Building a Passion for Reliability
Michelin Spartanburg, South Carolina

The extent of success for many manufacturing companies is determined by how much it costs them to produce their product, how much of their product they can produce and the quality of their product. This is especially true in the global marketplace of today. During 1992-93, Michelin's Spartanburg, South Carolina Truck Tire Plant explored ways to reduce manufacturing costs while improving on already outstanding product quality results. At that time maintenance was viewed as a substantial percentage of manufacturing cost and significant reductions could be made by focusing on the "Core Business" of just fixing the equipment and reducing all other resources. Unfortunately, due to the reactive nature of the "Core Business" work and the demands of continuous improvement, workloads began to increase. Demands quickly began to outstrip resources, reactivity increased and plant performance was impacted. The "work" had not truly been removed, and because it was more reactive, the cost increases to maintain that workload were inevitable. In 1998, new approaches and thinking were initiated and integrated to reduce the "work" and its associated costs. This paper describes how Michelin's Spartanburg facility "Built a Passion for Reliability" that made their processes require less work, and allowed them to become more reliable, more efficient, more predictable and more controlled. Generally speaking, this reduction in work and increase in control in the more reliable processes came from a lower number of defects.* Defects create a tremendous amount of work, and this work costs money and negatively impacts production and quality. As defects are eliminated (through the identification and elimination of their root causes) the total workload will decrease. Because less work is necessary, manufacturing costs will decrease and production and quality increase. Additionally, it is common for morale to improve as process stability increases; variation is eliminated and stress levels decrease. As Figure 1 indicates, all processes generate benefits and defects. Although Figure 1 is most directly applied to a manufacturing process, many of its concepts can be applied to all aspects of a company. One of the main goals in a completely successful reliability implementation is to eliminate defects from all aspects of the company.

*A defect as used herein is defined as anything less than "perfection" and is a relative term which may describe a machine, process, system, etc. "Defect" does not describe a defective product.
Because of the potential benefits offered by reliability, many companies have sought to understand and implement it. Unfortunately, many companies often are unable to implement reliability successfully once they have a basic understanding of it.

What follows is a description of how Michelin's Spartanburg, South Carolina heavy truck tire plant defined reliability; how the team built the passion for it; how they focused this passion to begin their implementation; and how they are sustaining their improvement and planning to continue.

Step One - Understanding the Need For Change

In most plants, the journey toward reliability begins when people realize the need for improvement and understand that improvement can be obtained by changing the way things are done. This realization is often due to the condition shown in Figure 2, where the company is the high cost producer in an increasingly competitive marketplace. Following this revelation, reliability is identified as an excellent process for making those improvements and changes. Hopefully this realization comes to someone who possesses a high level of authority; if this is the case then implementation has just been made a good deal easier. If not, implementation is still quite possible (but likely at a slower pace).

At Spartanburg, the revelation came to the Technical Services Manager and Plant Manager. They established the initial business case for reliability and identified a Reliability Manager. From that point forward, the Technical Services Manager and the Reliability Manager worked to formalize the business case for making the change that the Plant Manager had agreed upon. This was a critical step. Even though the three saw and understood the potential for improvement, for reliability to be completely successful at the plant, all of the other employees would need to come to the same conclusion. The importance of making a good business case cannot be overstated; very simply, if no passion for reliability is gained then the journey towards it will at best be mildly successful. The business case not only needs to indicate to people that the effort is justified, it must help them gain a passion for reliability. This passion is vitally important because before reliability can be successful, people must think and work differently (the culture under which the plant operates must change). A strong motivating force is required to change the culture: passion is that motivating force. This culture change becomes one of the most important aspects of success on the journey towards reliability.

Step Two - Defining the Vision

Once the initial "believers" have identified the reasons for the journey, they must develop a simple vision statement, which will give direction to the passion. It is critical that this vision be realistic and applicable to the organization's buy-in and understanding. It would be senseless to construct a very broad, company-wide vision statement when the team of "believers" is low in the organization and their own plant management is not supportive (in this case start small and grow the vision as successes are made and support is gained). Likewise, it would be inefficient to identify a vision that does not take advantage of the amount of support available if the plant or company management does support the journey. Needless to say, it is important that considerable thought and consideration must be given to the development of the vision, as it will define the direction of the journey.

At Spartanburg, the plant's management developed an early understanding of the business case; therefore the vision was written to take advantage of the support they could give. Two documents were created to direct the passion for reliability at Spartanburg. The first was a strategic direction and the second was a vision statement. The strategic direction highlighted three broad areas where the plant needed to improve and the vision provided more detail to the Asset Utilization direction.

The first direction for the plant was to create high-performance work teams to empower the hourly workforce. The second strategic direction, "Mastering the Process,"

described methods for machine referentials and locking down processes (rather than making constant adjustments and modifications to accommodate product and process variations). Thirdly, "Asset Utilization" described the core reliability efforts to be made. The term asset utilization was used instead of reliability to avoid the "maintenance only" mentality that reliability sometimes carries. All three of these directions where interwoven to produce the desired results.

The vision statement was used to communicate the need to move from a reactive culture to a planned, proactive and strategic culture. It detailed three basic focus areas designed to allow the plant to operate at full capacity with only 25% of the original troubleshooters. The attainment of this goal would vividly illustrate that the plant's entire work structure had been changed, meaning lower levels and greater efficiency.

Step Three - The Journey Begins

Once the vision is in place, the next step is to actually begin the work. There are two common occurrences at the beginning of this step. The first is to focus so completely on reliability concepts or data that no action is taken (sometimes referred to as analysis paralysis). The second is to get so excited with all of the very broad, far-reaching reliability processes available, that tools and projects are undertaken that are bigger than the plant's passion and understanding can sustain. Care must be taken in this step because reliability is still very much in its infancy stage and is still very fragile. At the beginning of the implementation, it is important to start with initiatives and projects that are easily measured and provide relatively quick payback. This is important, because even though the business case developed in step one may have been well received, if improvement is not seen relatively quickly, then the passion could easily be lost (seen as another "program of the month"). Another thing that might be noticed when beginning the journey towards reliability is that many of the tools and skills needed to implement reliability are typically very simple and often already exist in the plant.

At Spartanburg, there were two basic initiatives that were implemented initially, both of which would contain all aspects of both the Strategic Direction and Vision and would provide relatively quick improvement. The first initiative was restructuring the responsibilities of certain maintenance, quality and operations personnel to enhance their ownership of equipment and to better utilize their skills. This restructuring included assigning machines to individuals, giving them responsibility for the availability and quality of their machines and providing them with the training and authority to ensure their success. A powerful effect of this change was the improved relationships between maintenance and operations areas, leading to improved operator ownership of their equipment. This initiative proved to be very successful, as the number of reactive maintenance calls began to decline within six months of implementation and have continued to decline dramatically (see Figure 3). Work was truly eliminated, leading to an increase in availability, a decrease in variability and a decrease in reactivity. These changes meant realizing additional production capacity and improving already high quality products, which was easily seen at all levels of plant personnel, and by the customer.

The second initiative consisted of a training class, which used a plant simulation to help employees understand how reliability (and a lack of it) impacts the plant. This training

introduced the concept of operating domains, which described how a plant operates (see Figure 4). It conveyed the point that the culture under which a plant operates not only defines the domain in which it works, but it also confines it to that domain. In order for real, sustainable improvement to be realized in a plant, a great deal of well-directed passion and effort must exist to transform the plant culture into what is required to perform in the next domain level. Once the next domain is reached, it becomes the new "norm" for plant operation and requires the same, well-directed passion and work to move out of and into the next domain level. The second part of this training involved the formation of action teams (small, cross-functional teams) that selected an opportunity for improvement in their area on which to work. The team worked together over three months and then reported their results to the plant staff. Sometimes, the teams chose opportunities for improvement that were critical to the plant. Other times, they chose items initially perceived as smaller, nuisance items. In many cases, after these nuisance items were eliminated, the combined effect of their elimination lead to significant production and quality improvements. In either case, the plant was progressing due to the work of all its employees. As these results were reported to the plant staff, the need for reliability was solidified in the minds of the employees as well as the plant management.

It was clear in both cases that the activities supported the reliability culture change. They provided relatively quick payback and helped to solidify reliability as a viable approach with a very real payback. Their success helped provide the stable foundation necessary to venture into more elaborate tools and systems that would help systematize reliability at Spartanburg.

So I'm going to have to add lots of resources to achieve reliability, right?

Actually, no. Most plants have adequate resources available to make substantial progress in reliability without the addition of more. The problem is that often these resources are poorly utilized. By re-aligning resources and ensuring that they are fully utilized, there should be sufficient capability to begin eliminating work from the process. As this work is eliminated, further resources become available for reliability efforts.

Step Four – Expanding the Boundaries

Things are rolling, people are buying in, positive results are coming back and it's time to expand the boundaries. Hopefully, at this point, the plant has a great deal of passion that can be used to continue the reliability journey. The critical focus during this step is to continue growing the boundaries which reliability effects while ensuring that the effort does not fall into several potential pitfalls.

Two common pitfalls. First, when passion is high, it is very easy for the plant to fixate on something that initially proves successful but becomes unsustainable. Secondly, the plant may get very impatient because things are not happening fast enough - they see a good thing and want it all to be good IMMEDIATELY. Although these two pitfalls are somewhat different, they often manifest themselves in similar ways. One of these ways is the identification of the fabled "silver bullet;" defined as the one "super-tool" that will allow complete and permanent reliability success. There are a wealth of tools and methods available in the field of reliability

and it is very easy to pick one and come to the conclusion that “this is it, if we can just get this one in we’ll be there.” From our experience, there is no one tool or method that will achieve complete reliability. Different tools are effective in different areas. For example, RCM2 (Reliability Centered Maintenance 2) is very effective for establishing maintenance plans (maintenance being a *function* and not a *department*) but is less effective at RCFA (Root Cause Failure Analysis). It is necessary to understand the use and results of the tools to be able to select the tool that will give the biggest bang for the buck. It is important to identify systems and tools which can work together to provide a blanket approach. If a tool is tried and does not produce results then put it aside and find one that will. Some of the tools available today include RCM2©, vibration analysis, RCFA, thermography, Kaizen, life-cycle cost analysis, TPM, The Pit Stop©, etc. Also, do not overlook the skills and abilities already present in the plant. Some of the more effective but seldom discussed tools include activities that can be accomplished within the plant or company to increase employee ownership and understanding. Many times there is no fee or cost to implement these tools as they only require an effort from plant management to engage the workforce. It is very important to evaluate the plant’s opportunities and use the tools that are best suited for making improvements, keeping in mind that no one or two tools will produce the desired results.

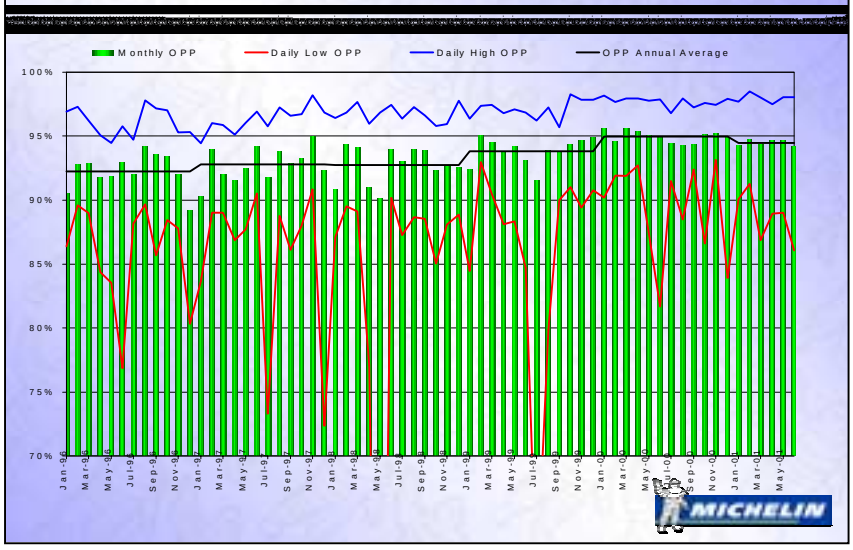
Another common manifestation of the two pitfalls leads to overlooking the monumental task of changing the way people think. In truth, people (all people) tend to be very rigid and unwilling to change their way of thinking. In many cases, the plant or company itself has instituted this old way of thinking through its environment or culture. For these reasons, making this paradigm shift is difficult and takes time.

At Spartanburg, there have been many tools applied to achieve results, each one aimed to maximize reliability in a particular area of plant business. As mentioned above, action teams worked to capitalize on opportunities that had traditionally been overlooked (penalties often seen as part of doing business). "Mastering the Process" concepts were applied to areas of the plant that had traditionally worked diligently to accommodate process variations. (A very important, but easily overlooked result of not making adjustments for process variations is that the variations are often the result of problems in the supply chain. When the variations are rejected, then the problems upstream are brought to light so their root cause can be identified and eliminated). Plant-specific training courses were developed to help employees gain a better understanding of the plant's direction and their role within it. Additionally, there is a constant effort to identify and evaluate potential tools that can be used to address a specific opportunity within the plant.

In addition to area-specific tools, Spartanburg implemented other tools to systematize reliability concepts so improvements could be sustained. One such tool was a comprehensive predictive maintenance system developed within QS9000 (a quality system already in place in the plant) and was designed to be easily updated as processes and equipment changed and to improve itself over time. Another very important step to systemizing reliability came with the inclusion of reliability objectives into personnel objectives. This has occurred at every level, from the plant manager to the hourly employees. In most cases, people will try very hard to be successful; the problem is that it is common for a plant's goals to not be included in its employees' measure of success. By including reliability goals, such as system implementation and defect elimination in management's indicators of success, the plant's goals and the employees' goals very quickly align. The result of the individual tools, increased understanding, and systems can be seen very vividly in the step changes in overall plant performance shown in Figure 5.

Figure 5

Spartanburg Overall Plant Performance (OPP)



At this point, many plants/companies establish a reliability group. This group typically includes engineers and may include technicians, mechanics, etc. There are a few guidelines to consider when developing a reliability group and its direction. First, a conscious effort needs to be made to ensure that reliability does not become just a group. To be successful, all plant and company personnel must embrace reliability. The reliability group should support the efforts of the other employees. They might do this through system development and implementation, researching potential reliability tools that might have application in the plant (vibration analysis, thermography, non-destructive testing, etc.) Second, it is very important to not let the reliability group be drawn into day-to-day, reactive issues. Any reactive involvement must be limited to providing assistance only after that area of the plant has exhausted all efforts. It is very difficult, if not impossible, for a reliability group to swing in and out of reactivity and remain effective.

What has proven to be effective at Spartanburg is a very small reliability group consisting of the two managers who first initiated the reliability concept and two

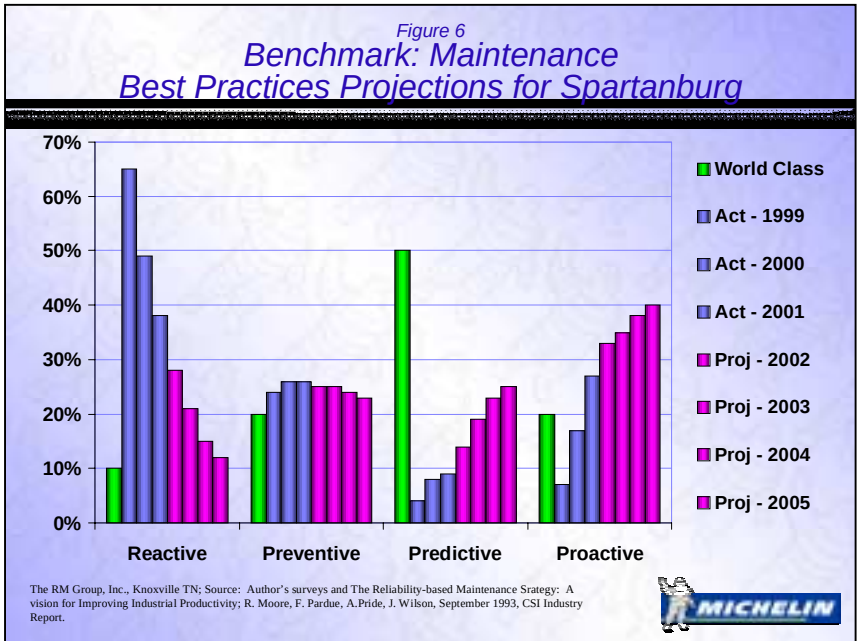
additional team members. In addition to the formal team, there are reliability "arms" in each area of the plant. With this arrangement there is not enough of a resource for reliability to become the group but the team is large enough to aid in system development, tool evaluation, training and other beneficial things.

Step Five – What Lies Ahead

At this point in the reliability journey, great efforts have been made to implement reliability concepts and to institute systems to ensure that improvement is sustained. What happens next is greatly dependent on how the whole effort began. If it began with a low priority in a plant organization, the future of the efforts resides with gaining the support of all plant personnel (beginning at the top) so that the full benefit can be realized. If implementation began at the top of the plant organization's list of priorities, then the next step will be to influence the rest of the company to embrace reliability. If the effort began at the corporate level, then yet another future is in store.

Referring to Figure 1 in the opening paragraph, there are many aspects of a process which produce defects and one of the ultimate goals of reliability must be to eliminate defects (and thus work) in all areas. If implementation began lower in the plant organization, then only the "operate" or "maintain" areas may have received focus. In this case, as support is gained, the effort should branch out, first into the other areas that are primarily under the plant's control. Then, once plant support has been obtained, the effort should move into the areas which are under the control of a corporate group. If implementation began at the plant staff level, then the future will consist of gaining the support of suppliers, corporate engineering, corporate purchasing, etc. Obviously, if implementation began at the corporate level, then defect elimination should be instituted in all areas and efforts to continuously improve systems might be next.

As stated above, the Spartanburg implementation began at the plant staff level and great progress has been made in defect elimination in all areas under the plant's control. In addition to continuing the efforts at the plant, efforts are being made to influence our suppliers (both within and outside the company), engineering, purchasing, etc. to embrace reliability principles so that the full benefits of reliability can be achieved. This influence manifests itself in many ways including presentations, a reliability web site on the



company's intranet, communication of plant successes and plant needs, to name a few.

The Future for Spartanburg

Spartanburg has seen significant improvements due to the reliability initiative and the future is extremely bright. Through vision, leadership and an open-minded approach, reliability has been embraced and implemented at a very rapid pace. What lies ahead is to continue to improve the plant's internal systems while influencing other plants and service providers within the company. The plant's five year plan includes a focus to make the plant perform at a world class level in all aspects of its activity (see Figure 6 for an example of this plan). Very simply, we want to produce the best tire, at the best price, in every segment of the market while providing the greatest level of performance for our shareholders.

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