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CENTER FOR INDUSTRIAL RESEARCH AND SERVICE
Partnering with the Iowa Manufacturing Extension Partnership

IOWA STATE UNIVERSITY
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CIRAS NEWS

INSIDE

Three Kaizen facilitators certified at Graham Manufacturing

By Jim Black, CIRAS

Andy Hubbard, plant manager, and Jerry Currie, president and CEO, recognized the need to reduce waste at Graham's commercial wood door plant in Mason City, Iowa. They had just installed the Graham production system, patterned after the Toyota production system or TPS, which is characterized by just-in-time production and jidoka or assurance of top quality. (Kaizen [continuous improvement] teams play a central role in identifying and eliminating muda [waste] within TPS). Work-in-process inventory at Graham had been sharply reduced after converting a key process from batch to flow.

Cultural change was required next, and Graham management decided to continue their Lean enterprise journey by implementing Kaizen teams. Due to the number of Kaizen projects they expected to implement, the decision was made to have three employees trained in Kaizen facilitation.

Hubbard and Larry Haugen, training manager, called Jim Black at CIRAS to discuss Kaizen implementation and facilitator training. A three-step certification process was proposed and accepted.

Project selection

Projects were selected based on biggest impact on the three key Kaizen drivers—quality, cost, and delivery. Once a project was chosen, management identified three or four objectives for each team. Team members were selected as follows:

- Three members who worked in the process
- One member from the preceding process
- One member from the succeeding process
- Three members from support departments whose assistance would be needed for the team to succeed

Presentation of certificates, left to right: Dan Patterson, Dale Boss, Russ Dalbeck, Jim Black, Rich Fjone, Jerry Currie

Facilitator selection

Management decided to train three employees in facilitation, two from Graham and one from Curries, a sister company that manufactures metal doors. Some of the attributes required of prospective facilitators included

- knowledge of all the processes
- trusted by employees
- extroverted
- excellent verbal communication skills
- self-motivated—good work ethic

Train-the-trainer process for facilitators

The three-step certification for the train-the-trainer process includes

- Step One—Prospective facilitators participate as regular team members in a Kaizen event. Documentation requirements include primarily taking good notes and asking good questions for the leadership steps to follow.
- Step Two—Prospective facilitators lead part of the Kaizen event including presenting some of the principles and concepts, as well as facilitating the group processes (e.g., observing and brainstorming). Documentation requirements include expanding personal notes, with a focus on documenting team progress and helping to prepare the team's report to management.
- Step Three—Prospective facilitators each lead a different part of the Kaizen event.

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CIRAS Mission Statement

The mission of CIRAS is to enhance the performance of Iowa industry through education and technology-based services.

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Management of product safety in the food industry

By Sam Beattie, Food Safety Extension Specialist; Assistant Professor, Food Science and Human Nutrition

Product failure in the food industry is potentially devastating for the company involved and those who consume the defective food. Food-borne illness from contaminated (defective) products can range from mild illness to death and can cost a company its reputation and viability.

In the early 1960s, NASA recognized that food product failure resulting in illness for the astronauts could endanger their lives and the overall mission. NASA researchers started investigating ways to ensure food safety. End-product testing to guarantee that 100% of the food was safe resulted in nearly all of the product being destroyed for the tests. And it could not be assured that the rest of the food was any safer than the tested material. There needed to be a better way—one that focused on the manufacturing process rather than the finished product to reduce the potential for a failed (contaminated) product.

NASA contracted with Pillsbury Company to look at quality systems management tools and how they might be used to enhance food processing. The U.S. Army, NASA, and others had implemented the failure, mode, and effects analysis (FMEA) approach to quality assurance. This system evaluates each step in a process and assesses what can possibly go wrong, how the failure was caused, and the outcome of the failure. Control measures are then developed to reduce the risk of occurrence of the failure. As a proactive failure management tool, FMEA could be modified for use in the food industry and was done so with cooperation between the U.S. Army Natick Research Laboratories, Pillsbury, and NASA. The result was the hazard analysis and critical control points (HACCP) methodology to identify, assess, and control hazards associated with food and the processing of the food. Pillsbury has continued to use HACCP in their food processing plants as a food safety management tool.

Pillsbury presented HACCP to the Conference for Food Protection in the early 1970s. In 1971, there was an outbreak of *Clostridium botulinum* caused by improperly processed canned potato soup, which prompted the FDA to mandate HACCP-type principles for the low-acid canning industry. Thus the new era of HACCP was born. Today, HACCP is mandated for several sectors of the food processing industry including slaughter, poultry and meat processing, juice processing, and seafood processing. It is estimated that all food processing will eventually fall under HACCP guidelines.

What HACCP is and is not

Quality control in food processing is typically done on ingredients or finished product. This aspect of food processing is very important in determining that the product meets specific quality parameters. Because of its nature, quality control is almost always reactive. The product is collected, a test is run, the product falls outside of specifications, and then there is a reaction. Major problems with this approach are that (1) there was likely far more product that is out of specification than just the sample and therefore is all subject to action; (2) it provides just a "snapshot" of the production run; and, importantly, (3) it takes time, which means product is either sitting in the warehouse or in transit.

HACCP is a proactive approach to food safety assurance that follows the flow of a specific food throughout the manufacturing process. Through a risk assessment, specific hazards inherent in the ingredients, the process, or potentially the final product are identified. At specified steps in the process, critical control points are identified that either reduce, eliminate, or prevent these hazards from continuing in the process. The specific hazards can be microbiological (bacteria and parasites, for example), physical (metal or glass fragments), or chemical (cleansers, metal ions, etc.). The power of HACCP is that the critical control points are continually monitored, which allows a corrective action to be taken if the CCP exceeds its critical limits. Corrective actions do two things—they bring the process back into control, and they protect the consumer from receiving defective (hazardous) foods. Of course, documentation of all phases of the HACCP program is necessary.

Pre-requisite programs to HACCP

HACCP is only part of a total commitment to food safety and quality that a food processing plant must implement. Current good manufacturing practices (cGMPs) and a set of standard operating procedures (SOPs) are the absolute minimum prerequisites for a food safety program. cGMPs effectively address the food plant environment and operating conditions necessary to produce food in a hygienic manner. These are mandated by regulatory authorities who inspect the processing plant and are codified in 21CFR110. The entire regulation is available at the FDA Web site, www.cfsan.fda.gov/~lrd/cfr110.html.

The quality pyramid for food processing plants includes HACCP.

HACCP

Historically, HACCP has been identified with seven principles, which are sequential activities. More current philosophy of HACCP has actually identified several steps that must be taken prior to actual HACCP planning. These five preliminary steps are applicable to all operations and help facilitate the HACCP plan development.

Pre-HACCP steps:

a. identify and assemble an HACCP team composed of management and senior workers who will develop, verify, and modify the HACCP plan
b. describe the food and its distribution process
c. describe the intended use and users of the food
d. develop an accurate flow diagram of the method used to process the food
e. verify the flow diagram

The seven principles of HACCP

Once the pre-HACCP planning has occurred, the HACCP team then can begin on the actual HACCP plan.

1. **Using the flow chart developed in the pre-HACCP activities, conduct a hazard analysis of the ingredients and the process.** This enables the team to identify preventive measures that will control each of the hazards. Hazard analysis is often the most difficult aspect of HACCP. It requires a sound understanding of food microbiology, the process used to control pathogenic organisms, and the individual process. For several of the HACCP-regulated foods, the FDA has developed excellent hazard guidance documents that assist in this stage of HACCP (www.cfsan.fda.gov/~lrd/haccp.html).
2. **Identify the critical control points in the process.** By definition, a CCP is a point, step, or procedure in a food process where control can be applied, and, as a result, a food safety hazard can be prevented, eliminated, or reduced to acceptable levels. Examples of CCPs include cooking to kill a specific pathogen, chilling to prevent the growth of pathogens, or adjustment of water activity, acidity, or other intrinsic factors of the food. Identification of CCPs is critical to the success of an HACCP plan. In order to correctly identify CCPs, the use of a decision tree or an expert is recommended. Failure to identify a CCP could result in an unsafe product; conversely, identifying too many CCPs results in a burden to the operation.
3. **Establish the critical limits for the CCP.** Critical limits are processing minima/maxima that a specific CCP needs to reach in order to control the identified hazards. Critical limits are monitored and, when out of specification, indicate that there is a food safety concern that must be addressed. Depending on the identified hazard and the CCP, critical limits may be based on factors such as temperature, time, physical dimensions, humidity, moisture level, water activity, pH, titratable acidity, salt concentration, available chlorine, viscosity, preservatives, or sensory information such as aroma and visual appearance. Importantly, critical limits are based in science and result in a safe product.
4. **Establish monitoring procedures for the CCP.** Monitoring is a planned sequence of observations or measurements to assess whether a CCP is under control and to produce an accurate record for future use in verification. Monitoring serves three main purposes. First, monitoring is essential to food safety management in that it facilitates tracking of the operation. If monitoring indicates that there is a trend toward loss of control, then action can be taken to bring the process back into control before a deviation from a critical limit occurs. Second, monitoring is used to determine when there is loss of control and a deviation occurs at a CCP, i.e., exceeding or not meeting a critical limit. When a deviation occurs, an appropriate corrective action must be taken. Third, monitoring provides written documentation for use in verification. Because of the potentially serious consequences of a critical limit deviation, monitoring procedures must be effective. Ideally, monitoring should be continuous, which is possible with many types of physical and chemical methods (National Advisory Committee on Microbiological Criteria of Foods [NACMCF], 1997). Questions that the HACCP team must ask about monitoring are who, what, when, and how will the critical limits at a CCP be monitored. Importantly, monitoring must be accurate and provide an adequate measure of the critical limits being monitored. In general, microbiological testing does not meet the requirements of HACCP monitoring because of the time frame involved in the test. As very rapid methods in microbiological testing become available, this may change.
5. **Establish corrective actions.** When monitoring determines that a critical limit at a CCP has been exceeded or not met, something must be done to prevent the food from continuing on to the consumer and to bring the CCP back into compliance. Written corrective actions for each CCP must be composed and enacted. Therefore, corrective actions must determine and correct the cause of the deviation, explain what becomes of the product that was produced under noncompliance, and, very importantly, document what was done.
6. **Establish verification procedures.** In order to be effective, all aspects of the HACCP plan must work. Verification is the set of procedures that are used to validate this fact. All justifications for CCPs, critical limits, monitoring, and other procedures must be validated that they are in fact correct. Validation can come from a variety of sources including experts, reviews of literature, and HACCP team expertise. Verification of aspects of the HACCP plan should be routinely scheduled and performed after alterations to the food or flow and anytime that there is a violation of a CCP.
7. **Establish recordkeeping and documentation procedures.** The records that are kept under HACCP include the hazard analysis and justifications, the HACCP plan itself including all documents generated during the pre-HACCP activities, support documentation used for validation of the plan, and all records generated during the operation of HACCP and prerequisite programs. Many companies find it

easiest to place these documents into a set of three-ring binders. Each binder corresponds to a specific program; for example, all GMPs and SOPs would be in one binder, the HACCP plan would be in another, and CCP processing records would be in another.

Principle seven is a very important aspect of the HACCP process. Without proper documentation, the plan is not stable and may change unknowingly. Additions and deletions are easily documented through the recordkeeping process. In addition, when regulatory authorities inspect, they usually will look for the monitoring records of the CCPs.

Management of HACCP

HACCP will not work without buy-in from all involved in the food processing operation. Management must take a proactive role in modeling and supporting all aspects of the quality assurance program including HACCP and the prerequisite programs. Furthermore, HACCP must remain a living program within a processing plant. An HACCP plan that sits on the shelf and collects dust is not doing anything to protect consumers.

HACCP does work. When Jack-in-the-Box restaurants implemented HACCP throughout their food flow, they saw a reduction in the number of complaints, and the microbial safety of their products increased significantly. Because of their proactive approach and the detail in which they implemented HACCP, competitors asked for and were given advice about HACCP development.

HACCP implementation will reduce the risk of failed products reaching your consumers. It must be implemented correctly and must remain an active part of the total quality program.

For more information on HACCP, please contact Sam Beattie at 515-294-3357; beatties@iastate.edu.

IMEP to relocate

As announced in the last issue of *CIRAS News*, the Iowa Manufacturing Extension Partnership (IMEP) is reorganizing. As a part of the reorganization, IMEP's administrative office will move from Ankeny to the Iowa State campus, specifically 2272 Howe Hall. The move should be completed in the first half of 2005; throughout the move, IMEP staff can be reached at 877-965-4637.

IMEP works with small and mid-sized manufacturers in nearly every sector of industry. A commonality among clients is a willingness to invest time, money, and people to improve business.

IMEP's clients include manufacturers who

- want expert, impartial advice to help them evaluate problems, capitalize on opportunities, or create solutions
- need assistance in locating specific resources or technologies
- need help solving specific problems, such as determining the cause of product defects, establishing employee training, or modifying plant layout to improve work flow
- want assistance in reversing negative business situations such as sales decreases, loss of market share, customer requirements for lower prices, and cost increases
- want to implement new technologies or processes that will help establish them as market leaders

IMEP is part of a nationwide network of not-for-profit centers linked together through the Department of Commerce's National Institute of Standards and Technology. Federal, state, local, and private resources provide funding to the center, making it possible for even the smallest firms to utilize IMEP resources.

For more information on IMEP, please visit their Web site at www.imep.org or contact IMEP at 877-965-4637; imep@imep.org.

Miller joins CIRAS as business manager

JoAnn Miller joined the CIRAS staff in February as the business manager for CIRAS. She previously worked as a financial officer for ISU Extension, CECS (Continuing Education and Communication Services). JoAnn also has an extensive finance background with the banking industry and most recently was employed as a financial specialist with Mid-Iowa Community Action, Inc. In that capacity, she assisted grant-funded, non-profit organizations in various states with reconstructive accounting, regulatory reporting, management, and funding issues.

Miller says, "Although the finance portion of projects may seem dull and tedious to some, it's really quite intriguing. The project has to balance out in work performed and how the dollars are spent. I look forward to working with all of the staff in creating financially successful projects."

A CPA with her BA degree in accounting with a math minor from UNI, JoAnn has passed the ACH professional exam and is licensed in commercial insurance. She enjoys biking, reading, and geocaching, and she recently joined the Special Olympics organizing committee for the 2006 national games to be held in Ames.

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Documentation requirements focus on the skills needed to record different types of exhibits in different software packages.

Kaizen projects/outcomes

Project one objectives were to document each step of the manufacturing process and identify/correct several safety (unsafe conditions and unsafe acts) issues.
Outcomes—The team implemented 5-S (workplace cleanliness and organization). Material savings of eight times project cost were implemented.

After the first Kaizen project was completed, Hubbard became the Kaizen promotion office manager for Curries, the commercial metal door side of the business. Dan Patterson, Curries, then became the plant manager for Graham. During the definition process for the second project, it became evident that the project scope was too large for a Kaizen event. Since defined issues still needed to be dealt with, Black proposed a Six Sigma project to address these quality issues. Patterson established a Six Sigma team for that purpose.

(NOTE: For more information on Six Sigma, see *CIRAS News* article "Grimm Brothers slashes defects and pegs delivery with Six Sigma" at www.ciras.iastate.edu/publications/CIRASNews/2004Summer.pdf.)

> ***"One of the most significant outcomes for Graham is the certification of our three facilitators. We have built the foundation to do our own Kaizen events, at will, and have gained the capability to control the flow of Lean activities in our plant."***
>
> *—Dan Patterson*

Project two objectives were to significantly improve quality, implement 5-S, and implement preventive maintenance (PM) in a key process.
Outcomes—The team implemented 5-S, developed standard work for the process, implemented quality at the source, implemented PMs, and developed action plans with the value of the improvements totaling 16 times project cost.

Project three objectives were to create a pull system in a key department—operating to TAKT time (producing to the rate of customer purchases).
Outcomes—The team succeeded in implementing pull, which laid the groundwork for running to TAKT time throughout the plant, and identified action plans with the value of the improvements totaling 11 times project cost. Equipment was identified that could save an additional nine times project cost.

CIRAS industrial engineer Jeff Mohr, with CIRAS for seven years, played an integral role in the Graham Kaizen train-the-trainer process. Mohr's participation was part of a recently completed internal training process, the goal being to provide CIRAS with another resource for Lean implementation projects. As part of this effort, Mohr was mentored by Black for 18 months on productivity improvement projects with Iowa manufacturers. During these projects, Mohr learned to apply Lean principles while facilitating Kaizen teams and utilizing the various Lean tools for continuous improvement.

Management support

Each project was kicked off by the plant manager, who reviewed the Kaizen philosophy and objectives with the team members. Over the course of each Kaizen event, managers would visit the team to see how the week was progressing. Several of the events required extensive data collection and knowledge of line controls. Joshua Masson, information technology specialist, provided indispensable data, software, and controls support for all of the teams.

Upon completion of the event, each team presented their report for management. Between 15 and 20 management staff members were present for each of the report out sessions. This gave management a chance to see the team accomplishments and reinforce their practice of team involvement. Lively discussion followed during the question and answer segment of the report. Members of management addressed the group, thanking them for their efforts. Each team was given an authorized level of spending to support their implementation efforts.

> ***"Jim guided us through the process of becoming conscious of cultural changes necessary to sustain Lean and mentored us through the steps to address those needs. Our facilitators are leading events at Graham and are prepared to help with events at Curries."***
>
> *—Jerry Currie*

Facilitator certification

It was time to recognize the three facilitators who had completed the three-step certification process. Certificates were presented and the celebration continued with shared stories and experiences.

Graham is committed to making Kaizen a permanent part of the company culture as they continue on their Lean journey. Monthly Kaizen events follow a logical progression through the shop. Moving to the focused factory or profit center model was another step recently completed. Patterson became the profit center manager for wood doors and Haugen became the profit center

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Electric short-course program

By Tom Baird, Program Manager, Extension

For more than 30 years, Iowa State's Department of Electrical and Computer Engineering and University Extension have collaborated to enhance the skills of people working in or serving the electric power industry. They've done so by offering numerous short courses. Classes are one to five days in length, depending on subject matter, and have drawn participants, with and without college degrees, from throughout Iowa, the U.S., and some foreign countries.

Five short courses were offered in 2004, drawing 208 participants mostly from Iowa and the contiguous states. More than half of the participants were employees of seven of the state's major electric utilities.

The purpose of the short-course program is to educate and train those who design, operate, and maintain the electric utilities in Iowa and surrounding states. These efforts will help to increase the reliability of electrical service, lower costs, and ultimately increase the quality of service to the utilities' customers. Courses are or can be designed to train individuals in fundamentals; acquaint them with the latest technologies, techniques, and trends; and advise them of regulatory requirements, such as those related to "deregulation." Instructors are often drawn from Iowa State University as well as utilities and consulting firms in the state.

The participation of utility workers from the contiguous states is encouraged because their companies are interconnected with Iowa utilities by the transmission grid. The quality of service provided by one utility definitely impacts the quality of service of its neighbors. Also, some Iowa-based utilities like Alliant Energy serve customers in the surrounding states.

Participants come from utilities of every size and type of ownership (investor-owned, municipals, co-ops, federal, state), and education and training needs vary somewhat from utility to utility. Short courses can be designed to meet the specific needs of particular utilities, like the one offered last September on secondary network protectors, which was requested by MidAmerican Energy. Other courses have universal applicability, such as those on protective relay testing,

Photo courtesy of Midwest Independent Transmission System Operator, Inc., Carmel, Indiana—www.midwestiso.org

substation maintenance, and power system operation held February-April each year. These courses promote cooperation between utilities and between the utilities and Iowa State. Advisory groups from utilities are involved in determining the structure of some courses. Iowa State engineering graduates who are employed by utilities often attend short courses, with the added attraction of a visit to their alma mater.

Iowa State awards continuing education credits (CEUs) for participation in short courses; registered professional engineers can use these credits to maintain their engineering licenses. Few sources are able to provide CEUs as cost effectively and efficiently. Iowa State has recently been designated an "approved CE provider" by the North American Reliability Council (NERC), which means that certified power system operators from Iowa (mainly at MidAmerican and Alliant) and around the nation who attend the well-known Power System Operators Short Course in April will be able to receive NERC-approved continuing education hours to assist them in maintaining their credentials. Improved power system operator training is recommended by the U.S.-Canada Task Force that investigated the blackout of August 14, 2003.

Courses for 2005 include protective relay testing, substation maintenance, and power system operation; substation/distribution automation (repeat from 2004); and protective relay theory (new).

More information on the electric short-course program can be found at www.ucs.iastate.edu/mnet/ecs/home.html or contact Tom Baird at 515-294-7678; tbaird@iastate.edu.

Graham Manufacturing

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manager for metal doors. The profit center model places all resources required to manage a product line or group under the control of a profit center manager.

What impact has Kaizen made at Graham? According to Patterson, "We have been able to implement a pull system operating to TAKT time. We've eliminated several major sources of waste—in both labor and material—and established a schedule of Kaizen events throughout the plant to continue the Lean/Kaizen journey."

For more information about Lean enterprise and Six Sigma concepts and applications, contact Jim Black at 515-294-1507; jimblack@ciras.iastate.edu; www.ciras.iastate.edu/productivity/.

USDA announces final rule to implement Federal Biobased Products Preferred Procurement Program

On January 9, 2005, the office of the U.S. Secretary of Agriculture announced the publication of a final rule to implement a program of preferred procurement of biobased products by federal agencies. This final rule establishes provisions for the Federal Biobased Products Preferred Procurement Program, which was authorized by section 9002 of the 2002 Farm Bill.

"The Federal Biobased Products Preferred Procurement Program creates a preference across the entire federal government to purchase biobased products, when practical, based on price, availability, and performance," said Ann Veneman (then ag secretary) during remarks at the 2005 American Farm Bureau Federation Annual Meeting. "This rule promotes energy independence and the use of environmentally sustainable energy from biological sources, while at the same time creating new demand for agricultural commodities and new business investment and job growth in rural America."

The new rule establishes the process by which the U.S. Department of Agriculture will designate "items" for preferred procurement by federal agencies. Items are generic groupings of biobased products, such as biobased greases, biodiesel and ethanol when used as additives, hydraulic fluids, biobased polymers, industrial solvents, biobased fertilizers, and cutting oils. Federal agencies have one year after the publication of this final rule to ensure that their procurement specifications require the preference of biobased products consistent with this rule. The rule is posted at www.biobased.oce.usda.gov.

The USDA soon will begin issuing a series of proposed rules that will designate specific items for program eligibility. After considering public comments, final rules will be promulgated. This process of designating items by rulemaking is expected to continue over the next three years. Once an item is designated, all manufacturers with similar products can claim preferred procurement status when marketing to federal agencies. While this program is still being implemented, many federal agencies are already incorporating biobased products in their acquisition orders.

The USDA is currently developing test information on 83 items to support designation by rulemaking. A listing of these items is available at www.biobased.oce.usda.gov.

More information on the Federal Biobased Products Preferred Procurement Program is available on the above Web site or from Marvin Duncan, Office of Energy Policy and New Uses, 202-401-0532, or mduncan@oce.usda.gov.

CIRAS to coordinate program

Iowa State University continues to work under a cooperative agreement with the U.S. Department of Agriculture to develop and implement a national program for biobased products evaluation, labeling, and outreach. The program is being coordinated by the Center for Industrial Research and Service (CIRAS). The Farm Security and Rural Investment Act (also known as the "farm bill") authorized funding for it.

Biobased products are made from renewable materials grown in farm fields, coastal waters, and managed forests. These resources can replace petroleum-based materials used in industrial and commercial products.

"The farm bill's biobased product initiatives will boost Iowa's agriculture industry, bring investment to our rural communities, and help meet our environmental goals. I am delighted ISU has been chosen by USDA to carry out these provisions since the university is a global leader in the bioeconomy and well situated to take on this important work," U.S. Senator Tom Harkin said.

For more information on the Federal Biobased Product Preferred Procurement Program at Iowa State University, CIRAS, contact Steve Devlin at 877-251-6522; usdabioinfo@ciras.iastate.edu.

University synergy program international conference

The Department of Industrial and Manufacturing Systems Engineering, Iowa State University College of Engineering, is collaborating with the Noaber Foundation and the Beehive Fund to present the 2005 University Synergy Program International Conference (USP 2005). "The Web-enabled Enterprise: Tools and Techniques for Leveraging the Internet in Today's Economy" will be held September 20–23 at the Hotel at Gateway Center in Ames.

In addition to two keynotes, the conference will feature papers from individuals in industry and academia on various topics related to the conference theme.

Complete conference details, including registration form, program brochure, and a current list of speakers and exhibitors, is available online at www.ucs.iastate.edu/mnet/usp/home.html.

Problem solving in the real world

By Merle Pochop, CIRAS

ISO 9001 requires certified companies to be engaged in the process of continuous improvement. While better performance is generally a goal of business, effort in this area may take a back seat to needs of the moment, like getting shipments out on time.

Another principle of ISO is that a certified company must "walk the talk." When Garry Janssen, quality management representative for Double HH Manufacturing, learned that his company was falling short of a performance metric, he knew he was obligated to initiate a correction action request, or CAR. (Management had established a goal of 90% production schedule performance; the actual level was 75%, sometimes less.) For Janssen, the overriding question became "How do we deal with this problem?"

For Double HH, the answer was not to let the schedule slide! Although many smaller companies view backlog as security and take orders even when they cannot deliver as requested, this was not an option for Double HH. One of the company's major customers, a supplier to the U.S. truck manufacturing industry, is TC 16949 certified. For this customer, on-time delivery is a prime measurement of performance.

To help solve the dual problems of late deliveries and answering the CAR, Janssen contacted CIRAS Industrial Specialist Merle Pochop. Pochop's suggestion was to create a team and train its members in the use of a problem-solving procedure that would identify—and, ultimately eliminate—factors limiting production success.

Responding to this suggestion, Loy Vant Hul, director of manufacturing, organized a problem-solving class/team that he co-facilitated with Production Manager John Wallenburg. Participants included sales, purchasing, and scheduling employees as well as individual department heads. The team met with Merle Pochop on an extended basis, scheduling meetings approximately one month apart to give participants enough time to complete action items and generate results. Initial meetings discussed problem-solving tools and usage. Problems in individual areas were identified and used as team assignments between meetings.

One of the last activities by the team was to begin using data to track the success of activities in specific areas. Double HH does have data from its MRP system, but this had been used for overall measurements, not specific operations.

After six months, the instructional part of the project was brought to a close. Since Double HH must, as a part of ISO, maintain gains that are achieved, it is unlikely that the company will regress to previous practices. Some of the more important lessons learned from this exercise are valuable for this company as well as others with performance improvement issues. They are:

HH Manufacturing Machine Operator Carl Surma and Quality Coordinator Garry Janssen examine one of the thousands of parts processed by the CNC cut-off machine on a daily basis.

1. Simplify problems by isolating them. A slipping production schedule is indeed a problem, but the causes for this are many and must be dealt with individually. Since team members are on a learning curve, success with specific problems builds confidence.
2. Focus on real-world problems, even during the training phase. People identify with and are willing to put effort into issues that are important. Hypothetical issues or examples simply do not represent the same learning opportunity. At Double HH, one of the best "real" problems was the task of improving part production on a CNC cut-off machine. By asking the basic problem-solving questions and making changes to existing procedures, parts/day increased from 1,200 to over 2,200! A big reason for this gain was the elimination of extra tasks from the operator's duties.
3. Pay attention to the basics. Early in the problem-solving effort at Double HH, when attempts were made to collect data about individual circumstances, the information was deemed inaccurate because events were not clearly defined or described. For example, a number of different causes can result in failure to meet production, and if those causes are not more clearly defined and isolated, finding and eliminating the cause is much more difficult.
4. Solve problems at basic levels and you'll resolve issues further up the chain. At Double HH, significant benefit was gained by improving machine tool production uptime.

Of course, learning experiences are always valuable, but do they result in a gain for the company? In the case of Double HH Manufacturing, the gains estimated at this early stage of completion include improving production schedule success from 80% to 90% in the last six months. This has been achieved by breaking the overall problem into smaller issues that are more easily managed by individual department heads and machine operators. During the same time period, sales have increased.

There have been extra costs. Double HH has spent several thousand dollars to improve availability of tooling, which is directly related to improving machine availability and reducing set-up times.

For more information on this project, contact Merle Pochop at 712-274-0048; mpochop@ciras.iastate.edu.

The Iowa State tornado simulator—A new engineering tool

By Fred L. Haan, Jr., Assistant Professor, Aerospace Engineering

Editor's note: Tornado damage to Iowa businesses and homes totals about $50 million annually. Here's a look at what Iowa State researchers are doing to make buildings withstand strong winds. All types of manufactured products from transmission towers, signs, windows and doors, lighting structures, and grain bins and dryers could benefit from direct testing of models in the ISU tornado simulator or from research resulting from the simulator.

The atmosphere we live in hosts a wide variety of interesting—and sometimes dangerous—flow phenomena. All humans and the buildings and structures on which they depend live within and interact with this atmosphere daily. Predicting the forces on built structures that result from interactions with the atmosphere is a vital part of supporting and maintaining the civil infrastructure. Realizing how important it is to study and quantify the wind loads on structures that result from tornados, Iowa State University Aerospace Engineering Professor Partha Sarkar conceived of the idea of a laboratory tornado simulator to test model structures. Sarkar designed and built this facility with the help of a graduate student, Ryan Kardell, and a team of undergraduates. It has been operational since April 2004.

Each year an estimated 80 deaths, 1,500 injuries, and property damage of $850 million are caused by tornados—with $50 million of that damage occurring in Iowa. A greater understanding of tornado wind loads on structures can lead to better building codes that, in turn, can mitigate these losses. While it may be cost prohibitive to design all structures to withstand all tornados, some essential facilities, such as hospitals, schools, defense-related structures, and power plants, must be built to withstand most of them. Tests such as those being conducted at Iowa State are the most appropriate for obtaining design load information that is necessary to design structures of varying degrees of importance.

Led by Sarkar, ISU's Wind Simulation and Testing Laboratory is a state-of-the-art facility for testing aerodynamic forces and atmospheric phenomena. The laboratory's centerpiece facilities are a recently completed large wind tunnel (8-ft.-by-6-ft. test section, 105-mph wind capability) and a tornado/microburst simulator. In the past, tornado simulators were constructed to observe tornado flow physics—to learn more about how tornados work. Such testing made important contributions to our current understanding of tornados. What has been missing until now has been the ability to place model structures of reasonable scale into a simulated tornado to measure wind loads. Iowa State's tornado simulator is the world's largest moving tornado simulator for engineering purposes. Models of structures can be placed in

the simulator to have tornados run past them while aerodynamic pressures and forces are measured.

The simulator itself consists of ductwork with a diameter of 18 ft. surrounding a 6-ft. diameter fan. It can generate tornado-like vortices with cores up to 4 ft. in diameter. Because the whole system is mounted on an overhead crane, the tornado can move over a 34-ft.-by-20-ft. ground plane where the models are placed for testing.

When considering tornado-induced wind loads, two fundamental difficulties arise. First, tornado wind speeds and flow structures are both difficult and dangerous to measure. In the past, inspecting tornado-induced building damage after the storm was the most commonly used means of accomplishing this task. Second, even knowing tornado wind speed magnitudes does not allow one to estimate tornado wind loads. Past knowledge of wind load information has come from tests in straight-line wind tunnels, which differ significantly from the flow patterns in tornados. To accurately quantify tornado wind loads on buildings and structures, a laboratory tornado simulator—not a conventional wind tunnel—is necessary.

An ongoing research project, funded by the National Science Foundation, is working to test a variety of structures in tornado winds. This three-year project uses the laboratory simulator, computational simulations, and full-scale measurements of actual tornados to address the aforementioned challenges. The research group, led by Sarkar, includes Iowa State faculty members Fred Haan, aerospace engineering; Bill Gallus, Department of Geological and Atmospheric Sciences; and Josh Wurman of the Center for Severe Weather Research.

Wurman operates mobile radars on trucks known as "Doppler on Wheels" (DOW). His research group "chases" severe storms and tornados to measure their wind speeds. Wind speed data from these DOWs are used to calibrate the laboratory simulator. Because most field data is measured at elevations above 50 ft., computer simulations are also being conducted at Iowa State's Department of Geological and Atmospheric Sciences to extrapolate the field data down to ground level. Efforts are also underway to enhance the DOW systems to make measurements below 50 ft. to further refine measurements relevant to ground structures.

Calibrated with the field and numerical data, the laboratory tornado simulator is being used to quantify surface pressures on five fundamental types of structures: residential homes, flat-roofed commercial buildings, low-rise office structures, high-rise buildings, and dome structures typical of nuclear power plants. Small models of these structures are made and then instrumented with force sensors and/or pressure taps to quantify the wind loads. No laboratory tornado simulator other than Iowa State's currently exists for this type of testing.

The unique character of the facility has drawn significant media attention. The simulator has been featured on *NBC Nightly News* and ABC's *Good Morning America* in addition to local television and radio stations. This type of publicity raises public awareness of the research being conducted at Iowa State and also helps attract quality students who can participate in the research.

Laboratory, observational, and numerical results are also being employed for activities that integrate teaching and research. This interdisciplinary project crosses the boundaries of the departments/majors and colleges involving engineering mechanics, meteorology, and civil, mechanical, and aerospace engineering majors. A large number of undergraduates and graduate students have been and are involved in many aspects of the work. Students are very excited to work on large-scale research projects such as this—particularly on a topic, tornados, that excites so many people. The opportunity to complement their education with work on this project significantly enhances students' learning experiences.

The tornado simulator represents the efforts of Iowa State researchers to improve public safety through advanced engineering research while providing excellent training experience for future engineers.

More information about the facilities and the research can be found at www.aere.iastate.edu/wind/facilities.htm.

Mark your calendars!

The next Central Iowa Breakfast, Business, & More meeting is May 5 at the Holiday Inn, 1050 6th Avenue, Des Moines. Take advantage of this opportunity to network with small-business owners, corporate buyers, and potential clients.

Registration begins at 7:00 a.m. followed by breakfast from 7:30 to 8:30 and networking from 8:30 to 9:00. The Iowa Procurement Technical Assistance Center (Iowa PTAC) co-hosts the event.

The fifth annual Mini-Expo and Breakfast will be July 14, also at the Holiday Inn, downtown Des Moines. Come speak with large-business and state and federal agency purchasing agents, who will come prepared to make bidding opportunities available.

Breakfast begins at 7:30; the Mini-Expo begins at 8:30. If you are a purchasing agent, we would be happy to reserve a display table for you (see contact information below).

For more information on these events or to make reservations, call Kathy Bryan, Iowa PTAC, at 800-458-4465; kbryan@ciras.iastate.edu.

Premium efficiency motor study with Alliant Energy-IP&L

By Alexandre Kisslinger, CIRAS

In a study done in 1994, the U.S. Department of Energy estimated that electric motors in industrial facilities accounted for approximately 23% of the electricity sold in the country. Standards were subsequently imposed, mandating minimum efficiencies for most integral horsepower polyphase motors sold in the U.S. after October 1997. These motors were then popularly labeled as high efficiency motors.

In 2001 the National Electrical Manufacturers Association agreed to co-promote, with the Consortium for Energy Efficiency, specifications for even higher efficiency motors that are now identified as premium efficiency motors (PEMs). These new motors are 1–2% more efficient than the minimum efficiencies imposed in 1997. Although motor technology has improved efficiency, not all industrial facilities have taken advantage of opportunities to save energy.

CIRAS is currently working with Alliant Energy-Interstate Power & Light Company (IP&L) on a statewide project to determine the degree to which energy efficient motors are being used by Iowa businesses. The project will assess familiarity with PEMs, barriers to considering PEMs, and energy savings from using them.

In keeping with its goal of helping Iowa manufacturers, CIRAS arranged to have Iowa State's Center for Survey Statistics and Methodology conduct a census of industrial facilities to investigate where PEMs are used and what considerations are taken when selecting motors. The census will also investigate reasons that industrial facilities choose not to install PEMs. CIRAS will conduct similar surveys with industrial motor distributors in the state to review the characteristics of PEMs purchased and the availability of incentive programs to companies purchasing PEMs.

With the support of companies that have been or are participating in the surveys, CIRAS will be able to provide valuable information to Iowa manufacturers.

For more information on this project, contact Alexandre Kisslinger at 515-294-1588; akisslinger@ciras.iastate.edu.

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You want to grow your company, but you're not sure how to proceed. The first step may be a feasibility study that examines the economic, marketing, technical, managerial, and financial aspects of your business plan. CIRAS staff can help you prepare a study that can strengthen your case to lenders or help you adjust your proposal to meet the requirements of funding sources.

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- Facilitate your strategic planning process, assisting with the development and implementation of the plan

Learn more about these concepts and the latest in business management tools at www.ciras.iastate.edu. Click on "Management Practices."

Focus: Management Practices

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