Can this team of ISE seniors improve the world’s leading manufacturer of synthetic cork’s production systems, impress the judges at Senior Design Day and sell their ideas to the company’s management team all before the semester ends?
IN THIS ISSUE

BACK TO THE HEAD OF THE CLASS
ISE inducts three new members into its fraternity of Distinguished Engineering Alumni. Welcome to the class of 2013.

ISE WORKS TO REVITALIZE OUR ECONOMY
ISE researchers receive nearly $4.5 million worth of support to take on the challenge of creating the next generation of United States manufacturing.

UPWARDLY MOBILE
As she prepares for life after college, senior Jessica Rose discusses how ISE made all the difference.

> FROM THE DEPARTMENT HEAD PAGE 01
> REAL WORLD PROBLEMS PAGE 02
> 9 WAYS TO COLLABORATE WITH ISE PAGE 18
> ISE LOSES A GOOD FRIEND PAGE 20
> ALL HAIL THE KING! PAGE 24
> MODELING PHILANTHROP-IE PAGE 25
> SENIOR DESIGN DAY AND SPONSORS PAGE 28
> ISE DISTINGUISHED ENGINEERING ALUMNI PAGE 32
> ISE ADVISORY BOARD PAGE 33
FROM THE DEPARTMENT HEAD

Dear Alumni and Friends of ISE,

This past academic year has been one of continuing change for the department. We welcomed three new faculty members through the Chancellor’s Faculty Excellence Program. A renewed understanding of the critical role industrial and systems engineering plays in economic growth has fueled a sharp increase in our undergraduate enrollment. For students wishing to change major we are the tenth most popular major on campus. At the graduate level applications increased 40 percent as the reputation of our faculty and research programs continues to grow. Moreover, the quality of students at all levels is impressive and improving.

We live in a global economy and ISE has endeavored to increase the immersion opportunities for our students internationally. The number of students studying abroad has increased three-fold over the last two years and the number of international internship experiences has also increased. Companies and government agencies around the world are learning of our research and are seeking to partner with us.

As industrial and systems engineers we all understand the need for effective teams to address the complex challenges that face our organizations. ISE is teaming with faculty in almost every department in the College of Engineering as well as the College of Veterinary Medicine, College of Natural Resources, College of Sciences, Biomanufacturing Training and Education Center, and Poole College of Management for research and education innovation. You will also see us collaborate with industry, hospitals, medical institutes and global partners as we seek answers to society’s most pressing problems.

ISE has remained true to its core but added new contemporary application areas for research. We also seek to prepare students for positions of leadership in the changing corporate landscape. I hope you enjoy reading about some of the exciting education and research innovations we are pursuing. I personally invite you to visit the department and learn firsthand.

Sincerely,

Paul H. Cohen, PhD
ISE Department Head and Edgar S. Woolard Distinguished Professor

IN THE NEWS

The spring semester was filled with exciting events and opportunities for ISE to continue spreading the news about our exceptional ability to address complex industry challenges. As business entities learn more about the opportunity for impactful collaborations with us, the media is also taking notice of the exciting work going on at ISE:

Companies flock to Engineering Career Fair at NC State - Featuring Dr. Anita Vila-Parrish

Organs Printed on Demand: The Challenges of Taking Engineered Tissue from Lab to the Bedside - Featuring Dr. Binil Starly

Thousands attend NC State Engineering Career Fair - Featuring Dr. Anita Vila-Parrish

Engineers use 3D Printers to Make New Organs, Joints - Featuring Dr. Paul Cohen, Dr. Ola Harrysson and Binil Starly

ISE’s Dr. Binil Starly talks about the future of 3-D printed organs on WRAL morning news

GPS Improvements Could Reduce Plane Crashes - Featuring Dr. David Kaber

Here is the next wave in 3D printing — human organs — courtesy of N.C. State University – Featuring Dr. Binil Starly

Printing Replacements - Featuring Dr. Ola Harrysson and Dr. Binil Starly

Project to Move Engineered Tissue and Organs from Lab to the Bedside, Operating Room - Featuring Dr. Binil Starly

Engineers Find Way to Lower Risk of Midair Collisions for Small Aircraft - Featuring Dr. David Kaber and Carl Pankok
Can this team of ISE seniors improve the world’s leading manufacturer of synthetic cork’s production systems, impress the judges at Senior Design Day and sell their ideas to their company’s management team all before the semester ends?

SE498 - Senior Design Project - is one of the last challenges that all ISE seniors must face before they can graduate. This course is an opportunity for students to partner with local industrial, service and governmental organizations to solve a real-world problem that the business currently faces. This gives the students the experience of defining and analyzing a problem and then synthesizing and presenting a designed solution.

This spring the ISE Department had the pleasure to work with nine local companies on senior design projects. One of those projects was Nomacorc, the world’s leader in synthetic wine closures. It was Nomacorc’s second time working with a team from the ISE Department on a senior design project.

Currently, Nomacorc has no means to model or analyze their extrusion machine area. They needed a simulation model of the area so they could test different equipment and personnel scenarios to determine the optimal production layout. That’s the challenge for the team of ISE seniors

Francesca Pilarinos, a member of the Alpha Omega Epsilon Women in Engineering Sorority and a Career Development Center Ambassador; Will Laundon, a Ben Franklin Scholar and double major in Industrial and Systems Engineering and Economics; John Mauney, a Hugh M. Duncan Scholar (See ISE Loses a Good Friend, page 20) and member of ISE’s Alpha Pi Mu honor society; and Carter Keough, an undergraduate research assistant in ISE’s Center for Additive Manufacturing and Logistics.

After defining the scope of the semester-long project with their professor, Dr. Anita Vila-Parrish, and Nomacorc, the team met with Rob Schabinger (BSIE, 2004), an industrial engineer at the Nomacorc plant in Zebulon, NC. Rob was the company’s point of contact for the ISE team and was responsible for communicating with the students as well as answering questions and providing information, direction and feedback on project tasks and outputs.
While at the plant, Schabinger and the team gathered the production data that would be needed by the team to create a model that would simulate Nomacorc’s production systems. The team also took a tour of the extrusion area and monitored the operations of the workers as they performed their daily tasks.

Armed with an abundance of raw data, the team returned to campus to begin construction of their simulation model. The team quickly realized that the volume of data for simulating thousands of orders using numerous production lines was simply too great for the software and the computers in the senior design lab to process. They knew they would have to go back to the beginning and logically consolidate and condense their model. To accomplish this task, the team enlisted the talents of one of the world’s foremost experts in simulation modeling, ISE professor James Wilson.

Under Wilson’s tutelage, the team was able to recreate their model, successfully analyze the results, and determine the optimal solution for redesign of Nomacorc’s production system.

Now that data had been analyzed and a solution was discovered, the team headed into the final phase of the project, the presentations. The team was required to present their findings to their classmates and professors, judges at the Senior Design Day event and finally, the engineers and management of Nomacorc.

First up, their ISE 498 classmates and faculty. For this presentation, the team knew they needed to focus their presentation on the process they used to complete their project. After answering questions from professors and industry partners, the team received valuable feedback about their presentation and interpersonal skills.

The team used this information to refine their presentation approach before the Senior Design Day event held at Talley Student Union on NC State’s main campus (See Senior Design Day 2014, page 28). Senior Design Day allowed ISE students to
The ISE team and Nomacorc engineer, Rob Schabinger, deliver their final presentation to a group of fellow engineers and management at the Nomacorc plant in Zebulon, NC.

For more information about the senior design program, go to: go.ncsu.edu/ingearonline-seniordesign

Join students from Electrical and Computer Engineering, Textile Engineering, and the Engineering Entrepreneurs Program to present their senior design projects to a panel of judges. In this format, the team had to develop and deliver a two minute or less “elevator speech” to each of the judges, including the Dean of the College of Engineering, as they circulated throughout the ballroom. The team built on the success of their classroom presentation to perform strongly and leave their mark in the minds of the judges. However, they couldn’t relax yet because they knew their biggest presentation was still ahead.

Before they knew it the big day had arrived. The team traveled back to the Nomacorc plant to present their findings to a room full of engineers and corporate management that included the company’s President and CEO, Lars von Kantzow. The team was undeterred. With PowerPoint slides whirling, each member of the team concisely delivered their report like a seasoned veteran. They concluded their presentation with a confirmation of one of Nomacorc’s initial ideas to shut down a production line and a solution for drastically reducing changeover times thus maximizing the use of the company’s existing work force.

But now came the real test; the question and answer session. The engineers challenged them with thoughtful questions that the team answered with a confidence that only a mastery of the knowledge could afford. When the session was over, the team closed the meeting to a round of applause and personal congratulations and well wishes from the entire group.

The team left the plant knowing that all of their hard work would be put to good use by Nomacorc’s engineers to reshape the future of synthetic cork production.

If you or your company is interested in sponsoring a senior design project, please contact Dr. Anita Vila-Parrish at arvila@ncsu.edu or 919.515.0605.

To receive news updates throughout the calendar year, please subscribe to inGear online by going to go.ncsu.edu/ingearonline.

The ISE team and Nomacorc engineer, Rob Schabinger, deliver their final presentation to a group of fellow engineers and management at the Nomacorc plant in Zebulon, NC.
On November 15th, the ISE Department had the great honor of inducting three new members into its fraternity of Distinguished Alumni. The Distinguished Engineering Alumnus (DEA) Award is the highest honor that the Edward P. Fitts Department of Industrial and Systems Engineering can bestow upon any alumnus. It’s given to department alumni whose contributions to their profession, community, and the department, college and/or university are notable and merit special recognition.

This year’s class consisted of William C. Burton, class of 1983 and 1988; Jay Paschall, class of 1983; and Caroline Reda, class of 1993. Surrounded by their families, friends and former professors, the inductees shared their perspective on
what it takes to pursue your dreams and achieve success. The ISE Department would like to welcome its newest members and wish them continued success in the future.

William C. Burton is assistant vice-president of Duke University Health System. He received his Bachelor of Science in industrial engineering from NC State in 1983. Upon graduation, he joined Premier, Inc. in Charlotte where he served as a management engineering consultant, supporting hospitals in North and South Carolina. While continuing to work fulltime at Premier, he returned to NC State to pursue his Master of Science in industrial engineering, which he received in 1988.

In 1993, William joined Duke University Hospital where he led the development of the Performance Services Office for Duke University Health System. Performance Services is a diverse group of engineers, analysts and nurses dedicated to the measurement, monitoring and improvement of organizational performance. Today, the office consists of 50 professionals providing support to all entities in the Health System including Duke University Hospital, Duke Regional Hospital, Duke Raleigh Hospital, Duke Specialty Practices and Duke Primary Care.

Jay Paschall is the national sales manager for Century Furniture Industries in Hickory, North Carolina. Jay received his Bachelor of Science in industrial engineering with a furniture manufacturing and management concentration in 1983. At Century, he is responsible for a large sales force and is involved with strategic planning as it relates to sales, merchandizing, product development and marketing.

Jay began his career with Baker Furniture Company as a sales representative. He later joined the Hickory Chair Company where he rose from regional sales manager to director of marketing, and then finally director of wood product development. The next step in his career took him to Baker, Knapp and Tubbs where he was the director of new product development and merchandizing. Before accepting his current position with Century, Jay was the vice president for sales and product development for Kindel Furniture Company in Grand Rapids, Michigan.

Caroline Reda currently serves as president and CEO of GE Hitachi Nuclear Energy (GEH). She is responsible for leading a billion dollar nuclear business that consists of 3,000 employees and several manufacturing, service and sales facilities around the globe. Caroline also manages the joint venture between General Electric and Hitachi. Prior to her current position, Caroline served as president and CEO of GE Sensing and Inspection Technologies and has also served as President and CEO of GE Energy Parts, Inc., a global organization providing parts for GE’s fleet of power generation equipment. She has also held leadership roles in New Product Introduction, Quality, and Plant Operations including serving as Chief operating officer for Global Nuclear Fuels Americas, LLC.

Caroline earned a Bachelor of Science degree in computer science from the University of North Carolina at Wilmington and a Master of Engineering in industrial engineering from NC State in 1993. In addition, she is a certified Six Sigma Black Belt.

For a list of all ISE Distinguished Engineering Alumni, see page 32.
From a very early age Thom Hodgson wanted to be an engineer. “I always thought I would be an automotive engineer and I ended up doing exactly that,” said Thom. Well, not only that. Thom’s love for engineering and a recommendation from his sister about a new program called science engineering led him to the University of Michigan. While at Michigan, he read an article on skydiving in *Popular Mechanics* and it struck a chord. He would eventually meet a group of guys who loved skydiving and after a full half hour of training, which included jumping off the porch of a farmhouse, Thom jumped out of his first airplane. By the time he graduated Thom had made 15 more jumps, one of which ended with a broken leg.

Having gone through ROTC in college, Thom’s next stop was the US Army as a transportation officer, in which he accumulated another 110 jumps, bringing his total up to 127, all freefalls.

After the Army, Thom headed back to the University of Michigan to continue his education and his skydiving. He and another student began teaching skydiving and it was this decision that would later have a profound effect on his career.

“We were training people in three hours how to make a parachute jump,” said Thom. “So there were two things. One is WHAT did you need to teach them and the second thing is HOW do you teach them. You had to be able to look someone in the eyes and ask, “Do you understand what I am saying?” You had to be able to read that person to see if they understood, not listen to what they said.” These principles formed the way Thom looked at teaching. “I still look into my students’ eyes for that flash of understanding,” he said.

It was during this time that he discovered and fell in love with industrial engineering. “Many of the required courses for my MBA in quantitative methods were in industrial engineering and they were the ones I really enjoyed,” said Thom. Upon completion of his MBA Thom took a position at the Ford Motor Company and became the automotive engineer he always thought he would become.

After a year and a half at Ford, Thom decided to return to the University of Michigan to pursue a PhD. Sadly it was during this period that his time of jumping out of planes came to an abrupt end as his 450th jump resulted in a broken back.

Upon receiving his PhD., Thom was faced with several offers from both industry and academia. He chose to take a teaching position in the Industrial and Systems Engineering Department at the University of Florida where he remained for 13 years before arriving at NC State as the new department head of the Industrial Engineering Department.

When Thom took over the department, it was ranked 36th in the nation but he saw that there were good people and potential in the department. He, along with the faculty and staff, made significant changes to streamline the undergraduate program and enhance the graduate program. In 1991, the year after he stepped down as department head, the department was ranked 12th.

In 2001, Thom was elected to the National Academy of Engineering. He has also held many positions at NC State including director of the Integrated Manufacturing Systems Engineering Institute (1995-2011); co-director of the Operations Research Program (2009-2013); and director of Graduate Programs for Engineering-On-Line (2009-2013). He was also elected to the in 2001. These days he has returned to his true calling, teaching as an ISE Professor.
1930s

1930
Industrial engineering first appeared as a curriculum at North Carolina State University.

1933
The first Bachelor of Science in industrial engineering degrees were granted to Henry Saunders and Harold Thomason.

State College tied Florida, 0-0, in the first football game held at Riddick Field (above) with its new concrete stands.

1940s

1945
John Harold Lampe (below) became Dean of the School of Engineering. During his time at NC State, Lampe oversaw the expansion of the engineering program as it became one of the largest in the country, while also facilitating the addition of new instructional and research programs.

1948
The Department awarded its first Master of Science in Industrial Engineering degree to C. A. Swerdlove.

1950s

1950
The first Bachelor of Science degree in furniture manufacturing and management was awarded to Charles Tripp.

1958
ISE won Most Outstanding Alpha Pi Mu Chapter in the United States.

1960s

1962
The School of Engineering installs the first half of an analog computer system on campus (below), a PACE computer, manufactured by Electronics Associates.

1969
The first Master of Industrial Engineering degree was granted to off-campus students in Greensboro, NC.

The first PhD in industrial engineering was awarded to Manmohan Wig, with Professor Salah Elmaghraby serving as his advisor.
TODAY
The Edward P. Fitts Department of Industrial and Systems Engineering builds on a tradition of excellence as it continues to be ranked nationally and respected globally. To stay on the forefront, the department maintains its core competencies and has expanded its programs to include biomedical manufacturing and regenerative medicine scale-up, healthcare engineering and logistics.

1970s
1974
NC State defeats Marquette, 76-64, in the finals of the NCAA Basketball Tournament in Greensboro, NC, to win the 1974 National Championship. Junior forward David Thompson (below) is named the Tournament MVP.

1977
The first CA Anderson Outstanding IE Faculty Award, established by undergraduate students, was given to Jim Tompkins.

1980s
1983
Led by Head Coach Jim Valvano (below), the men’s basketball team won the 1983 NCAA championship with one of the most memorable final shots in NCAA history.

1986
The IIE student chapter distinguished itself by earning IIE's “Most Outstanding Chapter” award after 6th, 4th and 2nd place finishes over the previous three years.

1990s
1991
The Center for Furniture Manufacturing and Management was created and a BSIE, Furniture Manufacturing Option was offered. It was the only such degree available in the US.

2000s
2005
Edward P. Fitts, ISE Distinguished Alumnus, made a generous endowed gift toward what would become the first named academic department at NC State.

2007
NC State Women’s Basketball coach Kay Yow (below) celebrated her 700th win. The Wolfpack beat Florida State, 68-51. Yow eventually racked up 737 wins (at NC State and Elon), making her the fifth winningest NCAA Division I basketball coach.

1997
Katharine Stinson (above), the first woman to graduate from NC State’s School of Engineering, has a street named after her. Katharine Stinson Drive, formerly North Yarbrough Drive, is one of the longest streets on campus.
ISE alumnus, Roger Jones, believes the key to success for ISE students in the business world is to think and act globally

by Steve Walker
ISE Extension Specialist

I was not what you would call a motivated student,” said ISE alumnus and Vice President of Global Logistics for Century Furniture, Roger Jones (BSIE-FMM 1978). As was often the case for the Baby Boomer generation, unmotivated students wound up in shop class. For Roger, shop class involved some woodworking projects which he took to quite readily. His dad recognized an opportunity and made a deal with Roger. If Roger made an “A” in the class, his dad would loan him the money to buy a lathe. One “A” later, Roger was the proud owner of a lathe, which was soon followed by a full range of woodworking tools Roger used to build up a nice little furniture making business for himself in New Paltz, NY. It was the start of what would become, and remains today, a highly successful and fascinating career in the world of home furnishings, aided in no small part by his industrial engineering education at NC State.

Roger came to NC State, the only university to which he applied, after an inquiry he made to the High Point Chamber of Commerce. He was looking for a school that had a furniture program, and the Chamber of Commerce directed him to the Furniture Manufacturing and Management program (FMM) operated through the NC State Department of Industrial Engineering. The FMM degree was the very best engineering curriculum with a furniture focus in the country. Once here, Roger entered into the co-op program after his first semester in school. Through this program, he wound up spending his entire co-op experience working with Century, alternating semesters between working at Century and attending classes in Raleigh. “Classes, after working at Century, made complete and logical sense. I would encourage all ISE students to go the co-op route if they can; it really enriches the learning experience,” Jones said when describing his ISE education. As a co-op
student, Roger worked his way through every manufacturing department at Century before working in the company’s engineering department.

In spite of a job offer from Century after graduating in December of 1978, Roger went to work for Hitchcock Chair in Connecticut. But after six months, he made his way back to Century where he started in a junior engineering position. He quickly moved up the engineering ranks and into management where he focused on advancing Century’s technological capability, upgrading equipment and information systems that far exceeded the norms in furniture manufacturing.

In 2000, Roger was part of the team that developed what would become Century’s first fully imported collection of furniture, marketed as “Destinations by Century.” Roger’s responsibilities within Century evolved to be more focused on planning and sourcing, especially as Century’s business model changed to include an ever increasing imported product component. With his engineering manufacturing, and product development skills, he was a natural to take the lead on behalf of Century in traveling the world to find the best home furnishings products to meet their customer’s needs.

When asked what advice he could give to the industrial engineering students as they start down the path of becoming an engineer, he offered two suggestions. First, “be willing to

“It’s important to always be learning new skills and new ways of doing things on your own, in your work and in your life”

ISE alumnus and Vice President of Global Logistics for Century Furniture in Hickory, NC, Roger Jones (BSIE-FMM 1978).
think globally in all that you do. Yes, we’re North Carolinians and Americans, but we’re also citizens of the world. We have a lot to offer the world, but the world also has a lot to offer us. Learn to appreciate that.” His second suggestion was “be prepared to be a lifelong learner. Certainly it’s good to continue formally educating yourself with advanced degrees (Roger earned an MBA from Wake Forest University in 2000) if you can, but it’s just as important to always be learning new skills and new ways of doing things on your own, in your work and in your life.”

His advice comes from where most good advice does: life experience. “When we first started our import program, we were very rigid in our approach. We made samples in our Tech Center, and we insisted that our suppliers replicate our designs perfectly. We did all that we could to make that possible for them, but we weren’t flexible. It wasn’t in our DNA to allow that.”

“Eventually and over time, we came to realize that many of our good suppliers might have better ways of doing things than we do. They might have developed techniques, or uses of different materials, that we never thought of, or aren’t even capable of thinking of. We started to mix their DNA with our DNA. The end result has been a much better product for our customers, as well as better working relationships with our vendors throughout the world.”

In other words, they’ve learned how to think, and act, globally.

“Eventually we came to realize that many of our good suppliers might have better ways of doing things than we do”
ISE professor co-founds a new journal for brain-computer interfaces

Taylor & Francis announced the publication of the first issue of its new Brain-Computer Interfaces journal in January 2014. The co-founding editors are ISE professor, Chang S. Nam and Dr. Jeremy Hill from the Wadsworth Center at the New York State Department of Health.

Brain-Computer Interfaces (BCI) delivers peer-reviewed scholarly reports and analysis on theoretical and practical advances in the research and development of BCI technology. BCI measures brain activity and translates it into a form that allows machines to compensate for lost or damaged brain functions, provide supplementary or augmented functions, or entrain lasting improvements in existing functions.

BCI research and development has a unified set of goals, but is highly multi-disciplinary, requiring inputs from experts in neuroscience, biomedical engineering, neurosurgery, rehabilitation engineering, psychology, human factors, computer science and engineering, machine learning, electrical engineering, industrial and systems engineering, and mechanical engineering. The new BCI journal integrates a range of perspectives from these various disciplines in order to deepen the understanding of issues, challenges and solutions in the field of BCI.

More information about the journal, subscriptions, and the full submission guidelines can be found at: www.tandfonline.com/tbci.

CS Nam is an Associate Professor in the Edward P. Fitts Department of Industrial and Systems Engineering and holds affiliate faculty status in the NC State/UNC Joint Department of Biomedical Engineering as well as the Department of Psychology. His research interests include brain-computer interface and neurorehabilitation, neuroergonomics, intelligent human-computer interaction, and u-healthcare engineering. A National Science Foundation CAREER Award winner, his research has been supported by the National Science Foundation (NSF), Air Force Research Laboratory (AFRL), Air Force Office of Scientific Research (AFOSR), Mack-Blackwell Transportation Center (MBTC), Arkansas Highway Transportation Department (AHTD) and NC State/UNC Rehabilitation Engineering Center.
In June 2011, the United States President’s Council of Advisors on Science and Technology (PCAST) recommended that the federal government launch an advanced manufacturing initiative. In March 2012, President Barack Obama announced plans to revitalize the US manufacturing base with the creation of the National Network for Manufacturing Innovation (NNMI). The NNMI is a proposed network of 15 research facilities, known as Institutes for Manufacturing Innovation (IMI), in the US that will focus on developing and commercializing manufacturing technologies and is a partnership between US industry, universities and federal government agencies. An inter-agency advisory council of technical experts determined the pilot institute’s focus to be additive manufacturing. That pilot institute, the National Additive manufacturing Institute for Innovation (NAMII - now called America Makes), was established in Youngstown, Ohio, in August 2012. President Obama made reference to the institute during his 2013 State of the Union Address.

A group of researchers from the ISE Department consisting of Dr. Ola Harrysson, Dr. Ron Aman, Dr. Harvey West, Tim Horn and several students has been selected to be part of an inaugural NAMII research team. The NAMII team consists of academic partners (Carnegie Mellon University, Wright State University, University of Louisville and Case Western University) and industrial partners (Pratt & Whitney, General Electric, Lockheed Martin, Kennametal and Bayer). The team is supported by the National Institute of Standards and Technology (NIST) and the Oak Ridge National Labs.
The team’s research project, entitled “Rapid Qualification Methods for Powder Bed Direct Metal AM Processes,” focuses on the predictability of a material’s properties based on its shape and method of construction. This information is critical to understand because most direct metal additive manufacturing processes are both geometry and orientation dependent, which means that the resulting material properties will vary due to the shape and how they are built.

“Since the ISE department was the first user in the world of the Electron Beam Melting (EBM) process, we will lead the academic partnership,” said ISE Professor Ola Harrysson. Carnegie Mellon, Wright State and Louisville will work on numerical simulations for additive manufacturing processes for both laser-based and electron beam-based powder bed systems. The ISE department, with the use of its new laser-based machine from EOS (Germany), is in charge of validating the models and developing new parameters for the simulation.

The simulation models will be used to predict what properties will result based on geometry and orientation. These predictions will be crucial for implementation in industries such as aerospace, automotive and medicine. Further, the simulation models can help speed up new material development for direct metal additive manufacturing processes, where the ISE team is one of the leaders.

The Rapid Qualification project was an excellent start to building a strong relationship with America Makes and associated partners, but it pales in comparison to what happened next. When President Obama arrived on campus in January 2014, everyone assumed that he was here to talk about economic development. However, his true objective was to announce that N.C. State was awarded this country’s second IMI, the Next Generation Power Electronics National Manufacturing Innovation Institute. The institute will be funded by the Department of Energy (DOE). The total funding for the Institute over the next five years is $140 million.

Dr. Harrysson was one of the principal investigators on the proposal that was submitted to the DOE which means that ISE’s Laboratory for Additive Manufacturing and Logistics will be a key contributor to the institute’s research efforts. Along with other grants that Dr. Harrysson received that same week, the lab will be part of $3.5 million in research funding over the next few years. Combined with equipment donations from last summer, the Edward P. Fitts Department of Industrial and Systems Engineering received nearly $4.5 million worth of support for additive manufacturing. This opens unbelievable opportunities for students to be part of the additive manufacturing/3D printing revolution.

The grants announced in January come in support of three different projects, each briefly described below:

**Project 1:** Automatic Finishing of Metal Additive Manufactured Parts to Achieve Required Tolerances and Surface Finishes

**Support:** America Makes (National Network for Manufacturing Innovation)

**Research Partners:** Iowa State, Kennametal, Fineline Prototyping, CalRam, John Deere, Productivity Inc., Advanced Machining

**Current Issue:** Parts that are created using the Direct Metal Additive Manufacturing (AM) process cannot be used directly due to the lack of dimensional accuracy and surface finish. While most parts can be produced in an AM system within 24-48 hours, it usually takes 4-6 weeks to do the finishing of just one component.

**Proposed Research Project:** Develop a fully automatic finishing system that is highly software driven and guides the system through the process. The goal is for this hybrid system to be used to finish any part regardless of the AM process used and the CNC milling machine that is available, as long as a 4-axis configuration is present. The hybrid system will accept a design file of the desired product and the software will plan the finishing by adding machining allowance to the required surfaces, optimizing the machining approach and adding sacrificial fixtures and part supports. The output file can now be used by an AM system to fabricate the geometry.

The next step is to place the unfinished part in a four-axis CNC milling machine that is equipped with a laser scanner. The part will be scanned to capture the exact volume as well as the exact...
orientation. The scanned information is fed back into the software package that will automatically realign the machine axis with the part axis and automatically generate a tool path using a concept known as CNC-RP.

**Project 2: A Database Relating Powder Properties to Process Outcomes for Direct Metal Additive Manufacturing (AM)**

**Support:** America Makes (National Network for Manufacturing Innovation)

**Research Partners:** Carnegie Mellon, the lead partner; N.C. State, ATI Powder Metals, Ametek Specialty Metal Products, Carpenter Powder Products, Medical Modeling, TE Connectivity, and the Robert C. Byrd Institute as primary partners; Walter Reed Army Medical Center, Oxford Performance Materials, Fineline Prototyping, CalRAM, United Technologies Research Center (UTRC) and Pratt & Whitney as associate partners.

**Current Issue:** Almost any high precision shape can be fabricated using either electron beam or laser powder bed direct metal processes so long as consumers use the manufacturers’ powders. These powders are expensive and only available from a small number of suppliers. This is perhaps the most severe restriction in the supply chain for direct metal AM component fabrication.

**Proposed Research Project:** Create a competitive, price-driven market for AM powders by making a large variety of powder systems useable in direct metal machines. This will allow consumers to pick a powder system based on cost and required part quality, and then adjust process variables to account for powder differences.

This project will create a first of its kind database relating powder properties to process outcomes. Furthermore, for at least one powder system that is not immediately useable in a direct metal machine, the project will identify process variable changes needed to make that powder system yield outcomes comparable to standard powders. All but one of the non-powder company collaborators has, or will have at the time of this award, at least one direct metal AM machine at its location, allowing for round robin testing in a wide variety of locations and environments. The powder producer collaborators are all located in Pennsylvania, and the goal is that this project will promote a regional strength in AM powder production, catalyzed by America Makes.

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**Project 3: Flexible Manufacturing – High-Volume 3D-Printed Metal-Ceramic Power Module Demonstration**

**Support:** The Wide Band Gap Manufacturing Innovation Institute (National Network for Manufacturing Innovation)

**Research Partners:** Arizona State University, Florida State University, University of California at Santa Barbara, Virginia Tech, ABB, APEI, Avogy, Cree, Delphi, Delta Products, DfR Solutions, Gridbridge, Hesse Mechatronics, II-VI, IQE, John Deere, Monolith Semiconductor, RF Micro Devices, Toshiba International, Transphorm, USCI and Vacon.

**Current Issue:** Current silicon (Si)-based semiconductor models are limited by the materials used in their manufacture. Wide bandgap (WBG) semiconductor materials are the future of power electronic components. These materials will allow components to be made smaller, faster, more reliable and more efficient than the current silicon (Si)-based models and these new components could transform the American energy economy.

**Proposed Research Project:** Develop a 3D printing process for fabrication of power electronic devices using a multi-material approach. Because of the fundamental one-piece flow, each piece can be customized for greater integrated functionality and can be produced in high volumes. The proposed process will utilize a number of different additive manufacturing concepts with some new and unique features.

For more information about the Center for Additive Manufacturing and Logistics, go to: camal.ncsu.edu.

To watch President Obama’s speech at NC State, go to: go.ncsu.edu/ingearonline-obama2014

To receive news updates throughout the calendar year, please subscribe to inGear online by going to go.ncsu.edu/ingearonline.
My first exposure to engineering was a high school trip on a hot and humid day to a pulp and paper mill in my home state of Maine,” said Jason Low, lecturer in the ISE Department. “I learned one thing about engineering that day. I didn’t want to be a chemical engineer in a pulp and paper mill.” Fortunately for ISE, Jason’s experience that day didn’t turn him away from pursuing engineering.

Jason’s passion for “taking things apart, seeing how they worked and putting them back together again” led him to the University of Maine, where he received his baccalaureate degree in electrical engineering. During his time at school, Jason had the opportunity to complete three co-op stints with computer company Data General and luckily for him, that is where he discovered industrial engineering. The experience would later define the direction that he would go after finishing his undergraduate degree.

So after graduation, Jason started his career as a manufacturing engineer with Digital Equipment Corporation. It was during this time that Jason’s love for manufacturing processes grew and he realized that he would need an advanced degree to reach his goals.

Through a recommendation from a good friend who was already pursuing his master’s in industrial engineering, Jason came to NC State in 1995 and was later offered a research assistant position in the ISE Department as he continued to work toward his degree. It was during this time that Jason made another discovery that would change the direction of his future. While heavily involved in both research and developing the department’s curriculum, Jason realized the magnitude and quality of the resources available to him at NC State. His surroundings, along with the ability to reach out and mentor students, lend Jason to accept a lecturer position in the department after receiving his degree.

Teaching has allowed Jason to explore beyond campus boundaries. He serves as the lead, both for the Universidad Católica Andrés Bello (UCAB) program, which allows students from Venezuela to visit and study for three weeks and high school engineering camps in the ISE Department each summer. “I enjoy teaching these summer program students because they are engaged; they want to be here and they love to learn,” said Jason. “They have tremendous interest and ask so many questions that are challenging. As a teacher, this is so rewarding.”

Currently, Jason manages the ISE manufacturing laboratories and continues teaching manufacturing processes and automation courses. Besides students, he can often be found teaching robots as well!
The Edward P. Fitts Department of Industrial and Systems Engineering works closely with a wide network of collaborators. Listed below are nine ways in which ISE and the professional community are working together for mutual benefit. We are always eager to explore new and creative ways to team up with our alumni and industry friends.

1. **INDUSTRY RESEARCH OPPORTUNITIES**
   ISE’s faculty and students work with corporations, governmental agencies and other organizations to perform in-context research that provides new knowledge, tools and insights. For more information, contact Dr. Paul Cohen: pcohen@ncsu.edu or 919.513.2857.

2. **PROJECT OPPORTUNITIES**
   ISE’s Senior Design course provides a unique opportunity for companies and organizations to partner with a team of dedicated students to analyze your work proposal with new concepts and fresh ideas. For more information, contact Dr. Anita Vila-Parrish: arvila@ncsu.edu or 919.515.0605.
PRESENTATIONS & LEARNING OPPORTUNITIES IN THE CLASSROOM

Industry executives from a variety of fields can interact directly with ISE students through class presentations, panels and lectures to inspire and engage students in real-world problems and solutions. For more information, contact Dr. Anita Vila-Parrish: arvila@ncsu.edu or 919.515.0605.

SUMMER CAMP OPPORTUNITIES

Industry leaders can interact directly with future ISE students through class presentations and hand-on exercises to expose students to what it’s like to be an industrial engineer. For more information, contact Jason Low: jclow@ncsu.edu or 919.515.1424.

TOURS OF INDUSTRIAL FACILITIES

Touring industrial facilities, such as manufacturing, warehouses and distribution centers, is a great opportunity for students to see how principles taught in the classroom are put into action. For more information, contact Dr. Rohan Shirwaiker: arashirwa@ncsu.edu or 919.515.6416.

COOPERATIVE EDUCATION AND INTERNSHIPS

Through undergraduate and graduate co-ops and internships, companies have the opportunity to work with some of the nation’s top students while evaluating their effectiveness and potential as future employees. Students also benefit by gaining valuable work experience. For more information, contact Dr. Anita Vila-Parrish: arvila@ncsu.edu or 919.515.0605.

RECRUITING

Interested in our students? Companies are encouraged to send job announcements to the department. For more information, contact Dr. Paul Cohen: pcohen@ncsu.edu or 919.513.2857.

CAREER FAIRS

Participate in one of NC State’s Engineering Career Fairs to enhance your company’s visibility to future job candidates in ISE. To register go to students.engr.ncsu.edu/careerfair/employers.php#/Register or contact Brian D. Koehler: engineering@ncsu.edu or 919.515.3263.

PHILANTHROPY AND SPONSORSHIP

Outside support through philanthropy and sponsorship allows us to enhance our programs, increase the number of graduate fellowship and undergraduate scholarships, provide endowed chairs and professorships and much more. For more information, contact Brian Campbell: becampbe@ncsu.edu or 919.515.7458.
We are sad to announce that a great friend of the ISE department, alumnus Hugh Monroe Duncan, passed away at the age of 84 on April 20, 2014.

Hugh served in the U.S. Marine Corps and over the course of his career, he held engineering positions with Industrial Piping, Inc., Pneumafil Corp., and Luwa Corp. In 1964, he purchased and revitalized Southern Precision Spring Co., Inc. where he served as president and on the board of directors. Over the next 30 years, his many innovations in quality control, cost accounting, and the computerization of manufacturing operations made SPS Co., Inc. one of the most successful companies of its kind. He retired in 1994.

Hugh received his BSIE from NC State in 1955. He was a second generation engineer with a degree from NC State and in 1997 he established the first endowed professorship sponsored by a single individual in NC State’s College of Engineering, the Dean F. Duncan Professorship in Mechanical Engineering, in honor of his father (BSME 1923). Hugh was selected as an NC State Distinguished Engineering Alumnus in the year 2000 and was an inaugural member of the ISE Distinguished Engineering Alumni in 2006. He and his wife Anne have also endowed a merit scholarship for undergraduates majoring in industrial and systems engineering since the year 2000. Since then, their scholarship has provided financial support to 13 deserving students who share his passion for industrial engineering.

“Hugh’s philanthropy extended outside the university as well. He was a long-time supporter of Junior Achievement and United Way. He was a former member of Rotary International and a sponsor of the Boy Scouts of America.

Friends can contribute to the Hugh M. Duncan Scholarship in Industrial Engineering by contacting:

**NC STATE ENGINEERING FOUNDATION, INC.**

NC State University
Campus Box 7901
Raleigh, NC 27695-7601
919.515.7458
www.engr.ncsu.edu/foundation

to me as I received no other sort of scholarships or financial aid. I depended on it to purchase my textbooks for various ISE classes. Without this extra scholarship money, I would have struggled to pay the rising costs of textbooks,” said John Mauney, 2012-2013 recipient of the Hugh M. Duncan Scholarship. “I am thankful for the chance to use the scholarship money, and I would say that Mr. Duncan has inspired me to one day donate toward scholarships for students in similar situations.”

John graduated this spring and has taken a position with GE Aviation in Cincinnati, Ohio.

“The Hugh Duncan Scholarship was very beneficial to me as I received no other sort of scholarships or financial aid. I depended on it to purchase my textbooks for various ISE classes. Without this extra scholarship money, I would have struggled to pay the rising costs of textbooks,” said John Mauney, 2012-2013 recipient of the Hugh M. Duncan Scholarship. “I am thankful for the chance to use the scholarship money, and I would say that Mr. Duncan has inspired me to one day donate toward scholarships for students in similar situations.”

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Friends can contribute to the Hugh M. Duncan Scholarship in Industrial Engineering by contacting:
UPWARDLY MOBILE

As she prepares for life after college, recent graduate Jessica Rose discusses how ISE made all the difference

by Jessica Rose

For four years people have been talking about graduation. It’s what everyone strives for during their time here at NC State. As graduation quickly approaches, the real world has become more and more real. Senior year is the time when the stress of finding a job grows dramatically. But for me, and many other ISE students, there has been less stress in finding a job and more excitement over entertaining job offers from numerous companies. I would have never dreamed four years ago that I would be evaluating multiple job offers and choosing the one that I wanted rather than taking the only job that was offered. I believe that NC State, the College of Engineering, and the Edward P. Fitts Industrial and Systems Engineering department have provided me with numerous opportunities and experiences that have allowed me to be competitive in today’s job market.

From day number one, I was told that a resume is more than just a 4.0 GPA; it’s all about the activities and experiences you have both inside and outside the classroom. So as a junior I became an Engineering Ambassador to represent both my college and my department. This experience alone opened many doors for me. I have met many company representatives, networked across the college, and gained valuable skills through my two years in the program. I gained confidence in being comfortable in my own skin, the ability to speak in front of large crowds and leadership skills, which have all given me an edge on the competition in today’s tough job market.

This year I also served as President of Alpha Pi Mu chapter, the only Industrial Engineering Honor Society. Through this organization, I have been able to make contacts with numerous company representatives that have come to recruit ISE students. It has also afforded me the opportunity to connect with many of our department’s faculty, staff and students ranging from undergraduate to PhD. Alpha Pi Mu has provided the opportunity to expand my leadership credentials, further providing me with a competitive edge in the job market.

Additionally, NC State’s renowned Engineering Career Fair has provided ample opportunities for me through internships, full-time job offers and networking. During my time here at NC State, I participated in two different internship opportunities that I received through our career fair. As an ISE career fair volunteer, I was able to network with representatives from a multitude of companies. While I was providing mints to these representatives, they would talk with me and many would ask for my resume. I wasn’t even trying to schmooze!

This past fall was the scariest career fair of them all because I was looking for a full-time job, my first step into the real world. Although a career fair of that size offers such opportunities, it can also be quite intimidating. But I believe my experiences both inside and outside the classroom had prepared me for this moment. Through my involvement in Engineering Ambassadors, Alpha Pi Mu, and the Engineering Career Fair, along with studying abroad and alternative service break trips, I was ready to sell myself to the companies at the career fair. I talked to companies from a variety of industries including manufacturing, consulting, and healthcare which landed me many interview opportunities and ultimately, three job offers from Eaton Corporation, Manhattan Associates, and Premier Inc. After much consideration, I chose to go work as a Performance Partner for Premier, a healthcare company, starting this July. This is the next step down the path toward my end goal of working with health systems in developing nations.

ISE has afforded me the great pleasure of knowing where I am going to work after graduation since November which has allowed me to enjoy my last semester of college mostly stress-free. I assure you that I am not the exception, but rather, I am the rule for involved students in our Industrial and Systems Engineering department looking for full-time jobs. Our department provides students with opportunities to succeed and prepares us to join the “suddenly not so daunting” real world.
NOTE: At the CA Anderson Award Ceremony in April, Rose received the last Rudolph Willard Award as the outstanding senior in furniture manufacturing.
Fitts Distinguished Professor, Russell King, receives the CA Anderson Outstanding Faculty Award

For one special night, NC State’s University Club came alive as it played host to the 38th annual CA Anderson Award Ceremony, fittingly named, “A Night for the Stars of ISE to Shine.” The awards dinner was a chance to celebrate the best and brightest students, staff and faculty that the Industrial and Systems Engineering Department has to offer.

Dr. Paul Cohen, department head, kicked off the celebration with a review of the outstanding accomplishments that made this year such an unrivaled success. The following are just some of the outstanding achievements from this year. Dr. Ola Harrysson will lead a team of ISE researchers as they work toward changing the future of energy distribution (See ISE Works to Revitalize our Economy, page 14). Three ISE faculty members received awards from such organizations as the Institute of Industrial Engineers (IIE), SME, and the Institute of Electrical and Electronics Engineers (IEEE) and both undergraduate and graduate students received awards from IIE for their work with the Food Bank of Central & Eastern NC. This level of success does not occur without the support of alumni, donors and friends of the department and many alumni attended the event for the first time in 2014.

The night had its surprises as well. Justin Lancaster, IT director, was honored with a College of Engineering Award for Excellence and a Pride of the Pack Award. This award was issued in March, but was kept secret until this ceremony so Justin could officially receive his award in front of his friends and colleagues. To no one’s surprise, Cecilia Chen was recognized as the ISE Staff Employee of the Year for her dedication to our graduate program.

But this night wasn’t just about the faculty and staff, the students’ stars also shone brightly. Professors Vila-Parrish, Ivy, Shirwaiker, King and Roberts all stepped to the podium to recognize their student organization officers with a variety of awards, honors and scholarships. As the furniture manufacturing and management program transitions into the next generation of advanced manufacturing, Professor Culbreth awarded the very last Rudolph Willard Outstanding Senior in Furniture Manufacturing Award to Jessica Rose.

The evening culminated with the three student organization presidents awarding Dr. Russell King the CA Anderson Outstanding Faculty Award. The Anderson Award recognizes the member of the Industrial and Systems Engineering faculty who, by consensus of the students, has made the greatest contribution toward their educational development. Dr. King has received the Anderson Award on four previous occasions (1986, 1996, 2002 and 2008). He was named to the NC State Academy of Outstanding Teachers (1990) and received NC State’s George Blessis Outstanding Advisor Award (2010). Congratulations to Dr. King on his well-deserved award. As the CA Anderson Award winner, he will provide the commencement address at the department graduations in the spring and fall of 2014.

To watch Dr. King’s commencement speech, go to: go.ncsu.edu/ingearonline-kingspeech2014
The facts are staggering. One in four children in North Carolina will sleep hungry tonight. North Carolina has the fifth highest food insecurity rate in the United States. Food insecurity is the most broadly used measure of food deprivation in the United States. The USDA defines food insecurity as meaning “consistent access to adequate food is limited by a lack of money and other resources at times during the year.”

The problem of food insecurity is not only caused by the lack of food or social welfare, but also by the poor distribution of the food on hand; which leads to waste in some places and shortages in others. So this is where the team of ISE researchers got to work.

The ISE research team, Julie Ivy, professor; Reha Uzsoy, professor; Irem Sengul, a fourth year doctoral candidate; and Amber Williams, graduating senior; and students from North Carolina A&T State University (NCA&T) are working with the Food Bank of Central and Eastern North Carolina (FBCENC) to develop models for identifying fair but effective strategies for improving the distribution of donated food to North Carolina’s food insecure population. Industrial engineering and operations research tools were critical for achieving these goals.

Their challenge was to balance the conflicting objectives of equity and effectiveness so that the FBCENC could devise “fair” strategies for distributing food. The ISE researchers quickly discovered that counties referred to as “bottleneck counties” have relatively low capacities compared to their demands. Faced with the requirement to distribute food equitably, these counties severely limited FBCENC’s ability to distribute food.

The team determined that increasing capacity in these bottleneck counties would have the greatest impact by increasing the total amount of food that can be distributed, reducing waste while maintaining equity. Through their NSF funded research project, the ISE researchers have been able to work with FBCENC to examine and model their distribution strategies, better understand trends in donations, forecast demand, and identify ways to reach more people with hunger needs.

This project has allowed ISE students to apply their engineering skills to improve the condition of many of those in North Carolina with the greatest need. In the process, they have been recognized nationally for their efforts: Irem Sengul was awarded first place in the 2012 INFORMS Interactive Presentation Competition and third place in the 2013 IIE Doctoral Colloquium Poster Competition; and Amber Williams was awarded third place in the 2014 IIE Regional Student Paper Competition (See Awards and Honors, page 30).

About the Food Bank of Central & Eastern NC

The mission of the Food Bank of Central & Eastern North Carolina is: No One Goes Hungry in Central & Eastern North Carolina. Established in 1980, the Food Bank is a nonprofit organization that has provided food for people at risk of hunger in 34 counties for 30 years. The Food Bank serves a network of more than 800 partner agencies such as soup kitchens, food pantries, shelters, and programs for children and adults through distribution centers in Durham, Greenville, New Bern, Raleigh, the Sandhills (Southern Pines) and Wilmington.
May Swangnetr launched her academic career at Khon Kaen University in Khon Kaen, Thailand. From there, she moved to Raleigh, NC and attended NC State where she received her doctorate in industrial engineering in 2010. Her dissertation focused on patient-robot interaction in healthcare tasks (she published this work in *IEEE Transactions on Human-Machine Systems* earlier this year).

This year, May took a post-doctoral research associate position at the University of Rostock in Germany at the renowned Center for Life Science Automation (CELISCA). CELISCA is a world-class research facility for design and development of advanced automated systems for processes, including: high-throughput screening of organic compounds as bases for drug-derivative development; screening of inorganic materials for toxic chemicals with environmental importance; and rapid cell culturing systems for integration in regenerative medicine processes. Dr. Kerstin Thurow (one of ISE’s new adjunct faculty members) and Dr. Norbert Stoll, a long-time research partner of NC State, manages CELISCA. May’s role at CELISCA focuses on optimizing human-automation interaction in delivering the complex science processes the Center has designed. Part of her position includes spending some time back at NC State.

In collaboration with ISE Professor David Kaber, May planned a research project to effectively add robotics to a process for analyzing the mercury content in old treated wood. This process is used in Germany to ensure the proper disposal of materials from dilapidated or demolished structures because Germany has strict regulations on disposal of treated lumber to prevent water table contamination. The advantages of using robots to perform this process include reduced chemical exposure to operators and increased efficiency and accuracy in materials handling.

May’s approach was to first conduct a task analysis on the manual process, verify the analysis with expert operators and collect operator performance and workload data for every step in the process. She then developed a human performance model including identification of visual, motor and cognitive operations for each step. May used the model to identify those steps posing the greatest demands on the operators. These steps represent “targets for automation,” specifically the use...
of humanoid robots, like the Dr Robot H20, with the capability to manipulate and transport samples like a human operator and to keep track of process steps through communication with a process control system.

May’s notion is that for physical operations requiring tracking of many objects and a high degree of accuracy in handling, the H20 can be used along with other specialized robots to reduce operator physical demands. For mentally demanding operations, her model is for the H20 to act as a reminder system to the technician as they progress through task steps; like a hygienist might do for a dentist.

Last fall, May returned to the ISE Department to work with Ergonomics Lab researchers on using a computational cognitive modeling and simulation tool (E-GOMSL) developed by David Kaber and another ISE PhD graduate. May transformed her existing human performance model to a computational form in order to simulate technician behavior in the mercury analysis process with the H20 applied to specific process steps. The E-GOMSL tool has the capability to generate stochastic estimates of task times along with indices of operator visuo-motor and cognitive loads. These outputs of the human simulation and modeling efforts will be used to direct engineering initiatives at CELISCA for automation of specific steps in the mercury analysis process.

This summer, May plans to use advanced workload analysis techniques with the lab technicians at CELISA. This additional data is to be used as a basis for further direction of the automation systems engineering on-going at CELISCA. The ISE Department looks forward to the results of May’s visit this past year and extends an invitation to other grads to consider scholarly research visits.
To receive news updates throughout the calendar year, please subscribe to inGear online by going to go.ncsu.edu/ingearonline.
Team Urban Ministries Wins!

Team Normacorc

Team Urban Ministries presents to the dean

Team Liquip International

Jessica Rose

Team Novozymes

Team John Deere

Dr. Vila-Parrish discusses the events of the day
This spring the ISE Department had the pleasure to work with nine local companies on senior design projects. These projects are an opportunity for companies to utilize student resources and have new concepts and fresh ideas injected into their real-world projects. This sponsorship is rewarding for both the project sponsor and the student team. ISE would like to thank this semester’s sponsors for their participation in the program.

**Caterpillar, Inc.**
- **Location:** Sanford, NC
- **Leader:** Martin Kegel, James Wood
- **Senior Design Projects:** 3+ times

To maintain its position as an industry leader, Caterpillar implements constant improvements in their production facilities. Currently, limited floor space, long wait times from the bottleneck of the process and large, bulky pieces of work lead to inconsistent work in progress (WIP). The ISE team’s project is to optimize crane usage and product flow, have no parts stored on floor and have optimal WIP. All the while maintaining established safety guidelines.

**John Deere**
- **Location:** Fuquay-Varina, NC
- **Leader:** Eduardo Castillo
- **Senior Design Projects:** 2 times

From tractors and engines to construction, forestry and turf care equipment, John Deere provides equipment, tools, technology and services that fit the needs of a changing world. Currently, the late configuration area of the warehouse has experienced significant growth in the last year and needs to have its processes optimized to increase effective production. The ISE team’s project is to identify and prioritize opportunities for improvement, develop the ideal future state process, create an implementation plan and begin the process improvement concepts.

**EMC**
- **Location:** Apex, NC
- **Leader:** Andrea Rekrut (NC State ISE 2004)
- **Senior Design Projects:** 3+ times

EMC is a leading provider of IT storage hardware solutions to promote data backup and recovery and accelerate the journey to cloud computing. Currently, the stockroom has been moved off-site which in turn has increased the potential of internal stock-outs, causing lost capacity or even missed shipments. The ISE team’s project is to analyze and optimize the new processes with a goal of reducing internal stock-outs by 10 percent.

**Liquip International**
- **Location:** Reidsville, NC
- **Leader:** Bryan Tregdon (NC State ISE 2001)
- **Senior Design Projects:** 1st time

Liquip International’s Aviation Division engineers and manufactures a wide range of aviation refueling products including refuelers, hydrant dispensers, stationary hydrant carts and filter vessels. Currently, the cellular vehicle assembly operations lack standard work and standard operating procedures. The ISE team’s project is to create standard work for all assembly functions to provide a predictable and consistent build cycle that reduces both product lead-time and overall cost.

Thank You Sponsors!
To receive news updates throughout the calendar year, please subscribe to inGear online by going to go.ncsu.edu/ingearonline.

To get more information about the senior design program, go to: go.ncsu.edu/ingearonline-seniordesign
The Distinguished Alumnus Award is the highest honor that the Edward P. Fitts Department of Industrial and Systems Engineering can bestow upon any alumnus. It's given to department alumni whose contributions to their profession, community, and the department, college and/or university are notable and merit special recognition. Members are listed with their most advanced degrees and in alphabetical order.

<table>
<thead>
<tr>
<th>Name</th>
<th>Degree</th>
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<tbody>
<tr>
<td>M. Tayfur Altiok</td>
<td>PhD 1982</td>
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<td>John V. Andrews</td>
<td>BSIE 1955</td>
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<td>Henry Booke</td>
<td>BSIE 1956</td>
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<td>Larry A. Bowman</td>
<td>BSIE 1973</td>
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<td>Wilmer “Will” Boykin</td>
<td>BSIE 1985</td>
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<td>William C. Burton</td>
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<td>Thomas E. Cabaniss</td>
<td>BSIE 1972</td>
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<td>Worley “H” Clark, Jr.</td>
<td>BSIE 1956</td>
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<td>John L. Colley, Jr.</td>
<td>BSIE 1957</td>
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<td>Mike Cramer</td>
<td>BSIE 1984</td>
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<td>William M. “Buck” Deal</td>
<td>BSIE 1963 (Valedictorian)</td>
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<td>Hugh M. Duncan</td>
<td>BSIE 1955</td>
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<td>Güln Ege</td>
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<td>Karen Eichelberger</td>
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<td>E. Emory Enscore, Jr.</td>
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<td>Edward P. Fitts</td>
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<td>Edward H. Frazelle</td>
<td>MSIE 1985</td>
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<td>Allen “Fred” Gant</td>
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<td>Ed Gerken</td>
<td>BSFMM 1974</td>
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<td>James A. Hackney, III</td>
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<td>N. Clark Hatcher, Jr.</td>
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<td>Steve Head</td>
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<td>Christopher T. Irwin</td>
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<td>J. Phillip Kennett</td>
<td>BSIE 1962</td>
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<td>Robert K. Koger</td>
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<td>Ross W. Lampe, Jr.</td>
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<td>Gayle S. Lanier</td>
<td>BSIE 1982</td>
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<tr>
<td>Thomas K. Laundon</td>
<td>BSIE 1974</td>
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<td>V. B. Lougee, III</td>
<td>BSIE 1951</td>
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<td>Leon McGinnis</td>
<td>PhD 1975</td>
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<td>Jacqueline Reynolds Mozrall</td>
<td>MSIE 1989</td>
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<td>Richard Earle Nance</td>
<td>MSIE 1966</td>
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<tr>
<td>Rajendra K. Pachauri</td>
<td>PhD 1974 (2007 Nobel Prize)</td>
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<td>David F. Parker</td>
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<td>Jay Paschall</td>
<td>BSFMM 1983</td>
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<td>Thomas D. Pearson</td>
<td>BSFMM 1965</td>
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<td>Joseph M. Pleasant, Jr.</td>
<td>BSIE 1972</td>
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<tr>
<td>Caroline Reda</td>
<td>MSIE 1993</td>
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<td>Robert Rhodes</td>
<td>BSIE 1960</td>
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<td>Tim Scronce</td>
<td>BSIE 1987</td>
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<td>William L. Sigmon</td>
<td>BSIE 1971</td>
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<td>Kenneth A. Stevens</td>
<td>BSIE 1972</td>
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<td>John S. Usher</td>
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<td>John B. Vaughan</td>
<td>BSFMM 1952</td>
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<tr>
<td>Edward I. Weisiger, Jr.</td>
<td>BSIE 1982</td>
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<tr>
<td>Edgar S. Woolard, Jr.</td>
<td>BSIE 1956</td>
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<tr>
<td>Kathleen McKinney Wynegar</td>
<td>BSIE 1986 (Valedictorian)</td>
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<tr>
<td>Willy G. Yamamoto</td>
<td>MSIE 1964</td>
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The ISE Department receives valuable input from its Advisory Board. The board maintains and fosters relationships with students, faculty, the Dean of the College of Engineering, the community and alumni. The Advisory Board assists the department head in achieving department goals and provides counsel and advice from its unique perspective. Board members are typically engaged in other ways, such as helping to connect the department with industry stakeholders. The Advisory Board meets each semester.

The following distinguished alumni and friends of the ISE Department currently serve on the Board:

**Dr. Leslie Alexandre**  
Director, Research Development and Collaborations at Georgia Regents University Cancer Center  
Board Member at Arbovax, Inc.

**Dr. Tony Atala**  
Director of the Wake Forest Institute for Regenerative Medicine  
W.H. Boyce Professor and Chair of the Department of Urology at Wake Forest University

**Larry Bowman**  
BSIE, North Carolina State University 1973  
Principal with Bowman Investments, LLC

**Edward Fitts**  
BSIE, North Carolina State University 1961  
Founder and CEO of Dopaco, Inc. (Retired)

**Dr. Leon McGinnis**  
PhD, North Carolina State University 1975  
Professor Emeritus in the H. Milton Stewart School of Industrial and Systems Engineering at Georgia Tech

**Joe Pleasant Jr.**  
BSIE, North Carolina State University 1972  
Chief Information Officer and Senior Vice President of Premier, Inc.

**Tim Scronce (Chair)**  
BSIE, North Carolina State University 1987  
President, Scronce Advisors, LLC

I am proud to say that since 2007, the ISE department has seen a 106 percent growth in undergraduate enrollment compared to the national average of just 16 percent. Our 2013 incoming class was the largest in recent history with 90 students and boasted an average GPA of 3.58 on a 4 point scale. The 2014 class was nearly as large and equally accomplished (GPA of 3.61). Furthermore, the 2014 class includes two students with Park Scholarships, a prestigious four-year scholarship awarded on the basis of outstanding accomplishments and potential in scholarship, leadership, service and character. Only 44 were awarded university-wide. These trends are a direct result of the hard work by our ISE faculty and staff to keep our academic program relevant and cutting edge. Likewise, our graduate program has grown more than 75 percent over the same period.

I’m excited to announce that the advisory board has recently updated its charter to more clearly define ways in which we can support the department. We have identified three areas of focus:

- To be ambassadors of the department
- To foster strategic thinking, new directions, networking, new revenue sources, and alumni and corporate development
- To support and advise the department head

With shrinking financial commitments from the state, the advisory board encourages all ISE alumni to help and support the department to realize its ambitious goal of being seen as an international thought leader in the field of industrial and systems engineering. Your financial support will fund scholarships, fellowships and professor endowments. A key metric in the *U.S. News and World Report* engineering rankings is alumni giving, and now more than ever, we need our alumni to help support our ISE department.

**Tim Scronce, BSIE 1987**  
Board Chair
**Amber Williams**, senior, placed third in the *Institute of Industrial Engineers Regional Paper Competition* for her paper *Regression Modeling of Food Supply*. The competition was held during the 2014 IIE Mid-Atlantic Regional Conference at Virginia Tech University in February.

She is currently working under the supervision of Dr. Julie Ivy in the area of humanitarian logistics for the Food-Bank of Central & Eastern North Carolina.

**Robert Young**, professor, received the inaugural *George L. Smith International Award for Excellence in Promotion of Industrial Engineering* from the *Institute of Industrial Engineers* at their annual conference in Montreal.

This award is for an individual who has made significant and long-standing contributions to the industrial engineering discipline and who exemplifies role model behavior as a “goodwill ambassador” for the profession across national boundaries by demonstrating global cooperation in their leadership and establishment of international initiatives.

**Rohan Shirwaiker**, assistant professor, received the *Distinguished Faculty Advisor Award* from SME, formerly known as the Society of Manufacturing Engineers. Its purpose is to acknowledge current student chapter faculty advisors and those who demonstrate commitment to advancing SME’s 2017 Strategic Direction.

Rohan also received the *Best Young Investigator Poster Award* at the *American Academy of Orthopaedic Surgeons-Orthopaedic Research Society (AAOS-ORS)* Research Symposium in Chicago, IL.

**David Kaber**, professor, was promoted to *Senior Member* status by the *Institute of Electrical and Electronics Engineers*. The grade of Senior Member requires experience reflecting professional maturity. All candidates must have ten or more years of experience as an engineer and have demonstrated five years of significant performance.

The ISE department would like to thank Dr. Mladen Vouk, department head and professor of computer science, for nominating Dr. Kaber for this honor. Only 7 percent of IEEE members are promoted to senior member.
HONORS

George Vincent, graduate student, qualified to compete in the semifinals of the Toastmasters World Championship of Public Speaking in 2013. He was one of only 88 people out of a pool of 30,000 to get a chance to compete for the title.

This spring George is back at it again. He has already advanced to the district level where he will be competing later this month. ISE wishes George all the luck in the world as he continues on his dream of capturing the title of world champion!

Justin Lancaster, director of information technology, was nominated for a College of Engineering Award for Excellence and Justin also received the Pride of the Pack Award that very same day.

The Awards for Excellence program recognizes the accomplishments and achievements of NC State employees and is the highest honor bestowed upon any employee at NC State.

Russell King, Fitts Distinguished Professor and co-director of the Laboratory for Additive Manufacturing and Logistics, received the 2014 CA Anderson Outstanding Faculty Award as part of the 38th annual CA Anderson Award Ceremony.

The Anderson Award recognizes the member of the Industrial and Systems Engineering Faculty who, by consensus of the students, has made the greatest contribution toward their educational development.

Cecilia Chen, graduate administrative assistant, received the 2014 ISE Staff Employee of the Year Award.

Irem Sengul, graduate student, received the 2014 ISE Outstanding Teaching Assistant Award.

Michelle Ebersole, senior, received the 2014 ISE Outstanding Senior Award.

Jessica Rose, senior, received the last ever 2014 Rudolph Willard Outstanding Senior in Furniture Manufacturing Award.

Jamie Yannayon, senior, received the 2014 ISE Faculty Senior Award.

Kayla Summer, sophomore, received the 2014 Alpha Pi Mu Outstanding Sophomore Award.

Stephen Taylor, senior, received the 2014 SME Outstanding Service Award.
A look at some of the numbers that shape the Edward P. Fitts Department of Industrial and Systems Engineering at NC State.

1948
The year the **FIRST MSIE DEGREE** was granted.

100
Percentage of **JOB PLACEMENT** for our recent graduates who were seeking employment.

500+
Total number of **UNDERGRADUATE** and **GRADUATE** students in the department.

3.57
On a 4 point scale is the **AVERAGE GPA** of the 2013 incoming class.

**NAMED AND ENDOWED**
The Edward P. Fitts Department of Industrial and Systems Engineering was the first named and endowed department in the University of North Carolina system.
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SUPPORT ISE

A gift to the Edward P. Fitts Department of Industrial and Systems Engineering is an investment in the future.

Gifts support scholarships, fellowships, professorships, academic programs, faculty research and other initiatives that are not typically supported through state appropriations. This private philanthropy empowers the Department to achieve excellence in both the classroom and the laboratory.

To learn about supporting the ISE department, contact the NC State Engineering Foundation.

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