TMG News

The Manufacturing Game®

January 15, 2007

"Sharing Information to Improve Reliability"

Why Cross Functional Teams Are Important

Our experience with sites throughout the world indicates that many of them are achieving approximately 60% planned work. Apparently, organizations left to their own devices are able to create 60% of their work as planned. Many initiatives we see people employing are to increase this 60% to higher levels of planned work. Not all work, however, is planable. Our definition of planned work is, "work that is planned and scheduled at least one week in advance". If an operator severely cavitates a pump tonight and creates a defect large enough to limit the life of that pump to one more day, this job, according to our definition, is not planned. Of course, some people today are waiting for a failure to occur and then begin the planning process to get that piece of equipment fixed in the next 4 to 10 weeks. We do not view this as legitimate planned work either, because it causes unnecessary risk on the part of the operating people.

Some people argue that the purpose of having spared equipment is to allow an efficient use of maintenance time for repair. We believe this is not the true purpose of spare equipment. The purpose of spared equipment is to ensure that production capacity is not lost when equipment is taken offline to be repaired. In many cases, the cost of spared equipment would not be justified if the only purpose were to make maintenance more efficient.

Since the original benchmark studies were conducted at DuPont, we have used our System Dynamics computer model as the repository of our learning and experience to help sites improve both maintenance and reliability. Our System Dynamics model has five sources of defect generation: quality of raw materials, level of operational discipline, level of maintenance workmanship, quality of spare parts, and validity of design. In the model, we also include extra defects that are generated by failure events.

We have always treated the generation of defects as a single process. This may be an error on our part. W. Edwards Deming always preached that you should not try to improve a process until the process is under control. We now think that we should look at defect generation as two processes. One in which the process is under control and the defect generation amounts to normal wear and tear. For example, the time based maintenance that we call Preventive Maintenance assumes that normal wear and tear over a specific time or number of cycles creates enough defects to cause a failure and therefore repair or replacement can be done in time to avoid a failure. The other process is a random one

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In The Groove

Another Action Team success story comes from the Motiva Refinery in Convent, Louisiana. After a Manufacturing Game Workshop, the Action Team of Ashley Norman, Randy Bourgeois, and Stan Bynum was established. Thomas Duffy, the Process Control Engineer, was later recruited to add his expertise to the team. Their mission was to find and eliminate a defect or "bug" in their refining plant. The team decided to work on a problem that had been put on Ashley's "to do" list when she took over the unit in 2006. What was causing the flow swings from the high-pressure to the low-pressure separator in the Hydro-Treating Unit 1? Approaching the "bug" from multiple angles, the cross functional team from operations, maintenance and engineering surrounded and eliminated the offending "bug". The impact to the refinery has been estimated to be between $3 million and $5 million annually.

Earlier work seemed to indicate that the problem was with the level control valve. Since the valve was old and somewhat outdated the team's recommendation was to replace the valve and positioner with a new digital positioner and valve. Initially the recommendation was not accepted due to the cost of the equipment and a lack of confidence in the diagnosis.

Ashley, Randy, Stan and Thomas decided to attack the problem and new possibilities

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What's Inside?

SCHEDULE

Throughout the year, The Manufacturing Game® holds workshops for the general public at various universities and/or professional organizations across the country.

2007 Public Workshops

2007 TAPPI Papermakers & PIMA International Leadership Conference

March 15, 2007
Jacksonville, FL
Conference dates: March 11–15, 2007

To register or for more information please visit:
www.TappiandPima.org

The Reliability Centered Maintenance Managers Forum & Enterprise Asset Management Forum

April 4, 2007
Honolulu, Hawaii
Conference dates: April 3–6, 2007

To register or for more information please visit:
www.MaintenanceConference.com

Mark Your Calendars!

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of generating defects due to lack of control of operating, repair, spare parts and raw materials procurement, and design processes. This random source of defects creates unplanable work. This model of the defect generation processes gives a better picture of the difference between the Planned Domain, where all of the planable work is being conducted according to a plan and a schedule, and the Precision Domain, where most of the unplanable work is eliminated and then all of the planable work is carried out according to a plan and a schedule.

So how does this relate to cross functional teams? We think that the only way to effectively create a culture that has the discipline to eliminate the vast majority of unplanable work is through cross functional teams. This is the big lesson we learned from observing the winners of the 1991 Total Productive Maintenance Awards in Japan. We concluded from our visits to some of these award-winning plants, that cross functional teams and good inspections were the key secrets to their success. The Japanese use small teams composed of operators, mechanics, engineers and others to analyze, check, and redesign any equipment when it is first put into production or goes in for "cleaning". Through this use of cross functional teams, they are able to do minor repairs, such as tightening a nut or bolt to line up with a match mark on a base plate while the equipment is in use instead of waiting until the problem worsens and the equipment has to be shut down for repair. Some of these plants reported that they had eliminated 90% to 98% of their failures as they improved from the Reactive Domain to the Precision Domain. We experienced this same level of improvement at the Lima refinery where they reduced the number of pump repairs by 87% through the defect elimination process. This level of performance resulted from the kind of inspections of the pumps that can detect incipient failures early enough to allow planning and scheduling at least one week in advance. Therefore, the consequence of this disciplined way of working is the improved efficiency of the maintenance process, but it is not the primary purpose of the improvement. The primary purpose of the improvement is to actually decrease the amount of work that needs to be done.

During Winston Ledet's 27 years at DuPont, a number of programs were implemented in order to get a particular site into the Planned Domain for a period of time, only to see the percent of planned work later back slide to the 60% level or lower. Winston later realized that this performance was an indication that there was never the degree of discipline across the functions necessary to eliminate the random defect generation process. Consequently, DuPont never reached the Precision Domain in those 27 years. This cycle of achieving the Planned Domain, only to see it later fail, is a pattern we see at many plants. The length of the cycle at plant sites seems to vary depending on the longevity of the managers who implemented it. At one greenfield site, Alumax - now Alcoa's Mount Holly, the cycle has lasted over 25 years due in large part to the fact that during that time period, the management at the site remained constant. The original Maintenance Manager, who remained at the site until his retirement, insisted that planable work was top priority. The Plant Manager at the start up site supported the Maintenance Manager completely. Most people will agree this is an anomaly. It is rare that the same management at any given site is maintained for more than three or four years.

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Without an autocratic way of enforcing the importance of planned work, and no system present to keep it in place, it eventually will disappear. In a recent conversation with Paul Campbell, former Plant Manager of this site, he agreed that even though Alumax (Alcoa–Mt. Holly) is well known for its Planning and Scheduling program (90% planned and scheduled one week in advance) they would not have been able to achieve their level of reliability without other tools. Planning and Scheduling alone could not attain the level of reliability that they have achieved. Planning and Scheduling along with "problem solving teams" that were cross functional were established to work on issues. This is another name for what we advocate as "cross functional defect elimination teams". These teams reduce or remove the unplanable work. Management established small budgets for each mechanic and operator to be used for improvements or defect elimination by problem solving teams. By pooling their budgets, they could often achieve the improvement they desired. This empowered the employees to do what needed to be done in their area of expertise and installed a sense of pride in their jobs. Long before OEE was the buzzword, Alumax had established their own early version of it. When Alcoa purchased Alumax, they tried to get their other sites to operate as the Alumax site did. Ron Moore, a consultant Alcoa engaged shortly after they purchased Alumax, pointed out to them that they "had too much maintenance in their reliability". What Ron meant by this statement is that the other sites were not involving operations people in the reliability effort or working cross functionally a sufficient percentage of time. Paul Campbell says you have to have the right leadership at the top that establishes maintenance and operations as equal partners working together in a positive cooperative manner. Operations is the pull for reliability; Maintenance is the deliverer of reliability. Paul stated, "Maintenance and Operations working independently is like trying to clap with one hand."

We find that as the amount of unplanable work increases, the planable work becomes a lower and lower percentage of the amount of repairs being done. The only sustainable way to improve this pattern is to eliminate some of the random breakdown events that are occurring by eliminating defects. By getting the whole organization involved in defect elimination, it becomes the new way of working. As Winston Ledet has often said, "In order to change the way you think, you have to change the way you work". As small defects are eliminated, the randomness begins to dissipate and the number of unplanable jobs decreases. As the unplanable work decreases, the planned work becomes a higher percentage of the work that is being done.

The only way we have found to achieve the Precision Domain is to engage the whole organization in defect elimination. In our experience, there are four ways to achieve that domain, and they all involve the use of cross functional teams. They are Total Productive Maintenance (TPM), Reliability Centered Maintenance (RCM), a tool like The Manufacturing Game® workshops to create passion in the workforce for defect elimination, or by designing cross functional work teams into your work processes and projects as Alumax did. ◆

How to Encourage Cross Functional Defect Elimination

1. Review work order data and reports to compile a list of defects on equipment not performing up to expectations.
2. Interview front line workers about equipment or process problems and add these to your defect list.
3. Focus on small defects that can be eliminated in 90 days or less and do not involve capital expenditures.
4. Determine who is involved with the equipment on the defect list including but not limited to operators, mechanics, engineers, purchasing/stores personnel, commercial personnel, outside contractors and vendors.
5. Put together small cross functional teams (6 people or less) who are interested in the improvement effort.
6. Give each team the choice of taking on one of the defects on the list or choosing another that they are more passionate about eliminating.
7. Be willing to help the team remove barriers that might impede their success.
8. Provide tools or skills training that might be necessary to aide in the team's success.
9. Follow up with the team to show your support and learn of their results.
10. Publicize and celebrate their success!

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"Never tell people how to do things.

Tell them what to do, and they will surprise you with their ingenuity."

—George S. Patton

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were quickly identified. A flow scan was performed on the High Pressure Separator Level revealing a groove in the feedback arm as well as grooves in the CAM and roller. As long as everything was stable, there were no problems. A small disruption, however, could cause major problems. The controller responds like a high-speed car whose wheel slips off the side of the road into a rut. When you turn the steering wheel sharply to one side to get out of that rut you often over compensate and land in the rut on the other side of the road. The safe way to solve the problem of over-correcting is to reduce the rates until the level smoothes out. This would slow down production.

Since the valve was an older model, the parts were not readily available. The Action Team put their heads together and chose to cannibalize some parts off another valve. The renewed valve improved the functionality of the unit. The tighter control allowed the rates on the HTU1 to increase by 17%. The team reported that this test run was able to determine unit limitation. PSM (Process Safety Management – safety limit) was reached.

The team was now in a defect elimination groove. They knew this 'bug' had surfaced its ugly head in 2004, and they had eradicated it. They also knew that defects often cause other defects. They suspected that they had not killed the "bug" that initially caused the grooves. A possibility was that the grooves were caused by line vibration. The team added and tightened extra pipe supports to reduce the vibration.

The team was asked to report their findings to the monthly meeting of the Expanded Leadership Team. They were surprised and happy to receive a standing ovation for a job well done. Ashley, Randy, Stan and Thomas felt a real sense of accomplishment. Ashley said, "It feels right to do good work like this; one more thing down, and it will reduce the problems it was causing the control room operators." The Action Team minimized lost production for the Motiva Refinery and improved the reliability of their high pressure separator with very little cost and considerable savings.