other devices are designed to harness the kinetic energy, or energy possessed due to motion, of vibrating engines and motors, dancers at night clubs, or even good ol' fashioned walking!

Kinetic energy harvesting in particular is one of the most highly investigated areas in this field. While this may sound like cutting-edge technology, the idea has actually been around since the 18th century. In 1770, a Swiss watchmaker pioneered the concept by inventing the first self-winding pocket watch. It essentially functioned the same as a modern-day pedometer; it wound the owner's watch through the use of an oscillating weight. Today, almost all mechanical watches on the market employ some form of this technology.

Until the last few decades, kinetic energy harvesters relied only on linear dynamic systems. According to Matt Allen, assistant professor in engineering physics here at UW-Madison, current research is based on non-linear equations of motion. Allen says, "The mathematical models used to describe the systems allow for much more complicated systems … which have the potential to harvest energy over a wider range of conditions."

Much of the present-day research in this field is geared towards creating self-powered microsystems and personal electronic devices through the use of kinetic energy harvesters. "We all have something that's burning power constantly in our pockets," Allen says. "It's not totally outrageous to think you could have cell phones that you never have to charge… as long as you're not too lazy." Allen is referring to the

Students rushing to class may never need to worry about their cell phone dying again



Matt Allen, Assistant Professor in the engineering physics department is working to use the kinetic energy of walking to charge a cell phone

idea of using an energy harvester powered by the motion of walking to charge a cell phone's battery.

There are many types of kinetic energy harvesters that could be used for such an application. The primary difference among these vibration-powered generators is the transduction mechanism employed. These mechanisms can be electromagnetic, electrostatic, or piezoelectric based, each with its own unique advantages and disadvantages. Current research here at UW-Madison is looking into using the last of these by having the device installed in the soles of your shoes!

So next time you are out running errands and that dreaded "Low Battery" warning rears its ugly head, there's no need to rush home and find your charger-- just make sure to walk where you need to go and your problem is solved.

Types of Vibration-Powered Generators:

Electromagnetic based harvesters make use of basic electromagnetic induction, which is the generation of electric current in a conductor subjected to a magnetic flux. To achieve this, one can either have the conductor and magnet move relative to one another, or produce a time-variant magnetic field. There are several examples of this technology already on the market, such as self-charging flashlights. This approach is the most well-established and there are a variety of configurations and materials available, making this method fairly adaptable. On small scales, however, this type of generator provides minimal output unless they are equipped with very powerful magnets.

Electrostatic generators involve displacing opposite plates of a capacitor. The capacitor is charged by a battery, which creates equal but opposite charges on the plates. Holding either the charge on the plates or the voltage between them constant, the plates are moved relative to one another by some external force. The work done against the electrostatic force between them produces energy that can then be harvested. Since this family of devices requires some energy input to establish the initial polarization, their application is the most limited.

Piezoelectric based devices rely on... wait for it... the piezoelectric effect! These devices use piezoelectric materials, such as quartz, which accumulate charge when subjected to mechanical strain. This charge accumulation leads to a polarization of the material, which can then be used to charge a capacitor or battery. This class of device offers the simplest and most direct approach, since the vibrations or displacements are converted directly into a voltage output. The limiting factor here is the piezoelectric materials themselves, because they tend to deteriorate quickly. There are few geometric requirements, however, and they do not require lots of additional components. This makes them the most effective per volume of the three. WE

Article By: Nate Rogers
Photography By: Nick Lepak
Design By: Evan Owens

MOON POWER:

He3-He3 FUSION

as a source for global energy supply

As global energy demands continue to grow and non-renewable energy sources steadily dwindle, human beings will need to turn to new and innovative ways to quench our energy thirst. Nuclear fusion is a promising technology that is destined for the limelight with the completion of the International Thermonuclear Experimental Reactor (ITER) set for 2016. ITER is an international collaborative project which aims to demonstrate the feasibility of sustaining an energy-positive fusion reaction for the first time. The reactor at ITER will use magnetic confinement to generate a fusion reaction based on the deuterium-tritium (D-T) cycle. The fusion of deuterium, a hydrogen isotope found in seawater, and tritium, a heavier and radioactive isotope of hydrogen, is the reaction that is utilized in thermonuclear weapons. ITER is intended to produce 500 Megawatts of power for every 50MW input—a 10:1 return.

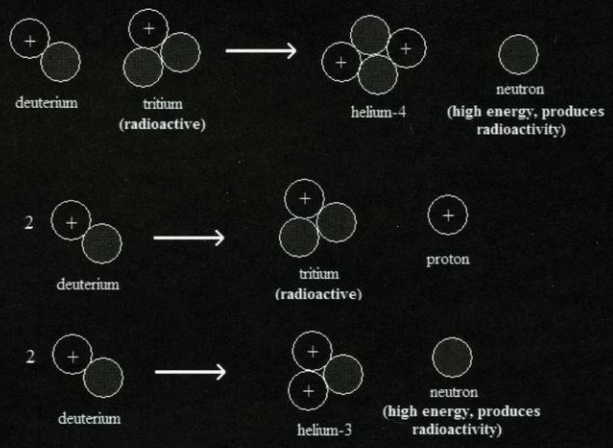
There are drawbacks to the deuterium-tritium fusion reactions. Nearly 80% of the energy is released as high-energy neutrons. Neutrons are not easily captured and must be slowed by some sort of medium. They cause significant structural damage over time. Additionally, concerns of radioactive waste need to be addressed.

"It is hypothesized that it would take 40 tons of Helium 3 to provide all of the electricity that will be used in the United States in 2011."

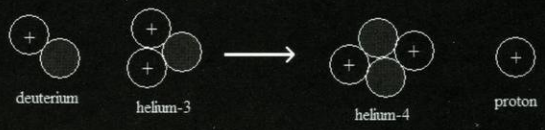
A second generation reaction based on the fusion of deuterium and helium-3 (D-3He) is an attractive alternative to the first generation D-T cycle reactions because it produces significantly fewer high-energy neutrons. Professor Gerald Kulcinksi, nuclear engineer and director of the Fusion Technology Institute at the UW-Madison, has been researching fusion reactions involving helium-3 for over thirty years. In the 1980s, Kulcinski began researching D-3He fusion. "The problem is, we didn't have any helium-3, and the only helium-3 on earth comes from the decay of tritium," says Kulcinski. Yet the lure of a D-He3 reaction drove Kulcinski and his colleagues to search for the elusive isotope. Kulcinski says, "Around 1985, we all sat around and looked at each other and thought about where to find large amounts of helium-3 for civilian use." Helium-3 is ejected from the sun as charged particles in the solar wind. However, the energy is not enough to get through anywhere atmospheric, and the particles will go around anything with a magnetic field.

Kulcinski says , "So you start out at Mercury. Mercury has no atmosphere, but it has a magnetic charge, so it did not catch any. Venus has no magnetic field, but it has a heck of an atmosphere. We have both, so we didn't get any. The only body that's close to the sun that has neither a magnetic field nor an atmosphere is the moon—our moon. So the scientists said it has to be there."

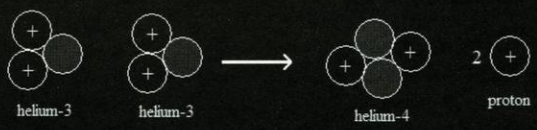
First Generation Reactions



Second Generation Reaction



Third Generation Reaction



After going through samples of lunar rocks brought back from the Apollo program, it was confirmed that every sample contained helium-3. "Even more interesting," says Kulcinski, "is that on several of the Apollo missions they dug into the regolith—the dark, very fine material that covers the lunar surface, and all of it contained helium-3." While the solar wind deposits only a thin layer of helium-3 on the surface of the moon, over the course of four billion years the moon has been repeatedly struck by meteorites which have pulverized the surface. This process has gardened the material into an extremely fine dust that can be up to 20 meters thick. According to Kulcinski, "the moon is the perfect catcher's mitt up in the sky to catch helium-3." There is an estimated one million metric tons of helium-3 on the surface of the moon.

While the majority of the world is studying the D-T cycle for fusion power, Kulcinski and his team of graduate students are experimenting with the fusion of two helium-3 isotopes (He3-He3). The reaction does not produce high-energy neutrons or radioactivity. It creates nuclear energy without nuclear waste.

"We're using a third kind of way to make fusion," says Kulcinski. "Not magnetic or inertial—we're using electrostatic. It's not new. It was invented by Philo Farnsworth who also invented the television. He didn't get very far, but we found his papers and saw that the way he did it was particularly suited for high energy reactions like He3-He3."

A He3-He3 reaction has been performed in the small reactor which resides in the lower level of the Engineering Research Building. "I have some really great students who have actually run this," said Kulcinski. "However, we have not yet gotten back more energy than we have put in. Mother Nature makes it harder as you go from 1st to 2nd to 3rd generation reactions. The third generation reaction requires on the order of four to five times more energy to make the reaction run. "Our goal is to produce a system that makes nuclear power with no nuclear waste. That's the pot of gold at the end of the rainbow. Now, I probably won't see that, but my students might. They have been making progress."

If the He3-He3 fusion reaction can be improved and eventually perfected, it would have massive implications on the global energy supply. It is hypothesized that it would take 40 tons of helium-3 to provide all of the electricity that will be used in the United States in 2011. A space shuttle can carry 20 tons of cargo, so eight of them could theoretically power the world for a year.

Kulcinski and his colleagues have spent considerable time designing mining rovers that would be able to extract helium-3 from the moon's surface. The rovers would forage the top layers of regolith and extract the particles less than a millimeter in diameter with a system of sieves. The dust would then be heated with solar energy to about 700°C at which point the helium would evaporate. Helium-3 would be separated from helium-4 on site, and the purified helium-3 would be shipped back to earth. Kulcinski claimsof this program that eventually, "the energy payback for every unit of energy we put into getting the material, we will get 300 units when we burn it. That's including the making of the rockets, the rocket fuel to get to the moon, the support of the base, and the return trip back."
Working with NASA Administrator Mike Griffin and former NASA astronaut Harrison Schmitt, Kulcinski was part of a group that

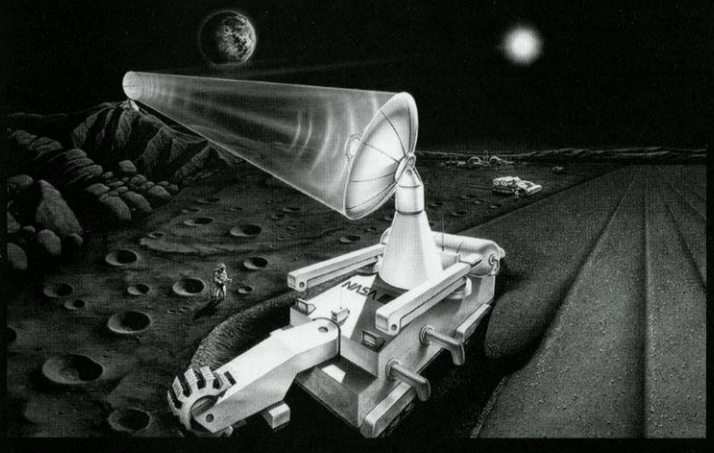
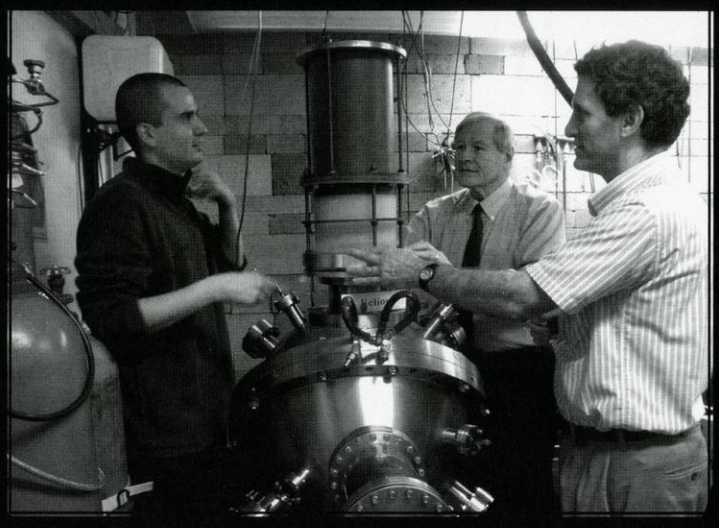


Photo credit of: University of Wisconsin

The Mark II Lunar Volatiles Miner, designed by students, faculty, and scientific staff at UW-Madison, would use solar energy to harvest helium-3 from the moon's surface.

was planning to make the seventh landing on the moon in the year 2017. When asked about his reaction to learning that the Obama administration had put an end to the manned space program, Kulcinski was predictably somber.



Professor Gerald Kulcinski consults with lab director (Rich Bonomo) and one of the program's graduate students (Gabriel Becerra), over *Helios*, one of three fusion devices in the UW-Madison Fusion Technology Institute.

Kulcinski explained, "My reaction was not simply disappointment. We worked so hard to get a return to the moon—not just for science even though science is very important—but this is the first time we knew of anything that was valuable enough that once we got there and set up all of our stations, we'd be able to send something back to earth to pay for the program."

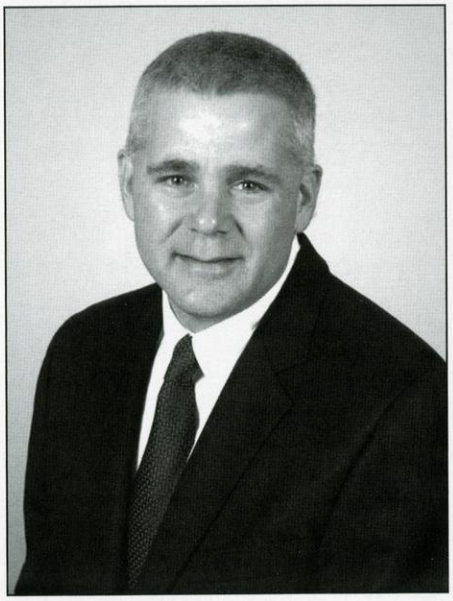
The United States is no longer interested in going back to the moon, so it may leave us behind with regards to He3-He3 fusion. While it's understandable that the U.S. would be hesitant to back a program that may not have a payoff for over thirty years, the potential consequences of letting another country dominate the helium-3 market must not be ignored. The Chinese have talked about going to the moon and harvesting helium-3. Japan, Russia, and India have also expressed interest in helium-3 fusion. Kulcinski asked about having to buy helium-3 from another country, "Now, politically you ask yourself, is that any different from buying oil from the Middle East?"

He3-He3 fusion is still a long way off from breaking even in energy conversion. When Kulcinski started doing research with helium-3, it was $1000 per gram. The last time they purchased it the cost was $7000 per gram. Within a few years, helium-3 is expected to go to $30,000 per gram. "That is going to put us at the university out of business," said Kulcinski. However, there is still enthusiasm for the project from those in the scientific community.

The group at the UW-Madison is currently the only ones in the world doing He3-He3 reaction research. The research is paid for almost completely through private funding. Two individuals in particular, Dave Grainger and the late Wilson Greatbach, have made significant contributions. According to Kulcinski, "We couldn't do this research if we didn't have Dave Grainger or Wilson Greatbach. Neither of them wanted any publicity or anything back. They just wanted to support students doing far out work and stretching their minds."

Article by: Matt Treske
Photography by: Sara Karraker
Design by: Akhilesh Dakinedi

Industry & Sustainability



Professor Craig Benson's story of living in the interface

Some people grow up living between separate parents, neighboring cities or clashing cultures -- Professor Craig Benson spent his childhood in two worlds. Growing up in eastern Pennsylvania he was raised between his family's dense industrial city home and their vacation home in the Pocono Mountains during the summers. In his eyes, growing up in a heavy industrial area was almost the "antithesis of sustainability." While he was still young, Professor Benson understood the "juxtapositions of worlds". The industrial world and the striking natural environment created an interface which he continues to cross each day in his position. He currently serves as the University's Director of Sustainability Research & Education, Co-Director of the Office of Sustainability and chair of civil & environmental engineering and geological engineering. He has also been named as a Wisconsin Distinguished Professor in July 2007 to the present day. On top of all of that his research papers have been cited over 1145 times. Perhaps what creates Professor Benson's continuing success at managing his numerous positions is his ability to be the link he saw at a young age between his two worlds.

Today, this value to transcend both spheres of the industrial and natural worlds as he did when he was young is integral to Professor Benson. He says the key issue of sustainability is "managing the interface between the natural and built environments, (while) understanding the importance of our industrial economy as well as our environment." Professor Benson is one of those people who manage it for everyone else. He likens his role to a "gatekeeper" who is constantly "moving back and forth between worlds." People who know Professor Benson understand his sincerity about the environment. Even his wife jokes that "he'd rather live in the woods than in the house." With this passion of the world, Professor Benson sees sustainability in all aspects. It is with this mindset at a young age that he built his life forward. Benson received his bachelor's degree from Lehigh University, worked in consulting for a year, then received his Master of Science in Engineering Degree and Doctor of Philosophy at University of Texas at Austin in Civil Engineering.

It was Wisconsin's environmental progressiveness that drew Professor Benson in. He received other university job offers, but this one stood out. Professor Benson acknowledges the UW - Madison's rich environmental history and culture as one of the alluring factors; environmental progressives from Aldo Leopold to John Muir have left their mark upon the University's sustainable intrinsic values. Upon arriving, he was immediately put to work instructing faculty and students, teaching classes such as Soil Mechanics (CEE/GLE 330), Waste Containment Systems, Environmental Remediation, and developing environmental courses as well.

On his commitment to lifelong learning Benson says, "I've been in a university since I was 18 years old and I'm almost 50." After receiving

his PhD from Austin he was attracted towards academia. He captures the sprit of academia best by saying, "It's about the creation of knowledge and pushing the frontiers of knowledge and science forward." The knowledge that comes from research and academia fits into the grander scheme of engineering. Professor Benson sees research tie into what he calls "the Triangle of our Profession" which is comprised of teaching, service, research and practice tied together to make the foundation and support.

If you've been around campus this last year, you've probably heard of the new environmental studies major. As of this last April, students on campus have the option of pursing the environmental studies major as a secondary major through the Nelson Institute, or can pursue a certificate in environmental studies. Along with the new environmental major, Professor Benson wants to spread the opportunity of sustainability to everyone, he says the "sustainability initiative has its roots in Nelson, but it's meant to be a bigger umbrella for all of us." As director of the Office of Sustainability Research and Education, he is working with faculty this fall to examine the curriculum being taught in hopes of creating a campus-wide sustainability certificate. Professor Benson will work with professors in order to "create opportunities for students across the campus."

Along with this opportunity, Professor Benson also hopes to provide future opportunities such as internships for students. These internships would be different than filling out an application – students would propose their ideas and apply with that program in mind. Through this future internship opportunity, students would work with all majors across colleges into teams. Professor Benson says working in diverse teams made up of business, social work, biology and engineering majors, students will foster a new kind of thinking. Often people overlook the humanistic challenges –Professor Benson says this story of opportunity would help students develop the skills to overcome the questions of, "what is often the biggest challenge, how do you get people to work together on a common goal?"

Through his university positions, Professor Benson continues to be an influential leader in the faculty community. He is currently working with faculty to capture sustainability opportunities such as grants by the Environmental Protection Agency. Being awarded future grants Professor Benson says, could "create things on campus that we don't have right now."

Through the Office of Sustainability this fall, Professor Benson says there will be campus based initiatives for students, faculty and staff. While they haven't been publically announced yet, Professor Benson says that they will affect our lives on campus and how we approach sustainability.

There's no doubt that Professor Benson loves learning, but what he loves the most about his role in the University is his students. He says his biggest professional accomplishment is "the number of students I have had that are successful." Over the years he has seen his students become successful consultants, contractors and faculty. Professor Benson acknowledges that affecting people's lives is truly the biggest accomplishment. He always leaves his office door open providing a valuable resource for students, staff and faculty. Capturing the essence of what it truly means to be a professor, Professor Benson says it is, "providing vision to others and affecting their lives is the real value added to society." WE

Article By: Rachel Feil
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The contrast of nature and industry has played a large role in professor Craig Benson's life

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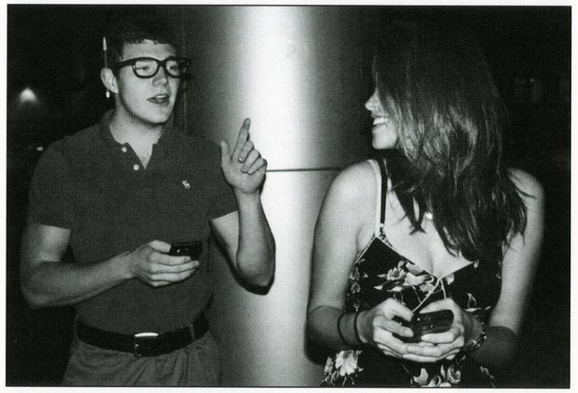

Urban Dictionary defines an engineer as, "A kick-ass uber-genius with godly math and science abilities, the training for which being at the expense of those abilities for spelling and talking to members of the opposite sex." But are our communication skills really that lacking? Do most engineers fit the stigma of 'socially-awkward nerd'? In talking with a multitude of my peers and also the professors that teach technical communications courses, engineers are not as socially awkward as many would assume.

To become an engineer, of course you need the math and problem solving skills, but what many people don't realize is how much communication experience you need as well. Professional engineers will spend anywhere from fifty to ninety percent of their day communicating. You could be spending your time giving presentations, writing memos or proposals, or even negotiating contracts with customers. No matter what form, communication comprises a vast amount of time in professional engineering. Additionally, engineers lacking proper communication skills will find themselves struggling in this area throughout their careers.

Traci Nathans-Kelly, director for the Technical Communication Certificate (TCC) and professor in a multitude of Engineering Professional Development (EPD) courses states that, "most people don't understand how important communication is for the professional engineering field until it is too late!" Traci also talks about the track that some engineering students get put on in high school. Math and science courses get loaded on and English gets pushed to the side. "It's really too bad that engineering students get molded one way toward math and science, but it's the really smart ones that can, and will, bring the two [subject areas] together." EPD courses help us to develop the variety of skills necessary to succeed in the work force. These courses involve much more than simply writing papers.

Many undergrads in engineering believe that our curriculum of Basic Communications and Technical Writing is sufficient and in some cases, over the top. However, every professor I spoke with that is involved in technical communications said that these two courses are the bare minimum and more should be required of us. Marty Gustafson, EPD professor and manager of commercial products at Orbitec, graduated from UW-Madison with a Bachelor's degree in Engineering Mechanics. She talked about the shock engineering undergrads will experience once they get into the real world, "It's going to blow students' minds when they get into the work force and realize how much documentation and

"Engineers have a different way of communicating."

-Professor Marty Gustafson

presentation they will have to do, you can't get away from it." Marty also has an extensive background in marketing and explains that, "Engineers have a different way of communicating. We rely on data, statistics, and designs to sell ourselves and our products. Non-engineers can't pick up on those subtleties."

At least ninety percent of the job postings on the UW-Madison's Engineering Career Services website (ECS) required skills in communication. I know many undergrads groan at the thought of taking more EPD classes, but it is a necessary skill for all engineering professions. The TCC is a distinguished program with as many as 42 people enrolled at a time. Nine credits in technical proficiency courses and fifteen credits in technical communication courses are required to obtain this certificate. There is a multitude of great ways outside of EPD to further your communication skills on campus: join an organization, get involved with leadership, or do internships and co-ops.

So, next time you think engineers can get by just with our 'godly math and science abilities,' think again. We are expected to communicate with not just engineers, but the customers, marketing team, business people, and managers too. Strive to enhance your communication skills before you advance to the professional level.

>> For more information on the TCC, visit: http://tc.engr.wisc.edu/certificate

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Team ROBOTICS

Each year, a team of engineers from UW-Madison, called Wisconsin Robotics, travels to the campus of Oakland University in Rochester, Michigan, along with about forty other teams, to participate in one of the world's most prestigious and challenging robotics competitions. The Intelligent Ground Vehicle Competition (IGVC) pushes autonomous vehicle technologies to their limits. Approximately forty competing robots are evaluated by a panel of judges based on their performance in the competition's four events:

Design Competition:

Each team of students presents a written design report and an oral presentation to the judges explaining their robot's design. The judges then examine the robots to gain a thorough understanding of their design and function. Teams are awarded points for innovative aspects of their robot's design and function.

The Wisconsin Robotics Team along with Singularity, their submission for the Intelligent Ground Vehicle Competition.

Autonomous Challenge:

Following the design competition, each robot is required to navigate an obstacle course without any external input; this task is the major event of the competition. The course consists of a path, outlined by white or yellow lines, that is littered with a variety of obstacles ranging from cones, to ramps, to sandpits and simulated potholes. The robots use a number of techniques to detect and avoid obstacles as they traverse the course. Most robots employ a camera and computer vision software to survey the surrounding environment and a number of short-range proximity sensors to avoid various obstacles, however teams can use other innovative systems to detect obstacles.

Navigation Challenge:

After their successful passage of the obstacle course, the robots are required to autonomously travel from a predefined starting point through a number of random waypoints, to a final destination. Obstacles are again placed in the robots' paths to test their obstacle avoidance capabilities. One of the most difficult obstacles in this event is a fence with a randomly repositioned opening. The robots almost always feature GPS hardware that allows them to sense their exact global position.

JAUS Challenge (optional):

JAUS stands for Joint Architecture for Unmanned Systems; it is a communication protocol for controlling unmanned vehicles. The purpose of JAUS is to enable unmanned systems to be controlled by any device using the protocol, regardless of that devices hardware or software manufacturer. In the JAUS Challenge, the competition judges issue the robots a number of increasingly complex commands using the JAUS protocol. The robots are evaluated on their ability to obey these commands.

Wisconsin Robotics is one of the largest teams in the IGVC each year, with approximately thirty members. Each of the team's members are interested in autonomous vehicles for different reasons, but one of its members says, "it's the challenge [...] everything has to fit together and it's a combination of innovative mechanical design, electrical components [and software]. We're just doing this because we think it's cool. We don't get any sort of course credit for it, we don't have any incentive to do this other than that it's cool." The challenge posed by the IGVC is certainly a daunting one, the robots use state-of-the-art navigational systems and contain highly complex circuitry and mechanical components. Many robots in the IGVC cost over $20,000 to develop over the course of several years. "[The competition] can be stressful, mainly because it gets down to competition and it's crunch time [...] and building [the robot] is a lot of fun but getting to the competition and realizing that it doesn't work outdoors on their course is not so fun."

The vehicle Wisconsin Robotics will enter into this year's IGVC is called Singularity. Singularity has been under development for three years and features a number of innovative design elements that the team hopes will give the robot a competitive edge over its opponents. One of the most amazing aspects of Singularity's construction is that almost all of its mechanical and electrical components were built from scratch by the Wisconsin Robotics team. WE

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