A “Just Do It Now” Philosophy Rapidly Creates a Lean Culture, Produces Dramatic Results at Novametrix Medical Systems

Change agents find and eliminate burning bridges, using lean tools and involving associates.

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April 2001: Novametrix Medical Systems had run out of space in its Wallingford, CT facility and needed to expand. Steve Brown, the newly hired vice president of operations, was given the task of solving this problem by planning and implementing a multi-million dollar plant expansion program, but Steve had other ideas.

February 2002: Instead of the expansion program, Novametrix has transitioned during the intervening ten months to a lean manufacturing culture. Now, even though sales remain strong, improvements stemming from the shift in culture have increased productivity and reduced inventory so much that the company is starting to bring previously-outsourced work in house and is looking for ways to increase sales further so it can make use of empty space in the plant and fully utilize its production employees.

Many companies become convinced that a conversion to lean manufacturing can improve their operations but then have difficulty starting the transition. Typical questions organizations ask are: Where should we start? Should we use a consultant? What changes need to be made? What training is required? These questions are difficult for many organizations to answer. At a recent all-day AME "kick the tires" workshop, managers and employees from Novametrix described the experience of their rapid transition to a lean culture. They shared their ideas with managers from companies, located throughout North America, that are considering or are in the process of implementing

About Novametrix Medical Systems

Novametrix Medical Systems was founded in 1978. The company is publicly held and is a recognized leader in developing, manufacturing, and selling "non-invasive" medical devices. These include hand-held pulse oximeters, volumetric carbon dioxide monitors, and non-invasive cardiac output monitors. The company is non-union and has 230 employees, with annual sales of $55 million. Its headquarters and manufacturing are located in Wallingford, CT.
a lean philosophy. This article will describe some of the key concepts and tools used by Novametrix to facilitate the transition to a lean culture as well as some of the dramatic results that have been achieved in a short period of time. The approach used by Novametrix to create a culture shift to lean manufacturing incorporated the following elements:

- The hiring of change agents
- Identification of burning bridges and a "Just Do It Now" philosophy.
- Using lean tools to change the culture.

**The Hiring of the Change Agents and Their Philosophy**

Hiring of change agents: Tom Patton became president and chief operating officer of Novametrix during the summer of 2000. He tried to improve the operations area with the company's existing management, but improvements were not occurring fast enough and Patton decided that a change was needed. Patton had become aware of lean manufacturing with another company but had no personal experience in implementing lean, so in April of 2001 he hired Steve Brown to be vice president of operations for the company. Brown has extensive experience in conversions from traditional manufacturing to lean manufacturing and extending lean to the entire enterprise. Brown also hired Brian Montanari, another lean change agent, to help in the conversion.

The philosophy: Key elements of the Novametrix approach are the identification of burning bridges and a "Just Do It Now" philosophy. Novametrix started its conversion to lean using an informal approach. The first step in the conversion was talking and listening to employees to identify the key problem areas that were hindering improvement. These problem areas are referred to as "burning bridges."

The second step was to focus on eliminating the burning bridges using a "Just Do It Now" approach. This approach does not involve extensive analysis or outside consultants. Instead, employees work with the in-house change agents (in this case Brown and Montanari) to implement basic lean tools to facilitate the elimination of the burning bridges. Brown's suggestion is "to pick the worst jobs in the plant," then find out from the employees what barriers are hindering the improvement of those jobs, and then focus on removing those barriers.

Montanari explained: "We found our burning bridges at Novametrix to be excessive inventory and lack of flow through the plant. The plant had a traditional batch and queue approach to manufacturing."

**Start With What You Know**

Novametrix used this approach for several reasons. First, it is important to "start with what you know." There is no recipe for the conversion to lean. Each organization is unique and will have to apply the lean tools to overcome obstacles unique to the organization. For example, since Novametrix produces medical equipment and is regulated by the FDA, a review and validation process must be performed prior to changing production processes. However, Novametrix was able to identify many areas where improvements could be made without changing the actual production processes (see later in text).

Second, the use of internal change agents instead of consultants speeds up the conversion and helps to create an understanding of the philosophy of lean within the organization. Brown believes you need to create a culture for change prior to using consultants. He feels

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**Figure 1.** The assembly area used for these products was called the gauntlet prior to the introduction of cells. It took 16 days to complete one unit from start to finish.
that if consultants are used prior to changing the culture, there is a delay between when an improvement idea is conceived and when it is implemented. A lot of organizations wait until the consultant is available to provide feedback on the proposed idea rather than "Just Do It Now" and implement the idea. Having change agents continuously available within the organization reduces the delay and also allows for more one-on-one training that facilitates a better understanding of the philosophy.

Third, it is important to build momentum with early successes and avoid spending too much time analyzing problems. Novametrix prefers a series of smaller improvements rather than "waiting for the 100 percent improvement idea." These smaller improvements add up and help build a momentum that enforces the desired culture shift. Furthermore, learning occurs each time an idea for improvement is proposed and then implemented. This learning is cumulative and also provides momentum for additional improvement.

Fourth, starting with a "Just Do It Now" philosophy without a great deal of formal training lays a foundation that will enhance subsequent formal training in the lean tools. The early on-the-job training through focusing on the burning bridges provides the context for the reasons why the lean tools are useful. When formal training is provided, the training is reinforced by experiences and also becomes "just-in-time" (the training can be immediately applied to solving problems). Novametrix does not use formal kaizen events because Brown feels the formal nature of these events can slow down improvements. Instead, Novametrix uses the "Just Do It Now" philosophy. In order for this philosophy to be successful it is important that the top management of the organization provide the proper environment for change. Some of the suggestions offered by Brown for top managers are to promote an environment where it is OK to fail, challenge what we do, be open minded, strive for continuous improvement, and have fun.

One of the biggest problems that can occur when trying to change an organization's culture is employees' fear of failure. Brown pointed out that improvement is a process and "problems are the raw material for improvement." Even when an idea fails, we can still learn something from the approach that can be used in a different approach to the problem. Also, even if you believe an employee's idea will not be successful, it is still important for that employee to attempt the idea. This reinforces the "Just Do It Now" philosophy, empowers the employee, and even if the idea fails it will lead to additional ideas and approaches that are likely to be fruitful.

Using the Lean Tools to Create Changes That Result in a Culture Shift

Changes to operations using lean tools to facilitate culture change included: physical changes, an organizational change, and the use of visual systems to manage operations. Two important physical changes to the operation were the conversion to cells and the elimination of the stockroom. These changes were undertaken in response to the burning bridges that were identified: lack of flow and excess inventory.

Conversion to Cells. Thirteen cells were created to produce prod-
products. Previous to the creation of the cells, the plant was organized into several departments, each performing a specific function. Examples of these departments were: testing; wiring; electrical; mechanical; assembly; and the stockroom. Cellular processes were created by reassigning resources from the various functional departments within a plant to an area dedicated to producing a group of similar products.

During the AME workshop, two leaders of the previous functional departments, Carol Bartiole and Tony Bia, explained how the cells are more effective, efficient, and easier to manage. A good example of how Novametrix organized into cellular processes is provided by the production of capnography products. These products use advanced technology to measure levels of CO₂ content. The products are small and assembly is very difficult. The assembly area used for these products was called the gauntlet prior to the introduction of cells. Figures 1 and 2 show the steps for producing the product before cells were created and the traditional layout, respectively.

Cable arrived from the supplier in batches of 1000, was inspected, and then was received in the stockroom. The product then had to visit 22 processes (which required a total of 22 steps) located throughout the plant. To perform each step, a work order for 1000 units was created and material was issued to the appropriate department. At the conclusion of processing at each step, the material was returned to the stockroom to wait for a work order for the next step. The back and forth movement of material between the production floor and the stockroom was a classic example of a batch and queue operation. The product traveled a total of 2181 feet, used 22 processes, required 22 steps, 11 operators, and it took 16 days to complete one unit from start to finish. Karl Raczkovy, a production supervisor with over 11 years of experience at Novametrix, worked with production employees to reorganize the production processes and created two cells organized as shown in Figure 3 (a post-reorganization photo is shown in Figure 4).

Now the number of processes required is five, the number of steps required is three, the number of operators is five, the distance the product travels was reduced to 215 feet, and one unit is completed every 20 minutes. Both of the burning bridges that had been identified — lack of flow and excessive inventory — were addressed by this change. Since all the required steps are performed in a small area and the steps were simplified, the need for batches was eliminated and the cells have a single piece flow producing a takt rate of three units per hour in each cell. The reduction of the batch size to a single unit as well as the elimination of travel back and forth to the stockroom enabled a large reduction in inventory.

Other forms of waste that were reduced as a result of this change are: transportation (movement between the stockroom and each process); waiting (the wait for a batch to accumulate or for a work order to be created and then an additional wait for the actual move); defects (defects that were not caught until after a batch of 1000 units were processed); and excess paperwork and information handling (generation of work orders for each of the 22 processes was eliminated). Other benefits were the reduction of floor space required and cross-training every operator to perform every job within each cell (making each cell better able to handle absences or vacations).
Elimination of the Stockroom.

One of the reasons for eliminating the stockroom was to support the conversion to cells. The stockroom was a functional department much like the others that were broken up and reassigned to cells. The elimination of the stockroom has allowed materials to be delivered directly to the cells, which reduces non-value added (NVA) activity and the leadtime required for production.

However, the elimination of the stockroom was also done for other reasons that have an even greater impact on the operation. An important lean tool is the creation of a visible workplace. One of the Novametrix burning bridges was excessive inventory, but the stockroom created a barrier that hid this excess inventory from the production employees and other support employees who are responsible for producing and managing the inventory. Eliminating the stockroom and reassigning the inventory to the appropriate cell removes a barrier and the problem becomes visible to everyone; this creates an environment that facilitates the generation of ideas for solving the problem. At Novametrix they use the expression, "make it ugly." Linda Chillemi, ECR lead person, explained that instead of hiding problems, problems are given increased visibility so they can be solved. A recent tour of the plant revealed materials dated 1997 and earlier. With the central stockroom these materials were never noticed and nobody attended to the root problems that caused the acquisition of these materials in the first place. Today each cell is considered a warehouse and the workers in the cell are responsible for managing their inventory and finding ways for inventory reduction.

Organizational change. The purchasing department was reorganized. Prior to the implementation of lean, the department had buyers and planners. With the implementation of lean, the buying and planning functions were consolidated into positions that do both the buying and planning (referred to as buyer/planners). Each buyer/planner is assigned to support specific cells. Three of the buyer/planners, Jackie Sala, Leo Levesque, and Phyllis Papa, enthusiastically described how their new role gives them more control over the process and allows them to be more effective. The change to the buyer/planner concept is consistent with the conversion to cellular processes and helps to extend the concept back through the supply chain to suppliers of raw materials. The change also facilitates the effort to reduce excess inventory.

Use of visual systems to manage operations. Visual systems are used extensively throughout the plant to identify problems as well as possibilities for improvement. Chuck Moore, a production manager at Novametrix, summarized the objective of the visual systems: "to run the floor without saying a word." Visual systems that are used include: visual Kanban boards, a visual finished goods scheduling board, visual takt boards for each cell, visual calibration boards, posting of standard work within each cell, cell flags, use of color coding, balanced scorecards for each cell and for overall plant performance, and the lean wall. Rather than describe all of these systems, this article notes only a few unique or key features.

Before the implementation of the visual finished goods scheduling board, each order was first brought to the appropriate production manager’s office where it would accumulate in a batch until
the manager had a chance to review it and deliver it to the floor. Now each order is immediately brought to the visual scheduling board where it is placed in the appropriate cell’s bin and is available for the employees in the cell where the product is produced. This eliminates the batching and queuing of orders and promotes a faster flow through the facility so production leadtime is reduced. The visual scheduling board is organized by cell and contains forecast, past history, and current status. By quickly looking at the board, each cell’s status can be determined. The board is also used to help level load each cell.

Novametrix uses color-coding for two purposes: current status of operations and the identification of activities or reports within specific cells. The colors green, yellow, and red are used to indicate status. Two examples are Kanban boards and cell flags. Each Kanban board for a part number is set up with a green, yellow, and red area. As Kanban cards accumulate and hit a red area, this indicates that the situation is critical for the part. The second example uses colored flags. Each cell has three flags: one colored green, one yellow, and one red. One of the flags is displayed over the cell. If the green flag is displayed, this indicates the cell’s capacity exceeds demand, a yellow flag indicates the cell’s demand is approaching capacity, and a red flag indicates the cell’s demand exceeds capacity.

The second use of color-coding is to tie activities and tasks that are performed remotely from a cell to the appropriate cell. Each cell has a specific color. The cell’s color combined with the status colors (described in the previous paragraph) allows for quick identification of a cell’s problems and the ability to quickly find any upstream or downstream sources of these problems. Examples of cell color-coding are the raw material Kanban boards located throughout the facility and the balanced scorecards that hang on the wall outside of the production managers’ offices. Each section of the Kanban board and each balanced scorecard have the corresponding cell’s identifying color. This approach helps reinforce the culture change from a functional view that resulted in a batch and queue operation with excess inventory and long leadtimes to a process view that focuses on inventory reduction and having products flow quickly through the plant.

As Novametrix has implemented the lean tools and employees are trained to use the tools, the associated training materials are posted on a long wall at the front of the plant. This also helps to instill the required culture and shows how the organization is progressing in its conversion to lean.

Results

The following results were achieved within a period consisting of nine months starting in April 2001 and extending to January 2002: Inventory was reduced from $13 million to $7.8 million (a 40 percent reduction); work-in-process inventory was reduced from $2.48 million to $266,000 (an 89 percent reduction); overtime was reduced 88 percent; the number of assemblers required decreased 55-60 percent; leadtimes decreased 99.6 percent; and floor space required decreased 33 percent (this eliminated the need for the planned multi-million dollar building expansion).

Novametrix expects to continue to improve on these results. The best way to summarize the progress Novametrix has made in such a short period of time is a statement by Brian Montanari: "We used to have racks of inventory. Now we have an inventory of racks."

What is Next?

The Novametrix conversion to lean still has a long way to go. The company has made substantial progress on the two burning bridges initially identified: lack of flow and excessive inventory. One-piece flow has been achieved in many cells and inventory has been reduced by 40 percent and will continue to be reduced by using the lean tools of Kanban and visual control. So what is the next step? The next step for Novametrix is to extend the lean culture throughout the enterprise. To do this, the lean concepts and tools need to be applied in all the functional areas of the company. Additional burning bridges that have been identified are: new product introduction; design for manufacturability; international product forecasting; and the need for quality systems to support rapid change.

The engineering department has started to use the lean tools to work with other functions of the company when developing new products. Tony Pierry, director of engineering, and Dave Rich, engineering manager, were quite proud to show a visual project board
which allows anyone to see quickly which phases have been completed for each new product.

A second program that has been started is a cross-functional review of products for possible elimination. Novametrix was founded in 1978 and until October 2001 had never eliminated a product; products proliferated over time. In many cases several products were almost identical with only minor variations in color or pack sizes. These variations were not important to customers and therefore did not add value to the product line. Now a monthly cross-functional obsolescence meeting is held, that includes the marketing, sales, and engineering functions as well as manufacturing and purchasing.

Concluding Thoughts and Advice

Tom Patton, president of Novametrix, provided the following thoughts on its lean conversion. At Novametrix sales are currently running at a level rate, and in this no-growth environment, top management needs a patient approach to exploiting the profit-and-loss statement impact of lean. The company should not lay off workers who are not needed due to productivity improvements obtained from lean. Instead, labor should be thought of as a fixed cost.

Patton suggested that possible new initiatives for increasing sales should be undertaken, but also companies may benefit by altering make-buy decision making. For example, Novametrix had outsourced the production of finger sensors to Costa Rica but found that with the increased productivity of their work force, these products could be produced less expensively in-house despite the difference in wage rates. In addition, logistical costs were eliminated and leadtime and inventory were reduced.

Brian Montanari offered the following observation: "Too many people are quick to point out why it is easier for other companies to implement lean." The key is to find a way to apply the tools to overcome unique challenges and meet your needs. A second suggestion offered by Montanari for those just starting lean is to take lots of pictures and document the current status and to continue doing this throughout the process. This provides clear evidence to everyone that progress is being made and reinforces the momentum required for improvement.

One statement best summarizes Novametrix’s advice for companies just starting a conversion to lean: "Just Do It Now."

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