IW BEST PLANTS COLLECTION
Intro
2010
Dressed for Excellence

1. American Axle & Manufacturing
2. Avery Dennison Office Products de Mexico
3. Batesville Casket Co.
4. Bunge Oakville
5. General Cable Franklin Plant
6. IEC Electronics Corp.
7. Landis+Gyr
8. Raytheon Integrated Air Defense Center
9. Snap-on Power Tools
In 2008, AAM’s Three Rivers Manufacturing Facility endured a bitter 97-day strike. Finally, the UAW’s Local 2093 decided to separate itself from the national union’s pattern bargaining agreement and agreed on a new contract that substantially reduced the plant’s labor costs. That “landmark” agreement, says plant manager Greg Yezback, “allowed us to insource a tremendous amount of work over the last two years.” In fact, the plant has transferred in 24 salaried employees from other AAM facilities and hired 352 new hourly associates.

When Three Rivers and four other plants were purchased from General Motors in 1994, AAM CEO Richard Dauch immediately set the expectation that AAM would become a world-class manufacturing organization. In 1994, the Three Rivers plant had a customer reject rate (PPM) of 570. Dauch told the facility the bar was being set at 25 PPM. “He took the approach of setting stretch goals and challenging the organization to meet goals that maybe we didn’t think we were capable of meeting at the time,” Yezback recalls. But by 2000, the rate had been slashed to 22. Today, it is zero.

The Three Rivers facility is a leader in implementing AAM’s continuous-improvement system, called the Lean Manufacturing System. The system is focused on safety, quality, delivery and cost. Managers use value-stream maps to optimize an entire value stream rather than simply individual processes. The plant employs lean steering committee meetings to review and update the value-stream maps and ensure appropriate progress is being made on key initiatives. Standardized work is used extensively by production workers and management. The plant employs a host of other continuous-improvement tools, including level schedules, pull systems, tugger routes, 5S and standardized work-audit systems.

All the more remarkable, plant quality has improved dramatically while the facility has taken on new business. In 1994, the plant only produced driveshafts. In 2002, the plant began building rear axles. “Through our agreement with the UAW, we were able to bring that axle out of Mexico and build it here at a profit,” Yezback notes. In 2004, the plant brought in a second axle. In July 2010, the plant began producing a front axle. Now, the plant produces all the products that go into a chassis. Moreover, it has added products for commercial vehicles to its existing truck and SUV business.

Plant management is quick to credit the workforce with being receptive to new ideas and to doing what it takes to win new business. Employees average 40 hours of training a year and are increasingly cross-trained to provide flexibility in job assignments. The plants frequently use team-based A3 problem-solving initiatives. While all salaried employees have been assigned an A3 project, Yezback says, he wants hourly associates to begin using this tool. “Our vision is we will have an hourly workforce that can use an A3 problem-solving tool to make their operation better. They can decide what their biggest problem is and how they can solve it.”

Despite the plant’s continuous-improvement progress, Yezback rates it as a 3 or 4 on a scale of 10. “We are constantly learning,” he says. “I don’t think that’s a bad thing. It makes us focus.”
THERE’S PROBABLY ENOUGH OPEN SPACE AT THE AVERY DENNISON OFFICE PRODUCTS DE MEXICO PLANT IN Tijuana to play a football game. Upon entering the plant, actual manufacturing activity seems so distant a pair of binoculars might be necessary. But plant leaders say the empty area is a sign of progress.

That’s because through value-stream mapping and lean initiatives, the organization was able to free 310,000 square feet of space in the 524,000-square-foot plant over a six-year period. By 2011 the effort is expected to bring the plant’s share of Avery Dennison’s North American office products production to 66% from just 15% in 2004.

The plant received a boost in 2008 when the company’s Fontana, Calif., distribution center closed and relocated to the Tijuana operations. The plant consolidated what occupied 400,000 square feet in Fontana into 230,000 square feet, says Key Fujimura, the plant’s continuous improvement leader. Then, on Oct. 20, 2010, the plant received more good news when Avery Dennison announced it would move its Ciudad Juarez printed media and dividers operations to Tijuana. The transition is expected to be completed in the fall.

The plant first began releasing space in 2004. At the time, the facility was cluttered with machines, inventory pallets and material, says plant manager Arnoldo Pena. Plant leaders began opening space by eliminating inefficient older equipment and improving existing machines, moving to continuous-flow production from batch processing and reconfiguring lines into U-shaped cells. In 2009, the area where the plant produces three-ring binders cut its footprint in half with a reconfigured cell design, Pena says.

All plant personnel are expected to keep a close eye on performance and improvement opportunities through various group activities. One of the more significant events comes in September when the school year begins and the company’s peak season ends.

On the plant floor, one of the more innovative employee-generated ideas came from line worker Azucena Robles, who operates the machines that apply labels to the company’s famous Glue Stic brand. Previously, when the feeder ran out of labels, Robles would have to stop the machine for five minutes as many as 30 times per day to refill the labels to prevent blank Glue Stic rolls from moving down the line. Robles suggested that the plant install a machine that shoots compressed air to push the blank rolls off the line into a box, saving the line from frequent delays.

Such a high level of employee involvement should come in handy next fall when product complexity is expected to double and the number of stock-keeping units will jump to 4,000 from 1,800.
Working with lumber is a challenging business. By its very nature, every board is unique and thus it immediately tests any manufacturer’s efforts to reduce variability. Additionally, a characteristic of the unfinished wood is that it always is trying to adjust to its environment. “It’s completely adaptive, and that’s a bad thing,” says Danny Hudson, quality assurance manager at Batesville Casket Co.-Vicksburg (Miss.) Operations. In short, slight environmental influences, such as fluctuations in humidity, can change the material even after processing, often in transit, complicating efforts to maintain quality.

Nevertheless, Batesville’s Vicksburg facility does it—maintain quality, that is. Its success at doing so is imperative, for this plant annually processes more than 18 million board feet of lumber to deliver wood component parts to assembly operations at sister plants in Mexico and the United States.

The facility’s attention to quality begins outside, in the lumber yard, where qualified vendors deliver “green” lumber, which is product that has not yet been dried. There, Vicksburg lumber inspectors evaluate each board to assure it meets standards set by the National Hardwood Lumber Association. Lumber that passes inspection moves into Vicksburg’s state-of-the-art drying facility.

Alesia Mathes, drying systems group leader, describes the processes that occur before the milling operations as the “front line defense” for the plant. Additional defenses against quality defects include layered process audits, which were introduced early in 2010. Batesville conducts layered process audits along the plant’s entire production process, from the lumber yard through to the shipping dock. The audits perform two functions: to assure that process parameters are being maintained as well as to answer the question, “How do we make this process better?” Approximately 195 audits are conducted per month.

“If you control the elements of the process, you control the output,” Hudson says.

Batesville’s Vicksburg plant remains as engaged in improving its operations as it was in 2007, when the facility first won an Industry Week Best Plants award. And greater use of data is helping it to better prioritize projects, says plant manager Russell Johnson.

Vicksburg has worked to “optimize” the yield of each board passing through its plant. (Optimizing the yield refers to achieving the maximum usable product from each board.) In 2007 the plant added scanning technology in several locations as well as new optimizing saws that use information from scanners to make cuts that provide the best yield from each board. It takes the technology just seven seconds to determine how to achieve the best yield for a board.

The introduction of new equipment was simply the beginning of the optimization effort. “We’re still on the vertical part of [the learning curve]” with the new technology, says engineering manager Keith Pittman. In addition, the plant is comprehensively challenging the strategy used to process lumber for best yields. For example, the plant recently launched a project to reduce its re-rip inventory (a byproduct of wood cutting), which both freed up floor space and reduced material handling.

At A Glance

Batesville Casket Co.
Vicksburg Operations,
Vicksburg, Miss.

Employees: 177, union
Total Square Footage: 197,816
Primary Product/Market: wood component parts for caskets
Start-Up Date: 1975
Achievements:
55% reduction in cost of quality since 2006; 76% reduction in OSHA-recordable injury and illness cases in past three years; 2007 Industry Week Best Plants winner.
At A Glance
Bunge Oakville
Oakville, Ontario, Canada

Employees: 49, nonunion
Total Square Footage: 98,000
Primary Product/Market: packaged edible oils and shortening
Start-Up Date: 1993
Achievements:
First Canadian food plant to be both ISO 9001 and Canadian Food Inspection Agency HACCP registered; more than 12 years without a lost-time incident; Kaizen events resulted in $1.02 million in cost savings over past year

Every day, a rabbi visits Bunge’s Oakville, Ontario, plant to make sure there is no cross-contamination between the facility’s kosher and non-kosher product lines. While a little divine intervention would be welcomed at many manufacturers these days, it’s not the source of this plant’s success. That falls to plant manager Rolf Manntei and his team’s focus on customer service, high quality standards and careful attention to production and inventory management.

The Oakville facility packages edible oil products on eight packaging lines. Edible oils are delivered in bulk liquid form to the plant from Bunge’s Hamilton, Ontario, crushing and refinery plant and other suppliers. At the plant, they are stored outside in temperature-controlled storage tanks. When the plant is ready to process them, they are pumped into the facility through filters to the filling equipment. Bunge uses three packaging lines with seven different package formats ranging from a 3-liter jug to 1,000-kg totes. Shortening products are pumped into the facility but then chilled and plasticized, a process that converts them from liquid to a finished shortening product.

As consumers have become educated about the health risks of trans fats, the market has moved away from solid shortenings to liquid oils, and there has been a sharp increase in the demand for canola oil. Some 50% of the plant’s production now centers around high-oleic canola, alternative oil blends and shortenings.

Customer focus is critical to the success of Bunge Oakville. Customers expect Bunge Oakville to deliver products with a 48-hour lead time, so most of the plant’s items are made-to-inventory rather than made-to-order. That’s no small task, given that the plant produces and handles 245 SKUs.

While Bunge Oakville has shifted to healthier oil products, that hasn’t meant the plant could relax its efforts to be a low-cost provider. In fact, competition has become more intense, encouraging efforts to improve productivity. The plant regularly holds kaizen events. In 2009, for example, the plant held five kaizens dealing with issues ranging from equipment OEE to sales and operations.

To help ensure customer satisfaction, the plant has a robust program for customer complaint investigations and corrective actions. Plant officials have held kaizens with suppliers to improve packaging. The plant also has instituted a quarterly meeting with its two primary packaging suppliers. The meetings have helped the organizations understand each other’s operations and enhanced communications.

Plant officials have targeted constant improvements in overall equipment effectiveness. From January 2009 to June 2010, OEE improved 72%. The plant has installed OEE displays that provide real-time information on machine operations. “Whenever a machine stops for any reason, it goes into alarm and a reason code is entered,” says Carm Cafagna, production supervisor. “We look back to those reason codes to determine where downtime occurs and address those issues.” Bunge Oakville takes a “safety-first” approach in its operations that has resulted in more than 12 years without a lost-time injury. So fittingly, a safety message and a tally of days without a recordable incident are posted at the top of the OEE displays.
Imagine a gyroscope the size of a midsize sedan spinning and whirling, winding together dozens of wires into a single cable, rolling it off the line into a cable running into infinity.

Some of these cables are for data communication, others for control panels and industrial equipment, or for high-end military applications.

Each year, more than a half-billion feet of wire and cable is manufactured at General Cable’s Franklin, Mass., facility, in more than 2,000 different varieties. Despite that volume and product range, less than 1% of the wire and cable produced turns out to be defective.

“One of the things that’s helped drive the improvement has been understanding what’s critical to quality and what’s critical to the process and how those two elements interrelate,” says quality manager Rob Johnson.

Since 2005, Franklin General Cable’s work-order delivery has improved to 97% from 66%, while product quality, as measured using defects per million units, has improved to 6,959 from 15,700. Through the end of November, for instance, Franklin General Cable’s DPMU for 2010 was 286, which equates to 99.95%, a significant achievement in control and quality. Out of an estimated 50 million feet of cable produced in August, only 150 feet was scrapped.

Three years ago, in an effort to better understand the key factors that undermine quality and cause defects, Franklin General Cable began using Pareto analysis tools, which provide a more creative approach to studying complex problems.

The Pareto reports were then distilled into more concentrated control charts and placed in highly visible areas at each workstation. The charts give operators step-by-step instructions for key issues that may arise. A sign in the datacom cell, for instance, details the critical quality issues related to diameter, what to watch for in using a micrometer for all measurements, and three common issues associated with the cell, along with appropriate reaction steps.

“They’re like CliffsNotes,” says Jim Clark, plant manager at Franklin General Cable. “They allow our operators to better understand the issues we’re seeing and what they can do when these issues crop up.”

“Material is like gold for us,” says Clark.

For all the specialized military cables produced in Franklin, nearly a third of its total production goes toward data communication. More than a dozen manufacturers in North America also make data communication cables, along with looming competitors out of the Far East.

“Essentially, cable is a commodity,” says Johnson. “In order to compete with them, performance quality and cost is the key. Our whole process is lean and built for quality and getting all the variances out of the process.”

The plant’s efforts in continuous improvement operate under the theme, “Create Your Own Destiny.” Plant leaders have transitioned toward a flexible workforce, one that can shift between several operations and is increasingly self-directed and empowered to stimulate ideas.
John Biuso says he will occasionally show employees video clips of a Kodak manufacturing plant in Rochester, N.Y., being demolished. As a former Kodak employee, Biuso points out that he knows firsthand what can happen to a plant if it doesn’t evolve.

Today, Biuso is the process improvement manager at the IEC Electronics Corp. circuit-board assembly plant in Newark, N.Y. Like the nearby Kodak plant in Biuso’s video, IEC’s Newark operation was once in danger of imploding, too. The Rochester-area plant struggled to remain viable as low-cost countries took over production of the motherboards IEC once produced for personal computers.

In 2005 the facility found itself in the unenviable position of starting over or shutting down. The company chose the former with the goal of diversifying its product portfolio and establishing lean manufacturing and Six Sigma processes.

The contract manufacturer moved to a high-mix, low-volume model of primarily build-to-order printed circuit boards for growing industries, including medical device and aerospace and defense manufacturing. “It was do or die at this plant if we didn’t diversify,” Biuso recalls. Over the five-year transition period, IEC’s companywide sales, led by the Newark plant, increased 500%.

The plant’s resurgence can be attributed to capital upgrades that reduced machine changeover times, a move from batch manufacturing to one-piece flow and a renewed focus on product development and in-house capabilities not easily replicated by competitors.

IEC invested $2 million in new automated assembly equipment that cut setup time in half over a three-year period. A row of feeders similar to film reels deliver tiny circuit board components seated in carrier tape into the robotic machine that assembles the boards. Previously, line workers changed feeders individually to replenish parts, a process that took approximately one hour, Biuso says. The new equipment allows the plant to swap out entire feeder racks that are kept at lineside. The changeover process now takes approximately five minutes.

Lines are located in different “focus factories” dedicated to specific market segments. One area that’s helped the plant secure new orders is its prototyping line. IEC separated the prototyping line from other focus factories to prevent production slowdowns in those areas, says Mark Talmadge, director of new product introduction. A “new product introduction ambassador” will hand-deliver the prototype and answer any questions the customer might have, he says. This helps build relationships with IEC customers.

Another capability that plant managers tout as a competitive advantage is the facility’s materials analysis lab. The plant employs two people with PhDs who conduct destructive analysis on defects that aren’t easily identified rather than sending the product to an outside lab. The process provides the plant with more intimate knowledge of customer problems and allows for a quicker response time, Biuso says.

By incorporating such innovative capabilities into its operations, the IEC plant has positioned itself for future growth and given hope to a regional workforce that’s too familiar with the perils of stagnation.
A lot of smart activity occurs at Landis+Gyr’s manufacturing operation in Reynosa, Mexico, beginning with the product it makes. Located just over the border from McAllen, Texas, the 100,000-square-foot facility produces electricity meters primarily for residential but also for commercial and industrial use. They largely are “smart” meters that record consumption and communicate the information back to the utility or consumer. Certain versions provide utilities with the ability to remotely disconnect or limit service. “Smart” is also how the facility operates. At the top, annual strategic planning drives the plant’s goals as well as the action plans required to meet those goals. Formal progress reviews assure that well-laid plans do not go astray or get ignored. “You give people tools and a vision to make [improvement] happen, and it will happen,” says Aubrey Williams, vice president of operations.

Landis+Gyr’s manufacturing strategy is to employ lean principles such as one-piece flow and flexible production cells to meet or exceed customers’ requirements. Primarily a high-volume tabletop assembly operation, Landis+Gyr’s attention to quality is readily apparent in its neat, brightly lit factory where banners suspended from the ceiling share word of new orders. Production lines are dotted with automated poka-yoke (mistake-proofing) processes that prevent product from moving to the next station unless components are correctly positioned. Additionally, quality alert buttons are embedded along the production lines. When they observe potential defects, operators can and do stop a line by pressing one of the buttons, which also draws immediate action from a team of trouble-shooters. The Reynosa operation also has a formal Six Sigma program.

Landis+Gyr, which is certified to the ISO 9001:2008 quality management standard, extends its quality concentration beyond its four walls to suppliers. The facility forges strategic partnerships with major suppliers to jointly improve cost, lead time and quality. For example, in 2010 engineers from the facility have been engaged in a Six Sigma project with a supplier, aimed at reducing defects and improving processes related to repair and rework.

Within its four walls, Landis+Gyr smartly recognizes that its pursuit of excellence is driven by a motivated, prepared workforce. To that end, the facility provides significant training to assure the plant is populated with personnel who can ably tackle high-volume production demands. In the past four years, the plant has increased shipments by 133%.

Midlevel manager training is one example of Landis+Gyr’s work force efforts. Employees who show potential for higher-level positions are nominated to the training by their supervisors. The training spans six months and is taught by senior management, who present lessons in their areas of expertise. Among the lessons taught by Williams is “It’s Okay to Be the Boss,” which shares lessons from a book by the same name. Approximately 70 employees have completed the training in the past four years.

Ultimately the plant’s aim is to be the smart meter integrator of choice. As a result, complacency has no home at Landis+Gyr. The manufacturer remains tightly focused on improving its products, processes and costs. “We are always moving forward, constantly willing to improve [and] try new things,” says Armando Benavides, residential operations manager.
It’s only 11 a.m., but the roar of a crowd emanating from Raytheon Integrated Air Defense Center’s Andover, Mass., cafeteria is unmistakable. It sounds more like overtime of an NBA game than late-morning in a manufacturing facility.

Upon closer inspection, all the commotion derives from a pep session for a team of two dozen operators that has pitched ideas on how to improve its department workflow. The team competes against 135 other groups at Raytheon’s Andover facility. And make no mistake, the competition here is fierce.

That emotional stake is the very essence of how Raytheon Andover was able to not just overcome the potential shuttering of its doors a decade ago, but ultimately rebound to become one of the most advanced production centers for defense systems in the U.S.

Since 2007, Raytheon Andover has seen productivity improvements of 6%. One of its largest programs, the Patriot Missile, has had 100% on-time delivery over the past two years and registered a 0% customer reject rate since 2005. In 2009 alone, Raytheon’s continuous-improvement campaign resulted in the reduction of manufacturing floor space requirements by 45,000 square feet.

Seven years into its continuous-improvement journey, Raytheon has refined its processes and engaged its workforce. Now the leadership team finds itself in a position many advanced CI companies do, which is to forge the next evolution of lean.

“When we started this journey, I had no idea how long a journey it was going to be,” says Michael Shaughnessy, senior director of operations at Raytheon’s Andover facility. “There’s still so much opportunity to be gained. Today, I have more to do in the next six months in improving how we run this operation than I did three or four years ago. That’s unexpected.”

Shaughnessy says Raytheon has cultivated relationships throughout its supply chain to focus on continuous improvement. The company has begun discussing with suppliers new ways to reduce cost, make products more affordable and improve quality.

Raytheon has recently undertaken several intriguing long-term CI projects. Two years ago, for instance, it instituted an interdependent approach to supplier management, creating communications elements within project lifecycle to spur faster flow and responsiveness to the customer from engineering, operations, supply chain and quality.

It has also begun a collaborative scheduling project to align the disconnects between the MRP (manufacturing) and ADT (engineering) systems, which schedule from opposite points of view—manufacturing from the back end and engineering from the front end. Raytheon instituted a virtual business system to track all engineering, supply chain and operations progress when a program is brought into production, ensuring visibility and management of detailed milestones all the way to the supplier level.

But the real opportunity, Shaughnessy says, is to implement continuous improvement at the beginning of the product lifecycle, not during production. To do that, he says, requires “shifting resources, be it operations, engineering or supply chain, to the front end of the process versus the latter end where we are today. That’s gradually happening each year.”
nestled in the Appalachian Mountains, the small town of Murphy, N.C., seems right out of a Norman Rockwell painting. But with the exodus of textile mills and other manufacturing plants in recent decades, Murphy’s economy hasn’t been a picture of small-town utopia. That’s why Snap-on Power Tools, which occupies a former Levi Strauss plant that shut down in the late 1990s, has a clear vision for its Murphy operations: to “create an enduring manufacturing footprint” in the sleepy town of 1,600 people.

“This area has seen a lot of jobs come and go,” explains Todd Rowe, RCI manager for the plant. “So we wanted this facility to be here many years into the future.”

With that goal in mind, Snap-on’s vision statement describes the plant as a “world-class manufacturing facility specializing in producing a broad range of power tools in relatively low individual volumes.”

“We want to be really good at what Asia doesn’t want to do,” Rowe explains.

The Murphy facility subscribes to lean principles with an almost religious zeal. Since 2003, lean—or “rapid continuous improvement” (RCI) in Snap-on’s corporate lexicon—has been the plant’s core operational strategy. The plant formed an RCI department in 2004; its nine employees facilitate the plant’s lean activities.

Walking the factory floor is a study in lean concepts in action. For example, a redesign of the plant layout vastly improved the flow in the machining area, where dedicated cells organized by component families have replaced a convoluted configuration of process departments. A supermarket with kanban replenishment tags, located between the machining and assembly areas, has replaced the MRP approach to scheduling the production of machined parts.

Visual cues abound at the plant. To ensure that the factory stays clean, older equipment in the machining area is painted white to make dirt conspicuous, while machine guards are painted yellow. Fluids for the machines are stored in color-coded containers.

The plant’s andon systems provide cell-by-cell updates of stock-outs, equipment problems and other issues, ensuring that workers don’t have to leave their cells to get supplies or flag down maintenance personnel.

The facility’s overall lean strategy has three components: benchmarking and training (the plant credits the help of Shingojutsu USA for some of its biggest breakthroughs); linking processes (through material presentation, kanban signals and other lean principles); and optimizing processes (through one-piece flow, setup reduction, total productive maintenance, standardized work and other continuous-improvement concepts).

A good indicator that the plant is on track with its goal of long-term viability: In 2009, the Snap-on Power Tools division shuttered a 68,000-square foot plant in Natick, Mass., and moved its five assembly lines and 38 machine tools to Murphy. Even with these operations, plant manager Brian Spikes estimates that the Murphy plant has freed up 12,000 square feet of space for future assignments—and the plant makes it plain as day by leaving that space open.

“When people from corporate visit, their first question to us is: ‘What goes here?’” Spikes says. “We tell them, ‘Whatever you want to put here.’ We keep reducing our footprint to prove we’re a good plant and a profitable plant for them.”

At A Glance

Snap-on Power Tools
Murphy, N.C.

Employees: 223, nonunion
Total Square Footage: 168,000
Primary Product/Market: Professional and industrial power tools
Start-Up Date: 2002
Achievements: Reduced order-to-delivery lead time by 55% over past three years; 96% first-pass yield for all finished products; OSHA SHARP site; winner of silver-level North Carolina Shingo Prize for Operational Excellence in 2007
2011
The Best
Never Rest
11 ...... Carrier Collierville
12 ...... Ethicon
13 ...... General Cable Corp.
        Lawrenceburg Plant
14 ...... General Cable Corp.
        Lincoln, Rhode Island
15 ...... Klein Steel Service
16 ...... L.B. Foster Co., Allegheny Rail Products
17 ...... Life Technologies
18 ...... Lockheed Martin Missiles and Fire
        Control, Lufkin Operations
19 ...... Swagelok Company Main Plant
20 ...... Toyota Industrial Equipment Mfg. Inc.
Meeting the Efficiency Challenge

A workforce dedicated to quality, productivity and continuous improvement fuels Carrier Collierville’s success. ■ BY JILL JUSKO

The workforce at Carrier Collierville knows all about the importance of efficiency. It is a critical component of the very products they manufacture: residential split-system air conditioners and heat pumps. These units must meet federally regulated minimum energy-efficiency standards in addition to appealing to homeowners.

Efficiency also is critical to the continuing success of this sprawling facility located just east of Memphis. Like many manufacturing plants whose fortunes are tied closely to the U.S. housing market, this 900,000-square-foot facility has had to weather—indeed continues to weather—tough economic conditions that show few hints of an impending turnaround.

Driving Carrier Collierville to meet the efficiency challenge is the diligent application of ACE, or Achieving Competitive Excellence. ACE is the operating system of United Technologies Corp., of which Carrier is a subsidiary. United Technologies describes ACE as a comprehensive approach to achieving customer satisfaction and business results through continuous improvement. Its success relies on three elements: culture, tools and competency.

For Collierville, ACE translates to this philosophy: “The plant’s greatest asset is the culture: people who apply the right tools with competency to understand customer value, the processes that create the value and [to] solve problems wherever value is lost.”

“ACE is how we do business,” says general manager Phil Grady.

ACE in action is evident throughout the clean, brightly lit manufacturing operations, where workers represented by the United Steelworkers build the outside components of residential split systems (a split system has components in two locations, typically one inside and one outside) in multiple sizes, nine different efficiency offerings, four electrical options and across seven different brands. In addition to assembly and test operations, production processes include the manufacture of sheet metal components, paint operations and brazing. During peak season, some 1,500 workers can be turning out product across nine assembly lines.

In an operation so vast, the opportunities to lose value are profound. Carrier Collierville has implemented multiple measures to reduce such opportunities, including:

● A quality improvement team, which included hourly workers, attacked a leak issue at braze joints on a heat pump component. Changes made to the work area, including improved lighting and modifications to the fixture that held the piece during the brazing operation, resulted in a nearly 50% reduction in leaks and the associated repair costs.

● Long changeovers eat up valuable time, particularly in high-volume areas. Carrier employees modified equipment in the coil shop operations and reduced an eight-minute changeover to a 10-second changeover. That’s a reduction of more than 90%.

● The Collierville team implemented a visual solution (flashing lights) at an assembly line work station that warns operators who accidentally introduce the wrong components along a high-velocity, mixed-model assembly line. The solution also prevents the product from continuing down the line until the error is corrected.

Such process improvements and problem-solving techniques have reaped rewards for Carrier Collierville. Achievements include a 50% reduction in the customer reject rate in the past four years, as well as a 79% reduction in scrap costs over the same time frame.

Carrier Collierville’s achievements were recognized by its parent company in 2011. UTC awarded the facility “ACE Gold” certification, the highest-possible designation presented to sites employing ACE to improve their operations.
Winter temperatures ranging from 0 to 10 degrees are par for the course in, say, North Dakota. But a February 2011 cold spell this extreme was so unusual for northern Mexico it caused power outages throughout the region and shut down manufacturing plants—including the Ethicon Inc. medical device facility in Ciudad Juarez.

Ethicon, a Johnson & Johnson subsidiary, needed help from some dedicated workers who were willing to sacrifice part of their Super Bowl Sunday so the plant could restart the next day. The producer of surgical sutures and wound-closure devices assembled 150 hourly and salaried employees who washed 80,000 square feet of this clean-room facility top to bottom and completed startup procedures—all within four hours, says plant manager John Schneider.

The same high level of employee participation was a key part of Ethicon’s ability to reach 100% productivity on its Secure Strap line just one week after launching the device in December 2010. It’s also a reason the plant expects to continue adding new products and increase revenue by approximately 21% to $772 million over the next three years. While the Secure Strap introduction represents a significant milestone for the plant, Ethicon’s history is rooted in absorbable and nonabsorbable sutures.

Managers at Ethicon’s Juarez facility attribute much of the plant’s growth—from 19 employees in 1999 to more than 1,100 in 2011—to its focus on continuous improvement. In 2010, Ethicon reached J&J’s Lean Integration level, the highest designation in the parent company’s Lean Maturity Assessment.

The Integration level indicates the plant is working with all stakeholders throughout the supply chain to achieve lean goals, explains Edgar Vasquez, process excellence manager. For instance, the Secure Strap line has become such a success the plant is spending more than $4 million to improve capacity throughout its supply chain, including improvements for external suppliers, Schneider says.

Secure Strap is a device used to attach hernia meshes during laparoscopic surgery, and it’s the plant’s first new product introduction. As of November, Ethicon was on pace to reach Secure Strap volumes that weren’t expected until the seventh year of production, Schneider says. On the plant floor, workers used a Six Sigma methodology known as DMAIC (define, measure, analyze, improve, control) during the initial product introduction phase to spot any potential issues before going live, says Manuel Ochoa, manufacturing facilitator. This included identifying a poka-yoke, or mistake-proofing, machine that reduced the likelihood of a potentially critical defect in the cannula subassembly.

The plant’s “lean Sigma” strategy offers employees the opportunity to receive Six Sigma belt certifications. But the certification process at Ethicon’s Juarez plant requires more than just standard training, says Luis Roman, vice president of manufacturing for Ethicon’s Americas region.
The key to success is not the guy in the corner office,” Paul Furtado emphasizes, “it is the people out on the floor. They get it. They understand that in order to survive, they have to change. They have to be flexible. Leadership is what gives passion to people to say, ‘We can get there.’”

As plant manager for General Cable’s Lawrenceburg, Ky., facility, Furtado is “the guy in the corner office,” but it is clear that his focus is on the 300 employees in the plant, and the immediate destination is a sweeping change to an operator-led process-control (OLPC) environment where employees “own and manage” the production process.

The Lawrenceburg facility produces two basic product lines. Telecom cables, the familiar thick cable seen on telephone poles and in underground installations, consist of from nine to 4,200 pairs of copper wire. These complex products cover thousands of part numbers. For General Cable, this is a maintenance business. The growth at Lawrenceburg comes from datacom cables, such as the Cat 5 and Cat 6 twisted pair cables used for computer and electronic data transfer.

The leading edge of change at the plant is at the CAT 3 cell, a production cell for datacom cable where hourly associates manage all aspects of the operation. “This is a supervisor-less cell,” Furtado notes. “We have one person who is a value-stream manager who checks in with them to see if they need anything and serves as a coach and mentor.”

At the cell, operator Mike Johnson describes how each of the five cell operators not only run the machines but are also responsible for a specific duty—production, safety, maintenance, quality and human resources. A large board in the cell tracks essential metrics as well as the operators’ progress on cross-training and action items. The cell operators have all undergone training designed to help them work as a self-directed team.

Why make the move to production cells? Furtado says it is essential to develop a structure where associates take responsibility for the day-to-day decisions in their work area and develop the flexibility to handle any job in the cell. Working as a team, he notes, the cell should see a 10% to 15% increase in throughput and utilize labor more efficiently.

Work on developing the second of what will eventually be six production cells is underway. “A year or two from now, this plant will be completely different than it is today,” says Furtado.

The Lawrenceburg plant sets direction for its continuous-improvement efforts through a LeanSigma council, consisting of Furtado, his staff and black-belts, that meets monthly. That group determines what issues need to be addressed, and reviews ongoing projects to assess progress and ensure the right resources are devoted to them.

During their first year at the plant, every employee takes an Introduction to Lean course. From there, employees are encouraged to become a Lean Technician, which involves five days of additional training and involvement in a kaizen or lean project. Lawrenceburg has 25 lean technicians, with eight more pending and another eight scheduled for 2012.

Furtado calls the production of wiring cables “hard-core manufacturing that takes good, strong people to run it.” And while he’s proud of the accomplishments at the plant, he is quick to point out, “What we’re excited about is how much more this facility can improve on over time.”

Lawrenceburg can produce 27 billion conductor feet (BCF) of telecom cable and nearly 5 BCF of data communications cable.

At A Glance
General Cable Corp.
Lawrenceburg, Ky.
Employees: 310, nonunion
Total Square Footage: 364,000
Primary Product/Market: Telecom and datacom cables
Start-Up Date: 1974
Achievements: Increased productivity 5.6% in 2010; improved cycle time by approximately 50% over last 3 years; had zero recordable injuries in 2009.
Change is Good
After decades of batch-and-queue production, a veteran workforce has embraced the switch to cellular manufacturing. ■ BY JOSH CABLE

General Cable Corp.’s Lincoln, R.I., plant was designed to manufacture and warehouse wire and cable products. For a company that makes wire and cable products, such a facility might seem well, ideal.

But in this age of lean manufacturing, a production flow that was efficient in 1974—when the former Carol Cable Co. built the facility—isn’t so ideal.

“If you were looking at the flow of a factory 15 years ago, the flow of this factory was very good,” plant manager Mike Brown explains. “Meaning it starts at zero and goes to one. Zero is incoming material, one is compounding, and that feeds our foundation [wire], which is two. Three is cabling, four is jacketing, five is packaging and six is shipping. Good flow.”

The problem, Brown says, is the old batch-and-queue flow created “a lot of WIP in between each one of those processes.”

“I mean a lot,” he emphasizes.

While there was too much WIP in the old batch-and-queue format—1 foot of completed wire traveled more than 2,700 feet through the plant—the physical layout of the plant discouraged camaraderie among the operators, notes human resources manager Mary Igoe.

“They didn’t even talk to each other,” Igoe says. “They were just making wire and pushing it along to the next operation.”

All of that has changed dramatically since the facility completed the switch to cellularization in 2005.

In late 2002, the plant began reorganizing its equipment layout and establishing work cells based on copper-gauge size, compound type and product construction. In 2003, the plant’s first physical work cell—the Small-Cord Cell—was up and running.

The creation of the Small-Cord Cell produced immediate results. With previously segregated processes—foundation, cabling, jacketing and packaging—now in the same physical cell, the distance that wire traveled was reduced to less than 100 feet, and the cycle time for a finished product went from days or weeks to just hours.

Meanwhile, WIP turns doubled, scrap rates plummeted and cell members began functioning as a team.

“The cell works out great because we talk to one another and we can really see what the next process needs, what my customer [another operator within the cell] needs, and I work toward that,” says Randy Beauregard, a CV (continuous-vulcanization) operator within the Small-Cord Cell. “Previously, we used to run out of wire, or colors and things like that. Now we’re a lot more on top of that, and we keep running a lot more as a result.”

The success of the Small-Cord Cell was a catalyst for the rest of the plant’s operations to go cellular. Today, the plant is organized into five physical cells, all of which have the equipment needed to make cable—from the bare copper to the finished product.

Turnover at the Lincoln plant is inordinately low, and you’d be hard-pressed to meet a first-shift employee with fewer than 30 years on the job (Beauregard, for example, is a 31-year veteran of the plant). Not lost on Brown’s management team is the fact that the workforce—and its union—easily could have balked at such a tectonic shift in its production format.

As part of the switch to cellularization, General Cable Lincoln consolidated job titles to promote cross-functionality and camaraderie. Ricardo Peralta is an “Operator B,” which combines previously separate cabling and packaging roles.

But manufacturing manager John Tremblay emphasizes that the buy-in of the workers and the local United Steelworkers union has been key to the success of the switch to cellularization.

“You can make the physical moves with the equipment, but the real benefits come when you get the associates engaged,” Tremblay says.
At A Glance
Klein Steel Service
Rochester, N.Y.
Employees: 146, non-union
Total Square Footage: 206,000
Primary Product/Market: metal processor, steel service center
Start-Up Date: 2004
Achievements: finished-product first-pass quality yield of greater than 99%; 86% reduction in OSHA-recordable injury and illness incidence rate from 2008-2011

Processing steel can be a dangerous business, and not only for the people directly involved in the production. Customers, suppliers and other visitors unwittingly can add to the potential for safety mishaps in a building full of heavy metal slabs and machinery that cuts, burns, machines and moves those slabs.

Recognizing this truth, Klein Steel Service, a privately owned steel distribution and processing company located in Rochester, N.Y., last year introduced a visitor safety program that established a number of guidelines. These include requiring visitors to the warehouse area to sign in and out, and wear safety glasses and hard hats.

In theory, the safety program worked fine. However, after observing it in practice for awhile, the receiving team in Rochester noticed that an awkward layout made it possible for visitors to enter the warehouse without first registering. Without fanfare, the team changed the flow of visitor entry into the facility; now visitors can’t avoid signing in and signing out.

This improvement project, one of many under way at Klein Steel, illustrates several important points about this 2011 IndustryWeek’s Best Plants winner. The first is the absolute imperative of safety. “Our team members train on safety from day one, with constant reinforcement, coaching, reminders, additional training and attention throughout their career,” notes the company in its competition application.

The second point is the value Klein Steel places on decentralization and empowerment, and on a culture of performance. The team members who improved the layout didn’t react in response to an order from management. They instead identified an issue, developed a solution and implemented the solution—not constantly engaging top leadership for approval.

That’s exactly the type of enterprise Klein Steel expects from its entire workforce. “Team members are empowered to seize the initiative,” explains Todd Zyra, chief operating officer.

It’s really more than that. Employees are encouraged to seize the initiative. “Do the right thing in the absence of supervision,” is one of the abiding principles at Klein Steel.

If it sounds as though the company places significant responsibility in the hands of all employees, it is because Klein Steel does exactly that. Therefore, hiring the right people into the company is an area of emphasis. Interestingly, however, deep knowledge of steel is not a requirement.

“We look hard for very special people, and we are willing to train,” explains John Batiste, president and CEO of Klein Steel. Where the company is unwilling to bend is in the hiring of people who embrace the company’s values, which include accountability, candor, customer satisfaction, integrity, and dignity and respect.

“We are very selective,” admits Rob Sihto, manager of human resources. His arsenal of hiring tools was recently augmented with an online assessment that helps identify star performers and candidates who share Klein Steel’s values and culture.

“If people get fired from Klein Steel, it is because they don’t walk the talk with these values,” Batiste says.

On the other hand, the company has implemented a robust talent-planning process for high-potential employees. It includes customized training based both on the individual and company needs.

Klein Steel’s focus on hiring and developing the right people has helped drive strong results, including a 10% increase in productivity over the past three years, measured as annual sales per employee, and a 34% reduction in manufacturing cycle time. Perhaps most importantly, the company’s success is driving growth.
Sweating the Small Stuff

When it comes to continuous improvement, you don’t have to swing for the fences to hit a home run. ■ BY JOSH CABLE

If L.B. Foster’s Pueblo, Colo., facility were a baseball player, it would be Ichiro Suzuki—or Rod Carew.

In the never-ending quest to control costs and boost productivity, plant manager Bart Peterson has found that small, incremental process improvements can add up to big gains.

“We aren’t necessarily looking for the home run every time,” Peterson says. “We’re looking for base hits. We score that way.”

Walk the floor of the 56,000-square-foot plant—which makes insulated rail joints for Union Pacific, BNSF and other rail companies—and you’ll see more “base hits” than you would at a Colorado Rockies game.

At the rail-grinding station, a worker uses a handheld grinder to remove excess epoxy from the rail joints. The process requires the operator to go through some 20 grinding wheels a day. Thanks to an employee suggestion, the plant switched from a finishing flap wheel that costs $7.50 to an equally effective grinding wheel that costs just 25 cents—saving the plant nearly $27,000 a year.

“You just chip away at costs and you keep at it,” Peterson says.

A bit further upstream in the assembly process, workers use hand drills to remove plastic caps from bolt holes in the rail joints. The plastic caps prevent epoxy from filling the holes when the joints’ components are glued in place—and are a vast improvement over the previous method, in which workers had to remove the epoxy with a drill press.

“We would have to take all those [rail] bars and palletize them, set them next to a huge drill press and a guy would stand there and drill all day long,” Peterson says of the previous method.

Using a drill press, it took 1 to 2 minutes to remove the epoxy from each hole, assistant plant manager Michael Smith adds. “Now that we’ve switched to plastic caps, we do about six holes in 30 seconds,” Smith says. “So we’ve reduced that time, and we were able to put it in our one-piece-flow process. We don’t have to batch them and move them to another workstation and then bring them back like we did before.”

The plant buys the plastic caps from an online company, paying just pennies per cap. The seemingly small investment has yielded big savings not only in time but also in cost compared with the previous method.

“Epoxy is not very friendly to keeping a drill bit sharp,” Peterson says. “So we were going through hundreds of dollars’ worth of drill bits a day.”

Such small improvement ideas generated by Peterson and the 23 employees at L.B. Foster Pueblo are adding up. Since 2007, the plant has cut its manufacturing costs per joint by 67%. During that same time period, the facility has reduced its man hours per joint by 63%.

Contrary to what Peterson says, though, the plant has hit at least one home run, asserts Steve Burgess, L.B. Foster’s director of continuous improvement. That is the plant’s one-piece-flow layout, which is enabled by a series of homemade conveyors, rollers, heaters, actuators and tools designed or modified by plant employees.

“The transportation system that these guys built—the rail moving in one piece like this—doesn’t exist anywhere else in the world,” Burgess says.

While Pittsburgh-based L.B. Foster has a corporate continuous-improvement program in place, you aren’t likely to hear Peterson and his team mention many lean buzzwords such as “kaizen event” and “value-stream mapping.” In fact, during a recent visit to the plant, most of the shop-floor employees admitted that they don’t know what lean is.

That’s just fine with Burgess.

“[Peterson] doesn’t necessarily know the true principles of lean—he just lives them, and so does his team,” Burgess says. “He’s naturally there. This plant has a special group of guys with a special leadership that has just created this vortex of mind-blowing improvement.”
A  t 8:15 a.m. on a Friday key members of Life Technology Inc.’s Austin, Texas, manufacturing operations convene in a conference room for a strategy session. The daily start-up meeting is a way to provide status updates on projects or initiatives and recognize employees for significant achievements. The session is a continuation of constant collaboration among the workforce in this laboratory environment.

“War rooms” throughout the complex provide self-sufficient work teams with analysis tools and dashboards they use to initiate their own improvements. These employee-led work groups, called “high-performance work teams,” helped the plant gain new business and drive $4.2 million in productivity improvements in 2010. Life Technologies’ Austin site produces ribonucleic acid formulations used by researchers for applications in areas such as pharmaceutical testing, university labs and government research institutions.

The plant has undergone a dramatic cultural transformation just three years after Applied Biosystems and Invitrogen merged to form Life Technologies. Brett Petrie joined the plant in 2007 after working for a pharmaceutical manufacturer to help convert the operation from an entrepreneurial environment to a lean plant. The facility had grown since its beginnings in 1989 as a six-employee startup called Ambion. But little manufacturing expertise existed in a company still heavily influenced by its science-based beginnings, says Petrie, senior director of manufacturing and Life Technologies global leader of operational excellence.

The first order of business was addressing foundational issues including an overhaul of data management systems and implementing financial accountability for managers, says Daniel Szura, the plant’s continuous-improvement manager. The facility advanced quickly with basic lean principles such as 5S. After gaining some quick wins, the facility moved forward with the creation of work cells, insourcing of certain raw materials and the formation of high-performance work teams.

Members of the work teams are cross-trained and track their available hours on a computerized scheduling dashboard. If the employee’s utilization rate is low, that worker can move to another line that needs assistance, says Caesar Almaraz, a leader for oligonucleotide production. Team-driven improvements played a deciding role in the facility being selected by the parent company as one of the anchor manufacturing sites for the company, plant leaders say. “Anytime you can layer high-performance work teams on top of lean and Six Sigma, then you’ve got a powerhouse that is very difficult to compete with,” Petrie says.

Moving forward, the facility is on track to transfer another product line later this year that will increase overall plant revenue 8% to 10% — another significant milestone since the lean transformation began. When Petrie arrived in 2007 time was running out on the plant’s ISO 9000 certification because of quality issues, he says.

Today, a countdown clock in the new product line’s war room keeps Life Technologies’ Austin employees focused on moving the plant beyond survival to a thriving manufacturing center.
Lufkin Makes Sure Missile Systems Are on Target

Plant leaders, employees ensure quality products during major expansion.

By Steve Minter

A wall of posters honors service by Lockheed Martin Lufkin employees and family members in the U.S. military.

Lining a corridor in the offices of Lockheed Martin’s Lufkin plant are posters with photos showing employees and their relatives who served, or are serving, in the military forces of the United States. Among them is a picture of Site Director Keith Johnson’s son, a Marine. The photos are a constant reminder that the missile system components being built at the facility are relied on in some of the most deadly areas in the world.

“There is a personal commitment to quality to make sure we get world-class, high-quality products to our war fighters,” says Johnson. “This stuff has to work first time, every time, no exceptions, no cutting corners. Quality is number one.”

Lockheed Martin’s Lufkin Operations, part of the Missiles & Fire Control division, produces electronics and sub-assemblies for the Patriot Advanced Capability-3 missile, a hit-to-kill interceptor that is its primary product, as well as the Guided Multiple Launch Rocket System (GLMRS) the Army Tactical Missile System (ATACMS) and the Terminal High Altitude Area Defense (THAAD) weapon system.

While the Department of Defense is planning to reduce expenditures, production of the PAC-3 and THAAD systems is ramping up. In fact, Johnson has had to maintain the facility’s zeal for quality while overseeing a dramatic expansion. In 2010, manufacturing space was doubled to accommodate a large contract to build the PAC-3 missile systems. Increased production has resulted in a near tripling of the employee population. Every workstation and piece of equipment in the plant was moved. “We did all that without sacrificing quality or schedule,” Keith recalls. “We didn’t miss any contract dates. Our defects per standard hour actually went down during that same timeframe.”

Keith emphasized communication during the transformation of the plant, hosting frequent all-employee meetings as well as small roundtable meetings where employees could provide their feedback on the changes. He held staff meetings every morning and afternoon for a year to coordinate the expansion.

To obtain the best new employees, Lufkin worked with a temp agency that screened applicants based on their educational abilities. They then went through hand/eye coordination tests (important for the assembly of intricate circuit boards and wiring) and then interviews and background checks. Several weeks of training followed, then job shadowing and finally several months of the on-the-job training where the new recruits were evaluated on their attendance, efficiency and quality of work.

The plant has three primary production areas: circuit card assembly, wire harness assembly and final assembly, integration and testing. The plant employs state-of-the-art machinery and processes to produce these sophisticated products and ensure that they will work reliably. For example, explains Jason Crager, the production operations manager and site deputy, the plant recently implemented an X-ray inspection machine that checks solder joints on circuit boards. The machine is set “high” so that it initially identifies more defects. Operators then check the joints to see if they are actually a defect or not. This information is fed back to the machine so that it refines its analysis of joints. The machine both speeds up and reduces variability in the inspection process.

To accommodate the increased production, Lufkin runs two 10-hour shifts four days a week. Lufkin also has developed a work-sharing program with Lockheed Martin’s Ocala, Fla. facility (a 2007 Best Plants winner). Using identical equipment and processes, they will produce some of the circuit boards and wiring harnesses and then send them to Lufkin for final assembly.

At A Glance
Lockheed Martin Missiles & Fire Control: Lufkin Operations
Lufkin, Texas
Employees: 208, nonunion
Total Square Footage: 102,000
Primary Product/Market: missile launcher electronics
Start-Up Date: 1995
Achievements: Reduced major end item deliverable cycle times by up to 38%; 1 lost-day work injury since October 1995; Superior security rating from Defense Security Service, won James S. Cogswell Security Award in 2008
By definition, Six Sigma is a pretty tight level of quality, but for Swagelok, Six Sigma isn’t quite good enough. At Swagelok, a manufacturer of tube fittings, valves, regulators, hoses and other products used in fluid system solutions, the threshold is zero, as in Zero Customer Disappointments (ZCD), a key metric the company uses to measure the performance of its lean supply chain program.

“ZCD was first articulated about six or seven years ago, when we started focusing on customer disappointments,” explains Michael Neff, vice president, operations. “We realized that we wanted to get to zero, not just Six Sigma, but zero.”

“If the customer is disappointed, that’s bad, no matter where in the process the disappointment happened,” adds Jay Nordholt, director of the Fitting Services Group. “The product itself might be perfect, but if something else went wrong—even if it’s an installation or MRO problem—it’s still a disappointment. The only number that’s ‘good enough’ is zero.”

Swagelok’s products are often used in high-risk environments, such as oil and gas production, chemical processing and even in nuclear submarines, so their tubes and fittings have to work all the time, every time, with no margin for error or customer disappointments. “It’s a live-or-death issue for some of our customers, so it’s important that all of our associates understand how the customers are using our products,” Neff says. That process starts with communication.

“From Day One, everybody who works at Swagelok learns and knows that focus on customers is important,” says James Francis, vice president, human resources. What’s more, the company heavily emphasizes its six core values, beginning with customer focus but also including quality, integrity, respect, continuous improvement and innovation.

Swagelok’s safety initiatives reflect all of the company’s core values, and associates are rewarded for proactively responding to safety issues. As part of the company’s continuous-improvement culture, supervisors regularly lead their teams through CEDAC (Cause and Effect Diagram with the Addition of Cards) meetings. “CEDAC puts responsibility on the associates to identify problems and come up with solutions,” Neff explains.

These kaizen-like events encourage associate problem-solving on the shop floor. One such event led to the design of an electric hoist that removed the burden of an operator bending and lifting metal filters several times a day. This solution ended up as Swagelok’s entry in the international 2011 Ergo Cup competition for ergonomic innovations.

In fact, safety is part of what Swagelok refers to as its “manufacturing cadence”—four operational drivers that every associate is accountable to: safety, quality, service and cost. These drivers can be seen throughout the plant in visual displays, and are reinforced verbally in daily CEDAC meetings, monthly shop talks and quarterly business reviews.

Swagelok has 14 manufacturing plants in northeast Ohio, and associates are trained so they can work in any of the plants. Each plant has the same metrics and adheres to the same core values. Thanks to the company’s investment in cross-training, Swagelok is able to flex its labor force as needed, which enables it to maintain a no-layoff philosophy.
The “Top Guns” at Toyota Industrial Equipment Manufacturing (TIEM) are swarming the plant looking for ways to reduce environmental impact through waste-paper reduction. Aply named Top Guns, this TIG (Toyota Improvement Group) team embodies the spirit of continuous improvement that permeates this plant, which produces 59 models of Class 1, 4, or 5 sit-down rider forklifts and Class 6 towing tractors.

With a 62% participation rate by hourly associates, the TIG Groups, similar to quality-circle activity, hone in on improvement projects through a structured program that includes choosing themes, creating countermeasures and measuring results. Participation is voluntary but there are some incentives such as paid overtime to work on the projects as well as pay based on completion of projects. The scope of a project is determined by the group based on an eight-step problem-solving technique. Competition, both against internal teams and corporate-wide, is a key element to the program.

“One important aspect of this project is that it empowers people to solve their own issues. Management isn’t here to solve all of the problems, but instead to provide direction and support. Everyone takes a lot of pride in finding solutions,” explains Scott Redelman, manager, production control.

Along with TIG, there also is Jishunken activity, which involves four groups consisting of associates and leaders from across the company who work on projects for four to five months. These groups are given specific themes to work on including safety, quality and productivity.

“For any improvements we do, we always start with the basics of 2S and standardization,” said Tony Miller, plant manager and vice president, manufacturing and engineering. The company also enlists employee suggestions, which last year amounted to 28 per employee and saved the company $717,000.

While employees keep a close eye on improving processes, the company stays focused on assisting employees through a variety of programs, including an on-site medical clinic as well as monthly social projects and recognition programs.

“Our focus is on fostering a sense of belonging to the company, rather than working for the company. We have many levels of communication, one of the most important being the interaction between associates. Supervisors’ offices are located on the floor and they spend most of their time walking the floor answering questions and listening to concerns,” said Bruce Nolting, vice president for production control purchasing.

One technique the company uses to both develop loyalty and transfer knowledge across the organization is to have associates rotate jobs and departments. Every six months, all levels up to vice presidents change responsibilities and assignments.

During recent difficult times when sales dropped off considerably, the TIEM facility demonstrated its loyalty to associates by keeping full-time employees on staff. One strategy to keep employees working was to bring more parts production in-house.

For example, in 2008 the company installed a laser-cutting machine for steel, which allowed TIEM to cut, stamp and manufacture more than 700 parts.

“This has also lowered our costs and assured better quality,” said Miller.
2012

Amazing Efforts, Amazing Achievements

21 ....... CNH Wichita Product Center
Wichita, Kan.

22 ....... Ethicon LLC
San Lorenzo, Puerto Rico

23 ....... Harris Products Group,
a Lincoln Electric Co.
Mason, Ohio

24 ....... La-Z-Boy Tennessee
Dayton, Tenn.

25 ....... Lockheed Martin Missiles
and Fire Control, Pike County
Operations
Troy, Ala.

26 ....... Warren Rupp Inc.
Mansfield, Ohio
John M. Hall remembers the CNH Wichita Product Center of six or so years ago. The facility was “dark and dingy,” with large amounts of material and inventory everywhere, describes the manager of the Product Customer Service Center and a 19-year veteran of the Wichita site.

“We had some issues,” he says. Today such disorder is hard to imagine at this site, the sole manufacturing location for the Case and New Holland brands of skid steer loaders and compact tract loaders. It is well-lit, with wide, clean aisles and no signs of inventory creep, courtesy of a workforce that recognized change was needed.

“For a while, you had to keep moving or you would be repainted,” Hall says of the reorganizing effort. He also notes a phenomenon that occurs when a plant begins to declutter. “Open space creates open space.”

The changes at the Case New Holland plant go well beyond the cosmetic, however. They go to performance.

For example, in the past three years the Wichita plant has reduced scrap and rework costs by 80.5%. It has reduced energy consumption by 60.1% per unit of production in the past three years. And it has combined two dedicated assembly lines into a single line capable of mixed-model production for improved efficiency and productivity.

Today, World Class Manufacturing is driving CNH’s continuing performance improvements.

Engineering services manager Kenny Callaway calls WCM “a lifestyle.” The facility’s WCM tools manual describes it as a change program, one that “involves all employees in continuous improvement, focusing on eliminating waste and reducing losses” while improving standards and methods.

Operations manager Eddie Smith, who joined the Wichita plant about 20 months ago, says a recent reorganizing effort at the front end of the assembly line provides a good example of the facility’s aim to reduce losses—in this instance, losses associated with non-value-added activities. Operators were spending excessive amounts of time walking and searching for parts. Additionally, the line required the introduction of work stations to address added product complexity.

A cross-functional team that included operators conducted a major kaizen (WCM and lean employ many similar tools). Ultimately, the team developed a new layout. Other improvements included a new means to both deliver axles to the line and install the axles, as well as the addition of parts kitting at certain stations.

In the end, the reorganization improved line efficiency. It also resulted in the reduction of several operators on the line, and one logistics employee per shift. The displaced workers were reassigned to other, overtaxed areas in the plant.

“The goal is to be more efficient, not drive headcount reductions,” Smith says.

Indeed, the Wichita plant has been in a growth mode the past few years. With new employees comes an increased need for training, and the facility has an enviable training center. So much so, that other CNH facilities have traveled there for training. The classroom training is led by training supervisor Jason Smoley. The training is largely interactive, and features both touch screen tools and an audience response system that captures an electronic record of the interactions. “We’ve had great feedback on [the tool],” Smoley says.
In an industry that has been plagued by product recalls, the medical devices built at Ethicon San Lorenzo, a Johnson & Johnson company based in Puerto Rico, stand apart. In the plant’s 24-year history, there has never been a product recall.

And given the volume of producing 110 million units yearly of non-absorbable sutures with over 2,500 SKUs, that is no small feat. Additionally the plant manufactures topical skin adhesive Dermabond, polypropylene meshes (used for hernia reparation) and Surgicel (blood clot-inducing material).

“Our quality record is due to the desire of all employees to get it right the first time,” explains Adnyl Grovas, QA director. The plant’s metrics bear this out. Since 2008 non-conformances have been reduced 50% while human error has decreased by 60%, contributing to an overall 98% rate of the products manufactured being correct the first time.

The structure underpinning these accomplishments is a system named “Do it Right Framework.” It has nine pillars, including: management oversight, mistake proofing, risk management, training and education and change management.

“How we have handled change management is the key to our success. By being transparent with our metrics as well as our competitive position, both within the industry and within the corporation, I have made clear to our associates the reasons for the changes that were made,” states plant manager Marinelba Rosado.

In order to compete within J&J for the opportunity to launch new products, the plant has established a strong partnership with marketing and R&D to get new products to market on time and design them for manufacturability. The plant has already begun manufacturing a new type of suture for 2014, the first time in 15 years that the plant has produced absorbable sutures.

Other works in progress include the next needle generation for cardiovascular surgeries called Everpoint, and a new formulation for Dermabond called Dermabond Advanced.

“The site is now positioned as one of the top innovative sites in information technology infrastructure and automation within the organization,” says Francisco Muniz, process excellence manager.

Enabling innovation is the emphasis on lean which began when the plant started automating production lines in 2006. No regular employees have lost their jobs as a result of these automation efforts. Instead employees were trained in both lean management and change management, with 65% of the exempt population having at least a green belt certification. All employees have had some type of lean training.

With lean and other improvements, the company has seen productivity gains of 8.5% over the last three years.

Improvement in employee engagement is yet another reason for stronger metrics. Concerted efforts to make sure everyone clearly understands the objectives of the plant has raised the employee engagement score from 62% in 2005 to 96%.

Moving from plant floor engagement to community engagement, the plant is employing a program called Connect whose vision is to “strengthen the trust in our products and organization by connecting ourselves as one entity with our customers and community through the exchange of knowledge and active participation.” Supporting activities include clients participating in procedures, supplier visits and an open house for the community at large.

To demonstrate how the greater community benefits from their efforts, all employees are shown a video featuring Dr. Gonzalez Cancel, a cardiovascular surgeon, explaining how he uses the products and which attributes are essential to positive outcomes.

“Each of us understands that the products we manufacture can be placed in our loved ones. What we manufacture saves lives,” says Rosado.
Driven by Data

By harnessing the power of information, Harris Product Group has rejuvenated its century-old business to record success. □ BY TRAVIS HESSMAN

As workers file in through the hallway overlooking the plant floor at Harris Product Group's Mason, Ohio, facility, they are privy to an endless array of data. The walls of the corridor are plastered with charts and graphs detailing all of the plant's vital performance stats, allowing workers coming in for a shift to check the plant's fill rates and profitability reports, even their managers' weekly 5S ratings. And of course there is the little matter of scrap rates—a chart the staff has enjoyed watching plummet for the past three years.

Since 2009, when these displays first started popping up, the company has seen steady, relentless improvement. From the 45% decrease in WIP to the 41% drop in customer reject rate and inching up toward a 90% first pass yield, the company's numbers are breaking records, shattering expectations and yielding industry best results.

These successes haven't escaped the attention of Harris Products Group president and CEO, David Nangle. “Our inventory is at its lowest and our fill rates and profitability are at their highest,” he says. “We are doing more today with the same number of people as we had in 2008 and getting the highest quality we've ever had.”

While it was no easy task to turn around the ingrained inefficiencies of a century-old company, Robert Temple, plant manager and lean champion at Harris, says the company had no choice but to take it on. Because Harris had such a strong standing in the industry, “we knew we could do 'good enough' and stay in business for another hundred years,” he says. “But when the recession hit and our competitors started to fail, we knew we had to do something more.”

That “something more” meant fundamentally transforming the processes of the entire plant into a lean, cooperative network for efficiency. The first step of that process was to take a closer look at what exactly the company was already doing.

“From my vantage point, there has been a huge evolution of how we do business here at the plant,” says CEO Nangle. “We started to document some of the things that we did and realized that while we thought we were really good, we could be much better. That's when the journey began.”

Discovering the Real Cost of Scrap

Nowhere has this played out more dramatically than its handling of scrap. The copper and silver the Mason facility melts into its finished products can represent as much as 97% of its total materials costs, yet historically very little attention has been paid to how much of it was scrapped in day to day operation. “All of the scrap we produce is remelted,” explains Nangle. “Since the price of copper and silver was going up, the thinking was that the scrap we redid could actually make us money.”

That logic, however, did not factor in labor or energy costs, which, compounded through the remelting process, far offset any potential gains.

Since they began collecting and working from data, Harris' casting team has “changed every paradigm in that department of what engineering scrap was about,” says Nangle, utilizing advanced metallurgical tools and going through a lot of experiments and projects.

By focusing on casting and scrap, and using data to guide them, the casting team has reduced scrap by some 80% since 2009, adding up to an impressive $1.23 million in project savings from that department alone.

“Data is driving everything,” Temple notes. “We are challenging legacy processes, improving quality, improving efficiency. Data is how we get there.”
La-Z-Boy Never Rests on Continuous Improvement

The Dayton plant is driving productivity with a lean culture, advanced machinery and an engaged workforce. ■ BY STEVE MINTER

Take a tour of La-Z-Boy’s Dayton, Tenn., facility with Continuous Improvement Manager David Robinson and be prepared for a bit of temporal distortion. For as proud as Robinson is of the facility’s current operations, his heart belongs to its “future state.”

The Dayton facility produces a wide range of upholstered furniture, including the famous La-Z-Boy recliner, in a staggering variety of styles and fabrics—11 million possible product variations in all. The facility cuts and shapes its own wood parts, stamps and shapes metal for furniture mechanisms, and cuts polyurethane foam from large buns for cushions and padding.

In the manufacturing cells, employees build the frames, stuff and seal the polyurethane into previously cut and sewn components and upholster each component. The finished furniture is inspected and then packed for delivery. Each cell team of six to eight employees operates on an incentive basis and is managed by a “coach” who supervises up to five teams.

In an American furniture industry decimated by foreign competition, a determined drive for cost efficiency and continuous improvement has allowed La-Z-Boy to flourish, even during the Great Recession. “If we were doing business the same way we did in 2005, somebody else would be here because we would already be closed,” Robinson observes. “We are $50 million a year better now than we were.”

La-Z-Boy has taken on the competitive challenge through its people, equipment and processes. Both managers and employees have been trained in lean concepts and involved in operational improvement efforts. For example, 23 managers and engineers have been trained in Six Sigma. Cross-functional teams completed 24 kaizen events focused on safety, quality and productivity.

The program has facilitated great strides in reducing defects. Robinson points to the plants first effort at launching an electric lift chair. The lift chair had about a 40% failure rate in the field. But after introducing a redesigned model with the flawless launch process, he reports, “We now have a fraction of 1% failure in the field.”

The Dayton facility has extended its continuous improvement efforts to its supply chain. The plant uses a supplier scorecard to evaluate performance on quality, delivery and cost. The plant established a supplier kaizen support team that travels to supplier facilities and helps identify opportunities to reduce waste.

Other “future state” plans include building a centralized parts distribution center at the site, reconfiguring manufacturing cells, introducing iPads for the parts picking process, and manufacturing boxes and staples. They all boil down to a simple ambition, Robinson explains. “We want to be great.”

At A Glance
La-Z-Boy Tennessee
Dayton, Tenn.
Employees: 1,400, nonunion
Total Square Footage: 1,208,000
Primary Product/Market: residential furniture
Start-Up Date: 1973
Achievements: Productivity improved 42% while scrap was reduced 71% over last three years. Received Tennessee OSHA Commissioner’s Award of Excellence in 2011, 2012 for +1 million hours worked without a lost time injury.
Lockheed Martin’s Pike County Operations sprawls across more than 3,800 acres in Troy, Ala. It is a rural location, heavily wooded, even bucolic. The rustic surroundings largely belie the high-tech activity under way in multiple buildings spread across the site.

Lockheed Martin’s Pike County Operations is part of the company’s Missiles and Fire Control business, and here a workforce of more than 300 assemble and test advanced missile systems, including the Javelin anti-tank missile and JASSM or joint air-to-surface standoff missile. Multiple tools and processes, in place to reduce electrostatic discharge and keep foreign matter from entering assembly areas, tell a tale of the sensitive technologies that comprise these weapons systems.

The site, which began operations in 1994 with an air-to-ground missile system (AGMS) that it continues to build, was named an Industry Week’s Best Plants winner in 1997. Today, like then, Lockheed Martin says the success of its Pike County Operations is due in large part to an engaged workforce. “People make it happen here,” says David Anderson, site director.

Even more, engaged teams make it happen. Fully 100% of the workforce participates in empowered or self-directed work teams, many as contributors on PMTs, or Performance Management Teams. PMTs develop performance goals in collaboration with leadership, and then are challenged to achieve and exceed those goals. Progress toward the goals, in cost and quality, for example, is reviewed on a regular, frequent basis, both weekly and monthly.

“What gets measured gets accomplished,” says Mark Hayes, site quality and mission success manager. And what gets accomplished gets rewarded. Strong reward and recognition programs propel team thinking and provide an incentive to improve continuously. Recognition may be small but significant—of the verbal “thank you” variety, gift cards or a pat on the back. Team performance also delivers team rewards, such as the catered lunch served in December to the Javelin program team for stellar performance during the year. A sitewide Team of the Year program also provides competition among high-performing Pike County PMTs, with a recognition banquet held to honor the winners.

The emphasis by Lockheed Martin’s Pike County Operations on engagement, teams and measurement has translated to performance excellence. Site metrics include 100% on-time delivery with zero customer rejects. They include 99% first-pass yield and a 43% reduction in energy consumption per unit of production over the past three years.

The emphasis also has contributed to a continuing flow of improvement ideas, such as a new safety feature for forklifts that will sound an alarm if an operator attempts to dismount without engaging the parking brake. A benchmarking trip to Hyundai’s assembly plant in Alabama provided impetus for the improvement. Another example: Standardized kitting trays for AGMS hardware were introduced to replace an inefficient process in which operators had to pull fasteners from a bag. The new trays provide operators with a better visual presentation of components and reduce the potential for foreign object debris to be introduced into the process, says Wenona Sublett, site Lean Six Sigma manager.

The Pike County Operations’ stellar performances have been achieved even as production and workforce numbers have ramped up. In the past three years, the number of production workers at this site has grown by more than 59%, while the production rate has climbed some 189% since 2009.
To picture the flow of parts, products and people in Warren Rupp’s Mansfield, Ohio, factory prior to spring 2011, former operational excellence manager Marty Carty uses this analogy: “Just think of a mouse trying to find its cheese in a maze.”

“We were handling our raw material way too often, in very inefficient ways,” adds Mike Kusche, director of quality assurance and operational excellence. “We had a lot of people who were wearing out tennis shoes to get the job done because they had to walk so far to get their parts.”

Fast forward to the present, says Kusche, and visitors “think they’re in a different facility.”

A new automated conveyor system moves material in a continuous single-piece flow, from assembly to painting, packing and shipping. Batch-and-queue is history.

Material-storage racks—previously far removed from assembly cells—now are stationed at the point of use, enabling the plant to redeploy material handlers to value-added tasks.

Finished products proceed through a new painting and drying system via a powered monorail, eliminating the plant’s most stubborn bottleneck.

“Everything in the plant moved, for the most part,” says assembly manager Tony Loveland. “There wasn’t much that we didn’t touch.”

These and other changes are part of what the plant calls its “Material-Flow Optimization,” or MFO, project. While the redesigned plant layout is the centerpiece, the project also encompassed:

• Refresher training for all employees on lean fundamentals such as single-piece flow and 5S.
• Investments in new technology, including the new conveyor system, wire-guided material handling equipment and real-time KPI-metric displays.
• A series of kaizen events in which cross-functional teams—often including employees from back-office operations—focused on making specific process improvements.

Cross-functional teams that included Kusche, Carty (who now is a district sales manager), former VP of operations Bill Jones and hourly employees led the MFO project. Over a period of several months, the team utilized value-stream mapping to draft dozens of possible plant-floor configurations before choosing the final layout.

The results have exceeded expectations. The plant hit its ROI target in three months—some 13 months earlier than it had expected—and estimates that the MFO initiatives will produce $1 million in annual savings.

Among other results, productivity has increased by 10%, the plant’s order-to-ship lead time has been shortened by 32%, and daily painting capacity has increased from 300 to 900 pumps.

“We did it on schedule, within budget and without disruption to our customers,” Loveland says. “It speaks highly to our workforce here.”

The fruits of the project’s “rapid-improvement events,” or RIEs (Warren Rupp’s version of kaizen events), are on display throughout the 80,000-square-foot facility, which makes air-operated double-diaphragm pumps for industrial applications.

An RIE team eliminated the use of expensive—and ineffective—foam protective padding inside the pumps’ shipping cartons by devising a corrugated insert that locks the pumps into place and eliminates wobbling. Warren Rupp estimates that the corrugated insert will yield an annual savings of more than $45,000.

In the paint area, workers previously had to cover each pump’s serial-number tag with masking tape to prevent it from being sprayed. An RIE team developed a metal cover—color-coded to indicate the pump color—that can be snapped into place and removed with a worker’s fingertip, saving time and improving paint quality. The process improvement has produced an annual savings of $2,000.
2013  
Peak Performers

27 ...... Flextronics  
Milpitas, Calif.

27 ...... General Cable – Jackson, Tenn. Plant  
Jackson, Tenn.

28 ...... Harley-Davidson Motor Co.  
York Vehicle Operations  
York, Pa.

29 ...... H.C. Starck Inc.  
Newton, Mass.

30 ...... Lockheed Martin Missiles and Fire Control  
Archbald, Pa.

31 ...... Thermo Fisher Scientific (Asheville)  
Asheville, N.C.

32 ...... 3M Aberdeen  
Aberdeen, S.D.
A Partner in Manufacturing Excellence

Speed-to-market imperatives in the technology industry spur continuous improvements at Flextronics’ Milpitas campus. By Jill Jusko

It’s a brisk December day in California’s Silicon Valley, and at Flextronics’ Milpitas campus, a multitude of activities are underway with similar brisk efficiency.

In one building, Flextronics employees assemble solar panels for customer SunPower Corp. In another, a sourcing team meets with colleagues from India—and located in India—via visual communications technology that all but places the two teams in one room rather than an ocean apart. At a third building, engineers test the dexterity of several recently acquired robots and also work to boost the capabilities of a homegrown automated guided vehicle system.

Similar—and dissimilar—industriousness can be observed in the seven additional buildings that comprise the Milpitas campus. The reason behind the industriousness is quite straightforward: the customer.

“Our quality is our customers’ quality. Our performance is their performance,” says Paul Henningsen, senior director of strategy and planning.

Indeed, as an electronics contract manufacturer, Flextronics’ Milpitas campus services more than 90 customers, both well-known technology firms and high-potential start-ups. In 2013 it also became host to one of several Flextronics Product Innovation Centers located around the globe.

Its role as a partner in new product introductions spells both challenges and opportunities. In 2013, for example, the Milpitas campus processed an average of 45 engineering change orders per day. Significant low-volume and customer prototyping work call for innovative supply-chain solutions. And because speedy time-to-market launches are critical to customers, they are critical to Flextronics as well.

Indeed, on that brisk December day, among the teams at work in Flextronics’ Improvement Idea Hub was one dedicated to reducing lead times in setting up new customers. (Meanwhile, it is also hard to miss the 80-foot-long value stream map sprawling across a far wall.)

Lean and Six Sigma both contribute to driving excellence across the Milpitas operations, as does a commitment to automation. The company sets its sights on improvement projects that contribute 50% gains. Not only do such big goals inspire out-of-the-box thinking, says Anand Pradhan, Flextronics senior director of business excellence, but they are in keeping with the disruptive types of technology leaps Flextronics’ customers aspire to.

And on the topic of customers, Zahid Hussain, vice president of operations for the Milpitas campus, explains the crucial role customers play in creating a culture of excellence at his location.

“We have a hundred cultures because of the customers,” Hussain says. “We enable them to succeed, and we learn from all of our customers every day.”

From Chopping Block to Award Banquet

How General Cable - Jackson, Tenn.’s new ‘altitude’ resurrected the plant. By Adrienne Selko

Undergoing a cost-competitiveness feasibility study in 2008 was not comfortable for General Cable’s Jackson, Tenn. plant. While the decision was
made to keep the plant in operation—and consequently invest more capital—due to its high volume potential, a complete turnaround was ordered.

By 2012, victory was theirs. The plant was named the best plant in North America in the General Cable family and this year was named an IndustryWeek Best Plants Winner.

“Our plant was in dire straits in one of the toughest economic times ever. However, we knew we could get to where we needed if everyone was willing to make fundamental changes,” explains Joseph Brown, plant manager. “We shut down the plant for a day, gathered all employees and launched our ‘All In’ program.”

The All In program, signed by all employees, required concentrating on a few key areas, including safety and achieving first-pass yield quality, in order to exceed performance expectations. The culture shift to achieve these goals called for a workforce that was engaged, flexible and willing to learn new skills.

The facility, which daily produces 25 million conductor feet of copper premise communication ca-

ble, also reorganized its production floor for cellular manufacturing. Cell members became responsible for safety, quality and tracking new metrics. Armed with green wrist bands that say “Consequence Thinking – Stop—Think—Plan,” all associates take an Intro to Lean Training class.

Equally important as training is the talent management program, called “Altitude.”

“Finding a comprehensive system to track training and coaching efforts was a way to aid our culture shift. It allows us to have positive touch points and demonstrate how important it is to be updated in our skill sets,” says Brown. In fact this plant’s program will be adopted at other General Cable plants.

The cellular structure, complete with a new cross-training and 5 Sigma program, formed the foundation necessary to continue current product production, at-

tract a new line and bolster its PVC (polyvinyl chloride) pellet production line that supplies the plant, and other General Cable plants, with jacketing extrusion.

The benefits of these efforts have been plentiful. The plant has gone over 2,660,000 hours without a lost-time accident. Customer complaints have been reduced by more than 20% in each of the past four years. And, in 2011, the plant received the corporate Most Improved Quality award.

“All associates are quite proud of the fact that the facility has become the company’s largest-volume and lowest-cost supplier of Category 5 riser premise cable,” Brown adds. That pride is demonstrated quite clearly by a very large wall, called Walking Tall in Jackson TN, which every visitor must pass.

Pride cannot be overstated at this plant. During an explanation of some of the metrics that a specific cell was examining, one of the team members had trouble getting the data he needed so he worked after hours to create a system that provided the information. To hear him tell it, that was just a part of his job.

That attitude and dedication, more than any system, is why the plant has shown a healthy increase in performance productivity over the past three years.

Closely tracking metrics, as this team member is doing, is one of the reasons behind the successful turnaround at General Cable’s Jackson, Tenn., plant.

At A Glance

General Cable Industries
Jackson, Tenn.

Employees: 181, non-union
Total Square Footage: 186,000
Primary Product/Market: Copper premise communication cable
Start-Up Date: 1991
Achievements: 129% increase in performance productivity over the past three years; 54% improvement in first-pass yield over past three years

Harley-Davidson Motor Co.,
York Vehicle Operations

Driving a Future of Excellence

Workers in York, Pa., rebuilt the Harley-Davidson plant there from the ground up, installing not only new machinery but also a new continuous improvement mindset. By Ginger Christ-Martin

A concrete expanse stretches behind a chain-link fence, weeds cropping up through the growing cracks in the ground that once supported a robust manufacturing operation.

The vacant lots serve as daily reminders of the transformation the Harley-Davidson plant in York, Pa. has undergone.

The plant, which once cast a mammoth 41-building shadow, now occupies two buildings with just one used for manufacturing.
Four years ago, 89% of the International Association of Machinists and Aerospace Workers employed at the York site accepted a concession-laden contract that would eliminate half of their jobs. Harley-Davidson Inc., struck by the recession, wanted to cut costs and was planning to do so either at the Pennsylvania site or by building a new facility in Kentucky.

Without the contract, without the jobs, York was fated to close.

“They voted to keep the jobs in York,” says Jim Waltermyer, union president.

Today, what is now referred to as New Factory York is a lean operation.

The plant management used the restructuring in York as an opportunity to completely rethink its leadership structure and retool its operations—to truly create a new factory.

It replaced the dark, dingy manufacturing environment in which institutional knowledge was most valued with a clean, automated factory driven by continuous improvement.

“Work was getting done, but it was not a world-class manufacturing environment,” says Ed Magee, New Factory York general manager. “We wanted to create a sustainable lean culture.”

Within the four walls of its lone manufacturing building in York, roughly 1,000 production workers now fabricate, paint and assemble motorcycles in three process areas with a system simplified by automated guided carts.

Conveyor belts transporting parts through the painting process that once stretched nine miles are now three miles in length.

Robots now rhythmically weld parts together—faster, more precisely. They churn out 20% more fenders per shift than in years past, with two fewer employees.

In the flatter organization, workers now have one of five job classifications, a notable change from the 65 classifications used in the old framework.

New Factory York also now relies on flexible workers to supplement its leaner workforce. During what it calls its surge period, the company ups its production by 50% and brings in a bevy of flexible workers to work side-by-side with full-time hourly employees.

“We’re making more motorcycles in one building than we did in all of those old ones,” Magee says.

And “we never stopped producing motorcycles while switching over,” he reveals.

When John Andy came aboard as manager of H.C. Starck Inc.’s Newton, Mass., site three years ago, he found himself at the helm of an operation that had recently installed a sophisticated manufacturing system based on 5S, Six Sigma and lean methodologies. But something was missing. While the facility—which makes fabricated metal plates, sheet and similar parts—was improving and growing, it wasn’t taking off. It wasn’t soaring.

“Our program—what we call our world-class manufacturing program—was introduced in 2009 and ’10,” Andy says. “In those first couple years, we saw pockets of success. But it didn’t really take off until 2011 and ’12.”

How did Starck’s Newton site go from pockets of success to lift-off? Andy attributes it in large part to his operations team’s gradual assimilation of the new methodologies. It took a couple of years for lean, 5S and Six Sigma to become part of the site’s DNA.

“Eventually it just became the way we run the business,” he says. “Simple as that.”

But getting to that point was not so simple. Andy—whose background includes work with PriceWaterhouseCoopers specializing in manufacturing turnarounds—had to figure out why the Newton site was achieving only intermittent success despite having assembled what he calls “an absolutely rock-solid world-class manufacturing program.”

He analyzed the site’s operations and found two problems. First, the organizational chart was out of whack,
Lockheed’s Weapon of Choice: Continuous Improvement

The defense contractor works to improve its processes to remain at the top of its competitive market.

By Ginger Christ-Martin

In northeastern Pennsylvania, at the end of a winding road, a 63-year-old plant perches atop a hill. Shrouded from the quiet town below, in this 350,000-square-foot building Lockheed Martin produces advanced weaponry for the U.S. military—naval nuclear systems and air-to-ground weapons.

Despite the weathered facade, the aging walls, the floors worn down by half a century of manufacturing, Lockheed Martin develops state-of-the-art defense products using advanced technology. It is an experiment in contrasts.

The plant, since its inception, has been the site of the manufacture of defense products—from Mark-56 Gun Sites in the 1950s to the naval systems it produces today. But now, in its current iteration, it has found a way to merge its historical success with a culture of continuous improvement.

Despite being a defense contractor and thus held to

At A Glance

**H.C. Starck Inc.**

Newton, Mass.

Employees: 130, non-union

Total Square Footage: 325,000

Primary Product/Market:
Refractory metal plates, sheet, foil, rod, powder, wire

Start-Up Date: 1961

Achievements:

- Increased labor productivity by 40% over last three years
- Increased space utilization, consolidating operations from four buildings down to three
- Reduced customer reject rate by 68% and scrap/rework as a percentage of sales by 56% over last three years
- Total plant unit volume increased 86% over last three years
- Achieved on-time delivery rate of 98%
- Reduced recordable injuries by 38% over the last three years
- Energy consumption per unit of production decreased 33% over last three years

H.C. Starck recently made several process improvements to reduce the amount of time it takes to melt tantalum ingots, thereby alleviating a bottleneck in one of its melting furnaces.
Growing a Quality Culture for the Lab

Thermo Fisher Scientific’s Asheville, N.C., plant makes continuous improvement the foundation for growth.

By Steve Minter

What is the secret sauce that keeps Thermo Fisher Scientific’s Asheville plant focused on improvement? The company’s dedication to serving science is certainly one important ingredient.

“We know that the instruments we make here are going into laboratories that are finding cures for Alzheimer’s disease, cancer and childhood diabetes,” says Phil McLellan, director of operations for the facility. “They have a very important role in the work that is changing human lives around the world.”

The Asheville site produces 78 different product lines, ranging from ultra low temperature freezers to laboratory furnaces and centrifuges. In 2012, the factory shipped 45,000 units, with 40% of the products exported to Asia and other markets. Much of the work involves building customized products for specialized applications for customers ranging from the Centers for Disease Control and pharmaceutical firms to university-affiliated hospitals.

Growth at the site stems in part from the company leaders to shift production from other facilities to Asheville, recognized as a center of manufacturing excellence. That growth has resulted in the site adding 100 jobs in the last 18 months. It has also made the implementation of lean manufacturing vital in terms of maximizing space and minimizing inventory while producing products to exacting quality standards.

For example, the ultra low temperature freezers that Thermo makes hold organic tissue samples and each freezer may store $250,000 to $500,000 worth of material. In some cases, the freezers hold samples from a scientist’s lifetime of research. “Obviously, the quality has to be bulletproof,” says McLellan.

To meet its quality and production targets in a high-mix, low-volume environment, the Asheville site uses a vertically integrated model, conducting metal fabrication, welding, brazing and painting operations in addition to making components and subassemblies. In 2012, the plant’s fabrication department, for example, produced 1.7 million parts out of 110,000 sheets of metal with a first pass yield of 99.43%.

Continuous communication helps keep Asheville on track. Work cells start their shift with a standup meeting. Similar meetings occur later for production supervision and the four value streams, culminating in an 11 a.m. meeting for site leaders. All meet-
At 3M Aberdeen, continuous improvement is built on a robust system of good safety habits.

3M’s Safety Habit

With over 2.3 million accident-free hours and counting, 3M Aberdeen closes the loop between safety and efficiency.

By Travis Hessman

Walking into 3M’s sprawling Aberdeen, S.D., factory, one is greeted by all the hallmarks of an IndustryWeek Best Plant: bright lights and clean floors, high-tech tools and engaged workers; that particular quiet hum of an efficient, well-tuned factory.

But what really stands out in this respirator, filter and tape plant, is its obsession with safety.

You can see that obsession in the odd habits of its 650-person staff, the way they always stop at intersections, for example, or the way they always look in the same direction they are moving and power-lift pallets—all of those ticks and traits of a truly safety-minded team.

The results of this safety focus are proudly displayed on the chest of every worker as numbered stickers counting the days since the last recordable safety incident—a respectable 17 when IW made our walkthrough.

“These are like a badge of honor,” says Paul Aufenkamp, manufacturing manager at 3M Aberdeen. “It’s a reminder to everyone about staying safe.” A reminder that everyone there seems to heed.

After recording seven lost-time incidents and 22 OSHA recordable incidents in 2010, 3M Aberdeen overhauled its safety program, taking it from a backseat, protocol-based system to one much more in the face of all of its workers—the Safety Observations Achieve Results (SOAR) behavior-based safety process.

Rather than simply enforcing safety policies from the top, the SOAR program helps create and reinforce good habits—like stopping at intersections—and brings the full staff on board to monitor the teams’ progress by way of daily covert observations until the new habit is mastered.

In the past three years, Aberdeen employees have collected 610,000 of these observations, identifying 877 near-miss hazards in the process. In all, they have helped create 113 new safe habits—which translates to 113 new standard practices, 113 new self-enforcing safety rules and 113 reasons why 3M Aberdeen is an IW Best Plant this year.

“What we did here was apply that same kind of methodology and thought process to our safety program’s results as we would with a cost program,” explains Keith Kelble, 3M Aberdeen plant manager. “There’s a real culture around change and continuous improvement in this plant that is very healthy. But without a strong safety culture, it’s hard to build the rest of your continuous improvement culture. It’s key.”

And the result of this experiment speaks for itself: “We are at over 2 million hours since the last lost-time accident,” reports Kelble. “Actually, 2.3 million hours and counting.”

At A Glance

Aberdeen, S.D.
Employees: 650, non-union
Total Square Footage: 430,000
Primary Product/Market: Disposable respirators; filters; tape for automotive, industrial, aerospace, electronics and health care applications
Start-Up Date: 1974
Achievements: 2.3 million hours without time lost due to accident; 45% reduction in customer rejection rate within past three years
2014 Pacesetters in Manufacturing Performance

Boston Scientific Maple Grove
Maple Grove, Minn.

Cessna Mexico
Chihuahua, Chihuahua, Mexico

General Cable Corp. -- Marion Plant
Marion, Ind.

L.B. Foster Rail Technologies Corp.
Vancouver, British Columbia, Canada

The Raymond Corp.
Greene, N.Y.

T&S Brass and Bronze Works
Travelers Rest, S.C.
Boston Scientific Maple Grove

Lean Gets to the Heart of the Matter

At Boston Scientific Maple Grove, continuous improvement is taken very personally.

By Dave Blanchard

All manufacturing companies focus on quality, and many can rightly claim that their products make a difference in people’s lives, but few have the intimate connection with end users that Boston Scientific has. At the company’s plant in “Medical Devices Alley” in Minnesota’s Twin Cities region, Boston Scientific’s Maple Grove facility designs and manufactures balloon catheters and stent delivery systems that ultimately will be surgically implanted into patients.

“Meaningful innovation is core to our operations,” Hentges adds. “It’s one of our competitive advantages.”

Boston Scientific structures its SQP processes on what it calls the four pillars, which are strategic goals of three to five years in duration. Currently, the company’s four pillars include: operational excellence, lean culture, accelerating growth and collaborative partnerships.

The company doesn’t necessarily “talk the talk” when it comes to its lean culture, frequently eschewing Japanese terms like “kaizens” in favor of “continuous improvement ideas,” but it definitely follows through in execution. In 2014, Maple Grove employees submitted over 5,700 suggestions, with 3,000 of them implemented.

To cite just one project, a cross-functional engineering team reduced cycle time on a balloon catheter product by 20% while reducing cost of goods sold by 54%, yielding annual savings of $35 million. This project involved changes in welding technology, automating human inspection and a production line redesign.

This kind of team sharing is fostered by the introduction of a “collaboratory,” an area where employees are encouraged to get together and come up with ideas that will help make Boston Scientific a leaner, smarter organization.

Cessna Mexico

Cessna Mexico’s Flight Plan: Attack the Processes

The Chihuahua operation follows a simple rule: Better processes drive better results.

By Jill Jusko

“Never attack people, attack the process.” Ruben Favela, continuous improvement senior manager at Cessna Mexico, shares this notion as he leads a visitor (me) on a tour through the aircraft manufacturer’s facilities in Chihuahua.

That philosophy isn’t revolutionary. Many people even would say the idea conveyed by those words is the underpinning of sustainable manufacturing excellence. Frequently, however, the words are more easily said than done.

That’s not the case at Cessna Mexico. The organization has completed more than 250 kaizens, “solving critical problems in complex processes,” according to its IndustryWeek Best Plants application.

Moreover, the evidence of Cessna’s efforts is readily apparent throughout the multiple locations and 631,000 square feet of manufacturing space that comprise the Cessna campus.

Take the “autonomated” manufacturing sequencer in the sheet metal
assembly area, for example. Favela points to this process innovation as one of the many that contribute to Cessna Mexico’s exceptional quality results. The sequencer looks a bit like the skeleton of a boat, but in fact it is a “smart” tooling jig that is able to detect whether an operator is following the proper manufacturing sequence. The number of steps and components required in an assembly can be significant.

If the correct assembly sequence is not adhered to, the jig shuts down the air that powers the tools and sends a visual signal to indicate where a fix is needed. Implementation of these “smart” tooling jigs, which have been replicated in well over half of the big tooling jigs, has significantly reduced errors in these processes.

In a second example, two teams collaborated to streamline a machining operation that had for many years required the use of three separate pieces of equipment—with three different setups, inventory requirements and associated quirks. The teams developed a solution that reduced the number of required machines from three to one by developing unique tooling able to perform trimming, molding and perforation processes.

Simplifying the machining process not only improved the cycle time through the operation, but it lowered the required inventory levels and improved safety for the operator.

Such innovations in processes are occurring everywhere, in sheet metal assembly, fabrication, in wire harness assembly and in composite parts manufacturing. Moreover, a significant amount of the work done in Cessna Mexico is manual or done with the help of machines, but it is not full automation. That means giving the workforce the tools they need to succeed is important, Favela says. “We are continually working with our workforce,” he says. “We want them to know ‘[we] are going to take care of you so that you can be successful.’”

The philosophy clearly is working for Cessna Mexico. The facility has near perfect first-pass quality yield, a sharp decline in scrap and rework costs, and a total recordable injury rate of zero in 2013.

General Cable Corp.
Marion Plant
Hard-Wired for Safety

In 2004, employees of the General Cable plant in Marion, Ind., met in a meeting room.

There would be a cost competitiveness feasibility study, they were told, to see if the plant would continue to operate. The future of the plant, of their livelihoods, was uncertain.

“This plant was at a crossroads,” says Lee Sneed, plant manager.

Yet today, more than 150 production employees file through the doors of the 860,000-square-foot Marion plant, a testament to the hard battle fought there over the past decade.

“It feels good from a plant perspective that we’re winning and the employees are winning,” Sneed says.

The plant, which had been hit by the dot-com bust and its effect on construction markets, was downsized and focused only on making products for the mining industry. The change, and the smaller workforce, encouraged collaboration and a focus on the operator Marion had never seen before.

“Marion’s progress during the darkest time established an environment for positive growth as the years progressed,” according to its Industry Week Best Plants application.

The plant that General Cable decided to take a chance on 11 years ago now manufactures products for renewable energy, oil and gas, and commercial building markets, adding three new product lines in the last four years.

It has diversified, focused on continuous improvement and championed lean. And it has made safety its top priority.

“I believe that if you show me a plant with good safety performance, you’ll also see that performance in every other thing that plant does,” Sneed says.

The plant in 2010 created a central safety committee and then introduced consequence thinking, which really was its turning point, says...
David Mooney, EH&S Manager.

“Do the right thing, have the courage to care for each other and do it one day at a time, and the numbers will take care of themselves,” Mooney says.

Through one-on-one meetings, small group huddles and complete transparency, the committee and plant leadership were able to start gradually creating a culture in which safety was unquestionably No. 1. They gave workers smoke detectors and weather radios, and pushed the idea that safety should be a driving force in all areas of life—not just at the plant.

“We’ve really been working to change a culture,” Sneed says. “We realized that a cultural shift was needed to ensure the long-term viability of the company. You have to earn the right to operate.”

When he assumed leadership of the plant in 2013, Sneed made it his mission to transform what had become a solid plant, a good plant, into a great one. One of his first meetings with the employees was called just that: “good to great.”

At that point, the plant’s leadership model changed from a directive one to a collaborative one, a shift that improved morale, increased employee participation and strengthened leadership’s relationship with the union.

And, on the safety side, that meant moving from tracking injuries to tracking near misses—a statistic that is now used throughout the General Cable footprint.

### General Cable Corp. -- Marion Plant
Marion, Ind.

**Employees:** 189, union

**Total square footage:** 860,000 square feet

**Primary Products:**
- Industrial and specialty cables
- Friction control solids

**Start-up:** 1910

**Achievements:**
- 65% water usage reduction in three years
- Elimination of all knives in three years
- 2013 General Cable CEO Award for Safety Excellence

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### L.B. Foster Rail Technologies Corp.

**How L.B. Foster’s Vancouver Plant Created a Culture of Lean**

Leaders helped staff to see inefficiencies and learn how to continuously improve.

**By Pat Panchak**

You don’t actually see lean in action at the L.B. Foster Rail Technologies Corp. plant in Vancouver, B.C., as much as sense it. But dig into the metrics, investigate the day-to-day practices and talk to the team, and the continuous improvement focus becomes clear. The effort permeates the place, without being obvious.

The focus is apparent in the lab, in the administrative and executive offices, and, of course on the plant floor. But more interesting is how continuous sustainable improvement efforts bridge the boundaries between and among the groups.

The facility is a little different from most other manufacturing facilities in that it houses substantially sized research and development labs, along with the factory floor, warehouse space and offices.

In the labs, research scientists devise new formulas for spray-on and solid-stick friction-control materials. On the plant floor, production workers produce the solid-stick lubricants and the hardware (brackets and applicators) to apply them. Throughout, the supply chain group leads the effort to identify, vet and manage the accurate flow of materials from the myriad specialized vendors.

Combined, the focus of plant operations is the R&D and delivery of proprietary Total Friction Management Systems (TFM) for freight rail and transit authorities.

But it’s a little more complicated than that. Because no single type of application system is appropriate for every customer, plant operations focuses on tailoring custom systems for each customer’s needs. As a result, the plant produces more than 137 bracket designs and 200 types of applicators.

It’s this successful integration of workgroups, built upon the “continuous improvement is the way we do things” attitude throughout the facility, and the plant’s stellar metrics that earn the L.B. Foster team the IW Best Plants award this year.

Steve Fletcher, general manager of the plant, credits a combination of entrepreneurial spirit and corporate influence for leading the facility to adopt such a seamless approach to lean practices.

The facility’s entrepreneurial roots, he recounts, date back to the company started by the inventor of friction management technology. Since its origins, Fletcher notes, people working together to improve was part of the process of developing a market for new products—and many of the people now work at the plant. They’re the people, he added, who “like working with the customer, understanding what’s important to them and translating that value back to something we’re trying to do.”

After the acquisition by L.B. Foster, corporate leaders John Kasel and Steve Burgess “set up a process to try to encourage us to see that things could be better,” Foster recalls. “Steve came in and ran through a bunch of different types of processes to try to identify inefficiencies, and [introduced] lean, etc… and he just really encouraged the people to develop those [the processes] themselves.”

Foster adds that he believes that approach—of teaching and leading
people to practice lean — helped embed lean practices into the plant’s culture. “They didn’t beat you over the head and say, ‘do this, do this, do this.’”

The Raymond Corporation
Chasing Zero
The Raymond Corporation has raised its game by going all-out to eradicate defects in its forklifts.
By Pete Fehrenbach
The rigor of the Toyota Production System. A laser focus on meeting customer expectations. And a relentless drive to eliminate defects. These factors have lifted The Raymond Corporation to the top of the material-handling equipment business and earned the Greene, N.Y.-based manufacturer a 2015 INDUSTRY WEEK Best Plants Award.

Founded in 1922, the family-run forklift maker was bought by Toyota in 2000 and began installing its parent company’s celebrated production system in 2007. Raymond’s meticulous, deliberate implementation of the Toyota system took about three years to complete, and since then TPS has become Raymond’s bedrock and catapulted the company to remarkable success as its post-recession business has come roaring back.

“The Toyota Production System is the key to everything we do here,” says Rick Harrington, Raymond’s vice president of U.S. Manufacturing “It motivates our people and helps them remember and continually recognize that everything we do is geared to our customer. If we can’t take care of our customer and surpass his expectations by giving him our highest-quality product, whether it’s a truck or one of our services, then we’ve failed.”

Harrington says his co-workers’ embrace of TPS is Raymond’s most important advantage over its competitors because it “brings great urgency to resolve nagging issues, repeat issues.”

“TPS really helps our whole team and all of the support groups get that same sense of urgency,” he says. “In many factories, it’s easy to tell the difference between an ops guy and an engineer. But we try to use the Toyota Production System so you can’t tell the difference. The engineer has the same amount of urgency, the same amount of ‘I gotta get this fixed because it’s impacting the line, it’s impacting the customer.’”

Raymond’s team uses an eight-step problem-solving method that incorporates “genchi”—“go see”—coupled with an array of visual tools to speedily assess and resolve defects and related production problems.

T&S Brass and Bronze Works
Plumbing Manufacturing Success at T&S Brass

Agile manufacturing and customer focus keep growth flowing at T&S Brass.
By Steve Minter
They get what they want when they want it and it’s good.”

That statement from Gary Cole, operations manager at T&S Brass, encapsulates the company’s approach to manufacturing. T&S Brass makes high-quality commercial plumbing products—brass fixtures that are solid and reliable. The company has over 10,000 products so it can provide a plumber or other customer pretty much whatever they need. And the company prides itself on filling customer orders quickly—87% of all sales orders are filled within 24 hours.

Manufacturing operations include machining of both forgings and castings for faucets and other components. Then these parts go through finishing operations that consist of emery and polishing steps. From there, the parts proceed through an automated racking line where a trivalent nickel chromium finish is applied to the parts. After inspection, the products move to work cells where they are assembled, inspected and packed for shipping.

The focus on fast turnaround was one of the driving forces in the company’s lean journey. Twelve years ago, the plant started to reconfigure its operations for one-piece flow with one manufacturing cell, explaining that the change was being made to make the job easier and simpler.

“Their strategy at first. No one likes change,” Cole recalled.
But soon the benefits of the new system were obvious. Over time, 10 cells were set up. These and other changes have allowed the plant to increase its annual sales by more than 80%, yet the production still occurs in the same 60,000-square-foot manufacturing area.

More efficient production and growing sales enabled the company to invest in newer equipment such as CNC machines and vibratory polishing machines. These investments helped the plant score a victory in the struggle to bring manufacturing back from Asia to the U.S.

Production of faucet flanges had moved to China many years ago, but company officials had lost the battle, not the war. They worked with their suppliers to cut material costs. Then they turned their attention to the manufacturing process, installing a CNC machine to produce the flanges. In addition, they attached a pallet changer to ease loading and unloading the machine. The result was a cheaper cost for the flanges, production capacity of 2,500 flanges a day, and no extra inventory to carry because of ocean crossings.

In keeping with its focus on efficiency, T&S Brass recycles everything it can, from cardboard and plastic to the coolant used in machining. In 2014, the plant recycled over 9,000 gallons of coolant. It also collects and sells the metal chips and dust from machining and grinding.

The plant’s veteran workforce plays a major role in its cross-functional continuous improvement teams. No matter what issue they are dealing with, those teams are always focused on three major areas — productivity, quality and safety. And the dedication to improving the operation doesn’t end when a team completes its work.

“We have had teams that are finished—made the presentations, got their shirts and free lunch. They still are coming up with new ideas, even though the team has been finished for years,” Cole reports.

T&S Brass and Bronze Works
Travelers Rest, S.C.

Employees: 264, non-union

Total Square Footage: 80,000

Primary Product/Market: Commercial foodservice and plumbing products

Start-up Date: 1978

Achievements:
87% of orders shipped within 24 hours; typica manufacturing cycle time of 15 minutes; 98% first pass yield for all products

Lean manufacturing has helped T&S Brass maintain its production footprint while nearly doubling sales.