CREATING A WORLD CLASS MANUFACTURER IN RECORD TIME

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Challenge

At the start of this change effort in 1999, Emerson & Cuming, a specialty chemical manufacturer, had just been acquired and its two plants had merged into one facility. Though the merger resulted in immediate operational cost savings, it also caused significant confusion and disorganization. Raw materials were difficult to locate and inventories difficult to gauge with any certainty. Production areas were disorganized and cramped, creating safety and environmental concerns. Employee productivity and morale was poor. Many customer orders had to be rushed to make up for production scheduling and customers complained more frequently. The plant's financial performance was disappointing.

The situation needed to be turned around quickly. However, the plant's current state was the result of many interacting technical, cultural and organizational issues. There was no single "root cause," no missing skill or piece of information, no organizational dysfunction or defective management routine. The key question was, "How can we address all of the interacting issues simultaneously to quickly improve business results?"

Background

Emerson & Cuming (E&C) manufactures epoxies and other formulations used in demanding electronics, automotive and aerospace applications. It has plants in several countries. Its Canton, MA facility produces about four million pounds annually of almost 1800 different products.

In 1999, the plant was organized as a typical "batch and queue" manufacturer with an emphasis on producing large batches of product following production schedules based on manufacturing resources planning (MRP) software. As a result of combining the two plants into this one site, there now were two historical product lines and two distinct work cultures under the same roof with little cooperation or trust across the workforce.

Approach

As the consultants planned the approach to the plant's improvement effort, they thought it important that the change effort begin with the cultural (or *social* side) of change rather than with a program of technical interventions. They used four guiding principles to develop the eventual transformation process:

- Engage the whole system. The two existing cultures had to evolve into one new culture. A new culture could not be taught, but it could be learned in action if enough members of the organization were involved.
- Let the workplace inform action. Operators, supervisors and managers need quick feedback on the impact of their actions and efforts to improve. Ongoing, direct experience in the workplace would be essential.
- Focus on what all agree upon for the desired future of the plant and the workplace. A focus on a common future would be more energizing than a focus on current problems to be overcome. Beginning with areas of common agreement would be more productive than trying to resolve the multiple areas of disagreement.
- Aim for incremental improvement (i.e., getting better) rather than a programmatic push (i.e., implementing perfect). Many in the plant had already been through quality and safety programs that taught them many tools and concepts. What they needed

was enough persistence over time to produce visible differences in the safety, quality and productivity of the plant.

The consultants decided that Future Search (Weisbord and Janoff, 2000) would be the initial intervention. Action Teams, some using Gemba Kaizen action learning techniques, would begin work on the improvement efforts identified during the Future Search. The consultants would provide limited but focused support to the teams. Follow-up meetings would be held periodically to reinforce the progress of the change throughout the whole plant.

Taken together, this set of Future Search, improvement activities and follow-up conversations were to provide "whole system action learning." That is, E&C's organizational change would be supported through a cycle of plant-wide actions, discussion to understand the results of those actions, and subsequent planning to create still more change.

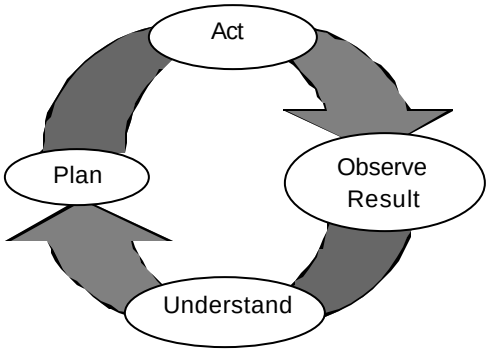

Figure 1: A Cycle of Learning and Change

Over the course of the first year, the whole organization was involved in a series of actions to improve the work place and conversations to understand the impact of those actions. In all, the plant underwent at least five cycles of learning and change.

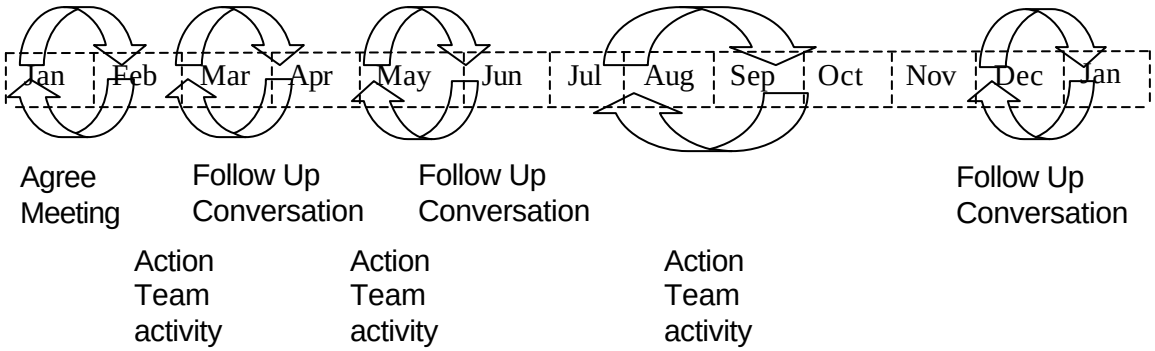

Figure 2: Cycles of Whole System Action Learning Across the First Year

Within six months of the Future Search (called the "Agree Meeting"), managers and operators began to see concrete results of their improvement efforts across all measures of safety, productivity and efficiency. Within a year, they had achieved a major turnaround in all key performance areas. Five years later, the Emerson & Cuming Canton plant is considered by its parent company, National Starch, to be an outstanding production facility and has won world-wide recognition for its record in safety, quality and improvement. The plant's current rate of safety incidents (OSHA recordables) is 0, its order-to-delivery lead time is three days, its quality issues (all inclusive) are below 110 per million shipped, and its inventory turns over 16 times per year. With the space saved in the plant through reduced inventories, two new businesses have been added which now represent one fifth of the plant's total revenue. Throughout this period, the operation manager's leadership was critical in supporting continuing cycles of plant-wide learning and change.

What Happened

October-November, 1998, Data Gathering, Design and Management Commitment. Just after they met, the operations manager and the consultants walked through the plant. What

they saw was a crowded, disorganized, and messy facility. People worked with little enjoyment and less eye contact. The recent merger had moved all of the material and equipment from the previous site into this building. Raw materials and finished goods were stored in several locations. Tools and excess materials were everywhere. Production, raw materials, finished goods and various support functions were scattered throughout the facility.

As they continued their tour, the operations manager explained his vision of a lean, efficient operation. He explained that to him, "lean" meant free from unnecessary activity, supplies, and materials that did not contribute to meeting customer needs. More important, "lean" meant helping employees work safely and effectively in producing what customers wanted. He felt that such a plant would not only be safer, but also improve financial performance and customer satisfaction. The plant he envisioned was also a *long* way from the dirty, disorganized, facility and unhappy employees that they saw around them that day.

Shortly thereafter, the consultants met with a cross section of employees in a series of focus groups. They found that operators and supervisors felt frustrated in their ability to work effectively in the plant. Necessary materials were hard to find and orders had to be expedited frequently. There were few standard procedures and there was a "them and us" feeling between the two product lines.

The consultants then met with supervisors, staff managers and the operations manager to develop and agree on the overall approach. Together they reviewed recent business results, along with comments from the focus groups and outcomes of an employee questionnaire. They discussed the importance of building the energy and commitment of employees from within. Improvement activities could begin with whatever was causing the most frustration among

employees. The tools and concepts of lean manufacturing would be the *means* used to achieve the *ends* identified by the employees in the Future Search.

January 20-22, 1999, Agree Meeting (Future Search). The first major effort to help the organization change its culture and results was a Future Search. This was held with about 1/3 of the plant employees as well as people from sales, R&D and corporate functions. The Future Search followed the standard design with one exception. To avoid consultant jargon or any suggestion of another program "launch," the session was called an "Agree Meeting." The stated focus was to agree on the, "…safest, highest quality, most productive workplace…" Forty managers, supervisors and operators were grouped into five stakeholder teams to represent all aspects of the plant as well as sales, corporate, and R&D functions. Operators represented the largest group of participants. This was partly because they represented the biggest group of employees, but also because their views had typically been overlooked in planning for previous changes.

The final vision for the plant's future as generated in this meeting included a number of specific agreements about what all wanted for the future of their plant. Among these agreements on the future workplace were:

- Satisfying customer needs, particularly critical customer needs
- Clean, neat, orderly workplace
- Reproducible, reliable, consistent processes and instructions
- Cross training between departments.

As the meeting came to a close, participants identified 12 specific projects to help them achieve their vision. Action Teams were formed around each project, with each team including a cross section of employees. Some of these teams and their initial goals were as follows:

- Product Line Management Team: eliminate low- revenue products.
- Inventory Reduction Team: reduce inventory by half within six months.
- Clean and Organize the Workplace Team: sort, straighten, scrub and standardize the entire workplace (i.e., "5S").
- Reorganize Work Flow Team: complete a model line within 12 months that demonstrates the new way of working.
- Improve Quality and Safety Programs Team: develop and implement new quality and safety standards.

In addition to the Action Teams, a cross functional and cross level (i.e., from operator to manager) Steering Committee was created to help coordinate the various projects. The operations manager would act as chairman of the nine member Steering Committee.

January 25 to February 26, 1999, Action Team Activity and Gemba Kaizen. The plan was for participants to take quick initial actions and then reflect on the results of those actions. Teams were told that they should spend a few weeks trying to implement their project plans, and then meet again to share their successes and frustrations. Some of these efforts were planned to provide immediate visible signs of progress to demonstrate that change was underway. In addition, the intent was to engage as many employees as possible as soon as possible. Over the first month, well over half of the plant employees were involved in the Agree Meeting and the subsequent improvement activities.

Gemba Kaizen Activities. Gemba Kaizen is an action learning method that quickly identifies and implements workplace improvement by working directly on and in the workplace (Imai and Heymans, 1999). Specifically, a team is set up to study the workplace, develop improvement ideas, implement trials of these ideas, and gather data about their effectiveness.

Some of the Action Teams set up in the Agree Meeting provided an opportunity for conducting improvement projects using this approach.

Two Action Teams used Gemba Kaizen activities to reorganize a warehouse and simplify a production area. Each team included a cross section of managers, supervisors and operators, some of whom did not normally work in these areas. Both projects were conducted over four days using the "5S" approach (a lean manufacturing technique where a workplace is Sorted, Straightened, Scrubbed, Standardized and the new practices are Spread). This provided immediate, visual progress in making the workplace safer, easier and more efficient. It also provided a framework the teams could use when they were presented with similar problems in the future.

March, 1999, Follow Up Conversation and Subsequent Actions. The first Follow-Up conversation was held a little over a month after the Agree Meeting and two weeks after the completion of the initial Gemba Kaizen projects. Members of all of the action teams were present along with other individuals from the plant who had not attended the original Future Search. Each Action Team reported out on the initial progress they had made. Everyone toured the two areas that had undergone the Kaizen efforts to see the very visible results.

Several of the Action Teams had made considerable progress towards aspects of the vision developed at the Agree Meeting. However, two teams had difficulty getting started. The three key questions for this Follow-Up conversation were:

- What have you accomplished so far?
- What haven"t you accomplished that you thought you would? And,
- What are you learning about leading improvement from both the successes and the difficulties?

The consultants used this meeting to reinforce the fact that the change process was the responsibility of everyone in the plant. After sharing their reflections, the group planned their next actions and asked for a second follow-up conversation in five weeks.

After this first Follow Up meeting, the Steering Committee decided to launch more projects in every department. They also chose to further explore lean thinking, especially "pull scheduling" (making to order, not to inventory). The consultants were asked to return to assist with three projects: 1) develop a "focused factory" with pull scheduling, 2) develop a "self-managed work team," and 3) improve the order entry process. Projects were completed over the next two months with periodic cycles of meetings across the teams to review and reflect on what they were learning about creating change.

With the Steering Committee taking over the governance role, the consultants looked for others in Emerson & Cuming to take over their role as "lean experts" and facilitators. Several employees were prepared to be internal experts by "apprenticing" with the consultants during the three improvement activities identified above.

April to December, 1999, Steering Committee Sponsorship of Improvement Projects. A number of improvement projects were conducted according to the vision developed in the initial Agree Meeting. These projects were sponsored by the operations manager and the Steering Committee with only occasional involvement of the consultants. (1)

- The whole facility was reorganized and standardized following the 5S approach. By organizing the workplace to support the work, the entire facility improved safety and quality while reducing nonproductive office, lab, and warehouse space to make way for additional production equipment. This way of thinking became characteristic of the new culture. For example, a project was launched to use the 5S process to rationalize the

product offerings from 3,000 SKUs to fewer than 1,800. Products were sorted (needed, not needed), then organized into families, then scrubbed (checked for presence of good manufacturing practices) and standardized. This use of 5S surprised the consultants for its creative use of the concept.

- The order entry process was mapped and analyzed to help reduce order to delivery time. As a result, the organization developed a new appreciation for this important role, which led to a change in focus, goal and even name: from "order entry" to "customer service."
- Using the same techniques as the order entry improvement project, an improvement team analyzed the engineering change order process (ECO). The ECO process controls changes made to the manufacturing standards, called *batch cards*, used to produce products. As the batch cards were reviewed and improved, the ECO process became the bottleneck to improvement, so it was improved as well.
- Customers and products were differentiated in an effort to provide the priority and focus the group desired. Although all customers would receive good quality and timely service, the group decided that they would "jump through hoops" only for the high volume, or growth oriented customers. Similarly, the almost 1800 products were classified by production volume. High-volume products would be produced on a steady, often daily basis based on demand, while low-volume products would be produced only as required.
- "Lean" requirements for suppliers were negotiated into agreements so that small, frequent shipments and consignment inventories became the norm. If suppliers were unable or unwilling to comply with E&C's requirements, the purchasing team worked to develop new suppliers in the greater Boston area who could.

Over this period, the consultants led one more Follow Up conversation to help the organization learn from the activities and results of the various team efforts. The design of this meeting was similar to the first and occurred about the third month after the Agree Meeting.

January 28, 2000, One Year Follow Up. At the one year anniversary of the initial Agree Meeting, the consultants facilitated a one-day meeting where participants from all areas of the plant reflected on their vision, goals, activities and progress.

Although the organization had made great progress, participants agreed that they still had room for improvement. Some of their observations were:

- While the "5S" activities had made a lot of progress there was no "shining" example.
- Team skills were not as well developed as they needed to be.
- Clarity of overall vision was not as good as it could be.
- The Steering Committee was not operating consistently.

The group recognized the weak areas that needed more attention and were also very positive and excited about their success so far. E&C had learned to "welcome problems" as opportunities and learn from the results of its actions.

During this follow up meeting the group also revisited some of the items that had not been included in the original vision or action plans because they had not been agreed to by everyone. Some of these items had once been points of real contention. But after a year of progress, it was clear that many of these issues were not as important as once thought and several were no longer relevant at all.

As this meeting was concluding, the National Starch newsletter (EEM News, January, 2000), published an article about the changes at the plant. The operations manager and his boss, Charles Call, reported that:

"…As the end of the first year (of improvement activities) approaches, the results achieved by the E&C teams are impressive….And more significant than these individual results is the development of a culture of continuous improvement in such a short time. Where most companies plan on a three to five year plan to implement this type of culture change, E&C has managed to dramatically change its culture in less than a year."

Among the first year results they reported were the following indicators of progress:

- Productivity improvements from 12% to 50% across different production areas.
- Warehouse space utilization improved by 23%. Productive floor space gains of 35% across all areas.
- Lead time to delivery reduced by 30-60% for major customers. On time delivery improved from 86 to 95%.
- Cross training of all applicable staff across all product families complete.

Four Years Later. Over the last few years, E&C has become a recognized flagship manufacturing facility for all of National Starch and its parent company, ICI. E&C has received international recognition for its safety record and manufacturing effectiveness and has accomplished this with very little change in technology or personnel.

In January of 1999, the employees of E&C envisioned their future and agreed to work together to attain that future. In time, their achievements far surpassed the expectations of their corporate managers or the consultants. Here are a few indicators of their achievement:

	January, 1999	December, 2004
Recorded safety incidents	9	0
Safety Suggestions	0	500

Employees	101	93
Hazardous waste generated	7,675 lbs	748 lbs.
On time deliveries	86%	98.4%
Customer issues (in parts per million)	400 PPM	110 PPM
Batches produced	5,236	9,063
Inventory turns	6.5	16 (21 in 2004)
Working capital as % of sales	21.3%	8.3%
Sales	$X million	$1.5X million
Order to delivery lead time	15 days	1-3 days

What Was Learned

Learning occurred for everyone during this process. E&C employees learned about each other and about their capability to make improvement. Along the way, they learned about lean manufacturing, about productive workplaces and about talking together even around areas where they held different views. Some learned about trust in the workplace. By following a completely transparent process, the operations manager and the consultants were able to provide a model for everyday interactions. Meanwhile, the organization learned to adopt a new culture, one of lean thinking. Even if employees could not exactly define the new culture, they recognized that it had changed. One of the senior supervisors quipped, "I'm still not sure why this lean stuff works. But as long as I keep (shipping) on time, I'll keep doing it."

Finally, the consultants learned more about the effectiveness of the four principles they used to guide their overall approach. In hindsight, they can reflect on how those principles operated in this situation: engage the whole system, let the workplace inform action, focus on

what all agree upon for the future, and incremental improvement can be more successful than programmatic push. The operations manager also adds his own views on his learning as the manager responsible for leading change while managing ongoing business performance.

Engage the Whole System. From the beginning the consultants and the operations manager recognized they had to involve everyone from across the two original plants if the effort was to succeed. In 1999, the plant had approximately 100 operators and employees. While everyone could not attend the Agree Meeting (Future Search), over a third of the plant's managers, supervisors and operators plus representatives from key corporate functions were involved from the beginning. Those operators and supervisors that had to remain at the plant to keep things running all had an opportunity to get involved, see initial change begin, and share their own ideas within the first 30 days.

Not everyone supported the change effort. In particular, one supervisor and one functional manager seemed to provide only minimal compliance with new ideas and initiatives. The operations manager had to keep these individuals from slowing down the overall change effort.

Another important way in which this effort "engaged the whole system" was in the work of the Action Teams and particularly the Gemba Kaizen events. In the first month people saw visible change as areas of the plant were cleaned and reorganized to better serve the work being done at these locations. Members of these teams included a cross section of managers, supervisors and operators in addition to the operators from that immediate work area. It made quite an impression on people to see the operations manager and other influential individuals spending three days on the shop floor cleaning and organizing an area. People later shared stories of how they saw the operations manager on his hands and knees cleaning a fitting with a

toothbrush. His actions provided very visible top management commitment and made it "safe" for others to support and participate in the improvement activities.

Let the Workplace Inform Action. From the beginning, managers, supervisors and operators were encouraged to ask questions about the workplace and the results produced there. Why was that machine located at that distance from the work station? Where were the raw materials stored? Why were things dirty? When did production orders arrive? Why were so many orders expedited? These questions were asked openly to build understanding and encourage lean thinking about how the workplace was, or was not supporting the work in a safe and efficient manner. The answers to these simple, direct questions came as equally direct and powerful improvement ideas. For example, when conducting a Gemba Kaizen activity in the warehouse, one consultant asked "How did all of these out of date products get here?" The team discussed the question and realized that most items were due to cancelled shipments. With some research, they found that most of the cancelled shipments were for distributors. A high priority was placed on better managing their distribution network. Once the warehouse was reorganized and out of date products removed, a severe shortage of warehouse space was resolved.

Focus on What All Agree Upon for the Future. The warehouse improvement story was one chapter in a fairly contentious issue when work began. At the Agree Meeting (Future Search), a number of people held that their vision for the future of the plant included a larger warehouse so that product could be more easily stored where all could find it. Considerable attention was given to a plan for acquiring more space so that enough material could be removed from the plant to make it easier and safer for people to do their jobs. While agreeing with the vision of a less cluttered workplace in which materials and products were easier to store and to find, other people disagreed with the need for additional warehouse space. These people felt that

lean thinking could help them achieve the same goal in their existing space. Since there was no common agreement on whether additional warehouse space was needed, no action was taken on this idea. However, since all agreed that the workplace had to be neater and easier to work in, several Gemba Kaizen efforts were devoted to creating some initial improvements in key areas, including the warehouse. Six months later the warehouse had so much extra room that some space had been turned over to production. Looking back, the group recognized they had achieved this aspect of their vision without getting stuck on one of the more contentious ideas.

Disagreements on means of achieving the vision arose a number of times. Plant management and staff learned to respect the areas of disagreement, but not to focus all their efforts on resolving them. They learned that by moving ahead on areas of agreement areas of disagreement might be resolved in time.

Incremental Improvement Can Be More Successful than Programmatic Push. By the end of the Agree Meeting, eleven Action Teams had been identified and formed. Two of the teams implemented their projects with consultant support, while the other nine teams worked on their own, using the improvement tools and concepts they already knew. This meant that the change effort was widely distributed across the plant. The message always was that this was their change to create. The consultants" role was that of support in a few focused areas.

The Follow-up conversations were explicitly designed to emphasize the improvement and learning occurring across all the teams from both successes and disappointments. Achievements were celebrated. A few of the achievements were surprising to all. At the first Follow-up session, some of the most exciting progress came from one of the most unexpected areas: updated instructions for making core products and plans for training people across product lines. These issues had been considered almost insurmountable problems. At the same Follow-up,

some teams reported that they were stuck or had otherwise failed to achieve some plan for the period. Such "disappointing" results were framed as useful and important, and helped the whole group to learn about the difficulty of making improvement and leading change at this plant at this time.

Reflections from the Operations Manager. Looking back over the five year period, the operations manager reached the following conclusions from his experience.

1. A critical role was played by his boss (the vice president, Charles Call) in creating space for change. Charlie made it clear to the surrounding company that the plant needed to focus on its own improvements. This was to be done from inside, by the people in Canton. Charlie demonstrated visible support through his personal involvement in the Agree and Follow Up meetings.
2. By establishing a ground rule (in the Agree Meeting/Future Search) that areas of disagreement should be acknowledged but not worked, the plant established a way to work through decisions more productively. Such focusing on areas of agreement is now firmly entrenched in the culture of E&C.
3. The plant was able to achieve small but observable and meaningful improvements within the first month. These helped to make the outcomes of the Agree Meeting real for the whole plant. More importantly, these early successes said "we can do it" to a workforce that was bruised and jaded from all the changes to which they had been subjected.
4. Persistence was important to deal with resistance. Many in the plant were used to seeing any change as only temporary, the change of the month. It was through a persistent focus on the vision for the plant's future that the natural resistance to change could be kept from stopping forward motion.

5. It was important to change everyone's perspective from that of a narrow functional view to a wider view of the system. Until this effort, managers and operators saw their work from the perspective of their own departments and responsibilities. A number of the activities in this change effort helped people see the broader processes and recognize how important it was to serve their internal customers as well as their external ones.

Conclusion

Emerson and Cuming's Canton plant is thriving today. It is so efficient that it can compete effectively in the global marketplace. Their parent company has recognized them as an outstanding example of lean manufacturing and they have been sought out by others looking for ideas and lessons. The consultants have not been involved with the plant since 2001 and the continued improvement has all been led from within.

Canton's difficult situation in 1999 seems like a long-ago dream. Change, once seen as a "flavor of the month" is now seen as "the way we work here:" it is expected and welcomed. The plant is growing in new ways, while still working with the same physical plant and many of the same people as it had in the past. They continue to complete cycles of learning and change. Today they are truly world class.

Footnotes

(1) One of the Gemba Kaizen efforts was led by consultant Derek Kotze.

References

Dixon, N. M. (2000). *Common knowledge: How companies thrive by sharing what they know.* Cambridge, MA: Harvard Business School Press.

E&C's Canton facility gets "lean." (2000). *EEM News, 2* (2), 3-4.

Hirano, H. (1990). *5 pillars of the visual workplace: The sourcebook for 5S implementation.* Portland, OR: Productivity Press.

Imai, M. & Heymans, B. (1999). Gemba Kaizen: Organizational change in real time. In Holman, P. & Devane, T. *The change handbook. Group methods for shaping the future* (pp. 109-122). San Francisco: Berrett-Koehler.

Kolb, D.A. (1984). *Experiential learning*. Englewood Cliffs, NJ: Prentice Hall.

Weisbord, M. & Janoff, S. (2000). *Future Search: An action guide to finding common ground in organizations and communities* (2nd ed.). San Francisco: Berrett-Koehler.

Womack, J.P. & Jones, D.T. (1996). *Lean thinking: Banish waste and create wealth in your corporation*. New York: Simon & Schuster.