Volume 8 Spring 2008

Wichita State University, Wichita, Kansas

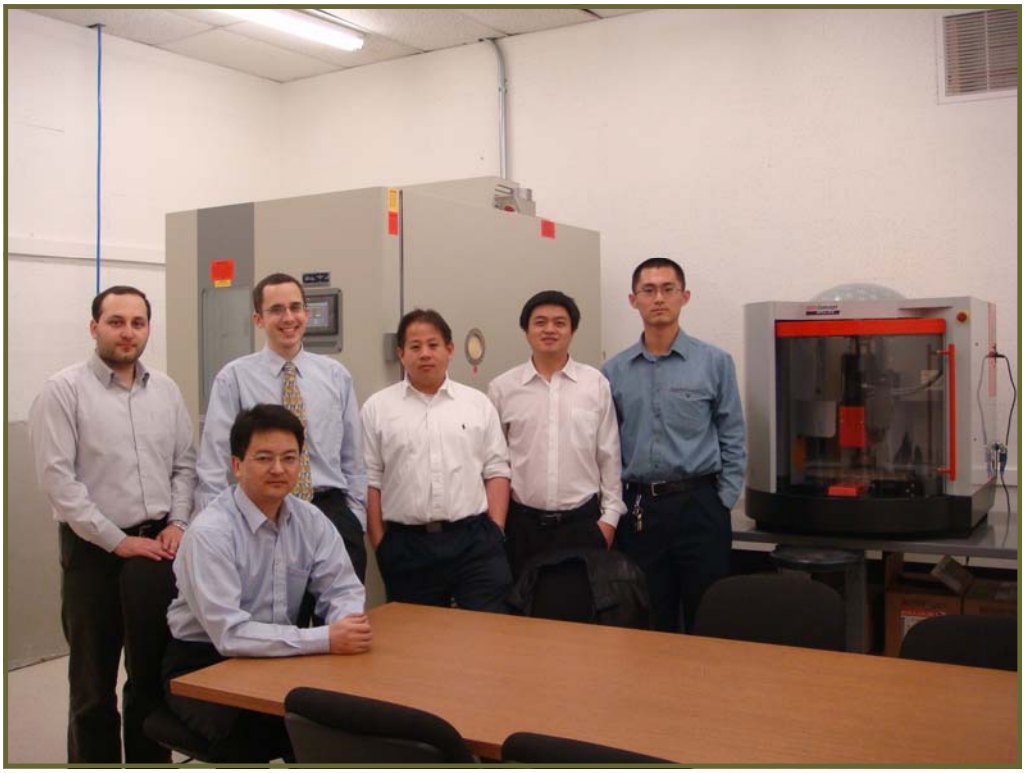
Industrial and Manufacturing Engineering

Born in 1949

Inside Look:

Accelerated Testing and Condition Monitoring

- A Fast Lane to Make Products More Reliable and Maintenance Logistics Less Uncertain



Dr. H. Liao, (front) and his students, S. Niknam, M. Rausch, C. Yip, Z. Li, and J. Sun, in the newly established Reliability and Maintenance Engineering Laboratory

Firms strive for developing series of processes that create new products and services, and a firm gains a competitive edge when it generates superior products and services that customers would like to pay for. The *Reliability and Maintenance Engineering Laboratory* led by **Dr. Haitao Liao** at the Industrial and Manufacturing Engineering Department has been established in order to assist industry in improving product reliability and efficiency of maintenance logistics. The laboratory houses a CSZ CA-32 Environmental Test Chamber, an EMCO CNC MILL 55, a wide spectrum of sensors, and software packages for reliability analysis. Accelerated life testing and a variety of degradation testing can be conducted in the laboratory. The facility has been made available for students, researchers, and industry partners to conduct scientific research in reliability. (*Continued on page 8*)

Message from the Chair

S. Hossein Cheraghi, Ph.D.

Welcome to the 2007 edition of WSU's Department of Industrial and Manufacturing Engineering (IMfgE) newsletter. During this past year, the department continued with the development and execution of plans for the achievement of its stated strategic objectives of increasing undergraduate enrollment, expanding the Ph.D. program, increasing collaborative research, and creating a state-of-the-art educational environment. I am very happy to report that with the support of faculty, students, the Industrial Advisory Board, alumni, and friends of the department, we have seen much success in achieving these objectives.

The enrollment numbers at all levels improved in 2007. The undergraduate enrollment increased by about 40 percent as compared to 2006. Enrollment in the graduate programs has remained steady at around 120 students. To further improve the rate of increase in undergraduate enrollment and to improve outreach activities, a half-time position has been created in the department, and an individual has been recruited. You will see her report in a section of this newsletter. With help from the Dean of the College of Engineering, we have initiated a 2+2 program with the University of Lima, Peru. Once finalized, this agreement is expected to result in a substantial increase in our undergraduate enrollment. During 2007, the IIE student chapter hosted a very successful Region V paper competition. For the sixth year in a row, our undergraduate students received the first place award and represented our region in the national IIE competition.

The department continued with its investment in laboratories and infrastructure. Our composites manufacturing lab has been expanded in terms of space and new equipment. The reliability and maintenance engineering lab has been established, and the ergonomics and occupational biomechanics lab has found a new and permanent location. As reported in last year's newsletter, a number of faculty members have taken a leadership role in initiating collaborative research within the College of Engineering. As a result, collaborative research efforts in sustainability, composites, manufacturing, and engineering education continued in 2007, resulting in a major grant from the Department of Energy, and the Federal Aviation Administration. Overall, the research expenditure in the department has continued its three years of growth. With these new initiatives in the works, it is expected that the department's research expenditure will see another increase in 2008.

The faculty, students, and staff of the Department of Industrial and Manufacturing Engineering are working together to achieve the stated vision of the department, which is to be nationally recognized as a leader in industrial and manufacturing engineering education and research, and to have its programs be the program of choice for both undergraduate and graduate students regionally, nationally, and internationally. Despite all these efforts and recent success, we still have a long way to go. Your support and generous financial contribution will make this road much easier to travel. To this end, I encourage you to visit our website at www.wichita.edu/imfge to learn first hand the achievements and activities in our department, and if you are in the Wichita area anytime, please stop by the department to meet us.

—- *S. Hossein Cheraghi*

Your tax deductible gift to IMfgE department will provide more opportunities for our students.

Please visit: **https://secure.wichita.edu/foundation/newgift1.asp** to make a difference in IMfgE.

Student Spotlight

In the past six years, WSU IMfgE students maintained excellent records in IIE Paper Competition at both the regional and the national levels. **Michael Hurley**, an IE undergraduate student, presented a paper co-authored with Jason Medenciy and John Wolf on "*Process Improvement at Via Christi Emergency Department*" which won the first place award in the 2007 region V paper competition. Congratulations to our students!

At IIE National Level

Name	Year	Place
Mitchell Rausch	**2006**	**First**
Janise Hamilton	**2005**	**Third**
Samantha (Vitt) Corcoran	**2004**	**First**
Jennifer Sutherland	**2001**	**First**

Michael Hurley, recipient of 2007 regional IIE student paper competition award

At IIE Regional Level

Name	Year	Place
Michael Hurley	**2007**	**First**
Mitchell Rausch	**2006**	**First**
Rebekah Drake	2006	Second
Janise Hamilton	**2005**	**First**
Kelly Zens	2005	Third
Samantha (Vitt) Corcoran	**2004**	**First**
Marki (Farris) Huston	2004	Second
Virginia Youse	**2003**	**First**
Carrie Ekrut	2002	Third
Jennifer Sutherland	**2001**	**First**
Charity Kennedy	2001	Second

IIE Student Chapter

Gilles Mouzon, Ph.D. candidate (center)

Gilles Mouzon, a doctoral student in industrial engineering at Wichita State University, was presented with the $1,000 Institute of Industrial Engineering's John S.W. Fargher Scholarship at the Lean and Quality Conference and Expo 2007. Mouzon, shown with conference co-chairman, Beth Cudney, Ph.D., and IIE executive director Don Greene, also earned his masters in engineering management from Wichita State University. The John S.W. Fargher Scholarship is presented to a full-time graduate student pursuing a course of study in industrial engineering or engineering management. Candidates are nominated by a faculty advisor or department head, must be active in an IIE student chapter and must have demonstrated leadership, and have promoted IIE involvement on campus.

APICS Student Chapter

The Wichita State University student chapters of APICS – The Association for Operations Management, has had much success this past year. The student chapter is very active. The student chapter has had several educational meetings and panels with industry professionals; has been active with the professional chapter in helping with their educational meetings and plant tours; has won several competitions and won the Platinum Award for the third year in a row. The Platinum Award is for the highest level of student chapter management (only six student chapters received these). Also, for the first time ever, we had a student place in the international paper competition.

Region Awards

First place Undergraduate – **Jenny Marshall**
Second place Undergraduate – **Gladys Moriasi**
Third place Undergraduate – **Amanda Maish**

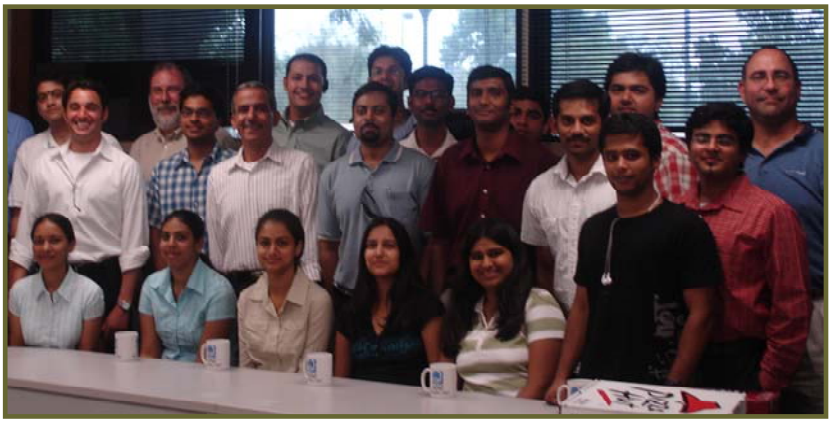
First place Graduate – **Dennis Leierer**
Second place Graduate – **Qamar Iqbal**
Third place Graduate – **Karthik Balakrishnan**

International Award Second place Undergraduate – **Jenny Marshall**

WSU—ASQ Student Branch

Several students are currently serving as officers for the WSU branch of the American Society for Quality (ASQ). Akhil Kulkarni is the 2006-2007 Chair, Ahmad Salha is Vice Chair, and Pallavi Sethi is the Website Coordinator. Congratulations to our student officers!

Over the last year, twenty five student members attended and passed the Six-Sigma Green Belt (SSGB) Certification Examination. This is a four-hour examination administered by the ASQ. Examinations are conducted twice a year, in June and December, by the local section. Each certification candidate is required to pass a written examination that measures comprehension of the body of knowledge. Included in this body of knowledge are the Six-sigma organizational goals and the tools utilized in the DFSS and DMAIC processes. Last July, members of the WSU branch, together with members of section 1307, recognized the hard work and achievements of the students.



Branch members recognized in July, 2007

During the fall of 2007, members of the student branch supported the local section's efforts to enhancing ASQ members' knowledge of statistical techniques. Dr. Weheba, the Faculty Advisor, instructed a short course on statistical data analysis and two student members volunteered to tutor participating members. The classes were held on Saturdays for eight weeks to help members prepare for CQT and CQE exams. These students are: K. Kandananond, CQE and N. Bapat, CSSGB. The branch will host the annual joint meeting with section 1307 at the WSU-Hughes Metropolitan Complex on April 14, 2008.

Our Ph.D. Graduates in 2007

Chandan Nayak, "Solutions to Dynamic and Uncertain Facility Layout Problems: Dynamic From Between Chart (DFBC) and Stochastic Layout Modeling (SLM)". Eaton Corporation. Advisor: Dr. Krishnan.

Said Khalidi, "Multivariate Quality Control: Statistical Performance and Economic Feasibility". Senior Engineer, Bombardier Learjet. Advisor: Dr. Weheba.

Karin Kandananond, "Performance Characterization of Integrated Statistical Process Control Systems". Engineering Faculty, Rajabhat University, Thailand. Advisor: Dr. Weheba.

Our Ph.D. Graduates in 2007 Cont.

Justin James, “Application of Probabilistic Fracture Mechanics for Life Prediction of Metallic Materials”. Fatigue and Damage Tolerance, Cessna Aircraft Company. Co-Advisor: Dr. Weheba.

Spring Hull, “Evaluation of Ergonomics Interventions for Bucking Bars in Aircraft Manufacturing”. Hawker Beechcraft, Wichita, Kansas. Co-advisor: Dr. Jorgensen.

Mahmoud Al-Bawaneh, "Optimization of the material constitutive models based on orthogonal machining tests". Ducommun, Parsons. Advisor: Dr. Madhavan.

Sajjad Shams, “Minimal Lead Time Quotation Under Service Level Constraint”. Advisor: Dr. Cheraghi.

Recruitment Activities — Who Wants to Be an IMe

Charity Kennedy
Assistant Director of Engineering Education
IMfgE Department Recruitment

This academic year the department took an aggressive step towards increasing the IMfgE programs size by creating and staffing a part-time position focused on achieving this objective. **Charity Kennedy** accepted this new position in October 2007 and has been handling recruitment, retention, and alumni relations. Charity graduated from WSU in May 2001 with her B.S.I.E. and has returned to WSU for an M.S.I.E. Prior to joining WSU in her staff position, she worked for Cessna Aircraft for two years and with the Eaton Corporation for four and a half years. During her time in industry she obtained a breadth of experience, working in six locations in four states and holding various positions ranging from industrial engineer to production supervisor to financial analyst. Thus far in her role, Charity has been working on updating the department’s recruitment materials, participating in on and off-campus recruiting events, and working on student retention.

One of the highlight student retention activities of the year has been the “Who Wants to be an IME?” event held on February 8, 2008 at WSU. This event was created by **Dr. Larry Whitman** in 2002 and this is the sixth time it has been held at WSU. The game is modeled after the popular television game show “Who Wants to be a Millionaire?” Questions are based on industrial and manufacturing engineering classes, trivia about the faculty, and department history. Dr. Whitman serves as the host, “Regis,” and has graduate students help out with sound effects and commercial breaks.

Students at “Who wants to be an IME?”

This year’s event started with taking volunteers from the audience to participate in the fastest finger round. Volunteers included four undergraduate students, three graduate students, and three professional engineers. In the fastest finger round contestants are given a list of items to place in the correct order. The contestant who turns in the first correct answer to the question, goes to the hot seat. Once in the hot seat, the contestant is given multiple choice questions. One wrong answer and they are eliminated. To help them get through difficult questions and avoid being eliminated, they have access to three life lines including polling the audience, phone a friend, and 50/50.

Regional Conferences Hosted by IMfgE

2007 IIE Region V Conference

Wichita State University IIE Student Chapter organized the 48th Annual IIE Region V Technical Paper Conference on March 1st-3rd, 2007. Region V includes Wichita State University, Kansas State University, Lamar University, Oklahoma State University, Texas A&M University, Texas A&M Commerce University, Texas Tech University, St. Mary's University, University of Arkansas, University of Houston, University of Kansas, University of Missouri at Rolla, University of Missouri at Columbia, University of Oklahoma and University of Texas at Arlington.

Some of the students and faculty attending the conference

Winners of the IIE region V paper competition
From left: Michael Hurley (WSU) 1st place, Stacie Hopson (KSU) 2nd place, Allison Greco (U. of Oklahoma) 3rd place

Department of Industrial and Manufacturing Engineering undergraduate student Michael Hurley presented a paper co-authored with Jason Medenciy and John Wolf on "Process Improvement at Via Christi Emergency Department." This paper won the first place award in the paper competition and represented at Region V at the International Student Paper Competition at the 2007 IIE Research Conference in Nashville, TN. Michael Hurley maintained the standard of excellence of the IMfgE students who have won five first place awards at the regional level and three first place awards at the national level in last six years.

2007 ASEE Midwest Annual Conference

The American Society for Engineering Education Midwest Section 2007 Annual Conference was hosted by Wichita State University in Wichita, KS, September 19-21, 2007. The theme of the conference was: "Educating the 21st Century Engineer." Several events were planned around this theme, including a panel discussion on various topics suggested by the National Academy of Engineers.

Dr. Whitman was the conference chair and **Dr. Masud** was the program chair. In addition to many excellent papers on engineering education, there was also a preconference tour of Spirit Aerosystems, a workshop on Engineering Education proposal writing, a panel on the future of engineering with executives from several engineering companies and a postconference tour of the Salt Mines and Cosmosphere in Hutchinson, KS.

Faculty Awards and Activities

Dr. S. Hossein Cheraghi received the 2007 Dwane and Velma Wallace College of Engineering Excellence in Research Award. This award was given to him to recognize his continuous research over an extended period of time and his significant contribution to his area of expertise. Dr. Cheraghi's area of interest is modeling and analysis of complex engineering systems. He has received over $3.6M of research grants and is the author/co-author of over 100 publications.

Dr. Michael Jorgensen has been awarded tenure and promotion to Associate Professor. Dr. Jorgensen teaches the Industrial Ergonomics related courses for the IMfgE Department as well as Statistics. His recent research has included assessment of job rotation in manufacturing, interventions to reduce low back pain for earth-moving equipment drivers, reducing hand-arm vibration exposure in aircraft manufacturing through alternative bucking bar designs, and assessment of carbon monoxide exposure in general aviation aircraft.

We Serve the Community

- **Dr. Cheraghi** served as a member of the Editorial Boards of *International Journal of Industrial and Systems Engineering* and *Journal of Industrial and Systems Engineering,* is a member of *CIEADH/IERC* executive committee*,* the *IIE national awards council*, and is a Program Evaluator of *ABET/IIE*.
- **Dr. Jorgensen** served as the Chair of the Industrial Ergonomics Technical Group of the Human Factors and Ergonomics Society, is a member of the Editorial Board of the journal *Human Factors*, was the Student Liaison for the Annual Conference Planning Committee for the Kansas Safety and Health Conference, Kansas Department of Labor, and was the Secretary of the Wheatland Local Section of the American Industrial Hygiene Association, Wichita, KS.
- **Dr. Madhavan** served as an Associate Technical Editor of *Machining Science and Technology*.
- **Dr. Masud** served as the President of *Alpha Pi Mu* (National Office), a Program Evaluator of *ABET/IIE*, a Peer Evaluator of *NCA/HLC*, the Program Chair of ASEE Midwest Section Conference, and a Session Chair of IERC.
- **Dr. Twomey** served as a co-organizer of the 5th Global Conference on Sustainable Development and Life Cycle Engineering, September 2007, co-organizers of "NSF Proposal writing workshop" and "NSF CAREER proposal writing workshop", and was a member of the *Steering Committee of Data Mining Section*, INFORMS.
- **Dr. Weheba** served as a member of Executive Committee -Section 1307, Wichita American Society for Quality.
- **Dr. Whitman** was elected the President-Elect for the *Information Systems Special Interest Group of Institute of Industrial Engineers*, 2007. He also served as a member of Board of Directors for the *Wichita Chapter of APICS* – The Association for Operations Management, a member and Working Group Chair of *International Federation of Automatic Control* – Technical Committee 5.3, a member of Program Committee of *IFAC National Congress*.
- **Dr. Yildirim** served as a Community Relations Officer of the IIE Wichita Professional Chapter and advisor of the IIE WSU student chapter.

Featured Research — Reliability Engineering Group

A Fast Lane to Make Products More Reliable and Maintenance Logistics Less Uncertain

(Continued from page 1)

The research group currently consists of 4 Ph.D. students and 6 M.S. students, and it has been growing during the past two years. They have seen that reliability testing and maintenance strategies and logistics are among the most important determinants in product life cycle reliability. To reduce uncertainties in life cycle reliability, a cohesive approach that involves various mathematical models as well as advanced engineering technologies is being investigated. Specifically, this group focuses on both reliability modeling and maintenance logistics and emphasizes information sharing among product design, testing, and usage. To expedite the product development process, accelerated testing (AT) is utilized as an enabling and powerful tool. Moreover, the design of optimal testing plans is being studied to avoid getting inaccurate reliability estimates and inappropriate maintenance decisions. In conjunction with reliability testing, condition monitoring techniques and maintenance models have been utilized as the key to solving many challenges encountered in maintenance logistics.

The current research of this group is sponsored by the National Science Foundation, Hong Kong Research Grant Council, State of Kansas, among other sources. The ongoing projects include:

(1) *Study of the equivalency of AT plans*. The current progress has shown that for an existing AT plan, its equivalent plan may be derived mathematically, which makes full use of the capability of testing equipment while giving desirable statistical properties of a reliability estimate. The results will enable reliability practitioners to choose an appropriate AT plan according to their real world engineering practice. (2) *Use of condition monitoring to drive maintenance logistics*. Currently, a comprehensive model is under development, which addresses continuous time degradation modeling and the optimization of spare part inventory control. This research will provide a means for manufacturers to minimize the capital investment in spare part inventory while ensuring that operational performance levels are maintained through equipment condition monitoring and optimization of maintenance strategies. Other funded research projects are: (3) *Degradation analysis of nanocomposites,* and (4) *Integrated vehicle health monitoring*. (http://engr.wichita.edu/hliao)

Faculty Scholarly Activity

Publications

- **Cheraghi, S.H.**, **Krishnan, K.K.**, Bajracharya, B. and Faisal, K., "Determination of Riveting Process Parameters to Ensure Quality of Rivets" *15th Industrial Engineering Research Conference*, Nashville, TN, 05/ 2007.
- **Cheraghi, S.H.**, **Krishnan, K.K.**, and Faisal, K., "Impact of Riveting Process Parameters on Quality of Riveted Lap Joints," *15th Industrial Engineering Research Conference*, Nashville, TN, 05/ 2007.
- **Jorgensen, M.J.**, Kittusamy, N.K. and Aedla, P.B., "Repeatability of a Checklist for Evaluating Cab Design Characteristics of Heavy Mobile Equipment" *Journal of Occupational and Environmental Hygiene*, Vol. 4 (12), 913-922, 2007.
- Jithavech, I., **Krishnan, K.K.**, and **Liao, H.T.**, "Risk-based Facility Layout Design Approach" *15th Industrial Engineering Research Conference,* Nashville, TN, 05/2007.
- Jithavech, I., **Krishnan, K.K.** and **Yildirim, M.B.**, "Analysis of Material Handling Scheduling using Simulation" *15th Industrial Engineering Research Conference*, Nashville, TN, 05/ 2007.

Publications Cont.

- Guo, H.R., **Liao, H.T.**, Zhao, W.B. and Mettas, A., "A New Stochastic Model for Systems under General Repairs" *IEEE Transactions on Reliability,* Vol. 56 (1), pp. 40-49, 2007.
- **Liao, H.T.** and Lee, J., "Predictive Monitoring and Failure Prevention of Vehicle Electronic Components and Sensor Systems" *2006 SAE Transactions, Journal of Passenger Cars: Electronic and Electrical Systems,* Vol. 115, pp. 240-246, 2007.
- Jin, T.D., **Liao, H.T.** and Luo, W., "Using Failure-In-Time Metrics to Drive Reliability Growth in Product Development and High Volume Manufacturing" *53rd Annual Reliability and Maintainability Symposium, Orlando, FL,* pp. 488-493, 01/ 2007.
- Li, Z.J., Hamada, M. and **Liao, H.T.**, "Maintenance Optimization for a Degrading System under Installation Constraints"*13th ISSAT International Conference on Reliability and Quality in Design,* Seattle, WA*,* pp. 285-289, 08/2007.
- Rausch, M. and **Liao, H.T.**, "Validation of Method of Moments for Uncertainty Propagation in Reliability Estimation" *13th ISSAT International Conference on Reliability and Quality in Design,* Seattle, WA*,* pp. 112-116, 08/2007.
- Deshpande, A. and **Madhavan, V.**, "Study of heat partition at the primary shear plane using finite element analysis of heat and mass transfer," Transactions of the North American Manufacturing Research Institute of SME, Vol. 35, Ann Arbor, MI, 05/2007.
- **Madhavan, V.**, Yegneswaran, K., Mahadevan, D. and Belur-Sheshadri, A, "Experimental determination of velocity and strain rate fields in orthogonal cutting," 17th US Army Symposium on Solid Mechanics, Baltimore, MD, 04/2007.
- Saket-Kashani, M. and **Madhavan, V.**, "Study of Damage distribution over the Primary Shear Zone in Metal Cutting using Nanoindentation," 17th US Army Symposium On Solid Mechanics, Baltimore, MD, 04/2007.
- Saket-Kashani, M. and **Madhavan, V.**, "The effect of surface tilt on nanoindentation results," Proceedings of 2007 ASME International Mechanical Engineering Congress and Exposition Seattle, WA, 11/2007.
- **Masud, A.**, **Yildirim, M.B.** and Meza, J. C., "Multi-Objective Model for Power Generation Expansion Planning" *15th Industrial Engineering Research Conference*, Nashville, TN, 05/ 2007.
- **Weheba, G.**, Mahmassani, A. and **Malzahn, D.**, "AS9100 Registration Difficulties and Organizational Benefits: A Supplier Satisfaction Survey" *Journal of Aerospace, SAE International Transactions*, Vol. 1, pp. 2438, 2007.
- Samarah, I., **Weheba, G.** and Lacy, T., "Characterization of the Effect of Material Configuration and Impact Parameters on Damage Tolerance of Sandwich Composites" *Journal of Aerospace, SAE International Transactions*, Vol. 1, pp. 2443, 2007.
- Self, T., Scudder, R. and **Weheba, G.**, "A Virtual Approach to Teaching Safety Skills to Children with Autism Spectrum Disorder, Topics in Language Disorders" *Lippincott Williams & Wilkins Journal*, Vol. 27 (3), pp. 238-249, 2007.
- Molina, A., Panetto, H., Chen, D., **Whitman, L.**, Chapurlat, V. and Vernadat, F., "Enterprise Integration and Networking: Challenges and Trends" *Studies in Informatics and Control: With Emphasis on Useful Applications of Advanced Technology*, Vol. 16 (4), 353-369, 2007.
- **Whitman, L.**, Kolyesnik, O. and **Malzahn, D.**, "Decision analysis for RFID" *International Federation for Automatic Control Cost Effective Automation in Networked Product Development and Manufacturing*, Monterrey, MX, 10/2007.
- **Whitman, L.**, Toro-Ramos, Z. and Skinner, S., "Educating the engineer of 2020: A practical implementation" *American Society of Engineering Education Midwest Section Conference*, Wichita, KS, 09/2007.

Publications Cont.

- **Whitman, L.**, **Cheraghi, S.H.**, and **Twomey, J.**, "Shockerphant Aerospace: Towards a sustainable model for teaching production system concepts" *American Society of Engineering Education Midwest Section Conference*, Wichita, KS, 09/2007.
- **Whitman, L.**, Steck, J., Koert, D. and Paarmann, L., "A class for undergraduate technical literacy using LEGO Mindstorms" *American Society for Engineering Education Conference*, Honolulu, HI, 06/2007.
- **Whitman, L.**, and Chaparro, B., "Efficacy of virtual models to teach factory concepts in the classroom" *International Conference on Research in Engineering Education*, Honolulu, HI, 06/2007.
- Khanna, N. and **Whitman, L.**, "A reusable enterprise ontology for a lean supply chain" *15th Industrial Engineering Research Conference*, Nashville, TN, 05/2007.
- Meza, J.L.C., **Yildirim, M.B.** and **Masud, A.**, "A Model for the Multi-Period Multi-Objective Power Generation Expansion Problem" *IEEE Transactions on Power Systems*, Vol. 22 (2), pp. 871- 878, 2007.
- Mouzon, G., **Yildirim, M.B.** and **Twomey, J.**, "Operational Methods for Minimization of Energy Consumption of Manufacturing Equipment" *International Journal of Production research*, Vol. 45 (18), pp. 4247 – 4271, 2007.
- **Yildirim, M.B.**, Duman, E., **Krishnan, K.K.** and Senniappan. K. "Parallel Machine Scheduling with Load Balancing and Sequence Dependent Setups" *International Journal of Operations Research*, Vol. 4 (1), pp. 42-49, 2007.
- **Yildirim, M.B.**, Duman, E., Duman, D. and Cetinkaya, C., "Allocation of Component Types to Machines in the Automated Assembly of Printed Circuit Boards" *Journal of Computers*, Vol. 2 (7), pp. 11-19, 2007.
- Asmatulu, R., **Yildirim, M.B.**, Khan, W.*, Adeniji, A. and Wamocha, H., "Nanofiber Fabrication and Characterization for the Engineering Education" *ASEE 2007 Midwest Regional Conference*, Wichita, KS 9/19-21/2007.
- Mouzon, G. and **Yildirim, M.B.**, "Genetic Algorithm to Solve a Multi-Objective Scheduling Problem"*3rd Annual GRASP Symposium*, Wichita, KS, pp. 45-46, 4/2007.
- **Yildirim, M.B.**, **Twomey, J.**, **Whitman, L.** and **Ahmad, J.**, "A Framework to Collect, Assess and Reduce Energy Consumption of Manufacturing Equipment" *First International Energy 2030 Conference, An International Forum on Energy Resources and Technologies*, Abu Dhabi, U.A.E., 2007.

2007 Funded Research Projects

- **Cheraghi, S.H.** and **Jorgensen, M.J.**, "Detection and Prevention of Carbon Monoxide Exposure in General Aviation Aircraft," FAA.
- **Cheraghi, S.H**., "Development of de facto standards for tool calibration programs," FAA.
- **Cheraghi, S.H.** and **Krishnan, K.K.,** "Application of Virtual Reality and Simulation for Assembly Planning and Costing," Aircraft Design and Manufacturing Research Center (ADMRC).
- **Jorgensen, M.J.**, "Bucking Bar Intervention Strategies for Reduction of Vibration during Riveting," Raytheon Aircraft Company.
- **Jorgensen, M.J., "**Aging and Obesity in the Workplace – Impact on Occupational Injury Risk," Regional Institute on Aging.
- **Jorgensen, M.J.,** "Ergonomic Assessment of the Structured Packing Production Area," Koch-Glitsch, LP.
- **Krishnan, K.K.** and **Cheraghi, S.H.,** "Virtual Reality Systems for Aircraft Manufacturing," ADMRC.
- Ahmed, I., Talia, G. and **Krishnan, K.K.**, "Thermal Spray Coatings for Composite Structures in Aviation," ADMRC.

2007 Funded Research Projects Cont.

- **Liao. H. T.,** "Collaborative Research: Design of Equivalent Accelerated Life Testing Plans Involving Single or Multiple Stresses," National Science Foundation (NSF).
- Steck, J.E. Horn, W.J., **Liao, H.T.** "Integrated Vehicle Health Monitoring Requirements Definition" National Institute of Aviation Research/Industry/State of Kansas (NIS).
- **Madhavan, V.** and Fang, N., "Collaborative Research: Experimental and Numerical Investigation and Improved Modeling of the Cutting Edge Contribution in Metal Cutting," NSF.
- **Madhavan, V.** "Friction and wear under very high electromagnetic stress," Georgia Tech.
- **Madhavan, V.** and Hijazi, A. "Development of an ultra high speed camera capable of simultaneous full-field deformation and temperature measurements", NSF.
- **Madhavan, V.** and Adibi-Sedeh, A.H., "Predictive modeling of machining processes based on finite element analysis," NIST.
- **Madhavan, V.,** "Optimal Design of Materials Processes," MILTEC/DoD/AFRL.
- **Malzahn, D.** and **Liao, H.T.** "Meta Data Enabled Systems Thinking Tool" NIS.
- **Weheba, G.** "Performance Analyses Using Work Sampling Techniques," Bombardier Aerospace Learjet.
- **Weheba, G.,** "Process Improvement and Capability Analysis at the Machine Shop," Bombardier Aerospace Learjet.
- **Whitman, L., Cheraghi, S.H.** and **Twomey, J.,** "Lean and Green Production Systems Class Project," NSF – CCLI.
- **Whitman, L., Twomey, J. Yildirim, M.B.** and **Liao, H.T.,** "Wichita State University (WSU) Industry University Cooperative Research Center for the Reduction of Waste in Aerospace Logistic Systems," NSF – I/UCRC.
- **Twomey, J**., **Yildirim, M.B**., **Ahmad, J.** and **Whitman, L.,** "Research Study: Inter-relationship of Operational Decisions and Environmental Impacts," NSF.
- **Twomey, J.,** "Logistics, Distribution, and Infrastructure Planning for Kansas Biofuels and Biomass Industries 2020," KS NSF-EPSCoR.
- **Twomey, J.,** "Sustainable Manufacturing: IV Global Conference on Sustainable Product Development and Life Cycle Engineering; San Carlos, Brazil Oct 3-6, 2006," NSF.
- **Yildirim, M.B.,** Kolarik, W.J., Nutter, D., **Twomey, J**. **Whitman, L., Liao, H.T.**, Turner, W., Frazier, R.S., "WSU/ University of Arkansas/ Oklahoma State University Industrial Assessment Center Proposal," Department of Energy.
- Asmatulu, R. and **Yildirim, M. B**., "Aircraft Interior Noise Reduction by Electrospun Polymeric Nanofibers," ADMRC.

Learn More About our Department

- First department chair **(Dr. H. Lawrence Hall)** was appointed in **1949**.
- Two ABET accredited undergraduate degree programs: BS IE and BS MfgE
- Graduate Programs: Master of Science in IE, Master of Engineering Management, and Ph.D. in IE
- Graduate program concentrations in Engineering Systems, Manufacturing Systems, and Ergonomics
- **87** undergraduate students, **120** graduate students
- **11** Faculty members (3 full professors, 6 Associate professors, and 2 Assistant Professors) *(Continued on page 14)*

Successful Alumni — Efforts Towards Excellence

In Academia

Wolter J. Fabrycky , Ph.D.
Lawrence Professor Emeritus of Industrial and Systems Engineering at Virginia Tech.

More than a half-century ago, **Wolter J. Fabrycky** gave up his position as a Junior Design Engineer at Cessna Aircraft, picked up his BSIE from Wichita State, and headed for graduate study and an IE instructorship at Arkansas. After receipt of his PhD from Oklahoma State in 1962, Dr. Fabrycky served there as an Associate Professor until 1965. He then joined Virginia Tech where he served as Founding Chairman of Systems Engineering, Associate Dean of Engineering, and Dean of Research for the University. Wolter is now the Lawrence Professor Emeritus of Industrial and Systems Engineering, Chairman of Academic Applications International, and a Registered Professional Engineer in both Arkansas and Virginia.

Dr. Fabrycky was elected to the rank of Fellow in the Institute of Industrial Engineers in 1978, the American Association for the Advancement of Science in 1980, the International Council on Systems Engineering in 1999, the American Society for Engineering Education in 2007, and is listed in Who's Who in Engineering and Who's Who in America. He serves or served on the Boards of APM, ASEE, IIE, INCOSE, and OAA. Fabrycky received the Holtzman Distinguished Educator Award from the Institute of Industrial Engineers in 1990, the Lohmann Medal from the College of Engineering at Oklahoma State in 1992, and the Pioneer Award from the International Council on Systems Engineering in 2000. He is Founder and President of the Omega Alpha Association, the Systems Engineering Honor Society.

Fabrycky is co-author of six Prentice Hall textbooks and co-edits the Prentice Hall International Series in Industrial and Systems Engineering that now contains more than 40 titles.

In Industry

John Huffman, Ph.D.
Associate Technical Fellow
Spirit AeroSystems, Inc.

From his youth, **John Huffman** had his sights set on a career in the Aerospace Industry. That began in 1981 when John accepted an offer from The Boeing Co. in Wichita upon graduating from Illinois Tech. He immediately applied and was enrolled for graduate studies at Wichita State.

Starting in Structures Engineering, John was drawn to the need for systems analysis work at Boeing. He sought to increase his skill set in this area. This led him to the Industrial Engineering Department where he earned a degree in Engineering Management Sciences in 1987. John was able to align his coursework at Wichita State with his projects at Boeing.

John became a licensed Professional Engineer in Kansas in 1990. In 1993, he was conferred with a Ph.D. in Industrial Engineering from WSU. His studies involved new uses for artificial intelligence technologies in Design For Manufacture programs. In 1994, Boeing selected John as an Associate Technical Fellow. John continued in that role after divestiture of Boeing's Wichita site to Spirit AeroSystems, Inc. in 2005. Today, John leads advanced information technology and process analysis efforts in support of Enterprise Architecture and New Business programs at Spirit. He is an active collaborator with the Industrial and Manufacturing Engineering Department and is a member of their Industrial Advisory Council.

John is outspoken about the excellent education and mentorship he has received from the faculty of IMfgE Department throughout the years. He believes that the interdisciplinary approach that the department takes to problem solving is unique in Engineering. He encourages others to consider taking classes in the department - no matter what their major. In fact, John proudly boasts of his daughter Jenna who is pursuing her undergraduate degree at WSU in Health Management Services. She took the Introduction to Engineering for Non-engineers course offered by the department and received an "A" – with no help from Dad (although he *really* wanted to help).

International Collaboration on Global Sourcing

Abdul Razak Ibrahim, Ph.D.
Visiting Scholar

We welcome Dr. Abdul Razak Ibrahim for visiting our department. Dr. Razak earned his Ph.D. in Business Administration from University of Strathclyde, Glasgow (Scotland) in November, 2002. He received his Master of Business Administration from Governors State University, Park Forest, Illinois and his Bachelor of Science in Business Administration (specialization in Operations Management) from Northern Illinois University, DeKalb, Illinois in 1998.

Dr. Razak worked as a production planner in a plastic injection molding plant of Thomson Consumer Electronics, a French multinational in Malaysia for 3 years. His responsibilities included scheduling of all plastic parts, capacity planning, procurement of raw materials via AS400 environment (MRPI), and parts coordination for many warehouses. He then moved to Perwaja Steel, a national steel company, as a Internal Auditor (Operations). During that time Perwaja had 3 separate plant locations in Malaysia. His responsibilities were in compliance audit on policies and procedures. He has done extensive audit on warehousing, plant capacity assessment, stock count, and many other functions. He spent 3 years in the company and moved to University of Malaya and became an academician. Since then, he has conducted research in the areas of healthcare services, performance measurement, quality management, knowledge management, and recently supply chain management. He has published in many national and international journals and conference proceedings. He is the Deputy Dean/Director of University of Malaya graduate school of Business. He teaches Operations Management, Supply Chain Management, and Business Research. Recently, by collaborating with Department of Industrial and Manufacturing Engineering he is getting into the area of global sourcing.

Global sourcing is an emerging area especially for a developing country like Malaysia. Based on the literature, today's organizations opt to source globally due to many reasons:

- Access to lower priced goods and cost,
- Greater access or exposure to worldwide technology (product/process),
- Better delivery service (performance/reliability)
- Better customer service
- Enhanced competitive position
- Improved supplier relationships
- Better management of total supply chain inventory

The objectives of Dr. Razak's research are to find in detail the concept of global sourcing and the best practices or an excellent framework for dealing with global sourcing. It is hoped that his research findings will assist Malaysian industries in learning and fostering good global strategies to enhance competition in the global marketplace. Dr. Razak will stay with us until December, 2008.

Learn More About our Department

(Continued from page 11)

Research Laboratories

Dr. Weheba (left) and students in Rapid Prototyping and Product Development Laboratory
Lab Director: Dr. Gamal Weheba

The Rapid Prototyping and Product Development Laboratory seeks to develop and disseminate processes that enable exceptional improvements in product quality during design and manufacturing phases. The laboratory supports multidisciplinary industry based research projects in the areas of Computer Aided Design and Manufacturing, Reverse Engineering, Reliability Assessment and Medical Modeling.

Student working on ZOLLER Genius III in Advanced Manufacturing Processes Laboratory
Lab Director: Dr. Vis Madhavan

Experimental research in the Manufacturing Processes Research Lab is focused on analysis of the mechanics and physics of machining. The lab also supports research in sheet metal forming. The lab also supports a new initiative on determination of material properties and friction during the high temperature forming of superalloys.

Students in Sustainable Engineered System Laboratory
Lab Directors: Drs. Janet Twomey and Lawrence Whitman

The Sustainable Engineered Systems Laboratory, formed in 2005, is actively pursuing research and education in environmentally sustainable systems. The group began with a focus in Green Manufacturing but has recently broadened its scope to include development of wind energy technology and issues related to the biofuels industry.

Students working in Human Performance & Design Laboratory
Lab Director: Dr. Michael Jorgensen

The Human Performance and Design Laboratory is equipped to perform laboratory studies on lifting and manual material handling, assessment of vibration, and balance. The ergonomics lab is used for lab exercises for the ergonomics courses, as well as ergonomics job evaluations in industry.

The Composites Manufacturing Laboratory provides students with hands-on experience in the manufacturing of composites. The laboratory is established to support the course in composites manufacturing. The course introduces students to all aspects of composites manufacturing including the various manufacturing methods utilized in the aerospace industry and the prevalent quality assurance methods. The developed laboratory provides the CoE the possibility of offering short courses in the area of composites. Furthermore, the newly designed CoE certificate program in Advanced Composite Materials also utilizes this laboratory.

Dr. Weheba (center) and students in Composites Manufacturing Laboratory
Lab director: Dr. Gamal Weheba

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