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The Role of the Reliability Engineer in a World of Conflicting Priorities
MARCON 2008

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Introduction

Over the last couple of decades globalization of the economy has increased pressure on corporations to be cost competitive. At the same time there is increasing pressure to be a good 'corporate neighbor' by providing a safe and environment/community friendly operating environment. It is becoming recognized in the board room that developing an Optimized Asset Management Strategy (OAMS) is fundamental to both initiatives. In usual response, Reliability becomes the buzz word, organizations are created to implement and the Reliability Engineer is created, at least on paper.

There is usually much anxiety over 'where' the position should report. Opinions have a tendency to be strong and there are pros and cons for each option. Regardless of the organizational constraints the functions of reliability engineering remain consistent. We will review these functions in relation to the steps in a three plateau journey to World Class Asset Management.

Once the role of Reliability Engineer is created it requires sufficient time to develop an OAMS. This is not always easy in today's world of simultaneous downsizing and initiatives' development. There are numerous diversions that can easily throw the Reliability Engineer off track. It may be understood that Reliability Engineers must stay focused on the long term goals and that completing their functions will positively impact the bottom line, but few organizations have the discipline or latitude to allow that universally. There may be the lucky few who have the organizational resources to have truly dedicated Reliability Engineers, but most of us are not that fortunate. To be successful we have to provide the Reliability Engineers with the tools that will allow them to manage the diversions and still accomplish their goals. We have to assure that the time they do spend on the function of reliability engineering is effective.

Organizational Considerations

Historically, there are three different organizations into which the Reliability Engineer can be placed: Operations, Maintenance, or Engineering. Because of the organization's size or the trend toward flatter and 'customer-focused' organizations, often all three organizations do not exist. Still let's review the pros and cons of each case:

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Operations:

Pros:

- Direct reporting to the Asset Owner
- Part of Team which has direct accountability for asset performance
- Re-design recommendations are 'easier' to implement
- Operating performance information is more accessible
- Closer ties to individuals who touch, feel, and hear equipment everyday

Cons:

- Organization focused on day-to-day
- Maintenance information less accessible
- Less influence on maintenance plan recommendations

Maintenance:

Pros:

- Part of Team which has the responsibility to take action
- Greater influence on and closer ties with Craft
- Failure and 'As-Found Condition' data more accessible
- Maintenance plan recommendations are easier to implement

Cons:

- Organization focused on day to day
- Equipment focused
- Re-design and long-term strategic recommendations are more difficult to implement
- Subject to periodic centralization/decentralization cycle

Engineering:

Pros:

- Part of Team with longer term focus
- Easier impact on 'Reliability in Design' decisions

Cons:

- Not as closely tied to either Craft or Equipment Owners
- Ease of implementation is strictly function of power to influence
- Ivory Tower Syndrome
- Can become consumed with project work or other initiatives
- Often seen as 'overhead' during organizational changes

As you can see, there are reasonable, and some times emotional, arguments for or against all three organizational choices. In reality, the 'function' of reliability engineering has to be independent of organizational structure. It is a long term outlook position and its function has to outlast the life of any organizational structure with today's high propensity for re-organization. The key is that the individuals in the role have to have strong influencing skills, be emphatic to the needs of each organization, know when to roll up the sleeves and be a team player, and know when it is imperative to keep a long-term focus regardless of peer pressure.

The Role of the Reliability Engineer along the Journey:

There are numerous ways to breakdown the journey to World Class Asset Management. We are going to look at a three plateau approach. The first plateau involves a front line cultural shift and an effective CMMS system and planning procedure. The second plateau is strategy development and implementation. The final plateau is continuous improvement, cultural entrenchment and long term sustainability. The role of the Reliability Engineer is vital at each plateau.

In the first plateau at least four things have to be accomplished:

- Create a sense of ownership into the Operations Staff
- Shift the focus of Maintenance from repair to reliability function
- Implement an effective maintenance planning and scheduling system
- Establish a Root Cause Analysis (RCA) Process for reliability issues

The sense of ownership manifests itself in Operations Staff paying closer attention to equipment condition. They may perform the day-to-day care activities for the equipment even including lubrication and calibration. At a minimum they have to be educated on the equipment and what to look, smell, listen and feel for during periodic walk throughs. They have to understand the importance of prompt problem reporting no matter how small.

The shift from repair to reliability function is a question of attitude and attentiveness. Craft have to realize that their recognition and reporting of as-found conditions during a repair or preventative maintenance task is fundamental to the progression of the asset management program. There may even include participation in predictive maintenance programs. There will definitely be involvement in root cause analyses involving equipment reliability issues.

The CMMS System is a cornerstone of the journey. It should provide a means of planning and scheduling maintenance work. Key Performance Indicators should be extractable. Hopefully equipment specifications can be held and accessed. It also should provide an interactive repository for failure and as found condition information. There are definite advantages to having the CMMS system in place prior to strategic development. It is not mandatory, however, and if one doesn't exist yet there can be benefits for conducting some strategic development prior or concurrent with its implementation.

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The Root Cause Analysis Process is a way of looking at recurring important failures and developing solutions. The key is to develop as many potential solutions as the severity of the problem dictates so that the 'best' solution can be chosen. It is best to have an RCA process that can be used for all types of incidents: safety, environmental, reliability, quality, etc. It has a better chance of becoming entrenched into the organization's culture. RCA works best when its concepts are at least understood from the leadership table to the floor. Personnel from all levels will have to be involved in RCA exercises if it is going to be successful.

The Reliability Engineers' role for this plateau is as educator, champion, communicator, and RCA facilitator. The benefits of the operator ownership and craft involvement have to be visually demonstrated to the front line. Visual management tools demonstrating the improvements allowed because of their hard work go a long way to sustaining their involvement. The Reliability Engineers have to also demonstrate that they are team players, by addressing equipment-related issues that the craft and operators bring to the table in a prompt manner. A certain amount of floor creditability has to be established at this phase so that when strategic decisions are brought to the floor later they are readily accepted. Finally, the Reliability Engineers have to establish what criteria generate an RCA analysis and facilitates most of the reliability oriented exercises. They should not, however, be burdened with a majority of the action items or tracking closure.

The second plateau includes:

- Alignment of asset management strategy with business goals
- Criticality ranking of equipment and identification of availability bottlenecks
- Maintenance plan optimization to meet business goals
- Implementation of the plans

The business goals, financial and risk management, have to be translated into RAMS requirements. RAMS stands for Reliability, Availability, Maintainability, and Safety. Once the Asset's RAMS requirements are understood, the appropriate asset management strategy can be developed.

Criticality ranking can easily be accomplished by a Reliability Block Diagram (RBD) availability analysis of the system. The RBD is a logic diagram that incorporates process flow, planned maintenance outages, weather implications, and other availability influences into a model. It takes into consideration redundancies, surge capacities, and work arounds. With minimal mean time to failure and mean time to repair data you can build a high level model that will demonstrate equipment's availability criticality. It will also identify bottlenecks for availability that can be prioritized and resolved by re-design.

Reliability Centered Maintenance (RCM) methodology can be used to optimize maintenance plans. Based on the criticality of the equipment and consequences of it failure the most cost/risk effective maintenance approach can be selected. The approach could be run-to-failure, time-based PM, condition-based PM or re-design.

Finally the plans have to be implemented. The plans will have to be incorporated into the maintenance planning and scheduling tool. Regardless of the organizational structure, each part of the organization has to understand their role in each aspect of the implementation plan. This is best done with a RACI style chart. RACI stands for Responsible, Accountable, Consulted, and Informed. It describes what each part of the organization's interface is with each part of the implementation plan.

The Reliability Engineers are the leaders/facilitators in the strategic development phase. They work with the business team and site leadership to establish the asset management goals. They facilitate the RBD and RCM analysis, obviously with representatives of other stake holders participating. They communicate and generate buy-in for the strategy. Finally, they establish the implementation plan and generate consensus for the RACI chart.

The final plateau includes:

- Development and implementation of continuous improvement processes
- Development and implementation of a 'Reliability in Design' process for new equipment
- Incorporation of Life Cycle Cost Analysis into critical equipment purchases and strategic decision analyses.

Key Performance Indicators (KPIs) have to be established to demonstrate when the strategy is generating the required results. Periodic evaluation of the KPIs against predicted performance by the RCM Model can identify any issues with the strategy. RCA can then be used to evaluate the discrepancy and generate solutions to improve the strategy. Subsequent equipment failure data can be incorporated into the RCM and RBD models to improve their accuracy. Any un-anticipated failures can be analyzed by RCA and solutions to eliminate the failures incorporated into the strategy. Failures that have not even happened yet, but the plausible failure mode was identified in the RCM can be analyzed by RCA to eliminate likely failures. Finally any changes to the process or business environment that impacts failure consequences can be built into the RCM model to appropriately adjust the strategy.

As with existing facilities, RBD and RCM analysis for new equipment is just as effective. Successful projects are incorporating asset management strategies as a deliverable prior to start-up. When the analyses are implemented at the conceptual phase of the project their benefits are their greatest. At this point it can influence decisions on equipment purchase and lay out. The closer implementation gets to actual start-up, the less beneficial the analysis becomes. At the least, an established asset management plan before start up provides the best chance of a well-maintained asset.

A mature optimized asset management strategy uses Life Cycle Cost (LCC) Analysis to make critical equipment purchasing decisions and strategic asset management decisions. LCC looks at the total cost of an asset/decision over its lifetime. It incorporates any R&D Costs, Procurement Costs, Operating and Maintenance Costs,

and Disposal Costs. Decisions are no longer based on procurement costs alone. This provides for the best impact on the company's bottom line throughout the life of the asset. It is difficult to develop a true apples-to-apples comparison in most situations, but the advent of computer-based systems has alleviated those issues.

The role of the Reliability Engineers at this plateau is as implementers and champions. They develop the KPIs, process the data for comparison, facilitate the RCA and manage the updating of the model. They facilitate the RBD and RCM exercises for emerging projects. They facilitate the LCC Analyses and push to make LCC part of the corporate culture. In addition, they must keep abreast of all technology advances in the field of reliability for the organization. Finally, they continue to do all the things they do in plateaus 1 and 2. All three plateaus continue to proceed from this point forward.

Allowing Reliability Engineers to Create an OAMS

Depending on the industry there are many roles that have a stake in asset management. A partial list would include:

- Operator
- Craftsmen
- CBM Techs
- Maintenance Coordinator
- Maintenance Planner
- Maintenance Engineer
- Process Engineer
- Operations Engineer
- Operations Coordinator
- Project Engineer
- Project Coordinator
- Discipline Engineer
- **Reliability Engineer**
- Plant Management

There are few organizations that have the luxury of having a truly dedicated Reliability Engineer regardless of intentions. Usually they 'wear' two or more of the hats from the list above. Perhaps they have to participate in larger capital projects as a discipline engineer or manage a turnaround. Maybe they have to coordinate and manage any work that results from one of their recommendations. Sometimes they end up 'managing' the planners, CBM techs or maintenance engineers. They are usually good candidates to 'mark up' to Maintenance or Engineering Manager while they are out. In addition, they were probably made Reliability Engineers because they were the best Maintenance Engineers and there will be important times when their knowledge will be necessary in an emergency condition.

In addition, Reliability is one of numerous initiatives all corporations are 'focusing' on to reduce risk and/or improve profitability. There is a long list of other, just as important, resource draws related or not such as:

- TPM
- Kaizen
- Six Sigma
- 5S
- Lean
- Process Safety Management
- Behavioral Based Safety
- ISO
- Environmental and Safety Audits

Even when it is recognized that the Reliability Engineer role is important, it is tough to protect them from the other initiatives. The traits necessary to be accomplished at it are strong leadership, team player, technically proficient, emphatic, business oriented, process oriented, etc. All of the qualities that caused you to choose your Reliability Engineers are what also makes them key candidates for participation in the other initiatives. The importance of the other initiative can not be questioned so it becomes difficult to maintain a truly dedicated Reliability Engineer unless you are well staffed. If you are in this last category I would just be quiet and smile.

Finally, even if you are lucky enough to have a dedicated Reliability Engineering function within your organization, developing the OAMS is only a part of the role. There are other facets of the roles as explained in the section above.

So if you are not staffed well enough to allow your Reliability Engineers to focus without multiple diversions, how do you get your program off the ground and create your OAMS? The most effective way is to provide your Reliability professionals with the tools that will make their allocated time most effective. In this wonderful world of PCs this becomes a little easier. There are many software tools available today that can take the Reliability Engineer well past the spreadsheet. The best ones have the following qualities:

- Provide analysis with minimal or 'dirty' data
- Predict failure probabilities into the future
- Predict effectiveness of PM and PdM tasks to manage failure
- Provide cost benefits and/or risk benefits of decisions
- Analysis results are directly uploaded in CMMS Systems
- Field data is directly downloaded from CMMS Systems
- Seamless and effective continuous improvement processes
- Responsive to changes in business climate or process
- Well documented strategic decision process so that it can challenged and facilitates periodic stops and starts in the process

PC simulator tools and sound mathematical models describing failure behavior can predict probabilities of failure and the effectiveness of PM and PdM tasks.

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Experience and data are required to generate the failure behavior model. Few organizations have 'perfect' historical failure or 'as-found condition' data and most have barely usable data. Weibull, however, is a distribution that allows models to be built with minimum data and maximizes the effectiveness of data extracted from the organizational experience base. (If you wait until your databases are fundamentally sound you will never start your program. Paradoxically, starting the program and creating the continuous improvement cycles is one of the best ways to improve your data bases.)

The model should predict future events such as failures and mitigated failures as a function of each strategic decision. The model should have the consequence of failure (risk, maintenance costs and business costs) for each failure mode built into it. It can then compare the cost and risk benefits of each strategic decision. A change in consequence because of a business strategy change or change in the process should be readily incorporated into the model along with subsequent shifts in strategy.

The model should be able to upload and download with your CMMS system. This will allow for easy implementation and evaluation of results. Each subsequent failure can be added into the model improving its accuracy. Any discrepancies between the model's predicted results and actual results can be analysed and adjustments made. The model and subsequent strategy improve with time.

Finally, the model has to produce a well documented decision trail. This will facilitate the reliability effort when the Reliability Engineers are 'diverted' periodically to other tasks. It makes it easier to start where you left off with minimal re-work. The documented decision trail will also help subsequent personnel who become accountable for the process when the current Reliability Engineer gets promoted to VP!

So the final question is when do you start. Granted it is much nicer when all of the systems are in place such as your CMMS system, PdM program, organizational stability, etc. But the key is to just get started. If you wait until everything is in place it will never happen. Just stop talking and start doing.