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## **Annual Report, 2008**

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# UNIVERSITY OF ARKANSAS

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COLLEGE OF  
ENGINEERING

Department of

## INDUSTRIAL ENGINEERING

2008 ANNUAL REPORT

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# FROM THE DEPARTMENT HEAD



Dear Colleagues:

Greetings! It is my pleasure to address you for the first time in my new role as Department Head. After a couple of years of transition at the helm, it appears as though we are positioned for a steady trajectory. First, I would like to acknowledge the dedication of Dr. Ron Rardin who served as Interim Department Head for the past year. Ron did much more than simply “fill the seat,” but during his tenure faced critical issues and had to make many important decisions that ultimately led to significant achievements by the Department. The Department is grateful for Ron’s leadership.

It has been a busy year. The Department made final preparations for their fall visit by ABET and oversaw a couple of faculty tenure and promotion cases. Despite a down-turn in the economy, the Department launched a new faculty search. The candidate pool was just outstanding and we were happy to end

up with not one, but two new faculty members who will be joining us next year. Finally, a significant effort was launched to develop a new five-year strategic plan to guide Department decision-making.

This report highlights many achievements over the past year. In addition, it focuses on the Department’s major thrust areas for which we are best known, namely transportation & logistics, healthcare systems, and risk, reliability and maintainability. Highlights of a few of the significant research accomplishments in these areas are shared.

In closing, let me state that I am extremely excited to be onboard. This Department has top-notch faculty, staff and students who are dedicated, committed to excellence and thirsty for even greater success in the future. We hope that you will enjoy examining our year in review and are confident that you will be impressed with what you see. We invite you to contact us for further information or even better yet, stop by for a visit. You will like what you see!

Warmly,

*Kim LaScola Needy*

Kim LaScola Needy, Ph.D., P.E., CFPIM  
 Department Head and  
 21st Century Professor of Industrial Engineering



**Kim LaScola Needy,  
Ph.D., P.E., CFPIM,  
Professor and Department Head**

Dr. Needy is Department Head and 21st Century Professor of Industrial Engineering. Her research interests include engineering management, engineering economic analysis, sustainable engineering and integrated resource management. She teaches courses in engineering management. She joined the faculty in 2008.

**Education:**

Ph.D. (Wichita State University)  
M.S.I.E. (University of Pittsburgh)  
B.S.I.E. (University of Pittsburgh)



**Nebil Buyurgan,  
Ph.D.,  
Assistant Professor**

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)

## FACULTY



**C. Richard Cassady,  
Ph.D.,  
Professor**

Dr. Cassady 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 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)



**Justin R. Chimka,  
Ph.D.,  
Assistant Professor**

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)

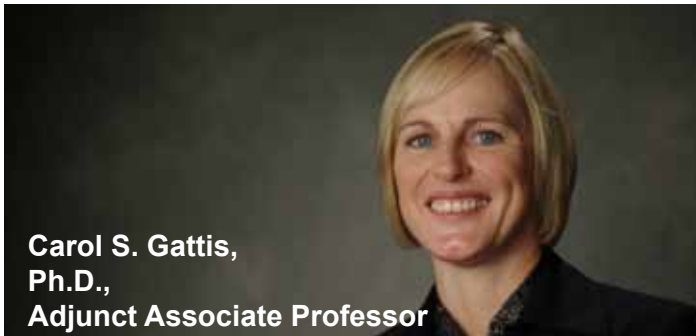


**Earnest W. Fant,  
Ph.D., P.E.,  
Associate Professor**

Dr. Fant's 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, automated systems and renewable energy. 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.,  
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 industrial engineering design, 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. Russell D. Meller,  
Ph.D.,  
Professor**

Dr. Meller is Hefley Professor of Logistics and Entrepreneurship and serves as the Director of the Center for Engineering Logistics and Distribution (CELDi) and the Deputy Director of the Center for Innovation in Healthcare Logistics (CIHL). His research interests include facility logistics, facility layout, material handling, logistics system design and operations research applications to healthcare logistics. Dr. Meller teaches courses in facility logistics and material handling. 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)



**Heather Nachtmann,  
Ph.D.,  
Associate Professor**

Dr. Nachtmann serves as the Director of the Mack-Blackwell 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)



**Chang S. Nam,  
Ph.D., CHFP,  
Assistant Professor**

Dr. Nam's research interests include haptic virtual environments, brain-computer interface, neuroergonomics, and organizational cognitive neuroscience. 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)



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

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. He serves as Director and Chair of Studies for the Operations Management Program and currently holds the John L. Imhoff Chair. 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)



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

Dr. Rardin is the inaugural holder 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 early 2007 and directs the Center for Innovation in Healthcare Logistics in collaboration with industrial partners and healthcare providers

**Education:**

Ph.D. (Georgia Institute of Technology)  
M.P.A. Municipal Administration (University of Kansas)  
B.A. Mathematics/Political Science (University of Kansas)



**Sarah E. Root,  
Ph.D.,  
Assistant Professor**

Dr. Root's research interests are in defining, modeling, and solving applied large-scale optimization problems. She is particularly interested in the application of optimization tools to problems encountered in healthcare and logistics. She teaches courses in operations research and service systems engineering. Dr. Root joined the faculty in 2007.

**Education:**

Ph.D. (University of Michigan)  
B.S.I.E. (University of Pittsburgh)



**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)



**John A. White,  
Ph.D., PE.,  
Distinguished Professor &  
Chancellor Emeritus**

After serving for eleven years as Chancellor of the University of Arkansas, Dr. White joined the faculty of the Department of Industrial Engineering full-time in 2009. A distinguished alumnus of the department, Dr. White teaches engineering economics, facilities planning, and queueing systems.

**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 doctorates from the Katholieke Universiteit of Leuven in Belgium and George Washington University.

# RESEARCH

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 transportation and logistics research from the Mack-Blackwell Rural Transportation Center (MBTC).

## CELDi

The Center for Engineering Logistics and Distribution (CELDi) is an Industry/University Cooperative Research Center sponsored by the National Science Foundation. CELDi is a multi-university research consortium with the University of Arkansas serving as the lead academic partner. There are more than 30 member organizations from the commercial, military and government sectors of the economy. CELDi

provides leading-edge logistics solutions to real-world problems and shares those solutions with its researchers and member organizations for leveraging opportunities.

At the University of Arkansas, CELDi benefits from the support of members, Arkansas Electric Cooperative Corporation, Invistics, Medline Industries, Red River Army Depot, Sam's Club, and Wal-Mart Stores. The research for CELDi and its member organizations is led by faculty members, Drs. Justin Chimka, Earnest Fant, Scott Mason, Russell D. Meller, Ed Pohl, Sarah Root and Manuel Rossetti, along with a team of excellent students.

Two recent projects are particularly noteworthy to highlight, with one related to the flow of product through the Sam's Club distribution supply chain and one focused on accurately forecasting demand for products.

## Sam's Club Project

Sam's Club, a division of Wal-Mart Stores, Inc., had an estimated annual sales of \$45 billion in FY08, with merchandise supplied by roughly 2,500 vendors. Such a large operation leads to a complex supply chain consisting of merchandise flow from vendors to Club distribution centers (DCs) and then onto clubs. Sam's Club has, at any given point in time, billions invested in inventory. To better manage the Sam's Club supply chain, vendors negotiate contracts to supply Sam's Club with merchandise based on a variety of constraints. Sam's currently has limited ability to





evaluate the impact of these constraints that ultimately have an impact on the inventory levels in the clubs.

The research team led by Drs. Scott Mason, Russell D. Meller and Sarah Root developed a simulator to replicate the functionality of the Sam's logistics software. Recommended settings in the software were pilot tested, verified, and then implemented by Sam's, reducing inventory cost by over 4% in categories to which the controls were applied. The impact of these savings is that Sam's Club will be able to more efficiently operate a leaner supply chain with fewer inventories on hand while simultaneously maintaining their already extremely high level of customer satisfaction and in-stock product percentage.

### Forecasting Intermittent Demand

As almost every organization realizes, forecasting demand for products and services is critical to effectiveness. And when that organization's success is dependent on forecasting intermittent demand, the typical solution has significant logistics and distribution impacts, stocking too much inventory. As a result, the selection of an effective forecasting technique is important and also challenging due to the intermittent nature of the demand. The research team led by Drs. Manuel Rossetti and Ed Pohl developed an object-oriented software framework for intermittent demand forecasting and inventory analysis. The object-oriented structure of this framework allows for easy implementation and integration of new data sources, forecasting techniques, and forecast metrics. This framework is implemented in Java within a user interface and is named the CID (CELDi



Intermittent Demand) Forecaster. The CID has the potential for high impact in many CELDi organizations.

### MBTC

The Mack-Blackwell Rural Transportation Center (MBTC) operates as an U.S. Department of Transportation University Transportation Center (UTC). MBTC's vision as an UTC is to improve local transportation systems and transcend rural needs by connecting the rural to the urban, the urban to the nation, and the nation to the world's transportation system through our research impacts, trained transportation professionals, and technology transfer activities. MBTC's research and education programs contribute to a safe, secure, efficient, and environmentally friendly transportation system through the study and advancement of this year's projects such as Dr. Russell D. Meller's *A Model to Design a National High-Speed Network for Freight Distribution* which investigates how to alleviate congestion issues, Drs. Heather Nachtmann and Ed Pohl's Emergency Response via Inland



Waterways that looks at the feasibility of constructing temporary medical facilities on barges to traverse inland waterways in response to natural or terroristic disasters, and Drs. Scott Mason and Ed Pohl's Improving Forced Transfer and Special Needs Busing in Rural Public Schools which has a goal of assisting rural school systems in developing effective strategies for dealing with transportation-related school overcrowding issues and special needs busing.

MBTC is also a member of the National Transportation Security Center of Excellence (NTSCOE) which conducts comprehensive research, education, and training programs to support ongoing and future efforts of

the U.S. Department of Homeland Security (DHS). Our NTSCOE focus is the security of the multi-modal transportation systems of the United States at the local, state, regional and national levels. Drs. Ed Pohl and Scott Mason are currently working on a project entitled Designing Resilient and Sustainable Supply Chain Networks which will develop an understanding of the inter-dependence within and between critical supply chain infrastructure systems. Dr. Manuel Rossetti's Simulating Transportation Models in Large-Scale Evacuation Scenario project involves the movement of people and resources both into and out of geographic areas under



threat of disaster/attack or directly after the incident. Dr. Justin Chimka's Information Enhancement among Aviation Security Partners project is currently addressing challenges facing DHS to improve intelligence and information sharing. All three of these projects support MBTC's focus on the security of the multi-modal transportation systems.

## CIHL

Despite breath-taking advancements in medical research, the supporting delivery systems of healthcare are often far more fragmented, confused, wasteful and outdated than those of comparable industries. This is especially true of healthcare supply chain and logistic systems where avoidable costs and efficiency opportunities can lead to a much more transparent, cost-accountable healthcare industry for America. After wages and benefits, materials and supply chains are the second greatest expense in healthcare – perhaps 30% of total spend in hospitals. As important, supply chain and logistic mechanisms have direct implications for safety and quality of patient care.



Left to Right: Julie Braden, Josh Eno, Dr. Ron Rardin, Yanchao Liu, Jennifer Pazour, Dr. Sarah Root, Ronald Walker, Yasin Unlu.

The Center for Innovation in Healthcare Logistics (CIHL) is an industry-university partnership, led by Drs. Ron Rardin, Director, and Russell D. Meller, Deputy Director, targeting the supply chain and material flow aspects of healthcare operations that can be addressed with improved information and logistics systems/processes. The work is a collaboration among researchers at the University of Arkansas, healthcare provider organizations, and industrial sponsors including Wal-Mart, Arkansas Blue Cross and Blue Shield, the VHA network of hospitals, Procter & Gamble Co., IBM, the Association for Healthcare Resource & Materials Management (AHRMM), the Strategic Marketing Initiative (SMI), and the GS1 global standards organization. The Center, which began operations in May 2007, has sustained funding of more than \$3 million for five years.

Seeking to avoid repeating the "one off" single-site successes that too often go unadopted elsewhere, the Center investigates system-wide opportunities that can be scaled and replicated for a host of supply chain partners. Specific projects during 2008 have included:

- Unit and Dose Packaging Systems Analysis (PI Dr. Russell D. Meller, CoPIs Dr. Scott Mason and Dr. Sarah Root) focused on improving the efficiency and reducing errors in repackaging pharmaceuticals as they pass from bulk quantities produced by manufacturers to unit or course-of-treatment dosage needed by patients. A finding that 3rd party repackaging may be the most advantageous choice has been presented across the industry and to FDA regulators.

- Receiving to Patient Hospital Supply Chain Digitalization (PI Dr. Ron Rardin, CoPIs Dr. Nebil Buyurgan, Dr. Craig Thompson - CSCE) addressed supply chains inside hospitals and large clinics. Central targets were processes for managing portable clinical equipment along with tracking and control of inventories of high-value implantable devices. Computer decision tools have been developed to aid providers in technology selection.
- Identifying Opportunities for Cost & Quality Improvements in Healthcare Logistics (PI Dr. Heather Nachtmann, CoPI Dr. Ed Pohl, with AHRMM) is using a systematic survey of healthcare logistics professionals to update and expand assessments of the cost savings and quality improvements available in different parts of healthcare supply chains. The goal is to both guide future CIHL project selections, and offer independent documentation of the size of the healthcare logistics opportunities. Results should be available in 2009.



- Provider Adoption of GS1 Standards for Product and Location Identification (PI Dr. Ron Rardin, CoPI Dr. Nebil Buyurgan) is investigating the costs and benefits to hospitals of adopting new global standard numbering systems for products and supply chain partners similar to those used in retail for decades. Pilot studies at particular providers will begin in 2009.

## ReliaSoft

Modern supply chains have evolved into complex systems due to globalization and decentralization. As with many complex systems, there are risks involved in supply chains. Of primary concern are the risks associated with large scale disruptions due to natural disasters, terrorist attacks, political instability, and transportation/network failures.



These important risks can have both direct and indirect impacts on supply chain continuity—they can dramatically reduce the effectiveness of the supply chain and result in significant economic loss and, more importantly, losses in human life. It is essential for organizations to assess these risks and develop strategies to mitigate them.

The risk profile of a supply chain depends on the configuration of its primary components (suppliers, warehouses, service centers, staging areas, ports of debarkation, and transportation modes). The location, transportation mode selection, and supply chain partner identification constituting these components are strategic decisions with which non-trivial costs are associated. These strategic decisions should make supply chains robust, reliable, and resilient, while at the same time not compromise an organization's ability to meet its mission requirements. Poor decisions with regard to any of these components can make a supply chain vulnerable to disruptions. Unfortunately, many organizations make these strategic decisions without considering the risk of disruption.

The research team led by Drs. Ed Pohl and Scott Mason is working to develop models for resilient, reliable, and sustainable supply chain network design and vulnerability assessment using both reliability and optimization-based tools and techniques. The concepts of reliability and resilience are relatively new in the supply chain literature. Previous research in supply chain management has focused on dealing with demand uncertainties and building "lean" supply chains. While these issues are important, the issue of large scale disruptions affecting supply chains cannot be overlooked. Events this decade such as the 9/11 terrorist attacks, hurricane Katrina, the 2002 West Coast port closure, and Operations Iraqi Freedom and Enduring Freedom have brought to light the vulnerabilities in current supply chains; in fact, they have motivated the need for new supply chain design tools, models, and techniques. Towards this end, we are also compiling an online, searchable literature repository and an article classification system

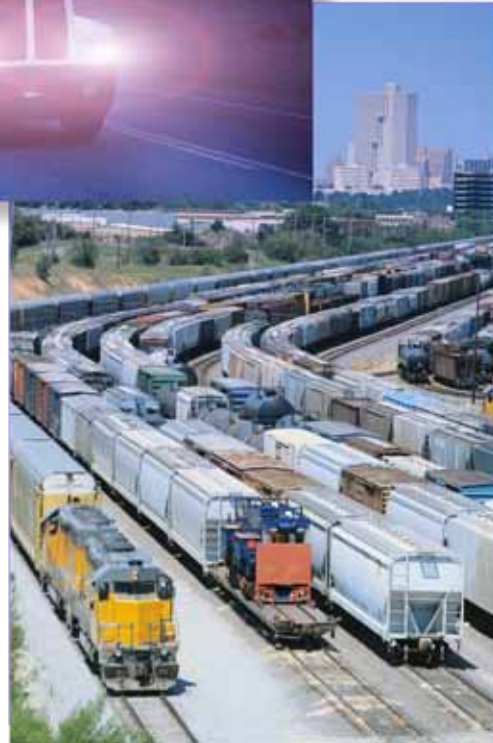
to help current and future researchers understand the rapidly expanding landscape of research related to these important topics. This database will serve in the development of a glossary of terms, definitions and metrics for evaluating supply chain risk and reliability.

### **Integrated Auto-ID Technology for Multi-disciplinary Undergraduate Studies (I-ATMUS)**

Auto-ID and RFID technologies have become more popular than ever while being led by industry rather than academia. As a result, a gap between the corporate practices and theoretical work has been formed. This caused a lack of potential experts in such emerging fields within the market of qualified personnel. In order to increase the number of engineering students who are acquainted with these technologies and fulfill the manpower demand of the industry, a team of University of Arkansas Industrial Engineering students, led by Drs. Nebil Buyurgan and Justin Chimka, constructed an RFID experimentation-system using interconnected, high-tech components that included RFID readers, servers and databases, and motorized RFID tags and antennas. Moreover, web applications were developed to give remote access to the laboratory

equipment in order to change the RFID testing setup and acquire read data from any place in the world. A programming language was designed and embedded to the website so as to provide advanced users with powerful manipulation over the moving mechanisms as well as the performance of computational and logical processes. The package was extended by adding teaching modules for AutoID technologies and their application areas such as supply chain, logistics, material handling, production planning, and automated manufacturing. The result was a powerful academic tool that not only increased the understanding of AutoID technologies and their utilization, but also improved students' attitudes about engineering education and enhanced their confidence towards the targeted technologies.





# PUBLICATIONS

The faculty of the Department of Industrial Engineering at the University of Arkansas published 3 books, contributed 8 chapters, published 20 refereed journal articles, 32 other refereed publications, made 32 contributions to unrefered publications and proceedings, offered 26 invited lectures and 46 other lectures, papers, and oral presentations. The department authors are indicated in bold face type.

## Textbooks

**Cassady, C.R.**, and J.A. Nachlas. *Probability Models in Operations Research*. Boca Raton, FL: CRC Press, 2008.

Konz, S., and **S.L. Johnson**. *Work Design: Occupational Ergonomics*. 7th ed. Scottsdale, AZ: Holcomb-Hathaway, 2008.

**Johnson, S.L.** *Work Design: Occupational Ergonomics - Instructors Manual (web based)*. 7th ed. Scottsdale, AZ: Holcomb-Hathaway, 2008.

## Chapters in Textbooks or Handbooks

**Cassady, C.R.**, **E.A. Pohl**, and T. Yeung. "Maintainability and Supportability in Logistics." In *Logistics Engineering Handbook*, edited by Don Taylor. Boca Raton, FL: CRC Press, Taylor and Francis Group, 2008.

**Johnson, S.L.**, and S.N. Roscoe. "What Moves the Airplane or the World?" In *Thirty Classic Contributions to Human Factors/Ergonomics Science and Engineering*. Santa Monica, CA: Human Factors and Ergonomics Society, 2008.

Taylor, G. D., **R.D. Meller**, and M.K. Ogle. "The Internet of Things: The Present and the Future." In *Progress on Material Handling Research: 2008*, Charlotte, NC, 2008.

**Meller, R.D.**, and J. A. Pazour. "An Analytical Model for Assignment and Allocation in an A-Frame System." In *Progress on Material Handling Research: 2008*. Charlotte, NC, 2008.

Gue, K. R., G. Ivanovic, and **R.D. Meller**. "Improving a Unit-Load Warehouse that has Multiple Pickup and Deposit Points." In *Progress on Material Handling Research: 2008\**. Charlotte, NC, 2008.

Ellis, Kimberly P., **R.D. Meller**, J. H. Wilck IV, P. J. Parikh, and F. Marchand. "Effective Material Flow for Assembly Operations." In *Progress on Material Handling Research: 2008*. Charlotte, NC, 2008.

**Pohl, E.A.** "Chapter 7, System Effectiveness." *Decision Making in Systems Engineering and Management*, Gregory Parnell, Patrick Driscoll, and Dale Henderson, Editors, John Wiley & Sons, Series in Systems Engineering and Management, Hoboken, New Jersey, 2008.

**Pohl, E.A.**, **H. Nachtmann**. "Chapter 5, Life Cycle Costing." *Decision Making in Systems Engineering and Management*, Gregory Parnell, Patrick Driscoll, and Dale Henderson, Editors, John Wiley & Sons, Series in Systems Engineering and Management, Hoboken, New Jersey, 2008.

## Refereed Journal Articles

**Buyurgan, N.**, A. Mendoza. "Creating a Learning Environment for RFID Education." *Decision Sciences Journal of Innovative Education* 6, No. 2, 257-261, 2008.

Yeung, T.G., **C.R. Cassady**, K. Schneider. "Simultaneous Optimization of Control Charts and Age-Based Preventive Maintenance Policies Under an Economic Objective." *IIE Transactions*. Vol. 40, No. 2 (2008): 147-159.

Maillart, L.M., **C.R. Cassady**, and J. Honeycutt. "A Binomial Approximation of Lot Yield Under Markov Modulated Bernoulli Item Yield." *IIE Transactions*. Vol. 40, No. 4 (2008): 459-467.

**Chimka, J.R.**, and K. J. Oden. "Statistical Quality Control for DNA Microarray Data." *Quality Engineering* 20, No.4 426-434, October-December 2008.

**Chimka, J.R.**, and L.H. Lowe. "Interaction and Survival Analysis of Graduation Data." *Educational Research and Reviews*, Vol. 3, No. 1, 29-32, 2008.

Pfund, M.E., H. Balasubramanian, J.W. Fowler, **S.J. Mason**, and O. Rose. "A Multi-Criteria Approach for Scheduling Semiconductor Wafer Fabrication Facilities." *Journal of Scheduling*, Vol. 11, No. 1, 29-40, 2008.

Erramilli, V., and **S.J. Mason**. "Multiple Orders Per Job Batch Scheduling with Incompatible Jobs." *Annals of Operations Research*, Vol. 1, No. 1, 245-260, 2008.

Jampani, J., and **S.J. Mason**. "Column Generation Heuristics for Multiple Machine, Multiple Orders per Job Scheduling Problems." *Annals of Operations Research*, Vol. 159, No. 1, 261-273, 2008.

Kurz, M.B., and **S.J. Mason**. "Minimizing Total Weighted Tardiness on a Batch-Processing Machine with Incompatible Job Families and Job Ready Times." *International Journal of Production Research*, Vol. 46, No. 1, 131-151, 2008.

Cherbaka, N. S., and **R.D. Meller**. "Single Plant Sourcing Decisions with a Multidimensional Knapsack Model." *Journal of Manufacturing Systems* 27, No. 1, 7-18, 2008.

Parikh, P. J., and **R.D. Meller**. "Selecting Between Batch and Zone Order Picking Strategies in a Distribution Center." *Transportation Research Part E: Logistics and Transportation Review* 44E, No. 5, 689-719, 2008.

Cherbaka, N. S., and **R.D. Meller**. "Modeling Multiple Plant Sourcing Decisions Journal." *International Journal of Production Research* 46, No. 18, 5165-5190, 2008.

**Nam, C.S.**, J. Shu, and D. Chung. "The Roles of Sensory Modalities in Collaborative Virtual Environments (CVEs)." *Computers in Human Behavior*, Vol. 24, No. 4, 1404-1417, 2008.

Seong, Y., and **C.S. Nam**. "Capturing Judgment Policy on Customer's Creditworthiness: A Lens Model and SDT Approach." *International Journal of Industrial Ergonomics*, Vol. 38, 596-600, 2008.

Miman, M., and **E.A. Pohl**. "Modeling and Analysis of Risk and Reliability for Contingency Logistics Supply Chain." *Journal of Risk and Reliability* 222, No. 4 463-476, 2008.

Muthuraman, K., T. Aouam, and **R.L. Rardin**. "Regulation of Natural Gas Distribution Using Policy Benchmarks." *Operations Research* 56, 1131-1145, 2008.

**Root, S.E.**, and A. Cohn. "A Novel Modeling Approach for Express Package Carrier Planning." *Naval Research Logistics* 55, No. 7, 670-683, 2008.

**Rossetti, M.D.**, M. Miman, and V. Varghese. "An Object-Oriented Framework for Simulating Supply Systems." *Journal of Simulations*, Vol. 2, No. 2, 103-116, 2008.

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Lehlou, N., **N. Buyurgan**, and **J.R. Chimka**. "An 'EIA' Approach to Support Laboratory Learning Environments." *Proceedings of the American Society of Engineering Education Annual Conference*, Pittsburgh, PA, 2008.

**Buyurgan, N.**, **J.R. Chimka**, and N. Lehlou. "Integrated Auto ID Tech for Multidisciplinary Undergraduate Studies." *Proceedings of the 2008 Conference of the American Society for Engineering Education*, Pittsburgh, PA, 2008.

Yu, P., J.J. Song, and **C.R. Cassady**. "Bayesian Reliability and Maintainability Parameter Estimation for a Repairable System Under Imperfect Maintenance." *Proceedings of the Annual Reliability and Maintainability Symposium*, Las Vegas, NV, January 2008.

**Cassady, C.R.**, and L.M. Maillart. "Introduction to Repairable Systems Modeling." *Tutorial Notes of the 2008 Reliability and Maintainability Symposium*, Las Vegas, NV, January 2008.

Xiang, Y., **C.R. Cassady**, and L.M. Maillart. "A Production System with Random Yield and Equipment Deterioration: Single Period." *Proceedings of the 2008 Industrial Engineering Research Conference*, Vancouver, BC, CA, May 2008.

Ferguson, J.A., and **S.J. Mason**. "Analysis of a Circuit Routing Strategy for Forced Transfer Busing, Industrial Engineering Research Conference." *Proceedings of the 2008 Industrial Engineering Research Conference*, 1556-1561, Vancouver, British Columbia, CA, May 2008.

Medal, H., D. Gade, **S.J. Mason**, **R.D. Meller**, and **E.A. Pohl**. "Pickup and Delivery of Poultry in Rural Networks." *Proceedings of the 2008 Industrial Engineering Research Conference*, Vancouver, British Columbia, CA, May 2008.

Ingalls, R.G., B. Hunsaker, **S.J. Mason**, **K.L. Needy**, B.A. Norman, M. Cornejo, C. Methapatara, P. Sittivijan, E. Claypool, N.M. Gokhan. "Integrating design for supply chain research into a graduate supply chain modeling course – a collaborative approach." 2008 American Society for Engineering Education Annual Conference Proceedings, Pittsburgh, PA, 2008.

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Saka, B., D. Mettenburg, and **S.J. Mason**. "Effective Freight Touring in Truckload Transportation." *Proceedings of the 2008 Industrial Engineering Research Conference*, Vancouver, British Columbia, CA, 709-714, May 2008.

Unlu, Y., and **S.J. Mason**. "Comparison of Formulations for Non-Preemptive Parallel Machine Scheduling Problems." *Proceedings of the 2008 Industrial Engineering Research Conference*, Vancouver, British Columbia, CA, 1550-1555, May 2008.

Zimmerman, J., L. Moench, **S.J. Mason**, and J. W. Fowler. "Determining an Appropriate Number of FOUPs in Semiconductor Wafer Fabrication Facilities." *Proceedings of the 2008 Winter Simulation Conference*, 2164-2170, 2008.

**Meller, R.D.**, Z. Kirkizoglu, and W. Chen. "A New Formulation for a Bottom-Up Approach to the Facility Layout Problem." *Proceedings of the 2008 NSF Engineering Research and Innovation Conference*, Knoxville, TN, January 2008.

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Kim, H.N., **C.S. Nam**, and T.L. Smith-Jackson. "User Interface Design Guidelines of Haptic-Thermal System for Visually Impaired Students in Obtaining Scientific Information." *The 4th International Conference on Social and Organizational Informatics and Cybernetics (SOIC 2008)*. Orlando, FL, June 2008.

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Gokhan, N. M., **K.L. Needy**, B. A. Norman, and B. Hunsaker. "Benefits of Incorporating Supply Chain Decisions into the Product Design via Design for Supply Chain." *Industrial Engineering Research Conference Proceedings*. Vancouver, British Columbia, Canada, 2008.

**Needy, K.L.**, N. M. Gokhan, M. M. Bilec, R. Ries, M. J. Horman, A. F. Phelps, and E. Enache-Pommer. "The Use of Process Mapping to Compare Green Children's Hospital Designs." *Industrial Engineering Research Conference Proceedings*. Vancouver, British Columbia, Canada, 2008.

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Varghese, V., and **M.D. Rossetti**. "A Parametric Bootstrapping Approach to Forecast Intermittent Demand." *Industrial Engineering Research Conference Proceedings*, Vancouver, British Columbia, CA, May 2008.

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Miman, M., **M.D. Rossetti**, V. Varghese, and **E.A. Pohl**. "An Object-Oriented Framework for Analyzing VARIMETRIC Systems." *Industrial Engineering Research Conference Proceedings\**, Vancouver, British Columbia, CA, May 2008.

**Rossetti, M.D.**, V. Varghese, M. Miman, and **E.A. Pohl**. "Simulating Inventory Systems with Forecast Based Policy Updating." Edited by S.J. Mason, R. Hill, L. Moench, and O. Rose. *Proceedings of the 2008 Winter Simulation Conference*, Miami FL, December 2008.

\* Best Paper Award

# GRANTS

During 2008, the following research grants were active. Project PIs are indicated in bold face type.

**Buyurgan, Nebil**, Air Force Office of Scientific Research, \$72,173, "AutoID Technologies in Intransit and Total Asset Visibility," 2006-2008

**Buyurgan, Nebil**, and Justin Chimka, National Science Foundation, \$149,709, "Integrated Auto-ID Technology for Multidisciplinary Undergraduate Studies (I-ATMUS)," 2007-2009

**Cassady, Richard** and Edward Pohl, National Science Foundation/CELDi, \$20,000, "Research Experiences for Teachers," 2005-2009

**Cassady, Richard**, Edward Pohl, N.Z. Gebrael and J. Kharoufeh, Air Force Office of Scientific Research, \$148,727, "Adaptive Maintenance in a Sense-and-Respond Logistics Environment," 2006-2008

**Chimka, Justin**, Air Force Office of Scientific Research, \$79,238, "Improved Outbreak Detection for Bio Terror Response Logistics," 2006-2008

**Chimka, Justin** and Edward Pohl, Wal-Mart Stores/CELDi, \$45,000, "Bin Locating System," 2007-2008

**Chimka, Justin**, Wal-Mart Stores/CELDi, \$45,000, "RDC Scheduled Delivery", 2008-2009

**Fant, Earnest**, Red River Army Depot/CELDi, \$45,000, "Logistics Charting Using Time Series, Balanced Score Card", 2008-2009

**Fant, Earnest**, Red River Army Depot/CELDi, \$49,869, "Assessing Change Indicators in Activity, Equipment and Inventory for Automated Storage Facility," 2002-2008

**Johnson, Steven**, American Transportation Research Institute, \$49,000, "Investigation of Safety and Economic Impact of Speed Differentials Between Heavy Trucks and Automobiles," 2006-2008

**Johnson, Steven**, Mack-Blackwell Transportation Center, "Field Evaluation of Lane Departure Systems: Operational Effectiveness, Effect on Driver Behaviors and Managerial Use of Data to Assure Driver Acceptance," \$51,360, 2005-2008

**Mason, Scott**, and Russell Meller, Sam's Club/CELDi, \$45,000, "Improving Retail Logistics through an Examination of Merchandise Flow," 2007-2008

**Mason, Scott**, National Science Foundation/CELDi, \$25,000, "Collaborative Research: A TIE Research Program on e-Design for Design of Supply Chain," 2007-2009

**Mason, Scott**, State of Arkansas, \$4,320, "SURF: Focused Research in Public School Transportation," 2007-2008

**Mason, Scott** and Nebil Buyurgan, Air Force Office of Scientific Research, \$97,153, "Scheduling and Coordination of Disaster Relief and Deployment Operations," 2006-2008

**Mason, Scott**, Russell Meller, and Edward Pohl, Mack-Blackwell Transportation Center, \$58,741, "Routing Models for Rural Transportation Networks with Time-Varying Constraints," 2006-2008

**Mason, Scott** and Heather Nachtman, Air Force Office of Scientific Research, \$140,151, "Integrated Distribution Planning and Forecasting for Medical Logistics," 2006-2008

**Mason, Scott** and Edward Pohl, Department of Transportation, \$46,340, "Improving Forced Transfer and Special Needs Busing in Rural Public Schools", 2008-2009

**Mason, Scott**, Sarah Root, and Russell Meller, Sam's Club/CELDi, \$45,000, "Assessment of Vendor Contract Impacts on Retail Logistics", 2008-2009

**Mason, Scott**, State of Arkansas, "SURF: Exam of Impact Binning on Customer Demand Satisfaction and Profit Max". 2008

**Meller, Russell**, Mack-Blackwell Transportation Center, \$98,629, "A Nationwide High-Speed Rail Network for Freight Distribution," 2006-2008

**Meller, Russell**, National Science Foundation, \$835,016.16, "CELDi Center Administration," 2002-2009

**Meller, Russell**, National Science Foundation, \$238,797, “Designing Distribution Centers for a Service Economy,” 2006-2010

**Meller, Russell**, National Science Foundation, \$221,973, “A Sequence-pair and MIP-Based Facility Layout Algorithm,” 2006-2009

**Meller, Russell**, National Science Foundation, \$23,920, “An Engineering Virtual Organization for Discrete-Event Logistics Systems,” 2007-2009

**Meller, Russell**, National Science Foundation, \$6000, “REU: Designing Distribution Centers for a Service Economy”, 2006-2010

**Meller, Russell**, Medline/CELDi, \$45,000, “Distribution Center Configuration Models” 2008-2009

**Nachtmann, Heather**, Richard Cassady, and Edward Pohl, Mack-Blackwell Transportation Center, \$28,925, “Homeland Security for Rural Transportation Networks,” 2007-2008

**Nachtmann, Heather**, and Edward Pohl, Mack-Blackwell Transportation Center, \$44,512 , “Emergency Response Via Inland Waterways”, 2008-2009

**Nachtmann, Heather**, Kevin Hall, and Jack Buffington, Mack-Blackwell Transportation Center, \$328,097 , “Administrative NRTSC Project”, 2007-2011

**Nachtmann, Heather**, Kevin Hall, and Jack Buffington, Department of Homeland Security, \$100,000, “Mack-Blackwell Transportation Center National Transportation Security Center of Excellence Planning Grant”, 2008-2012

**Nachtmann, Heather**, Kevin Hall, and Jack Buffington, U.S. Department of Transportation, \$9,390, “NTRSC-Mack-Blackwell Transportation Center Professional Advisory Board”, 2007-2011

**Nachtmann, Heather**, Kevin Hall, and Jack Buffington, U.S. Department of Transportation, \$22, 596, “Technology Transfer Project”, 2007-2011

**Needy, Kim** and Robert Ries (Univ. Florida), Construction Industry Institute, \$210,753 (total), “Quality Management in the Capital Facilities Delivery Industry – A Best Practices Refreshment,” 2007-2009

**Needy, Kim** and Bryan A. Norman (Univ. of Pittsburgh), National Science Foundation/Center for e-Design, \$50,000, “Collaborative Research: A TIE Research Program on e-Design for Design for Supply Chain, 2007-2010

**Nam, Chang**, Air Force Office of Scientific Research, \$120,924, “Experimental Evidence on Team Coordination and Collaboration within a Distributed Medical Logistics Network,” 2006-2008

**Nam, Chang**, and Tonya Smith-Jackson, National Science Foundation, \$570,028, “I FEEL SCIENCE: Innovative Flexible Experimental Environment for Learning in SCIENCE,” 2007 - 2010

**Nam, Chang** and Joon J. Song, Mack-Blackwell Transportation Center/ Arkansas State Highway & Transportation Department, \$124,096, “A Model-Based Risk Map for Roadway Traffic Crashes,” 2006-2007

**Pohl, Edward**, Air Force Research Laboratories/CELDi, \$133,560, “Decision Support for Logistics Response to Chemical, Biological, or Radiological Attacks,” 2006-2008

**Pohl, Edward**, National Science Foundation/CELDi, \$35,925, “Information Product Quality in a Network Centric Environment,” 2004-2008

**Pohl, Edward**, Mack-Blackwell Transportation Center, \$35,845, “Modeling, Assessing and Managing Risk in Transportation Systems,” 2004-2007

**Pohl, Edward** and Richard Cassady, National Science Foundation/CELDi, \$20,000, “Research Experiences for Teachers,” 2005-2008

**Pohl, Edward** and Russell Meller, Air Force Office of Scientific Research, \$178,442 “A Human Centered Approach to Sense and Respond Logistics,” 2006-2008

**Rardin, Ronald**, Russell Meller, Scott Mason, Sarah Root, Nebil Buyrgan, Manuel Rossetti, Heather Nachtmann, and Edward Pohl, Corporate and Professional Sponsors of the Center for Innovation in Healthcare Logistics \$3,175,000, (All projects), 2007-2012

**Rardin, Ronald**, National Science Foundation, \$121,213, “Optimization of Intensity Modulated Radiation Therapy with Time Varying”, 2008-2010

**Rossetti, Manuel**, National Science Foundation, \$50,000, "CELDi/ CHMR TIE Project: Examining Inventory Allocation in the Health Care Value Chain," 2004-2008

**Rossetti, Manuel**, National Science Foundation through CELDi, \$50,000, "Radio Frequency Identification and Productivity Improvements in Military Supply Chains," 2004-2008

**Rossetti, Manuel** and Edward Pohl, Air Force Office of Scientific Research, \$119,577, "Developing and Evaluating Operationally Robust Forecasting Techniques in Military Logistics," 2006-2008

**Rossetti, Manuel** and Edward Pohl, National Science Foundation, \$40,000, "An Intermittent Demand Forecasting Tool," 2008

**Rossetti, Manuel**, Invistics Corporation/CELDi, \$45,000, "Inventory Models for Intermittent Highly Variable Demand and Safety Stock Adjustments to Meet Desired Service Level Requirements", 2008-2009



# UNDERGRADUATE 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 ABF Freight System, Inc., Ayrshire Electronics, Black & Decker, Hawker-Beechcraft, Intel Corporation, J.B. Hunt Transport, Lockheed Martin, Pratt & Whitney, Rheem Manufacturing, 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 served as the Chair of Undergraduate Studies. More information concerning the undergraduate program may be found at: [www.ineg.uark.edu/1443.php](http://www.ineg.uark.edu/1443.php)

In the fall of 2008, 140 students were enrolled in our undergraduate program. The enrollment has increased slightly since the Freshman Engineering (FE) Program was implemented two years earlier. The program continues to be directed by Dr. Richard Cassady of our department. The FE Program provides a common academic foundation in engineering to all incoming freshmen before allowing them to major in a specific engineering discipline.

## Highlights

During the 2007-2008 academic year 44 BSIE degrees were granted. Members of the class of 2008 were hired by nationally recognized companies such as ABF Freight System, Inc., Alltel, Boeing, Georgia Pacific, Halliburton, J.B. Hunt Transport, Lockheed-Martin, Raytheon, United Parcel Service, and Wal-Mart. At least 39 offers were made to 25 of our graduates with an average starting salary of \$53,000 (high \$65,000). A number of students chose to remain at the University of Arkansas for graduate studies in Industrial Engineering and Business Administration.

The *Industrial Engineer* magazine recognized several of our undergraduate students in the September 2008 issue. Brittany Bogle was recognized as a recipient of the United Parcel Service Scholarship for Minority Students for the 2008-2009 academic year. Maria Brazhkina received the Dwight D. Gardner Scholarship. In addition, Coby Durham and Dia St. John received the Harold & Inge Marcus Scholarship.

Brittany Bogle (faculty advisor: Dr. Scott Mason) was also the recipient of a State Undergraduate Research Fellowship (SURF) for her honors thesis topic on economic analysis of forced transfer busing for public schools. Brittany presented her research at the 2008 Industrial Engineering Research Conference.

Becca Carlson and Prabuddha Lohani received Honors College Undergraduate Research Grants. Both of these students achieved Academic Excellence for Spring 2008 and Fall 2008.

The Imhoff Global Studies Endowment was established by John L. Imhoff (Founding Department Head) to provide financial support for activities designed to enhance the understanding of global economy, global business practices, and global cultures by IE students at U of A, Fayetteville. In 2008 the Imhoff Global Studies Endowment supported three students studying abroad. Becca Carlson traveled to Greece while Brittany Bogle and Rachel Townsley traveled to Singapore. Brittany and Rachel participated in a study abroad program during the Fall 2008 semester. They attended college at the University of Singapore, ranked 8th in the world for engineering. The students said they gained valuable international experience and enjoyed the intercultural interaction. They also improved their Chinese language while encountering diverse perspectives of engineering.

A team comprised of Seniors Brent Carter, Sean O'Meara, Kevin Oden and Jonathan Jones (team advisor: Dr. Russell D. Meller) took 2nd Place at the 2007-2008 Material Handling Student Design Competition which was sponsored by the College Industry Council on Material Handling Education and Bastian Material handling (BMH). The competition provides student teams with the opportunity to design a manufacturing or distribution facility to support the objectives of a fictional company (case content is drawn from real-world implementations).

In Spring 2008 three students received the Hytrol Challenge Award; Laura Hobbs, Douglas Marek, and Jeremy Wasson.



Mark Blanco garnered the ABF Freight Systems Outstanding Freshman Award.

Cooper Power, Danaher, Montana Tractors, Pozza's Pasta, Veterans Administration Medical Center, and Wal-Mart were some of the local companies that served as clients for our senior design course in 2008. 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 2008 IIE national chapter recognition competition. During the 2008 term the chapter had two presidents: Ernesto Sigala and Coby Durham.

The College of Engineering's Alpha Pi Mu chapter received second place in the national 2007-2008 Outstanding Chapter Competition. Kevin Oden and Stephanie Garman shared the presidency during the 2007-2008 academic year. Dr. Heather Nachtmann serves as the Alpha Pi Mu faculty advisor.

# GRADUATE PROGRAM

## Overview

The Graduate course offerings of the Industrial Engineering Department, as well as research opportunities for graduate students, continue to grow and diversify. A sampling of the published work of our graduate students, highlighted in this section, illustrates the range of research interests they are pursuing under the guidance of our faculty. Also featured below is our professional graduate program in Operations Management.

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 two areas:

- **Master of Science in Industrial Engineering (M.S.I.E.)**
- **Doctor of Philosophy in Engineering (Ph.D.)**

In addition to the traditional degree options, the Industrial Engineering Department also offers the following non-traditional degree programs:

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





Dr. Scott Mason served as the Chair of Graduate Studies. More information concerning admission requirements and degree programs can be found at [www.ineg.uark.edu/1441.php](http://www.ineg.uark.edu/1441.php)

## Highlights

The University of Arkansas is the only institution in the state ranked in the first tier of national universities in America's Best Colleges. At a department-level we are pleased to report that our graduate program is ranked 27th by *U.S. News & World Report*. During the reporting period, more than 500 students were enrolled in our graduate programs (25 Ph.D. students and 20 Master's students, as well as 468 students enrolled in the Operations Management graduate program). The students who entered our graduate program in the fall of 2008 had the following average GRE scores: MS 1233 and Ph.D. 1193.



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

Our graduate students gained recognition, awards and honors in 2008 and published or presented their research in several major venues:

Bringing additional notoriety to the Department are accomplishments from some of our Ph.D. students. Letitia Pohl was highlighted in *Modern Materials Handling* for her research contributions related to research with Dr. Russell D. Meller investigating non-traditional aisle layouts that reduce the amount of travel required to store and retrieve unit-loads.

Doctoral student Hugh Medal (advised by Dr. Ed Pohl and Dr. Manuel Rossetti) was selected as the Mack-Blackwell Rural Transportation Center (MBTC) 2008 Outstanding Student of the Year based on the contributions made to MBTC through the project: Routing Models for Rural Networks with Time-Varying Constraints. He graduated from North Dakota State University with a B.S. in Industrial Engineering and Management in 2006. Hugh's research interests are in modeling, simulation, optimization and its application to transportation and logistics problems. Hugh recently completed a master's thesis entitled "Multi-Objective Simulation Optimization: A comparison of Methods." Hugh examined the use of a variety of simulation optimization techniques on a multi-objective military transportation logistics problem. Hugh's research

for the Mack-Blackwell Rural Transportation Center focused on routing models for rural transportation networks with time-varying constraints. The models developed focused on the transportation of live chickens in a rural poultry network with an emphasis on being able to deal with disease outbreak in the poultry industry and how to find alternate routes to reach their destinations so that the chickens being transported are not exposed to the potential disease. Hugh's research was presented at the Industrial Engineering Research Conference in May of 2008. Hugh's goal is to continue as researcher and educator upon graduation.

The Material Handling Education Foundation awarded several scholarships to our top students: Zeynep Kirkizoglu received the \$1,500 Southworth International Group Honor Scholarship; Jennifer Pazour received the \$5,000 Frazier Industrial Honor Scholarship; Letitia Pohl received the \$5,000 Tiffin Metal Honor Scholarship; and Jared Townsley received the \$2,500 Unarco Material Handling Honor Scholarship.

Graduate students Edosa Aibangbee, Angelica Burbano, Eray Cakici, Willie Montgomery, Jennifer Pazour, and Letitia Pohl each presented research papers at the 2008 INFORMS Annual Conference in Washington, DC.

Steven Johnson presented his research at the 2008 Annual Meeting of Arkansas Society for Neuroscience.

Nabil Lehlou presented his research at the 2008 Industrial Engineering Research Conference (IERC) in Vancouver, Canada and also at the 2008 ASEE Annual Conference in Pittsburgh, PA. Vijith Varghese co-authored a paper with Dr. Manuel Rossetti which received the Best Paper Award in the Simulation and Modeling Track at the 2008 Industrial Engineering Research Conference. Additional graduate students presented research papers at IERC including Jennifer Pazour, Behlul Saka, Yasin Unlu, and Letitia Pohl whose paper (co-authored with Dr. Russell D. Meller) was selected as Best Paper in the Facilities Logistics Track.

Jennifer Pazour joined the departmental recruitment activities and was invited to present "Benefits of Graduate School" to undergraduate students from her alma mater, the South Dakota School of Mines and Technology.

## Operations Management Master's Program

The Master of Science program in Operations Management, under the leadership of Dr. Ed Pohl, continued its expansion throughout 2008. With 468 students enrolled in the fall semester of 2008, Operations Management continues to be far and away the largest graduate program of the University of Arkansas. Total enrollments and active student headcount grew at a rate of 16% over the previous calendar year. Since its inception in 1974, this hybrid live and distance learning-based master's program has graduated over 4500 participants.

In July of 2008 the Operations Management Program held its biennial Faculty Meeting, hosting nearly 40 faculty members from Fayetteville and the five other residence centers that the program operates across Arkansas and in other states. Faculty members were given advanced training in the administration of distance classes and discussed a number of important academic issues, including the introduction of enhanced degree requirements taking effect in fall of 2008.

The Operations Management program is designed for the working student who typically holds a professional or management position in an organizational setting, be it business, military, non-profit, or governmental. Program content focuses squarely on the concepts, methods, and tools that are essential to the successful management of work processes, projects, and people in a wide spectrum of organizations. The curriculum grows out of an Industrial Engineering perspective on the science of management and equips graduates to carry out their managerial responsibilities both



Dr. Donald M. King of the Operations Management (Fayetteville Campus) faculty listens intently to a student's question in his Strategic Management class. King (Ph.D., University of Michigan) is a former executive of Ford Motor Co.

more efficiently and more effectively. The curriculum is presented both by Industrial Engineering faculty and by academically qualified business professionals who have accrued extensive managerial and industry experience in the specific subjects they teach.

Operations Management coursework emphasizes the acquisition of practical knowledge in areas such as project management, economic decision-making, supply chain management, human behavior analysis, quality management, and operations research, as well as many other areas of importance to today's manager. Students are able to select from over 20 courses to make up the ten required to complete the degree.

The independent study component of the program emphasizes action or applied research, rather than the formal research that is typical of most traditional graduate programs. Several specific paths through the course material are offered providing concentrations in Industrial Management, Business Management, Human Resource Management, or Health & Safety Management. Students come to the program from three primary sources: the business world, the armed services, and undergraduate academic programs. The corporate affiliations of our current students include numerous Fortune 500 companies such as Wal-Mart, Sam's Club, Tyson Foods, J.B. Hunt Transport, FedEx, Lockheed-Martin, and Pratt & Whitney.

In addition to evening classes, held on the U of A Fayetteville campus, live instruction is provided at five other graduate residence centers: Naval Support Activity Mid-South in Millington, TN; Little Rock Air Force Base in Jacksonville, AR; the Air Force Special Operations base at Hurlburt Field, FL; SAU Tech in Camden, AR; and ANC University Center in Blytheville, AR. While all program sites offer live classes, for added flexibility a number of courses are available in distance learning formats.

Operations Management is an accelerated, non-thesis degree program consisting of 30 graduate hours and is delivered in five eight-week terms per year. Students who meet the university's graduate admission standards can enter the program in any term and from any major, provided that program prerequisites are met within the first 12 hours of study.

More information concerning the Operations Management Program can be found at [www.msom.uark.edu](http://www.msom.uark.edu).

# FACULTY SERVICE and ACHIEVEMENTS

In August 2008 the Department welcomed Dr. Kim LaScola Needy as Department Head of Industrial Engineering. She also holds the Twenty-First Century Professorship in Engineering with the rank of professor. Prior to her transition to the University of Arkansas, Dr. Needy served as a faculty member in the Department of Industrial Engineering at the University of Pittsburgh in Pennsylvania.

Her research interests are in engineering management, engineering economic analysis, sustainable engineering, and integrated resource management. Her research has been supported by more than two dozen grants. She has advised nine doctoral students and four master's students. In addition, she has served on numerous doctoral committees.

Dr. Needy is a respected scholar and teacher. Her research has appeared in *The Engineering Economist*, the *Engineering Management Journal* and the *International Journal of Production Research*. Her research has been recognized with two best paper awards. She is the recipient of the 2000 Beitle-Veltri Memorial Teaching Award at the University of Pittsburgh School of Engineering.

She is very active in multiple professional societies. She is a member of the American Society for Engineering Education; the American Society of Engineering Management, serving on its Board of Directors; the American Production and Inventory Control Society, holding a certification at the fellow level in production and inventory management; the Institute of Industrial Engineers, having previously served on its Board of Trustees; and the Society for Women Engineers. She is a registered Professional Engineer in Kansas.

Our faculty members continue to bring visibility to the department. Dr. Heather Nachtmann was named "Trendsetter" of *Public Works*. She and her research team concluded that risk-based urban transportation assessments cannot simply be applied for rural transportation assets. The team provided rural networks with a tool to create risk assessments of their infrastructure assets.



Mike Ogle (CICMHE), Kevin Gue (Auburn), Russ Meller (Arkansas), Carter Kerk, Chair of Judging Committee.

The University of Arkansas Academic Advising Council and the Office of the Provost honored Dr. Heather Nachtmann as the 2007-2008 College Outstanding Academic Advising Award Recipient. To quote one of her advisees, "Her constant support and encouragement showed me the impact that a professor could have on the life of a student. It was from this attitude that I decided to pursue a Ph.D. and enter into the academic realm myself."

Dr. Steve Johnson's research article was selected as one of the 30 most influential articles in Human Factors/Ergonomics in the past 50 years and published in the "Thirty Classic Contributions to Human Factors/Ergonomics Science and Engineering."

Dr. Russell D. Meller, Hefley Professor of Logistics and Entrepreneurship and Director of the NSF Center for Engineering Logistics and Distribution, received 1st place in the 2008 Outstanding Material Handling & Facility Logistics Research Paper Award competition sponsored by the College Industry Council on Material Handling Education (CICMHE) and the Material Handling Industry of America. This award is given every other year to recognize the best research papers appearing in the prior two years. The paper, "Improving the Unit-Load Warehouse," was published in *Progress in Material Handling Research* in 2006.

The Department performed well at the annual Industrial Engineering Research Conference held in Vancouver in May 2008. Dr. Manuel Rossetti received the best paper award in the Modeling and Simulation Track for his paper entitled "A Parametric Bootstrapping Approach to

Forecast Intermittent Demand” co-authored with Vijith Varghese. Dr. Russell D. Meller (together with graduate student Letitia Pohl) received the best paper in the Facility Logistics Track for their paper entitled “Travel Models for Warehouses with Task Interleaving.”

Within the College of Engineering the Department of Industrial Engineering faculty members received the following awards for 2008:

- Dr. Manuel Rossetti - Outstanding Teacher Award
- Dr. Ed Pohl - Outstanding Student Service Award
- Dr. Russ Meller - Outstanding Research Award

In addition, Dr. Scott Mason garnered the AAIE Industrial Engineering Faculty Member of the Year award.

The following is a record of our faculty’s service activity to national professional organizations and journals during 2008.

#### **Buyurgan, N.**

- Associate Editor, *International Journal of RF Technologies*
- Chair, Society of Manufacturing Engineers

#### **Cassady, C.R.**

- Member, Management Committee, RAMS
- Associate Editor, *Journal of Risk and Reliability*

#### **Chimka, J.R.**

- Newsletter Editor, *INFORMS Quality Statistics and Reliability*

#### **Johnson, S.L.**

- Certification Exam Committee Member, Board for Certification of Professional Ergonomists
- Certification Exam Committee Member, NIOSH Education and Research Center (ERC) Evaluation Team
- Member, TRB Truck and Bus Safety Committee (ANB20)
- Member, Industry Research Committee (ATO60)

#### **Mason, S.J.**

- Member, Editorial Board, Applied Cost Modeling, Wright Williams & Kelly
- Technical Vice President, Institute of Industrial Engineers
- Program Co-Chair, 2008 IERC, Institute of Industrial Engineers
- Proceedings Editor, 2008 Winter Simulation Conference
- Member, 2007 International Technology Roadmap for Semiconductors, Semiconductor Industry of America
- Associate Editor, *IEEE Transactions on Electronics Packaging Manufacturing*

#### **Meller, R.D.**

- Education Liaison to Board of Governors, Material Handling Industry of America
- 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: 2008*
- Editorial Board Member, *Journal of Manufacturing Systems*
- Editorial Board Member, *Transportation Research Part E: Logistics and Transportation Review*
- Member, 2008 and 2010 IMHRC Planning Committees
- Member, 2008 IERC Program Committee (Facilities Logistics Track)

#### **Nachtmann, H.**

- Secretary/Treasurer, American Society for Engineering Education, Engineering Economy Division
- Area Editor, *The Engineering Economist*

**Nam, C.S.**

- Editorial Board, eMinds: *International Journal on Human-Computer Interaction*
- Editorial Board, *The Journal of Information Technology Education*
- Member of Program Board, International Conference on Human-Computer Interaction
- International Program Committee, The IASTED International Conference on Human-Computer Interaction (IASTED-HCI)
- International Program Committee, The IASTED International Conference on Education and Technology (IASTED-ICET)
- Member of Scientific Board, Applied Ergonomics Conference
- Newsletter Editor, Cognitive Ergonomics and Decision Making Technical Group, Human Factors and Ergonomics Society
- Newsletter Editor, Virtual Reality Technical Group, Human Factors and Ergonomics Society

**Needy, K.L.**

- President-Elect of the American Society for Engineering Management
- Board of Directors for the Engineering Management Division of American Society for Engineering Education (ASEE)
- Book Editor, *The Engineering Economist*
- Associate Editor, *Engineering Management Journal*

**Pohl, E.A.**

- Associate Editor, *Journal of Risk and Reliability*
- Associate Editor, *The Journal of Military Operations Research*
- President, Military Applications Section, INFORMS
- Conference Management Committee, Reliability and Maintainability Symposium, Tutorial Chair 2008

**Rardin, R.L.**

- Associate Editor, *Operations Research Journal*
- Associate Editor, *International Journal of Information Systems in the Service Sector*

**Root, S.**

- Judge, COMAP Interdisciplinary Modeling Contest
- Organizing Committee, INFORMS Southwest Regional Conference

**Rossetti, M.D.**

- Proceedings Co-Editor, Winter Simulation Conference
- Associate Editor, *International Journal of Modeling and Simulation*

**White, J.A.**

- Chair, Alan T. Waterman Award Committee, National Science Board
- Co-Chair, Northwest Arkansas Council

# RESEARCH/TEACHING LABORATORIES

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 is a state-of-the-art interactive teaching facility made possible by a generous donation by Mr. and Mrs. Foust in 2002. Students have 24-hour access to 30 workstations, all equipped with the latest software designed for Industrial Engineering projects. The lab is equipped with a plasma-screen display along with projection equipment to facilitate instruction, software demonstrations, and Design presentations. There is also space within the lab for students to use when working on 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.

## Larry and Gwen Stephens Undergraduate Research Laboratory

The Larry and Gwen Stephens Undergraduate Research Laboratory is a research facility made possible by a generous donation by Mr. and Mrs. Stephens in 2006 and designed to support the research projects of undergraduate students in the Industrial Engineering department. This initiative stems from the University's commitment to promote research at all academic levels.

The lab houses 12 undergraduate student researchers supported by their 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 shared, tested and refined.

## Human-Computer Interaction Laboratory

Dr. Chang S. 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 brain-computer interface (BCI), cognitive ergonomics, haptic audio virtual environments (HAVEs), adaptive and intelligent human-computer interaction, 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



## Manufacturing Automation Laboratory

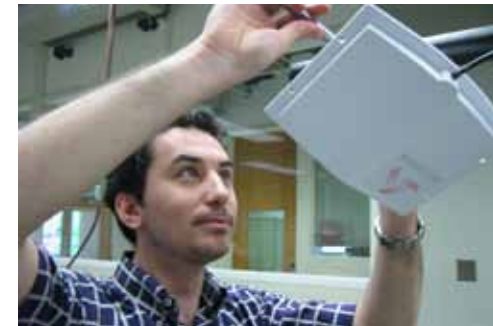
The Manufacturing Automation Laboratory houses three new Adept robotic arms (a six-axis articulating arm, a two-axis linear module and a four-axis SCARA with a four-camera machine vision system), an IBM SCARA robotic arm/machine vision work cell with conveyor, and a new Southworth lift table. This equipment 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 1200mm to 1800mm. 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.



There is a new stand alone machine vision work cell with several new lighting sources and fixed, variable and telecentric optics for Cognex, PPT, and Banner Engineering smart cameras to perform research and to introduce students to this technology.

## RFID and Material Handling Laboratory

The RFID and Material Handling Laboratory is a state-of-the-art facility housing more than \$500,000 worth of material handling and AutoID technology equipment. The first Industrial Engineering RFID laboratory at the University of Arkansas was established by Dr. Nebil Buyurgan in January 2005, within the existing Materials Handling Laboratory. Several types of modern antennae, high-performance multi-protocol readers, software and an RFID tag printer were installed for students to use with previously available material handling and storage equipment. Since its inception, the laboratory has provided students with a variety of hands-on experiences in conjunction with several courses, offered by the Industrial Engineering Department.



In February 2007, the RFID laboratory was expanded and a next-generation collaborative learning environment for both on-campus and off-campus students was developed. User-friendly, web-based applications which provide access to off-site students were built by a research team led by Drs. Nebil Buyurgan and Justin Chimka. A motorized hardware system was assembled in order to provide RFID technology testing setups in the laboratory. An agent-based architecture was used to build the hardware and software framework to make experiment setups more flexible. The software infrastructure was constructed with a view to enabling interaction among the diverse devices in this environment. The effort was supported by the National Science Foundation, Division of Undergraduate Education, Course, Curriculum, and Laboratory Improvement Program under award no: 0633334.

In addition to the hardware and software tools available, the website of the RFID laboratory offers online teaching modules for AutoID technologies and their applications in areas such as supply chain, logistics, material handling, production planning, and automated manufacturing. The RFID and Material Handling Laboratory serves as an excellent resource for supporting undergraduate and graduate level course instructions, master's and doctoral level academic research, and nationally and internationally recognized research.

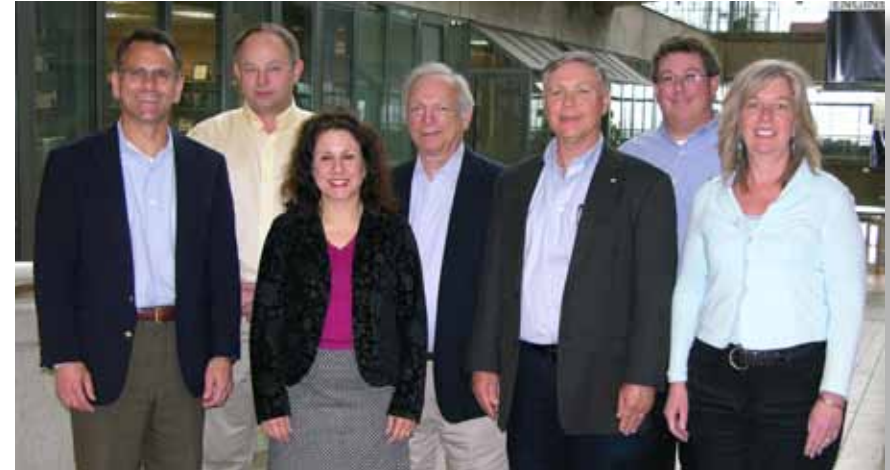
# ADVISORY BOARD

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 2008 Liaison Committee are:**

- Grant DuCote, Divisional Replenishment Manager, Wal-Mart Stores, Incorporated
- Melinda Faubel, AAIE President-Elect, Director of External Affairs, AT&T Arkansas
- Ralph Sandage, AAIE President, Project Engineer, Falcon Jet
- Curtis Sawyer, Jr., AAIE Past President; Director, Supply Chain Implementation, Conagra Foods
- Gary Whicker, Senior Vice President Engineering Services, JB Hunt Transport, Inc.
- Harvey Wolfe Ph.D., Professor Emeritus, University of Pittsburgh

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.



Members of the AAIE Liaison Committee with Department Head, Dr. Kim La Scola Needy. Left to Right: Gary Whicker, Curtis Sawyer, Dr. Kim La Scola Needy, Dr. Harvey Wolfe, Ralph Sandage, Grant DuCote and Melinda Faubel.



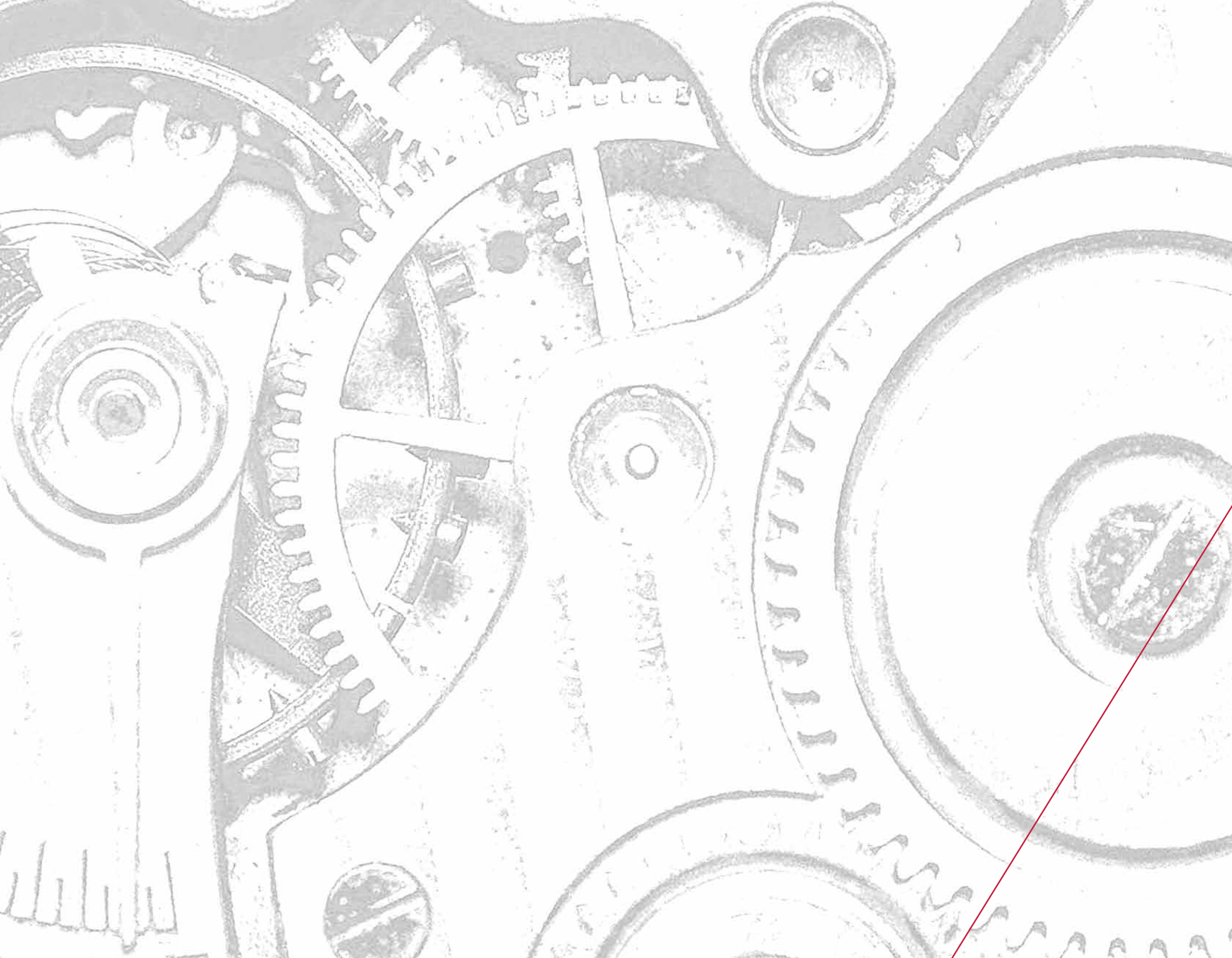
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