OMDEC
Optimal Maintenance Decisions Inc.

Maintenance Consulting Scope

Part 3: Control

1.Introduction

In Part 1 of this scope document, we focused on where to start – the process of Assessing Current Maintenance Practices, and the steps required for doing Benchmark comparisons with other organizational units.

In Part 2 of the series, we address the Leadership layer of the Maintenance Cube of Excellence - specifically Strategy and Management. The application and content of the Cube is also summarized in Part 2.

In this current paper we cover what for most Maintenance Organizations, is the heart of the maintenance function – the Control layer.

Part 4 covers Continuous Improvement and the final section,

Part 5, addresses the Enablers – Technology, Processes and People.

Most businesses spend most of their maintenance time and resources in the Control Layer – which includes Materials, Tactics, Data, Measures and Work. Each of these will be reviewed in turn.

2. Materials

OMDEC is in the business of equipment and system reliability; as such we are automatically in the inventory management business. There are several logical approaches, depending on your objectives....

1. **If you want to improve the management process of ordering, receiving, issuing, restocking** and disposing of inventory, then we have a 12 step approach that is based on the practical application of good management techniques largely through the EAM system. We can teach you these methods as part of a standard training program ("Improving your Inventory Management through CMMS/EAM") lasting two or three days depending on the amount of practical workshops you would like.

2. **If you want to optimize the on-hand inventory using the above techniques**, then we can guide you through the implementation of these management processes - setting goals and KPI's, followed by training and then on-the-job monitoring of results. Depending on the size of the inventory and the numbers of people you wish to involve in the process, this would normally require about two to four weeks on-site.

3. **If you want to research the on hand requirements of expensive parts** so as to balance cost and system reliability, then SMS (Spares Management Software) will do this very nicely. This applies advanced statistical methods to standard inventory and cost data to determine the "right" level of spares according to the reliability, availability and cost criteria required. Capital cost reductions of 50+% are standard using this approach.

4. **If you want to use an on-going analytical approach** that constantly monitors your existing inventory levels and recommends buy quantities and dates, plus surplus-for-disposal amounts, then an on-line approach is the response. Here we will analyse transaction data from your CMMS/EAM, confirm or re-set re-order points, determine EOQ's and min-max levels and provide monthly reports on the required inventory transactions - all automatically via a secure website.

5**. If you are looking for a very in-depth analysis of the reliability and logistics** of components (more usually appropriate to military situations), the again we have the resources and software to deliver these.

For further information, send us an email at info@omdec.com

3. Tactics

Ultimately, the tactics used by an organization will largely determine the results and effectiveness of the Maintenance Organization. Yet many believe there is a mystique surrounding the selection of the tactics to employ.

Let's start with a few basics:

a. The underlying concept of Maintenance must be to add value to the organization; conversely, **if it adds no value, stop doing it.**

b. Most companies are striving to maximize the amount of PM work that is being done; yet studies continue to show that something like 70% of PM's add no value.

c. Condition Monitoring (CM) and Condition-based Maintenance (CBM) have become the mantra for advanced maintainers; yet little or no attention is paid to determining the interrelationship of multiple condition variables and their relative impact on the ability to predict and therefore avoid failure

d. Minimizing Run to Failure is a primary target for many companies; yet RTF is clearly the right approach in many instances.

In response to these and other strongly held **(but wrong!!)** views, there is a compelling logic. If we define the ultimate role of Maintenance as to "add value" (and who can logically argue against this point), then we need a simple and effective means of assessing value. Let's offer two simple approaches **– increased ROI** (Return on Investment – the most important single corporate KPI), and **reduction of Risk** (the one measure that keeps senior Execs awake at nights!).

Using ROI, we can balance the cost of doing a PM against the cost of not doing it. In looking at the cost of each of these tactics, we must include three elements:

- the cost of the PM or the cost of the fixing the failure as a result of no PM
- the cost of downtime or loss of mission readiness in each case
- the penalty costs (fines, loss of market share, loss of public image) involved in each case

Clearly the cost of the PM must be less than the cost of not doing it for a positive ROI to result. Yet even this analysis needs an additional step – introduction of Risk. A simple yet very workable definition of Risk is the Cost of Failure times the Probability of Failure. We can advantageously use for the cost of failure the definition shown above. For the probability, we also need three elements – a percentage likelihood of it happening, a time frame for the calculation of the percentage (**without a time frame, the probability of failure is always 100%!)** and the level of confidence we have in the accuracy of our percentage.

Historically, the percentage probability of failure has been very elusive whenever there is more than a single condition variable. Fortunately as a result of the work done by Prof Jardine and his team at the University of Toronto, the proportional hazards modelling process embedded in EXAKT software answers this need very nicely. By linking the costs of failure to the next scheduled outage, a simple traffic light output chart shows at a glance the level of risk involved.

Another very easy approach is to examine the details of a PM work order and ask the question

"which specific failure (or failure mode, to use an RCM term) is being prevented by each task?"

If there is no linkage between the two, then the PM should at minimum be challenged. Using similar logic, we can ask if the cost of a failure is less than the cost of prevention – if so, then let it fail. Run-to-failure is accepted as a standard outcome when we get to RCM in Part 3 of this series; we can accept that logic in anticipation of that outcome in Part 2, and use it the question the value of our current maintenance programs.

These examples are typical of the straightforward common-sense approach that OMDEC uses to assist companies to sharpen their Maintenance tactics. There is of course, a series of more sophisticated techniques in our kit bag; but as a starting point, we suggest:

1. a spot check analysis of the effectiveness of the tactics currently in use by reviewing samples drawn from current CMMS data

2. a short training program focusing on types of tactics, when they are most effective (and when they should be avoided)

3. practical hands-on workshops with your planners to hone and apply these principles for your specific organization

4. periodic follow-up audit and training to ensure the benefits continue after we leave your site.

The benefits are largely self-evident – the right tactic applied to the right situation. But what kind of savings can you expect? That clearly depends on the current state of your maintenance business. But if we look at a couple of simple metrics, calculate the cost of failure (using the above definitions); and assume you are better than the average and that only 50% of your PM work is a waste of time. In both cases, these are the potential savings.

For more information on our Tactics consulting service, EXAKT and other software, contact us at info@omdec.com.

4. Data

Two opposing problems dominate data - too much and too little.

So much data is now capable of collection that it far outstrips our ability for analysis; ***yet the data we do have is inconsistent, unreliable and has major gaps***. What to do?

In broad terms, we have three major sources of data –

a. **historical data** – mainly from past records in our CMMS and Work Order systems – covering the acquisition, installation and maintenance of our equipment, major components and systems
b. **current data** – mainly from the Condition Monitoring systems, plus production and process contrail, SCADA etc. This tells us the current status of an equipment
c. **data about our expectations** – largely focused around how we want and how we expect the equipment to behave. This is mainly in production plans, RCM databases etc

Our standard practice is to ask:

"what can we learn from this data? What useful knowledge can we extract?"

In most cases, sadly, the answer is **"not much".**
The reason for this is that we humans mainly look at what we have and ask what it means.

What we need to do is to reverse the questions and ask:

"what do we need to know? – and consequently what data do we need to collect?".

The net result of this is to quickly identify the gaps and deficiencies in our databases, as well as to identify that data which contributes little or nothing to our better understanding of how to manage the equipment.

Some key issues that typically emerge:

a. for predictive purposes the majority of condition data provides no value and can be discontinued
b. for reliability improvement purposes, "as found" and fault code data recorded on work orders is not useful
c. data gaps are not the end of the analysis – changing the collection process now will reap major benefits in a few short months
d. simple statistical tests can be applied to validate the conclusions drawn from data so that we can assess our confidence in the accuracy of that conclusion
e. linking costs and benefits to this data is essential in order to determine whether the conclusions provide real value.
f. in order to effectively use smart analytical tools, the preparation of a data mart or data warehouse is critical to automatically feed those tools.

A consistent claim is that we cannot collect good data; the "reasons" boil down to the same tired excuses – no time and no interest. Neither of these is the root cause;

the root cause is "no priority".

The steps needed to change this view are simple and straightforward.

First, explain why collect the data.

Second, show how to collect the data.

Third, allocate time on the work order task list to collect the data.

Fourth, make it a priority to collect the data.

And finally, make it a performance issue if the data is not collected correctly.

By the way, one simple technique is to have a separate work order for the data collection and analysis. That way, resources will be allocated, as will a priority. Plus if it is not done, then it will be on the backlog list at the weekly backlog meeting.

Another frequent question is *who is responsible for the accuracy and the collection of the data*. In most cases, the planner (through the work order) will define the data requirements; the inspection or maintenance technician is responsible for following the work order instructions to collect the data, and the supervisor is responsible for ensuring that it is done. As a final check, the person who closes the work order (often the supervisor or the planner) should check that the data looks good, and reject the work order if it is not.

One thing is for sure; the absence of reliable, consistent and accurate data will always invalidate the best and most sophisticated analysis.

Bad data makes for bad maintenance!

OMDEC has developed a series of simple but very effective procedures for investigating and correcting situations where poor data undermines good maintenance. These are applied at all four stages – collection, processing, storage and analysis. Find out more from info@omdec.com.

5. Measures

One significant and welcome change in the recent world of Maintenance is the introduction of KPI's – Key Performance Indicators – to measure and track progress towards our goals. Many KPI's exist; one leading author identifies over 140 different ones. Certainly for every desired result, you can be sure there is a KPI waiting to be used. However most articles on KPI's miss the fundamental point.

A KPI is only as good as the action that it prompts.

Conversely, if a KPI does not prompt a change in actions or behaviour, then it is probably a waste of time and should be stopped. Of course there are a few exceptions, such as those required for government reporting, but these are few and far between.

So a good starting point for selecting, developing and introducing KPI's is to ask:

"What changes do we want to make happen? What issues do we want to highlight and resolve?"

In taking an overall look at KPI's, also consider the following:

1. **Who is the audience?** Senior Execs will focus on the issues that are most relevant to their role in the organization, so ROI, Risk, Consistency and Cost of Output will be the KPI's of most interest to them. We must respond by providing them with Maintenance KPI's that match this need. For the Maintenance Managers, focus on those KPI's that provide information on the results of the work that is being done in the department – measuring inputs, outputs and the efficiency of converting one into the other. For the technical team, concentrate on KPI's that measure the reliability, the equipment effectiveness and the ability to solve problems quickly

2. **What is the focus?** Here we can look at, for example, categories such as the following; specific KPI's can then be developed in each group.
   - Maintenance Results
   - Maintenance Productivity
   - Maintenance Organization
   - Maintenance Work Efficiency
   - Maintenance Costs
   - Maintenance Quality

3. For a deeper and more intense view of performance, we can **focus on the equipment itself** and examine power consumption, failure costs, throughput, maintenance costs and so on.

4. **How do the various KPI's interrelate with others** in the same business – both up and down the organizational hierarchy, and across the equivalent level in the organization? The overall sum and effect of the KPI's need to be consistent with the business objectives – easy to say, but tough to do. Some neat software has recently become available to help solve the problem using attractive and effective graphical output.

Of the many “standard” KPI’s that have come into use over the past few years, perhaps the most commonly adopted is OEE – Overall Equipment Effectiveness. Shortly put, it shows the actual output as a percentage of design throughput.

In doing so, it measures Utilization, Availability, Performance and Quality, and has two points of real value:

1. as it is a standard methodology, it can do a good job of comparing different equipments, plants or companies.

2. but more important is to concentrate on the reason for the shortfalls so that action can be taken to remedy them.

Although it is probably the best accepted overall Operations and Maintenance KPI, it is far from a perfect measure – two very significant missing elements are:

3. no account is taken of the increasing probability of future failure as a result of striving to increase the short term numbers

4. and even more importantly, an increase in OEE may cause a reduction in the ROI – ie the cost of increasing the OEE may be more than the value derived from that OEE increase.

Linking KPI’s to the delivery of additional value (or more specifically, a higher ROI, improved cash flow and payback time), should be standard practice for the Maintenance Manager.

Other techniques that have become very popular recently include the **Maintenance Dashboard and Life Cycle Costing.** Borrowed from the example in your car, the Maintenance Dashboard shows those KPI’s that merit immediate attention at the start of the day, and those that you require quick access to throughout the day. The content will vary according to the user, but many CMMS packages now present these as part of their standard output. Before accepting them at face value, make sure that the data and the KPI procedures are sound in the context of your own specific business processes.

Life Cycle Costing prompts us to take an overall view of the cost of acquiring, owning operating, maintaining and disposing of an equipment – the cradle to grave approach. More important than simply adding up the individual costs, LCC can play a key role in selecting the best of several alternative equipments. This can be used as a major breakthrough for the Maintenance function – historically, the impact that Maintenance has had on the selection of equipment (and spare parts) has been insufficient. With the advent of LCC, one of the “must have” inputs is the cost of maintenance – the opportunity for Maintenance to have its voice heard..

Implementing an effective KPI regime is not easy. Our 10 step approach is straightforward and logical. Resulting from years of practical experience, it has been carefully designed to maximize the probability of a fast success. For more details, and a short case study, contact us at info@omdec.com

6. Work

The Management of Work has become one of the major focal points for effective maintenance improvement. As equipment becomes more complex and more costly, budgets have been shrinking. As the demand rises for higher productivity, access to the equipment for maintenance has become more difficult. The pressure continues to mount for Maintenance Managers to do more with less. Yet consistently we see results that show:

- wrench times in the 30 to 40% range
- reactive to proactive ratios in the order of 70:30
- up to 70% of PM's providing no value
- a very high proportion of condition monitoring that has no bearing on failure prediction
- PM compliance rates in the 25 to 30% range.

So what's going on?

Well of course there is no simple silver bullet – but there are a series of steps that we can take to move us firmly in the right direction.

Let's start with planning.

A key target is to continuously increase the percent of work that is performed based on a well-thought out plan. Easily said – but how to make it happen? First, why? The literature suggests that unplanned work takes about 3 times the time and resources as planned work; one of our colleagues challenged this and did a detailed analysis. The result? – 3.4 times! Start slowly and simply with these steps:

1. **appoint and train a planner**; it does not have to be full time until you see the results starting to take hold.

2. **focus on planning a few repeat jobs** – typically these will be inspections and PM's that are performed on a regular basis. Concentrate initially on building templates for two key areas – identifying the most effective sequence for the job steps, and making sure that the list of materials and tools for the job is complete.

3. **actively look for feedback from the technician** when the job is complete to see if there are improvements that can be made. Specifically ask about missing parts and missing tools; look for areas where the job is being held up, and ask why? - often equipment availability, permits and supervisory sign-offs are a problem here.

4. **make sure these improvements are included in the work order** template for next time.

This simple process will get you started, and consistently applying this technique will quickly pay dividends in time saved. Remember also, that at the same time, you are building a best practice library of jobs. So as you expand the concept, focus on how maintenance improvement can become a standard process – ask the question **"is this the best we know how to do?"**

Next look at some similar steps to introduce scheduling.
Planning and scheduling are often done by the same person – but they require quite different skills. Planning requires a depth of understanding of how the work is performed. Scheduling brings all the resources together at the right place at the right time. Planning is best done by

experienced technicians and engineers; scheduling requires marshalling many different resources to the job site at the required time.

As a result, build your Best Practices for Planning and Scheduling

For organizations which have implemented the planning and scheduling and want to go to the next level, the approach needs to be more sophisticated. Here we must concentrate on techniques such as:

1. improved workflow to identify and streamline or eliminate inefficiencies, duplicate and unnecessary steps. Typically we see about 16 business procedures in the maintenance function; analysing the key ones using well-proven techniques will highlight and eliminate these inefficiencies. A key aid here is the power of electronics through computers, email and PDA's.

2. determining value and identifying loss of value. Over the past years, "more PM's" has been the mantra – to the point where many serve no purpose. As a simple test, if the cost of failure is less than the PM used to prevent it, then run to failure is the right alternative. But make sure you have the right components of cost of failure identified; and for each element in the cost of failure there is an equivalent one in the cost of the PM.

3. testing whether the PM task is directly linked to the prevention of a specific failure; if not, challenge the PM.

4. evaluating whether the work quality is up to standard. A simple technique here for more complex jobs is to have a post-completion review at the machine site involving all the maintenance technicians and operators. Walk through the job steps to see if the quality is delivered and if improvements can be made.

A frequent question is who is responsible for the quality of the work. In most cases, the planner (through the work order) will define the "as left" equipment status required; the maintenance technician is responsible for following the work order instructions to deliver that quality, and the supervisor is responsible for ensuring that it is done.

As a final thought, many KPI's have been developed to track work – intelligent selection and use of these KPI's will ensure that the effectiveness and the quality are maintained.

For information on how our consulting experience can bring benefits to your organization, or to ask us about our recommended Best Practices for Planning and Scheduling email us at info@omdec.com.