PENNSTATE

HIGHLIGHTS
OF THE
FIFTY-SIXTH
ADVANCED MANUFACTURING FORUM
November 2004

CENTER FOR THE MANAGEMENT OF TECHNOLOGICAL AND ORGANIZATIONAL CHANGE
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JLG Industries, Inc.

Creating a Culture of Continuous Improvement

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JLG Industries is the world's leading producer of access equipment (aerial work platforms and telehandlers) and highway-speed telescopic hydraulic excavators. The company opened its 300,000 square foot Shippensburg facility in February 2000 with the intent to use Lean philosophies and to set a new standard for JLG facilities worldwide. JLG embraced this opportunity, building on its foundation of Continuous Flow Manufacturing and using Lean tools such as Team Member Involvement, 5S, Just-in-Time/Just-in-Sequence, and Process Integrated Quality and Technology to create a culture of continuous improvement.

Long recognized for design and manufacturing excellence with successful distribution and customer support, JLG's business model includes four additional value-added touchstones for their customers: equipment services, service and parts, accessories, and access financial solutions. The model represents a solid foundation for future growth in the global marketplace.

Tacelosky provided a description of the Shippensburg facility, where 12 assembly lines handle three product families consisting of 34 different models. There are 1600 variations of those models. Organizationally, Shippensburg is flat and lean, with the management mantra that each manager see the operation through the eyes of the entire organization, not just their functional area. The focus is on people, processes, and results, not on "who should get it done".

(JLG continued on page 3)

Gulfstream Aerospace

Concurrent Manufacturing, Re-Engineering and Variability Control

Joseph T. Lombardo
Chief Operating Officer, Gulfstream Aerospace Corporation
and
Vice President, General Dynamics Corporation
Savannah, Georgia

Business aviation is an extremely competitive industry and in a competitive environment, you have an obligation to get costs down, quality up, and to market as quickly as possible. But how do you introduce a new ultra-long range airplane and continue with production of a very popular model when you traditionally build one plane at a time? Do you stop production of one to go with the other?

The decision at Gulfstream was to co-produce, and do it at higher rates. Joseph Lombardo shared with Forum attendees how Gulfstream met two evolving and dependent challenges:

- Produce two+ models concurrently at higher rates, without any additional "brick and mortar".
- Perform *more* Final Phase Manufacturing with *less* capacity.

The issues they faced were considerable:

- Capacity constraints in Final Phase Manufacturing
- Lead times beyond customer expectations

(Gulfstream continued on page 5)

Kautex-Textron

Lean Transformation Supporting Survival and Growth

Brian Hatter
Vice President, Lavonia Operations

Transformation Acceleration Process: TAP for Six Sigma

Brian Wolfe
Manufacturing Manager, Lavonia Operations

Kautex-Textron
Lavonia, Georgia

The Kautex-Textron (KT) Lavonia Operation was one of two Kautex North American-based facilities to be recognized in 2003 as an *IndustryWeek* **Best Plant Winner**. KT-Lavonia adapted many well-recognized lean operating philosophies and supporting tools in order to sustain profitability in a rapidly changing and highly competitive Automotive Washer Systems market, while simultaneously supporting extensive growth into the Automotive Fuels Systems market. In less than two years, KT-Lavonia tripled in physical size, entered a new market with new technologies in plastic fuel systems, expanded from having only one to five major OEM customers, all while launching 17 new products into full production. How did KT-Lavonia do it? Brian Hatter told the KT story.

(Kautex-Textron continued on page 6)

Lockheed Martin

Unleashing the Potential: A Lean Journey with High Involvement Teams in a High-Tech/Low Volume Industry

Ron Hull
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Lockheed Martin Maritime Systems & Sensors (MS2) Syracuse originated as General Electric Aerospace. It was purchased by Martin Marietta in 1993, and in 1995 Martin Marietta merged with Lockheed Corporation. The Syracuse site is home to the production and integration of radar, surveillance and sensor equipment used worldwide. Engineers, technicians, machinists, electrical workers and support staffs prepare radars that protect the lands and skies of more than a dozen countries, produce the sonar systems that scour the depths of the oceans and integrate the ship control system that guides the U.S. Navy's newest and most technologically advanced submarine. MS2's vessel traffic management systems aid the shipping industry by making ports and harbors safer for inbound and outbound traffic, and its Nexrad and Wind Profiler radars are the tools of meteorologists with the military and the U.S. Department of Commerce's National Weather Bureau.

MS2 was faced with having to change some years ago – it was forced upon the business as the defense industry consolidated, as foreign competition increased, and as world events occurred to increase demand (the collapse of the Soviet Union, 9/11, the war on illegal drugs, more sophisticated customers, more sophisticated enemies). MS2 needed to double production about six years ago, and they accomplished this with no change to the infrastructure, no addition of a second shift. How? By using Lean and Six Sigma tools, following an intuitive→practical →tactical→strategic development path.

Carl Cangello likened MS2's lean journey to building a house: you need an electrician, a carpenter, and a plumber, with their toolboxes. Using just an electrician will not build a home. One of the tools within the electrician's toolbox will not build a home. All of the tools, and all of the people, are needed. Six Sigma is their toolbox for quality, Lean is their toolbox for eliminating waste, and Teaming is their toolbox for employee involvement. MS2 needs all of these tools to get to where "LM 21" wants to go – the organizational structure within the company that is charged with preparing Lockheed Martin to operate in the 21st century. The goal is to have lean processes that operate at Six Sigma capabilities. LM 21 subject matter experts (SMEs) are assigned to plants within Lockheed Martin to help organize and train their own black and green belts.

Using Six Sigma as a base (sort, straighten, shine, standardize, safety, sustain), the company started on their lean journey in 1998-99 by doing some events and projects from an intuitive standpoint, answering the question, 'where's my pain?", and subsequently fixing that pain. Their lean structure followed, and then the Lean/SixSigma overview was developed. MS2 makes designs and processes lean first; why do Six Sigma on something that may be eliminated when you do the lean analysis? "Every Lockheed Martin leader has to go through the lean/Six Sigma training," Cangello added.

Lockheed Martin is organized by value streams – not a typical organizational structure until recently. The leaders for each of those value streams own all the human resources necessary to build that product: production people, manufacturing engineers, quality people, production control people. It is not departmentalized – each value stream goes across all of the different departments.

It is all capped by metrics; metrics tell you where you are. "Everyone knows where you want to be, but you can't do that math unless you know where you are," Cangello said. "The goal is not to put up numbers of events – you want results from the numbers of those events." As an example, Cangello discussed team metrics that are examined every month, with an idea toward finding out where and what kind of help is needed to resolve problems. Each "score card" helps with defining the solutions to the problems. Data is reviewed for three-to-four month periods, and, where available, for a period of years, to evaluate trends.

Metrics are reviewed monthly at the value stream level, and from there, metrics are decomposed to the work cell level. Each work cell wants to know which of the value stream metrics affects them, and the approximately 32 work cell metric boards are located right in the

(Lockheed Martin continued on page 7)

57th Advanced Manufacturing Forum

April 14-15, 2005

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JLG Industries *(Continued from page 1)*

People

The selection process for new hires includes two interviews and aptitude testing. Once on board, employees participate in formal classroom orientation training as well as on-the-job training. Internal continuing education addresses topics such as safety, manufacturing processes, lean principles, quality systems, facility measurements and information access. JLG also has a tuition reimbursement program in place to further workers' formal 'external' education. "An educated team is an empowered and productive team," said Tacelosky.

JLG fosters several channels of communication within the plant:

- Tactical information is shared in daily meetings.
- Monthly PEP (People Expressing Possibilities) meetings provide an opportunity to communicate corporate strategies, benefits updates, safety education, facility news and metrics, and to brainstorm how to improve processes, eliminate waste, etc.
- Birthday celebrations are held on the 2nd Wednesday of every month in the cafeteria. Cakes are provided, and the time is taken to celebrate each person. JLG uses birthdays because everyone has one – they do not want to miss anyone.
- TIP (Team Involvement Program) is a form of communication and team member feedback. Every team member is asked to take ownership of their 25 square feet in the plant. Team members suggest and implement continuous improvements and document them as "TIPS".
- The chairman of the board accepts letters from anyone and every letter receives a response. The entire organization understands the importance of communication.
- Team members who participate in a product introduction find themselves on the "First Machines" wall. Everyone who contributes signs a poster with the name and serial number of the first machine produced on that line. The poster is framed and displayed in the cafeteria – a great way to promote pride in workmanship.

Processes and Lean Principles

JLG deploys an arsenal of tactics to control and manage manufacturing processes, with three objectives always at the forefront: eliminate waste and reduce variability; minimize the use of space, time, and handling of material; and know the status of materials and production simply by walking through the facility.

JLG operates under seven concepts for continuous improvement:

- Quality is at the source; it cannot be 'inspected into' a product. It must be inherent in all phases of the product's life cycle. JLG operators are the inspectors and need to produce work that continually satisfies the customer.
- Know WHO your customer is, both internally and externally. One lean or kaizen activity is to drill down through "who is using the machine" and eventually the operators get to the point that the person in the next cell is their customer, too. Customers include the people in the next cell, the end user, and even the shareholders in the company. The team has a vested interest in making continuous improvements to the company.
- Know WHAT your customer wants and needs; what does the customer perceive as value?
- Standardize work; it is important to have a baseline from which continuous improvement can begin.
- Make incremental improvements.
- Speak with data – opinion and intuition have their place, but they must be backed up with data.
- Integrate product development. Engineering, operations, procurement, sales, service, and the rest of the organization can actively participate in the design of the product and process concurrently. It is far too costly to re-engineer a product once it is in production.

These concepts lay the groundwork for what JLG calls its "Agile Line Setup". The assembly lines are set up with consistency in mind. The overhead structures, roller conveyors, tool gyms – they are all identical regardless of the assembly line, providing flexibility to respond to customer demand, add new products and refine existing product lines. JLG has modeled its capacity, and uses the model as a tool to understand their facility utilization, to identify constraints in the process, and ultimately to manage capacity.

Any production team member, anywhere in the world, can access JLG's web-based manufacturing navigation tool called AYNTK (All You Need To Know). This application provides simple and real-time access to machine production schedules for any assembly line world-wide. Engineering drawings, work instructions, quality documentation, process specifications, master schedules, production metrics (daily and month-to-date status of assembly lines regarding on-line work-in-process, completed, shipped) – are all on-line.

JLG builds many different configurations (34 models, with 1600 variations) - one at a time, with single-piece flow from their fabrication facilities through Shippensburg to the customer. The flow builds from their supply chain to their coating operation, to assembly, to test. In order to keep inventory low, the right materials need to be deployed for the right applications. Some of the tools used to accomplish this:

- Point of use storage – there is no structured warehouse. Materials are brought in from the receiving dock to a staging area, scanned, and taken to the point of use location. The next time the material is touched, it is being put on a machine.
- Consumption-based replenishment plan – when a part is emptied, a scanned barcode releases an order directly to the supplier to replenish that bin.
- Just-in-sequence delivery – it was not too long ago that 'just-in-time' was cutting edge at JLG. In order to manage the large components, special colors and single piece flow for JLG's complex models, it is critical that materials are received not only just-in-time, but just-in-sequence.
- Warehouse on wheels – suppliers load trailers just-in-sequence, the trailers are dropped at the loading dock, and components unloaded as needed. No floor space is used. Suppliers also stock all hardware, fittings and small electrical components right at the point of use locations.
- Minimum raw materials – milk runs are used to increase deliveries and minimize freight. Trucks can be routed to multiple suppliers to consolidate truck loads.
- Returnable packaging – used to kit parts and minimize waste in handling. Some of these containers are actually the demand signal to release the next order to the suppliers.

Results

Representative of the change that JLG has undergone between 2000 and 2004, Jason Watkins offered these statistics:

- Reduced facilities' footprint by almost 600,000 sq. ft.
- Acquired four new companies and still reduced footprint.

(JLG continued on page 4)

JLG Industries *(Continued from page 3)*

- Maintained capacity to meet demand of previous peak in 2000 and to meet the outlook for 2005.
- Improved raw turns 44%
- Increased WIP turns over 240%
- Increased overall productivity by 43%
- Safety – lost time incident rate was zero for fiscal 2004, and a medical incident rate of 2.44 for fiscal 2004, better than the industry average by 77%. The goal is always zero.

The Shippensburg facility is clean, organized and disciplined. Assembly lines are ergonomically friendly and present product, material and tools at the proper working height. "Discipline squares" are taped to the shop floor to clearly identify the proper location for tools, parts, fixtures, paint parts, material handling devices and even housekeeping items. Time is not wasted searching for parts.

Slingboards ensure operators use the appropriate lifting device for the job. Safety goes hand-in-hand with quality and productivity. Clear operational information in the form of highly visible charts and graphs are strategically placed so all team members can see them. If team members can see and understand the measurements, they are going to have a positive impact on them.

JLG has been on a long, fruitful journey, adding tools to their lean toolbox. Six Sigma means fewer defects in equipment, improved customer satisfaction, and lower manufacturing costs. JLG has laid the groundwork for a structure that is committed to continuous improvement – JLG has 12 black belts and 23 green belts assigned to represent their facilities across North America and Europe, and next will be the introduction of a formal Six Sigma program to continue to build the culture of continuous improvement and take JLG to the next level of performance excellence. ◘

2005 Advanced Manufacturing Forums

Spring Meeting: April 14-15, 2005

Fall Meeting: October 20-21, 2005

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Third Klein Symposium on the Management of Technology

October 14, 2005

The theme of the Third Klein Symposium will focus on small and medium-sized enterprises (SMEs) and the global economy: how SMEs can become effective exporters, with secondary themes of internationalization, innovation, networks and alliances, and policy and evaluation research. The symposium is organized by Gerald I. Susman, Klein Professor of Management, and is supported by funds from the Robert and Judith Klein Endowment to Penn State University.

Additional information will be posted as it becomes available to the CMTOC website:
http://www.smeal.psu.edu/cmtoc/index.html

Gulfstream Aerospace *(continued from page 1)*

- Outfitting cycle time over 30 weeks – noncompetitive
- Excessive outfitting costs
- Every aircraft different
- High recurring engineering costs (all planes are customized)
- Different engineering configurations/drawings by facility
- One-off component manufacture
- Aircraft difficult to service and maintain for interiors and options

They wanted to reduce variability and costs without sacrificing quality. Variability could not be eliminated altogether because some customers were quite demanding. The more variability, the more you have up for speculation and interpretation: galley location, carpet color, seat color, cabinetry colors, types, etc. "When you give a customer unlimited options, you enter into a relationship that is replete with risk. Interpretation is lost in translation, you have to go through three or four iterations, and something will get missed, guaranteed," remarked Lombardo. Customers are paying $40 million for a plane; they will not care that you missed something. Fix it. Add on penalties for late delivery, and soon you are not making any money.

How did Gulfstream do things differently to meet their challenges? Concurrent manufacturing (or "rollback"), lean manufacturing, and standardization were key to their process improvement methodology. Gulfstream's view of concurrent manufacturing is that within the 'value stream' of manufacturing, you have the necessity, if not the obligation, of maximizing the distribution of resources and tasks. They started by assuming that waste exists and in large amounts, and that it contributed to the high cost/low quality and lack of predictability that Gulfstream had in its business. "It was very important that we get our arms around this and apply this philosophy successfully," said Lombardo.

Gulfstream found that 80 per cent of their customers had the same standard configuration for their cabins, so they set about reducing the cycle times on the standardized configurations, not the customized ones. They wanted to reduce man-hours associated with engineering efforts. Instead of redrawing every aircraft, they ended up with standardized drawings, with standardized engineering configurations and furniture; standardized wiring, too, with what are called 'premium harnesses' that are rolled back into the initial phase of production. Factory capacity actually increased in consolidated spaces and footprints. They went from a 12-week outfitting cycle time to approximately four weeks, a very significant time savings. They also had a more repeatable product.

Lean manufacturing is an umbrella program for Gulfstream – all others fall underneath this overall process. For example, a process within General Dynamics (Gulfstream's parent company), called 'lean pathways', has been very successful. Gulfstream partners with a major supplier and actually value-stream maps not only Gulfstream's process but their supplier's, and between the two parties, costs are cut.

How does Gulfstream manage various lean initiatives within the company? By first taking into consideration payback. There are limited resources, limited numbers of manufacturing engineers who can spend time identifying waste in their business. Their direction is primarily strategic – there has to be benefit for the company over the long term. So they start with what they call "the parking lot": ideas, brainstorming, from all sites, from the bottom up. These ideas then go onto a "backlog list": the idea is good but there is no time to work on it right now. An idea will make it onto the "active list" when it has satisfied these rules:

- It supports the five year lean vision.
- There is a positive business case for it.
- There are sufficient resources and budget to implement the idea.
- There is a clear definition of objectives with responsibility and schedule.

The whole process is very focused on data – the active list is managed and best practices are coordinated every month. Every item on the list will have hours or dollar costs associated with it, with a continuous focus on cycle time.

Lombardo closed his remarks with comments on General Dynamics' manufacturing excellence program. "It is very typical in business to experience a plateau," he said. The purpose of the program is to stimulate opportunities for excellence through a series of self-assessments in various "impact areas" in manufacturing operations, including their manufacturing vision, the leadership culture, visual management, 5S and safety, quality improvements/Six Sigma, and delivery/service improvements. The self-assessments are then checked by an independent group, with a focus on the number of points *still available* out of the total points for any assessment category.

In summary, Gulfstream uses lean and Six Sigma characteristics to continue to find opportunities to take cost and variability out of the business. Sticking to a continuous improvement criteria gives Gulfstream the means to evaluate and re-evaluate processes. Clearly it is working: the Gulfstream G550 won the prestigious Collier Award for excellence in aerospace technology in 2004. ◘

Kautext-Textron *(continued from page 1)*

In 1952, Textron had to redefine itself due to a declining textile industry and the ending of some military contracts. Their first strategies to effect change: vertical integration and the purchase of other businesses. Fast-forward fifty years, and Textron is now a $10B multi-industry company with more than 43,000 employees in 130 countries. KT employs over 4,000 of those employees in 29 manufacturing operations in 15 countries.

Up until two years ago, Brian Hatter had never met anyone from another KT division. They were separate business entities with separate finances; synergies were never combined. All this has changed dramatically; and the transformation started at the top, with the company's culture. At week-long leadership training sessions, Hatter now meets with his counterparts from other KT divisions (Cessna, E-Z-Go, Bell Helicopter, to name a few), and they are starting to leverage each other's knowledge, capabilities and technologies, and to share best practices. An example: as an automotive supplier, KT-Lavonia had a noise suppression problem with the pump that pumps washer fluid onto a car's windshield. But KT-Lavonia did not have electronics engineers...who did? Bell Helicopters did. KT-Lavonia's black belts called Bell's black belts and within two weeks, KT-Lavonia had a solution.

The KT-Lavonia plant is characterized by:

- a non-union, employee empowerment-focused work environment;
- daily application of Textron 6 Sigma methodology to all aspects of the business;
- the transition to a continuous-flow manufacturing value stream;
- the transition to a preventative/predictive-based manufacturing culture.

According to Hatter, the most significant contributor to KT-Lavonia's Best Plants recognition came from its rapid transformation from batch manufacturing to one-piece flow in cellular manufacturing.

"It was very common in our plant four years ago to blow bottles as fast as you could. The traditional manufacturing company says make it faster. Improve or reduce the value-added time and forget about the non-value added time. The time the product sits in your plant is the non-value added time, which is about 95% of the time. Focus on reducing this time, and set your value-added time to what your customer demand really is in fact. These types of philosophies were key to KT-Lavonia getting out of an off-site warehouse," Hatter said. "Your value stream has to be very predictive and very preventative in order to become lean and remove waste. Maintenance data needs to be accurate, available, and visual." Hatter offered as an example two metrics that KT-Lavonia was not even measuring until recently: mean time between failures and mean time between repairs.

Components significant to KT-Lavonia's success:

- Company culture. KT-Lavonia's org chart is a series of concentric circles, with customers in the center. The chart is prominently displayed on a wall in the plant, and sends the message of what is critical to the plant and why the company's personnel come to work every day: the customers. The next critical component: the company's value-added associates, their personnel, in whom the company invests time and money for training. "Traditional manufacturing can look at their personnel as a variable cost. We look at them as a fixed asset," said Hatter.
- Textron's 6 Sigma - a system of three proven methodologies:
  - DFSS (Design for Six Sigma) = Grow and Innovate
  - DMAIC (Define, Measure, Analyze, Improve & Control) = Reduce Variability
  - LEAN = Eliminate Waste

Where the three methodologies intersect, you will find profitability, customer satisfaction and transformation. KT-Lavonia holds lean workshops where associates look at total labor, and balance the labor to customer-driven takt times. The first four to six hours of every workshop is training: teaching people how to run a stopwatch, how to go collect and balance labor, how to calculate takt time, identify wastes and make it go away. Associates remove the non-value-added work and define the standardized work. The key deliverable out of the workshops is the creation of standardized work in the best possible, safest, most efficient way to do the job. Value-stream mapping also helps identify waste opportunities and other variables that influence the output.

Hatter's goal is to have the associates on the shop floor become green belts, with the tools to drive the lean process and the DFSS (best practices, benchmarking, and "things gone wrong"). At KT-Lavonia, "we're bubbling up ideas, using statistics to solve problems when we need to, and capturing lessons learned and driving them back into our standards." The big-level metrics are posted for all associates to see. Hatter also walks around the plant with a digital camera – a good tool for spot-checking and for discussions among associates and managers.

KT-Lavonia's accomplishments can be attributed to three strategies:

Cellular Manufacturing:

- Driving the elimination of waste through reductions in non-value added material handling, work and touch reduction.
- Reducing inventory levels and eliminating off-site warehousing through one-piece flow operations.
- Improving quality performance through improved reaction time and reduced lead time.

Employee Involvement:

- Improving plant safety and quality performance through heightened awareness and self-audit with cross-functional team-based workshops.
- Improving the level of buy-in to change.
- Improving the use of standardized work and reducing labor costs due to optimized takt time-based labor balance.

Customer Satisfaction:

- Providing significant logistics savings to two major customers through the transfer of work from Northern facilities to the Lavonia Operation as part of a "Southern Supply Strategy".

Transformation Acceleration Process: TAP for Six Sigma

Employee involvement and empowerment is a key component driving the plant's "transformation". Brian Wolfe is one of ten TAP coaches in North America; his goal in 2005 is to have every KT-Lavonia associate through a TAP class, and to have area leaders administering TAP classes.

(See Kautex-Textron, continued on page 8)

Lockheed Martin *(continued from page 2)*

middle of the work floor. Each metric board contains a flipchart where anyone may comment. If a worker does not have the right tools needed for a job that day, the worker makes a mark on the flipchart. When the director of operations walks by, sees the note, comes by the next day and it is still there.... The only person who can get rid of an action item on a flipchart is the person who put it there. The workers love it. Occasionally the issue cannot be resolved that day, or within a few days. The action then becomes part of the database and action items in the database are reviewed monthly. There are about 2,000 items in the database currently.

Quality, schedule and cost are the metrics that most people review. This is the order in which Lockheed Martin looks at them, not 'cost, schedule, quality'. "If you have quality of process, you are not going to have scheduling problems. Cost is a follow, a result," said Cangello.

The remaining part of the equation is people. Ron Hull provided background on Lockheed Martin's relationship with its union workforce, which was at one time very adversarial, punctuated with strikes and walkouts. Now, the goal is to engage the experience and intellect of the workforce, and leverage those qualities in terms of continuous improvement.

The current teaming effort started in 2001, when MS2 had the nice problem of needing to double the rate of production on their ground-based radar. With the union laws and regulations, how would grievances and day-to-day problems be solved? The decision was made to initiate teams, with the realization that successful teams would mean management and the union walking down this path joined at the hip. Management decided to put themselves through the training process for the union workers, and then tailored that process for the work at Syracuse. Teams were piloted, and based on those results, 24 teams were instituted by the end of 2002. Processes were adapted as it became obvious what was working and what was not.

The joint union/management model worked. Teams were expanded from 24 to 42 in 2003, when the plant won an *IndustryWeek* award. All of the teams have bargaining team members as their leaders. The organizational pyramid is inverted, with all team members at the top, and everyone else in a supportive relationship.

Hull shared some of the lessons learned during the teaming process:

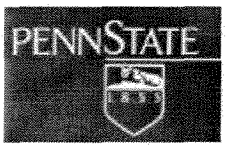
- The best solutions come from the people doing the job.
- Active union leadership is a critical success factor.
- Feedback is key to successful teaming implementation.
- Teaming is a journey...you are never finished.
- Start team leadership skills training earlier.
- Celebrate, have fun, as you implement. It is important to celebrate when you go through a process like teaming - you spend more time during your waking hours with your co-workers than with anyone else!
- Communicate, communicate, communicate.

The results of MS2's 2001-2003 lean journey:

- Sales per employee have almost tripled
- Manufacturing cycle time per major system was reduced 50%.
- Internal Cost of Poor Quality was reduced by 50%.
- Hard dollar savings of 10-12% of the manufacturing budget were added to the bottom line each year.

Hull and Cangello also offered the following golden nuggets for consideration on a lean journey:

- Focus on customer values and goals.
- Make quality the first priority in all products and services.
- Engage the full commitment and capability of every employee.
- Have courageous leaders willing to take a chance, to listen, to bring work in-house, to make a mistake and fix it.



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www.smeal.psu.edu/qmm/overview.html

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Kautex-Textron *(Continued from page 6)*

"All companies understand the need for number-crunching and having your people understand the critical points. If you have been making $11 on a part and now will be making only $5, your associates have to know this. They are part of the challenge in making a better facility," said Wolfe. And cultural elements play a significant role is accomplishing change. An oft-heard quote regarding Six Sigma: "implementing the hard tools [e.g., statistics] of Six Sigma is easy, implementing the easy tools [e.g., different cultures] is hard.

Elements of Successful Change	**Elements of Unsuccessful Change**
Leadership is strong.	Leadership was poor or non-existent.
The need for the change is communicated	The need for the change was never understood.
Goals and objectives are clear and motivating.	Goals are not clear.
Resistance is managed.	Those against the change were allowed to win.
The culture is modified to encourage change.	There were no incentives to change.

TAP is a generalization from a General Electric tool that focuses on cultural acceptance, and has at its heart a "change effectiveness formula":

Q x A = E

Q is the quality of a technical strategy or solution
A is cultural acceptance
E is effectiveness

The effectiveness of any initiative is a function of the Quality of the technical solutions times its Acceptance by the culture. Lessons KT-Lavonia has learned:

- devote as much energy to the A as you do to the Q;
- get the Q right; it is tough to gain cultural acceptance of a poorly defined technical strategy. Technical data has to be the best it can possibly be.

Small changes in "A" (acceptance), even with larger strides in "Q" (technical quality) will mean only small improvements in "E".

Wolfe explains, "I don't take any data…I simply bring the associates into the room and we talk about their cells and their flow. I ask them 'what is it that you have to face everyday that makes your job difficult, so difficult to where you cannot make your production? I get them to talk, and to write their own project definitions. I facilitate things to a certain point so that we understand the threats and opportunities through different exercises. What is the threat if we are not successful – overtime, loss of jobs? What are the opportunities – more business, more car companies coming, looking, liking what they see and approving us as a supplier? "

"We were awarded Best Plant for the transformations we had accomplished, and we realized that we still had a long way to go. It was a slow start. After my training in TAP, we now have racks being put up without my knowledge. The work cells are doing it on their own, which is the beautiful part of it," Wolfe commented.

TAP classes are integrated with the production schedule. A class may be split over several weeks; or if a class needs three days, the plant either builds three days worth of inventory or the lines stay up by using cross-trained personnel. The associates figure out what they want to do, discuss it with other teams, and manage the down time. All plants have concerns about production time and labor productivity. KT-Lavonia has a very well-defined "required to operate" number and plant operations are managed to that number every day. Every work cell has a four-panel chart that details the performance metrics for that cell; what are the top three or four things in the cell that are robbing you of scrap or uptime, and who is working on it? Wolfe's presentation concluded with a chart that detailed the benefits of TAP:

Benefits of TAP	***Keys to Success***	***Risks Without***
Leading Change	Have a champion who sponsors the change.	Slow change, lacks attention & resources.
Creating a Shared Need	The reason to change is clearly understood by all affected parties. Need clearly outweighs resistance.	Bottom of the inbox/low priority.
Shaping a Vision	The desired outcome of change is clear, legitimate, widely understood and shared.	Fast start, but fizzles without direction.
Mobilizing Commitment	There is a strong commitment from key constituents to invest in the change, make it work, and demand and receive management attention.	Bright ideas; no support.
Making Change Last	Once change is started, it endures, flourishes; learnings are transferred throughout the organization.	Improved results are not sustained.
Monitoring Progress	Progress is real; benchmarks are set and realized; indicators are established to guarantee accountability.	Results are not achieved or sustained. Changes to course are done blindly.
Changing Systems & Structures	Changes are permanently imbedded into current operating processes; resource structures support them.	Anxiety/frustration.