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Department of Industrial Engineering
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Clemson IE Generates Partnership with Korean University

The Department of Industrial Engineering at Clemson University and the Department of Systems and Management Engineering at Inje University, South Korea,

have established a partnership agreement. Inje University, a private university of 12,000 students located in the southern part of South Korea, is one of the major colleges in the region. Equipped with quality educational systems and extensive research programs, Inje University has established similar partnerships with governments, industries and other universities in other countries. The partnership with Clemson will foster mutual and reciprocal cooperation between the two departments through educational and academic exchanges, collaborative research projects, and other academic pursuits.

For more information on Dr. Shappell's work at Clemson University visit the Industrial Engineering website at www.ces.clemson.edu/ie or contact Dr. Shappell directly at HFEng@clemson.edu.

Safer Skies: Using HFACS and HFIX To Target Human Errors in Aviation

If you are looking for perfect safety, you would do well to sit on the fence.

~Wilbur Wright

Clearly, today's travelers are not sitting on the fence, and although Clemson's Dr. Scott Shappell might agree with Wilbur Wright, he has devoted his career to moving today's transportation industry closer toward the goal of "perfect safety" by focusing on the human factors associated with transportation accidents.

Human error has been associated with 60 to 80% of all transportation incidents and accidents. In light of this finding, Dr. Shappell (Clemson University) and his colleague Dr. Douglas Wiegmann (University of Illinois and Mayo Clinic) have conducted extensive research in the field of human error, culminating in the development of a framework for identifying, tracking, and analyzing human causal factors associated with accidents/incidents. This tool, the Human Factors Analysis and Classification System (HFACS), is a system-safety model that effectively bridges the gap between human error theory and applied human error analysis. Originally developed for U.S. Navy/Marine Corps aviation accidents, it has been used by a variety of other aviation organizations in the U.S. and around the world (e.g., Department of Defense, Federal Aviation Administration (FAA), Canadian Air Force, Indian Air Force, Dutch Air Force, and Australian Transportation Safety Board). In addition, HFACS has been applied in a variety of other industries such as mining, oil, manufacturing, and medicine.

A step forward in the identification of human error trends among accidents/incidents, HFACS is unique in its ability to identify data-driven interventions. With this in mind, Drs. Shappell and Wiegmann have developed a companion tool, the Human Factors Intervention matriX (HFIX) for mapping intervention strategies onto specific forms of human error identified within HFACS. When used together, HFACS and HFIX allows for the generation of comprehensive intervention strategies that directly target underlying systemic causes of errors.

Recognizing the importance of this research, the FAA has given Drs. Shappell and Wiegmann more than $2 million over the past 6 years to fully explore the use of HFACS and HFIX with commercial and general aviation accidents. In fact, this past May, Dr. Shappell was awarded a 3-year $560,000 grant to identify interventions for general aviation using HFIX. With Jaclyn Baron (2nd year Human Factors Psychology graduate student), Dr. Shappell will explore a number of interventions to prevent general aviation accidents associated with flight into weather and the loss of control in flight during the next three years.

In addition, as HFACS and HFIX are not specific to aviation, Rebecca Iden (2nd year Industrial Engineering graduate student) and Dr. Shappell have begun examining fatal U.S. roadway accidents from 1994-2004 using data obtained from the National Highway Traffic Safety Administration (NHTSA). Their initial findings have provided insight into the types of errors drivers make and will hopefully lead to ways to address those concerns in highway safety.

Message from the Chair

This issue outlines various efforts currently underway in the Department, specifically focusing on the new undergraduate curriculum, the most recent research initiatives, and several senior design projects. One of the most important accomplishments this year was the revision of the undergraduate Industrial Engineering curriculum. The Undergraduate Committee working with various constituents has ensured that the new curriculum reflects the current emphasis on information technology. The timing of this revision coincided with the changes in the University's general education requirements.

As you can see in this issue, the Department enrollment and faculty activity continue to remain strong. We currently have 160 undergraduates and 60 graduates, of whom 30 are doctoral students, and the faculty continues to be active in pursuing research and scholarship. Over the last couple of years, we have seen a significant growth in research funding. In an effort to improve research space for our students, we have completely remodeled their offices and work area. This renovation significantly improves their quality of space and their access to computational facilities. It was a vital step for attracting top quality talent to Clemson.

In the coming year the Department will welcome Dr. Maria Esther Mayorga. She received her Ph.D. from the Industrial Engineering and Operations Research (IEOR) Department at the University of California, Berkeley (UCB) in 2006; her B.S. in Mechanical Engineering (Summa Cum Laude) from The George Washington University in 2000; and her M.S. in IEOR from UCB in 2002. Her research explores how firms integrate operational decisions with strategic decisions and consumer choice behavior. Her teaching and industry experience, in addition to her research area, will be a welcome addition to the Department.

We thank you, our alumni and friends, for your generous support over the years. We truly appreciate your contributions to the department. I encourage you to visit our Web site at www.ces.clemson.edu/ie — and please do visit us if you happen to be in the area. I would enjoy visiting with you and showing you around the Department.

IE Welcomes Dr. Maria Mayorga

Maria Esther Mayorga received her Ph.D. from the Industrial Engineering and Operations Research (IEOR) Department at the University of California, Berkeley (UCB) in 2006. She received her B.S. in Mechanical Engineering (Summa Cum Laude) from The George Washington University in 2000 and her M.S. in IEOR from UCB in 2002.

Her research explores how firms integrate operational decisions, such as inventory and production, with strategic decisions, such as capacity and product line design. Her dissertation, Consumer Heterogeneity and Optimal Stochastic Resource Allocation, investigates optimal policies for three stochastic resource allocation models of firms at different supply chain stages. The first two focus on the interaction between capacity and production allocation decisions for a make-to-stock production firm serving multiple consumer classes, while the third explores the interaction between product attribute and inventory decisions for a retailer. Her dissertation has resulted in one publication, "Optimal Control of a Make-to-Stock System with Adjustable Production Rate" (*Journal of Probability in Engineering and Informational Sciences*, Summer 2006), and two working papers. Her current research focuses on the integration of consumer choice behavior and operational decisions.

Maria most recently resided in Ann Arbor, MI, where she was a Visiting Scholar at the University of Michigan. While there, she was a full Instructor for an Introduction to Operations Management course. Her previous teaching positions include graduate student instructorships for Service Operations Design and Analysis and Operations Management courses at UCB. Her industry experience includes work in a manufacturing group at Hewlett Packard in 1999. From 2001-2002 she worked as a global supply chain analyst at LifeScan, where she created a corporate training module as a consultant.

IIE Alumni Tailgate and Golf Outing

This fall IIE will host an IE Alumni Tailgate. It is planned for Homecoming weekend, October 21, 2006. More information can be found on our website http://people.clemson.edu/~iie.
We hope to see you there!

In spring 2007, IIE will host a Golf Outing. Our website will provide further details as the event draws near. We appreciate your participation and support! GO TIGERS!

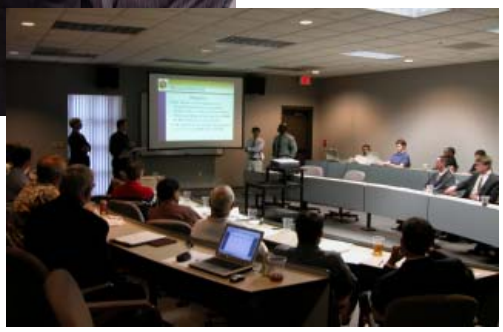
Your support makes a difference!

We appreciate your continued support of the Clemson IE program and ask that you please use the enclosed envelope or go to the following secure online giving site to make your donation.

www.clemson.edu/isupportcu

From the Classroom to the Boardroom: Preparing IE Seniors for the "Real World"

It's the beginning of the semester, and the classroom is beginning to fill quickly with the anticipatory buzz of friends discussing what they did over break, the grades they earned in IE 381, and where they want to work after graduation. Most are familiar faces – having worked on late-night programs or studiously crammed for tests together many times. This is IE 467, Senior Design, a class that marks the compilation of 3 ½ years of exams and study sessions and the introduction of the students into the IE workforce.



The purpose of this class is to enable students to use their classroom-based knowledge to complete projects for local industries. For example, last semester a Clemson IE team worked with Seneca's Tyco Corp. to reduce down time and improve ergonomics on one of their main production lines. This project helped the students build teamwork skills, practice interaction with a client, and learn to manage projects in a very real setting, all while receiving feedback on performance from both institutional instructors and Tyco management. "This project allowed me to implement real-world tools that I'll be using in just a few months," said Marquita Wise, a graduating senior who worked with the Tyco team.

In the past, this class has partnered with a range of local industries including Borg Warner, 3M, Tyco, Caterpillar, BMW, St. Jude Medical and Square D, to name a few. Overall, the customer response has been overwhelmingly positive with repeated team sponsors year after year. Wilbur Janowski, an ergonomist with BMW said, "[We are] very proud of the level of expertise and maturity your students presented."

Local companies interested in sponsoring a student team for either the Fall or Spring semester should contact Anand Gramopadhye by e-mail (agramop@ces.clemson.edu) or phone (864-656-4717).

Industrial Engineering Awards

The Clemson Industrial Engineering Department recognized its best at the 2006 Annual Awards Banquet. The awardees are listed below.

The Jim Chisman Outstanding Senior Award
William Gronstrom Eby

The Karen and Carl R. Lindenmeyer Leadership and Public Service Award
Austin Lee Graham

The Kimbler Undergraduate Research Award
Lindsay Michelle Becker
Jaclyn Diana Brenes
Michelle Hatcher
Candice C. Hein
Matthew Barrett Johnson
Desiree Goli Steinmann

The IIE Award of Excellence
Crystal Nichole Vickery

Senior Academic Achievement
Christian Max Buchmann

Junior Academic Achievement
Sarah Jane Grigg

Sophomore Academic Achievement
Ashley Michele O'Brien

Outstanding Graduate Teaching Assistant
Esengul Tayfur

Outstanding Junior Award
Laura Rayfield Young

Teaching Assistant of the Year
Esengul Tayfur

Professor of the Year
Dr. Joel Sandor Greenstein

A Curriculum Revision for the BSIE Program

The Department introduced a new undergraduate curriculum this past academic year, a revision coinciding with changes in the University's general education requirements. In particular, competencies for academic and professional development; ethical judgment; information technology; and reasoning, critical thinking and problem solving are now distributed across the curriculum rather than being centered in one course or department.

The Department's Program Outcomes and Program Educational Objectives guided this curriculum revision. The first specify what our students should be able to do by the time of their graduation, while the Educational Objectives focus on the expected accomplishments of our graduates several years following graduation. These Educational Objectives are based on the missions of the University and the Department, the needs of the program constituencies and the requirements of the Accreditation Board for Engineering and Technology. Both the Program Outcomes and Educational Objectives are subject to continuing review, with the faculty reviewing the former, and our primary constituencies and Industrial Advisory Board the latter.

In revising the curriculum, the faculty focused on Program Outcomes concerning applying knowledge of mathematics, science, and engineering; identifying, formulating, and solving engineering problems; and integrating systems using appropriate analytical, computational and experimental practices. In addition, we reviewed the new specifications of the FE exam since it measures the achievement of these outcomes. In particular, we observed a decreased emphasis on manufacturing processes and a greater emphasis on information technology, facilities planning, management and ergonomics than currently exists in our curriculum. We also focused on the outcome of preparation for graduate education. Toward this end, we benchmarked the curricula of several top 20 industrial engineering programs. Specifically, we observed that almost all of these had a probability and statistics sequence, along with a second operations research course, whereas our current curriculum did not. The curriculum was ultimately revised in accordance with these observations, subsequent to the appropriate review process.

Since the new curriculum incorporates the University's new general education requirements, the Department's program outcomes and indicators, the new FE specifications, and the curricula of the benchmark institutions, we are optimistic that it reflects the trends both in industry and academia that will serve our students well in this decade and beyond**.**

Where are they now?

Highlighting Clemson IE Alumni Tony Elliott

Mr. Tony Elliott, a 2002 Industrial Engineering graduate, has been employed at Michelin North America, INC., for the past two years. After spending the first year and a half as an Industrial Engineer, he now works in the Personnel Department as the MDP/OR Coordinator. In this position, he is responsible for the development and empowerment of the high performance production teams within his facility in Sandy Springs, South Carolina. He has traveled to France, Spain, and Germany in preparation for his new role. A member of the Michelin Recruiting team for Clemson University, Tony lives in Piedmont with his fiancée, Tamika, and their dog, Lennox.

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