Modeling Sustainable Organizational Change

Why did change at BP Lima sustain while the change at DuPont faded away?

Winston P. Ledet ***Paul Monus***
Tony Cardella ***Warren Burgess***

The whole approach taken is based on learning from experience. The four authors have many years of experience in creating more reliable organizations. This presentation will review four distinct experiences shared by Winston Ledet, Tony Cardella, Paul Monus and Warren Burgess. First is the experience at DuPont where Winston Ledet and Tony Cardella created higher reliability through a planned maintenance strategy. Second is Warren Burgess' experience at BP's Andrew Platform, Paul Monus' experience at BP's former Lima Refinery where we were able to create much higher reliability by introducing defect elimination and finally, Winston Ledet's experience with the Premcor refinery at Port Arthur.

Tony, Winston and others at DuPont created The Manufacturing Game® as part of the work of the Corporate Maintenance Leadership Team based on a very large benchmarking study DuPont conducted around the world on maintenance best practices. In order to understand the information in the benchmark study, they created a System Dynamics model to discover the structure of the system that creates value in a manufacturing organization. Once they had a model that helped them to better understand how maintenance added value to manufacturing organizations, they were unable to communicate their understanding through normal communications media. Having experienced the Beer Game as a way to learn the principles of System Dynamics, they decided to create a game to convey what they had learned by modeling the manufacturing process. This game is now used to help manufacturing organizations understand how to create more reliable facilities.

The Manufacturing Game® gives participants the experience of the essence of the whole system of manufacturing a product as part of an organization. The game is based on experiential learning which is basically instant learning or what most people call the "ah ha" experience. The basic lesson of the game is that the defects in their equipment, processes, and policies are the source of unreliability that leads to poor performance in their plants. This game experience can then be used to guide action in their plant to eliminate the defects and thereby improve the reliability of their equipment and organization as a whole.

This chart summarizes the big discovery that came out of the DuPont benchmark study through the System Dynamics model. All of the facilities that were benchmarked fell into one of the three

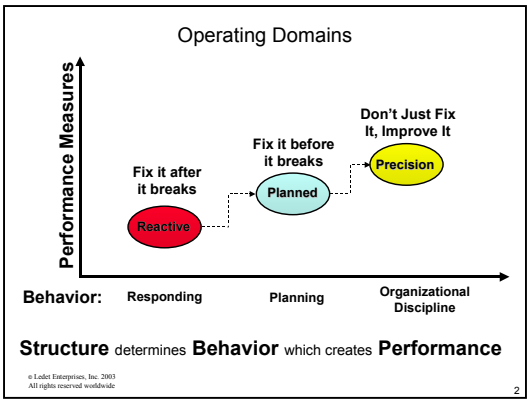

Figure 1

operating domains on this chart. Virtually all of the DuPont plants fell somewhere in the reactive domain, which reflects a range of performance.

The goal for any improvement effort should be to move up from the current domain of operation to a higher one. Of course, work within an organization can be happening in different domains depending on the history of improvement efforts in various parts of the organization. Most work in client organizations, that we have had experience with, were found to be in the reactive or planned domains with a smattering of work being done further up the domains. A particular change effort

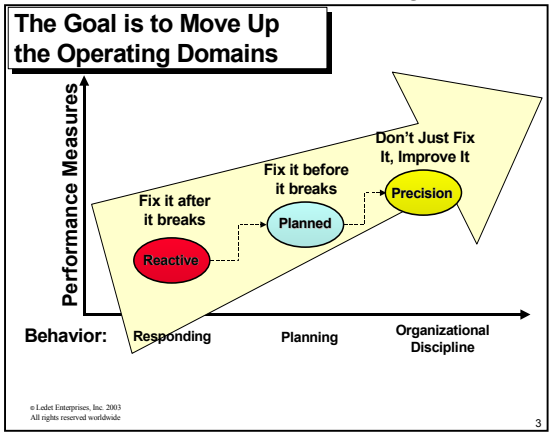

Figure 2

can be targeted at moving some specific work practices to higher domains based on the business need. In the places where there was success in improving the reliability of an organization, a pattern was found that is called “Heroic Change” because it requires a lot of everyday heroes to make the change. In our experience, this type of change happens in three stages, requires three processes and for the people involved, it is a Heroes’ journey according to the pattern in many stories told throughout the ages.

The three stages are: first, the organization has to be unfrozen so that change can be made, then the changes are made, and finally, it is important to refreeze the organization at the new performance level to avoid back sliding to the old ways. The rest of this presentation explains what happened in each of these three stages at DuPont, the Andrew platform, the Lima Refinery, and the Premcor refinery at Port Arthur.

The three processes are required to deal with power issues. The first process is one to articulate the business need which is the power demanding the change. The second is to empower the workforce to change the way work is done, and the third is a leadership process to deal with authority issues.

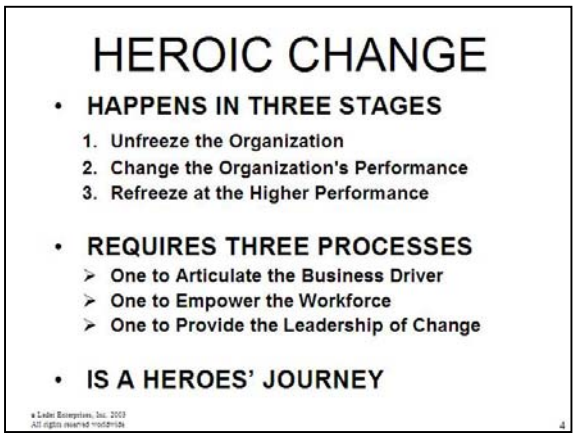

Figure 3

It is very helpful to understand the Heroes’ Journey pattern to anticipate the feelings people will have along the way and to be prepared to deal with the issues that will arise as people go through the personal agony of changing their work habits. This subject is too involved to cover here except to say that a Hero Journey framework was used to help facilitate our game and the overall change process at our clients.

From our experience, the way this type of change happens is like an S shaped curve. In Stage 1, the performance improvement starts as the organization becomes more open to change. The real work is to discover a better way of working.

In Stage 2, the big change comes as more people get involved and the new work practices become widespread. This is a time to perfect the new ways of

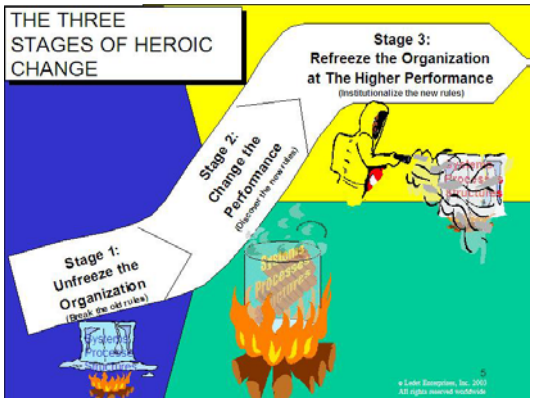

Figure 4

working. In the DuPont and Andrew experiences, the new ways of working were planned work practices. In the Lima and Port Arthur experience, the performance improvement came from eliminating work by eliminating the many defects in the equipment, practices, and policies of the organization.

In the third stage, it is essential to institutionalize the best practices by creating habits to support the new ways of working. Stage 3 is where the best practices learned from other organizations are installed. Unfortunately, this is where most organizations want to start their improvement program. While the best practices and the systems to support them are in fact the right things to do, you can't install those until people are ready and able to use them. Stages 1 and 2 are necessary preparation for these new best practices to succeed.

To be successful, an organization must create three processes that compliment each other in the change effort. The first process is one to articulate the business driver for the change. If there is not a clear business need to change, people will not be motivated to change their work practices and therefore nothing

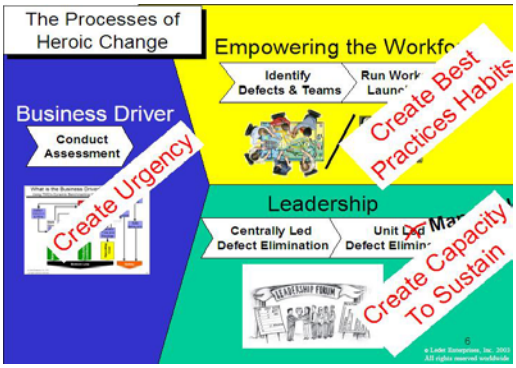

Figure 5

new will happen. The second process is to empower the workforce. A tool for this is to use The Manufacturing Game® to help workers understand their entire system of work and how their part fits into the whole. They are then asked to apply the lessons of the game to the real world by eliminating defects in small, temporary, cross-functional, "on the job" Action Teams. We advocate a large number of these small teams as a way to make the new work practices a habit. In the long run, people only do what is habitual so it is important to have enough repetitions to make the new ways of working a habit to replace the old habits.

The third process is a leadership process that supports the change effort. This process is needed to insure that the changes to the management systems are coordinated with the work change efforts and support the empowerment of the workers. An interesting thing is required when a company reaches the third stage of the change effort. It is then necessary to switch from a leadership-focused process to a management-focused process. The distinction we make at this point is that leadership is about change while management is about maintaining order. It will be shown later how this did not happen at DuPont or the BP Andrew

Platform, and as a result they have lost their performance over time while Lima made this transition and are continuing to sustain their improvements.

The DuPont Experience

DuPont, started the change with a corporate push to cut cost in 1985 – this was their business driver. In Stage 1, a CMMS system was installed as the way to change to planned maintenance work

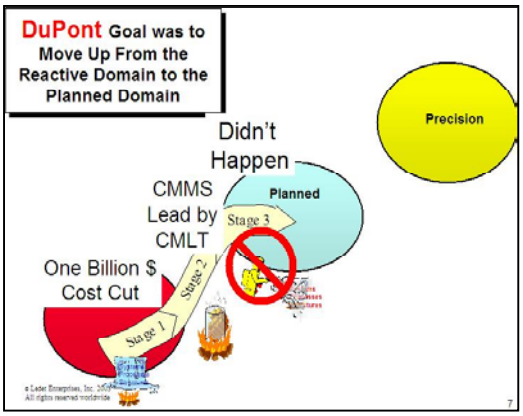

Figure 6

habits. This process was rather slow because it was not possible to buy a CMMS system like we can today so one had to be created. There was a large training effort to teach people the planned maintenance work practices. The Corporate Maintenance Leadership Team (CMLT) was created to lead this change, which really helped in Stage 2 as people were helped at the sites to share these new practices with each other.

This led to a substantial improvement in the maintenance cost of the whole corporation as shown in Figure 7. Note that the total maintenance cost as well as the cost as a percent of the total replacement investment on the chart was substantially reduced starting in 1986 after 10 years of fairly steady cost as a percent of replacement investment of 3.3% and a steady increase in total maintenance cost as DuPont added new investment to their sites. The total savings per year grew to over $300 million relative to the projected cost for the extra investment. The cost as a percent of replacement investment dropped to a low of 2.2% in 1994. However, the cost per replacement

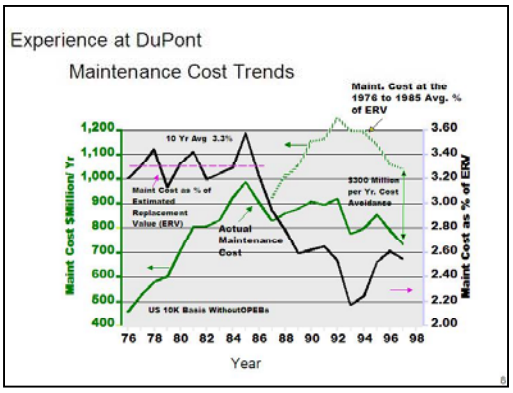

Figure 7

investment then turned back up at this point and that increase still continues today.

The failure to sustain this improvement can be traced to the failure to switch the leadership process to a management-focused process. Since the CMLT was an ad hoc group to lead this change, the leadership disappeared as the CMLT gradually went out of existence. This failure could have been avoided if a management-focused process had been created back in the line organization before dissolving the CMLT. An attempt was made to establish a leadership initiative at the time but they did not understand what was needed.

The BP Andrew Platform Experience

Another attempt to make a change to the planned domain occurred at the BP Andrew Platform in the North Sea. The business driver was a need to expand the life of the platform by drilling more wells. The platform was

originally designed with limited facilities, so that the smaller reservoir could be produced economically. Because of this, there was not sufficient

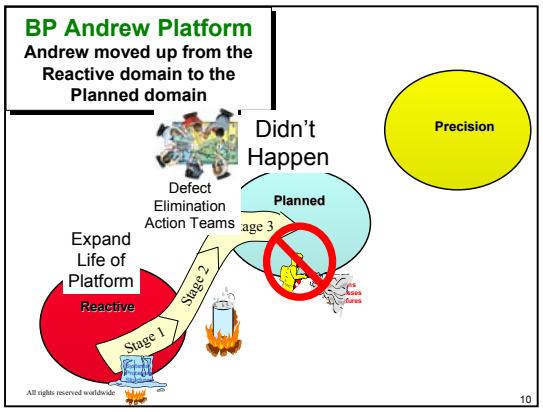

Figure 8

living space and facilities to accommodate an initiative to improve the production performance while extra people and equipment were engaged in drilling a new well. The new wells were needed to tap the extra oil and gas in the reservoir to extend the business viability of the Andrew Platform. It was decided to eliminate defects in the production facilities to ensure the reliability of the production facilities before drilling of the next well began. This worked very well and the performance of the production facilities was substantially upgraded as shown in Figure 9. The production efficiency increased from 58% to a peak at 95%, which allowed them to very successfully drill well number A16 on time and on budget.

However, the production from A16 was not enough to extend the life of the field. They then proceeded to drill the next well, A17, and again were on time and on budget. In the mean time, however, they were not able to continue the defect elimination at the same rate due to the combined effect of several additional activities for the Andrew team:

1. The well drilling activity
2. Increased statutory requirement to manage produced water disposal
3. Increased corporate standards for managing integrity
4. Thinking about other new production opportunities from nearby reservoirs

At this point, a number of unforeseen defects caused the efficiency to drop again to the earlier performance. In this instance, it is thought that the failure to sustain the performance resulted from business drivers that required more expansion work and this conflicted with the needs to perform defect elimination to continue to improve the reliability of the production facilities. This is the well-known conflict of expansion via projects versus concentration on existing facilities.

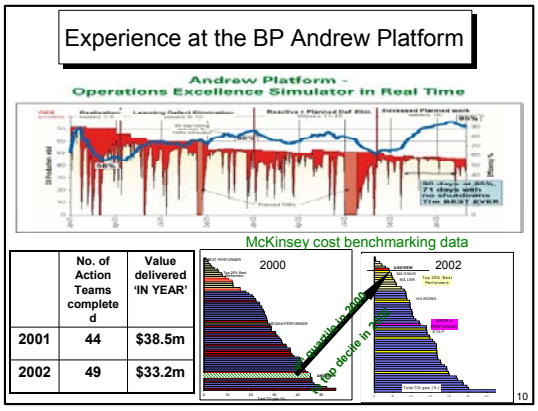

Figure 9

Andrew moved up from the Reactive Domain to the Planned Domain (fig 8)

The Planned Domain on Andrew was unstable - they were forced to react to the defects in 2003-04. However, their response did eliminate the 'difficult-to-see' defects of design and performance is now improving again. It is still not clear whether sufficient defects have

been eliminated to deliver a sustainable high operating performance.

The BP Lima Refinery Experience

On the other hand, the experience at the Lima refinery took a very different approach. The business driver there was a threat of closure of the plant. This was a much stronger driver for change since it affected everyone at the site as compared to the cost cutting at DuPont being focused primarily on maintenance cost. Different people came to this realization at different times but eventually everyone recognized the threat. The Manufacturing Game® was introduced as part of the refinery's

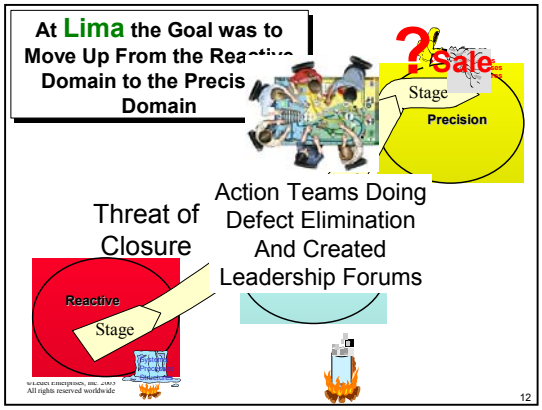

Figure 10

approach to the BP corporate continuous improvement initiative. The program was called "The Proactive Manufacturing Initiative" to reinforce that it was more than the maintenance initiative in effect at DuPont. The game was a much larger part of the Lima experience than the DuPont experience because the game was not created until 1991 when the initiative at DuPont was already succeeding. In fact people at DuPont could not be convinced to pursue the Precision Domain because the corporate earnings in 1991 were at record levels and no one believed more improvement was necessary. It is clear today that the extra improvement was necessary as DuPont splits into two companies to revive its growth.

The Action Team process was introduced at Lima to concentrate on defect elimination as a means to pursue the Precision Domain instead of the planned maintenance work practices. At the time no one knew if you could skip a domain. As it turned out, not only was it possible to skip the planned domain, but it was easier than pursuing the planned domain. One reason for this is that the planned approach only makes work more efficient but does not eliminate any of the work. In the precision domain, you actually reduce the amount of work that needs to get done by eliminating the root causes of the losses, which are the defects that lead to loss production, waste, and/or health, safety or environmental incidents.

As the next chart shows, the improvements at the Lima refinery were much more extensive than the cost cutting at DuPont. There was an annual improvement of $45 million for this single plant as compared to DuPont's savings of $300 million for about 70 plants. At DuPont, there were no claims of safety or environmental improvements to go along with the cost reductions.

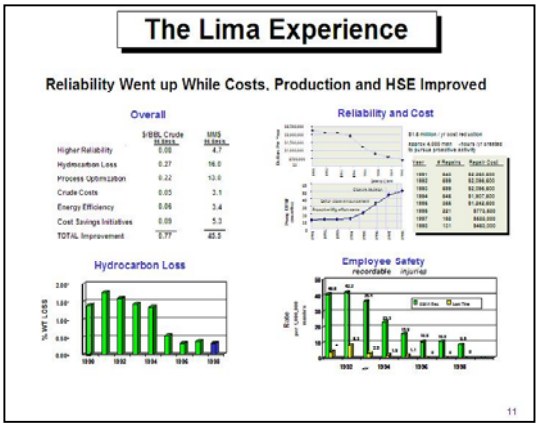

Figure 11

The unique thing created at Lima was the leadership process. The name chosen for this process was Leadership Forums. These forums were monthly meetings of any and all people at the site who were in leadership positions. While these forums normally did not have the hourly workers included, they would have been welcome. The leadership model used to create this forum was a combination of several ideas associated with Learning Organizations as described by Peter Senge from MIT. The most prominent idea was the idea that there are three types of leadership – executive, operational, and network. The forums were dedicated exclusively to supporting the Proactive Manufacturing initiative and did not include many of the traditional management processes such as overall performance reporting, etc. Decision-making was not the normal outcome of these meetings. The product more often was learning some new concepts about the change process or better understanding some obstacle to change. This organizational learning was then used to make changes in how they ran and managed the refinery back in their normal jobs.

All of these performance improvements were accomplished in Stage 2 of their journey and led to Clark Refining purchasing the refinery in 1998 instead of BP closing it in November of that year as planned. This, as it turned out, was the beginning of Stage 3 where they needed to stabilize the changes to sustain the higher-level of performance. During the transition from BP to Clark about 100 of the 458 employees did not stay with the refinery. Included in the group that left the refinery, were many of the change leaders who had been the heroes up to that point. Everyone believed that would kill the improvements as happened at DuPont, but it did not.

All of the program elements of the Proactive Manufacturing initiative in fact stopped, and it was thought that was the end. However, in 2003, we returned to see how they were doing. To our surprise, they are continuing to improve their performance but at a slower pace. The heroes at this stage are not the change agents but the people who value orderly processes and great discipline. They are the rotating equipment specialist, who insists on precision work on that equipment; the operations manager, who is pushing for clear procedures and routines for operators to optimize the output from the equipment; the training supervisor, who is pursuing training on advanced troubleshooting techniques; etc. Therefore, the departure of the change agents made room for this new set of heroes to play their parts. This is what didn't get done at DuPont. DuPont is now working again on the same issues that were worked on 15 years ago.

Port Arthur Refinery Success

Mascot Helps to Boost The Transformation of Premcor Port Arthur

In 1995, a refinery in Port Arthur, Texas was sold by Chevron and acquired by Clark Refining & Marketing. At the time, Clark owned two small refineries in the mid west, a retail operation with a number of gas stations, and a string of bagel stores, but Clark was not a dominant presence in any of these markets. Clark wanted to acquire other refineries and upgrade their operations as a means of creating a public company that would increase the value of their under performing refineries.

The Clark leadership team settled on a strategy that would solve several problems. They negotiated with Pemex to supply Myan crude to the Port Arthur

facility, thus giving Pemex a stable outlet for this heavy crude in exchange for lower prices. With the guaranteed higher margins, expenditures that were not originally economically justifiable were now justified. This allowed the leadership team to secure nearly a billion dollars from various sources to install a World Class Coker to process the heavy crude at Port Arthur. Unfortunately, there were no more "rabbits to pull out of the financing hat" to purchase more equipment. They realized that they were going to need to rely on much of the old, deteriorating equipment. They needed a plan to improve reliability to meet the demands that the new Coker would create for the old equipment.

Shortly thereafter, Clark decided to purchase the Lima, Ohio refinery from BP before it was scheduled for shut down in 1998. Clark executives had found out that the Lima refinery had made a great deal of progress in the past two years and believed the refinery could be a valuable asset. With the acquisition, Don Kuenzli, who was the plant manager at the Lima facility and the leader of the transformation at Lima, joined the Clark organization. Clark offered Don the position of plant Manager at the Port Arthur facility to lead the transformation there.

When Don arrived at Port Arthur and surveyed the state of the facility, he concluded that it had great potential, especially with the heavy oil upgrading project. It was obvious that reliability would have to be improved at the site to match the demands of the new Coker. He began to talk about a vision he believed should be pursued by the site. His vision was to create "**A World Class Facility with Pacesetter Performance**." He pointed out that potential margins from the world-class Coker would only be fully achieved from pacesetter performance in the old equipment as well as the new.

To support Don's new vision, he introduced the Proactive Manufacturing initiative that had been used at Lima and began the process by running Manufacturing Game workshops to introduce employees to the idea of defect elimination and the use of Action Teams as the means of engaging employees in performance improvement. This program started the engagement of front line workers and a continuous improvement forum was started as a leadership process to support the teams that were eliminating defects. Don recruited Marc Schomerus who was very well respected throughout the refinery, and also open to change. They later attracted Jim Griffith, who had been the maintenance manager at Lima, to join the organization and be the Maintenance manager at Port Arthur.

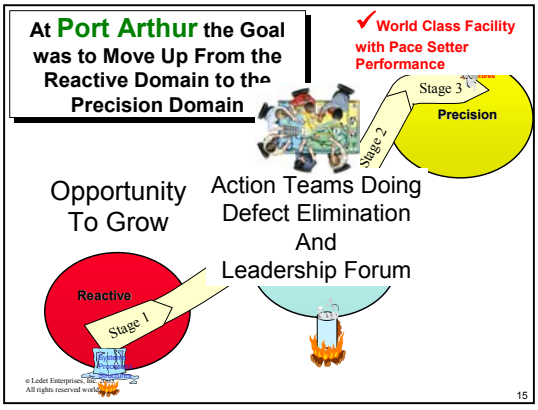

Figure 12

Other key players in the improvement effort were Keith Mullins, Nat Byrom and Billy Job, among others who conducted the facilitation of the Manufacturing Game workshops for the entire site. Eventually, every person at the refinery had the opportunity to attend a TMG workshop and employees became engaged, to varying degrees, in eliminating defects as the means to creating pacesetter performance.

George Roth, a consultant, set up a new program on Productive Conversations to develop individual and organizational learning. Later Natural Work Teams were introduced as a means to take the continuous improvement forum idea down to the work areas.

In the beginning of the transformation, Don was met with some skepticism that the entire site would adopt his vision. Some viewed it as the initiative of the month for the new manager and believed that, in time, it would fall by the wayside. Others outside the facilitator team thought the vision was naïve and that there was other approaches that should be used to better train employees. There was also some concern that the union would not go along or participate.

Another obstacle the team faced was the availability of funds. The Heavy Oil Upgrading Project (HOUP project) needed large sums of money to fund the construction, which had to be borrowed. This severely limited the availability of funds for other improvements like the defect elimination program. The company sold off the retail portion of the business to raise more funds in order to survive until the new facilities were ready to come on line. Not only was the survival of the refinery at stake, but also the survival of the company was in jeopardy. As the workshops continued people asked why the money was being spent on the workshops when costs were being cut everywhere else. Don was steadfast in his belief that the workshops had to continue. The TMG workshop Action Teams were getting good results but there was still a lot of work to be done.

In preparation for the startup of the new Coker, Marc Schomerus was put in charge of operations for the new units and he began by assigning head operators and an operations supervisor to the project a year before the startup so they could begin the culture change in the operating people. They worked to have a committed and involved workforce by encouraging employees to be open and honest and to ask questions like “what”, “why” and “how” when something went wrong instead of looking for someone to blame. They also studied an explosion incident report from another refinery that showed that the only way to avoid such incidents was to empower the operators to shut down equipment when it was not safe to run. They took the operators and some of the mechanics on benchmark trips to see other plants that were achieving higher performance and had programs in place to achieve worker participation in making decisions.

Marc Schomerus and Jim Griffith recognized that it was too expensive to eliminate every defect in the new equipment before it was installed, so they decided to back their supervisor who wanted to set up a new program to take all new rotating equipment down for an inspection every 45 days. This program was called preventive maintenance and became the hallmark of the new culture. It demonstrated that the management team was serious about the new philosophy of doing things right to prevent repetitive failures instead of the 1994 policy of running the equipment at all cost and getting the maximum production on a daily basis instead of taking care of the equipment so that you produced at higher levels in the long run. This endorsement of the preventive maintenance program migrated to other units in the facility.

Old work practices were gradually left behind and the new philosophy was taking root. One of the visible signs of the culture change was the creation of Boris, the new refinery mascot, a blue green bug with a yellow tooth sitting in a circle with a line

through it quoting “DO IT RIGHT! DON’T LET THE BUG BITE”. Boris started gracing shirts and Nomex uniforms and every one who participated in a TMG workshop received one of the embroidered patches and displayed them as a symbol of defect elimination. Managers wore Boris on their shirts every single day. Boris was showing up everywhere; on posters, walls, clothing, memos and handbooks.

The benefits realized by this culture change were enormous in the first several years. The goal was set at $41 million improvement in operating profit and that was surpassed even before the large increase in the profit margins because of increased gasoline prices. The larger benefits are accruing now in the midst of much higher margins.

Because of the high reliability, record margins are being produced. This would not be the case if their performance was still as poor as it had been in 1994. The new culture seems also to have carried over into the turn-around activities and the new expansion projects being installed. This has allowed the refinery to continue to grow and to attract more investments to ensure the future of the plant.

It took a lot of hard work, courage, innovation, and a little help from Boris, the mascot bug logo used to symbolize the defect elimination effort, to change the culture at the refinery. Now the hard won improvements have become the habitual way of doing business at the refinery. The emblem of Boris is worn on the shirts of every manager every day at the site. Each person who attended a workshop was awarded a Boris patch to wear on his or her work uniform. This has become a constant reminder that elimination of the defects (bugs) is essential to maintain pacesetter performance. They can now boast that they are a world-class facility with pacesetter performance.

Conclusions

To recap the three processes at DuPont, BP Andrew platform, Port Arthur and Lima, it is apparent that the business driver for DuPont was to cut cost. At Andrew it was to extend the life of the field while at Lima the drive was to survive, which is a much stronger drive and at Port Arthur it was to grow. The process to empower the workers at DuPont was planned maintenance training along with the use of a new CMMS system while The Manufacturing Game® was used as the primary empowerment tool at Andrew, Lima and Port Arthur. The leadership process at DuPont was the Corporate Maintenance Leadership Team. When it dissolved, nothing was left to manage the process. The leadership at Andrew Lima, and Port Arthur were the Leadership Forums. At Lima later the job was turned back over to the line management while at Port Arthur they are evolving to Natural Work Teams. As has been shown, all four approaches

Recap of DuPont & Andrew versus Lima & Port Arthur

Process	DuPont	Andrew	Lima	Port Arthur
Business Driver	Cut Cost	Extend Life Of Field	Survival	Opportunity To Grow
Empower Workforce	Planned Maintenance Training (Not Sustained)	The Manufacturing Game (Not Sustained)	The Manufacturing Game (Sustained)	The Manufacturing Game (Sustained)
Leadership	CMLT Leadership to None	Leadership Forums to Engineering	Leadership Forums to Line Management	Leadership Forums to Natural Work Teams

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Figure 13

succeeded for a while. The initiatives at

DuPont and Andrew, however, did not sustain in the long run while the ones at Lima and Port Arthur are still alive today after two changes of ownership and three sets of management change.

So what made the difference at Lima and Port Arthur? Was it the fact that line management conducted the leadership process at Lima and Port Arthur while it was provided by staff groups at DuPont? If this were the case, the Andrew Platform should have sustained. Could it be that the planned domain is in fact not stable? This is a possibility since both DuPont and Andrew pursued the planned domain while Lima and Port Arthur pursued the improved precision domain. Finally, could it be the difference in the business driver? Both DuPont and Lima did not have to deal with the conflict of exploration versus exploitation because they were both in a no growth mode while Andrew was expanding to take advantage of its business needs. However, Port Arthur had a huge expansion while making their change.

Change in other organizations will be as unique as the experiences at DuPont, Andrew Lima, and Port Arthur, however success will depend on the same three processes that were seen at all of these places. Organizations must be encouraged to be very clear about how they intend to create these three processes in their change effort is our conclusion. We have begun a modeling effort using agent-based software to try to simulate the differences we see in these four instances of implementing the same change at different sites.

BIOGRAPHIES

Winston P. Ledet, President, Ledet Enterprises, Inc.

Winston's background at DuPont spanned 27 years and encompassed various positions throughout the organization. His first position was a Chemical engineer in the research department. He then moved on to technical work at several plants, then works engineering that included computer control and environmental to operations superintendent in one of the nylon intermediates plants, organizational change for several years, employee relations which included the safety department, and finally he was part of the Corporate Maintenance Leadership Team in the last 5 years of his career with DuPont.

Paul A. Monus
Global Quality Manager--BP Solar
Frederick, Md.

Paul Monus is currently Global Quality Manager for BP Solar operations. He has been involved with system dynamics, knowledge management, and learning organization pursuits within BP Group worldwide. In this capacity, he implemented continuous improvement processes for BP Oil as part of the Pacesetter Refining Team. In this role, he spearheaded the changes at the BP Lima refinery reported here.

His prior experience includes operating and technical roles that cover a wide range of BP Chemical's US technologies including

-- Manufacturing Manager, Barex
-- Process Technology Manager, Barex
-- Area Superintendent Catalyst, HCN, Acetonitrile, Loading/Shipping
-- Area Superintendent Barex

Paul has a BS degree in Chemical Engineering from University of Minnesota.

Tony Cardella

Tony has 25 years experience in DuPont serving in a variety of professional and management assignments including operations, engineering, maintenance, and information systems. Since his early retirement in 1998, he has worked with a variety of organizational sizes in chemicals, energy, homebuilding, manufacturing, and technology sectors.

He began his study of systems, systems dynamics, and organizational change 15 years ago while participating on a small team that was charged with unraveling conflicting benchmark studies. The study culminated in the development of The Manufacturing Game® which is used by companies around the world to reduce defects, reduce maintenance cost, and improve reliability.

Tony blends his experience in systems dynamics, accelerated learning, Theory of Constraints, and life to present issues in a practical, down to earth style. This pragmatic approach to process and organizational change directly improves the bottom line.

Warren Burgess
Operations Central Coach, BP Exploration, Aberdeen, UK.

Warren Burgess is currently one of a global team of internal consultants leading the worldwide implementation of key common processes in BP's Upstream Operations. He has been involved with several change management efforts in 15 years of offshore oil & gas production operations in the North Sea. As Offshore Installation Manager for BP's Andrew oilfield, he played a key role in leading performance change from within, engaging staff at all levels to apply the principles of defect elimination through action teams, reported in this paper.

Warren graduated as a Mechanical Engineer from Dublin University. His prior experience includes mechanical, projects, maintenance and operations engineering roles in BP's UK operations.