

MRC NEWSLETTER

Maintenance & Reliability Center
The University of Tennessee
"where industry & academia meet"

Editor
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MRC Members Venture to New Mexico For Winter Meeting

The 2008 Winter MRC Members' Meeting was held February 20-21 in Albuquerque, NM, hosted by our MRC members from Sandia National Laboratories. The meeting was held at the Rio Grande Best Western, adjacent to Albuquerque's Old Town and Plaza, allowing attendees a chance to visit these historic areas during their limited free time. While attendance was down somewhat from normal, those that were there were treated to an excellent meeting of best practices, networking, and various tours and events.

The meeting kicked off Wednesday morning with several best practice presentations by Sandia personnel about many of their programs. After an introduction and welcome by Jeff Quintenz,



Lynnwood Dukes presented the Sandia Change Management approach espoused by Michael Hammer. Shelley Whitener then reviewed the reliability optimizing strategies that she and her team were using to improve their performance. Ed Williams and Shelley then presented their maintenance planning and scheduling system.



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Wednesday afternoon, Tom Byerley reported on the status of programs from the MRC including MARCON 2008, the Intern Program, and Monash University.

Kevin Stewart shared what the Alcoa Primary Products Business Unit was doing in the way of a global reliability strategy, including things that worked well and lessons learned through the process. Al Weber of Ivvara then shared perspectives on Culture Change and how being able to change is essential to long-term survival.



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Director's Corner

Spring is in the air – it's time to anticipate the return of new life to our yards, and indeed, to our overall environment. And it's a great time to consider the surge of activity and new life in our MRC activities and programs. We are currently in the midst of our busiest time of the year for the MRC.



Tom Byerley

We just conducted a great Winter members' meeting in Albuquerque, hosted by Sandia National Laboratories. You can read more about the meeting on this newsletter's cover and on page 3, and on our MRC website. I do want to thank Ed Williams and the Sandia folks for all their work in hosting the meeting.

Our MRC Intern Program is looking very good this year with over 30 positions available for students (up from 20 in 2007). Dr. Toby Boulet is extremely busy helping match up prospective interns with the companies that have requested them. Meanwhile, we are in the process of gearing up for Boot Camp (Overview of Modern Maintenance and Reliability Concepts) that we will hold the week of May 11th.

We have started the first semester in the UT-Monash Graduate Studies program for 2008 and have wrapped up all the administrative details involved with the 17 students enrolled this semester. Meanwhile the UT Masters in MRE is going well and growing in participation.

We are deep into the preparations for MARCON 2008 which promises to be our best annual conference yet. Kim Kallstrom has put together a terrific program with loads of pertinent content. With John Mitchell and Dr. Hap McSween as keynoters, along with Dr. Bob Abernethy sharing stories of the Blackbird development, this is a conference you won't want to miss. Plus, Terry O'Hanlon and Bill Partipilo have put together another larger and more diverse exhibition to add to the value.

So, like all of you, we are very, very busy at the MRC. But it is great to see the positive results of our activity: undergraduate students learning about maintenance and reliability; member company representatives sharing best practices; working professionals gaining knowledge and academic credit; MARCON attendees coming away with useful information to help them better their enterprises. I only hope my yard has such positive results this Spring.

Tom

Spring 

WINTER MEMBERS' MEETING (CONTINUED FROM PAGE 1)



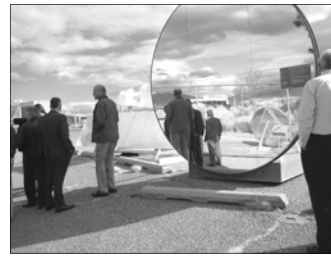
The day was finished off by a terrific tour, reception and dinner at the near-by National Atomic Museum. Gary Hoe and Wes Mozley of Sandia proved to be excellent hosts and Gary also proved to be an outstanding docent, recounting fact after fact and story after story about the exhibits throughout the museum. In addition to the exhibits and education within the museum, we had a wonderful buffet of New Mexico cuisine and experienced some terrific networking among the attendees.

The Thursday morning session brought a first-hand look into several other Sandia programs such as Roof Management, Energy Programs, and LEEDS attainment in existing buildings. James Byrd of member company BWXT Y-12 made an excellent presentation about the progress of utilizing RCM in the Y-12 facility in Oak Ridge. Then we heard from Bob Cranwell about Sandia's Center for Systems Reliability (heavy stuff).



After a brief discussion about our upcoming tour of Sandia, followed by lunch, the group boarded a bus and spent the afternoon touring part of Sandia National Laboratories (emphasis on "part"). Sandia is HUGE and it would take days to see it all. Additionally, much of the lab is behind classified boundaries. Gary Hoe and Wes Mozley, along with a couple of their colleagues, led the touring and conveyed a tremendous amount of information as we visited such far flung areas as the "Rings of Saturn"

Accelerator (the Saturn accelerator is a modular, high power, variable spectrum, x-ray simulation source), the National Solar Thermal Test Facility, the Rocket Sled Test Track, and the power plant.



It was an amazing tour and a tremendous effort by our Sandia hosts. They did a great job and we really appreciate all their work. I conclude by sharing a statement I made to the group in Albuquerque.

"I always knew that Sandia was a national laboratory – now I realize that it is also a national treasure!"

Thank you Sandia folks for hosting our meeting!

Managing the Iceberg through Basic Conditions

By: Bob Welnick, Reliability Manager, Michelin Tire Corp

****Editor's Note:** This is a follow-up to Bob's article "Managing the Iceberg through Planning and Scheduling", which was printed in the Jan '08 issue. If you missed it, you can download a copy from the MRC website. The final installment will be included in our July issue.

In the previous article, 'Managing the Iceberg through Planning & Scheduling', we discussed how planning and scheduling is the foundation of any asset utilization improvement strategy. The next step in an asset utilization improvement strategy is establishing Basic Conditions. This article will discuss what it means to establish basic conditions and how that can be done.

Breakdown Prevention Model

An analogy to equipment conditions could be shown as an iceberg (Figure 1). Many of the defects are under that surface and have yet to cause a breakdown. Finding and correcting these potential breakdowns before an actual breakdown occurs is a primary goal. Finding and correcting potential defects is like reducing the size of the iceberg underneath the water. As the size underneath the water is reduced, the number of breakdowns (represented by the ice above the water) also decreases.

How to Reduce the Submerged Iceberg?

In the first article we discussed how the process of planning and scheduling shrinks the size of the iceberg. We shrink the iceberg by identifying defects through preventive maintenance and eliminating known defects through corrective maintenance before they result in a breakdown.

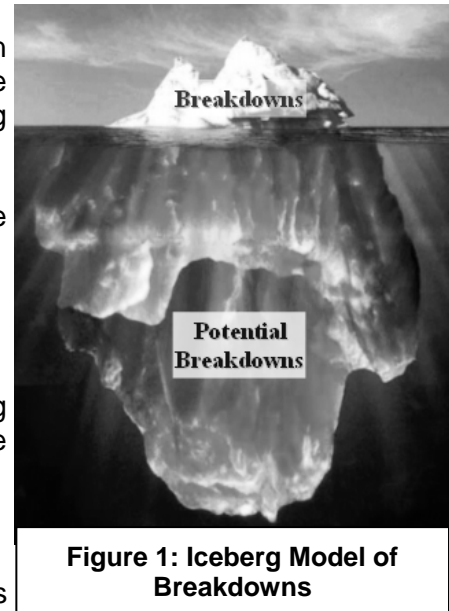
A principal of reducing or eliminating deterioration reduces the rate of growth of the iceberg. Whereas planning and scheduling can shrink the iceberg through eliminating potential breakdowns, establishing basic conditions slows the growth of the iceberg through slowing the rate at which defects are generated.

Facts to consider while shrinking the iceberg:

1. A systematic approach that is often used to reduce breakdowns is to pareto historical breakdowns over some time period. The highest breakdown causes are then targeted for evaluation and elimination. Once the highest cause is addressed, focus is shifted to the next highest cause. *This approach works as long as the major breakdown causes are chronic (recurring)*. When the major failures occurring are sporadic, this approach does not work for reducing downtime. Examples of this are unique failures that are not regularly recurring. These types of failures are addressed, but the next week or the next month other non-related failures occur and the overall downtime does not decrease.

Electronic component failures often fall into this category. These types of failures can be especially exasperating because of the time necessary to diagnose the failed or failing component. Once an electronic component failure is encountered and identified, finding the cause can be difficult. To address these types of failures the iceberg approach needs to be applied – *eliminating or improving the conditions that lead to these premature failures*.

2. Establishing basic conditions reduces the rate at which the iceberg grows, but a system is needed to actually reduce the size of the iceberg. Obviously if basic conditions are poor,



the deterioration is rapid and the size of the iceberg increases. This would be a situation where the capability to identify and correct problems is outstripped by the rate in which new problems are created, hence a reactive environment. Once basic conditions are established, accelerated deterioration is eliminated or reduced, and the rate in which failures are corrected can shrink the size of the iceberg. Hence the shift from a reactive to a planned environment becomes possible.

Figure 2 represents the initial Total Productive Maintenance (TPM) process to eliminating equipment breakdowns. Step 1 is summarized into repair and restoring existing deterioration (Planning & Scheduling). Step 2 is targeting eliminating or reducing the source of accelerated deterioration (Basic Conditions). Step 3 focuses on establishing or improving preventive maintenance (Preventive Maintenance Optimization).

These three phases are actually overlapping in their execution. For example, as existing machine defects are found and corrected, deficiencies in basic conditions are identified. In addition, as basic conditions are identified and established, preventive maintenance is created.

TPM practitioners state that applying these three phases should result in a 90% reduction in equipment breakdowns.

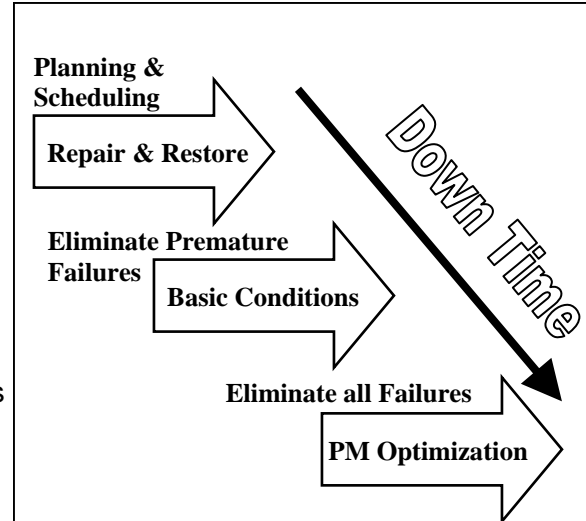


Figure 2: Maintenance Transformation Sequence

Theory of Basic Conditions

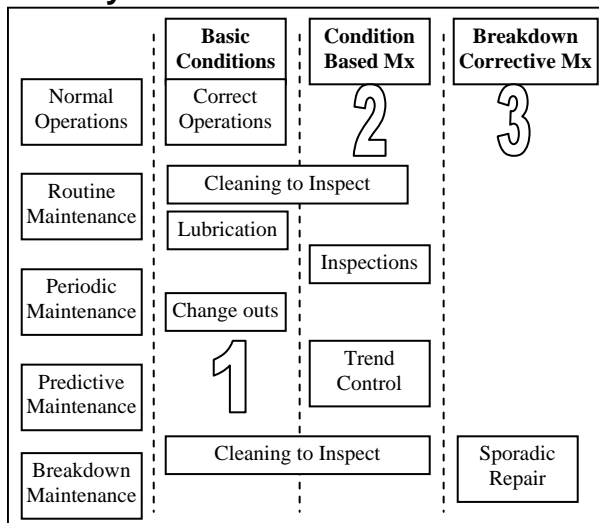


Figure 3: TPM Day-to-Day Activities

Anyone with experience in the maintenance field already understands that establishing basic conditions is plain good maintenance. The TPM term for “basic conditions” is “preventing deterioration”. Preventing deterioration is so important a concept that it is the number one priority for day-to-day maintenance activities in the TPM philosophy (Figure 3).

Classification of Equipment Maintenance Activities (Nakano, 2003, p.25-26)

1. Deterioration prevention—The purpose is to protect equipment from accelerated deterioration through routine maintenance. Correct operation of equipment and routine maintenance such as cleaning, oiling, and tightening will prevent accelerated deterioration.

2. Deterioration measurement—Even if the equipment suffers only natural deterioration, the equipment will eventually fail. In order to take some restorative actions beforehand, it is necessary to measure the degree of deterioration.

3. Restoration of equipment condition

Based on the measurement data and information, we must select the method of equipment restoration. These methods include regular replacement, regular maintenance, and regular inspection and diagnosis. These methods involve more time and a high skill level.

Figure 3 is an interesting visual subdivision of types of maintenance activities. “Preventing deterioration” are activities that shrink the rate at which the iceberg grows. “Measuring deterioration” are activities to find hidden failures that exist (submerged part of the iceberg) so that they can be addressed before causing breakdowns. “Rectifying deterioration” are activities to fix broken or failing components (reduce the size of the iceberg).

The phased TPM approach gives a good roadmap on prioritizing what to focus on first in reducing the iceberg. For example, from a TPM approach it doesn't make sense to measure deterioration (perform predictive type of maintenance activities) if accelerated deterioration is occurring. This would be likened to not changing the oil & filter on your car, but having sophisticated diagnostic equipment to know when it was going to fail (probably because of lubrication failure). This is an expensive maintenance approach.

Establishing Basic Conditions

Establishing basic conditions means eliminating phenomena where accelerated deterioration is taking place. This has two positive effects. First it drives down equipment breakdowns (reduces the rate at which the iceberg grows). Second, because components last longer, spare parts cost is reduced.

The Pareto Approach to Establishing Basic Conditions: The first challenge is to look at the production machinery with a new set of eyes. In a reactive environment the focus is on the biggest causes of downtime and coming up with strategies to reduce these. This strategy can be effective with recurring type of failures. However, how do you handle non-recurring failures? Non-recurring failures are identified by pareto charts. If top causes of breakdowns change from month to month, how do you know what to attack first? When these unique failures occur they are viewed as unique and the problem is seen as fixed when the component is replaced and the equipment is put back into operation.

Another type of failure difficult to prevent are failures with no P/F interval. From a preventive approach these are components traditionally classified as run-to-failure.

Examples of these are electronic failures. If a major cause of breakdowns is caused by electronic component failures and the maintenance strategy is run to failure, when a failure occurs the common consensus is that there is nothing you can do to prevent this because you cannot predict it. Again, since these are viewed as non-preventable the consensus is that the problem is solved when the component is replaced and the equipment is back in operation.

This is where a mindset change is required. Someone has to stand up and say, “No! Failures can be eliminated; we cannot accept that this is just the way it is.” This is a turning point. When the maintenance management starts not accepting previously accepted failures a transformation has already started. Addressing the example of electronic failures, someone needs to start asking and finding out what is causing the failures. Are the control cabinets being maintained at the proper temperature? Are the control cabinets being contaminated by dirt from the surrounding environment? Is poor power quality impacting the electronic components? Is the cabling being properly shielded? Are components in the cabinets affecting other components?

Still using the pareto approach, we look at classes of components related to failures instead of just individual components. From this approach it may show significant downtime or maintenance cost related to electronic components. Or it might point to lubrication type of failures. In any regard these types of failures scream the need to address basic conditions and eliminate accelerated deterioration.

*****Don't forget to read our July issue for the final installment of the article where Bob will discuss the TPM approach to establishing basic conditions.***

2008 MRC Intern Program

This year's intern program has blossomed with over 30 company positions now available. Dr. Toby Boulet is busy helping match up our bright young engineering students with those company positions. As the demand for industrial maintenance and reliability professionals continues to grow, this program of introducing potential engineers to the field is a proven success. If you are not already taking advantage of this membership benefit, you should certainly consider it.

For more information about the program, visit our website, e-mail us at mrc@utk.edu, or call us at (865) 974-9625.



Some of the
2007 MRC Interns

Overview of Modern Maintenance and Reliability Concepts

May 12 – 16, 2008 UT Campus Knoxville, TN

Sign up now for this outstanding one-week overview course conducted in conjunction with our MRC Intern training (Boot Camp). Learn from noted faculty and industry presenters as they share the latest thinking in the maintenance and reliability field.

This is an excellent introduction for new or young professionals in the field and also an excellent re-enforcement for those who have been in the field for a while. See **pages 10 and 11** for the agenda and application form. **You do not have to be an MRC member to attend.**

Missed Getting Started in this Year's UT-Monash Master's Degree Program??

It's not too late to apply for Semester 2!!

This year, we converted back to a semester basis in the UT-Monash Master's Degree program. Semester 1 runs from March through June and Semester 2 runs from July through October. Now is the time to apply for enrollment in Semester 2 if you would like to get started with earning your Master's Degree in Maintenance and Reliability Engineering. This distance delivered program is well established as an excellent program that provides solid, useful information to the participants.

If you would like to get going on the dream of earning your Master's Degree, then go to our website at www.engr.utk.edu/mrc and click on Professional Development and then on the UT-Monash program for details and an application. Don't delay!

3 Outstanding Pre-Conference Workshops!

- Physical Asset Performance Management
 - Basic & Intermediate Reliability
 - Weibull Analysis

3 Informative Presentation Tracks!

- Asset Management
- Best Practices/Case Studies
- New Technology/Research

Special Session: "Tales of the Blackbird" with Dr. Bob Abernethy

MARCON '08

Knoxville, TN • May 6-8

Register On-Line Now:

<http://www.engr.utk.edu/mrc/marcon>

This year we are co-located with:

Plant Engineering and Maintenance Show

Managing a plant or facility is serious business in today's intense environment and you have no time to waste!! Now, in conjunction with the great program content of MARCON 2008, we have put together 2 days of value packed solutions that support better operations and maintenance and help you meet mission critical goals while keeping your operations running smoothly.

Attendance at the Plant Engineering and Maintenance Show is free, so you can bring additional colleagues or your entire team to see the latest products, services, software and technology on display all in one place over one or two days.

You can find a list of participating solution providers on the MARCON website.

MARCON KEYNOTE PRESENTATIONS...

Keynote #1, Wednesday, May 7th: John Mitchell, Meridium, Inc.

“Value and Risk Based Asset Management”

One of the primary challenges facing any asset management program is prioritizing opportunities to match resources—a crucial bridge—for there are always more of the former than the latter! Rather than beginning an optimizing process from the bottom with one or more programs such as RCM, RCA, CBM, Work Management, etc, industry leaders are beginning to identify opportunities from the top based on statistical analysis and factors such as risk, lost production and increased business value.

In this sequence, programs, practice and technology are selected to address and provide the greatest results for specific improvement opportunities. This is far more effective when compared to selecting a program first and hoping value will be discovered somewhere along the implementing path. In addition to the well known Pareto analysis, leaders are utilizing Weibull and comprehensive risk analyses to identify and prioritize improvement opportunities by potential business value. Whether these or other methods are employed, accurate, accessible data, powerful analytical methods and reliability professionals who can successfully bridge from business objectives to value directed technology and practice are a must.

The concept of asset management as a top down, master process driven by statistical analyses of variations from performance and cost objectives may be somewhat unconventional. With that stated, centering an asset management program upon the localization and prioritization of opportunities for improvement by value potential offers major opportunities for increased effectiveness during initial implementation as well as within a mature program.

This presentation will outline the processes used by several industry leaders, factors driving them in this direction and imperatives for success.

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Keynote #2, Thursday, May 8th: Harry “Hap” McSween, The University of Tennessee’s Dept. of Earth & Planetary Sciences

“Reliability of the Mars Exploration Rovers”

Design and assessment of reliability for a Mars rover mission are obviously essential, as there are no adjustments (other than uplink of new software or changes in operations procedures) that can be made after launch. The Mars Exploration Rovers (Spirit and Opportunity) have faced numerous unexpected challenges, stemming from engineering problems and from the harsh Martian environment. The triumphs and tribulations of these rovers will be reviewed, as well as some sense of the exhaustive reliability testing NASA mandates for spacecraft and flight payloads. We will also consider procedures adopted to ensure the reliability of operations directed by fallible scientists and engineers. The synergy provided by having other spacecraft orbiting Mars simultaneously also has increased rover reliability. The remarkable reliability of both rovers is demonstrated by their continued scientific operations far in excess of their stipulated design capabilities (originally designed to operate for three months, they are now in their fourth year of operations).

Overview of Modern Maintenance & Reliability Concepts Tentative 2008 Schedule

Monday, May 12th	
8:00 - 8:30	Welcome/Introduction
8:30 - 10:00	What is MRE?
10:00 - 10:30	Break
10:30 - 12:00	Reliability Basics (equations, design, etc.)
12:00 - 1:30	"Get Acquainted" Lunch & Social Time
1:30 - 3:00	Reliability Basics (equations, design, etc.)
3:00 - 3:30	Break
3:30 - 4:30	Case Study
Tuesday, May 13th	
8:00 - 8:30	Case Study Reports
8:30 - 10:00	RCM
10:00 - 10:30	Break
10:30 - 12:00	RCM
12:00 - 1:00	Lunch
1:00 - 2:30	Planning/Scheduling/Preventive Maintenance (PM)
2:30 - 3:00	Break
3:00 - 3:45	Metrics & Measures
3:45 - 5:00	Physics, Mathematics, CBM Technologies
Wednesday, May 14th	
7:00 - 6:00	CBM Technologies and Plant Tour
Thursday, May 15th	
8:00 - 8:30	Case Study Reports
8:30 - 10:00	RCFA
10:00 - 10:30	Break
10:30 - 12:00	Tying it Together
12:00 - 1:00	Lunch
1:00 - 2:30	Tying it Together
2:30 - 5:00	Case Study
Friday, May 16th	
8:00 - 11:00	Final Case Study Reports
11:00 - 11:30	Expectations
11:30 - 12:00	Wrap-Up
12:00	Early Dismissal for Travel

Maintenance and Reliability Center

“Overview of Modern Maintenance and Reliability Concepts”

Attendee Registration Form

May 12-16, 2008

(Please complete one form for each seat requested)

A. Attendee Information:

Company: _____

Address: _____

City: _____ State: _____ Zip: _____

Company Attendee: _____

Position: _____

Phone: _____ Fax: _____ Email: _____

B. Enrollment Fees:

Is this a complimentary enrollment for a company supporting an intern?: _____

Or an additional MRC member company enrollment at \$1000/week: _____

Or a non-member company enrollment at \$2,000/week? _____

C. Return completed application to:

Maintenance and Reliability Center
The University of Tennessee
506 East Stadium Hall
Knoxville, Tennessee 37996-0750

For additional information contact the MRC at
Phone: (865) 974-9625 or (865) 974-8376
Fax: (865) 974-4995

**Maintenance & Reliability Center
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We're on the Web!
www.engr.utk.edu/mrc

MRC 2008 Calendar of Events

Apr 11	MARCON Early Bird Deadline
Apr 14-17	MARTS, Rosemont, IL
Apr 16-17	SMRP Executive Meeting, Chicago, IL
May 6	MARCON Workshops
May 7-8	MARCON & Plant Engineering and Maintenance Show, Knoxville, TN
May 12-16	Intern Boot Camp and "Overview of Modern Maintenance and Reliability Concepts" Training
May 12-Aug 8	MRC Intern Work Session

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