THE PRE-ENGINEERING *TIMES*

A publication of JETS

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What are you doing to celebrate Engineers Week 2008?

Explore...Assess...Experience Engineering

JETS provides programs and resources that help students explore, assess, and experience engineering first-hand. From exciting student competitions to assessment tools and career exploration materials, JETS helps students plan for rewarding futures by showing them how engineering can help them pursue their dreams.

EXPLORE...
Find your dream job, meet extreme engineers, watch video

Feature Story

Biological Engineering

Biological engineers are creating many new ways to provide water, food, energy, fiber, and health products—the necessities of life—using biological solutions in place of traditional tools, such as mechanical devices and chemicals.

A rapidly growing area of study, biological engineering applies engineering practice to problems and opportunities presented by living things and the natural environment. Biological engineers are involved in a variety of interests that continue to evolve as our understanding of science and nature grows-and as we figure out how we can make biological systems and processes work to our benefit.

Biological engineering is as broad as the biological world itself. Areas of interest range from environmental protection and remediation, to food, fuel and feed production, to medicine and pharmacology. Some biological engineers develop

(continued to page 2.)

In This Issue

JETS Spotlight

JETS Affiliates help increase awareness of and interest in engineering and technology-based careers to pre-college students, parents, teachers, and school counselors.

To fit your organization's needs, JETS has created several ways to become a JETS Affiliate. To learn more about how your organization can participate as a JETS Affiliate and help JETS inform and excite young people about engineering careers click here.

NICET

Alfred State
SUNY College of Technology

Pass it On!
Please encourage your students and their parents to subscribe to the Pre-Engineering Times! It's not only a great resource for the classroom, but also for students and their parents as they make career choices and learn about the world of engineering.

To sign up to receive the monthly Pre-Engineering Times, please go to http://www.jets.org/programs/enewssignup.cfm. If you wish to unsubscribe, click here and include "REMOVE" in the subject line.

instruments and imaging products for analyzing biological materials. Others develop strategies for natural pest control and treatment of soil and water pollution and hazardous wastes. Some work for NASA, developing life-support systems, like deployable greenhouses, for extended space missions. These days, biological engineers are also extensively involved in the development of alternative fuels, specifically biofuels and the processes by which biological materials—vegetable oils or agricultural waste products, for example—can be converted to energy.

Biological engineers typically go to school for four years, obtaining a degree through programs such as agricultural, biosystems, biological, or environmental engineering. Many go on to graduate school or even earn a Ph.D. Students who choose biological engineering should have an interest in biology and enjoy finding new ways of solving problems. In addition, biological engineers also take physical science, mathematics, and core engineering courses.

Here are a few places where biological engineers work:

- Oakridge National Laboratory
- NASA
- University research and extension services
- BP Global
- USDA Agricultural Research Service
- USDA Natural Resources Conservation Service
- US Environmental Protection Agency
- Aquaculture facilities
- Archer Daniels Midland
- ConAgra
- Purina
- Disney's Epcot Center

Useful Links:

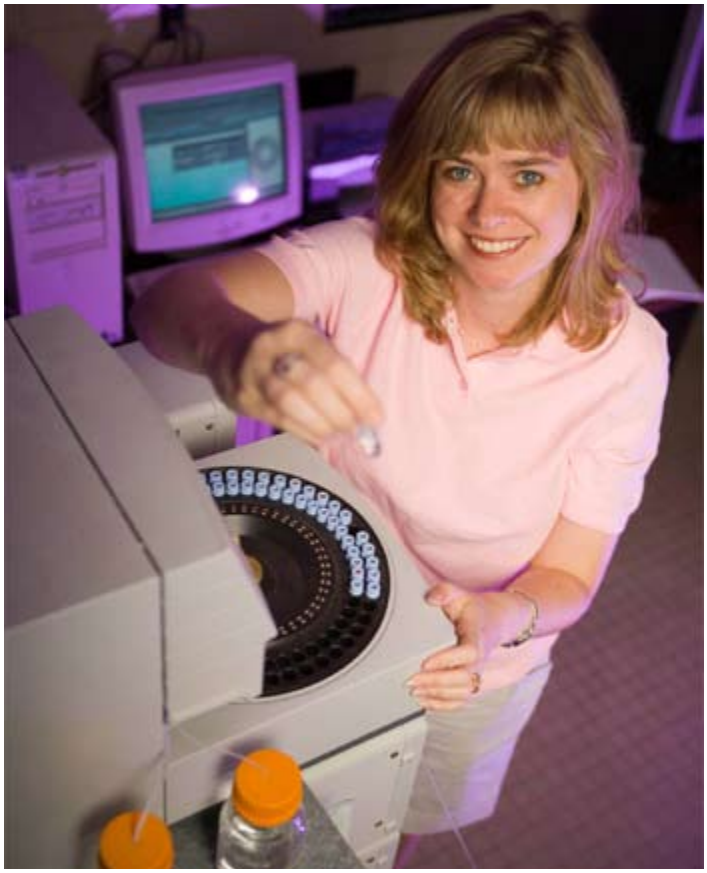
American Society of Agricultural and Biological Engineers

Biological and Agricultural Engineering—Finding Solutions for Life on a Small Planet

Careers in Agricultural and Biological Engineering

Extreme Engineer of the Month

Profile: Czarena ("Czar") Crofcheck, Biological Engineer and Associate Professor, University of Kentucky



Education:

- B.S. in Chemical Engineering, Michigan State University
- M.S. in Chemical Engineering, University of Kentucky
- Ph.D. in Biosystems and Agricultural Engineering, University of Kentucky

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Favorite Classes: Heat transfer because it was something she sees all around her in everyday life. It was interesting to know the science behind it and to calculate the equations.

Best Skills: Communication. She particularly enjoys brainstorming sessions, drawing out new ideas, and keeping the design team on target.

Hobbies: She hasn't had many hobbies, but as a mother, she is now enjoying scrapbooking. It provides an artistic outlet, where the goal is to keep everything in a straight line.

Role Models: One of her regrets in life is not finding role models or mentors to guide her earlier in life. It wasn't until graduate school that she found several women professors to look up to and model herself after.

Advice: "Be active and keep your eyes open. Go out and find information for yourself—something I didn't do. Follow your dreams."

While both of her grandfathers were engineers, Czar got to college without an awareness of the profession and what it entailed. Her favorite subjects in school were always math and science. In fifth grade she remembers telling her parents that she wanted to be the one to make Crest toothpaste "new and improved." Her family has yet to let her forget that. In high school she started thinking about chemistry. Specifically, she was interested in using her knowledge to make new things-and that's where engineering fit.

However, she didn't discover that connection until she had already enrolled as a chemistry major at Michigan State University. "Engineering was not well publicized in high school—and particularly not to females," she says. Her entry-level chemistry classes had a lot of chemical engineering majors in them, and as someone who enjoys math, she was taking calculus classes as well as chemistry classes. Her chemistry friends wondered why she was taking calculus, and her engineering major friends wondered why she was a chemistry major if she was taking calculus.

The truth is that she had always wanted to be an engineer, she just didn't know what it was. She always wanted to be the one to make the new things and put the pieces together in terms of math and science. With this realization, Czar went to her counselor and switched majors. Fortunately since the decision came early in her college career and she had been taking calculus, it was not a problem. She didn't have any courses to make up.

Czar got a bachelor's in chemical engineering and then a masters in chemical engineering. Then she discovered biosystems engineering. "This is probably what I wanted to do all along; I just didn't know about it," she says. "I love biological engineering because of the ties to biology and chemistry and all the pieces that go into it. And it is about doing things better for human kind."

One thing she really likes about the field is that it is an applied discipline with some overlap with more fundamental disciplines of engineering such as mechanical and electrical engineering. It uses many of the same disciplines, using them in different ways to solve different problems. "We take those systems and refocus them on biological engineering problems," she says.

Czar explains it this way: "As a chemical engineer, you are taking chemicals and reworking them to make new products. As a biological engineering you are not always reworking or changing biology. You're using biology and building things around that biology to get products you want."

After getting her Ph.D. in biosystems/agricultural engineering at the University of Kentucky, Czar was hired as a member of the faculty there and became an assistant professor of biosystems and agricultural engineering. In addition to teaching classes, she is conducting research on ethanol and biodiesel.

A key project Czar is working on is new methods to produce ethanol. "If we're really going to use ethanol, we're going to need new more fully utilize our resources and use lignocellulosic feedstock."

She says that a lignocellulosic feedstock, for example, would be the stalks, cobs, husks, and leaves of the corn plant, everything but the grain. These are the parts of the plant are typically a agricultural waste products. They still have carbohydrates and sugars in them, but they have to be broken down to get the energy out. Her research is looking for cheaper ways to do this and ways that farmers can do this pretreatment on the farm so we're not transporting large amounts of biomasses long distance, but rather transporting the sugar feedstock to the ethanol facility.

From Wikipedia: http://en.wikipedia.org/wiki/Lignocellulose

Lignocellulosic biomass[1] refers to plant biomass that is composed of cellulose and hemicellulose, and lignin. The carbohydrate polymers (cellulose and hemicelluloses) are tightly bound to the lignin, by hydrogen and covalent bonds. Biomass comes in many different types, which may be grouped into four main categories: wood residues, including sawmill and paper mill discards, municipal paper waste, agricultural residues, including corn stover (stalks and straw), and sugarcane bagasse, and dedicated energy crops, which are mostly composed of fast growing tall, woody grasses.

Biodiesel is another promising area of research. This comes from an oil crop—such as soybean oil or even recycled cooking oil. By adding methanol and a catalyst and through a process called transesterification, biodiesel and glycerol are produced — with glycerol as the byproduct. Specifically, her research focuses on developing new catalyst systems to produce a better product with less waste. They are changing from a liquid catalyst to a solid catalyst because it is easier to remove after processing.

Biodiesel is particularly promising because you can use it without modifying engines. Another benefit is that it is energy balanced—you get more energy out than the energy it takes to produce it.

Her career goals include exciting more young people about careers in bioengineering. In addition to research, Czar teaches classes on energy and biological systems-from pre-engineering classes (such as thermodynamics, heat transfer, and fluid flow) to graduate level courses in energy and thermodynamic processing of biomass cells. In addition she teaches probability and statistics. "There is lots of randomness and variation in biological systems," she says.

ASSESS...
Find your strengths, prepare for the future

ASSESS is a comprehensive toolkit for students in grades 9-12 who are on the path to discovering a future career in engineering. ASSESS provides guidance about engineering careers by allowing them to gauge academic preparedness in subject matter important for the profession.

EXPERIENCE...
Get active and unlock the mysteries of engineering

TEAMS, the flagship program of JETS, kicks off at the end of January, challenging students across the country to go *behind the scenes* and solve real-world engineering challenges related to large scale sporting events such as the Super Bowl, World Series, or Olympic Games.

TEAMS

The TEAMS competition is well underway with over 14 competitions having already taken place and some 60 more events set to take place in the coming weeks.

TEAMS, the flagship program of JETS, kicked off at the end of January, challenging high school students across the country to go behind the scenes and solve real-world engineering challenges related to large scale sporting events, such as the Super Bowl, World Series, or Olympic Games. Teams vie for the ultimate $5,000 grand prize as well as local, state, and national rankings and awards.

TEAMS is hosted on college and university campuses across the country during February and March. To learn more about how your institution can get involved, contact JETS at teams@jets.org. Find out more by ordering a complimentary TEAMS DVD by visiting the TEAMS website and following the links.

Host Highlight: University of North Carolina, Charlotte

UNC CHARLOTTE

Background
"The foundation of the UNC Charlotte program is the creation of the NCJETS clubs on middle and high school campuses," explains UNCC TEAMS Coordinator Deb Sharer. These NCJETS club activities revolve around a series of competitions and events held throughout the academic year and are designed to encompass mathematical, scientific, and communication skills necessary in the engineering and engineering technology fields, with one such competition being TEAMS.

Meet the Host
The UNC Charlotte Leadership Team consists of Dr. Deborah (Deb) Sharer, Assistant Dean Patricia (Patty) Tolley and co-Student Project Directors Mike Phillips and Adam Harris. While Deb is the Principle Investigator of Phase II, both she and Patty have both learned "that Mike and Adam rule when it comes to coordination and implementation of the project… we pretty much do what we are told!" says Sharer.

The Competition
The TEAMS competition is part of a multi-event day for high school clubs on the UNC Charlotte campus. "We are still refining the order of our competitions and events but, in 2008, we held TEAMS, a beam competition and a poster competition on the same day. Our clubs are generally large enough that they are able to sponsor a varsity and JV TEAMS team of eight students each and also have teams for beams and posters. Of course, we try to overlap as little as possible so everyone can root for their club!"

This club structure also allows for community college and university student chapters of professional societies to provide mentors for secondary school students. Additionally, specially-trained College of Engineering students serve as NCJETS mentors, and attend meetings on the club's home campus as well as act as a resource for competitions and other events.

The Benefits
"JETS provides a wonderful opportunity for students to work together and prepare for this challenging competition. Club sponsors report that their students often get together after school to practice and prepare for the event. I know the UNC Charlotte project team is always inspired when we see a couple hundred high school students having fun with math and science so early in the morning!" says Deb.

While the UNC Charlotte team can see their hard work paying off on the faces of the students who visit their campus every year, the team also has an extensive assessment tools and processes that helps them receive solid feedback so that they can continually improve their program.

Feature Product:

Engineering and You: 2008 Edition

Code: **20008**
Price: **$15.00**

The newly updated, 2008 version, of the popular 4-panel informational brochure. This brochure provides an excellent overview of engineering and is especially designed for high school students.

Sold in packets of 100

The National Engineering Design Challenge (NEDC

The **National Engineering Design Challenge (NEDC)** is a competition educating young people about careers in engineering, raising social awareness, and inspiring a spirit of engagement and a willingness to help others.

Congratulations to the 2008 NEDC Winners!

Gardner Edgerton High School Wins National Engineering Design Challenge

DESIGN THAT MATTERS
jets.org/nedc

Sponsored by the AbilityOne Program

Gardner Edgerton wins with *BART*, the *Bag Attachment and Replacement Technology*, a compound device that allows a user to change and tie a trash bag with only one hand. BART consists of three main components: a cylindrical dispenser for trash bags, a clip that holds the trash bag in place on the trash can, and a tying mechanism.

Gardner Edgerton has won $3,000 for their school's sponsoring department and a trip to Los Angeles, CA, April 14-17 to present at the NISH annual conference.

Congratulations to our second place winners and finalists. The second place winners have both won $1,500 for their school's sponsoring departments:

- **Outstanding Engineering Design** — Parapalegic Agricultural Lift (PAL), Garfield-Palouse High School, Palouse, WA
- **Outstanding Assistive Technology Design** — eSAS, The Texas Academy of Mathematics and Science
- **Finalist** — The High Roller, Flowery Branch High School
- **Finalist** — The Arthriscissors, Edcouch Elsa High School
- **Finalist** — The SinkAble, Upper St. Clair High School

Applications are NOW being accepted for the Next Generation Scholarship Fund!

Hurry! Deadline to apply is March 3rd!

Students: Thinking about a career in engineering? Maybe you're thinking about getting a degree in **chemical**, **electrical**, **mechanical**, **materials**, or **nuclear** engineering. Did you know that with any of those degrees you can pursue a career in the power industry?

Now is a great time to consider a career that helps run the world! Power generation is the backbone of what makes our economy and society function. Electricity, in some way, impacts nearly every aspect of our lives. From our homes, our businesses, our cars, to our health and safety, our critical infrastructure requires a dependable and economic supply of electricity.

Quick Facts:

- Over the next 15 years, it is estimated that more than 300,000 people will retire from the power industry.
- The International Energy Agency estimates world electricity demand will double by 2030—only 23 years from now!
- The US Department of Energy projects national demand will increase 45% in twenty years.

JETS and *Power Engineering* Magazine are offering a scholarship to help make your pursuit of a power engineering career possible. The Next Generation Scholarship is now taking applications! This $5,000 academic scholarship is open to all currently enrolled 12th grade students in the United States. Students expressing an engineering career interest in the power industry and planning to enroll in a four-year engineering program should apply.

Click here to download the application guidelines and essay requirements. Entries must be received by JETS no later than March 3, 2008. Contact JETS for more information.

What's your idea of a dream job? Check out www.engineeryourlife.org and find out about cool jobs and different kinds of engineering, meet inspiring women who love their careers, learn from students about what engineering programs are like, and get information on how to get started toward an engineering career.

Bold Visions: Women in Science & Technology
This DVD is produced with girls in mind and is a positive resource teachers and school counselors can use when promoting engineering and technology to their female students.

New DVD Available for FREE!

Bold Visions: Women in Science & Technology

Bold Visions gives us a glimpse into the lives of women who are dispelling the myths commonly associated with professionals who work in the fields of science and technology by showing how engineers make a difference in our lives. Order your FREE copy now by contacting JETS at info@jets.org. Simply email JETS with the subject heading: "Bold Visions" and provide us with your name and mailing address.

Engineering Pathway
–Your Portal to Engineering Education Resources

This month's resources look at imaging as a part of Biomedical Engineering. The activity provides high school juniors and seniors with a Laboratory Demonstration of X-Ray Principles. By using a lamp with an incandescent light bulb to simulate an x-ray tube, these exercises teach students important principles of x-ray imaging without exposing them to ionizing radiation.

Light bulbs and x-ray tubes both emit photons so a light bulb can be used to simulate an x-ray tube. Photons from a light bulb do not penetrate through the human body in the same way that x-rays do. Photons from a light bulb do penetrate through transparency film, though. In this way, transparency film with shades of grayscale on it can be used to simulate the human body. In these laboratories, students will explore detector resolution, and they will be able to

see and measure the geometric unsharpness effect. Biomedical engineers must account for these effects when designing x-ray imaging systems.

This resource comes from the VaNTH Engineering Research Center (ERC). In order to access curricular materials beyond the above link on the VaNTH ERC website above, you will need to agree to the VaNTH-ERC Courseware Non-Exclusive End User License Agreement. More information on this agreement can be found on the VaNTH ERC website.

This activity is brought to you by the new Engineering Pathway, a part of the National Science Digital Library. This collection includes resources from all over the Internet catalog just as Laboratory Demonstration of X-Ray Principles has been. The portal provides high-quality teaching and learning resources in applied science and math, engineering, computer science/information technology and engineering technology — for use by K-12 and university educators. The Engineering Pathway brings together quality engineering education materials from all over the internet, allowing teachers to search all of these documents in a single location.

New this Year: Engineers Without Borders Activities!

"Building a Better World One Community at Time"

Did you know that 1.2 billion people (out of 6.4 billion) do not have access to clean water. A basic human need? JETS is pleased to announce a new collaboration with Engineers without Borders - USA (EWB-USA) that will help you and your students explore how engineering is essential in bringing basic human needs to developing countries.

Visit www.jets.org/experience to learn about the EWB/JETS Classroom Activity and the EWB/JETS Annual Design Challenge.

Society Spotlight:

National Institute for Certification in Engineering Technologies

The National Institute for Certification in Engineering Technologies (NICET) provides an independent evaluation of technical knowledge and experience among those working in the fields of engineering technology. Through its certification programs, NICET defines and supports career paths and ensures recognition and continued professional development of engineering technicians, engineering technologists, and other related disciplines.

Established in 1961, NICET has awarded over 121,000 certifications to engineering technicians and engineering technologists. Certification ensures that an individual has met rigorous standards based on work experience, examination, and third-party evaluations. Currently, NICET offers certification programs in more than 25 technical areas in the following fields:

- Fire Protection
- Transportation
- Security Systems
- Construction Materials Testing
- Building Construction
- Geotechnical
- Land Management and Water Control
- Underground Utilities Construction
- Industrial Instrumentation
- Low Voltage Communications Systems

NICET is a non-profit division of the National Society of Professional Engineers. For more information about NICET and its certification programs, please visit www.nicet.org or call 888-476-4238.

University Spotlight:

Alfred State College

Alfred State College is a college ideally suited to purposeful, action-oriented and goal-oriented individuals.

Alfred State enables its students to hit the ground running®. Our students get a head start on their careers as our programs, our curriculum, and our teaching methods all focus on providing intensive, hands-on usable, real-world learning. Alfred State students are doers, not bystanders.

- Alfred State offers the following engineering technology programs:
- Air Conditioning and Heating Technology
- Architectural Engineering Technology
- Architectural Technology
- Automotive Parts Technology
- CAD/CAM Technology
- Computer & Electronic Systems Technician
- Computer Engineering Technology
- Computer Technology
- Construction Engineering Technology
- Construction Management Engineering Technology
- Construction Management Technology
- Digital Media and Animation
- Drafting/CAD
- Drafting/CAD-Model Building & Process Piping Drawing
- Drafting/CAD-Technical Illustration
- Electrical Engineering Technology
- Electrical Engineering Technology
- Electromechanical Engineering Technology
- Electromechanical Engineering Technology
- Engineering Science
- Manufacturing Technology
- Mechanical Design Engineering Technology
- Mechanical Engineering Technology
- Mechanical Engineering Technology
- Robotics and Computerized Control Technology
- Surveying Engineering Technology
- Surveying Engineering Technology

Find out more at www.alfredstate.edu or call 1-800-4-ALFRED.

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