IOE Goes Lean
By Jeffrey Liker, Newsletter Editor and Associate Professor, IOE

In past issues of our Alumni Newsletter we discussed how IOE is “going lean.” We developed a complete course on lean manufacturing (IOE 425: Manufacturing Strategies) and a number of faculty and adjuncts associated with the Japan Technology Management Program were doing research on lean and running successful conferences. Over time the revolution in manufacturing embracing lean has grown exponentially, but the number of universities developing strong programs has not kept pace. At U-M we have been continuing to build capability and interest in lean manufacturing. Our fourth annual lean manufacturing conference sponsored by the Japan Technology Management Program and organized by John Shook and Mike Rother drew about 400 registrants this past year. A number of faculty put on short courses in the annual Traverse City Management Briefings in August. Lean concepts are being introduced into other courses like Production and Inventory Control and Facilities Planning.

In this issue we hear from a number of faculty and adjuncts about what they are up to in lean manufacturing. John Shook, originally a Toyota manager, who taught TPS to many Americans while at Toyota, has taken a lead role as Director of Lean Manufacturing Programs working with Mike Rother through JTMP. Walt Hancock, Professor Emeritus, is now consulting on lean manufacturing to a number of different industries. Izak Duenyas is teaching short courses and a new academic course on “Factory Physics.” Factory Physics was created by an IOE alumni and an associate and provides a scientific framework that helps make decisions about implementing lean manufacturing. Yavuz Bozer has incorporated lean concepts into his facilities layout teaching and research and now offers short courses to industry on lean facility layout. Steve Rasch and John Birge have been teaching short courses on “financial engineering for lean manufacturing.” Steve is an adjunct and an alumnus whose dissertation empirically estimated the financial returns on lean manufacturing and Steve is one of our most popular instructors.

Financial Engineering student Anchada Charoenrook studies to the tranquil sounds of the reflecting pool fountain. This addition to North Campus was a gift from the Engineering Class of 1947.
From The Chair

By John R. Birge, Department Chair and Professor, IOE

How is higher education going to change in the next century? That is among the questions the IOE department is facing as we undergo our transition to the College of Engineering's Curriculum 2000 and our next accreditation visit in the Fall of 1999. In both efforts, we are focusing on measuring our outcomes, which include you (our alumni) and your accomplishments. You will soon receive a survey that asks about your education and career. Please help us in our continuous improvement process by completing and returning that form. Your feedback is a crucial part of this effort.

Our other outcome measures include a course-by-course skill listing that we are mapping into our program objectives. With this list of abilities, IOE students can now describe their undergraduate experience explicitly for prospective employers and set their career objectives accordingly. We will then help improve their focus by using your survey replies to modify our skill list and enhance the overall experience for all undergraduates.

At the graduate level, we have been steadily increasing the number of classes offered via distance learning. In the Winter of 1999, we may have as many as a half-dozen courses offered via interactive and tape-delayed video. With interactive video available to unite students at remote locations, we can now offer off-campus students opportunities to share experiences and perspectives with on-campus students. If you would like to explore these possibilities, but your employer does not currently have access to the U-M educational network, you can contact the College of Engineering's Center for Professional Development at off-campus-ed@umich.edu.

Outcome-based curricula and distance learning are two of the trends overtaking higher education. Other waves include asynchronous learning that follows the just-in-time philosophy that so many of us have preached for years. In this approach, students can learn at their own pace when the knowledge is critical for practical tasks that they must complete. The curriculum then becomes a set of these experience-based tasks and a collection of the skills mastered to complete those tasks. This system calls into question the fixed-credit, graded semester courses that have dominated this century's higher educational system and gives faculty a different role as mentors instead of lecturers. Many believe that productivity gains in higher education can only be possible if this change occurs.

I would appreciate hearing your views about the future of higher education or any other aspect of IOE teaching, practice, or research at jrbirge@umich.edu. I also encourage you to visit our web site often at http://www.engin.umich.edu/dept/ioe. We will soon have additional alumni-focused items on the page including employment listings and a forum to communicate with other IOE alumni. Please send me any comments you might have on the web page as well. I look forward to hearing from you.

Philip T. Dattilo
The University of Michigan College of Engineering Alumni Society awarded Ralph E. Reins the Industrial and Operations Engineering Alumni Society Merit Award at the College’s annual Alumni Society Awards Dinner held on October 23, 1998.

The Alumni Society Merit Awards were established to honor alumni who personify the College’s tradition of excellence and who have achieved significant accomplishments in their professional life. The Award is given to one alumnus from each of the eleven academic departments within the College. Recipients are selected by the departmental committees whose members are chosen and headed by the department chair.

Alumni Society Merit Award

Ralph E. Reins received the 1998 IOE Alumni Society Merit Award from College of Engineering Dean, Stephen W. Director, along with Jody Hall and John Birge, IOE Department Chair.

Then, in 1972, he left GM for Rockwell International Corporation, where he was appointed engineering and reliability manager for the Truck Axle Division. He rose rapidly through the management ranks at Rockwell, eventually serving as president of three different divisions.

In 1985, he was offered and accepted the role of senior vice president of ITT Corporation and president and CEO of ITT Automotive. In this position, he had responsibility for a $2.9-billion global automotive components business with 30,000 employees.

In the early 1990’s, he held top management positions with Mack Truck, United Technologies Automotive, Allied Signal, and Envirotest Systems Corporation. In 1995, he settled in at AP Parts International, leading the company from the dual positions of president and chief executive officer. Under his tutelage, the company restructured its OEM business, rebuilt its leadership team, instituted new business practices, encouraged team-focused manufacturing, and negotiated a strategic alliance with a French supplier. At the request of the company’s owners, Mr. Reins negotiated the sale of AP Parts to an interested buyer.

Since retiring from AP Parts in January of this year, Mr. Reins has launched and fostered a family business enterprise. He also serves on the National Advisory Committee of the University of Michigan College of Engineering.
IOE: A Leader in Lean Manufacturing

By Jeffrey Liker, Newsletter Editor, Associate Professor and Director, VCAP and Japan Technology Management Programs

In recent years, the momentum in industry embracing lean manufacturing as the new paradigm has grown. There seems to be general agreement on a number of principles:

1. Mass production thinking which encourages large batch processing and emphasizes the efficiency of individual machines and workers is outmoded as a paradigm.

2. Lean manufacturing, which views continuous flow as the ideal and emphasizes optimizing systems of people, machines, materials, and facilities, can lead to great gains in quality, cost, and delivery performance.

3. Lean manufacturing is a fundamental transformation of a business and needs to be approached as a total organizational transformation.

Lean manufacturing is a term coined by a group of researchers from MIT to describe what they saw at Toyota. The Toyota Production System (TPS) is the original lean manufacturing model. Over time, Toyota has continued to excel as a company and a model, not only for automotive, but for industries throughout the world. The two key pillars of TPS are just-in-time manufacturing (JIT) and built-in quality. JIT is not just a matter of delivery, but a matter of building just what is needed when it is needed. There are many tools available to help support the ideal of continuous flow and building just what the customer wants when they want it, i.e., pull. These tools include quick changeover methods, error proofing, workplace organization, standardization, and total productive maintenance. Bar these are just tools. The overarching goal is to create a value-added flow in order to give customers what they want when they want it. The movement in industry to build-to-order with short lead times is one of the drivers of a desire to adopt lean manufacturing practices.

My edited book, Becoming Lean: Experiences of U.S. Manufacturers, this year won a Shingo Prize for Excellence in Manufacturing Research. IOE faculty, students, and adjuncts wrote many of the individual chapters. A book by Mike Rother and John Shook (both instructors of IOE 425), Learning to See, is only being sold through James Womack’s Lean Enterprise Institute and is selling like hot cakes. A new program within IOE, the Value Chain Analysis Program, looks at the supply chain from a lean manufacturing perspective. With all these activities IOE has emerged as one of the leaders in lean manufacturing — another accomplishment that can make you proud to be IOE alumni!

Financial Engineering and Lean Manufacturing

By Steven Rasch, Adjunct Assistant Professor, IOE

Frederick Taylor revolutionized the workplace during the early twentieth century with his ideas on work organization and task decomposition. Since then, many organizational theorists have redefined management and workforce relations to improve productivity and worker satisfaction. Today, “lean manufacturing” concepts are widely accepted as the most effective way to manage manufacturing processes and attain a high degree of worker competency and dedication.

Similarly, financial management and cost allocation methods were initiated at the beginning of the industrial revolution as manufacturing firms instituted mass production techniques and started tracking expenditures in an effort to understand the overall cost structure of the products they produced. Inventory valuation methods were established to account for production work-in-process. Conventional methods of standard costing were developed to estimate material, direct labor, and overhead costs. In turn, these standard costs formed the basis for establishing operational and maintenance budgets and, ultimately, financial performance measures used to measure management performance. Finally, capital budgets and equipment acquisitions were justified using financial analysis techniques based on product cost information.

This process worked well for many firms until the mid...
1980’s when Japanese competition forced western companies to look at lean manufacturing techniques. The Japanese system of lean manufacturing eliminated many western business practices through team-based organizations which focused on quality and just-in-time production methods. The heart of lean manufacturing practices can be summarized as follows:

- Concurrent Engineering Teams
- Use of Sole Source Suppliers
- Formal Production Teams
- Pay Incentives
- Production Worker Cross-training
- Production Worker Involvement
- Business System Automation
- Just-In-Time Inventory Methods
- Preventative Maintenance
- Formalized Quality Programs

As lean manufacturing techniques became widely accepted in western companies, several problems associated with measuring financial performance through the use of standard cost accounting systems surfaced. These problems include:

- Batching of orders to create favorable variances by eliminating setups at the expense of higher priority orders
- Production overruns to create favorable variances at the expense of unneeded inventories
- Completing easy orders at the expense of tougher orders which have a higher priority
- Maintaining high inventory levels to prevent worker idle time
- Allowing marginally acceptable levels of quality to pass inspection
- Delaying scheduled preventative maintenance to attain higher productivity levels
- Delaying production training and cross-training to prevent under-utilization
- Accepting a buffer of backorders to insure an adequate level of work for production workers

Lean manufacturing practices are redefining the way organizations view their business. This repositioning necessitates a reassessment of overall goals, operational procedures, and financial justification practices. New and innovative financial metrics for accurately determining the financial performance of lean manufacturing practices is the next challenge for industrial engineers during the next decade.

**Facility Layout and Lean Manufacturing**

By Yavuz A. Bozer, Professor, IOE

In manufacturing facilities, facility layout is primarily concerned with the placement of production and service departments in the facility and the parts-flow patterns generated by alternative placements. Long before new paradigms such as “just-in-time” and “lean manufacturing” were introduced, facility layout was (and continues to be) a very active area of industrial engineering practice and research. As new products
are introduced (and obsolete ones are removed), as product design or process changes occur in the spirit of continuous improvement, one is often forced to reevaluate the layout in order to maintain efficient flow paths in the facility. Quite frequently, however, the layout falls behind, and as a result of poor strategic planning, people “paint themselves into a corner.” Before long, new lines or new departments are placed in the facility on a where-there-is-room-available basis, which leads to poor space utilization, poor flow paths, and wasted material handling dollars in the long term.

The primary goal of lean manufacturing is to eliminate waste. A poor (or out-of-date) layout generates considerable waste due to longer travel distances and possible damage to the parts in the process of handling them. However, a more subtle yet more extensive “waste” generated by a poor layout has to do with “transfer batch sizes,” also known as the transfer lot size or handling batch size. In simple terms, the transfer batch size (TBS) is the number of parts moved together in one trip from one department to another in the factory. The ideal TBS under lean manufacturing would be a batch size of one (also referred to as “one-piece flow”). While one-piece flow can be achieved within a department (such as a U-shaped line that consists of several machines arranged in series), moving parts one at-a-time across the factory as a whole is not practical due to a finite-capacity material handling system.

Generally speaking, the longer the travel distance for a particular move, the larger we need to keep the corresponding batch size in order to stay within our material handling system’s throughput capacity. In other words, long travel distances imposed by a poor layout often forces one to use large TBSs throughout the factory. A large TBS, however, leads to a significant increase in work-in-process (WIP). A part that has been processed at a particular department has to wait for all the remaining parts in that batch before it can be moved to the next department. Likewise, the department receiving the parts experiences what is known as “bulk arrivals,” where there are no arrivals for a while and then suddenly a batch of parts arrive and they must now each wait for processing. Such increases in WIP lead to increases in the cycle time (i.e., the total time required in the factory to complete one end-product) as well as delayed feedback concerning possible quality or scheduling problems between the departments.

The cycle time itself affects the lead-time; that is, the longer it takes to complete the product, the longer it will take for the product to reach the customer. The significance of maintaining short lead-times in a competitive market is well-known. Consequently, the wasted material handling dollars generated by a poor layout may actually be small compared to the cost of running a factory with long lead-times and excessive WIP. Next time you are faced with the question of what to do with the factory layout, ask yourself what it would mean to save material handling dollars and reduce the travel distances for the parts. But don’t forget to also ask yourself what it would mean to reduce your WIP and lead-times.

Factory Physics: The Science of Lean Manufacturing

By Izak Duenyas, Associate Professor, IOE

Just-In-Time and lean manufacturing are extremely popular buzzwords in industry today. Many companies hire Just-In-Time consultants who typically undertake a high-profile pilot project and educate employees on the basics of takt time, kanban, and setup reduction.

In a recent paper, Buzacott (1995) differentiates between naïve JIT and sophisticated JIT. He writes that naïve JIT assumes that “systems have no uncertainty and variability and that good managers can get rid of any process variability... Once this is done, we can then aim at the ideal lot size of one.” As Buzacott also points out, naïve JIT usually works well for large corporations for dealing with much smaller suppliers or as a pilot project in a small portion of the plant. However, when further areas within the plant or a whole division attempt to introduce JIT, progress is lacking. Much of this is due to the fact that JIT is easy to describe as an ideal; however, although most practical JIT manuals tell companies where they want to be, they do not necessarily do a very good job of describing how to get there. For example, the practical JIT literature emphasizes the importance of reducing setup times to ideally achieve setup times of zero. However, it does not give a way to prioritize setup reduction.
projects to achieve the largest improvements first. Similarly, reduction of process variability to zero is emphasized but in the pragmatic JIT literature, there is no guidance on how to identify the areas where variability reduction would have the highest impact.

One of the central tenets of the JIT philosophy is that inventory is evil as it hides the problem areas. Just as when the level of water is decreased, rocks will become more visible; when inventory is decreased, the problem areas will become more visible. Therefore a lot of JIT consultants will prescribe cutting inventory levels to find out the problem areas in a plant. The assumption is that the only reason problems are not solved is because inventory is hiding them. However, it would clearly make more sense to first identify all the non-value added processes, all sources of variability, uncertainty and disturbance in a manufacturing system. One could then prioritize improvement alternatives based upon the effect that each alternative would have on basic performance measures such as Work-In-Process, cycle time, and throughput.

Factory Physics, a recent book by Hopp and Spearman (1996) which won the Institute of Industrial Engineers book of the year award, develops basic manufacturing laws and a systems approach that help managers identify the manufacturing strategies that will be most effective in their environment. The “laws” of Factory Physics describe the underlying logistical behavior of manufacturing systems, including the fundamental relationships between basic performance measures such as throughput, Work-In-Process, manufacturing cycle time, and process variability. By understanding these relationships, and using the powerful analytical tools described in the text, managers can diagnose their manufacturing systems and make major improvements in throughput, cycle time, customer service, and quality. In particular, the laws of “Factory Physics” give managers a way to identify the largest sources of waste and variability and to compute the effect of alternative improvements before implementing them. As Hopp and Spearman note, it makes much more sense to use sonar to identify the rocks and remove them before lowering the level of water. “JIT, as described in the American literature, offers neither sonar (i.e., models that predict the effects of system changes) nor a sense of the relative economics of level reduction versus rock removal—that is, procedures for evaluating the trade-offs between the benefits of WIP reduction and the costs of eliminating problems.” Factory Physics offers both.

Hopp and Spearman have developed an innovative course based on their book. I had a chance to teach an offering of their course during my sabbatical at Northwestern and Wally Hopp and I also taught an executive short course last summer in Ann Arbor which was very well received. It seems that many companies are now realizing the dangers of management by buzzword and imitation and looking for tools that provide means of sound analysis.

I will offer a version of the factory physics course next term for students in the Tauber Manufacturing Institute at the University of Michigan and continue to offer short courses to industry. My graduate students and I are also continuing our research on development of tools to address different problems using the factory physics framework.

References:

What Led Me to Lean Manufacturing
By Walt Hancock, Professor Emeritus, IOE

In the early 80’s, the American auto industry had a renewed interest in quality control of their manufacturing processes. This renewed interest led to a substantial increase in statistical process control, design of experiments, and process capabilities. This effort continued throughout the eighties. Many assumed that the quality methodologies were the primary reason why Japanese automobiles were of superior quality until we began to hear that the Japanese had stopped using control charts and were dissatisfied with design of experiments because it was too cumbersome. We began to hear about the Toyota
Lean Manufacturing at the Japan Technology Management Program

By John Shook, Adjunct Lecturer, IOE and Director, Lean Manufacturing Systems, JTMP

The Japan Technology Management Program is a major IOE program that has sponsored numerous Lean Manufacturing projects and programs. JTMP was founded by Jeff Liker and John Campbell, Professor of Political Science, in 1992 with funding from the Air Force Office of Scientific Research. In 1994, the Program took a strong Lean Manufacturing focus as they brought in John Shook from Toyota and then Mike Rother from the Industrial Technology Institute to develop new Lean initiatives. The results have been outstanding. U-M has the reputation of being a national leader in lean manufacturing. In this article we will describe what JTMP has contributed to lean manufacturing in IOE. But first it is worth taking a few paragraphs to define what we mean by lean manufacturing.

JTMP’s view of Lean Manufacturing:

Beginning in 1984, the International Motor Vehicle Program at MIT began its now-famous five-year, five-million dollar study of the world auto industry, the findings of which were summarized in the bestselling volume, The Machine that Changed the World. The researchers concluded that the system of manufacturing pioneered by Taiichi Ohno at Toyota differed so fundamentally from mass production as to warrant recognition as a new kind of manufacturing. As they put it: “(The system) required half of everything to produce twice as quickly so we decided to call it lean.”

Since the publication of that report, extraordinary attention from industry, academia, and government has focused on lean manufacturing with little furthering of the task to define “lean” but with much focus on the Toyota Production System. Considerable confusion has resulted regarding exactly what this “lean” is (what does it look like, how can we say that a given production system or site is “lean” or not?). Some assert that lean is simply another word for the Toyota Production System. Others have expended extraordinary amounts of time and effort developing related theories that essentially rehash the same or similar concepts (agile manufacturing, re-engineering, continuous improvement), adding little of substance to the issue but much to the confusion.

The concepts “mass production” and “lean production” do not refer to production systems so much as they reflect ways of thinking about production, the assumptions that underlie how people and institutions formulate solutions to the problems of organizing people, equipment, material, and capital to create and deliver products for customers. Mass and lean are paradigms that reflect and inform the thinking about production within particular cultures and eras. From these paradigms are developed production systems. The original Ford production system and all the systems subsequently developed by auto and auto
parts manufacturers, as well as virtually all manufacturing systems in most industries around the world have reflected the mass way of thinking for most of the 20th Century. The rise of the Japanese manufacturing industry after the second world war took place in a constrained, resource-poor environment where the mass paradigm would simply lead to failure. The struggles to adapt to these circumstances gave birth to a new approach to manufacturing, lean production, which is best exemplified by the Toyota Production System (TPS). TPS is nothing more or less than one set of solutions to achieve the “lean” ideal.

The term “Lean Manufacturing” is unfortunate in a couple of ways. First of all, “Lean” should not be confused with “mean” or with simple “downsizing” or “re-engineering.” Lean means fundamentally rethinking and changing the way we do business, with the aim of providing optimum value for the customer with a minimum of waste. Second, it is not just “manufacturing,” but demands the “rethinking of all business processes” product development, engineering, operations management, the customer interface, and all corporate governance functions. Thus, Lean refers to an underlying philosophy that supports a comprehensive system that consists of numerous specific tools and techniques.

Following are descriptions of a few of the Lean activities sponsored by JTMP.

The Annual U-M JTMP Lean Manufacturing Conference.

June 1999 will see the 5th Annual U-M JTMP Lean Manufacturing Conference. The conference attracts a crowd of over 400 attendees from various ranks, functions and industries, sharing a common interest in Lean Manufacturing. The conference has become recognized as one of the premier events in the “Lean world”.

Lean Manufacturing course in IOE.

JTMP has subsidized one section of IOE 425 since Winter semester of 1995.

IOE has offered the course, “Manufacturing Strategies” (IOE 425), since the fall of 1990. Created by Professor Emeritus Walton Hancock as Special Topics 591 in the Winter of 1987, the course originally focused on providing students with more real-world manufacturing exposure than the students were getting through their ordinary course work.

The course quickly evolved along with the thinking of Professor Hancock. By the time of the publication of The Machine That Changed the World by Dan Roos, James Womack, and Dan Jones in 1990, Professor Hancock had already become one of the first engineering scholars to embrace lean manufacturing as the new manufacturing paradigm and to begin teaching about it to university students. As he became convinced of its power he made lean manufacturing the focus of the Manufacturing Strategies course. The course became one of the most popular courses of the department, with a perpetual waiting list of dozens of students.

Professor Hancock retired from the university in 1996. In the Fall of 1994, John Shook sat in and provided some lectures for Professor Hancock’s last semester of teaching Manufacturing Strategies. The following semester John began teaching the course, utilizing the basic structure established by Professor Hancock, and drawing upon his Toyota experience to make the content even more specifically focused on the Toyota Production System. New lecture material and exercises were added, so the course took on a look and feel not dissimilar to a Toyota internal training course for employees.

The following semester (Winter 1996), Mike Rother co-taught the course with John, and the two have alternated teaching one section of the course since that time, steadily revising and improving the course along the way. Over the following couple of years, Mike strove to improve the teaching materials, making them more professional and understandable and adding several new exercises. An improvement of particular note, beginning in the Fall of 1997, was the inclusion of Value Stream Mapping as a major focus of the course in general and specific focus of the plant visits and reports in particular.

Throughout this time, Don Jahncke, an ex-Ford Motor Corporation plant manager, has taught another section...
of the course, also using the structure established by Professor Hancock, and utilizing his extensive experience in manufacturing gained from many years working in manufacturing management at Ford. Don Jahncke worked closely with Mazda to launch Ford’s Escort plants in Mexico and Dearborn and was exposed to the Mazda Production System, modeled after the Toyota Production System.

Jeff Liker began teaching the course in the Fall of 1998, with plans for Steve Rasch to teach a section in the Fall of 1999. Beginning with the Fall of 1999, IOE 425, like many other courses in the College of Engineering, will switch to a 2 credit hour structure, which will result in further evolution and no doubt improvement of the course. One thing is certain, the basic purpose of the course will remain the same, to provide a balanced look at Lean Manufacturing as a strategy to meet the manufacturing challenge: how to make what the customer wants — no more, no less — when he or she wants it, with a value stream that has the shortest possible lead time and a minimum of waste.

Objectives of the Manufacturing Strategies course:

1. Acquire understanding of lean manufacturing as a philosophy, as a system, and as a set of techniques.
3. Learn about and practice Value Stream Mapping.
4. Acquire the ability to quickly and thoroughly assess a manufacturing facility.

The focus of the course is plant floor manufacturing and management. Other systems — supplier management, human resources, product development — are brought in as appropriate and as they relate to or support manufacturing.

Internships.

Internships for students in Japan and with companies in the U.S. attempting to implement Lean. JTMP has arranged internships for eight students at four American and three Japanese companies.

Lean Study Tours.

To Japan. JTMP has twice led study tours of leading lean companies in Japan. The tours have been attended by a mix of industry executives and faculty. U-M faculty who have joined the tour include IOE faculty Jeff Liker, Walt Hancock, Izak Duenyas, Tava Olsen, as well as Business School faculty Bob Haessler, Roman Kapuzinski, Will Mitchell and Shannon Anderson. Many of these faculty members focused their research and teaching toward more lean topics following their experience on the tour.

To Toyota Kentucky. In the Spring of 1998, students and faculty joined a bus trip to visit Toyota’s Georgetown, KY assembly plant and a leading JIT supplier, Summit Polymers, combined with a pre-visit seminar on “What is Lean Manufacturing?”

Lean implementation projects.

CIUG. Mike Rother is a co-creator, along with Kiyo Suzaki, of the Continuous Improvement Users Group method of learning about and implementing Lean. Mike led a JTMP sponsored project involving five area manufacturers in a one year lean joint Lean initiative.

Mechanical Products. JTMP is partnering with the Industrial Technology Institute to work with this Jackson, MI-based aerospace company in a hands-on implementation project that has already led to significant improvements in plant floor operations.

Short Courses, lectures.

Lean Executive Seminar. The first JTMP Lean Executive Seminar is was held November 11-13 1998. A three-day curriculum took about thirty participants through a detailed overview of Lean, including a hands-on value-stream mapping exercise at a host company’s plant floor.

Conclusion: Lean in the IOE Department.

Promoting Lean within IOE has been a central objective of JTMP for the past five years. The inclusion of more Lean content in various courses, the addition of new, specifically Lean-focused courses, the conduct of Lean-related research by faculty and students, and the creation of numerous Lean-oriented conferences and seminars are all evidence of significant progress in the development of a Lean curriculum within IOE.
Center For Ergonomics
By Thomas Armstrong, Professor, IOE and Director, Center for Ergonomics

The Center for Ergonomics continues to be a focal point for ergonomic related teaching and research within the Department. The NIOSH Occupational Health and Safety Engineering Center continues under the leadership of Professor Monroe Keyserling as one of the major sources of support for students wishing to pursue graduate education in occupational health and safety. Although there has been some tempering in the overall demand for safety and health professionals, the demand for graduates from our programs remains high. Professor Gary Herrin is completing a project on the quality, productivity and health/safety impact of ergonomics in manufacturing. Professor Yili Liu just returned from a sabbatical at the University of California at Irvine where he completed his contribution to Wickens, Gordon, and Liu: Introduction to Human Factors Engineering, a new textbook on ergonomics which was introduced in IOE 333 this year. Professor Liu also continues his research in the cognitive area of human computer interaction and driving. Dr. Martin is involved in studies of virtual reality, keyboards, and vibration exposure. Dr. Martin has also joined Professor Chaffin as a co-author of the third edition of Chaffin, Andersson and Martin: Occupational Biomechanics, which is due out in time for the winter term. Dr. Sheryl Ulin directs a Safety Education Training Grant from the State of Michigan. In addition to providing a service to small Michigan employers, this project has spawned many research opportunities. Randy Rabourn directs the NIOSH ERC Continuing Education program. The Center continues to offer a selection of state-of-the-art education health, safety, and ergonomics programs and symposia. Check out our web page for the latest offerings. James Foulke, Charles Woolley, and Eyvind Claxton continue to provide essential technical support for ergonomic research and teaching activities.

Professor Chaffin has relinquished the directorship of the Center for Ergonomics, to focus on a new initiative: Human Motion Simulation. This initiative is concerned with development of biokinematic models that simulate human movements with a high degree of fidelity. We are grateful for the direction and standard of excellence Professor Chaffin has given to Center and the faculty, staff, and students personally. Professor Tom Armstrong has moved to the department full time and is acting director of the Center for Ergonomics. He is both honored and humbled by the prospect of representing faculty and staff of the Center for Ergonomics. Professor Armstrong is also director of a newly funded Rehabilitation Engineering Research Center concerned with ergonomic barriers to employment. Co-investigators in this initiative include Professors Don Chaffin, Monroe Keyserling, and Bernard Martin and Dr. Sheryl Ulin from the department. It also includes Professors Andrew Haig, Simon Levine, and Robert Werner from the Department of Physical Medicine and Professor Alfred Franzblau from the Department of Environmental and Industrial Health. Professors Werner and Franzblau also hold Research Scientist positions in the Center and provide important clinical links for health related projects.

Dr. Jerry Duncan (middle) is shown presenting a $17,000 thesis support grant and scholarship from the John Deere Foundation to IOE PhD candidate, George Page (left) at the annual Human Factors and Ergonomics Conference this past October. Don Chaffin (right), George’s thesis co-chair, looks on during the presentation.
Program Updates

Financial Engineering Program Update
By John Birge, Department Chair and Professor, IOE

The Master of Science in Financial Engineering (M SFE) program began its second full year this September with over 30 students from a variety of backgrounds. Several students come from Ph.D. programs in other departments such as Economics, Mathematics, and Finance. Others have full-time work experience in the financial industry at institutions such as Ford Credit, Comerica, and the Federal Reserve. Students converting from traditional manufacturing and design positions compose another portion of the class. Placements of graduates so far include investment banks (e.g., Morgan Stanley Dean Witter), corporate treasuries (e.g., Ford Credit), financial consulting (e.g., Bain), and software providers (e.g., Infinity).

To help students gain greater practical experience, the M SFE program has expanded its laboratory with real-time feeds from all major exchanges and hardware and software donated by Reuters, Intel, and Fame. Using these resources, students are encouraged to try their skills in investment contests. Juan Riveros, for example, a joint Economics Ph.D.—M SFE student, won the Eurobanco Commercial Bank competition by increasing a paper portfolio from $250,000 to $12 million in 3 months.

To help provide research as well as training, the M SFE program is currently establishing an affiliates program beginning with a donation from Ford Motor Company. Other affiliates are expected to join shortly. You can learn more about this effort and other information on the M SFE by visiting its web page at www.umich.edu/~fep.

University of Michigan Rehabilitation Engineering Research Center: Ergonomic Solutions for Employment
By Thomas Armstrong, Professor, IOE and Director, Center for Ergonomics

The Department of Industrial and Operations Engineering is the home of the new University of Michigan Rehabilitation Engineering Research Center: Ergonomic Solutions for Employment. This Center brings together investigators from the College of Engineering, Medical School and School of Public Health to develop a model system to facilitate placement and return to work persons with physical restrictions and to perform studies of causes and management of musculoskeletal disorders. The model includes procedures for assessing workers, analyzing jobs and work sites, identifying accommodation needs, and selecting interventions and assistive devices. A hierarchical system is proposed for evaluating workers and jobs so that investigators can quickly identify appropriate medical or job interventions or assistive devices. Investigators from IOE and the medical center work as a team to review cases and develop interventions. The team’s experience is captured in a relational database for evaluation of the proposed
model and for sharing with others. The RERC includes three intervention projects that will examine human and ergonomic factors in the use of voice recognition technology for more effective use and improved outcomes; use of material handling devices for accommodation of persons with low back pain; and exercise therapy for specific back muscles for controlling low back pain. Four biomechanics projects will provide tools for: evaluating effects of intermittent hand exertions; for evaluating static trunk postures; for managing carpal canal tunnel syndrome based on intracarpal canal pressure; and managing carpal tunnel syndrome cases and related upper extremity disorders. Two national level conferences and annual continuing education courses on ergonomic barriers to employment are proposed for sharing information with other professionals. RERC investigators include: Tom Armstrong, Don Chaffin, Jim Foulke, Monroe Keyserling, Bernard Martin, Sheryl Ulin and Chuck Woolley from IOE; Andy Haig, Mike Geisser, Simon Levine and Robert Werner from Physical Medicine; and Al Franzblau from Occupational Medicine. Project investigators will be assisted by graduate and undergraduate students from IOE and Biomedical Engineering.

Near Zero Stamping Program: Overview

By Jan Shi, Assistant Professor, IOE and Technical Director, Near Zero Stamping Program

The Agile and Precise Sheet Metal Stamping—Near Zero Stamping Program (NZS) has entered its third year. The NZS program is funded jointly by the NIST—Advanced Technology Program and the Auto Body Consortium (ABC). The goal of the program is to develop a new generation of sheet metal stamping technologies in order to achieve precision and agility in sheet metal stamping. This program has been carried out jointly by 22 Auto Body Consortium companies, in cooperation with the “Big Three” domestic automobile companies (Chrysler, Ford, and General Motors), and five research institutions (the University of Michigan, Ohio State University, Wayne State University, Sandia National Laboratory, and the Industrial Technology Institute).

In the past year, significant progress has been made in NZS research. Fundamental issues in die design and tryout, stamping signature analysis, die/press proactive maintenance, and innovative measurement strategies have been addressed. Several systems, including global strain measurement, optical checking fixtures, the robot-based measurement system, the material handling grip location optimization package, and active binding-controlled dies have been developed and tested in the projects. The program has generated significant interest among the stamping industry. A significant milestone
A ceremony was held on August 7, 1998 to dedicate the new stamping laboratory. Pictured (left to right) are ME Professor, Jun Ni, Mr. Ernie Vahala, President of the Auto Body Consortium and College of Engineering Dean, Stephen Director.

was the dedication of the stamping lab on August 7, 1998. The stamping lab features two state-of-the-art industrial presses, various pieces of testing equipment, and specially designed dies. According to CoE Dean Steve Director and Mr. Ernie Vahala of ABC, the stamping research lab represents the successful cooperative partnerships among the university, industry, and government in research and development efforts. It will have significant influence on stamping-related research and education. The stamping research lab will be used for various research projects in NZS research, the NSF Industry/University Cooperative Research Center, the S.M. Wu Manufacturing Research Center, and for teaching the courses Automotive Body Manufacturing Processes (IOE591-042) and Sheet Metal Forming (ME582).

New Stamping Laboratory Dedicated
By Rod Perkins, Temporary Assistant Editor, S. M. Wu Manufacturing Research Center Publications

At an August 7, 1998, ceremony, the University of Michigan and the Ann Arbor-based Auto Body Consortium dedicated a new stamping laboratory at 1921 Green Road, Ann Arbor. Guests included Dr. Steven Director, Robert J. Vlasic Dean of Engineering of the College of Engineering (CoE) at the University of Michigan (U-M), Mr. Ernie Vahala, president of the Auto Body Consortium (ABC), and representatives from companies that donated equipment for the outfitting of the Stamping Lab.

This new Stamping Lab, with its industrial-quality presses, establishes the U-M as a leader in terms of stamping-related research. The lab provides the first-class facilities for both research and education. U-M is one of the few universities in the world to have the capability to perform stamping research at the level and scale afforded by the Stamping Lab. Sheet metal stamping is of key importance in many industries, particularly in automotive industry. The Stamping Lab, with its state-of-the-art presses and facilities, will enable U-M to conduct world-class research and education in stamping. Additionally, the industrial presses in use at the Stamping Lab ensure that the research performed at U-M can be tested and validated in a semi-industrial environment. The Stamping Lab thus plays a critical role in linking academia and industry.

The project strengthens partnerships between the CoE and industry. Faculty members and students can now work more closely than ever with engineers and technicians from industry. This commitment from academia and industry lays a solid foundation for the future research and development.

Program in Manufacturing (PIM)
By Henia Kamil, Administrative Associate, PIM

The Program in Manufacturing (PIM) is now entering its sixth year at the College of Engineering. Since last October, Thomas W. Weber, PIM's first Doctor of Engineering student completed his degree of D. Eng. in Manufacturing Degree. PIM students also initiated their advisory committee, named PIM PAC. The first elected officers were Jeff Ahrens (M. Eng./MBA), Micheline Cudhay (M. Eng./MBA), Kellie Durling (M. Eng.), Sherri House (M. Eng./MBA), Steve Kowalski (M. Eng.), and Walter Ingram (M. Eng.). The group provides the PIM Director and staff with input on students' needs and participated in the 1998 April External Advisory Board Meeting. In Winter 1998, General Motors, Technical Education Program (GM

Program Updates
TEP), selected PIM as its corporate distance-education provider for the Master's in manufacturing. The Master of Engineering in Manufacturing will be delivered to GM employees worldwide through the College of Engineering's Center for Professional Development. In addition to GM TEP, there are distance-education students from United Technologies, Chrysler, and Bosch.

In January of 1998, PIM moved to its new location, the Integrated Manufacturing Systems Laboratory (IMSL). IMSL is located in the 1100 H H Dow building, renovated space with a grant from the National Science Foundation and the College of Engineering. The new location houses the NSF Engineering Research Center for Reconfigurable Machining Systems, the Sam Wu Research Manufacturing Center, the NSF Industry/University Collaborative Research Center, and PIM. The total space allocated for IMSL is 22,000 sq. ft. and houses faculty, students, and staff affiliated with manufacturing activities in the College of Engineering.

PIM established in cooperation with the Industrial Engineering Department the Engineering Global Leadership program, which allows students to acquire a BS in IOE/M Eng. in Manufacturing in 5 years and is closely associated with the Joel D. Tauber Manufacturing Institute.

On April 24, 1998, PIM held its Spring External Program Updates Advisory Meeting where the PIM graduating class was honored for its achievements. The total number of graduate students as of August 1998 is 65 students.

In September 1998, Professor A. Galip Ulsoy, PIM's founding Director was appointed Chair of the Department of Mechanical Engineering and Applied Mechanics, and Professor Debasish Dutta, who served as PIM associate director during the academic year 1997-98, was appointed as the new Director of PIM.

PIM has also seen growth in its student body with 94 students pursuing the different degrees offered by the program.

For further information on PIM, please contact Henia Kamil at (734) 764-3312 or hek@umich.edu, or access the PIM homepage at http://www.engin.umich.edu/prog/pim/

Program in Occupational Safety Engineering and Ergonomics

By W. Monroe Keyserling, Professor, IOE and Director, University of Michigan Center for Occupational Health and Safety Engineering

The IOE graduate program in Occupational Safety Engineering and Ergonomics has received a grant from the National Institute for Occupational Safety and Health (NIOSH) totaling $140,000 for the 1998-99 academic year. This grant is used to support the training of Masters and Ph.D. students who plan professional or research careers in Occupational Safety and Ergonomics. In addition, the grant supports library and laboratory facilities in the IOE Building. For additional information on financial aid opportunities, contact Prof. Monroe Keyserling.

The Integrated Manufacturing Systems Laboratory, located in the former Dow Engineering Library, opened its doors on January 1998. It is shared among the S. M. Wu Manufacturing Research Center, the Engineering Center for Reconfigurable Systems, and the Program in Manufacturing.
New IOE Research Program: VCAP

By Jeffrey Liker, Newsletter Editor, Associate Professor and Director, VCAP and Japan Technology Management Programs

The Value Chain Analysis Program (VCAP) is housed in the Industrial and Operations Engineering Department of the University of Michigan. VCAP was founded with alumni funding (J. Dann Engels, Principal of Optiprise, Inc.) to connect University of Michigan research and education to real-world problems in value chain analysis and management. VCAP supports state-of-the-art education and research on tools and methodologies used to efficiently and effectively manage the total value chain in manufacturing enterprises. The value chain encompasses the entire value creation process which transforms materials (within the enterprise as well as in the total supply chain) and information in order to satisfy customer needs. VCAP seeks to optimize the total system through appropriate mixes of people, organization, logistics, and information technologies. The focus is on streamlining the value chain to reduce non-value-added waste in the system. The focus of VCAP includes the following areas:

- Managing interorganizational relationships in the value chain
- Information systems for enterprise integration
- Mathematical models for scheduling and distribution systems
- Financial justification of integrated enterprise systems
- Just-in-Time manufacturing and delivery systems
- Managing systems change

VCAP works with its sponsoring companies to encourage and support education and research in a variety of ways.

- Provide direct financial support for university-based research.
- Arrange for access to affiliate companies by U-M faculty and students so they can work on real problems in shaping their research.
- Encourage collaborative working relationships between affiliate companies and U-M faculty and students.
- Underwrite short courses and seminars.
- Encourage publication of articles both in traditional academic journals, as well as in professional publications read by practitioners.

Companies are being sought as affiliates and supporters. VCAP will work collaboratively with affiliate companies to define relevant research topics, share research findings, conduct education and training seminars, while protecting intellectual-property rights. Please direct all inquiries about VCAP to Jeffrey Liker, Director, VCAP, (734) 763-0166.

Tauber Manufacturing Institute - Project Spotlight!

By James Bean, Professor, IOE and Co-Director, Tauber Manufacturing Institute

The Tauber Manufacturing Institute (TMI) facilitates the interaction between faculty and students in the College of Engineering, U-M Business School, and many industry partners. It is best known for the Team Projects in which teams of two to four engineering and business students, advised by faculty from both units, go on-site to solve strategic manufacturing problems facing partner companies. Participating students are enrolled in the Engineering Global Leadership Honors Program (EGL, based in IOE), the Masters of Engineering.

This year's winners, Team Steelcase, took top honors for its work in implementing lean manufacturing. The team consisted of (left to right) Bill Reeves, Ryan Schmidt, Charlie Choi and Chris Spears. Here they are accepting their first place check from Joel D. Tauber (center).
The fourth Spotlight! took place on September 25 at the Michigan League. Deans B. Joseph White of the U-M Business School and Stephen Director of the College of Engineering gave opening remarks. Former TMI Co-director Brian Talbot was honored for his service to the Institute. Then 300 attendees witnessed 68 students give 46 presentations on the current state of manufacturing. The day concluded with Joel Tauber presenting scholarship checks to five teams judged best by the executive panel.

Team Steelcase took top honors for its work in implementing lean manufacturing. Savings of $5M per year were reported. The team consisted of Bill Reeves (EGL), Chris Spears (MSE in IOE), Ryan Schmidt (M.Eng. Manufacturing student with an IOE undergrad) and Charlie Choi (dual degree, MBA/MC, M.Eng. Manufacturing) and was advised by Professors Yavuz Bozer of IOE and Bill Lovejoy of UMBS.

Second prize, Team Intel, re-engineered worldwide logistics for delivering completed product to customers from the Chandler, Arizona plant. Students included David Rochlen (EGL), Jonathan Safran (MBA/MC) and Amarpreet Singh (MSE in IOE) who were advised by Professors Rachel Zhang of IOE and Ana Muriel of UMBS.

Third prize was a tie between Team Alcoa and Team ITT Automotive. Professors Tassos Perakis of Naval Architecture and Joan Penner-Hahn of UMBS advised the Alcoa team of Erin Eisenberg (EGL), Jennifer Dunn (EGL), and Douglas Grady (MBA/MC). They developed new production strategies and markets for Alcoa’s ultra pure aluminum products. The ITT Automotive team implemented the Toyota Production System in Juarez, Mexico. Students Shawn Kahn (EGL), Jie Huang (M.Eng. Manufacturing) and Ali Samikoglu (MBA/MC) were advised by Dr. Dariusz Cegarlek of Mechanical Engineering and Applied Mechanics and Professor Robert Haessler of UMBS.

Team Cabot took fifth prize, a great accomplishment for a company involved with the Team Projects for the first time. Professors Steve Pollock of IOE and Shannon Anderson of UMBS advised students Phiroze Irani (EGL) and Jay Khetani (MBA/MC).

Program Updates

The process of setting up the Team Projects begins each November. Companies submit project proposals and TMI staff work with them to develop the most valuable projects for the firm and TMI students. In January, companies present their proposals in Ann Arbor. In February, the firms return to interview students of interest to the firm and those who are interested in the firm. Firms and students rank each other. These rankings, together with the rules for team formation, are fed into an integer program and collective happiness of students and firms is maximized. Projects take place on-site during early May through late August.

The Team Project annual cycle concludes with the Project Spotlight! each September. The Spotlight! is a manufacturing conference where presentations are made by all project teams. A panel of industry executives judges the projects and presentations. At the conclusion of the day, scholarship awards are given to the projects judged best. In truth, all projects win as the students gain valuable experience presenting before a large and sophisticated audience and advertise their work to faculty and potential employers. The Spotlight! has become the beginning of the annual recruiting season. Many students receive job offers or requests to interview from attending companies.
Student Organizations

The Project Spotlight! began in 1995 as an opportunity for the Team Project students to report back to the University community. In the past four years it has developed into a substantial conference and recruiting event. Over 50 companies were represented this year by 200 industry executives seeking to learn what topics are currently important to a variety of manufacturing companies, and how those firms are addressing them. Many also take the opportunity to begin employment discussions with graduating students. We invite you to join us next September for the fifth Spotlight! Watch the TM I web page (www.tmi.umich.edu) for details or contact Professor James Bean (734) 763-1454, jbean@umich.edu.

Team 3M members (left to right) Venkat Gopalakrishnan, Odell Mapp and Vincent Varner on site during their TMI project.

Student Organizations

Alpha Pi Mu (APM)
By Sarah Gorman, Chapter President

Alpha Pi Mu is continuing to provide opportunities for members to meet other students and become more involved in bettering our department and the college experience. Many of the successful events from the past will be held again this year along with a few new programs. A new community service event will involve building a relationship with an area high school. Our hope is to teach students about engineering, evoke interest in the field, and serve as mentors to the students. We will also participate in community service events such as Habitat for Humanity, Tech Day, Ronald McDonald House and tutoring. We will also award winners for the Wyeth B. Allen Memorial Scholarship and IOE Professor and Graduate Student of the Year. Fund-raising events will include a t-shirt/sweatshirt sale, resume book sales and caramel apple sales. We are continuing the tradition of the IOE newsletter, the Industrial Blueprint. The articles cover a vast amount of topics concerning IOE students and are mostly written by APM initiates. In the area of professional development, we will continue to have company presentations, the exam file, senior advice night, and the IOE Career Pathways dinner. We are also thinking of having a graduate student panel and planning an IOE Career Fair with IIE and VIBES. Last but not least, we will take part in many social events this year. We will compete with Tau Beta Pi for the Capture the Flag trophy. We will have Happy Hours, the IOE barbecue, the initiation banquet, Rock ‘n Bowl, and intramural sports. In facilitating a relationship with faculty, we will continue to sponsor IOE get-togethers and invite professors to speak at APM meetings. Having faculty-student luncheons is a new event we would like to try. It will be a very exciting and productive year!

Institute of Industrial Engineers (IIE)
By Christopher J. Miller, Chapter President

The Institute of Industrial Engineers strives to provide an awareness of the Industrial and Operations Department and its resources. IIE works to develop an interdepartmental relationship and present information into career opportunities. Maintaining a strong relationship with the IIE Detroit Senior Chapter creates an industry connection easily accessed by all.
students. We also try to plan events that will bring IOE students together. This semester we planned or are planning many activities such as Rock ‘n’ Bowl, Career Pathways Reception, IOE Career Fair, Tech Day booths, IOE T-shirt fund-raiser, and a Yost skate night. We also put out several publications such as the Industrial Blueprint (in coordination with Alpha Pi Mu) and the IOE Yearbook, which comes out in April.

Vibrant Industrial Black Engineering Students (VIBES)
By LaBrina V. Loving, President

Vibrant Industrial Black Engineering Students (VIBES) was founded in 1993 for the purpose of improving the preparation of minority industrial engineers at the University of Michigan. Since that time, the organization has expanded tremendously and seen many of its members graduate, embodied in the VIBES spirit of academic excellence, professional success and community awareness. We have set the following objectives in order to accomplish our goal:

- Provide the necessary academic resources so that students may compete on an academic level at the University.
- Increase the awareness of industrial engineering among minorities and the many options existing in the field.
- Increase relations between students and faculty members.
- Help develop professional skills so that students are prepared for careers after graduation.
- Provide a strong support network through student, corporate, faculty, and alumni participation.

We realize that the key to our success will be in our ability to find proper resources and extending those resources to our students. This year, we are hard at work planning activities that can bring together many resources for our students. Some of the upcoming events that we have planned are Options in Industrial Engineering Day, Plant Trips, attendance at Midwest Minority Career Conference, Faculty-Student Mixer, IOE Career Fair, Alumni Dinner and Recognition, monthly social activities, and monthly industry-sponsored lectures and workshops. In addition to these events, we are organizing both student and corporate mentorship programs, where students can have more personal relations on an on-going basis.

VIBES is very excited about the possibilities that networking with alumni can bring to our organization. We invite interested alumni to contact us at vibes-ebd@umich.edu or please call us at (734) 764-3026.

VIBES would like to thank Dr. Jerry Duncan and the John Deere Foundation for their most generous support. We greatly appreciate it.

Society of Women Engineers (SWE)
By Brooke Laitala, 1998 President

The Society of Women Engineers hit the ground running this fall with our Pre-Interview program going strong and the successful completion of our largest ever Career Fair. Thousands of students and over 215 companies participated. One of our largest events this Fall was the Women in Engineering Symposium on November 8. This one day event will include panels and seminars in support of women in engineering. Community service events at the Ronald McDonald House, high school visits to tell students about the opportunities in engineering, and our high school student Shadow Day are planned for the semester. For more information about events please call (734) 763-5027 or e-mail swe.info@umich.edu.
**Tom Armstrong, tja@engin.umich.edu**

Thomas Armstrong continues to study manual work and health issues. He recently served on a steering committee of the National Research Council that brought together an internationally recognized group of investigators to review the scientific evidence underlying work related musculoskeletal disorders (www.nap.edu). He continues to serve as chairperson of the American National Standards Institute accredited Z-365 committee on Work Related Cumulative Trauma Disorders - now in its ninth year. This summer he delivered a keynote address at the International Conference on Hand and Arm Vibration Disorders in Umea, Sweden. On the research front he recently completed a study concerned with prevention and medical management of musculoskeletal disorders in offices. His energies are now focused on the our new Rehabilitation Engineering Center on Ergonomic Solutions for Employment, acting as director of the Center for Ergonomics and developing some new course offerings for IOE graduate and undergraduate students.

**James Bean, jbean@umich.edu**

James Bean continues as Ford Motor Company Co-Director of the Tauber Manufacturing Institute (TMI) and advisor to the Engineering Global Leadership Honors Program. With Sloan Foundation funding, he has been researching replacement strategies for portfolios of assets such as truck fleets where capital expenditure budgets link the decisions for each individual asset. Working with Professor Chelsea White, Professor Bean's study of partially observed Markov decision processes is funded by NSF. Professor Bean is Secretary of the Institute for Operations Research and the Management Sciences. He teaches a course in Integrated Product Development and a project course based on the TMI Team Projects.

**John Birge, jbirge@umich.edu**

John Birge has just been elected President-Elect of the Institute for Operations Research and Management Science (INFORMS). In this role, he will focus on increasing global awareness of OR/MS and its potential for improving 21st century life. He has also been active in developing the U-M Financial Engineering Program, which now has more than 30 students. His research includes, among other activities, a study of the emerging deregulated electric power market, the pricing of capacity and other resources in networks, and the expansion of securitized assets in other arenas.

**Yavuz Bozer, yabozer@umich.edu**

Yavuz Bozer continues to work in the area of facility layout and material handling systems. His recent work is concerned with multi-period, dynamic layout problems and the analysis of automated storagel/retrieval systems (or "stockers") under stochastic demand. During the summer of 1998 he held a workshop at the U-M sponsored Management Briefing Seminars at Traverse City, and subsequently a summer short course in Ann Arbor, on the topic of lean manufacturing and facility layout. The book he co-authored (Facilities Planning, 2nd edition, Wiley) continues to be a leader in the market and has been translated into Japanese, Korean, and Chinese. He was promoted to the rank of Professor effective September 1998.
Don Chaffin, dchaffin@umich.edu

Don Chaffin this year launched within the Center for Ergonomics the Human Motion Simulation (HUMOSIM) Laboratory. Currently six companies, Ford, GM, Chrysler, Johnson Controls, Navistar and TRW, are supporting the Laboratory. This past summer, over 4200 human reaching motions performed by a variety of volunteers were studied. These motion data are being modeled with the assistance of Prof. Julian Faraway in the Statistics Department. The resulting models will enable quicker and more accurate representation of people’s motions in future computer-aided design of workstations, automobiles, and truck and bus interiors. Prof. Chaffin also has continued to work with the Ford Advanced Manufacturing Group to better predict how different mechanical lifting devices (e.g., hoists and balance arms) can be designed to improve productivity and reduce physical stresses on a workers’ back and shoulders.

Stephen Chick, sechick@umich.edu

Stephen Chick is continuing his simulation research by linking the theoretical with practical applications. He and Prof. Shane Henderson recently finished a project for reliability simulations for Chrysler. Prof. Chick is also participating in the ERC for Reconfigurable Manufacturing Systems to develop new methodologies to efficiently identify the most desirable manufacturing system from a large list of competing systems, using simulation and queueing models. A rather different application of simulation to aid decision making in public health, Prof. Chick and Prof. James Koopman (Epidemiology Department) are developing models and methods to improve the effectiveness of public health interventions to fight epidemics. They are currently funded by the CDC in Atlanta, and have begun work with the Genesee County Public Health Department. Prof. Chick is also the new advisor for the joint Masters of Health Services Administration and MS IOE program.

Izak Duenyas, duenyas@umich.edu

Izak Duenyas is back at Michigan from his sabbatical. He spent the 97-98 academic year at Northwestern University. He is continuing his work on production planning and control. His current projects include an NSF-funded project on dynamic scheduling, an NSF-funded project on investment decisions for reconfigurable manufacturing systems, and game theoretic modeling of pricing and capacity planning decisions. His Ph.D. student Scott Carr, jointly advised by William Lovejoy from the Business School, recently joined the UCLA Business School as an Assistant Professor. Professor Duenyas is heavily involved in editorial activities, serving on the editorial boards of Management Science, Operations Research, IIE Transactions on Scheduling and Logistics, Manufacturing and Services Operations Management, and International Journal of Flexible Manufacturing Systems.

Shane Henderson, sg.henderson@auckland.ac.nz

Shane Henderson is currently on leave at the University of Auckland in New Zealand. He teaches courses in mathematical modeling, queueing theory, linear programming and simulation. His research continues on the design of systems that contain a great deal of uncertainty. Examples where he is applying this work are

- The St. John Ambulance Service in Auckland, New Zealand determining how many ambulances are needed, and where to place them, to ensure response times to calls are acceptable.
- Voice Technology Ltd, a New Zealand based company that specializes in call centre solutions, in determining staff rosters that ensure acceptable customer service at low cost.
- Team New Zealand, the current holders of the America's Cup, developing simulation software that assists in making design decisions for racing yachts.
Gary Herrin, gdherrin@umich.edu
As part of the new “Curriculum 2000” initiative, Gary Herrin has developed a new sophomore level course IOE 265: “Engineering Statistics” which is being offered for the first time to all engineering students, Fall 1998. He has also been appointed Assistant Dean for Advising and First Year Studies. In his new position, he will be responsible for helping high school students make the transition to the College of Engineering and to select a program of study. He will also be responsible for supervising two new engineering courses (Engin 100 and Engin 101) which introduce the engineering profession and modern computing to freshmen engineers.

Monroe Keyserling, wmkeyser@umich.edu
Monroe Keyserling is one of several IOE faculty participants in the new U-M Rehabilitation Engineering Research Center. He is working with IOE Prof. Bernard Martin and Dr. Andrew Haig from the U-M Spine Center in a study of how people with chronic back pain and “normal healthy” people tolerate various trunk postures commonly found in manufacturing and service jobs. Guidelines for job design will be developed to reduce the incidence of new cases, and exercise therapies will be developed for back pain patients to speed recovery and return to work. He continues to work on developing ergonomic interventions for reducing the frequency and severity of injuries in automotive service parts packaging and distribution operations. Last winter, Keyserling spent his sabbatical working with the U.S. Department of Labor in Washington summarizing and critiquing biomechanical research on work-related musculoskeletal disorders. Prof. Keyserling continues to serve as Director of The University of Michigan Center for Occupational Health and Safety Engineering, an interdisciplinary research and training project with programs in Engineering, Public Health and Nursing.

Jeffrey Liker, liker@umich.edu

Vadim Linetsky, linetsky@engin.umich.edu
Vadim Linetsky’s research and teaching are in the area of financial engineering. He is teaching two new financial engineering classes he introduced into the IOE curriculum: IOE 552 (Financial Engineering I) and IOE 553 (Financial Engineering II). These courses are among the required core for the new graduate degree M.S. in Financial Engineering. His research focuses in derivative securities and risk management. He introduced a new type of option contract, the so-called step option (“Steps to the Barrier”, RISK magazine, April 1998 and “Step Options”, Mathematical Finance, forthcoming).
Faculty Focus

Yili Liu, yililiu@umich.edu

After obtaining tenure in the summer of 1997, Yili Liu spent the fall semester of 1997 doing sabbatical at the Institute for Mathematical Behavioral Sciences at the University of California at Irvine, where he attended numerous seminars and workshops, continued his research work, and completed the final version of an introductory human factors textbook. The textbook was published by Eddison-Wesley Publishers early 1998 and is being used in several universities. After returning to Ann Arbor early this year, Yili Liu continues to teach an ergonomics class and continues his research on human performance modeling, driver performance and driver-vehicle interface analysis, and several other studies with his Ph.D. students. Beginning the fall of 1998, Yili Liu is serving as the Undergrad Program Advisor of the IOE Department.

Bernard Martin, martinbj@umich.edu

Bernard Martin’s research interests involve the study of human sensorimotor control systems. He continues to study the effects of mechanical vibration on humans and more specifically the contribution of vibration to muscle fatigue and upper limb disorders. Muscle fatigue and low back pain is also studied as part of the research program developed within the new Rehabilitation Engineering Research Center. Muscle load in computer keyboard and pointing devices use, and in lifting/carrying tasks are studied in collaborative projects with the University of California, San Francisco and the Lawrence Livermore National Laboratory, respectively. Another current research project, taking place at Cybernet (a local high-technology company), involves the study of human behavior and the development of an interface for remote control of vehicles. He is the co-author, with D. Chaffin and G. Anderson, of the third edition of the book “Occupational Biomechanics” which will be published by Wiley in January 1999. He continues to teach ergonomics, human performance and biomechanics courses.

James Miller, jmmeng@umich.edu

Professor James Miller became Emeritus in 1998 but continues to teach IOE 563, Legal and Labor Issues each Winter Term. He also continues to advise PhD students and manage his outside engineering consulting company. His reduced University commitments became necessary as he and his wife, Rebecca, now have four children under age 6. Summers are spent on their ranch in Idaho. In Spring 1999 two more of his books on the topic of product warnings and safety instructions will be completed which he is co-authoring with Professor Mark Lehto of Purdue. Specific research projects in the past year have focused on: child choking hazards, Microsoft product instructions for their new hardware division, boating occupant restraints, CO detection equipment and psychophysiology, labeling of toxic chemicals, and child toy and furniture standards for ASTM.

Katta Murty, murty@umich.edu

Katta Murty continues his efforts with the GAANN (Graduate Assistance in Areas of National Need) program funded by U S Department of Education which continues to provide full support for five Ph.D. students. Among the five Ph.D. students supported last year, one (a minority female student) graduated and joined the U-M Business School as an assistant professor.
Faculty Focus

Vijay Nair, vnn@stat.lsa.umich.edu

Professor Vijay Nair has a joint appointment in IOE and in the Department of Statistics in the College of LS&A. He is currently serving as the Chair of the Statistics Department. He has continued his research activities on engineering statistics over the past year. He published papers on statistical methods for yield and process improvement in semiconductor manufacturing, robust parameter design for variation reduction, software testing, software reliability, and process control. His research has been supported by three NSF grants and an Airforce/ARPA grant, including a new NSF grant on Statistics in Advanced Manufacturing. Professor Nair received an Excellence in Research award from the College of LS&A in 1998. Over the past two years, he has developed and taught a new MS-level course on Reliability. Professor Nair also serves on a number of professional committees and panels and is the current editor of the journal, International Statistical Review.

Tava Olsen, tlennon@umich.edu

Tava Olsen continues her research on the scheduling and analysis of manufacturing systems. She has also begun research on supply-chain management. She is an active participant in both the Engineering Research Center for Reconfigurable Manufacturing Systems and the Tauber Manufacturing Institute. Professor Olsen continues to teach courses in simulation and stochastic processes. Her new graduate course in stochastic processes, which was designed to fill current gaps in the stochastic processes curriculum, should become an official course Winter 1999.

Stephen Pollock, pollock@umich.edu

Stephen Pollock is continuing to explore the theoretical and practical basis for two separate industrially important topics. The first involves developing proactive maintenance policies, and is supported by a grant from General Motors and -- with technical contribution from Jeffrey Alden, IOE PhD (1986) and Daniel Reaume, IOE PhD (1997) currently at the GM R&D Center -- as well as by an NSF grant directed by IOE Professor Jan Shi. The second, finding improved decision-analytical based procedures for “buying off” production processes, is being jointly undertaken with Professor Shannon Anderson of the U-M Business School, and Karl Majeske IOE, PhD (1995), supported by a grant from the NSF program on Total Quality Organizations. He is continuing to teach the undergraduate “capstone” senior design course instituted over a decade ago, as well as decision analysis, queueing systems, stochastic processes and mathematical modeling. This past summer he helped supervise an award-winning TMI student summer project for the Cabot Corporation.

Romesh Saigal, rsaigal@umich.edu

Since January this year, Professor Romesh Saigal is the graduate Program Advisor for the department. He replaces Professor Monroe Keyserling. Professor Saigal continues to teach courses in and conduct research in optimization theory and is in the last stages of completing a book entitled Handbook of Semidefinite Programming, co-authored with Professors Lieven Vandenberghe (UCLA) and Henry Wolkowicz (Waterloo). This book is to be published by Kluwer Academic Publishers.
Jan Shi, shihang@umich.edu

Jan Shi continues his research to develop methodologies in the area of in-process quality improvement (IPQI). He received a three-year National Science Foundation grant last year on Proactive Maintenance Research. He also received a major new three-year project from National Institute of Standards and Technology’s Advanced Technology Program on real-time dynamic balancing for high speed machinery (received jointly with Dr. Jun Ni of the Department of Mechanical Engineering and Applied Mechanics). Prof. Shi is currently supervising eight Ph.D. students and two postdoctoral students in IPQI research. In Autumn 1997, Prof. Shi taught his new graduate course on “Automotive Body Manufacturing Processes” for the second time. This course was simultaneously offered at the U-M and at General Motors, and was well received by the students. According to College of Engineering (CoE) Dean Stephen Director, the student evaluations for the course ranked it among the top in the College of Engineering in 1997. In the past year, Prof. Shi has been active in establishing a new Quality, Statistics, and Reliability (QSR) Section in INFORMS. The new QSR section has been officially approved by the INFORMS board, and Prof. Shi serves as the first chair of the QSR section.

Robert Smith, rsmith@umich.edu

Robert L. Smith recently received a grant from the Army Research Office for optimizing the design and operation of Low Energy Mobile Digital Communications, a part of the Army’s 21st Century Warrior initiative. One of his recent PhD students, Alfredo Garcia, has been offered a seat on the Federal Power Commission of Columbia by the President of that country. Smith will be spending the Winter term of 1999, as a visiting Professor in the Faculty of Information Technology and Systems at the Technical University of Delft in the Netherlands. Two of his PhD students will be joining him there.

Chelsea White III, ccwiii@umich.edu

C. C. White is Co-Director of The University of Michigan’s Trucking Industry Program (UMTIP). This year the program was successful in winning an additional three year grant from the Alfred P. Sloan Foundation. The $1.8M grant will be used to fund research to understand the nation’s motor carrier industry in three broad areas of research, labor and human resources, operations and technology, and benchmarking studies. UMTIP’s multidisciplinary research projects bring together engineers, economists, and industry experts, along with doctoral students, to study broad issues of importance to the industry.

Rachel Zhang, rzhang@engin.umich.edu

Adjunct/Visiting Faculty Focus

Paul Green, pagreen@umich.edu

Paul Green has spent the last year working on a variety of projects having to do with driver information systems in cars of the future. This includes studies of navigation systems, electronic maps, head-up displays, and driver workload. He has just finished a draft of a Society of Automotive Engineers standard that specifies what drivers should not be allowed to do with a navigation system in a moving vehicle, a precursor to an international standard.

Donald Jahncke, wldobber@engin.umich.edu

Don Jahncke continues to serve as an Adjunct Lecturer in Industrial and Operations Engineering. He teaches Manufacturing Strategies (IOE 425), and serves as a counselor to his present and past students in their career planning. His course has four objectives:

1. To provide a comprehensive understanding of the methods and philosophies of lean manufacturing.
2. To provide first hand observations of actual manufacturing by three plant trips each semester.
3. To provide an outline on how to become an effective manager.
4. To provide an outline of the history of manufacturing and the development of automobiles.

Prior to joining U-M five years ago, he had a forty-two year manufacturing career with Ford Motor Company in six different countries. Currently, he also serves as a Senior Vice President of the Compass Group, which is a Management Consulting Group in the U.S. and internationally, primarily in the automotive industry.

Marika Jones, marikaj@umich.edu

Marika Jones is continuing her work as Managing Director of the Tauber Manufacturing Institute (TMI). This year, she worked with Andy Crawford, Jim Bean and a small group of students to develop a leadership program for TMI students that will be offered in conjunction with programs being developed for the College of Engineering. Marika also continues her work with the IOE Alumni Academy, discussing issues such as increasing industry involvement in IOE classes and programs, and meeting new accreditation board requirements. Marika and her husband, Dean, are expecting their second child on December 5, 1998.

Laurent Langlet, langlet@engin.umich.edu

Laurent Langlet is a visiting researcher on a year leave from the Vehicle Engineering Division of Renault. He is currently working with Prof. Liker and PhD students Y. Ro and J. Karlin on a project entitled “Supplier involvement in product development” (part of the Japan Technology Management Program). The goal of the project is to identify state-of-the-art practices (partnering relations, early involvement, communication, guest engineer ...) in the engineering relations between car makers and automotive suppliers within their North American operations.
Adjunct/Visiting Faculty Focus

Glenn Mazur, gmazur@engin.umich.edu
Glenn Mazur, adjunct lecturer of TQM, was awarded the 1998 Akao Prize for Excellence in Quality Function Deployment at the 4th International Symposium on QFD in Sydney Australia last August. Publications this summer include Policy Management: Quality Approach to Strategic Planning co-authored with two Japanese Hoshin Kanri experts was published by International Quality Dynamics, and several chapters on QFD in The QFD Handbook from Addison-Wesley and in Japanese in Practical Applications of QFD: The Results of 10 Years of the USE QFD Research Sub-Committee published by the Union of Japanese Scientists and Engineers (UJSE). Current projects include QFD and Voice of Customer program development for the Accelerated Product Development program with the Queensland Manufacturing Institute in Australia and developing QFD standards for the update of ISO 9000. Also a redesign of the ENG/MFG 401 TQM Virtual Course Pack in response to an increase in distance learning students. The Virtual Course Pack, including course notes, software links, and others are available to alumni at http://www.mazur.com.

Steve Rasch, sfrasch@engin.umich.edu
Dr. Rasch is president of the Ann Arbor Consulting Group and an assistant adjunct professor at the University of Michigan. He has worked for two nationally recognized management consulting firms before starting the Ann Arbor Consulting Group in 1991. Dr. Rasch's B.S. and M.S. degrees are from the University of Michigan and his M.B.A. is from the University of Chicago.

Dr. Rasch completed his Ph.D. from the University of Michigan in Industrial and Operations Engineering. His dissertation is entitled, "World-Class Manufacturing Practices - Do they Work in American Companies?" His research focuses on measuring the productivity and quality improvements that American companies have realized through the implementation of lean engineering and manufacturing practices. Dr. Rasch's teaching activities at the University of Michigan have concentrated on economics and organizational theory and manufacturing techniques and strategies.

John Shook, jyshook@engin.umich.edu
John Shook is currently the Director of Lean Manufacturing Systems for the Japan Technology Management Program. John divides his time between university work and consulting with auto industry companies and others on how to understand and implement lean manufacturing through TWI network, a network of lean manufacturing consultants.

For eleven years John worked for Toyota in Japan and in the U.S. He joined Toyota in 1983 in Toyota City to help with the process of transferring the company's management and production systems to NUMMI, and subsequently to their manufacturing facilities around the world. His first encounter with the Toyota Production System came from building Cordless at the Takaoka Plant in Toyota City. He later created internal TPS training manuals and led TPS training sessions. During his seven-year stay at Toyota's worldwide headquarters, he became the company's first (and still only) American "Kacho" (manager) in Japan.

Nicholas Steneck, nsteneck@umich.edu
Nicholas Steneck joined the faculty of the College of Engineering in 1996 as Adjunct Professor of Ethics in Industrial and Operations Engineering with primary responsibility for implementing the ethics thread of Curriculum 2000. He has been a faculty member at the University since 1970, with his primary appointment in LSA as Professor of History specializing in the history of science and technology. His current scholarship is divided between research policy, including ethics, and engineering ethics, with occasional talks and short articles on the history of the University of Michigan. Portions of his engineering ethics work will shortly be on line through an interactive webpage: ref.engin.umich.edu. Anyone interested in talking about ways to introduce ethics in the engineering curriculum should get in touch with him at the e-mail address above.
Andersen Consulting Scholarship
Jonathan W. Opdyke
Erin K. Eisenberg

Michael Goldberg/Andersen Consulting Scholarship
Brad M. Finkbeiner

Myun W. Lee Scholarship
Catherine M. Kobus

Herman R. and Dolores I. Rasch Scholarship
David J. Suarez

Alpha Pi Mu Outstanding Teaching Award
Karl D. Majeske

APM Outstanding Graduate Student Instructor of the Year Award
Robert G. Feyen

Wyeth Allen Award
David J. Suarez

Outstanding Undergraduate Student
Matthew Blosl

Outstanding Graduate Student
James Bander

CoE Distinguished Leadership Awards
Meredith Salomone
Brad M. Finkbeiner
Matthew Blosl
Jonathan Opdyke
Shannon Wahl
Amy Koivula

Vulcan Award
Brooke Laitala

CoE Awards
Charles Barth Prize
David Ostreicher

Henry Ford Prize
Jonathan W. Opdyke

Congratulations!!!
We would like to thank the following alumni and corporations for supporting us during our building renovation and expansion. Your financial pledges have made the project a reality. However, we are still in need of your financial support to continue the endeavor. And, as always we have other needs such as student fellowships and scholarship support and equipment to allow students and faculty to make the most from their research.

Remember that you may take full-market value deductability for appreciated assets, and that many corporations offer matching funds. The last page of the newsletter has been provided for your convenience in mailing a donation. We appreciate your continued support!

Mr. Kedrick D. Adkins  
Mr. Aaron R. Andreas  
Mr. David J. Barrett  
Mr. Karl G. Barscht  
Mr. Douglas L. Berg  
Mr. Sonny S. Bloom  
Dr. Amy H. Boyd  
Mr. James Fredrick Burkett II  
Alcoa Corporate Center  $ 7,500  
Allied Signal Foundation, Inc. $ 25,000  
AMP Incorporated $ 25,000  
Andersen Consulting Foundation $ 3,390  
Boeing Defense & Space Group $ 7,500  
Cabot Corporation Foundation, Inc. $ 7,500  
Chrysler Corporation $ 15,000  
Cummins Engine Company, Inc. $ 7,500  
The Detroit Edison Foundation $ 50  
Ernst & Young Foundation $ 120  
Exxon Education Foundation $ 1,350  
Ford Motor Company $ 21,560  
General Cable Corporation $ 10,000  
General Motors $ 20,150  
Harley-Davidson Motor Company $ 6,500  
Hewlett-Packard Company $ 7,820  
Intel Corporation $ 51,000  
Mr. Kedrick D. Adkins BSE 1974  
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Don B. Chaffin, Ph.D. PhD 1967  
Jeffery M. Costow BSE 1985  
Mr. Richard M. DeLong BSE 1956  
Mr. Robert W. Denner BSE 1970  
Mr. James M. DuBay BSE 1984  
Jill E. Feldman BSE 1974  
Dr. Paul A. Fuhs M SE 1975  
Mr. Michael A. Grossman BSE 1988  
Eric R. Haan BSE 1992  
Thom J. Hodgson, Ph.D. PhD 1970  
Michael A. Kahn BSE 1971  
Dr. Donald L. Keefer M SE 1972  
William M. Keyserling, Ph.D. M S 1976  
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Chrysler Corporation $ 15,000  
Cummins Engine Company, Inc. $ 7,500  
The Detroit Edison Foundation $ 50  
Ernst & Young Foundation $ 120  
Exxon Education Foundation $ 1,350  
Ford Motor Company $ 21,560  
General Cable Corporation $ 10,000  
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Harley-Davidson Motor Company $ 6,500  
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Alumni Updates

This news is from alumni responses to the last newsletter. We’d love to hear from you! Please use the response form to drop us a line and tell us what you are doing. Remember to include any name or address changes.

Aaron Andreas (BSE ’94) is now a Senior Simulation Engineer at Emperical Solutions Corporation which conducts discrete event simulation projects for manufacturing companies.

David Childs (MSE ’81) currently works as an Element Manager at Jet Propulsion Laboratory in Pasadena, California. He is responsible for managing data and computing services of the Cassini Project.

Alexander B. Jones (BSE ’97) works as an Industrial Engineer for the Intel Corporation in Arizona.

Michelle Leopando (BSE ’93) is now Head of Industrial and Operations Engineering at Spectrolabs, Inc. (a division of Hughes Space & Telecommunications). She is responsible for manufacturing control and systems improvement.

Andrew V. Masterman (MSE ’93) was recently promoted to President of Walbro Asia Pacific where he will be responsible for operations in Japan, China and Korea. He currently resides in Tokyo, Japan with his wife Cheryl which he married October 18, 1997. Walbro Corporation, which is based in Michigan, is a designer and manufacturer of precision fuel systems and products for automotive and small engine markets.

Kevin Quaid (MSE ’94) currently works as a Project Manager for Ergonomics, Inc. His responsibilities include workstation analysis (biomechanical methods), tool design & fabrication, equipment implementation and follow-up. He was married on July 18, 1998 to Ms. Amanda Bell.

Mark Simms (BSE ’92, M SIE ’96 - Cleveland State University) is a Senior Consultant at Ernst & Young LLP providing supply chain planning and scheduling.

Robert A. Sparks (BSIE ’68, M BA ‘71 & J.D. ‘77 - Southern Methodist University) now practices law at his firm, Sparks & Rugley, P.C. in Cleburne, Texas.

Edward A. Stokel (BSE ’78, M SE ’79 & M.D. ‘85 - U-M) is now a full-time orthopaedic-hand surgeon at the San Ramon Valley Orthopaedic Group in California.

Tom Vern (BSE ’90, M SE ’92) works as a Senior Quality Engineer at Britax Vision Systems (North America). His responsibilities include quality and manufacturing engineering and advance quality planning.

We regret to inform you that Joseph Thomas Arno, II, passed away on August 31, 1998, at the age of 38 after a courageous battle with cancer. He received his BSE from U-M in 1982 and an M S in Management from Georgia Tech in 1984. Memorial contributions may be made to the Arno Children Trust, 1401 Tammy Lane, Ann Arbor, MI 48103.
RESPONSE FORM

For Alumni History, Future Newsletter Items, and Offers to Assist the Department

The Department and your fellow alumni would like to know where you are, what you are doing and any other news you’d like to share. We invite you to return this form so that we may include this information in future newsletters.

We also welcome any contributions of time or funds. Use this convenient form for such purposes. Also, recently, you should have received a solicitation form from the College of Engineering requesting a year end tax contribution. For the IOE Department to be credited with your contribution, you must designate “IOE Department” on any pledge or contribution sent to the College or University. (Note: Michigan residents receive a particularly large deduction on the first $500 donated)

Please return this form to: John R. Birge, Chair
Industrial and Operations Engineering
University of Michigan
1205 Beal Avenue
Ann Arbor, MI 48109-2117

Name _________________________________________________________________________________________________________

Address _______________________________________________________________________________________________________

IOE Graduation Year/Degree Received _____________________________________________________________________________

Other Degrees Received _________________________________________________________________________________________

Place Of Employment ____________________________________________________________________________________________

Job Title _______________________________________________________________________________________________________

Responsibilities _________________________________________________________________________________________________

______________________________________________________________________________________________________________

News You’d Like To Share In The Next Newsletter ____________________________________________________________________

______________________________________________________________________________________________________________

Check below if you would like information on the following:

______ Speaking about your profession at an IIE/APM/VIBES luncheon
______ Sponsoring a senior project team
______ Joining the alumni academy
______ How your company can sponsor research
______ How you or your company can financially assist the department

Enclosed is $ ____________ for the general support of the educational programs in Industrial and Operations Engineering.

(please make checks payable to “The University of Michigan”)

Back Cover Photos:
Top: TMI Students Yvonne Jones and Basil Siddeeqi at their Ford TMI project this past Summer. (Larinner Photographic)
Bottom: Students Allison Noe (in chair), Cathy Kobus, Woojin Park and Katy Armstrong (right) participating in research of human/vehicle interactions. (Michael Schimpf Photography)
Right: Ken Hung and Kristin Míssel of the Financial Engineering Program working at the Media Union workstations sponsored by Reuters, Intel, and Fame. (Phil T. Oatts)

Nondiscriminatory Policy Notice (March 1995)

The University of Michigan, as an equal opportunity/affirmative action employer, complies with all applicable federal and state laws regarding nondiscrimination and affirmative action, including Title IX of the Education Amendment of 1972 and Section 504 of the Rehabilitation Act of 1973. The University of Michigan is committed to a policy of nondiscrimination and equal opportunity for all persons regardless of race, sex, color, religion, creed, national origin or ancestry, age, marital status, sexual orientation, disability, or Vietnam-era veteran status in employment, educational programs and activities, and admissions. Inquiries or complaints may be addressed to the University’s Director of Affirmative Action and Title IX/Section 504 Coordinator, 4005 Wolverine Tower, Ann Arbor, Michigan 48109-1281, (734) 763-0235, TDD (734) 747-1388. For other University of Michigan information call (313) 764-1817.