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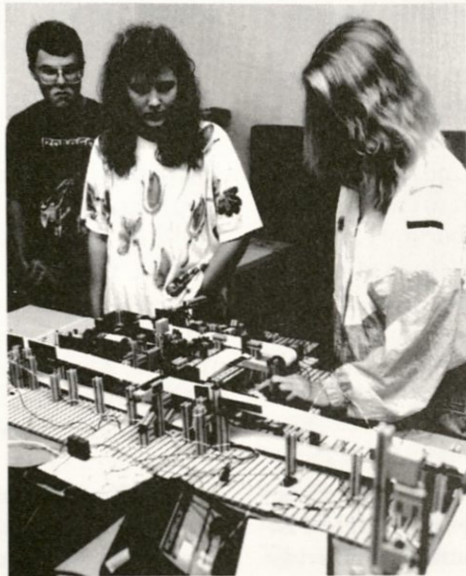
IMSE LABS WILL BE "HANDS-ON" SHOWCASES FOR STUDENTS

Whether they're assembling fischertechnik component parts to simulate a shop floor environment, conducting burn-in tests to determine product failure rates, or writing and testing CAD-CAM programs on Silicon Graphics IRIS workstations, current and future students in the Department of Industrial and Manufacturing Systems Engineering (IMSE) will have an opportunity their predecessors didn't—hands-on experience in one or more of IMSE's five new laboratories.

The labs, each associated with one or more IMSE courses, will give students an environment in which they can practice concepts from the classroom, says department chairperson and professor **Way Kuo**. "An important part of an engineer's education is to get hands-on experience, so he or she is prepared to meet the challenges of an actual industrial environment," he says. The labs will expose students to various manufacturing areas—quality and reliability, design, integrated systems, materials handling, manufacturing processes—that they'll encounter when they enter industry.

The laboratories (see sidebar) are a first for the IMSE Department, notes Kuo; in the past students and faculty concentrated on classroom theory with some computer work. The department's increased emphasis on manufacturing accounts for the need for such labs. "We want students, upon their graduation, to be able to apply their knowledge to help industry quickly," he says. "We want them to have knowledge beyond the classroom concepts."

Kuo also hopes that the department's new lab development will propel it into the ranks of the very best industrial engineering departments in the country. "We are leading the nation in terms of IE laboratory development," says Kuo. The new Integrated Manufacturing Systems Laboratory has received a \$29,000 National Science Foundation (NSF) Instrumentation and Laboratory Improvement

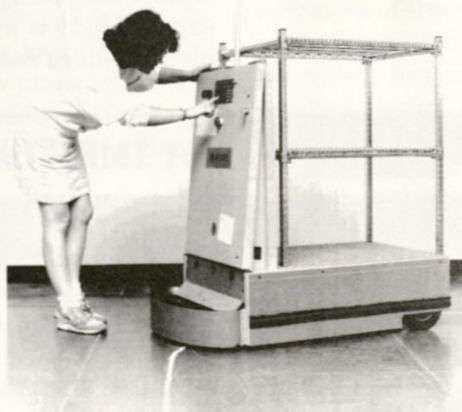


Students simulate a plant floor.

grant, and the Quality and Reliability Laboratory is the recipient of one NSF grant totaling \$105,000.

"The chances of receiving just one NSF grant are in the single digits," Kuo says. "For us to receive two grants for our labs shows the high regard the NSF has for our efforts and the importance of the quality and reliability area." In fact, the Quality and Reliability Laboratory will be the first of

its kind in the United States. The new labs join three others—the Large-Scale Systems Performance Laboratory, the Human-Machine Laboratory, and the Methods Laboratory—on the third floor of the Engineering Annex, except for the Manufacturing Processes Laboratory, which will be located in the basement of the Nuclear Engineering Building.



An IMSE student programs the AGV.

IMSE faculty canvassed industry (General Motors, John Deere, NCR, New London Engineering, Silicon Graphics, and Telos) for equipment and funds and wrote successful equipment grant proposals to the U.S. Army as well as to the NSF. The university, the College of Engineering, and IE alumni contributions are also supporting the

laboratory development effort, but "there is so much more that can be done," says Kuo. "Maintenance on this equipment is expensive, and we will need to hire a technician to keep it running." Alumni interested in contributing to a laboratory endowment fund can check the appropriate box on the response form on page 3. "We also appreciate the support we've received from industry in equipping these labs and would welcome new industrial partners who want to help us educate future employees," he adds.

The new laboratories, when completed, will be "showcases" for the IMSE Department, says Kuo. "If someone wants to know what our department is all about," he states, "they can just look into these labs and see our students getting hands-on industrial and manufacturing experience."



Macintoshes provide CAD experience.

New labs complement IE courses

IMSE's new laboratories include the following:

♦The **Integrated Manufacturing Systems Laboratory**, the most established of the five new labs, has been used by students for the last two years for a manufacturing systems control course emphasizing microcomputer applications (IE 339), says assistant professor **John K. Jackman**, who is in charge of the lab's development. Using Macintosh computers, table-top manufacturing equipment, and modular system components (a type of sophisticated Legos that can be used to build a plastic mock-up of a physical system), students write programs and actually build mini-manufacturing systems that can control an entire plant or shop floor.

"Students have to get a system up and running, delivering, storing, and machining parts," explains Jackman. Dealing with many control-related items, such as hydraulics, resistors, transistors, and other electronic components, the approximately 20 students per semester who take the class get a taste of real-world frustrations and successes. "The students, who react enthusiastically to this course, spend many hours in the lab trying to make their systems work," he notes. The lab is supported by an NSF instrumentation grant and matching funds from General Motors and ISU.

♦Jackman is also developing the new **Materials Handling Laboratory**, which will be used for the industrial materials handling course (IE 443). Using a palletized conveyor system funded by New London Engineering, automated guided vehicles (AGVs) from NCR, and conveyors funded by General Motors and the college, students will direct the AGVs—essentially computerized carts used in office automation systems—to deliver materials using the sophisticated palletized conveyor system. "Students have to set up systems in which materials are delivered to the right place at the right time," says Jackman. "In addition they have to worry about congestion and contention for the materials handling devices."

♦IMSE's unique **Quality and Reliability Laboratory** (see main story) will give students access to instrumentation—vibration testing systems, temperature/humidity chambers, a chamber/shaker interface, software, Macintosh computers, a large-screen projec-

*continued on
back page*

FACULTY DEVELOP NEW COURSES

As part of the proposed changes in the IMSE Department outlined in the January 1990 issue of *IMSE News*, a number of new courses have been developed by the faculty. The undergraduate courses include the following:

IE 419X, Manufacturing Systems Modeling. Assistant professor Douglas G. Gemmill developed this course to provide engineering students with a course that addresses performance analysis modeling issues in manufacturing systems such as material handling, inventory, and production systems. The course uses simulation languages such as GPSS, SIMAN, and SIMFACTORY. Students develop expertise in the design of simulation models and analysis of simulation data. Analytical models based on queueing network approaches such as MANUPLAN are presented.

IE 436X, Introduction to Reliability Engineering. This new, three-credit course was offered for the first time last spring by professor Way Kuo, chairperson of the IMSE Department. IE 436X examines why and how manufactured products fail, the effects of failure, and aspects of design that affect the likelihood of failure. This course also introduces failure processes, paying attention to design variability. Topics include reliability mathematics, analyzing reliability data, load-strength interference, reliability modeling and prediction, reliability in design, maintainability and availability, reliability testing, and systems reliability optimization.

IE 444X, Computer-Integrated Manufacturing I. Developed by assistant professor Richard J. Linn, this course focuses on CAD systems (drafting stations), wireframe representations, solid modeling, internal data file structures, design analysis, and the concept of integrated design and manufacturing. This course, the first of a two-course sequence, will be offered next spring.

IE 445X, Computer-Integrated Manufacturing II. This is the follow-up course to IE 444X developed by assistant professor Linn. The course will be offered in fall 1992 and focuses on integrated manufacturing and CAD/CAM integration. The concept of integrated planning and control of manufacturing processes to achieve desired product quality and process flexibility while maintaining low production cost will be explored.

IE 465X, Knowledge Engineering. Professor Thomas A. Barta developed this course, which centers around the theory and structure of knowledge-based systems and the practice of knowledge engineering. Expert system shells are used to develop an expert system for industrial application. Students are introduced to the elements of an expert system and given laboratory projects to reinforce learning. Topics include inference engines, probabilistic information and certainty factors, backward and forward chaining, search methods, predicate calculus, languages for artificial intelligence problem solving, and expert system building.

IE 476X, Designing for Humans in Industrial Systems. Associate professor Patrick E. Patterson developed this course to provide hands-on experiences, in conjunction with lectures, that deal with the application of ergonomic information to industrial situations for improving worker efficiency, safety, and comfort. The course focuses on the modeling, simulation, and analysis of the worker in areas where ergonomic refinements can improve the human-machine interface. Areas of emphasis include biomechanics, work physiology, and work environment. Lab experiences are based on real-world industrial problems from local companies.

New graduate courses include the following:

IE 501X, Economics and Dynamics of Production. This new graduate course, developed and taught by assistant professor K. Jo Min, focuses on the mathematical theory of production, exploring both static and dynamic production systems. It addresses the conventional problems of production systems in conjunction with the economic environments of the production systems. Topics treated included optimal production planning processes, production function estimation, and optimal production control.

IE 542X, Computer-Aided Manufacturing I. Assistant professors Linn and Amy J.C. Trappey developed this course to introduce the application of computers in the planning, controlling, and monitoring of manufacturing processes. CAM concepts, functions, and technology are introduced. Numerical control, part programming, group technology artificial intelligence, data base, solid modeling, and CAD/CAM integration are specifically discussed. IE 542X will be offered for the first time this fall.

IE 544X, Geometric Modeling and Computer-Aided Design. Assistant professor Linn developed this graduate level course, which requires a background in computer programming and linear algebra. Parametric modeling, solid modeling, computer graphics, and the concept of CAD/CAM in concurrent design are presented.

IE 642X, Simultaneous Engineering in Manufacturing Systems. Assistant professors Gemmill, Linn, and John K. Jackman collaborated in the development of this graduate-level experimental course that explores current research in simultaneous engineering. Today's manufacturing industries look to concurrent or simultaneous engineering to significantly reduce lead time and life cycle costs and to improve quality. Students in this course are exposed to new methods in the field and complete a guided research project.

'91 IMSE banquet attracts big crowd

A big crowd and corporate and individual sponsorship made the 1991 IMSE Student/Faculty/Parent Banquet a great success. The annual banquet, held April 18, attracted 186 people, including 143 students and parents, 23 business representatives and scholarship donors, and 20 faculty and staff members.

At the banquet faculty members and students were recognized for their achievements. Thirty-three student scholarships totaling \$31,858 were announced, and several faculty members received recognition for their teaching and research accomplishments.

Because of generous donations by individual and corporation sponsors, students were able to purchase tickets for the event at a reduced cost. The IMSE Department wishes to thank and recognize the following friends for their generosity to the IMSE Banquet:

Allen-Bradley Co., Milwaukee, WI
Alpha Pi Mu, ISU
Amana Refrigeration, Inc., Amana, IA
Furnas Electric Co., Osceola, IA
Graduate Students, IMSE Department
Hutchinson Technology, Inc., Hutchinson, MN
Ingersoll-Rand Co., Charlotte, NC
Institute of Industrial Engineers, ISU
Institute of Industrial Engineers, Sioux Region Chapter
James P. Kouri, St. Paul, MN
James River Corporation, Neenah, WI
Rockwell International, Cedar Rapids, IA
Rolscreen Company, Pella, IA
Saginaw Division, GMC, Saginaw, MI

Way Kuo, IMSE chairperson and professor, has received the 1991 Institute of Industrial Engineers' Fellow Award.

This award is the highest grade of membership in the 40,000-member, international institute and recognizes outstanding leaders of the profession who have made significant, nationally recognized contributions to industrial engineering.

Kuo studies reliability and performance-related issues in the areas of electronic components, software, military systems, and non-military environments, such as power companies, that require intensive communication and control functions. He has developed original models for evaluating reliability in communications systems and validating software systems. Kuo's work in promoting and successfully incorporating design into a multidisciplinary engineering curriculum has earned him international recognition.

Tamashunas, Kuo honored



Victor M. Tamashunas, IMSE retired professor, was recognized for his long-time contributions to student advising by the ISU College of Engineering, which presented him with its Superior Engineering Adviser Award for 1991.

Engineering Dean David T. Kao presented a plaque and \$500 to Tamashunas at the college's fall convocation August 22. The award recognizes superior advising performance as shown by student and faculty evaluation. The recipient must have advised undergraduate students for three or more years.

Tamashunas has been advising undergraduate students since he joined the department in 1956. Most recently he has served as adviser and chairperson of IMSE's cooperative education program, working to place junior and senior students in "co-op" positions in business and industry. (For more on Tamashunas' career at ISU, see retirement story on page 3.)

Special Daily offer will keep you up-to-date with ISU

The *Iowa State Daily* is offering alumni a unique subscription opportunity this year. For \$15, the Daily will send you one paper per week—the Friday issue—starting at the end of August through the middle of May. This Friday issue will be the same one that current ISU students receive, with an added special "Week in Review" section that will list headlines and a short description of the big stories of the week.

To keep up with news, events, sports, and opinions at ISU, send your check or money order for \$15 (30 issues) to the *Iowa State Daily*, 108 Hamilton Hall, Ames, Iowa, 50011, or place a credit card order by calling 515/294-4123. Partial year subscriptions are also available; call 515/294-4123 to inquire.

MORE IMSE RESEARCH

This article concludes a summary of IMSE research projects.

Functionality and cost engineering. Professors Way Kuo, Herbert T. David, and Stephen B. Vardeman and assistant professor John K. Jackman have received a \$147,000 grant from the National Science Foundation with matching funds provided by ISU and John Deere for a two-year functionality and cost engineering project.

In this project, the concepts of functionality and life cycle costs are considered at the initial product design stage for products consisting of assemblies of machined parts. The manufacturing costs are distributed over the useful life of the product, and reliability of the finished product is regarded as a key attribute of the life-cycle cost.

Intelligent design and implementation of automated survivability assessment tools for a generic information network. The Army Research Office has awarded professor Way Kuo a fifth-year grant to design and implement automatic survivability assessment tools for a generic information network. The project has totaled over \$400,000. Both the operational and functional specifications of concern, as defined by the Army tactical command and control system, will be mapped into the structure of a generic information system. The focus of the research is to be carried out in the survivability modeling area of information and communication network to serve as the C³INAT (Command Control and Communications Information Network Analysis Tool).

Efficient routing and scheduling of trucks to minimize the cost of collection of post-consumer recyclable products. Assistant professor Ram Pandit has been conducting research on the efficient routing of trucks to minimize the cost of the collection of post-consumer recyclable products. This project is funded by the Plastics Recycling Foundation, Washington, D.C., through the Center for Plastics Recy-

cling Research, Rutgers, New Jersey.

The first step in the recycling process of a product is to collect it from the users. According to the Center for Plastics Recycling Research, three approaches are used to perform this step. These approaches with their recovery rates are voluntary drop-off (10%), buy-back centers (15%-20%), and curb-side collection (70%-90%). It is clear from the recovery rates that most of the recovery is done at the curb side, but none of the collection approaches should be abandoned.

To make the collection process cost effective and increase the overall collection, it is essential that efficient collection technologies be developed. The primary objective of the truck routing project is the development of a systematic and scientific approach to solve the problems of routing and scheduling of collection truck centers.

Integrated control logic and process design for automatic control software development. Assistant professor Richard J. Linn is conducting research into the development of automatic control software in manufacturing, funded by the Engineering Research Institute. The software design and development process accounts for a major component of implementing an automated manufacturing system in terms of both cost and lead time. In order to support concurrent product design, and to simplify process design and development, an intelligent process design system that can facilitate the design and evaluation process is needed.

This research effort focuses on creating the prototype software for integrating machine design and control logic in one CAD system. An engineer can design the machine members, define the control logic, assemble the machine, wire in the logic, and test the system to validate the operation of the machine without any physical implementation. If any improper operation is identified, the engineer can either modify the machine design or control logic to correct the problem.

Professor Vic Tamashunas retires



Victor M. Tamashunas, IMSE professor, retired in May after serving on the faculty of Iowa State University for 35 years.

Vic joined the industrial engineering faculty as an instructor in 1956. He earned the M.S. degree in 1959 and was promoted to full professor in 1974. His areas of expertise included production systems design, facility layout planning, management organization theory and practice, production and inventory control techniques, and materials handling.

Vic has been the department co-op program adviser and chairman for the past several years. Active in the Central Iowa Chapter of the Institute of Industrial Engineers, he received that organization's Distinguished Service Award in 1971, was named Engineer-of-the-Year in Region XI in 1974, and served as regional vice-president from 1977-1979. He also was named the college's Professor of the Year in 1962 and recently received the college's 1991 Superior Adviser Award (see awards story on page 2).

Please stay in touch!

We want to hear about your career moves and personal news for our alumni news page. We need your help, too, with donations to scholarship funds, lab facilities, and student groups. If you're making a contribu-

tion to your alma mater, please consider designating it for the Department of Industrial and Manufacturing Systems Engineering. The form below will make it easy for you.

Name _____
Address _____
City, State, Zip _____

I want to tell you about: _____

I want to help the department with a contribution to:
☐ New laboratories development fund
☐ Scholarships
☐ General department use
☐ Other: _____

SCHOLARSHIP RECIPIENTS

American Institute of Plant Engineers
Dave Havelick \$500

Andersen Consulting
Donald Jabro, Deanna Ternus \$1,000 each

Arthur Collins
Michael Sage \$2,000

College of Engineering
Sharon Buzicky \$1,000

Don Grant Incentive
Angela Woolery, David Kim \$300 each

Eastern Iowa American Society of Quality Control
Stuart Christenson \$1,000

Frank H. Ricker
Wai Siang Lim \$500

General Motors
Jeffrey Podhajsky \$2,452

George W. Catt
Matthew Crum \$500

Hempstead-Walkup
Kelly Jansen \$650

IE & Health Care Scholarship
Jill Hodson \$200

IIE Senior Chapter
Angela Grunig \$350

James McKean
Jennifer Kollbaum \$150

James River Corporation
Jeffrey Harty \$1,000

John Deere
Sarah Roemig \$2,500

Kleinschmidt-Squires
David Lee Kim \$200

Lane Wells
Troy Santi \$230

Material Handling
Sarah Roemig, Deanna Ternus, and Jeffrey Harty \$1,000 each
Jill Hodson \$1,500
Todd Koellner and Mark Taylor \$2,500 each

Maytag Foundation
Karma VanOmmeren \$500

3M
Cynthia Snyder \$750
Daniel Toft & Tammie Galles \$1,000 each

Paul E. Morgan
Cynthia Lasell \$976

Pella Rolscreen
Karen Borgeson \$1,000

Robert C. Fields
Sally Eberhard \$1,000

Walt Lyons
Chi Wah Chow \$300

A . L . U . M . S

1982

Lynn E. Refer, IE, director of investments and acquisitions, Ameritech Corp., Chicago, IL.

1984

Jeff Williams, IE, director of management systems, St. Joseph Mercy Hospital, Mason City, IA.

1985

Kevin Powell, IE, senior manufacturing engineer, Fujitsu Business Communications Systems, Placentia, CA.

David Rush, IE, manager, Kurt Salmon Associates, Management Consultants, Atlanta, GA.

1988

Andrea Kurtz Lorden, IE, promoted from material supervisor to purchasing and production planner, IN-CIRCUIT TEST, Latham, NY.

1989

Angela Boles, IE, operations management analyst, MSP International Airport, St. Paul, MN.

1990

Edward Lovetinsky, IE, technical writer for Data Communications, Inc., Cedar Rapids, IA.

Tony Scalzitti, IE, engineer with GE Medical Systems, Florence, SC.

1991

Toi Anderson, IE, industrial engineering associate, James River Corporation, Green Bay, WI.

LABS (continued from front page)

tor—needed to obtain data for task and workplace design, life-cycle cost relationships, and failure mechanisms. Many industrial engineering programs are just establishing a curriculum in this area, says Kuo, while ISU has had a required quality control course (IE 361) for more than 20 years. "The area of quality and reliability really belongs to the industrial engineer," notes Kuo. "We want to show our students how quality and reliability can be realized—that it's more than just a concept."

Kuo, Jackman, and IMSE professor **Stephen B. Vardeman** are currently developing a lab that unites modern quality control and reliability principles with the latest computer technologies. "Students typically fall short in being able to transfer the technology of quality control and reliability into the manufacturing environment," says Vardeman. "We see this in exam situations where students have a difficult time differentiating between control limits and specification limits and between process stability and product acceptability."

In addition, many students do not readily perceive the limits or the benefits of statistical process control (SPC) technology. In the new lab, students will be able to apply a variety of SPC techniques and make necessary decisions, adjustments, and recommendations under controlled settings. The lab, which will be used by approximately 60 to 70 students each semester, is funded by an NSF grant and matching funds from ISU.

♦IMSE assistant professors **Richard J. Linn** and **Amy J.C. Trappey** direct IMSE's new **CAD/CAM Laboratory**, in which graduate students are setting up six IRIS workstations donated by Silicon Graphics and two purchased by the department. Students will use the workstations, which are designed for high-performance computing involving real-time graphics and three-dimensional solid modeling, to perform solid modeling related to product/process design. The workstations are linked with a high-speed local area network that connects to the university-wide network, providing access to other research groups, universities, and supercomputing facilities. Linn and Trappey will use the lab in experimental undergraduate and graduate courses in geometrical modeling and CAD (IE 444X and 544X) and CAM (IE 445X and 542X), with expected enrollments of 30 undergraduates and 15 graduate students.

♦The newest of the five labs, the **Manufacturing Processes Laboratory**, recently received department and college funding for Macintosh computers, a bench-top CNC milling machine and lathe, and CAD/CAM software. Students will learn how to operate and program the equipment, using it to investigate basic metal chip-removing processes and finishing operations. Assistant professor Trappey will direct the lab, incorporating her expertise in automated fixture planning into the industrial methodology course (IE 374) and a new CAD/CAM graduate course (IE 542X) that will be associated with the lab. Approximately 60 to 70 students will use this lab each semester.

IMSE T-shirt available

Are some of those old ISU and E-Week T-shirts in your weekend wardrobe getting a bit tattered and faded? The IMSE Department is coming to your fashion rescue!

The department is offering 100% cotton T-shirts and cotton-poly sweatshirts for sale this fall sporting the unique IMSE design illustrated here on light grey fabric. One-size-fits-all, baseball-style caps displaying the logo will also be available.

To order, send a check or money order by **October 1** to the Department of Industrial and Manufacturing Systems Engineering, 205 Engineering Annex, ISU, Ames, Iowa 50011-2070. Specify quantity and T-shirt adult size(s) S, M, L, or XL. T-shirts cost \$10 and sweatshirts \$15; caps cost \$6.

**IMSE**

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