Logo of the newly created Freshman Engineering Program under the direction of Industrial Engineering Associate Professor C. Richard Cassady. Dr. Cassady and his staff will guide students who enter the College of Engineering in their first steps toward the engineering discipline of their choice. More information about the department’s new role in structuring a common academic and professional experience for freshmen can be found in the “Undergraduate Studies” section of this annual report.
Dear Colleagues:

The past year has proven to be one of considerable growth and significant development for the Department of Industrial Engineering at the University of Arkansas. I trust that this has been an equally fruitful year for your faculty, staff and students. This Annual Report chronicles some of the more notable initiatives undertaken by our department in the course of 2006. Thanks to the dedicated and innovative efforts of our faculty, we continue to be one of the outstanding Industrial Engineering programs in the nation.

We are further proud to announce the recent addition to our faculty of Dr. Ronald Rardin as the inaugural incumbent of the John and Mary Lib White Systems Integration Chair in Industrial Engineering. Dr. Rardin also assumes the directorship of the new Center for Innovation in Healthcare Logistics, in which the department will partner with major corporate entities to address many of today's most critical healthcare systems engineering challenges more effectively.

In reviewing this report, you will discover many additional contributions, initiated by our faculty, alumni, staff and students alike. But as much as I enjoy sharing news of our progress, I am also eager to receive reports of your departments’ achievements. I hope that such ongoing information exchanges can serve as a mechanism for discovering opportunities to collaborate and for advancing both the field and the industrial engineering profession. So, if you find an item within these pages that piques your interest, please know that you are most welcome to call, write or visit us whenever the opportunity arises. On behalf of all of us at the U of A, I wish you a stellar year ahead.

Sincerely,

John R. English, Ph.D., P.E.
Professor and Department Head
Dr. English is an IIE Fellow. His research interests include quality control, reliability engineering and applied statistics. He is currently teaching in the area of quality engineering and management. He joined the faculty in 1991.

Education:
Ph.D. (Oklahoma State University)
M.S.O.R. (University of Arkansas)
B.S.E.E. (University of Arkansas)

Dr. Buyurgan’s research interests include Auto-ID technologies; RFID system optimization and data quality assessment; inventory control and management; auctioning methods; distributed control of large-scale systems; modeling and control of discrete event systems; modeling and analysis of flexible manufacturing systems; and automation and integration of advanced manufacturing systems. Dr. Buyurgan teaches courses in manufacturing design, processes and system analysis. He joined the faculty in 2004.

Education:
Ph.D. (University of Missouri - Rolla)
M.S.E.M. (University of Missouri - Rolla)
B.S.I.E. (Istanbul Technical University)

Dr. Cassady holds the John L. Imhoff Chair in Industrial Engineering and serves as Director of Freshman Engineering for the College of Engineering. His primary research interests lie in repairable systems modeling. He also conducts research in the areas of reliability engineering, statistical quality control, transportation/distribution systems modeling and sports applications of operations research. Dr. Cassady teaches courses in reliability and maintainability engineering, operations research, probability and statistics, and statistical quality control. He joined the faculty in 2000.

Education:
Ph.D. (Virginia Tech)
M.S.I.S.E. (Virginia Tech)
B.S.I.S.E. (Virginia Tech)

Dr. Chimka’s research interests include categorical data analysis, inventory control, statistical quality control, survival analysis and time series. He teaches courses in applied statistics, generalized linear models, optimization and production. Dr. Chimka joined the faculty in 2002.

Education:
Ph.D. (University of Pittsburgh)
M.S.I.E (University of Pittsburgh)
B.S.I.E. (University of Pittsburgh)
Earnest W. Fant, Ph.D., P.E.,
Associate Professor

Dr. Fant is the Associate Director of the Center for Engineering Logistics and Distribution (CELDi) at the University of Arkansas. His research interests include applications for machine-visioned robotics in automated production/processing and material handling systems and the application of operations research to in-plant logistics systems and warehousing. He teaches courses in robotics, machine vision and material handling/warehousing systems. Dr. Fant joined the faculty in 1988.

Education:
Ph.D. (Texas Tech)
M.S.I.E. (Southern Methodist University)
B.S.I.E. (University of Arkansas)

Carol S. Gattis, Ph.D.,
Adjunct Associate Professor

Dr. Gattis has been responsible for undergraduate student recruitment and taught courses in statistics, work methods and measurement, and engineering economics. She is currently the Director of Recruitment, Retention, Honors and Diversity for the College of Engineering. Dr. Gattis joined the faculty in 1991.

Education:
Ph.D. Engineering (University of Arkansas)
M.S.E.E. (University of Arkansas)
B.S.E.E. (University of Arkansas)

Steven L. Johnson, Ph.D., P.E., CPE.,
Professor

Dr. Johnson’s research interests have spanned the continuum from occupational ergonomics (e.g., hand tool design, reduction of musculoskeletal disorders, development of computer-based job analysis systems) to in-vehicle information, communication and entertainment systems in commercial trucks and automobiles. His current research involves modeling driver workload, evaluating lane-departure systems and investigating the effect of heavy truck/automobile speed differentials on highway safety, efficiency and economics. He teaches courses in human factors engineering/ergonomics, quality control and design of experiments. Dr. Johnson joined the faculty in 1982.

Education:
Ph.D. (SUNY at Buffalo)
M.S. Human Factors (University of Illinois)
B.A. Psychology (University of South Dakota)

Scott J. Mason, Ph.D., P.E.,
Associate Professor and Associate Department Head

Dr. Mason serves as the Chair of Graduate Studies and began serving as Associate Department Head in 2004. His research interests include production planning and control, scheduling, and large-scale system optimization, modeling and algorithms, with emphasis on semiconductor manufacturing and transportation logistics. Dr. Mason teaches courses in optimization, sequencing and scheduling, and in the modeling and analysis of semiconductor manufacturing. He joined the faculty in 2000.

Education:
Ph.D. (Arizona State University)
M.S.E. (The University of Texas)
B.S.M.E. (The University of Texas)
Dr. Meller is Hefley Professor of Logistics and Entrepreneurship and serves as the Director of the Center for Engineering Logistics and Distribution (CELDi). His research interests include facility logistics, which is logistics at the facility level, as well as supply chain design and other operations research applications to production systems. Dr. Meller teaches courses in facility logistics. He joined the faculty in 2005.

Education:
Ph.D. (University of Michigan)
M.S.I.O.E. (University of Michigan)
B.S.I.O.E. (University of Michigan)

Dr. Nam’s research interests include cognitive and cultural ergonomics, adaptive and intelligent human-computer interaction, haptic virtual environments, brain-computer interface and ubiquitous computing. Dr. Nam teaches courses in human factors and ergonomics. He joined the faculty in 2004.

Education:
Ph.D. (Virginia Tech)
M.S.I.E (SUNY at Buffalo)
M.A.B.A. (Sogang University)
B.S.I.E. (SungKyunkwan University)

Dr. Nachtmann serves as the Associate Director of the Mack-Blackwell National Rural Transportation Center. Her research interests include economic decision analysis, cost estimation, intermodal transportation networks and engineering education. Dr. Nachtmann teaches courses in the areas of engineering economy, cost and financial engineering, and operations research. She joined the faculty in 2000.

Education:
Ph.D. (University of Pittsburgh)
M.S.I.E. (University of Pittsburgh)
B.S.I.E. (University of Pittsburgh)

Dr. Parker teaches courses in operations research, project management and engineering management. She retired in 1997 and rejoined the department in 2003 to serve as the Director and Chair of Studies for our operations management program.

Education:
Ph.D. (University of Arkansas)
M.S. Anthropology (University of Arkansas)
B.S. Natural Sciences (University of Arkansas)
Dr. Pohl’s research interests include repairable systems, large-scale systems engineering and analysis, probabilistic design, risk and reliability, and engineering optimization. He teaches courses in quality control, engineering statistics, non-linear programming, heuristics, risk modeling, systems engineering and management. Dr. Pohl joined the faculty in 2004.

Education:
Ph.D. (University of Arizona)
M.S. Reliability Engineering (University of Arizona)
M.S. Systems Engineering (Air Force Institute of Technology)
M.S. Engineering Management (University of Dayton)
B.S.E.E. (Boston University)

Edward A. Pohl, Ph.D., Associate Professor

Ronald L. Rardin, Ph.D., Distinguished Professor
Dr. Rardin is the inaugural incumbent of the John and Mary Lib White Systems Integration Chair in Industrial Engineering. His research and teaching interests center on large-scale optimization modeling and algorithms, including their application in healthcare delivery, transportation and logistics, and energy planning. Dr. Rardin joined the faculty in the current year and directs the new Center for Innovation in Healthcare Logistics in collaboration with Wal-Mart, Blue Cross Blue Shield and other industrial partners.

Education:
Ph.D. (Georgia Institute of Technology)
M.A. Public Administration (University of Kansas)
B.A. Math/Political Science (University of Kansas)

Ronald L. Rardin, Ph.D., Distinguished Professor

Manuel D. Rossetti, Ph.D., PE., Associate Professor
Dr. Rossetti serves as the Chair of Undergraduate Studies. His research is focused on the design, analysis and optimization of transportation, inventory, healthcare and manufacturing systems, using stochastic modeling, computer simulation, information systems and heuristic modeling techniques. He teaches courses in the areas of probability modeling, discrete event simulation, object-oriented and database systems, transportation/logistics modeling, and inventory modeling. Dr. Rossetti joined the faculty in 1999.

Education:
Ph.D. (The Ohio State University)
M.S.I.S.E. (The Ohio State University)
B.S.I.E. (University of Cincinnati)

Manuel D. Rossetti, Ph.D., PE., Associate Professor

John A. White, Ph.D., PE., Chancellor & Distinguished Professor
In addition to being the Chancellor of the University of Arkansas, Dr. White is both a distinguished alumnus and faculty member of the Industrial Engineering Department. He is a member of the National Academy of Engineers and a recipient of the Frank and Lillian Gilbreth Industrial Engineering Award, the highest award conferred by the Institute of Industrial Engineers (IIE). In 2006 Dr. White was also recognized by the American Society for Engineering Education (ASEE) with the John L. Imhoff Global Excellence Award for Industrial Engineering Education. Dr. White teaches engineering economics.

Education:
Ph.D. (The Ohio State University)
M.S.I.S.E. (Virginia Tech)
B.S.I.E. (University of Arkansas)

Dr. White also holds honorary degrees from the Katholieke Universiteit of Leuven in Belgium and George Washington University.
RESEARCH

The faculty of the Industrial Engineering Department at the University of Arkansas is engaged in a wide variety of research endeavors. This section of our annual report features a sampling of faculty research in the areas of transportation and logistics, warehouse layout and homeland security risk assessment. Also highlighted in this section are the newly dedicated Larry and Gwen Stephens Undergraduate Research Laboratory and some of the student research currently underway in that facility.

Transportation and Logistics

The University of Arkansas has a longstanding tradition of conducting advanced research and educational programs in the area of transportation & logistics. Through participation in the Center for Engineering Logistics and Distribution (CELDi) our department has received millions of dollars for industry-funded research on a wide range of issues related to logistics engineering and transportation. The department also receives substantial funding for logistics and transportation research from the Mack-Blackwell Rural Transportation Center (MBTC).

Center for Engineering Logistics and Distribution

CELDi is a multi-university, multi-disciplinary National Science Foundation sponsored Industry/University Cooperative Research Center (I/UCRC). The center was created to provide integrated solutions to logistics problems through research related to modeling, analysis and intelligent-systems technologies. During 2006, the center increased to nine academic partners by adding Clemson University. Clemson joins the other CELDi academic partners: Texas Tech University, the University of Arkansas, the University of Florida, Lehigh University, the University of Louisville, the University of Nebraska, the University of Oklahoma, and Oklahoma State University.

Faculty members of the Department of Industrial Engineering at the University of Arkansas bring their expertise to the partnership in the areas of material handling systems, logistics network optimization, simulation of logistics systems, analysis of spare-parts logistics systems and logistics systems performance measurement. The more than 30 member organizations of CELDi drive the research endeavors of the center. During 2006, our faculty obtained more than one million dollars of research funding from CELDi and its member organizations. More information can be found at the center’s web site: www.celdi.ineg.uark.edu.

Fishbones Yield Faster Order Retrieval

A recent logistics and distribution research initiative, undertaken by Dr. Russell D. Meller, CELDi Director and Hefley Professor of Logistics and Entrepreneurship and his colleague, Dr. Kevin Gue of Auburn University, is based on investigating alternatives for enhanced warehouse layout with a view to improving stock retrieval time. This research is being funded by a $400,000 grant to Meller and Gue from the National Science Foundation.

Initially raising the researchers’ suspicions that an opportunity for optimization may be at hand was the observation that the traditional rectilinear configuration of aisles and rows in warehouse layout design had not been reconsidered in over thirty years. Meller and Gue further observed that the design rules implicit in the conventional layout were as follows: (1) picking and cross aisles must be straight; and (2) the cross aisles must meet picking aisles at right angles. Thinking outside this conventionally laid-out box, they designed and tested alternative floor plans that would minimize travel time for warehouse workers as they strive to fill orders. Meller and Gue came up with two alternative designs that provide substantial improvements in picking response times, as well as in the associated costs.
The first of the alternative layouts created by Meller and Gue replaces rectilinear cross aisles with a set of angled cross aisles that originate from a single pickup and deposit point at the middle of the warehouse floor. The cross aisles form a “V”-shaped path through the picking aisles, which allows warehouse workers to take advantage of traversing the hypotenuse of a triangle, rather than only its legs—a constraint implicit in conventional rectilinear layouts. This “Flying-V” cross-aisle design produced reductions in travel of approximately 10 percent. In a further refinement, termed the “fishbone” design, diagonal cross aisles were extended to the far corners of the warehouse floor and the picking aisles along the outward-oriented edges of the diagonal aisles were turned ninety-degrees to face the cross aisles. Using this design in tests on a 21-aisle warehouse, Meller and Gue achieved a dramatic 20.4 percent reduction in travel distance.

They then compared their new design to a hypothetical warehouse in which workers could travel directly to each item on the floor (i.e., travel by flight). The surprising result was that the hypothetically perfect travel-by-flight layout improved upon the fishbone design by only an additional 3.1 percent, which validates the fishbone design as a solution that closely approaches the limits of optimal improvement in warehouse layout.

The researchers recognize that there are costs involved in restructuring warehouse space to upgrade to the fishbone model. However, the cumulative cost savings obtained from a significant reduction in stock retrieval costs could be significant for large retailers, such as Wal-Mart, Lowe’s, and others where product volume is a major consideration in the business model.

Mack-Blackwell Rural Transportation Center

The Mack-Blackwell Rural Transportation Center (MBTC) is a U.S. Department of Transportation funded interdisciplinary research center, headquartered in the Department of Civil Engineering at the University of Arkansas. By contributing to better road, waterway, rail and airway systems in rural areas, MBTC helps to move people and goods to their destinations more efficiently and economically. MBTC has become a national center for excellence in transportation infrastructure design and maintenance, in traffic/logistics planning and management, in transportation policy and in the effects of transportation on social and economic conditions. MBTC sponsors interdisciplinary research in all modes of transportation at the University of Arkansas and other institutions. All research funding is matched dollar-for-dollar by state and industry sources. MBTC-sponsored projects are required to involve graduate and/or undergraduate students, thus giving many students from our department the opportunity to gain research experience. More information may be found at the center’s web site www.mackblackwell.org.

The department’s 2006 in-force research awards through MBTC, together with industry and state matching funds, exceeded $400,000. The research conducted by our faculty applied the department’s expertise in a variety of areas. In the following section, we describe an MBTC project, led by Dr. Heather Nachtmann, who also serves as the Center’s Associate Director.
Homeland Security for Rural Transportation Networks

Dr. Nachtmann, together with co-investigators Drs. Edward Pohl and Richard Cassady questioned whether assessment tools, currently used to evaluate the vulnerability of urban transportation systems to security risks, were equally well-suited for use in evaluating such risks to rural transportation networks. This research examined not only if the methodologies of urban assessment studies could be applied to rural transportation networks, it also sought to identify preferred procedures for conducting rural transportation vulnerability assessments.

The researchers first reviewed the tools and techniques used to perform risk assessments of urban transportation systems. In all, ten different methodologies were analyzed, summarized and compared as part of this effort. In order to determine whether any of these tools could be applied to a rural transportation system, the differences between rural and urban transportation systems were then examined. Among the differences identified were: (1) rural areas have low population densities and large distances between population centers; (2) large variation in terrain types requires that larger transportation networks and often different varieties of transportation modes be utilized when compared with urban settings; and most importantly; (3) rural areas often have fewer assets to protect. Based on these differences, the researchers established that vulnerability assessment tools based on critical assets, rather than risk scenarios, are better suited for rural settings. The U.S. Department of Transportation’s Guide to Highway Vulnerability Assessment for Critical Asset Identification and Protection was selected as the most robust vulnerability assessment tool for rural transportation networks. Further, the Analytic Hierarchy Process was used to provide an alternative vulnerability assessment methodology for rural communities. By excluding some critical asset factors in areas that do not affect a particular rural community, time could be saved. Additionally, this approach provided an opportunity to check for consistency in the process.

The researchers concluded their investigation by applying the selected methodologies to assessing risk to the transportation networks of a specific rural community. Two examples based on Jackson County, Arkansas were constructed and analyzed. Both methodologies described above were found to be easy to implement and to provide essential information on the risk associated with the critical transportation assets in the county. Such
information can prove to be highly useful to emergency responders and county planners in the development of their county emergency response and management plans.

**Stephens Research Laboratory Dedication**

In September of 2006, the recently inaugurated undergraduate research laboratory was formally dedicated as the Larry and Gwen Stephens Undergraduate Research Laboratory. Establishment and future upgrades to the laboratory were secured by a substantial gift from the Stephens family.

Larry Stephens is a 1958 UA industrial engineering graduate. He is vice chairman of Mid-South Engineering Co. in Hot Springs, a forest products consulting firm he helped found in 1969. He has worked in the forest products field for nearly 50 years. With professional licenses and registrations in eight states, Larry Stephens was a founding member and initial president of the Arkansas Academy of Industrial Engineers and has served on the UA College of Engineering Advisory Council since 1992. Gwen Stephens joins her husband of 44 years as a lifetime member of the Arkansas Alumni Association, the Chancellor’s Society and the UA Legislative Network.

The newly dedicated laboratory, funded in large measure by the Stephens’ gift, provides state-of-the-art hardware and software designed for industrial engineering projects. As many as 12 undergraduate researchers, supported by faculty advisors, can be accommodated. The laboratory initiative supports the College of Engineering’s goal for increasing research opportunities for undergraduate students. Both potential students and prospective employers express considerable interest in engineering programs that offer undergraduates opportunities to conduct research in collaboration with Ph.D. researchers and professors. The Stephens Lab will serve as a magnet for attracting the best and brightest students, and to better prepare those students for their future careers.

Two student researchers currently assigned to the lab are juniors John Miller (advisor: Dr. John English) and John DeForest (advisor: Dr. Nebil Buyurgan). John Miller’s research is aimed at the needs of large retail
companies that struggle with issues of inventory accuracy as a result of the large number of stock keeping units (SKU’s) sold through their outlets. In order to gain a better approximation of items actually on the shelf, companies have implemented measurement approaches such as cycle counting; however, this methodology becomes questionable in environments characterized by thousands of SKU’s.

It has been suggested that statistical process control (SPC) could be used to improve cycle counting in such environments, but Miller hypothesizes that different products may follow different probability models, which would imply the selective use of process control charts with unique characteristics, rather than a one-size-fits-all approach. To this end, he is evaluating the robustness of three different process control charts with respect to tracking SKU’s. In the course of this investigation he also hopes to discover SKU’s that share common characteristics which would make them better candidates for the application of charts, characterized by a particular probability density function.

John DeForest is pursuing a double major in Industrial Engineering and Mathematics. His research aims at the effective uses of Radio Frequency Identification (RFID) technologies, which find many applications in retail and manufacturing businesses. Essentially, DeForest investigates different methods to help reduce errors, save money, and improve efficiency in supply chains that utilize RFID technology by finding better ways to measure the effects of unstable environments on data quality.

A variety of environmental factors can affect the visibility of tracked items as they are moved through a supply chain. Such factors include orientation, distance and various physical obstacles to transmission. By refining his understanding of data quality metrics, DeForest is developing a data quality model and designing experiments to test metrics such as believability, timeliness, and consistency for their effectiveness in capturing the unquantifiable variations in data integrity, characterizing an unstable RFID environment.

All the students who are currently assigned to the Stephens Lab speak highly of its value both as a state-of-the-art home base that is equipped with portable, dedicated research tools, and as a place to obtain and exchange information with others about their studies, the department, and the field.
PUBLICATIONS

The faculty of the Department of Industrial Engineering at the University of Arkansas published one book, contributed chapters to 6 textbooks or handbooks, saw the publication of 20 refereed journal articles and made 20 contributions to refereed conference proceedings and other refereed publications during 2006.

The following is a list of these publications. Faculty members’ names are shown in **bold**.

**Textbooks**


**Chapters in Textbooks or Handbooks**


**Refereed Journal Articles**


Refereed Conference Proceedings and other Refereed Publications


## GRANTS

During 2006, the following research grants were in force for the faculty. Project PIs are indicated in **bold**.

<table>
<thead>
<tr>
<th>Name</th>
<th>Sponsor</th>
<th>Amount</th>
<th>Project Title</th>
<th>Years</th>
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<tbody>
<tr>
<td>Cassady, Richard</td>
<td>National Science Foundation</td>
<td>$20,000</td>
<td>“Research Experiences for Teachers,”</td>
<td>2005-2007</td>
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<tr>
<td>Fant, Earnest</td>
<td>National Science Foundation</td>
<td>$50,000</td>
<td>“Economic and Technical Feasibilities of Implementing Robotics in an Automotive Repair Environment,”</td>
<td>2006-2008</td>
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<tr>
<td>Johnson, Steven</td>
<td>American Transportation Research Institute</td>
<td>$48,917</td>
<td>“Investigation of Safety and Economic Impact of Speed Differentials Between Heavy Trucks and Automobiles,”</td>
<td>2006-2007</td>
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<tr>
<td>Mason, Scott</td>
<td>National Science Foundation</td>
<td>$10,000</td>
<td>“Research Experience for Teachers,”</td>
<td>2006-2008</td>
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<tr>
<td>Mason, Scott</td>
<td>and Richard Cassady, E&amp;J Gallo Winery through CELDi</td>
<td>$50,000</td>
<td>“Cellar Tank Piping Network Analysis,”</td>
<td>2004-2006</td>
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<td>Meller, Russell</td>
<td>National Science Foundation, $60,000, “CELDi Lehigh/Florida Center Support,” 2004-2008</td>
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<tr>
<td>Nam, Chang</td>
<td>Air Force Office of Scientific Research, $120,924, “Experimental Evidence on Team Coordination and Collaboration within a Distributed Medical Logistics Network,” 2006-2008</td>
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<td>Nam, Chang and Joon J. Song</td>
<td>Mack-Blackwell Transportation Center/Arkansas State Highway &amp; Transportation Department, $97,344, “A Model-Based Risk Map for Roadway Traffic Crashes,” 2006-2007</td>
<td></td>
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<tr>
<td>Rossetti, Manuel</td>
<td>United States Navy through CELDi, $49,998, “Weapon System Inventory Demand Forecasting,” 2002-2008</td>
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</tbody>
</table>


Rossetti, Manuel, Nebil Buyurgan, and John English, Wal-Mart, Inc. through CELDi, $50,000, “Improving Inventory Record Accuracy within Retail Store Operations,” 2004-2007

Faculty member Dr. Russell D. Meller won a first place award for Outstanding Material Handling & Logistics Research Paper. The paper, entitled, “A Throughput Model for Carousel/VLM Pods,” was presented at the Material Handling Industry of America Annual Meeting in September, 2006.

The following is a listing of our faculty’s service activity to national professional organizations and journals during 2006.

**Buyurgan, N.**
- Chair-Elect, Society of Manufacturing Engineers, SME Chapter 199
- Program Committee Member, Seminar Organization, Identity Solutions Symposium and Workshop
- Program Committee Member, Conference Organization, First Annual RFID Eurasia Conference and Exhibitions
- Publication Chair, Conference Organization, First Annual RFID Eurasia Conference and Exhibitions
- Review Board Member, *Journal of Materials and Manufacturing Processes*, Editorial Board, appointed 2006

**Cassady, C.R.**
- Member, Management Committee, RAMS
- Guest Co-Editor, *IIE Transactions*
- Associate Director and Judge, INFORMS, Interdisciplinary Contest in Modeling, Consortium for Mathematics and Its Applications (COMAP)
- Associate Editor, *Journal of Risk and Reliability*

**Chimka, J.R.**
- Director, Quality Control and Reliability Engineering Division, Institute of Industrial Engineering
- Immediate Past Director, Quality Control and Reliability Engineering Division, Institute of Industrial Engineering

**English, J.R.**
- Co-Chair, 2006 IERC New Faculty Colloquium
- Member, IIE Honors and Award Committee
- Member, IIE Reliability Society, Administrative Committee
- Member, IIE Conference Content Planning Task Force

**Johnson, S.L.**
- Member, NIOSH review team for Auburn University Education and Research Center (ERC) for Safety and Ergonomics

**Mason, S.J.**
- Past President, Operations Research Division, Institute of Industrial Engineers
- Member, Editorial Board, Applied Cost Modeling, Wright Williams & Kelly
- Program Co-Chair, 2008 IERC, Institute of Industrial Engineers,
- Member, 2007 International Technology Roadmap for Semiconductors, Semiconductor Industry of America
Meller, R.D.

- Director, Center for Engineering Logistics and Distribution (an NSF I/UCRC)
- Immediate Past President, College-Industry Council on Material Handling Education
- Chair, Facility Logistics Special Interest Group, Transportation Science and Logistics Society, INFORMS
- Department Editor, *IIE Transactions on Design & Manufacturing*
- Special Issue Guest Co-Editor (Facility Logistics), *IIE Transactions on Design & Manufacturing*
- Co-Editor, *Progress in Material Handling Research: 2006*
- Editorial Board Member, *Journal of Manufacturing Systems*
- Member, 2006 IMHRC Planning Committee
- Member, IIE Student Design Competition Committee
- Member, 2007 IERG Program Committee (Facility Logistics Track)

Nachtmann, H.

- Area Editor, *The Engineering Economist*
- Immediate Past Director, Institute of Industrial Engineering - Engineering Economy Division
- Member, Wellington Award Selection Committee, Institute of Industrial Engineering - Engineering Economy Division
- Session Organizer, Institute of Industrial Engineering Research Conference
- Member of the Planning Committee, Transportation Research Board – UTC Spotlight Conference
- Member of Advisory Board, Identity Solutions Symposium

Nam, C. S.

- Member, Program Board, 2006 International Conference on Human-Computer Interaction
- Member, International Program Committee, The IASTED International Conference on Human-Computer Interaction (IASTED-HCI)
- Member, International Program Committee, The IASTED International Conference on Education and Technology (IASTED-ICET)

Pohl, E.A.

- Associate Editor, *Journal of Military Operations Research*
- Associate Editor, *IEEE Transactions on Reliability*
- Guest Co-Editor, Special Issue on Homeland Security, *IIE Transactions*
- Associate Editor, *Journal of Risk and Reliability*
- Vice President, Military Applications Society of INFORMS
- Council Member, INFORMS Sub-Division Council
- Member, Management Committee, Program Committee, Annual Reliability and Maintainability Symposium

Rossetti, M.D.

- Co-Editor, *2009 Winter Simulation Conference Proceedings*
- Associate Editor, *International Journal of Modeling and Simulation*
In the fall of 2006, 157 students were enrolled in our undergraduate program. The freshman class was well prepared for the academic rigor involved in pursuing an engineering degree. The average ACT score for incoming freshmen was 29.1. Their average high school GPA was 3.91.

**2006 Highlights**

During the 2005-2006 academic year 39 BSIE degrees were granted. Members of the class of 2006 were hired by nationally recognized companies such as Proctor & Gamble, UPS, Schlumberger, J.B. Hunt Transport, and L’Oreal. A number of students chose to remain at the University of Arkansas for graduate studies in Industrial Engineering and Business Administration. Other graduates are furthering their education at institutions, such as Georgia Tech, Vanderbilt and UA Medical School in Little Rock. Among the latter, senior Lauren Chambers (advisor: Dr. Edward Pohl), has entered graduate school at Florida State University as one of a select group of Department of Homeland Security Fellows.

Awards and honors earned by undergraduates include the following:

Senior Mauricio Carrasco (advisor: Dr. Richard Cassady) was recognized by the Society of Reliability Engineers for the outstanding paper authored or co-authored by a member of the society and presented at the Annual Reliability and Maintainability Symposium. Carrasco’s paper, “A Study of the Impact of Prognostic Errors on System Performance,” was co-authored with Dr. Cassady.

Senior Seth Borin (advisor: Dr. Heather Nachtmann) received the A.O. Putnam Memorial Scholarship from the Institute of Industrial Engineers.

Senior Josh Liu (advisor: Dr. Nachtmann) and juniors Brittany Bogle (advisor: Dr. Scott Mason) and John Miller (advisor: Dr. John English) were recipients of the State of Arkansas’ Undergraduate Research Fellowship.
Dia St. John garnered the ABF Freight Systems Outstanding Freshman Award.

The Hytrol Challenge Award for Material Handling went to seniors Meredith Griffin, Alex Natividad and Kelly Sullivan.

Pratt & Whitney, Sam’s Club, UPS, and Arkansas Best Freight Systems were some of the companies that served as clients for our senior design course in 2006. This course draws on all prior courses in exposing the students to an integrated capstone design experience. The students work in teams to identify and solve real-life industrial engineering problems for their respective client organizations.

The department has an active student chapter of the Institute of Industrial Engineers (advisor: Dr. Justin Chimka). The chapter received the Gold Award in the 2006 IIE national chapter recognition competition, while the department’s student chapter of Alpha Pi Mu (advisor: Dr. Heather Nachtmann) earned the Outstanding Chapter Award for the year.

Program Overview

The goal of the Industrial Engineering Undergraduate Program at the University of Arkansas is to prepare men and women for professional careers and graduate studies in Industrial Engineering. We provide a foundation in mathematics, science, the humanities and social sciences, engineering science, and engineering design in order to produce Industrial Engineers with the intellectual, technical, and professional competence to develop, implement and manage industrial engineering solutions to complex industrial, governmental and societal problems.

Our program includes opportunities for study abroad, an optional cooperative work program and an honors program for qualified students. The study abroad program is administered through the Office of Study Abroad and International Exchange. The John L. Imhoff Global Studies Endowment supports academic scholarships that help defray expenses incurred by industrial engineering students engaged in for-credit overseas study and/or an overseas work experience (internship or cooperative work program).
The aim of the University's cooperative education program is to provide interested students with opportunities to complement their engineering education with degree-related work experience. The work experience provides participants with opportunities to apply what they have learned in the classroom and to interact with experienced industrial engineers. Participants also gain insights into the industrial engineering profession that help them define their educational and career goals. In recent years, students from our department have participated in cooperative work experiences at Ayrshire, Boeing, Hallmark, International Paper, Lockheed Martin, Pratt & Whitney, Trane, Union Pacific, Wal-Mart, and other major employers.

The Industrial Engineering Honors Experience is designed for industrial engineering students that are also enrolled in the University of Arkansas Honors College. The program gives honors students the opportunity to pursue unique coursework and research experiences. The program requires a minimum of 12 hours of honors engineering courses, an undergraduate research experience and a written thesis.

Dr. Manuel Rossetti serves as the Chair of Undergraduate Studies. More information concerning the undergraduate program may be found at www.ineg.uark.edu/UndergraduateStudies.

**Freshman Engineering Program**

The Freshman Engineering Program, headed by Industrial Engineering Associate Professor C. Richard Cassady, was developed in 2006 in order to help new students entering the College of Engineering obtain a solid grounding for academic and professional success. All engineering freshmen with the exception of advanced students intent on a concentration in Chemical Engineering are included in the program, which will deliver relevant educational content to prepare freshmen for discipline-specific College of Engineering undergraduate programs. This foundation-building program will also facilitate the development of academic skills so that new students come to understand the professionalism, ethics and workload required for success in a rigorous academic environment. Finally, the program will provide proactive academic, career, and personal advising for new students.

The Freshman Engineering Program includes both academic and student services components. On the academic front, new engineering students take a common set of courses for one year. Upon successfully completing the academic curriculum, students will move on to a discipline-specific undergraduate program within the College of Engineering. The student services aspect of the program provides proactive support to new engineering students through summer orientation; peer mentoring; tutoring; academic and career advising; personal counseling; and academic success strategy training.

The selection of Dr. Cassady as the inaugural director of the Freshman Engineering Program served as further recognition of his dedication to providing students with a high quality educational experience. Earlier in the year he garnered the Charles and Nadine Baum Faculty Teaching Award and was elected to the University of Arkansas Teaching Academy.
The Graduate course offerings of the Industrial Engineering Department, as well as research opportunities for graduate students, continue to grow and diversify with the addition of Dr. Ronald Rardin to the faculty. Inaugural incumbent of the John and Mary Lib White Systems Integration Chair in Industrial Engineering, Dr. Rardin brings, among other research interests, a healthcare logistics initiative to the department.

During the 2005-2006 academic year, 276 students were enrolled in our graduate programs (31 Ph.D. students and 22 Master’s students, including 223 students enrolled in the Operations Management program). The students who entered our graduate program in the fall of 2006 had the following average GRE scores: Verbal 486 and Quantitative 759.

Approximately 90% of all on-campus graduate students received some sort of financial assistance from the department through graduate research assistantships.

2006 Highlights

Our graduate program was again recognized in the US News and World Report rankings of graduate manufacturing and industrial engineering programs. It is ranked 29th along with two other IE graduate programs.

Awards and honors garnered by graduate students include the following:

Ph.D. students Jennifer Ferguson (advisor: Dr. Scott Mason), Hugh Medal (advisor: Dr. Edward Pohl), and Jen Pazour (advisor: Dr. Russell D. Meller) were awarded Doctoral Academy Fellowships (DAFs) by the Graduate School. This prestigious award provides an additional annual stipend of $10,000 over and above the department’s $18,000 Ph.D. assistantship for up to four years.
Ph.D. student Letitia Pohl (advisor: Dr. Russell D. Meller) won the Frazier Industrial Honor Scholarship from the Material Handling Education Foundation.

Ph.D. students Alp Ertem and Alejandro Mendoza (advisor: Dr. Nebil Buyurgan) received scholarship awards from The Material Handling Education Foundation. These students also presented research at the annual Industrial Engineering Research Conference in Orlando, FL. Ertem’s study, “RFID System Evaluation for Industrial Applications,” was co-authored with his advisor Dr. Nebil Buyurgan. Mendoza’s paper, “A Laboratory Environment for Radio Frequency Identification (RFID) Technology,” was co-authored with Buyurgan and Dr. Justin Chimka.

Ph.D. student Mehmet Miman’s research was selected for presentation at sessions of the International Reliability and Maintainability Symposium and the Winter Simulation Conference. The first paper was coauthored with his advisor, Dr. Edward Pohl; the second, with Dr. Manuel Rosetti and fellow students, Vijith Varghese (advisor: Rosetti) and Yisha Xiang (advisor: Cassady) - see the ‘Publications’ section for complete citations.

Graduate student Dinakar Gade (advisor: Pohl) presented his research at the INFORMS Military Applications Society Conference and the INFORMS Annual Meeting.

Course of Study Options

For students pursuing graduate studies in the field of industrial engineering we offer several options in terms of degrees, areas of specialization, and full-time or part-time studies.

Graduate degrees for on-campus students are offered in three areas:
• Master of Science in Industrial Engineering (M.S.I.E.)
• Master of Science in Operations Research (M.S.O.R.)
• Doctor of Philosophy in Engineering (Ph.D.)

In addition to the on-campus degree options, the Industrial Engineering Department also offers the following off-campus degrees:
• Master of Science in Engineering (M.S.E.)
• Master of Science in Operations Management (M.S.O.M.)

Our faculty’s wide range of expertise provides opportunities for study in a variety of areas:

- Economic Analysis
- Engineering Logistics and Distribution
- Ergonomics/Human Factors
- Facilities Design
- Healthcare Logistics
- Homeland Security
- Human-Computer Interaction
- Logistics and Distribution
- System Design
- Manufacturing Systems
- Operations Research
- Production Control and Materials Management
- Quality Assurance
- Reliability Engineering
- Safety Engineering
- Simulation Modeling & Analysis
- Work Measurement

Dr. Scott Mason serves as the Chair of Graduate Studies. More information concerning admission requirements and degree programs can be found at http://www.ineg.uark.edu/441.php

Graduate Program Review

In the summer of 2006 the full complement of graduate programs offered by the Department of Industrial Engineering was reviewed by a committee made up of distinguished professors from other universities, as well as faculty from appropriate departments within the University of Arkansas. Comprising the Graduate Program Review committee were Martin A. Wortman, Ph.D., Professor, Department of Industrial & Systems Engineering, Texas A&M University; Louis Martin-Vega, Ph.D., Dean of Engineering, University of South Florida; Alan Ellstrand, Ph.D., Director, MBA Program, Walton College of Business, University of Arkansas; Marlin U. Thomas, Ph.D. Dean, Graduate School of Engineering and Management, Air Force Institute of Technology; Terry Martin, Ph.D., Associate Dean, College of Engineering, University of Arkansas; and William Warnock, Ph.D., Director, University Program Review, University of Arkansas.
The Program Review committee spent several days examining the structure, content and quality of the department’s Ph.D. program, as well as its full-time and part-time master’s programs. Interviews were held with faculty and students from all graduate programs to help committee members assess the scope, rigor and effectiveness of the department’s graduate offerings. The committee also reviewed the range and depth of research being undertaken by department faculty and students.

Areas of strength reported by the committee include the department’s “well-established reputation for its research in logistics and distribution, quality and reliability, and related efforts in transportation and applied operations research.” Also noted were the effectiveness of department leadership, addition of outstanding new senior faculty, and a strong commitment to recruiting high quality graduate students.

All graduate programs passed inspection with flying colors, with only occasional opportunities for further development noted. Most such opportunities are related to taking the next steps toward increasing the visibility of the department’s graduate programs through well-supported and orderly growth of its Ph.D. program and placement of graduates in highly ranked peer institutions.
Our research and teaching facilities continue to expand through the addition of new laboratories, as well as through procurement of additional equipment and enhancement of existing equipment in all our laboratories.

### David D. and Nancy J. Foust Computation Laboratory

The David D. and Nancy J. Foust Computation Laboratory, a state-of-the-art interactive teaching facility, is made possible by a donation made by Mr. and Mrs. Foust in 2002. The laboratory is a state-of-the-art interactive teaching facility. There are 44 workstations which the students use to access the latest software designed for industrial engineering projects. The lab is equipped with a large plasma-screen display and projection equipment to facilitate instruction, software demonstrations and design presentations. There is also space within the lab that the students may use for working on and storing their design projects.

### Ergonomics Laboratory

The Ergonomics Laboratory supports both research and teaching in the field of ergonomics. The laboratory houses equipment used to measure the physical, physiological and psychological dimensions of human performance. The laboratory is used by both graduate and undergraduate students as part of the industrial engineering curriculum. In addition, both graduate and undergraduate students use the laboratory to conduct their thesis research.

A STISM driving simulator and an iViewX eye motion monitoring system were recently acquired for the laboratory. This equipment provides the opportunity to conduct research on a variety of topics related to improving the safety of both automobile and heavy truck driving. Currently, Dr. Steven Johnson and his research team are using the driving simulator to research in-vehicle information systems. The iViewX eye motion monitoring system has a variety of research applications such as the evaluation of driver distraction and workload when using different in-vehicle navigation configurations.

### Human-Computer Interaction Laboratory

Dr. Chang Nam established the Human-Computer Interaction (HCI) Laboratory for the purpose of studying how individuals interact with complex information systems. The HCI lab is being used for both basic and applied research. Established research areas include new approaches to cognitive ergonomics, adaptive and intelligent human-computer interaction, brain-computer interface (BCI), multimodal user interfaces, and ubiquitous computing. The lab is used for instructional purposes in courses on the subjects of human information processing and human computer interaction, as well as in an advanced human factors course.

Students play Air Hockey in Dr. C.S. Nam’s Human-Computer Interaction Laboratory, using a networked virtual environment which enables both participants to receive haptic feedback in addition to visual information as they play. The haptic interface allows users to integrate information from the sense of touch with other sensory inputs, thus providing them with a richer and more realistic sensory experience in the virtual world.
Manufacturing Automation Laboratory

The Manufacturing Automation Laboratory houses three new Adept robotic arms (a six-axis articulating arm, a two-axis linear module and a four-axis SCARA with a four-camera machine vision system), an IBM SCARA robotic arm/machine vision work cell with conveyor, and a new Southworth lift table. This equipment is used for both instructional and research purposes. Recently, Dr. Earnest Fant combined the two-axis linear module with the six-axis articulating arm such that the latter could be carried in an inverted position to any location within a range of 200mm to 800mm. Both robots use the same controller and programming, but different power supplies. An electric-hydraulic scissor table can lift projects within the reach of the six-axis articulating arm as the arm lowers itself to the project below. Machine vision can also be incorporated into the new work cell. The new Adept SCARA robotic arm with an Automated Temperature Measurement system and touch screen panel computer for system control has been modified so that other research and instructional projects can be performed by students.

Material Handling Laboratory

The Material Handling Laboratory is a state-of-the-art facility housing more than $500,000 worth of material handling and storage equipment. The laboratory serves as an excellent resource for supporting undergraduate and graduate level instruction, masters and doctoral thesis research, as well as externally funded research. The laboratory houses a full-scale Hytrol conveyor system that consists of linear and circular components, integrated with barcode technology. A horizontal storage carousel serves as an automated storage and retrieval system (ASRS) for the conveyor system. Material handling and storage machinery is controlled using cutting edge programmable logic controllers (PLC) that allow students to simulate and develop digital and analog control models. The lab provides students with a variety of hands-on experiences in conjunction with several manufacturing related courses offered by the department.
Larry and Gwen Stephens Undergraduate Research Laboratory

A new facility, designed to support the research projects of undergraduate students in the Industrial Engineering Department was dedicated in 2006. This initiative stems from the University’s commitment to promote research at all academic levels and was funded by a generous gift from the Stephens family.

The new lab houses 12 student researchers who are supported by faculty advisors. Students engaged in research are assigned desk space in the lab for up to three regular semesters and issued wireless laptops to aid in their investigations. Most of the student researchers attend classes together and have collaborated on class projects, which lends the lab a collegial atmosphere in which ideas and methods can be tested, refined, and shared (See the 'Research' section for more information about the dedication of this new facility and about the work of its occupants).

RFID Laboratory

In January 2005, a laboratory equipped with state-of-the-art radio frequency identification (RFID) equipment was established. Several types of antennae, high-performance multi-protocol readers, an RFID tag printer and software have been installed for students to use with previously available material handling and storage equipment. The new facility, which supports the teaching/training of AutoID technologies and shares space with the Material Handling Laboratory, enables students to test various applications of RFID, including asset and inventory management, network-centric manufacturing, and RFID operational effectiveness. This lab is utilized in tandem with the RFID lab at the Walton College of Business by both students and faculty.
The Arkansas Academy of Industrial Engineering (AAIE) organizes a liaison committee that serves in the capacity of an advisory board to the department. The committee is comprised of accomplished professionals from business and industry who bring both an applied perspective and an independent assessment to the industrial engineering program at the University of Arkansas.

The members of the 2006 Liaison Committee:

- **David Elizandro, Ph.D.** - Professor of Industrial and Systems Engineering – Tennessee Tech University

- **Gary Maxwell**, Senior Vice President International Supply Chain - Wal-Mart

- **William McKamey**, Immediate Past President, AAIE Board; Vice-President External Affairs - Public Service Company of Oklahoma.

- **Andrea Sandage**, President, AAIE Board; Supply Chain Specialist, Raytheon Aircraft Co.

- **Jeremy Weinstein**, Past President, IIE; Chairman and CEO, Armstrong Global Investments, LLC.

- **Gary Whicker**, Senior Vice President Engineering Services - JB Hunt Transport, Inc.

The AAIE was founded in 1986 to recognize the achievements of University of Arkansas Industrial Engineering graduates and to provide continuing guidance and support to the Department of Industrial Engineering. The Academy also provides its members with the opportunity to nurture the organization that played an important role in their professional growth and development. These members provide tremendous financial resources that endow many scholarships for the student body within the department.
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