Manufacturing

ILS has lead major operations improvements for our clients in a wide range of manufacturing settings. Whether the goal is solving a complex quality problem or total lean transformation at the extended enterprise level, we create for our clients:

- Exceptional return on investment
- Processes that operate with minimal waste
- Strong systems integration
- Trained and capable employees who understand lean systems and can apply the methods and tools they have learned across their organization
- Effective management systems that make the changes stick, rapidly resolve problems, and ensure performance targets are met
- A culture of continuous improvement and the skills needed to support it
- Ongoing partnership and guidance to take the organization's performance to higher and higher levels as we move forward and learn together.

Industries	
Aerospace	Military Equipment
Automotive (Vehicles and A Broad Cross Section Of Parts, And Subassembly Production)	Metal Forming and Stamping
Agricultural	Painting and Coating Operations
Custom Capital Equipment	Paper and Paper Products
Casting and Foundries	Petrochemicals
Consumer Products	Pharmaceuticals
Electronics and Circuit Boards	Plastics
Food and Beverage Processing And Packaging	Printing and Labeling
Foam Products	Rebuild Operations
Furniture	Recreational Vehicles
Glass Products	Recycling Plants
Heavy Equipment	Rubber Products

HVAC and Refrigeration Products	Textiles and Apparels
Kitting and Sequencing Operations	Weldments
Machining	Weapons Production
Marine Products and Boats	Wire, Cable and Wiring Harnesses
Medical Devices	Wood and Construction Products

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[wptabtitle] What We Do[/wptabtitle]

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We apply the ILS System™ to take your operations, business, and people from their current state to a more competitive, higher-performing future state. ILS System™ is a structured process for working with clients that starts by creating a clear vision of what true operational excellence would look like in your business, a vision that incorporates lean, six sigma, and ILS-developed principles, practices, and technical tools. The future state is then implemented through a special engagement process with your people that results in fast transformation, strong learning, exceptional results, change that sticks, a strong foundation for future advances and an ongoing enthusiasm for positive change. See Our Approach for more information.

The advances we create together will be custom-designed for your business. They address areas such as:

- **Value stream design**

  At most organizations the greatest opportunities for improvement are to eliminate system-level waste through more effective integration of operations across the value stream. There is a strong need to ensure that all players in the work flow - including indirect operations, SG&A, and external suppliers – are effectively interfacing and working with common purpose to create highest value for your customers. We will help you design and implement creative operational systems that meet this goal. See this example.

- **Lean tools implementation**

  We will help you effectively implement all standard lean operational tools such as 5S, standardized work, visual control, rapid changeover, and andon, as required to support operational transformation. We can handle the most challenging tools applications such as total externalization of changeover on a progressive machining cell (for example,

reducing downtime from 5 hours to zero) or standardized work playbooks that bring efficiency and control to high variety low volume operations.

- **Detailed Work Design**

  We work with your operations leaders to apply our special work design process. This process is highly effective in identifying and eliminating major wastes that constrain productivity. It identifies and implements low cost improvements that have high impacts, with 30-40% gains in parts-per-manhour typical. Our work designs are often creative. One example is the use of flex-work strategies that can achieve near full labor utilization on lines with large unit-to-unit work content variation, such as boat manufacturing. Another is the use of supercells where one operator runs multiple cells at their takt pace with special timers and visual controls that always keep them on the critical path task in order to maximize output.

- **Facility layout**

  Layout has a major bearing on waste and the effectiveness of supporting systems such as internal logistics and line supervision. We will help you improve your operations through layouts that function well in all respects. For example, consider this design for a new facility for machining large parts. The arrangement enables flexible deployment of labor allowing one operator to easily run from 1 to 4 machines and the right number of operators to be used to match the work content as a whole. This enables the work design to adjust so that high productivity is always maintained as parts, work content, and demand levels change over time.

- **Internal logistics and material flow**

  These systems can make or break an operation and are often a major source of waste. We design systems that streamline material flows, minimize deadheading, reduce the need for driver’s to scouting work, and employ milk run and train principles when practical. In many cases our pull approaches, level scheduling and pattern production systems dramatically simplify logistics operations. In high variety manufacturing, we have carefully designed kitting approaches to reduce setup and material handling waste as well as part selection errors.

- **Capacity Planning and Labor Allocation**

  Its one thing to have a highly efficient work design, it is another to realize full benefit from that design every day as you try to match production staffing levels to variable customer demand. So many companies fail in this effort and productivity benefits from improved work designs do not flow to the bottom line. We help you do these tasks effectively through the development of planning tools, labor allocation boards, work leveling, and other techniques.

Production Control, Scheduling, and Inventory Management

We understand how to achieve the full benefits of pull production control and apply it for many purposes. For example, in a recent installation, we use it to dispatch jobs into a complex department with variable product routings so that there is a steady, controlled queue of work behind each of four distinct finishing operations. This dramatically reduced production lead times and overcame capacity losses at the finishing areas.

We design effective scheduling systems and specialize in pattern production. This is a change in scheduling paradigm that enables full and level loading of staffing and bottleneck resources and realizes enormous efficiencies that can be only be realized when products are consistently run in designed sequences. It is particularly valuable in high variety manufacturing and in certain process industries.

Our systems are strongly complementary to effective inventory management because they enable high frequency stock replenishment. This allows us to significantly reduce your inventory levels. We have developed special stocking solutions for various clients. This includes a service parts stocking approach used in a pattern production environment where we ensure desired service rates targets are realized with low inventory. Another example is a special leveled plant production strategy that enables the operation to efficiently respond to pooled demand from a major customer’s 18 distribution center network that holds their stock on consignment.

- **Standardized Work and Job Training Systems**

  Improved work designs are most effective in a strong standardized work culture. We help our clients to build a custom work documentation process, one that clearly communicates standard processes and captures the knack and key points that differentiate novices from experts. We build fundamental skill training systems that capture the expertise required for the core repetitive tasks across the production floor. These systems enable trainees to rapidly learn and practice until they become highly proficient, having built the tacit skills that would otherwise only come from years on the job. We establish customized practices for systematic job instruction and help our clients deploy strategic cross training programs so that they have the flexibility they need to continuously run to standard as personnel and demands change.

- **Operations management**

  Lean systems should always be complemented with special daily management systems, and we help our clients to put them in place. We delineate an org structure that aligns management with value streams and establishes effective spans of control. We define everyone’s roles and responsibilities in the new system. We identify where rapid response systems are needed and build the needed processes and protocols. Operational metrics are defined that fit and drive proper behavior in your operation. Mechanisms, such as a structured system of daily management boards, are put in place to make problems visible and to drive their solution. We help you establish an effective

standard process for problem solving and use it as a basis for maintaining performance targets and reaching stretch goals.

- **Team Building and Leadership Coaching**

  We help you to establish effective teamwork, ensuring effective team alignment, communication, collaboration, and conflict resolution. We help your leaders become more effective in their roles. This includes ensuring strong collaboration across the top functional layer in the organization (the direct reports to the CEO) to manage the significant change that comes with lean transformation.

- **Structured Problem Solving**

  Often nagging operational problems persist and drag down the performance of the business -- items such as part rusting, inadequate seal integrity, excessive scrap, misclassification of inspected items, or low OEE on a bank of machines. They require special effort to resolve. ILS is highly skilled in six sigma problem solving techniques and will lead your organization in structured efforts to identify root causes and resolve them. This includes all of the statistical methods and tools such as ANOVA and experimental design. We also have successfully put in structured problem solving systems -such as quality gates and C4 processes - as part of our client's management structure, and these systems have shown very high payback.

- **Tightly Link Operations With Financials**

  We strongly believe in setting targets for performance gains early in the transformation process and ensuring that these gains show up on the bottom line. We make sure that work release aligns with available hours, deployment of labor is controlled and labor tracking is accurate, projects are audited and adjustments are made if they are not achieving expected performance gains, and time standards are updated in a timely manner. We measure performance differences from the beginning to the end of each project to confirm that we have beat the goals that were set at the beginning.

- **Educate Key Personnel and Teams**

  We help you build the expertise you need internally in your organization to keep lean efforts going forward. We have exceptional curriculum on lean systems and operations management as well as all lean sigma tools. These educational programs are always run as a learn-by-doing effort with a curriculum that has been customized to your needs. The cohorts complete select structured projects that not only ensure strong learning but more than pay for the training effort. Excitement is created as they report out their accomplishments to top management and peers. Our clients often use these to develop special procedures and teams who will lead transformation efforts in the future. For example, one company developed a product launch team and a standard working process they will follow to design and implement all new work cells and improve them until they meet challenging performance targets that ensure high quality products and

strong operating margins.

- **Hoshin Planning and Partnership**

  As operations have been restructured, people developed, and that initial performance leap is under the client's belt, the time comes for our clients to think strategically on how to go forward. We help our them put hoshin planning in place as a means for goal setting, organizational alignment, and combining the collective wisdom of all employees to achieve demanding performance targets. As our learning about your business deepens and your trust of our ability strengthens, we typically step into a role of partnership and serve an ongoing role advising our clients. For example, one client has us do a new plant assessment at each of their facilities every year. We identify improvement opportunities, they build the projected gains into their operating budget, and the projects are implemented. We help them on some and they do others themselves. The financial gains from these efforts have not tailed off over 6 years of relationship. This company, despite belonging to a depressed economic sector, is highly profitable and now the clear leader in its industry.

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[wptabtitle]Our Approach[/wptabtitle]
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We work with our clients through a structured approach that we call ILS System™.

ILS System™ begins with a site visit and discussion about your needs. We then conduct a detailed assessment of your current state. We take tours and ask questions to grasp your current processes. Your customer'€™s needs and your product'€™s value proposition are defined. Operations are carefully observed with a trained eye to identify all forms of waste. We discuss existing methods, problems, and constraints with front line personnel. Your operations are compared to ideal lean models that we have developed for similar classes of operations and the gaps are noted. Time measurements are taken and data are analyzed to estimate improvement potentials. The operations are reviewed from a value stream perspective to identify opportunities for stronger integration across departments and supporting operations. Wastes are identified at all levels and promising, practical, and affordable countermeasures for eliminating them are devised. We synthesize an achievable future state design that promises high performance gains.

The assessment pulls no punches. It provides the absolute truth about what is happening and identifies a series of activities to launch the transformation of the organization. Most clients find our insights penetrating, our future state vision compelling, our system designs novel, and the improvements dramatic. The assessment report includes firm estimates of the savings these activities will produce and their costs.

As part of the assessment process, we consider your internal skillsets and resources; training needs needed to support, sustain, and build upon the improvements; and the urgency for making them. This helps us develop an effective plan of action and select the best engagement models to use in implementing the future state.

An ILS Engagement Leader is assigned to your company. Working closely with key leaders and influencers throughout the company, we prioritize and schedule critical improvement activities and identify leaders and teams for executing them.

Following ILS System™, we execute the projects through a form of highly effective operational improvement workshops called bootcamps. We carefully prep for bootcamps, completing the activities necessary to ensure rapid and effective operational restructuring during the bootcamp event, which typically lasts from 3-5 days. This might involve gathering data, conducting analyses, lining up resources, light fabrication, moving equipment, etc. During the bootcamp, your teams learn the principles, practices, tools, techniques, and underlying theories behind everything we do. They then design, pilot, implement, problem-solve, and confirm the effectiveness of the improvement projects. The days are long and the work is intense. But by teaching the participants, they understand, contribute to, and enthusiastically support the change. We set high goals and objectives and push the teams to achieve better outcomes than they believed were possible. (Seven figures in annualized cost savings have often been realized during a single bootcamp activity.) They gain confidence by working in a team that truly collaborates to produce better results for customers, and better results for the company. They leave equipped to continue driving improvements long after we are gone. Note that we typically embed our special work design process within the bootcamps, a process that delivers major efficiency gains for your operations.
Other engagement models -€“ e.g., value stream design workshops or lean certification educational series tied to specific project implementations -€“ are employed depending on the projects and your needs. In all cases, we insure that everyone learns and can effectively support the future state system they create.

Once future state operations are in place, we follow through with an important component of ILS System™, the implementation of an effective lean daily management system. This system, based on the principles of Jidoka, is designed to create immediate visibility of operational problems, rapid response with appropriate temporary countermeasures to contain the problem, and, where appropriate, root cause problem solving and permanent countermeasures that prevent recurrence. It insures that the improvements implemented stick and provides a strong foundation for problem solving and continuous improvement capability. This effort involves

- Organizational design to insure management alignment with value streams
- Definition of roles and responsibilities for all operational levels from front line personnel to corporate level senior management
- Delineation of daily work routines to support the system
- Complementary auditing systems for safety, production readiness, 5S. standardized work, and other systems with a goal of building in control through these systems
- Development of any special tools or methods needed to make problems visible, e.g., on

one low-volume operation cycle timers were installed on bottleneck machines so that the run ratio (ratio of planned to actual cycle time) could be calculated for each part, enabling full visibility and documentation of downtime
- Establishment of appropriate metrics, KPIs and performance target levels, including direct linkages to financial reporting
- Deployment of management boards at all organizational levels along with procedural development and training on effective use of these boards, including communication and meeting protocols
- Establishment of andon and rapid response systems, custom designed for the operation in question
- Tracking performance of all response systems to insure they are effectively resolving operational issues
- Structured problem solving systems that are used to resolve high priority operational problems
- Assurance that the system is working, people are accountable, performance is on-target and getting better

It is common to develop strong job training systems and cross-training programs for our clients. These systems are very important because they insure that everyone is trained and consistently uses the new work methods. Moreover, they are highly effective in building control into your operations so that safety and quality performance are strong and problems are minimized. These systems include:

- Custom-designed standardized work documentation forms and processes. This insures clear communication of work methodology and fully documenting safety, key, and knack points. The objective is to provide a complete foundation for operations control, learning and continuous improvement
- Fundamental skills training systems. This involves identifying core fundamental skills that are used across your shop floor and need to be part of the repertoire of each team member. These skills are standardized, key and knack points are documented, and training stations (generally offline) are developed so that team members can learn and practice the skills. These stations address the task at both the fundamental level and from different application perspectives that are relevant to your shop floor (e.g., shooting a bolt to the front and overhead). Strong effort is made to train the operators in tacit knowledge relative to the job. With these systems, new trainees can build skills quickly that would otherwise take years of experience to master.
- Job instruction training. This involves training trainers, including primary process owners and supervisors, how to train operators on new work skills. These systems are applied consistently, even with experienced operators, to learn new or modified jobs. They are instrumental in giving supervisors the skill to quickly identify and correct any performance deficiencies among their team members.

- Strategic cross-training. A cross training plan is designed and implemented over time to give the flexibility that your operations need. Such an effort is instrumental to a strong continuous improvement program.
- Standardized work auditing systems. Auditing is critical to building a standardized work culture and realizing the high benefits from a strong standardized work system. Audits must be done with regularity, care, and a trained eye. We help our clients build such systems and capabilities.

ILS System™ insures that your key people will have the knowledge, skills, and enthusiasm to sustain the new systems and to apply what they have learned in other parts of your operations. Much of this skill will be built through our special engagement processes. It is also common to complement the transformation effort with special training programs with structured around select improvement projects. We have a very strong lean and six sigma curriculum and we customize the training to meet your needs and to fit your operations. The training is always is learn-by-doing. We identify additional projects that the teams will undertake as part of the program based on their impact and importance to the business. The training is spread over time and the teams learn, apply, and problem solve by completing the special projects. We insure that the training more than pays for itself through the realized savings (and will, of course, make our fees contingent upon this). They report out their accomplishments to top management and they are tasked with additional projects as they move forward. Often special processes, such as new-product launch, and special purpose teams are developed with these complementary programs.

ILS will continued to stay involved in your transformation, coaching your people, helping set new goals, evolving your management system, and minimizing back-sliding until youâ€™re confident enough to go it alone. Once the initial transformation effort is going strong, performance improvement has been realized, and your people have been developed, it is time for the organization to establish effective formal continuous improvement processes. We help our clients to establish effective hoshin planning. Using this approach they set performance improvement targets in strategic areas, align the organization to meet these goals, and enlist the collective brainpower of all employees to devise and implement the best means for reaching the goals. The training and daily management systems we have implemented strongly complement this approach. As part of this process, many of our clients engage ILS in strategic partnership where we work in ongoing collaboration to develop their people, advance their operations, management systems, and business performance. This might include, for example, ongoing assessments to guide future improvement efforts. As we gain intimate familiarity with our clients operations and business model, we have been successful in helping them go beyond operational excellence to operational strategy where novel operational approaches are developed that create high value and differentiate them from their peers in a way that creates strong, long term, competitive advantages.
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[wptabtitle]Our Work[/wptabtitle]

A major line of business for Company X involved the fabrication of large steel structural weldments used in the construction/mining equipment, aerospace, petroleum, and defense industries. These units were produced in two facilities, which we will call Facility A and Facility B, located in small Midwestern U.S. towns about 20 miles apart. Operations at Facility A involved

- Receiving all steel plate
- Plate blasting upon receipt (high volume plates) or prior to cutting (low volume plate)
- Cutting and deslagging of components created from steel plate on two large plasma burn tables
- Sawing of other components made from steel bar
- Minor secondary operations such as bevel-cutting the edges of the components
- Welding components into certain subassemblies (some subs were quite substantial)
- Storage, picking, and kitting of all components (including components with secondary machining and forming operations performed at Facility B) into tack and weld-off kits at the major part source for the welding-based fabrication operations at Facility B, and
- After fabrication and any post-fabrication machining at Facility B, sandblasting, painting, rust prevention, inspecting, and final protection (installation of caps, plugs, wrapping, etc.) of the finished weldments prior to shipment to the customer.

Operations at Facility B included

- Secondary operations on certain components, machining or forming them and sending them back to Facility A for storage and subsequent kitting
- Fabrication of the major structural units in welding booths, first tacking together the major components/subs on large dedicated fixtures and completing the structural welds and adding weld on components and subassemblies on secondary work holding devices (note that certain important product lines required fabrication of sets of units not just a single unit)
- Post-fabrication machining and straightening (using large presses), of the fabricated units as required (certain units required painting at Facility B prior to this machining)
- Heat treatment of certain units as required by the customer.

A classical MRP approach was used in production control. The customers firmed orders and delivery requirements and this was used to launch purchase orders for plate/bar, as well as work orders for component cutting, secondary operations on components, kitting, and

fabrication. The burn table operators would decide what to burn based on their work order backlog. Specifically, they would look ahead over several weeks (there was an effort to reduce the look ahead window) and identify sets of components that could be fabricated from common plate. They would then use nesting software to nest these parts dynamically in an attempt to maximize yield. They were, of course, producing well in advance of demand (overproduction) in order to maximize yield. This created high inventories and prevented flexible and timely application of burn capacity to producing the parts needed by the fabrication areas as Facility B in the short term. Moreover, there was no remnant management system that would enable production of smaller batches of components under high yields; the goal was to consume a full sheet of steel with a dense nest giving a high yield.

After deslagging, parts were palletized and stored if no secondary operations were required or they were staged for transfer to Facility B for secondary machining or press operations. The secondary operations were performed at Facility B and/or A, routing the parts to beveling, machining, or press operations. Logistics were complicated since the parts had to be sent back and forth between the two facilities before they were complete and then they would be stored in racks at Facility A.

Kitting was done at Facility A prior to launch of the major fabrication operations at Facility B. This non-value-add step was labor intensive and, more often than not, the kits were shipped short (despite very large inventories of cut parts). Because of these shortages, there was a constant need to expedite cutting and/or secondary operations and often these efforts failed and production of a unit was delayed. This created havoc in managing production in the fabrication areas, welders were constantly being redeployed from job to job, overtime was high, and late shipments to the customers were not uncommon.

The fabrication shop, about 70% of the floor space at Facility B, was space constrained by low volume products requiring large footprint fixtures and work areas. This was preventing them from seeking additional product lines since a new facility would be required. Moreover, workstations for smaller, labor intensive high volume products were split up across the shop just to fit them in somewhere and often moved from location to location with little thought on layout and work design.

The fabrication areas, in general, suffered from

- Weak component and material staging resulting in excessive handling and transfer times
- Weak material handling, loading, and transfer procedures for large/heavy components and subs
- Measuring and locating waste in the tacking operations.
- Double handling of subs.
- Weaknesses in ergonomic presentation of work targets to team members for adding components or welding.
- Excessive walking to retrieve components or supplies
- Non-balanced work design, preventing full labor utilization
- Lack of standardized methods
- Failure to monitor conformance to pace, preventing accountability and timely

identification and remediation of production issues.

The operation was losing money on nearly all product lines, operations were chaotic and inefficient, customers were complaining, and there was considerable internal pressure to simply close the business. It was hoped, among other things, that lean transformation could bring control to the operations and achieve the necessary cost improvements to make the operation viable.

The first step undertaken was an operational assessment by an external lean expert. The expert identified the wastes noted above and created a preliminary future state vision. Major components of this vision were as follows:

- Transfer of operations between Facility A and B to eliminate major logistics backflows, to enable more efficient work design and faster throughput through secondary operations, and to enable more effective space utilization so that opportunities to increase product lines could be pursued without the need to add an additional fabrication facility.
- Complete restructuring of production control and material logistics, employing pull mechanisms to synchronize flows of components through burn, secondary and subassembly operations into final fabrication kits in a manner that regulated inventories, insured kit completeness, eliminated expediting and prevented part shortages from delaying fabrication operations, and eliminated the component warehouse and non-value-added storage and picking operations.
- Detailed standardized work development for the fabrication operations, focusing on product lines with highest opportunity first, and addressing organization of fabrication of product sets using work cells, efficient component presentation on properly designed kit racks, improved transfer of heavy components, stronger presentation of the work to team members for welding operations, improved locating devices, balanced work design and standardized work documentation and practice.
- Support of these major changes through development of an effective daily management system.

Estimates were made of annualized savings that would be realized through these improvement and they were very significant, enough to make the operation viable again. In addition, certain data gathering activities were initiated to prepare for the operational transformation with a particular focus on videotaping long cycle time fabrication operations on important product families.

Top management reviewed the assessment with the expert, and strongly agreed with the

findings. There was agreement that the scope of the transformation would focus on all operations at the two facilities, production control, internal (including inter-facility) logistics, management structure, and daily management systems. This represented a total value stream transformation. (Only the final painting process was neglected, and this would be temporary to enable the focus on more important opportunities.) The TLT was formed as a small team of managers, supervisors, and production engineers.

The TLT first received training. This consisted of a two day simulation-based lean systems overview followed by special education on value stream mapping along with tools highly relevant to their value stream: pull systems, work design, and standardized work development. The TLT and consultant worked together for a week to develop the future state design in detail. Current state operations were carefully mapped and all operational issues and evident wastes were noted. The team worked extensively to establish an effective future state design. This included:

- Movement of fabrication operations for one major product family that from Facility B to Facility A so that these operations could be consolidated and organized in labor-balanced work cells with efficient rack-based part presentation, improved work stands, fixtures, and locating devices, and improved material handling. This also involved movement of a heat treat furnace so that backflows of these units could be eliminated.
- Movement of two small CNC machines and a press from Facility B to Facility A so that all secondary operations on components prior to kitting could be done at one facility without back-and-forth transfer of material. Moreover these machines could be combined with saws and existing secondary ops in work cells to enable faster throughput times and higher labor efficiency. In particular, machine watching could be eliminated with the machines operating in a cell environment instead of stand-alone.
- Transfer of a small number of sub assembly operations located at Facility B to Facility A so that all subs would not be produced at Facility A and complete kits could be built there.
- Note that the operational transfers identified in the three previous bullets enabled complete fabrication of kits from raw materials at Facility A followed by fabrication (welding) and post-fabrication machining at Facility B followed by return to Facility A for painting. Material flows were dramatically simplified and the numerous backflows between the two facilities were completely eliminated.
- After an intense development activity conducted by the TLT during the value stream design week, a highly effective pull strategy was developed. When a new kit is launched at the fabrication area, this sends a signal for replenishment back to the burn table. A visual control board maintained electronically and visible at both plants shows the replenishment backlog for all finished products. This board can be used to prioritize which job should be cut next by identifying those jobs where buffer levels are lowest relative to future demand. For each product a series of primary nests would be designed. These nests would be based on a small batch size (typically 2 or 3 units) where components for that product using common plate are nested. The batch size and nesting would be carefully designed to give consistent high yields and typically 8-12 plates of steel are burned in a standard order each time the job is triggered. These primary nest parts, after burning, are split into one of three groups:

- Direct-to-kit parts â€“ parts that require no secondary operations that are kitted on racks and ready for fabrication immediately after cutting
- JIT parts -€“ parts that require a minor secondary operation without major setup (e.g., edge beveling) and a "€œJIT Cell"€• would be adjacent to the burn tables to complete these operations immediately after cutting and put the parts in the kit rack
- Three-bin parts -€“ parts that require major secondary operations with significant setup. These parts are accumulated in bins (3 bins total) and send to secondary cells (not co-located with the burn table) for processing once the bin is full. This enables the cell to run a larger batch size than the primary burn parts and avoid an excessive number of changeovers.

Flow of the three-bin parts is by FIFO lanes where they flow through one or two cells to an area near the cutting/kitting operations where they are picked and kitted with the parts from the other two categories.(Because of the lead time required for the secondary operations, three-bin parts cut from the current primary nest will be processed and subsequently kitted with direct-to-kit parts from a later pull signal.)

The remaining parts, which were typically small and required unique materials, were manufactured using secondary nests. Secondary nests used batch sizes that were a multiple of the primary nests, e.g., the primary nest batch size might be 3 and the secondary nest batch size might be 4 x 3 = 12. These secondary nests would be cut periodically, along with the primary nest parts, in the example every 4th time the primary nest is cut. The larger batches allowed for higher yield nesting of these small parts.

Note that in certain cases, rather than nesting a whole sheet of steel for the primary or secondary nests, a convenient fraction of a sheet such as ½ a sheet would be nested and standard remnants would be produced and managed in order to maintain consistently high yields. Standard remnants were not employed frequently because of the challenges of remnant handling, but it did give a convenient tool for inventory and yield control that was very valuable in certain cases.

Also note that if other products had a pull backlog and secondary nests that used the same material, they would also be cut from the sheet of steel and in this case nesting simply involved multiple side-by-side "€œslivers"€•.

With this system, component put-away, storage, and kit-picking were completely eliminated. Moreover racks were designed for efficient loading, transfer to the fabrication area, and presentation of parts to the welders. Special procedures were developed as well to respond to part shortages. By design such shortages should not occur, but there are possibilities of defects being produced during burn and secondary operations and parts getting lost.

- Layout design for Facility A in order to accommodate all of the equipment transfers from

Facility A, new work cells for the fabrication products transferred from A, and new work cells for the secondary op cells that would be established. Certain material handling equipment, primarily carts and overhead and jib cranes would need to be moved or purchased in order to insure efficient material flow in this facility. Payback period was calculated for each piece of purchased equipment and only equipment providing rapid payback was considered for purchase.

- Layout design for Facility B where the fabrication cells were rearranged in a manner that enabled equipment sharing for low-volume product lines and smoother material flows through the facility. Importantly, free zones were identified that would allow the plant to efficiently accommodate short term volume increases for existing products as well as seek to add additional product lines.
- In depth standardized work development would proceed for all fabrication areas and product lines, focusing on higher volume products first.

The TLT was very excited about this work. It summarized its design with value stream maps, layout drawings, and presentations. The team visited with all the major work groups a number of times and considerable time was spent explaining the future state plans, answering questions, and soliciting feedback. In general there was strong acceptance of the future state plans by supervisors and front line workers alike. In addition, the feedback revealed some issues that had been overlooked and the design was modified to accommodate those issues.

The next phase of the effort was to prepare the operation for the change. All employees were given lean systems training so that they understood the direction the company was headed. The TLT was enlarged with some additional specialists who would assist in development and implementation activities. There was a lot of work to be done:

- Development of all of the primary and secondary standardized nests for each product
- Development of a strategy to consume the current inventory of parts that had already been cut in advance (there would be complications in following the standardized nests until this inventory was consumed)
- Detailed layout of the work cells
- Organization of the equipment moves
- Transfer of personnel between the plants and required cross training to so they could operate the cells
- A number of developments to support material flow and the pull system, including the electronic work dispatch board, component racks, bins and containers for the 3-bin parts, and
- Quoting and installation of certain equipment needed to support the reorganization.

Concurrent with this activity, the standardized development process was launched, starting with a complex high volume product where production volume had just doubled and then progressing to address other products largely in order of their importance to the business. This effort involved small teams with the supervisor and operators from the fabrication area in question and a facilitator. Videos, often many hours in duration because of the long fabrication cycle time, were taken and analyzed. The analysis identified motion waste and methodology improvement opportunities. Work for the complex product, which involved fabrication of sets of items, required the development of balanced cellular work designs where the items were produced concurrently. Improved methodology, fixturing, material presentation/handling, and layout opportunities were developed and standardized work design and documentation was completed, ready to pilot. The ambitious goal was set to build twice the volume with no additional direct operators but with a new supervisor (comparable to a group leader) who would support the effort and take the lead in launching the daily management system in this area. In general, the same approach was followed for the other areas.

Also concurrent with the standardized work roll out was a major effort to 5S all work areas. The TLT was trained in 5S and then lead the implementation with the work groups, training and implementing this important lean tool.

We stop at this point, just as the operational transformation is being fully implemented. This is the time it becomes necessary to give great attention to the daily management system. It is important to see how we have set up for this:

- We are undertaking major restructuring of the entire value stream.
- The future state promises very large performance gains through two means. First, the system-level restructuring promises to eliminate inventories, reduce non-value-added component put-away, picking, handling and back-and-forth trucking between the two facilities, eliminate the highly disruptive problem of component shortages, and significantly improve labor efficiency through work cell development and elimination of non-value-added tasks. Second, the standardized work development promised, by balancing work and improving methodology, promised major productivity gains for all products and enormous gains for certain important products.
- The TLT has been educated and developed strong skills in lean systems design and implementation. Project leaders were identified for the major implementation thrusts and, in this case, the plant manager, who demonstrated a strong grasp of lean concepts, solid abilities to lead change activities, and an intense interest in making the transformation a success assumed the role of Lean Champion.

The organization is now poised to make an about face and start on its way to becoming lean, an effort that, if successful, will change it future from dire to bright.
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