Best Practices in Lean

The Momentum Builds

June 2005
Executive Summary

This report presents best practice case studies from selected manufacturers that have recently improved or deployed Lean strategies, techniques, and technologies. These companies stand out from their peers because their Lean programs have driven and continue to drive significant improvements in manufacturing performance, customer responsiveness, and bottom line financial results. Each case study in Chapter 3 is unique, the industries are varied, some companies are Lean veterans, and others have just implemented Lean processes for the first time; but each is a ‘winner’.

This best practices study is a continuation of the Aberdeen’s June 2004 Lean Strategies Benchmark Report. At that time, we reported that very few manufacturers were using packaged solutions to support their Lean implementations. Over the past twelve months, the market for technology-enabled Lean solutions has picked up considerably. There are more solutions available, manufacturers with Lean pilots underway gained traction over this past year and are seeking solutions to help them standardize Lean operations and scale beyond pilots. Finally, there is a growing recognition that technology enabling Lean is a requirement for building customer-responsive supply chains.

Best in Class Case Studies

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Source: AberdeenGroup, June 2005
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Chapter One: Issue at Hand

Key Takeaways

- Continued pressures to improve operational performance and manufacturing flexibility remain the primary drivers for Lean veterans.
- Gaining price and/or service advantage is the primary driver for companies to engage in Lean for the first time.
- Low-tech and smaller companies should seek out Lean visionaries and be prepared for organizational change supported by widespread education.

Manufacturers are under intense, unrelenting pressure to find new ways to cut costs, improve productivity, and boost customer satisfaction. The best in class manufacturers presented in this report are leveraging Lean philosophies, Lean techniques, and supporting technology solutions to eliminate waste, simplify processes, and continuously improve all aspects of their organizations.

In June 2004, Aberdeen published a groundbreaking benchmarking study entitled The Lean Strategies Benchmark Report. This report was based on survey data from 275 manufacturing executives across several industries. Summarization of this data followed by subsequent interviews for this best practices report enable us to identify characteristics that set the best in class performers apart from the rest: a visionary driver/leader with the authority to make organizational changes; top management commitment to the principles of Lean; the ability to execute a multi-phase, multi-year plan; and the foresight drive change into manufacturing, and subsequently across the supply chain.

In this study, participants were asked to identify the top three business factors that either drove or will drive them to adopt Lean (Figure 1). Over 80% of the respondents

Figure 1: Top Five Business Factors for Lean Adoption

Source: AberdeenGroup, June 2004

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ranked operational performance and competitive advantage among their top three drivers. This benchmarking data is supported by the manufacturers profiled in this report:

- **Continued pressure to improve operational performance.** Pilkington Glass was given the opportunity to substantially and quickly increase its corporate revenues if it could double its production throughput without additional resources. The company met this challenge by consolidating its work cell scheduling information and systems into a single optimization tool to level the entire plant.

- **Maintain competitive advantage in price and service.** Mahindra & Mahindra found itself faced with new and tough offshore competitors when India removed its import restrictions in the late ‘90s. The company was suddenly under intense pressure to simultaneously reduce prices and dramatically improve its customer service performance across the country. By strengthening its network of distributors and retailers as it implemented Lean techniques in its Mumbai plant, Mahindra & Mahindra has achieved significant results.

- **Pressure to improve profit.** Husqvarna was forced to consolidate its manufacturing assets across three facilities and merge multiple product lines and facilities into its Beatrice facility. With an eye toward Lean, it readily designed a new factory layout, work cells, and processes for the newly outfitted facility. Lean was also the core philosophy which enabled them to restore profitability to its highly competitive service parts business.

- **Customers demanding shorter order cycle times.** As a leading supplier of precision optical equipment to the firearms industry for decades, traditional Leupold & Stevens customers were familiar with the four week delivery times. However, growing the business meant satisfying the needs of major retailers; these new customers were demanding delivery times of five days or less. As a result, Leupold & Stevens was forced to revamp its manufacturing processes, implementing Lean work cells for many of its major product lines.

- **Customers demanding reduced prices.** A few years ago, the U.S. division of WIKA was surprised to find that its competitors, both foreign and domestic, had suddenly cut their prices. Committed to creating value for its customers and retaining a manufacturing presence, WIKA developed customer enrichment programs as it Leaned out its manufacturing operations.
Chapter Two: 
Key Business Value Findings

Key Takeaways

- Substantial reduction to customer order delivery time is a major benefit reported by all winners in this study.
- Ultimate flexibility can be achieved when Lean manufacturing processes and techniques are extended into the supply chain.
- Newer solutions, technologies, and deployment options are providing unprecedented choice as Lean manufacturers prepare to move beyond pilot programs.

According to Aberdeen’s Lean Strategies Benchmark Report (June 2004), continuous improvement and elimination of waste are top of mind for most Lean manufacturers. Figure 2 also shows that well over 70% of the manufacturers that participated in that study intend to use Lean-enabled strategies to reduce manufacturing and supply chain costs and assets.

Figure 2: Top Five Lean-Enabled Business Strategies

Interviews with the manufacturers represented in Chapter 3 confirmed that the Lean-enabled business processes shown in figure 2 were also high priority for these best in class companies:

- Implement continuous improvement culture and methods. The Marena Group sewing factory in Georgia has made remarkable strides from a cultural perspective. Its Lean program drove the transition of hundreds of semi-skilled workers paid by the piece into work cell teams where they sometimes must wait for customer orders to arrive before they can begin work. From a business process and technology perspective, the change from an MRP push-based system to the pull-based Infor Visual Easy Lean solution was driven by a Lean visionary and supported by the owners of the family owned business. As a result, today the Marena Group has reduced work-in-process inventory by 50% and the customer order lead time has gone from 2 weeks to 1 day.
• **Reduce inventory and assets required to produce and deliver product.** After consolidating three lawn care manufacturing facilities into a single plant, traditional manufacturing processes were redesigned and work cells added with the help of the Pelion Manufacturing Process Optimization solution. Post consolidation, Husqvarna reports a 50% reduction in work-in-process inventory, a 50% reduction in manufacturing cycle time, and a 12% floor space savings in the original plant.

• **Eliminate non value added manufacturing, logistics, and selling costs.** When the DoD asked this major defense contractor to ramp-up the production of its electronic guidance systems in wake of September 11th, the company launched a major Lean initiative. Experts were assigned to analyze detailed production data, search for new technology solutions, and implement a number of continuous improvement programs. Today, the contractor has cut its manufacturing cycle time by two thirds and decreased its work-in-process inventory by 70%.

• **Synchronize manufacturing and logistics processes to deliver on time and complete orders.** While maintaining its commitment to 100% on time delivery, this leading multi-tier automotive supplier focused on synchronizing and stabilizing its supply chain, both internally and externally. It worked with Factory Logic to schedule and level work centers, and tightly integrate manufacturing with enterprise and legacy systems; upon completion of this project, there will be 30 North American plants up and running with this Lean solution.

• **Improve flexibility of manufacturing and logistics operations.** Flexibility is exemplified by the Pilkington Glass story. Awarded a series of new contracts by OEMs, Pilkington was faced with doubling their plant throughput with additional resources within a 45 day period. Working with JRG Systems, they were able to implement a scheduling optimization solution that increased the daily throughput from 8,000 to 17,000 glass assemblies and improved equipment utilization from 52% to 90%, both in a two month period.

**IT is Finally Making Headway in Lean**

When manufacturers were asked which solutions they used to support their Lean initiatives for Aberdeen’s *Manufacturing Performance Management Benchmark Report* published last year, respondents overwhelmingly responded with “other/none” or “custom” (figure 3).

Lean technology solution providers have made inroads into manufacturing companies over the past twelve months. Until recently, many plant managers relied on manual and Excel solutions to manage one or more work cells. However, as customers demand faster response, leading manufacturers want to move Lean beyond one or two product lines. The manufacturers interviewed for this report are using technology solutions to capture best practices, model new processes, and deploy Lean into other facilities. While manufacturing is the first and most important step, by automating Lean processes, they are integrated with enterprise and supply chain systems, enabling ultimate responsiveness.
Over the past year, more Lean manufacturers have adopted packaged solutions and there are more solutions available. Built on Microsoft technologies, Axapta Lean delivers its solution on a services based architecture which provides customers like WIKA with a highly configurable and low cost solution. Pelion is unique in its ability to deliver the business process modeling tools needed to ‘scale’ the results of value stream mapping activities. JRG delivers interactive scheduling solution an ‘on-demand’, web-based service. Factory Logic promotes Toyota Production System techniques with its factory scheduling solution. Infor Visual Easy Lean supports the drum-buffer-rope philosophy which was critical to convincing a small manufacturer up and running on Lean. Although the APO module has been available from SAP for some time, managed services provided by companies like Bristlecone should make it more accessible and digestible for companies unwilling to make a major IT support investment. Given the opportunity to refit an automotive plant, Intier was able to tightly link its Lean operations by standardizing its process control systems with Rockwell Automation. Brooks Software has been instrumental in helping a major defense contractor implement over 200 continuous improvement efforts as it transitioned from MRP to Lean production. Epicor Software was able to build on its long term relationship with one of its customers to develop a Lean module that today is supporting a hybrid manufacturing operation.

**Stacking Up Against the Competition**

Aberdeen has developed a competitive framework that helps determine success factors for best in class performers. Survey respondents were evaluated on five criteria: process, organization, knowledge, technology, and performance measurement. Take a minute to see how you stack up.

If the descriptions in the *Laggard* column best describe your environment, your manufacturing strategy is causing you competitive disadvantage. Your responsiveness is slower
than industry average, which will result in escalating customer dissatisfaction. So, you should establish a manufacturing excellence program.

If the descriptions in the **Industry Average** column best describe your environment, then your company has an undifferentiated manufacturing strategy and does an adequate job of managing operations. However, adopting leadership strategies may enable you to reduce costs and improve flexibility.

If the descriptions in the **Best in Class** category best describe your environment, your manufacturing capabilities differentiate your company from the competition. However, unless the majority of your answers are in the **Best in Class** column, there’s still significant room for improvement.

Table 2: The Aberdeen Lean Strategies Competitive Framework

<table>
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<tbody>
<tr>
<td>Sporadic use of Lean line design techniques and Kaizen events</td>
<td>Complete use of Lean programs for manufacturing process design, production leveled through pacemaker operations, and Kaizen event process institutionalized for manufacturing</td>
<td>Lean programs deployed beyond manufacturing and into customer acquisition, supply chain, or product commercialization processes; operational design focused on improving value chain performance, enterprise-wide Kaizen events</td>
<td></td>
</tr>
<tr>
<td>Focus just on the Lean basics (e.g., the 5Ss); no organizational champion; no coordination outside of manufacturing</td>
<td>Manufacturing operational and performance improvement decisions based on Lean; manufacturing management commitment; some coordination with sales, logistics, and/or suppliers</td>
<td>Corporate- or division-wide operational and performance improvement decisions based upon Lean; president/COO/general manager support; enterprise, or division-wide coordination, including suppliers.</td>
<td></td>
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<td>Limited internal knowledge; expertise comes from external consultants hired on an occasional basis</td>
<td>Lean led by a handful of “gurus,” some are external consultants; manufacturing workforce led through Kaizen events.</td>
<td>Pervasive Lean expertise through all organizations; Kaizen events launched top-down and bottom-up; corporate tracking of continuous improvement progress and results</td>
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<td>Extremely limited: manual line design, scheduling solutions, and continuous improvement tracking; paper-based Kanban support and modified ERP solutions for daily material back-flushing</td>
<td>Point solutions: spreadsheet-based line design, scheduling solutions, and continuous improvement tracking; modified ERP solution for material back-flushing when finished product is produced and electronic Kanban support</td>
<td>Integrated solution: Lean strategies design tool; integrated customer acquisition to delivery solution, with real-time scheduling and tracking of orders into manufacturing and logistics and suppliers; production and delivery scheduling is dynamic and based on order mix, priority, etc. Web-based enterprise-level continuous improvement tracking and score-carding.</td>
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<td>Performance metrics</td>
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<td>Below industry average manufacturing costs and inventory turns; struggle to reliably meet delivery dates</td>
<td>Industry average manufacturing costs, inventory turns, return on invested capital, order lead times, and customer service</td>
<td>Best in class industry order cycle times, supply chain costs and return-on-invested-capital; little or negative working capital; viewed as the supplier of choice in competitive situations</td>
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Source: AberdeenGroup, June 2004
# Chapter Three: Best in Class Case Studies

## Key Takeaways
- More mature implementations can be found in multi-tier automotive suppliers
- Getting started requires a visionary and Lean ‘guru’
- Small companies can achieve dramatic results but must ‘keep it simple’

The case studies represent different industries, multiple challenges, and demonstrate that each company is taking its own unique journey toward Lean.

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Source: AberdeenGroup, June 2005
Husqvarna Supports Multi-Factory Consolidation

Business Challenge

Originally founded in 1689 as a Swedish musket factory, Husqvarna honed its engineering and manufacturing expertise as it progressed through motorbikes, microwaves, and chain saws. Today, as a member of the Electrolux Group, Husqvarna Turf Care Company is the world’s leading supplier of outdoor power products for parks, forests, and gardens. It has 2200 employees and is represented in over 100 countries around the world by 18,000 dealers. Customers include commercial users such as golf courses, consumer retailers such as Lowe’s, and equipment rental companies.

Husqvarna is in the final stages of a major plant consolidation. The assets of its Denver plant, new Bluebird products from a recent acquisition, and an offsite warehouse that was used for some final assemblies are being consolidated into a newly designed Beatrice Nebraska facility. As the specialty plant for the Turf Care division, the Beatrice facility supplies the more complex, harder to manufacture products such as Zero Turn lawnmowers and is responsible for the worldwide service parts business.

Driven by requests for shorter lead times and improved customer responsiveness, the company introduced the Lean 5S principles: clearing up, arranging, neatness, discipline, and ongoing improvement to pave the way for improved inventory management processes. At the same time, there was a growing recognition that the forecasts the Beatrice plant had relied on for production planning were becoming increasingly inaccurate and did not recognize important customer orders or market promotions, causing instability in the production schedules.

Strategy and Selection

To simultaneously shore up a failing (on-time shipments less than 50% of the time) service parts business and consolidate three manufacturing facilities, priorities had to be set.
First, the decision was made to use the Lean 5S principles to guide the consolidation of facilities and to streamline all supply chain activities. Because the service parts business was receiving unfavorable ratings from its customers, revamping the replenishment and distribution processes would take the highest priority. The second and more difficult goal was to redesign the Beatrice facility and its manufacturing lines so that it could accommodate the additional products resulting from incorporation of the new Bluebird product line, and the off-site warehouse final assembly processes without additional investments.

The first step was to pilot Lean for target products that experienced more volatile demand; small teams were selected and assigned to work cells (dissimilar machines grouped into a production unit to produce a family of parts having similar routings), taking responsibility for all phases of production.

Husqvarna’s management team recognized that it would need external resources to supplement their efforts and engaged Pelion Systems based upon their deep Lean Flow experience and adaptive software products. Husqvarna needed a solution that could be implemented without operational disruption, yet would be flexible enough to adapt to new processes and design as the project moved forward.

**Phase I: The Service Parts Business**

To improve its on-time delivery record, the Husqvarna-Pelion project team redesigned the service parts supply chain to be demand-driven. As a result, when a service part is sold by a distributor, a signal is sent back to Beatrice; each day, these service part requests are included in customer demand assumptions. This integrated customer demand signal is processed by the Pelion MPO (manufacturing process optimization) software which performs demand-driven planning and scheduling for the factory, and sequences production for lines and work cells. This process enables manufacturing to serve the service parts customers as it would a product customer. Today, the orders are received and shipped on the same day. And, as soon as the service part is shipped, a Supplier Kanban signal is sent to the ERP system and the demand request is forwarded directly back to the supplier. Supplier communication and performance metrics are managed through the Pelion Supply Manager portal capabilities. Due to Pelion’s strong industry expertise and Pelion MPO solution, Husqvarna was able to ‘go-live’ in only four months. As a result of this implementation, service parts on-time shipping has improved from 45-50% to 95-99%+.

**Phase II: Plant Consolidation**

The next task was to consolidate the operations from three facilities into a single plant in the middle of the 2002 busy season without shutting down. The Husqvarna-Pelion team worked together to reorganize Beatrice production lines to be more efficient. Value stream mapping techniques supported by Pelion’s MPO (manufacturing process optimization) software were used to map out the resources and processes required for new,
mixed mode production lines, while eliminating all wasted movement, inventory, equipment, etc. Its “what if” scenario modeling capabilities enabled the project team to create and evaluate multiple line possibilities without disrupting current production. The Pelion MPO solution enabled the plant to get up and running quickly, and also provides an integrated tool to make changes as needed based on its scenario modeling capabilities. Today, the plant relies on Lean for more volatile products and on a work order based pull system for easily forecasted products; both send Kanban signals back into the plant and replenishment signals all the way to the supplier for parts and components.

Results

The consolidation of three product lines into the Beatrice facility in considered an overwhelming success. Today the plant boasts a new mixed model final assembly production line that has reduced manufacturing time by 50% and improved productivity by 10%. Not only have the additional product lines been fully incorporated, but Beatrice floor space requirements have been reduced by 10% as well. Although the major production line remains for the time being, it sends Kanban signals to component parts inventory and electronic replenishment signals directly to suppliers. As a result, the overall work-in-process (WIP) inventory has been reduced by 50%.

Simultaneously, Husqvarna more than doubled the on-time shipping performance for its service parts business from 45-50% to a remarkable 95-99%. This has given the company a much needed boost in customer service and responsiveness.

Future Outlook

Recognizing the importance of Lean to the future success of the Beatrice facility, the company is preparing to transition the remainder of its workforce from its current departmental structure to process-focused teams. A comprehensive education program has been instrumental in preparing employees for the transition to work cells; today Lean education is part of the new hire training program at Beatrice.

The Beatrice facility had been anticipating space constraints resulting from the plant consolidation and corporate considered building a new site at another location outside the United States. But, using the productivity increases from its Lean program and considering the geographic logistics service and cost advantages of the Beatrice location, management used the modeling capabilities of the Pelion MPO software to design and layout the new facility. Management was able to demonstrate that the company could be cost competitive with other locations while having a considerable service advantage. As a result, corporate authorized construction of a new “green field” plant across the street from the existing Beatrice facility. The new facility recently went on line using the new flows and processes supported by the Pelion MPO software.
Aberdeen Conclusions

Husqvarna North America was under pressure to simultaneously consolidate three major lawn care product lines into a single manufacturing facility at the same time it recognized the need to dramatically improve the performance of its service parts business. Forward planning, careful execution, and the support of a strong technology partner facilitated these critical transitions. The company leveraged its own Lean principles and solutions from Pelion Systems to design new production lines, thus enabling all products to be manufactured in the same facility. Additionally, because Pelion enabled demand signals to be sent all the way back to the suppliers, the service parts organization was able to more than double its customer service response rates.
Integram Launches New Lean Plant

Business Challenge

Integram St. Louis Seating, a division of Intier Automotive, manufactures the interior seats used in Chrysler minivans. Just as Integram received a contract from Daimler-Chrysler to redesign and manufacture contoured seats for its 2001 model year, it was notified that its customer, the Daimler-Chrysler assembly plant, was relocating to Missouri. To mirror its customer’s change in location, Intier elected to move the production of its contoured seats to its Fenton Missouri facility. As a result, Integram was given a unique opportunity to overhaul its manufacturing operations to support new Lean work cells and deploy new standardized control systems across an integrated architecture to simultaneously support, coordinate, and track multiple production processes.

Strategy, Selection and Deployment

Seizing the opportunity to redesign its manufacturing processes, Integram was committed to replace its old continuously moving assembly line with flexible cell-based processes. The newly fitted manufacturing plant processes would be managed by a single control architecture; in addition to providing real-time data to support continuous improvement programs, it would also monitor and track serialized part numbers throughout production and afterwards. During the design phase, engineers focused on production efficiencies while enabling rapid reconfiguration for future designs or model-year changes with minimal effort.

To technology-enable the newly designed factory; Integram looked at several MES (manufacturing execution systems) solutions providers. Selection criteria included:

- Support Lean and work cell processes
- Comprehensive control system architecture

| Best Practices in Lean
| Company Name |
| Integram St. Louis Seating (division of Intier Automotive) |
| Solution Provider |
| Rockwell Automation |

| Business Challenge |
| Meet Chrysler seating requirements for the 2001 model year and revamp two plants to support Chrysler location switch |

| Strategy |
| Redesign the Fenton Missouri plant to meet Chrysler requirements; install new equipment and systems during 7 week shutdown period |

| Value Achieved |
| Reduced manufacturing cycle time from 10 hours to 8 hours |
| Improved productivity by 20% |
| Improved control of finished goods inventory due to improved scheduling |
| Increased the number of inventory turns |
• Provides real-time information to enable trouble shooting
• Support TREAD and other genealogy requirements
• Easily integrates with other systems
• Enables rapid adaptation to future model-year changes

Integram selected a Rockwell Automation solution which combined MES and control systems into an integrated architecture designed for the newly fitted plant.

Implementation

The plant was shut down for a complete overhaul between July 11th and September 25th in 2000. This seven week window allowed the removal of existing equipment, the installation of new equipment, and the implementation and testing of new systems. As the new equipment was being installed, Rockwell hardware and software products were implemented to support new flexible cell-based processes. The Rockwell RSSql transaction manager software was deployed to centralize data storage, link plant floor systems to the enterprise, and create a central access point for production reports. Because the Rockwell solution spanned all process control systems, production processes could be better coordinated, monitored, and information shared.

Results

The benefits of Integram’s combined Lean and Rockwell solution include:
• Maintain or increased daily efficiency while reducing
• Support continuous improvement by justifying improvements
• Improved manufacturing flexibility (work cells)
• More accurate control of the coordinated assembly processes
• Improved data management by eliminating hand-written records
• Reduced costs by minimizing cycle times, labor, and waste
• Standardization on control systems enabling flexibility
• Availability of data such as build schedules available on the intranet

Future Outlook

By standardizing on the Rockwell Automation architecture and control systems, Integram can standardize operations and training, and more readily adapt to changing production requirements.

Aberdeen Conclusions

Due to a relocation of its assembly plant by Daimler-Chrysler, Integram was given a unique opportunity to overhaul its production processes and systems. In a seven week period its Fenton plant was able to discard its old continuous assembly process in favor of a Lean work environment with work cells focused on producing the complete seating product. In its journey toward Lean, Integram focused on standardizing and building a
mission critical technology infrastructure as part of its overall effort to automate its Lean manufacturing processes. While this organization is a relatively new arrival to Lean, its direction and strategy is well founded.
Sighting Change for Leupold & Stevens

Business Challenge

Leupold & Stevens is a leading provider of precision optical products, including rifle scopes, spotting scopes, binoculars and mount systems, used for mounting a rifle scope on a firearm. Its manufacturing operation includes the fabrication of parts, creation of subassemblies, and final assembly of the scopes and binoculars.

While the company traditionally delivered its products to distributors within four weeks, new retail customers were demanding three day delivery times. Until this time, Leopold & Stevens was relying on MRP to manage manufacturing operations; however the Lean workcell that they piloted a few years ago would soon take center stage.

Strategy, Selection, and Deployment

Leupold & Stevens’ goal was to develop a hybrid manufacturing strategy that would support the ‘right’ combination of MRP and Lean techniques. For high volume products, MRP would continue to drive work order processing. For lower volume products, Lean processes would be automated. Information from both manufacturing methods would be integrated via the corporate ERP system. In 2003, the company began to look for application software that would automate and integrate its hybrid production environment. Selection criteria included:

- Monitor Kanbans
- Control backflush processes
- Determine Kanban sizes correctly
- Continue to use MRP to ‘push out’ high volume orders
- Integrate Lean and MRP systems

Company Name
Leupold & Stevens

Solution Provider
Epicor Software, Avante Lean

Business Challenge
Struggle to meet customer on-time delivery expectations; reduce manufacturing lead times

Strategy
Develop hybrid manufacturing strategy to provide optimal performance for all products.

Value Achieved
- Customer delivery times from 4 weeks to 3 days
- Manufacturing lead times from 4 weeks to 3 weeks
- Inventory reduced by 50%
- Administration associated with work orders and purchase orders reduced by 25% to 50%
An Epicor Avante customer for several years, Leupold & Stevens opted to work with jointly Epicor as its initial Lean Manufacturing customer. The new Avante module complemented its Lean processes and created a link between its ERP system and manual Lean methods. A single product line was piloted early in 2003, five more product lines were added in October, and the company went live with Avante Lean Manufacturing in the first quarter of 2004.

Today, Leupold & Stevens is using the Lean Manufacturing module to monitor customer order transactions and automatically releases demand instructions from sales-order line items directly to the cells without manual intervention. On the procurement side, the system automatically releases specified replenishment quantities against blanket purchase orders when minimal levels of material or component Kanbans have been reached in a cell by automatically notifying the supplier of a purchase order release via email or fax.

To keep faster moving items flowing smoothly, the plant implemented a postponement strategy that includes a Kanban finished goods pull system with a small buffer of inventory, which is replenished based on demand, not forecasted stocking levels.

**Results**

By incorporating traditional manufacturing orders, Lean techniques, and manufacturing postponement strategies, Leupold & Stevens has substantially reduced its customer delivery times and manufacturing lead times. Using Kanban techniques to replenish semi-finished products has enabled the company to slash customer delivery times from 4 weeks to 3 days. Its hybrid (combination Lean and work order) manufacturing strategy has resulted manufacturing lead times dropping from 4 weeks to 3 weeks. Improved visibility and scheduling has enabled a 50% reduction in overall inventory.

**Future Outlook**

Leupold & Stevens continues to look for ways to streamline its business and manufacturing processes and increase the value that it delivers to its customers. Moving forward, it will automate traditionally manual processes such as advance shipping notices, acknowledgements and receipts as well as develop the ability to share cost information. The company is also investigating how it might integrate new product development and design change information from its engineering system directly with manufacturing.

**Aberdeen Conclusions**

As a leading provider of precision products for the firearms industry, Leupold & Stevens has gradually embraced Lean techniques throughout manufacturing over the past several years; from leveraging work cells to produce more complex products to using Kanban replenishment signals for semi-finished products. As a mid-size manufacturer, the company has struck a harmonious balance between MRP and Lean by developing a strategy for each product line; for instance make-to-order products require daily re-planning, while the higher volume products are typically planned according to retailer forecasts.
which are received on a regular basis. Although maintaining buffer stocks of semi-finished products are not desirable for Lean ‘purists’, its lengthy manufacturing cycle and demanding retail customers leave provide few options. Leupold & Stevens hybrid manufacturing strategy and use of technology to automate Lean and integrate it with the rest of manufacturing and the enterprise has paid off with impressive reductions in customer delivery times, manufacturing cycle times, and inventory investments.
The Marena Group Keeps it Simple

Business Challenge
The Marena Group designs, manufactures, and distributes external compression clothing used by patients recovering from plastic and dermatological surgical procedures. Founded in 1995 by the Watkins family to make post-operative garments more comfortable, the company has grown 20-30% a year over the last ten years. It drop ships directly to domestic distributors and is represented by other medical distributors in over 50 countries. Over time, the number of product offerings has multiplied to over 4500 different items. Despite building a state-of-the art sewing factory in Lawrenceville Georgia in 2000, the production environment had become increasingly complex.

By 2001, the company was faced with a ‘battle of the lead times’. As the business grew, it took longer and longer to get larger batches through production; at the same time, customers were demanding much shorter lead times. In its search for external expertise, the company contacted Chesapeake Consulting. As a major proponent of Lean, specifically the theory of constraints (TOC) and drum-buffer-rope, Chesapeake convinced the Marena Group that to ultimately solve the production challenge, the company would better served by waiting for the customer orders and producing in smaller batch sizes.

Strategy and Selection
To deal with the increasing complexity, the company first tried to implement an MRP system to drive production. However, when demand is strong, MRP tends to flood the plant with more work than is actually necessary, and production management must manually expedite to-order jobs to meet the tight deadlines. Trading off work between make-to-stock replenishments and make-to-order demands was a continual struggle. Additionally, requirements for shorter lead times, the seasonal nature of the business, and the combination of make-to-order and replenishment goods were not being met with existing systems. In fact, operations managers were manually manipulating MRP forecasts
daily to release the right products at the right time; this placed a significant burden on planners, and customers could be served only through continuous effort and a high inventory level of stocked goods.

Prior to beginning its Lean journey, some lead times were as high as six weeks; and, manufacturing wanted to make the batches larger which would have ultimately slowed production down even more. Although the company was interested in finite computerized scheduling solutions, over time it concluded that only common sense, not computers, would solve its production problems. The company started the Lean program by identifying the 10% of items that were ‘high movers’ and setting strategic ‘buffer’ levels to assure availability for shipping. Secondly, the company reorganized the factory employees into self-directed work teams. The ‘high movers’ are produced in batches of 10, rather than the typical lot sizes of 100; at the end of key processes, the batch is bar coded and replenishment signals are sent to inventory. The less popular items are produced ‘on demand’ (pulled) within a single shift to meet the 24 hour delivery requirement of the domestic market.

Once production was under control using semi-manual processes, a project team was assigned to evaluate technology solutions to support this newly Lean production environment. Many systems were evaluated, but the team ultimately decided to extend its Infor VISUAL Enterprise solution by adding the Visual Easy Lean module to schedule operations, manage shop floor activities, and capture costs for piece work payroll.

**Implementation**

Because Lean processes were in place prior to the selection of Visual Easy Lean, the implementation took four weeks. Almost immediately, the Marena Group began noticing improvements; the software was scheduling and releasing work to the floor the way they had already been manually, but with far less effort.

Education was important but the focus was more on the common sense aspects of Lean such as eliminating non-value added data points, keeping clean work centers, and maintaining an orderly plant. Because workforce bonus is paid by the piece produced, transitioning from having large batches waiting for processing to waiting for customer orders and processing in batches no larger than 10 pieces created anxiety with employees. However, productivity ultimately increased 30%. Today, the workforce is highly productive and 20% of worker compensation is based on team incentives.

**Results**

Today, the ‘high movers’ are stocked for same-day domestic shipment, with demand signals sent to replenish as needed. International orders must ship within one week. The simple drum-buffer-rope philosophy was working well; today the software releases and prioritizes work following the same principles with more precision and much less effort. Within a few weeks of activating the system, a new prospective order for 5,000 units arrived. The Marena Group was fully confident in quoting the order to be completed within
the requested time frame, without interfering with their existing workload or jeopardizing existing due dates. VISUAL Easy Lean made it possible to schedule the unusual demand through the plant, without conflicts, and without the need to reschedule work already in process.

Work-in-process inventory and lead times were cut in half within three weeks of going live. International customer delivery times have gone from two weeks to one with fewer disruptions and modifications to the floor.

**Future Outlook**

The Marena Group is continually seeking opportunities to utilize technology to enhance business process automation and continue its journey toward Lean. Marena is also reaching out to its textile suppliers to share forecasts to smooth inventory and communications over time. From a technology perspective, the company will continue to build on the solid foundation and add capabilities as their business grows and they are faced with addressing new requirements.

**Aberdeen Conclusions**

The Marena Group had grown quickly but had reached the point where it was difficult to scale production to handle more volume without dramatic changes. The implementation of common sense thinking in the form of Lean enabled the company to significantly increase its throughput while holding the line on costs. At the same time, the industry was demanding one day rather than two week delivery times. With the vision, the company was able to implement the processes and technologies that are enabling the company to remain a leader in its industry.
Pilkington Glass Optimizes Production

**Business Challenge**

Pilkington is one of the world's largest manufacturers of glass and glazing products for the building and automotive industries. Founded in 1826, the Pilkington Group is headquartered in the U.K and posted annual revenues of approximately $4 billion in 2004. It has manufacturing operations in 24 countries on five continents and sells in 130 countries, employing about 23,900 worldwide.

Pilkington North America, headquartered in Toledo, Ohio, does 70% of its business with OEMs such as Ford and GM, and the remainder with tier-one suppliers. The company has manufacturing plants in Michigan, Indiana, Kentucky, Ohio, Mexico, and Canada.

About two years ago, the Niles facility was awarded a series of new automotive contracts that would come to fruition for the 2005 vehicle model year. This new business meant that the annualized sales for Niles would double in less than seven months, with most of the new orders due in a 45-day period between the beginning of August and mid-September 2004.

The manufacturer had to absorb major changes, growing from four or five customers and 20 major products, to 11 customers and 100 major products in a few short months. The company decided to accommodate the added business without adding scheduling or planning resources.

**Strategy, Selection and Deployment**

Pilkington is well acquainted with Lean and its workforce was organized into customer-focused teams and work cells a few years ago to ensure that a designated team takes responsibility for each customer order, from the time that it enters the company until it’s shipped out the door.

When Pilkington was awarded the new OEM contracts, the Niles plant became concerned with the plant’s ability to more than double its production capacity within a few

<table>
<thead>
<tr>
<th>Best Practices Lean</th>
<th>Company Name</th>
<th>Solution Provider</th>
<th>Business Challenge</th>
<th>Value Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pilkington Glass (NYSE: PILKF)</td>
<td>JRG</td>
<td>Double production in 45 days at Niles plant.</td>
<td>- Niles plant increased annualized sales($38M to $90M) in 45 days</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Optimize existing capacity</td>
<td>- Daily throughput at Niles soared from 8,000 to 17,000 in just two months</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Maintain 100% schedule compliance</td>
<td>- Process equipment utilization for injection molding increased from 52% to 90%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Extend Lean systems into scheduling processes</td>
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</tbody>
</table>
months. Although Pilkington was using corporate ERP system for production planning, the plant needed to be able to integrate daily demand and interactively insert special orders into the schedule as was needed; the current system was not able to support this.

The plant looked for inexpensive solutions that supported its fairly straightforward planning process, quickly discounting the major planning vendors as ‘overkill’. It considered using enhanced Excel scheduling capabilities with macros, but decided to choose the relatively new JRG web-based scheduling solution. The team agreed that the JRG solution should enable them to introduce this new technology solution while:

- Supporting the Lean manufacturing philosophy
- Aligning production more closely with demand
- Simplifying scheduling processes and reducing the time
- Improving plant flexibility through rescheduling
- Demonstrating the impact of changes prior to rescheduling
- Scaling to accommodate doubling of demand

Pilkington selected JRG because it provided the strongest price performance solution. Also, it was able to input demand from the ERP customer order system, as well as other sources, and enable team leaders to develop optimal manufacturing schedules for their work cells.

Implementation

JRG consultants worked closely with the team leaders throughout the 10-week implementation process in the winter of 2003/2004. Because manufacturing processes were well established, there were very few adjustments to manufacturing processes. The project team leveraged JRG workflow capabilities to map out the ‘as is’ and ‘to be’ processes; next all the input and output data streams were identified. Within two weeks of testing, the JRG system quickly started to replace the established team leader scheduling processes.

Results

This new scheduling solution has enabled Pilkington to more than double its sales and triple production throughput in six weeks. Annualized plant sales jumped from $38 million to $90 million in this timeframe; and daily production units have more than doubled from 8,000 to 17,000. By optimizing production processes, the utilization of the process equipment (primarily injection molding) has increased from 50% to 90%. And, perhaps most importantly, Pilkington’s ability to respond quickly and decisively to a major sales opportunity better positions the company for future opportunities.

Future Outlook

Currently, the Niles factory is scheduling all its Lean operations with the JRG solution; the same solution is also being implemented in Clinton, MI. Once up and running, JRG solutions will be deployed across all six U.S. plants. The U.K.-based IT organization,
impressed with the results, is considering a strategy to roll out the JRG system across its European operations as well.

**Aberdeen Conclusions**

Pilkington was better positioned than many companies to more than double its production capacity within 45 days. Its adoption of Lean processes, evolution of its work cell factory environment, and continuing focus on eliminating non-value-added activities helped to prepare the company for this important transition. The company has also been well served by the JRG interactive scheduling tool with its ‘what if’ change capabilities. While this solution may not provide the robust functionality and complete integration of major APS providers, its graphical interface and rescheduling capabilities were sufficient to support Pilkington’s Lean work cells and production environment. Additionally, because JRG is delivered as web-based service, Pilkington is benefiting from lower monthly fees and lack of IT resources to provide support.
WIKA: Leveraging Lean for a Major Comeback

Business Challenge

WIKA is the world’s leading provider of pressure gauges with worldwide sales of over $400M, 4500 employees, locations in 27 countries and manufacturing facilities in 9 countries. Last year, its U.S. operation contributed revenues of $85M by manufacturing and selling pressure gauges to domestic OEMs and distributors. However, 2001 was the year that both domestic and foreign competitors dropped their price points below WIKA’s manufacturing costs. Regardless of the double digit revenue decline the division suffered that year, the company recommitted itself to retaining manufacturing capabilities in the U.S.

In 2001, WIKA U.S. aggressively tackled the issue of competitiveness by introducing Lean philosophies into its Lawrenceville Georgia plant. First, in an effort to reduce order lead times and improve manufacturing flexibility, employees were reorganized into value-stream teams or work cells and asked to transform the manufacturing of their product lines from a ‘batch and queue’ orientation to a ‘pull’ environment. Next, the president initiated a customer value program based on Lean concepts. Teams were assigned to work with customers to help reduce their inventories.

Strategy, Selection and Deployment

On the plant floor, WIKA reorganized its first shift employees into seven major value stream teams. This new work structure enabled the plant manager to move people and machines around from one team to another as the business changed. Second shift employees were simultaneously cross-trained and made available to fill in the slack for any cell that was overloaded with work.

Once the WIKA work cells were operational, U.S. manufacturing teams focused on selecting a technology solution to support this new Lean production environment. WIKA had recently completed the implementation of an ERP system but the relatively new system required ongoing modifications to support the increasing focus on Lean. As the team...
considered additional investments in this system, it proceeded to evaluate major ERP vendors along with the Microsoft Axapta Lean Enterprise provided by its U.K.-based distributor, eBECS. Criteria for the technology solution selection included:

- Strong business and manufacturing fit; support Lean philosophy
- Ability to operate with Lean alongside more traditional processes
- Microsoft technology to support corporate standards
- User-friendly toolset to quickly change operations
- Low cost of ownership.

The U.S. team selected the Axapta Lean Enterprise because it was the strongest business fit; it also supported the recent corporate standards for both Microsoft technologies and Axapta Enterprise for its other manufacturing facilities. Both the U.S. and corporate IT in Germany are pleased with this selection because it will enable them to more easily transition technology solutions as increasing numbers of WIKA plants go Lean around the globe.

**Implementation**

WIKA and eBECS joined forces in the fall of 2004 to implement Axapta for the WIKA 183 gauges made in the U.S. Implementation steps included:

- Analysis and conference room pilot
- System configuration
- Implementation

After a four month implementation cycle and successful pilot of the WIKA 183 gauges, the team is now preparing for a “big bang” in October. By this time, all information and records for those products manufactured in the Lawrenceville plant will be transitioned over to the Axapta database and system. Simultaneously, employees and equipment are being transitioned into teams and work cells; new processes will be piloted over the summer. In October, all production will be transitioned into the Axapta Lean solution.

**Results**

As a result of the deployment of Lean and implementation of Axapta, WIKA reports these results:

- Revenue increase – 55%
- Space utilization – 100%
- Quality improvement – 100%
- Inventory improvement – 100%
- Productivity increase – 75%
- Lead time reduction – 80%, from six weeks to five days.

**Future Outlook**
The goal for the next phase is to take the demand signal from the customer back through the supply chain as far as possible. WIKA U.S. will continue to source from Germany and will work with local suppliers to cover demand peaks. Combined WIKA U.S. and IT teams will travel around the globe with eBECS consultants to implement this solution at other facilities.

The next step for WIKA USA is Lean accounting, supplier relationships, and building out the customer supply chain through seamless demand signals from the customer as far down the chain as possible.

**Aberdeen Conclusions**

A sudden and real market crisis drove WIKA U.S. to aggressively embrace Lean by reorganizing its workforce and implementing customer value programs. Simultaneously supporting the company’s choice of Microsoft Axapta manufacturing systems and industry standard technology should provide the flexibility and cost advantage required to keep them one step ahead of the competition.
Advancing Lean Across Automotive

Business Challenge
This multi-tiered automotive supplier develops, manufactures, and sells seating systems, instrument panels, and other interior technologies to all of its major OEM customers. The company has experienced 58 consecutive years of top line revenue growth.

Lean techniques are embedded throughout the company’s manufacturing process, which extends from incoming parts to final products assembled in the customer’s vehicle. The company sees Lean as an indispensable element to maintain profitability. To maintain its market leadership and profitable growth, the company looked for ways to extend Lean beyond manufacturing and into the supply chain. In 2001, a Steering Committee set goals for this Lean initiative that include improving customer responsiveness, increasing plant efficiency, and stabilizing the supply chain.

Advanced Lean concepts were piloted at a plant located in the Midwest prior to being rolled out to other facilities. The automation of level production scheduling, sequencing, and Kanban sizing methods for purchased goods have been kicked off in nine sites as of June 2005. By integrating scheduling capabilities with legacy systems, customer driven changes can more easily be incorporated into the production plan. As these processes become proven, they will be formally rolled out to approximately 30 manufacturing plants across North America during 2005 and 2006.

Strategy, Selection and Deployment
Once the pilot work cells were operational using spreadsheet planning processes, the Lean project team began its search for more sophisticated software to support these processes. The team evaluated two traditional ERP vendors, an APS vendor, and several startup firms specializing in Lean. Project team criteria included:

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Multi-tier automotive (unnamed)</th>
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<tbody>
<tr>
<td>Solution Provider</td>
<td>Factory Logic</td>
</tr>
<tr>
<td>Business Challenge</td>
<td>Create a supply chain that can respond to demand in the shortest possible timeframe without increasing inventory levels or nervousness inside the chain.</td>
</tr>
<tr>
<td>Strategy</td>
<td>Define value from the customers’ perspective, then determine fastest and most efficient way to delivery complete orders using ‘flow’ in all areas and all forms of ‘pull-based manufacturing’: and seek perfection through continuous improvement.</td>
</tr>
<tr>
<td>Value Achieved</td>
<td>More stable supply chain process</td>
</tr>
<tr>
<td></td>
<td>Improved utilization of capital equipment</td>
</tr>
<tr>
<td></td>
<td>Assurance of supply (100% on time delivery)</td>
</tr>
<tr>
<td></td>
<td>Inventory turns increased &gt; 20%</td>
</tr>
<tr>
<td></td>
<td>Increased plant efficiency</td>
</tr>
<tr>
<td></td>
<td>More efficient internal supply chain</td>
</tr>
</tbody>
</table>
• Product functionality –
  o Work center (Heijunka) scheduling, sequencing, and leveling for work centers
  o Ability to efficiently send leveled production planning requirements to the supply base for planning
  o Ability to send updated Kanban signals out to the supply base to trigger replenishment based on consumption.
  o Provide shop floor planners with interactive scheduling tools
• Integration to other systems –
  o Enable integration to MES, ERP, and other homegrown and external systems
  o Enable visibility into shop floor information and performance to plan
• Ability to support Toyota Production System principles: Mudi, Mura, Muri, or the elimination of waste, variance, unevenness

Based on these criteria, the team selected the Factory Logic Operations Management System. In addition to providing the requested functionality and other requirements, its standard data structure enables the integration with legacy systems, including QAD, and TradeBeam (iSupply, Kanban).

Implementation

Factory Logic consultants worked closely with the customer’s supply chain, operations and the IT teams from June 2003 to April of 2004 to pilot the work center scheduling system. The pilot project was successfully completed in August and approved by the Steering Team to move forward into the live production environment.

The next step is to roll this functionality out across the company’s North American plants; 22 plants have been identified for deployment by the end of 2005. When the North American phase is complete, more than 30 plants will be up and running on a complete, standard Lean manufacturing infrastructure provided by Factory Logic. Today (June 2005) the deployment is on track with nine plants up and running.

Results

This multi-tier automotive supplier has applied Lean tools and principles for years and made a conscious commitment to spread Lean as an overall philosophy in 2001. The company then took a major step forward in its journey toward Lean by leveling (Heijunka) scheduling and implementing Kanban techniques with the Factory Logic solution in nine U.S. plants as of June 2005. With the assistance of the Factory Logic solution, the company has already increased productivity, decreased inventory, and improved utilization of capital equipment in several of these plants. The next step is to integrate this with the legacy systems creating a tight link to the overall supply chain, enabling it to become more efficient and stable. By transmitting leveled production plans to work cells they are able to ensure that only products scheduled to be produced are transmitted to suppliers assuring that pull replenishment more closely matches the MRP plan. As the
company implemented these improvements, they continued to meet their 100% on-time delivery goals.

**Future Outlook**

This has the potential to be one of the largest rollouts of advanced Lean technology-enabled processes in the industry. The company will continue to roll these techniques and technologies out to the remainder of its 22 manufacturing plants, with the potential to apply portions of the Factory Logic solution to all 80 of the North American plants.

**Aberdeen Conclusions**

As a global leader in the automotive industry, the company was already receiving a number of benefits associated with Lean. Taking the next logical step by implementing more advanced production planning technologies and integrating manufacturing with the supply chain is another example of why the company has such a strong track record financially and retains its leadership position in the automotive market. By initially focusing its efforts on a single product line in a single plant, it was able to pilot the organizational re-structuring, work cell flow and tasks, and advance the transition from a ‘push’ based replenishment system to a demand-driven ‘pull’ system. Once these changes were in place, the ability to leverage technology to strengthen scheduling, level production across work cells, and integrate directly with customer demand signals helped improve visibility and control.
Major Defense Contractor ‘Leans Out’ Operations

Business Challenge

Following September 11, the U.S. Department of Defense (DoD) asked this major defense contract manufacturer to ramp up production for one of its major products over the next 18 months. Lean principles and techniques were adopted to increase production throughput and meet more stringent DoD quality regulations.

The Lean program began with a review of manufacturing facilities looking for opportunities to eliminate waste:

- Overproduction
- Time (wait time and cycle time)
- Inventory management
- Processing waste
- Transportation/motion
- Defects
- Underutilized people

Strategy, Selection, and Deployment

The defense contractor appointed a cross functional team and requested a formal technology solution selection process. Employees from production, IT, and quality developed an RFI (Request for Information) for a solution that would automate the proposed Lean production processes. The Brooks FACTORYworks solution was ultimately selected to support the Lean initiative after a number of onsite demonstrations and an audit of its software development practices.

To support the manufacturing and genealogy requirements, a Lean team that included Six Sigma black and green belts, factory associates, and supplier and customer Lean experts was appointed. The team’s first task was to examine data from high-volume manufacturing lines to look for cycle time improvement opportunities. The Brooks FACTORYworks solution supported this process by providing detailed transaction data; more than 300 time stamped records were recorded in its database as each time a product traveled through the production process. The Lean team examined this data and identified more than 200 potential improvement initiatives, many of which are underway today.
At the same time, a number of continuous improvement programs were launched to drive additional changes. For instance, the visual Kanbans that were used to regulate the flow of material to production lines have been automated and integrated into the Brooks FACTORYworks solution. Today inventory information is available across all plants, providing visibility into other lines and parts in process all over the U.S.; information that once required ‘line of sight’ today is available ‘virtually’ via the Internet.

Although the defense contractor has benefited from its many Lean initiatives, it operates in a hybrid manufacturing environment; the company continues to rely on the MES (manufacturing execution system) that it implemented in 1997 to track and manage projects in the factory. The Brooks MES also provides scheduling and resource management, production and labor reporting, data collection, statistical quality control, process management and optimization. Additionally, it enables access to information from anywhere and stores the regulatory compliance data required by the DoD.

**Results**

Today the contractor uses 10 instances of FACTORYworks at two of its manufacturing sites. The Lean manufacturing initiative supported by MES has resulted in:

- Within the first six months, the contractor reduced work-in-process by 70 percent from 1,100 assemblies to 350 on its high volume line.
- In one product line, the cost of inventory was decreased by $83,000 due to tracking using engineering data collection; another experienced work-in-process reduction of 77 percent.
- Manufacturing cycle time for commercial products was cut from 60 to 18 days.
- Contractor was able to ship 300 percent more product in its high volume line, turning inventory by six to seven times the normal rate.

**Future Outlook**

In April 2005, the contractor rolled out its new ERP software; this will link in directly to all 10 FACTORYworks instances and manage financial and production planning for all factories. Information such as production orders, bills of material and other ERP routings will be shared with FACTORYworks; data from key steps in the production process from the initial production order on will pass back up to ERP in real time. Tying the programs together will enable the contractor to further its Lean initiative throughout its supply chain, providing better coordination with suppliers, customers and between plants.

**Aberdeen Conclusions**

This defense contractor has made significant strides in its journey toward Lean in a relatively short period of time. It assigned, motivated, and provided its team of Lean experts with the tools and technologies they needed to look for opportunities to improve existing processes. Based on detailed transaction data and analytics, this high powered team was able to implement a number of improvements that have tripled production throughput and have led to numerous other improvements for this major DoD contractor.
Author Profile

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Manufacturing Research
Aberdeen Group, Inc.

Jane Biddle is leading manufacturing research efforts for Aberdeen Group clients. Prior to joining Aberdeen, Jane was providing strategic advisory services to technology and service providers in the supply chain and manufacturing sectors. Jane’s career in manufacturing began in the eighties as a consultant implementing and supporting MRP systems for Hewlett Packard; then subsequently as the MRP/ERP product and process industries CIM solution manager for Digital Equipment. In the mid-nineties, she established the Benchmarking Partners’ manufacturing advisory services, and was later recruited by SAP to build the U.S. Industry Centers of Expertise (ICOEs) and Global Solution Maps. More recently, Jane held positions as Chief Commercial Officer and VP Marketing for technology firms in the international trade and logistics sectors. Jane received her MBA and BS in Computer Science from Rivier College in Nashua New Hampshire. Certified by APICS (CPIM), Jane remains actively involved with APICS.
Appendix A: Research Methodology

Between April and June 2005, AberdeenGroup assessed the Lean manufacturing implementations of more than a dozen enterprises. Best practice deployments were assessed based on the following criteria:

- Breadth and scope of Lean program and system deployment
- Quantifiable benefits delivered to the manufacturer in terms of cost savings, improved manufacturing cycle times, inventory reduction, etc.
- Adherence to Lean principles
- Alignment and integration of Lean processes with customers, supply chain processes, and suppliers

Aberdeen began by screening manufacturer nominations that described the scope, solution selection, deployment, and benefits of Lean programs. Aberdeen analysts conducted in-person and/or telephone assessments of each finalist before selecting the final “winning” enterprises.

Solution providers recognized as sponsors have no substantive influence on the direction of the Best Practices in Lean report. Their sponsorship has made it possible for AberdeenGroup to make these findings available to readers at no charge.

Best practices case studies not published in this free report are available to qualified members of AberdeenGroup’s enterprise community and AberdeenGroup clients at www.aberdeen.com.
Table 4: PACE Framework

<table>
<thead>
<tr>
<th>PACE Key</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aberdeen</strong> applies a methodology to benchmark research that evaluates the business pressures, actions, capabilities, and enablers (PACE) that indicate corporate behavior in specific business processes. These terms are defined as follows:</td>
</tr>
<tr>
<td><strong>Pressures</strong> — external forces that impact an organization's market position, competitiveness, or business operations (e.g., economic, political and regulatory, technology, changing customer preferences, competitive)</td>
</tr>
<tr>
<td><strong>Actions</strong> — the strategic approaches that an organization takes in response to industry pressures (e.g., align the corporate business model to leverage industry opportunities, such as product/service strategy, target markets, financial strategy, go-to-market, and sales strategy)</td>
</tr>
<tr>
<td><strong>Capabilities</strong> — the business process competencies required to execute corporate strategy (e.g., skilled people, brand, market positioning, viable products/services, ecosystem partners, financing)</td>
</tr>
<tr>
<td><strong>Enablers</strong> — the key functionality of technology solutions required to support the organization's enabling business practices (e.g., development platform, applications, network connectivity, user interface, training and support, partner interfaces, data cleansing, and management)</td>
</tr>
</tbody>
</table>

Source: AberdeenGroup, June 2005

Table 5: PACE and Competitive Framework Interaction

<table>
<thead>
<tr>
<th>PACE and Competitive Framework How They Interact</th>
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<tr>
<td>Aberdeen research indicates that companies that identify the most impactful pressures and take the most transformational and effective actions are most likely to achieve superior performance. The level of competitive performance that a company achieves is strongly determined by the PACE choices that they make and how well they execute.</td>
</tr>
</tbody>
</table>

Source: AberdeenGroup, June 2005

Table 6: Competitive Framework

<table>
<thead>
<tr>
<th>Competitive Framework Key</th>
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<tbody>
<tr>
<td>The Aberdeen Competitive Framework defines enterprises as falling into one of the three following levels of Lean practices and performance:</td>
</tr>
<tr>
<td><strong>Laggards (30%)</strong> — practices that are significantly behind the average of the industry</td>
</tr>
<tr>
<td><strong>Industry norm (50%)</strong> — practices that represent the average or norm</td>
</tr>
<tr>
<td><strong>Best in class (20%)</strong> — practices that are the best currently being employed and significantly superior to the industry norm, and result in the top industry performance.</td>
</tr>
</tbody>
</table>

Source: AberdeenGroup, June 2005
Appendix B:
Related Aberdeen Research & Tools

Related Aberdeen research that forms a companion or reference to this report include:

- Lean Strategies Benchmark Report, (June 2004)
- Process Manufacturing Excellence: Strategies for the Plant Floor and Beyond, (January 2005)

Information on these and any other Aberdeen publications can be found at [www.aberdeen.com](http://www.aberdeen.com)
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To be the trusted advisor and business value research destination of choice for the Global Business Executive.

Our Approach

Aberdeen delivers unbiased, primary research that helps enterprises derive tangible business value from technology-enabled solutions. Through continuous benchmarking and analysis of value chain practices, Aberdeen offers a unique mix of research, tools, and services to help Global Business Executives accomplish the following:

- IMPROVE the financial and competitive position of their business now
- PRIORITIZE operational improvement areas to drive immediate, tangible value to their business
- LEVERAGE information technology for tangible business value.

Aberdeen also offers selected solution providers fact-based tools and services to empower and equip them to accomplish the following:

- CREATE DEMAND, by reaching the right level of executives in companies where their solutions can deliver differentiated results
- ACCELERATE SALES, by accessing executive decision-makers who need a solution and arming the sales team with fact-based differentiation around business impact
- EXPAND CUSTOMERS, by fortifying their value proposition with independent fact-based research and demonstrating installed base proof points

Our History of Integrity

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