Capacity Improvement through Maintenance Optimization

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Process Optimization Conference

Marriott Houston Westside
Houston, Texas

April 8 – 10, 1997

Organized by
Gulf Publishing Company
and
HYDROCARBON PROCESSING

Capacity Improvement through Maintenance Optimization

5 Essential Elements for every Asset Management Program

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Overview and Vision

Today's dynamic forces are reshaping how companies are doing business. Business process reengineering has demonstrated that new technologies and methodologies are available today to combat competition and tackle the challenge of increasing profits while improving the reliability of plant assets. The culture of the organization must change to recognize that "maintenance" is not just an evil expense that rears it ugly head when production and operations need their help; but rather that "maintenance" is a process that directly impacts "capacity", and that "capacity" drives the profits of the corporation.

It is easy and traditional to look at a tank of raw materials that is 80% expended and say that unless we add to the tank, we will only be able to produce *xxx* more pounds of product. Then why is it that we don't look at a pump or motor, for instance, with the perspective that it only has *yyy* amount of product that it can produce before it is degraded past the point of acceptable performance?

One additional challenge is to reduce costs while executing your new maintenance program. The area of maintenance, for many companies, is the single, largest, controllable cost within an operating system. The goal for all of these companies should be to transform their maintenance process into a "proactive" environment, where they experience all of the benefits of having maximum control over their maintenance issues. New technologies and methodologies are available today to put into practice these challenges that will elevate them to "world class" levels.

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Follow the 5 essential elements of maintenance optimization and you will get dramatic improvements not only in production capacity, but a greatly more knowledgeable workforce and work group service team.

The meaning of Business Process Reengineering as it relates to Maintenance

To meet our capacity improvement goals may require that we completely reevaluate how we do business, and how we do maintenance. Let us term this process … "maintenance optimization."

With the help of Michael Hammer and Steven A Stanton from their book The Reengineering Revolution, let's make sure that we all understand this often, misused and simply abused term.

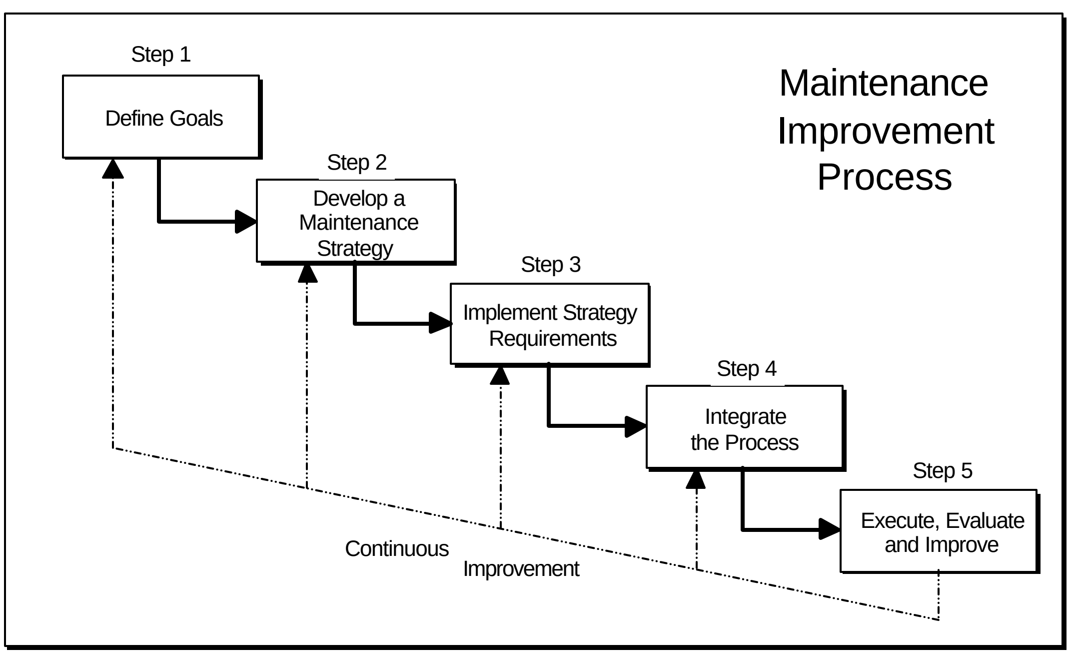
> The purpose of the maintenance optimization process is to offer fundamental rethinking and *radical redesign* of business *processes* to bring about *dramatic* improvements in performance.

Dramatic improvement is not about making marginal changes, such as 5% to 10% improvements, but rather about making quantum leaps in performance, achieving breakthroughs.

Radical means going to the root of things. The optimization process is not about improving what already exists. Rather, it is about throwing it away and starting over; beginning with the proverbial clean slate and reinventing how you do your work.

Process recognizes a group of related tasks that together create value for the customer. Taking tasks individually, not one of these activities is of the slightest interest or value to the customer. The customer's only concern is with the end result.

Maintenance optimization is about how work is done. We often think of design as applying only to products. Yet, maintenance optimization is based on the premise that the design of processes - how work is done - is of essential importance. The starting point for organizational success is well-designed processes.



Step 1 Define Goals

Prior to embarking on any new process, clearly define the targets and objectives, and communicate those goals to every member of the team.

Some goals will be broad and general because of a well documented history, while other goals will be crisp and to the point. All goals must be measurable and contained within a specific time reference.

The goals are extremely important because they establish the measures of effectiveness by which to evaluate whether or not the program is successful. They also provide the guidelines for continuous improvement during the entire duration of the program.

Typical goals for a capacity improvement and maintenance optimization process would be:

- Improve overall system availability by ___ %
- Improve customer satisfaction index by ___ %
- Decrease maintenance expenditures by ___ %
- Decrease unplanned outages by ___ %
- Decrease annual equipment replacements by ___ %
- Improve craft skill and cross-training knowledge by ___ %
- Decrease personnel overtime by ___ %
- Improve the documentation of equipment problems by ___ %
- Implement automated work order processing for ___ services centers by {date}
- Reduce the number of safety related incidences by ___ %

Step 2 Develop Formal Maintenance Strategies

Cost effective maintenance clearly improves the company's bottom line. Equipment reliability is improved, equipment life is extended, product quality is improved, and capacity goes up. The net effect is an improvement in the overall equipment effectiveness (OEE), achieved by increasing the combination of factors associated with availability, capacity and quality.

The key issue in order to achieve improved OEE is therefore …

> "What is the best process by which to maintain and operate the critical and important equipment?"

World class organizations are rapidly discovering that the best maintenance strategies consist of a mix of time-based, condition-based, and run-to-failure tasks. Strategies are developed by understanding the functions of the equipment and systems, understanding how degradation and failure impact the ability to meet those functions, and then generating regular tasks that should be performed on that equipment. This is the desired result of Reliability Centered Maintenance (RCM), but experience has shown that the traditional methods of performing RCM are expensive, paper intensive, and difficult to implement.

Do RCM, but make sure you do it right.

When performed correctly, the RCM maintenance strategies will address the following key areas:

- What are the "right" things to do, on a consistent basis, to keep the equipment running better and longer?
- What tasks are we currently doing that seem to have little value, and can be eliminated?
- Are there some technologies better than others at providing the condition assessment information that we need.
  - good condition assessment information is critical when it comes to building confidence toward eliminating maintenance tasks that have been being done for many years.
- What monitoring instrumentation would be cost beneficial to install or acquire?
- What are the best "frequencies" to perform tasks in order to get the maximum benefit?

There have been many lessons learned from both successful and unsuccessful RCM endeavors. Some of these lessons learned are shared here.

- The key to good results is an excellent strategy. The result of the program seems to grow exponentially with the effort expended in the early RCM strategy development phase.
- Get broad buy-in on the maintenance strategy at all levels. Increased buy-in improves the success of execution. Better buy-in is achieved if everyone understands the process and is offered some opportunity of involvement on the strategy development phase.
- Use good RCM software that promotes faster and easier development. RCM Strategy Plus™ is designed for streamlined development with maximum interface to the entire maintenance optimization process. Contact the author for inquiries and information.
- Implement RCM strategies as soon as they become available. Don't wait to implement several at the same time, as this delays the potential results.

As these strategies become implemented, the maintenance philosophy will transform from being a "reactive" program to a "proactive" program. In other words, corrective maintenance requirements will be replaced by tasks that are designed to prevent failure. The net effect is positive control over the equipment, resulting in positive control over the process.

Step 3 <u>Implement Strategy Requirements</u>

Implementation of the strategy requirements concentrates on the resources that are necessary to be able to execute your new program.

Specifically, these resources are:

1. New enabling technologies, including an integrated information system and monitoring instrumentation.

2. Computerized Maintenance Management System (CMMS)
3. Maintenance procedures.

4. Operator & technician training

New Enabling Technologies

If the maintenance organization wants to make better business decisions about their equipment, then they absolutely need two things.

- They need to have better information about the condition and performance of their equipment, and

- They need to know how to consistently use that information.

There are a number of new technologies that are available to provide better information about the condition and performance of equipment. Classified under the general category of "predictive" tools, these would include such technologies as vibration analysis, thermography, motor analysis, performance trending, etc. The list is huge, and most of them are very good at providing the information that they advertise within their "niche" specialty. The biggest disadvantage of most of these technologies, is that they fail to adequately integrate their information to the information from other technologies in order for the operator to make a better "correlated" assessment.

The second issue is personnel related, and it is becoming more critical as the work force is rapidly losing the senior "knowledge experts" and replacing them with junior, inexperienced staff. There needs to be a way to capture this expert knowledge from the most senior staff, and package it in a way that it is available to every member of the team for optimum diagnostic and trend analysis.

EQL TAPSÔ

EQL's Total Asset Performance Solution™ provides the functionality to meet those two needs. It incorporates a number of industry proven tools that integrate with the "predictive" monitoring instruments, and also builds "expert" diagnostic rules using those monitored parameters based on the knowledge of the most senior technicians and engineers.

One of the tools in EQL TAPS™ was developed in response to the U.S. Navy's simple directive from the Pentagon:

"Operate and maintain the fleet for 40% less cost without sacrificing readiness."

In 1990, the Navy began testing this system aboard ships, and results were so outstanding, that in 1992, the Navy identified this system as the core technology around which to implement condition-based and diagnostic monitoring.

In 1996, this technology was transitioned to a commercial environment with the processes and methods used by most utility and industrial applications. This technology and the associated methodology offers the radical redesign of business processes and dramatic improvements in performance that maintenance optimization strives to achieve.

CMMS Implementation

An effective computerized maintenance management system is critical to the optimization process. Considering the thousands of companies that sell them, and the large volume of literature about them, it would be very surprising to discover an industrial company not using a CMMS in some form or another.

Regardless of who's CMMS is being used, maybe even in-house developed, experience has proven one point.

An effective CMMS is the one that gets used, not the one that costs more or has the most features.

Keep it simple !!

The implementation of a CMMS is always a difficult experience, but if performed properly should exceed expectations. Particular areas of difficulty usually include a change in culture, initial training, conversion of data from the old system, and often accompanied by new hardware unfamiliar to the users. Carefully selected consultants can help ensure that this is a pleasant and successful experience.

Maintenance Procedures

As the strategies get executed and the maintenance tasks are performed, the only way to apply consistency to the performance of those tasks is to follow a formal procedure. Technicians without discipline will ignore procedures under the illusion that their knowledge is adequate and they don't make mistakes. We wish to congratulate those technicians for their knowledge and skills, and the authors humbly admit that we don't stand up to such perfection.

But when the equipment maintained by such a technician fails, (usually repeatedly), then typical questions that arise might be:

- were the replacement parts defective?
- was the equipment operated in a manner it wasn't designed for?
- what is the failure history of similar equipment, and are they maintained the same way?
- was the proper procedure performed, and does the procedure need to be modified?
- did the technician(s) fail to perform any step of the procedure, or perform one of the steps improperly?

Without written procedures these questions will rarely be answered properly, and the equipment will have to fail several times before the real reason becomes known.

Procedures not only add consistency to the maintenance process, provide a means for improved training to junior technicians, but also eliminates many of the above questions and allows the investigator to focus on fewer potential causes of the problem.

Operator Training

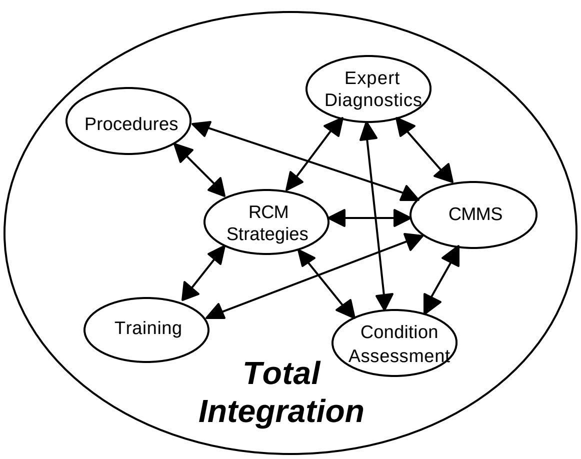
Operator training follows very closely to the comments associated with maintenance procedures. If the equipment strategy dictates that equipment be operated in a certain way, then operators need adequate training to do their jobs properly. Enough said.

Step 4 Integrate the Process

If you've succeeded in developing all of the individual pieces of the maintenance optimization program discussed so far, you're doing very well. You will see improvements, and you have the framework for continued success. But it's still not world class.

The competition is doing all those things too.

The next requirement is to integrate all of the above elements into a common architecture so that all information is available to every member of the team, all the time.



The power of maintenance optimization is that information and knowledge drive the business decisions. No longer acceptable is the process that would takes days and weeks to gather accurate information and to act on it, especially when it comes to equipment reliability and unplanned downtime.

The information infrastructure is available to integrate all of the above elements, and the successful companies are designing today's processes to meet tomorrow's needs.

Step 5 Execute, Evaluate and Improve

As with all processes, achieving the desired proactive environment will take time and continual adjustments during the journey.

The defined goals and measures of effectiveness must be evaluated regularly to determine how successful the strategy and the execution of the strategy actually is. Normally, a combination of reliability engineers, manufacturing managers, and business managers comprise the team to evaluate the progress of the program.

If the goals were achieved too easily, then they need to be modified to shoot for higher limits. If it appears that the goals might be unachievable, then perhaps the strategies or the execution may need adjustment before actually relaxing the goal. In either case, continual improvement is essential as is continuous communication to all of the team members.

SUMMARY

We hope that this article has been thought provoking and has helped you identify areas in your plant that can benefit from a reengineered management program.

The maintenance optimization adventure can be an extremely rewarding experience, and the authors wish you the best of luck in your journey.

We would appreciate your questions or comments. Please don't hesitate to call either:

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RCM Strategy Plus™
EQL TAPS™
EQL AMMO™

Mr. Dundics has over 22 years of experience in the nuclear, utility, and general industry with particular emphasis in the areas of equipment reliability and plant operations.

Mr. Dundics graduated with honors from the U.S. Naval Academy in 1975, and qualified as Chief Engineer for Navy Nuclear Propulsion Plants after performing duties as Reactor Training Officer, Principal Assistant, and Chemistry and Radiological Controls Officer. Also served on the Nuclear Mobile Training Team (MTT) to prepare all nuclear ships for successful acceptance by the Operating Reactor Safeguards Examining board.

After leaving the Navy, Mr. Dundics worked with NUS corporation managing on-site start-up and operations contracts, Gilbert Commonwealth as an Instrumentation and Controls Engineer, and was an integral member of the U.S. Navy's Advanced Research and Development Team as consultant in the development on a state-of-the-art integrated condition assessment technology. He is a registered Professional Engineer, and has held positions on the board of Regional High Technology Councils.

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Mr. Lapicola has over 25 years of experience in the nuclear industry with particular emphasis in the areas of testing, startup and plant operations.

Formerly, Mr. Lapicola served as President of AVO Multi-Amp Services Corp. and AVO Technical Services, Limited. Mr. Lapicola was also Director of the AVO Multi-Amp Institute, America's leading provider of electrical maintenance training.

Mr. Lapicola graduated with distinction from the U.S. Naval Academy in 1968, received his Master's of Science degree in Engineering Mechanics from the Naval Post Graduate School in 1969, and qualified Engineer of Navy Nuclear Propulsion Plants while serving in the nuclear submarine force.

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