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The Ideal Philosophy and The Pain of Implementation

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The Road to Proactive Maintenance: *The Ideal Philosophy and The Pain of Implementation*

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Abstract

The alphabet soups of maintenance, monitoring, diagnostic, and scheduling programs that are out there to help maintenance personnel perform their tasks in a planned and cost-efficient manner are many and varied. The optimum choice is out there somewhere. How do you read between the lines to select the methodology that helps you do your job and gets you where you want to be in the shortest amount of time and effort? The “trick” appears to be in how your organization is structured and what hoops and hurdles you have to overcome in that nasty phase called implementation.

This paper will present some lessons learned in the school of hard knocks and some of what all maintenance organizations either have learned or will find out when they wade into the proactive maintenance philosophies that abound in the commercial world.

Maintenance Philosophies

The Old Philosophy: A Vicious Circle of Breakdown, React, Correct

Many people refer to this “run-to-failure” attitude as *maintenance*. Folks mistakenly call it corrective or reactive maintenance (RM.) However, this is really no maintenance at all. A company or household could operate its equipment, systems, and machinery in this manner without a maintenance department of any kind just buying rebuilt or new equipment. From a systems or process standpoint, it is a type of maintenance, but from the standpoint of an individual component or machine it is no maintenance at all.

As obvious as this is, many companies today have maintenance departments consisting of management, engineering, supervisory and craftpersons to perform 75-85% of their maintenance tasks *after* their equipment, system, or machinery has ceased to function.

Some serious questions need asking:

- Are managers really utilizing their maintenance departments to obtain optimum management of their companies' assets?
- Would maintenance departments themselves (usually consisting of some engineers and technical people, supervisors with craft backgrounds, and seasoned craftpersons) recommend that the companies' equipment, systems and machinery be operated in this manner?

We all know the answers to these two questions. However, we also know that it is very difficult to change our methods of operation. Take heart! Many companies *have* changed.

A Better Philosophy: Periodic, Preventive Maintenance (PM)

Preventive maintenance (PM) is a step forward from the “run-to-failure” philosophy. There are many and varied PM programs, but they are all *time-based*—they all refer to maintenance performed at *fixed-time* intervals. In many cases complete rebuilds are performed at intervals derived from averages of machine time to failure data. The philosophy of *preventing* unforeseen breakdowns by rebuilding before the average time to failure arrives is a good one. However, the problem with this philosophy is twofold:

- The actual condition of the machinery is not considered.
- The deviation from average varies greatly among varied equipment, systems, and machinery.

Unnecessary rebuilds, parts replacements, and production or process downtime occur all too frequently in the best of PM programs. Sometimes new problems are introduced by installing the wrong parts or improper installation of the right parts, validating the saying “*If it ain't broke, don't fix it!*”

As early as the 1960s, maintenance philosophies were changing.

Completely New Philosophies on The Road to Proactive Maintenance (PAM):

These new philosophies are all *proactive* (acting in advance to deal with an expected difficulty; it is the opposite of *reactive*.) The proactive proportion depends upon the particular philosophy (or variation of it) and its peculiar implementation in your company.

All of these new philosophies contain an element of condition monitoring (CM.) To be more accurate and to help clarify their usefulness as maintenance philosophies, they all monitor *condition changes*, so CM represents the first real effort to move upward from PM. We may not need a weatherman to know which way the wind is blowing, but we will need one if we want to know which way *it will be blowing* at some future point in time. He does this by monitoring *changes* in conditions.

To drive home this point, how many games do you think your favorite football team would win if their entire football strategy were only *reactive*? Do you believe they need not consider what their opponent might try after half-time? They would probably lose about 80% of the time, which is about the same percentage as our average *corrective* or *reactive* maintenance activities across the country.

Would you blame the players for the 80% losses? The obvious answer is no. However, in the maintenance arena, the tendency is to blame the players when the coaches and the team owners are calling the shots. The 80% corrective or reactive maintenance jobs result in 80% lost opportunities for the company to maximize cost savings and production capacity.

When we make even the slightest inroads toward developing and implementing any of the above philosophies, we are truly on the road to proactive maintenance. Staying on the road is tough. You must have a destination and a desire to get there.

The Proactive Philosophies

Predictive Maintenance (PdM)

This is probably the term most widely used today for a proactive philosophy. However, in some ways, other philosophies go beyond the predictive philosophy of maintenance. Predictive maintenance philosophy is a giant leap from even the PM philosophy. Predictive Maintenance is condition based. For example, by using mechanical, performance, and lubrication condition information for rotating equipment, maintenance histories; operators' logs; and process performance data, near-term operating life can be predicted so that maintenance can be planned and scheduled to lessen the impact on production, operations, or research projects.

Predictive maintenance actually produces a product when production, operations, or research uptime and availability are considered. That product is quantifiable capacity or availability. A question immediately comes to mind:

Why have all maintenance organizations not adopted this philosophy for maintaining equipment, systems or machinery critical to their production, operation, or research project?

The answer follows:

*"[It is]... easier to justify repair costs than to invest in more efficient Predictive Maintenance" -John Mitchell, Author,
Introduction to Machinery Analysis and Monitoring, 2nd Ed., Penwell, 1993*

As more and more companies prove the value of PdM through true maintenance cost reductions and real increases in availability and uptime, the remaining companies are beginning to ask why their maintenance programs are not more efficient. Predictive maintenance can help them become so.

It is easy to see from the estimate below or from an estimate for your own organization how the cost of implementing a PdM program could be recovered in as little as 12 months.

Maintenance Program Philosophy	Maintenance Cost Per Horsepower per Year (estimate)	Approximate Maintenance Cost for 100 Critical Machines @40 HP
Run to Failure or RM	20	\$80K
Preventive Maintenance	14	56K
Predictive Maintenance	7	28K

Reliability Centered Maintenance (RCM)

Maximum reliability is the goal of RCM. Everything necessary to ensure reliable equipment, systems, and machinery goes into successful RCM. RCM focuses on cost-effective

maintenance for equipment, systems, and machinery down to each individual component. The cost of avoiding failures and the environmental impact of failures are considered in RCM.

RCM is traditionally a reliability and maintainability (RAM) focus on mean time between failures (MTBF) of components for a system reliability calculation. Therefore a full RCM analysis is usually done prior to plant startup. RCM furnishes a list of prioritized systems and components to the maintenance department prior to baselining.

Goals and objectives are clearly defined and agreed to by all stakeholders. When considering the fact that government facilities are usually more concerned with reducing the damage done—especially to the environment—than with reducing the cost of production, it seems an RCM-type philosophy would be a minimum requirement for success.

RCM has been refined and fully utilized by the Electric Power Research Institute (EPRI) and the nuclear power industry.

Demand Activated Maintenance (DAM)

All of the prior philosophies mentioned are recognizable terms familiar to many maintenance people. The one mentioned here is different. It is a proactive maintenance philosophy developed to address specific problems at specific production plants, but it can be used to address your plant or organization's problems as well.

DAM is maintenance performed only when necessary,

- according to your plant's process physics and economics impact
- according to anticipated future production runs including load variances
- according to the economic realities that sometimes require an *intelligent decision* to keep production running under conditions of slight, temporary quality degradation vs. major shutdown in late run stages that could mean customer demand would not be met. [This decision at first glance may seem like the wrong one from a proactive maintenance standpoint, but if process downtime impact and the negative cascade effect upon all companies and customers involved is considered, it may well be the bottom line best choice.]

DAM requires a sophisticated, anticipatory algorithm to "predict lifetime" of equipment, systems, or machinery. It uses computerized monitoring *ala* PdM, and combines this data with process, economic, and safety data or any data deemed valid.

DAM would make it possible to automatically predict the nature and time of a failure, and calculate the safest and most cost-effective point in time to perform the exact optimum maintenance on the exact equipment, system, or machinery!

What CEO would not embrace a maintenance philosophy and its implementation whose primary goal is to perform maintenance only when it is absolutely necessary to carry out his or her company's mission? Or to meet his or her company's production schedule? Or to satisfy his or her company's customers' demands? *Or better yet, factor in each variable according to the DEMANDS of the company, which would ACTIVATE an optimum MAINTENANCE SOLUTION based on those demands!*

Condition Based Maintenance (CBM)

Ideally, the condition of equipment and machinery and the performance of processes and systems are assessed against established normal conditions and performance in order to recognize the abnormal condition. In so doing, catastrophic failures and unnecessary preventive maintenance rebuilds can be avoided. Realistic normal condition must be established for the program to be valid.

If you add the phrase, "context-dependent" to the term CBM, you have a very close corollary of demand activated maintenance.

The Ideal Philosophy for Your Organization

It Is Out There, Somewhere: The Optimum Choice

As you can see, no one philosophy will fit any organization to a tee. It is true the optimum choice is out there somewhere, but it is even more true that it currently exists in your company, in your organization, in the hearts and minds of your people. The mechanics of the technologies, the methodologies of implementation, and so on, is the easy part. More on this later. For now, believe that this optimum choice, this ideal philosophy can be discovered.

It Can Be Discovered

The key is there—it is right there in your plant, in your organization, in the hearts and minds of your people. Do you know any craftperson, supervisor, janitor, manager, secretary, CEO, engineer, operator, technician, production supervisor, research scientist, maintenance mechanic, finance officer, safety officer, auditor, or environmentalist worth his or her salt who does not want to be a contributor to your company's success in his or her heart of hearts? Everyone should be involved: ask, listen, and *empower!*

It Must Be a Key Combination Derived from the Alphabet Soups of Philosophies and Their Methodologies in the Journey to a Proactive Philosophy of Maintenance.

Are you getting the picture yet? The problem is much bigger than being just a maintenance problem. Maintenance is a part of the organization. Any time maintenance fails in its function of maintaining the equipment, systems, and machinery, the entire organization suffers.

It Must Be Effective, Cost Efficient, and Direct

It must get there with the least expenditure of time and effort. Today's competitive world economy demands it.

The Pain of Implementation

Experienced By All

Everyone who has ever tried to implement something new has experienced pain.

The pain of

- Change
- Something new
- Realizing past ways are not the best ways
- Adopting proactive philosophies, or at least in the beginning

It is easy to pick up the jargon of new philosophies, but it is much more difficult to adopt them:

“Too many plants attempt to implement these tools [...such as predictive maintenance...], but fail to implement changes that correct poor practices, attitudes, and philosophies that are the root-cause of poor plant performance.”
-Keith Mobley, “Commitments and discipline: keys to improvement,”
Plant Services, January 1997

Why is this so? It is because of *The Pain of Implementation!*

It Can Be Eased By Revealing Some Lessons Learned

This is true. By learning from the “school of hard knocks,” the pain can be eased by anticipating what may lie ahead on *The Road to Proactive Maintenance*. Guidance for the journey can also help to ease the pain.

The preliminaries have concluded. Orientation has ended. It is time to go to *school!*

The School of Hard Knocks

Hard Knocks 101:

We have all been to this school. It is painful but necessary to some degree. Some things must be discovered by the old trial and error method, and it is foolish to think everything on any subject can be learned by anyone without attending this School.

Hard Knocks 199:

Don't go there! Some people never learn any other way. However, most people are glad to learn from the mistakes of others so they do not need to continue “reinventing the wheel.” Every person, organization, and company is different. If just one hard knocks lesson can eliminate just one stumbling block for one person, organization or company, this paper will be a success!

Hard Knocks 101

Who Needs a Plan or a Process; Let's Just Do It?!

A proactive maintenance philosophy will not evolve on its own. It takes planning. It takes processing. It takes applying a systematic approach to solving your maintenance problems by anticipating them before they arise.

Hey, Maybe We Can Do This Without Top Management Support.

Look at all of the improvement projects, major changes, and innovations in your plant or organization, and identify just *one* that came to fruition without top management support. If you can identify one, it will be an extreme rarity.

Let's Not Use the People Who Actually Maintain the Machinery.

This is great, provided you do not want to implement a real, effective program. No information from any source can replace the experienced eyes, ears, hands, heart and mind of the experienced millwright, electrician, machine technician, maintenance mechanic, pipefitter, technician or whomever the craftperson may be. No matter what some may say, the fact remains,

“It takes exactly twenty years to get 20 years' experience, no more, and certainly no less.” -Anonymous

It is true, computerized, interactive training can shorten the *learning curve*, allowing untrained persons to become useful in a shorter period of time, but it is no substitute for experience. If your organization or company is fortunate enough to have people with several years of experience actually *working* on the equipment, systems, or machines to be maintained under a new philosophy of maintenance, your program will possess one of the major ingredients for success. You will probably learn more from your mistakes than your successes, but if you have no one in the field to see the mistakes, you do not “close the loop.” If you do not learn from your mistakes you are doomed to repeat them.

When We Do Something Good, Let's Keep It a Secret Until a Later Date

There are a lot of reasons for doing this:

- Fear of discovery of minor errors
- Tendency to perfect before broadcasting small, early success
- Standard reporting technique not yet developed
- Fear of ridicule

These may or may not be good reasons, but they are all invalid when trying to implement a successful proactive philosophy of maintenance. Why? Because *perception* in today's work environment is at least as important as *reality*. If you do not broadcast your program successes in the early stages, you probably will not have any program to talk about later!

Reporting, Cost/Benefit Summaries, and Justifications Just Add Extra Work—Forget Them!

Not only must you begin doing these things as early as possible, you must realize the necessity of continuing them throughout the duration of any proactive maintenance program. When these are discontinued, even the best of these programs will wither and die. Either progress is being made or the program is dying. Without a *progress report*, most managers assume there is nothing positive to report. Without a *justification* for continuing a program after most of the easy fixes are done, the program will be seen as having fulfilled its original purpose.

You may have read one of the many true stories similar to this story. It is about a good PdM program—a model of success for the maintenance organization and the company. Four years down the road, the Plant Manager retires or transfers to a new company. The new manager is looking for cost-cutting measures. He looks at the reduced or nearly non-existent unexpected failures, and he decides to dismantle the entire PdM program. The moral of the story is: eternally *justify!*

Do you notice the change? Nothing in today's global economy and global work unit is a finished product. It is constantly evolving or devolving. This may seem like a minor point,

but it is this very change in basic attitudes toward maintenance as well as the work ethic generally that is required for success in today's environment! That is why no single program or philosophy will be ideal for you, your company or your organization *unless you make it yours! It will then change as necessary to KEEP it yours, because when it is yours, you will nurture it.* True also, if it is *yours only*, you will be the *only one nurturing*. It takes everyone.

Now, some will go directly from Hard Knocks 101 to Graduate Studies, but some will stumble over the pitfalls described in Hard Knocks 102...

Hard Knocks 102

Hey, Look at the Neat Way Wachtel Widgets, Livealotmore Laboratory, or Enrico Edison Electric Does It!

On the surface, it seems a valid premise. Just follow the exact method of one of the many companies who have been able to demonstrate real success in the proactive maintenance arena. It is great to use the success of others as a guideline for developing *your own program*, but it rarely works to copy exactly what another company is doing.

All We Have to Do is Follow One of Their Plans, and We Are Guaranteed Success!

Following the path of others is great IF the SHOE FITS. This cannot be overemphasized. If you are looking for a blueprint that will work at your company or in your organization without modifications, additions, and subtractions, you are probably creating more barriers than you will be removing on the road to proactive maintenance.

Graduate Studies: Programmed for Success!

Read, Study and Understand the Pros and Cons of the Philosophies and Your Company's Maintenance Organization.

Most large organizations have the tools and the people to succeed.

Although this may be sad in a way, it is also reason to be hopeful for success in these organizations. They do not have to start at ground zero, where the pain of beginning the ascent to a proactive philosophy of maintenance is the greatest.

However, an understanding of the philosophies and their pros and cons is not enough. Understanding your company's maintenance organization is not enough. It is the harmonic synthesis of these into a unique plan or process for developing a plan that will lead to success.

Large companies or organizations need a plan or process for developing a plan.

If you, your company or your organization do not have: (1) a maintenance *cost* problem; (2) an equipment, systems, or machinery availability problem; (3) a maintenance perspective problem; (4) any complaints about ineffective, costly maintenance; (5) or any other

maintenance problem, then you go on home, and take the rest of the day off. You have a better program than most organizations in the world!

If you have read this far, you *do* have a PROBLEM with maintenance in your company or organization, and you *are* seeking a SOLUTION to the problem. Why would you not then apply one of the many widely known problem-solving techniques to your company's maintenance problem? Or why not apply your own, your manager's, or your operations or production organization's technique?

It's your problem, *make it your program!* The point to be made is that this is no haphazard endeavor. Your company's very future may be at stake here. Develop a plan. Follow a process. *Use your people, your company, and your organization.*

Set Program Goals in Accordance with Your Company's

Mission

Does your company have a mission statement? If so, what is it? Is your maintenance organization currently on a MISSION for the company? If not, what needs to be done?

You have no mission statement? Develop one for your maintenance organization anyway, with the companies needs in mind.

Philosophy

What is your company's philosophy of doing business? Is your maintenance organization operating according to that philosophy? Has it adopted the philosophy as its own? Does the philosophy of the production or operations organization agree with your organization's philosophy?

Values

What values are practiced and cherished where you work? If you know of none disseminated, what is your work ethic? How does what you do in the maintenance arena agree with your work ethic?

Some will scoff at the use of mission, philosophy and values as tools to assist in setting maintenance program goals for their companies, but when everyone understands what they are and what they mean for their companies and organizations, they do not waste time deciding what criteria to use for every large or small decision that arises.

If you think they are unimportant, let me ask you if the long-time success of the companies' slogans below is a mere accident:

“At ___ *Quality is Job One!*”

“At _____ *Progress is our most important product.*”

“Own a piece of the ____.”

Everyone knows something about these companies. Their slogans say something about their mission, philosophy and values. Their product thrust may change from time to time, their maintenance programs may have changed from time to time, but they all have a special

something so ingrained in their day-to-day operations it permeates everything they do! They have stood the test of time, and they are still going strong.

Use an Existing Process or Develop Your Own

Plan a program

Get buy-in. If you do not, you will have no program to implement.

Implement it

You cannot do it alone. The other stakeholders must help with the implementation.

Maintain it

Use the ongoing effort to build a cadre of enthusiastic supporters with special talents.

Measure program performance

Set goals, audit, post, and publish them. If the results are published and posted, everyone works to attain the goals.

Report Performance to Maintenance, Engineering, and Operations Managers

A weekly or monthly e-mail is sufficient at first. Always write a report for equipment exceptions to the owner. Later on, formalize a small report with economics in it and publish the report on a regular basis.

Re-evaluate Program Direction Against Mission, Philosophy, and Values Periodically

Do this at least annually, and involve *everyone!*

Recommendation

Begin NOW!

There is no time like the present. Many neophytes get bogged down by the knowledge that their program is way behind the cutting edge of proactive technologies. However, perseverance pays off here. The first time you see the light go on for someone else is a big boost from ground zero, and ascending to a proactive philosophy will no longer be an *if* for you, but a *when*.

Get Out of the Office and Into the Field!

Talk, ask, listen, take notes. If you are over 40 and need to remember the good ideas, write them down, note their author, and give credit where credit is due!

Successful programs have a champion

The champion involves everyone he can involve. As Dilbert says "Always team—it dilutes the blame." More importantly, it "spreads the credit" when success comes, and surely it will.

Successful programs have a plan of action in case the champion is out of the picture

If true teamwork is thriving, this will present little or no problem. And now, our plans.

The Road to Proactivity: A Draft Plan for PdM

Obtain Stakeholders' Support

- Meet with top managers in operations, maintenance, engineering, utilities, and research, and union officials.
- Meet with vibration specialists, oil analysis specialists, thermography specialists, PM and PdM specialists, trainers, and crafts.

Agree on Program Roles and Goals

- Program goals
- Program funding
- Program scope: people and equipment
- Program methodology
- Program development
- Program performance
- Program evaluation

Assemble Team Based on Roles and Goals

- Trainer
- Data collectors
- Data analyzers
- Database manager
- Data evaluator and reporter

Implement Program

- Establish routine data collection
- Trend data evaluation
- Establish PdM Learning Lab

Report Results

- Report results of any data collected or synthesized
- Report the results of movement toward plan goals established earlier

Program reevaluation

- Revisit roles and goals
- Measure against mission, philosophy, and values

Conclusion

As you can see, this is not a blueprint for the ideal program, but it does give you guidelines and lessons learned from those who have developed successful programs and from those of us who are in the process of developing successful programs. It is our hope that you, your company,

and your organization can avoid some of the pitfalls on *the road to proactive maintenance* and be guided by those who have and are succeeding with *the ideal philosophy* for their company while avoiding some of the *pain of implementation*.

Good luck on your journey toward a proactive maintenance program based on proactive philosophies.

Blake Van Hoy

Bob Bracher