Strategic Asset Management Inc.

25 New Britain Avenue
Unionville, CT 06085
(800) 706-0702
www.samicorp.com
info@samicorp.com

THE SAMI Asset Healthcare Triangle Series:
Stage 1

by Dave Army, CMRP

The following is a compilation of 12 articles written by Dave Army outling the components of Stage 1 of the SAMI Asset Heathcare triangle.

- Part 1Identification of Work
- Part 2 Work Prioritization
- Part 3 Long Range Scheduling
- Part 4 Look Ahead Scheduling
- Part 5 Materials Management
- Part 6 Preventive Maintenance
- Part 7 Planners
- Part 8 The Work Plan
- Part 9 Work Execution
- Part 10 Work Closure
- Part 11 CMMS
- Part 12 Metrics

Dave Army is the Vice President of Results Delivery for SAMI. His expertise includes analysis, design and implementation of maintenance and operations solutions for numerous industries. He currently oversees all SAMI implementation activities.
davea@samicorp.com

The Operational Reliability Maturity Continuum:
Part 1 The identification of Work

Beginning with this article, I will, over the next few months take the reader through the basic elements of SAMI's model for Maintenance Excellence -- The Operational Reliability Maturity Continuum.

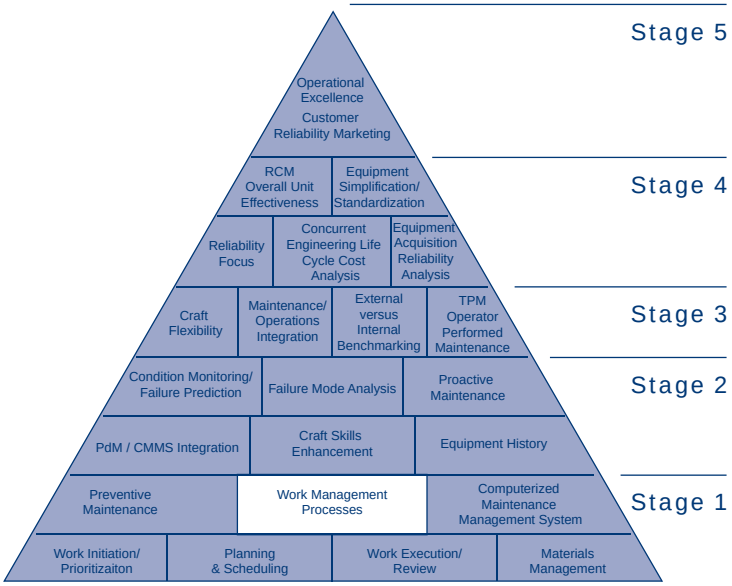
The first step in this process is the identification of work. Why is identification of work so important? Some may say that we've got so much work on the books, that we can't handle it anyway. Well, when the other Stage 1 elements fall into place, it is imperative that you understand the material condition of systems, components and structures. Knowing the condition, through an aggressive work identification process, allows for the proper prioritization of activities and corrective actions prior to failure.

In a purely reactive mode, work is usually identified as equipment fails. Maintenance is then tasked to fix the equipment in as rapid a manner as possible (after all, the equipment that failed has most likely affected production or some critical function). If you're lucky enough to schedule and actually perform a preventive maintenance (PM) task, you may identify other related tasks that, if identified earlier, would have been more easily accomplished.

Minor tasks, when left to their own devices, will often turn into larger tasks. Sometimes these minor tasks will turn into emergencies. Often, the minor leakage of steam from a valve packing turns into a valve replacement due to steam cutting. What once could be performed on line has turned into a major activity involving isolations, welding and replacement of parts. A simple task has turned into an expensive one.

For those of you who work on mobile equipment, when a piece of equipment comes into the shop for PM, doesn't it just make your day when you identify other work in addition to the PM you've scheduled? Most of this work is not necessarily difficult to accomplish, but without the parts on hand, they are difficult to complete. The result is that either the equipment goes back into the field with a known deficiency, or the time in the shop is increased until the part(s) is located and the repair made. All of which leads to the perception that maintenance is ineffective or that schedules are meaningless.

In these two examples, there are a couple of quick and easy solutions. First, your organization must be willing to accept the concept that "Maintenance" is not the sole responsibility of the Maintenance Department. "World Class"



The Operation Reliability Maturity Continuum

maintenance organizations have embraced the concept that like safety, good maintenance is the responsibility of all organizations. I firmly believe, and tell clients when working reliability solutions, the first line of defense is the operator. The operator understands the equipment better than anyone else does. They are around the equipment at sometime during every shift and are the "eyes, nose, ears, etc." for detecting the first indications of degrading equipment.

Second, we often don't capitalize on this understanding. Therefore, I encourage all of us to make use of this resource. Make operators part of your first line of defense. The use of operator rounds, check lists, walk-downs, etc. are all valuable tools to use.

Getting the operator to properly identify equipment related issues, prior to failure, is a powerful cost saving tool. Knowing beforehand, allows the maintainer to plan for the activity, have the part on hand and finally, take prompt and efficient corrective action. We can now prevent that small task from turning into the costly, inefficient, and time consuming task. Everyone profits. Why don't you give it a chance?

The Operational Reliability Maturity Continuum:
Part 2 Prioritization

In the last issue of this newsletter, I discussed the importance of Work Identification. In this article, I will, cover the second element of SAMI's Stage 1 model for Maintenance Excellence, prioritization. As you may recall Stage 1 includes the following elements:

- ➔ Work Identification
- ➔ Prioritization
- ➔ Planning
- ➔ Scheduling
- ➔ Work Execution
- ➔ Trending and Follow-up
- ➔ Preventive Maintenance
- ➔ Computerized Maintenance Management Systems (CMMS)

Why is the proper prioritization of work so critical? Well, as someone really important (I can't remember who) once said, "If everything's important, then nothing's important." What does this mean to you, in a maintenance setting?

As a universal concept, everyone knows what emergency work is. It's that problem that has to be fixed right now. Drop everything and attend to it, regardless of the cost and the impact on other activities. As maintenance professionals, we're conditioned to this response and are rewarded by our ability to immediately address these crises. You all know the feeling; the boss comes up and pats you on the back, praising you for a job "well done." We live for those moments and these traits characterize a reactive organization.

In a well-disciplined, highly evolved organization (I don't mean maintenance department), true emergencies are few and far between. In organizations that are less evolved, high priority activities are the rule rather than the exception. Why does this happen, and what are the impacts?

As a rule of thumb, work can be segregated into about 5 levels of urgency (priority):

1. Really, really important – The world will cease to exist as we know it
2. Kind of important – Needs to be done pretty soon, or we'll really have a problem
3. It can wait – Can be done in due time
4. Fill in – Nice to do, minor in nature, get it when you can (This priority is often considered a "black hole")
5. Shutdown required – Need a system or equipment outage to perform

There are many variations to this prioritization scheme, but I have usually found that more than five priorities are confusing and don't provide any better help with getting work performed.

When production or operations departments have no confidence or trust in the ability of maintenance to accomplish work in a timely manner, priorities will often get inflated. A priority 2 will become a priority 1, or a priority 3 will become a priority 2. Why is this? Simply stated, the person creating the priority knows that unless the Work Order enjoys a high priority, it will never get done.

If a Work Order initially receives a priority of 3 or 4, it disappears into the Maintenance "black hole." Therefore, the originator inflates the priority. By the time you know it, work is dominated by emergency and high priority work. If management attempts to control the amount of high priority work (requiring justification for P-1 activities is a common ploy) without an accompanying process change, then the baseline emergencies drop. For example P-2 work orders take over and are often followed up by phone calls. I remember a time when, as a maintenance manager, my organization went through one of these attempts at control. I ended up seeing work orders with priorities of 2 HOT!, 2 ***, 2 in Red, etc. You get the picture.

When we assess organizations for their level of Asset Management sophistication, we look for the number of high priority work orders as a percentage of total work. This gives us an indication of how much control the organization has over emergent work. Without exception, P-1 and P-2 activities are unknown immediately prior to execution and consequently conducted with little or no pre-planning. Parts are most likely unavailable, and other work will get interrupted. We calculate that emergent, high priority work costs three times more, takes three times longer to complete and is three times less likely to be successful than planned work. This tells us that there are potentially great financial savings to be gained by reducing the amount of high priority, emergent work.

What can an organization do? Some answers are contained within the priority setting process. Simply defining and training personnel in the priorities and educating them about the consequences of insisting on high priorities will help. However, the most effective way to reduce the impact of high priority reactive work is to modify the planning and scheduling processes. This will result in an atmosphere that will allow work to be performed in a timely manner. If work won't be ignored, and the production or operations personnel feel that work will get done, prior to failure, they will resist the temptation to inflate priorities. This approach will subsequently result in a lessening of the stress on the maintenance organization. We'll discuss these process improvements in a later article.

The Operational Reliability Maturity Continuum:
Part 3 Long Range Scheduling

In the rush to get work done we often forget activities that we know we should deal with. I flash back to the good old days when we would receive Work Requests to block off vents, repair insulation, repair heating fans, etc. Of course it was during the winter months, and Preventive Maintenance tasks designed to deal with winterization issues had been sadly deferred so that we could deal with more important issues, usually reactive maintenance items that took on a higher priority. Not that we didn't have good intentions, it just seemed that we could never find the time.

As I grow older, I find that if I don't write a commitment down on my calendar, I have a tendency to schedule two or more activities at the same time. Long sad experience has shown me that I'd better pencil in those days I earmarked for vacation or those special events that mean a lot to loved ones. My calendar serves as my long-range plan. I don't bother to pencil in those things that have become routine, but everything that occurs monthly or greater has found a place on my schedule. Is this because I have a poor memory (some would say yes)? The real answer is no, but if not highlighted, I run the real possibility of a scheduling conflict and unnecessary turmoil in my life.

We can apply these techniques to our lives as maintenance professionals. In any work environment, there are activities that lend themselves to long range planning. These fall into four categories: known major events; preventive maintenance activities; regulatory requirements; and resource constraints.

Every facility that I've been involved with has had a long-range plan. These plans often include unit turn-arounds or outages, major modifications, or planned shutdowns of major equipment. These plans are usually developed well in advance. They also include funding, assigned resource responsibility detailed plans, schedules, advanced parts ordering and all those things that lend themselves to successful execution. Most importantly, they are subject to little or no calendar movement.

When you think of preventive maintenance, consider those repetitive tasks that have a frequency greater than a month. Weekly or daily preventive maintenance tasks usually have no need for formal scheduling. In addition, you should only consider those tasks that are intrusive or require special coordination or support from other resources.

Regulatory requirements are usually well know, at least by somebody in the organization. If regulatory requirements aren't tracked as preventive maintenance tasks in the CMMS (Computerized Maintenance Management System), then the organization runs the risk of missing a commitment that can lead to financial penalties. Most regulatory requirements run on a cyclical or calendar schedule and readily lend themselves to long range scheduling.

Lastly, every organization has periods during the year when resources are scarce, reduced or unavailable. The best examples I can think of are hunting season, the opening of fishing, major holiday seasons, or known vacation periods. In Europe, August is not a good month to plan major resource loaded activities. At one plant I worked at, the opening week of deer season almost led to a plant closing each year. Again, these resource-limiting times are usually well known by the organization.

Now, why would you need to know this information? The reason is quite simple; having this information available will allow you to view your year's activities at a glance. You can quite easily set up a spreadsheet with all this information laid out in calendar sequence. Look at the spreadsheet, move tasks that fall into a period of low resource availability to one of high availability. Adjust regulatory requirements a few weeks, either way, if they fall within a major equipment outage. Then use the spreadsheet like a Day Planner. Always look to the future to foresee what is coming up.

One of the greatest benefits of using such a tool is that it allows you to see PM activities before they are scheduled. Shifting a PM one week one way or the other (remember we're only looking at activities that recur at one month or greater) really makes no difference. What often happens is that we rely on our CMMS to schedule our PMs automatically and arbitrarily based on some frequency and/or last finished date. This reliance tends to "hide" the PM. Depending on the system, the PM pops up on the radar screen right before it's due. This allows the planner little time to properly prepare for the task, consequently leading to a greater probability of deferment or delinquency. Having the ability to visualize the task allows for recognition, planning and execution. Another benefit is that viewing the event on a calendar allows adjustments to meet seasonal needs.

All of these benefits ultimately result in better planning, coordination and results. I feel that this is a simple tool that allows us to solve a basic impediment to establishing a long-range scheduling horizon. We'll discuss how to use this tool in another issue.

The Operational Reliability Maturity Continuum:
Part 4 Look-Ahead Scheduling

In my last article, I discussed the development of a Long-Range scheduling tool. This tool, if developed with some thought should contain routine activities and identify instances where resources may be constrained (such as vacations, outages, etc.). If you consider the long range plan to function the same as your "Day Planner," then you are ready to enter the world of look ahead scheduling.

Often when we visit prospective clients we enter into a discussion about work scheduling. Most of the maintenance people we talk to promptly respond that all of their work is scheduled. But what does this really mean? In most cases, this means that all work is put onto the schedule the same day it is scheduled. Their "look ahead" horizon is less than one day! It looks really great on their reports when a high level of "scheduled activities" is reported. However, while living within the letter of the law, they're missing the intent of scheduling.

Why schedule at all? Well, I can think of many (and probably not all) the reasons for scheduling work. Some of these reasons are:

1. Coordination of activities between maintenance and production
2. Having parts and support available prior to work commencement
3. Combining many tasks to occur at the same time
4. Taking advantage of resources availability
5. Reducing wait time
6. Completing more work per unit of time

You can probably think of many more reasons to schedule as the list goes on. As a maintenance professional, life gets a lot easier when you can schedule your work. If you make production a partner in schedule development, you create closer ties and a sense of organizational ownership.

So, how do we go about scheduling? First of all, set your scheduling horizons high. Look-ahead scheduling, as the name implies, requires that you look at least one week into the future. With our clients, we set the horizon at **six weeks**! To most maintenance personnel that are part of a reactive organization, this window seems completely unrealistic. However, if I can slot (schedule) work six weeks into the future, I help my Planner by identifying his planning priorities. I also give the planner up to six weeks to identify and secure parts, materials, permits, production assistance, and anything else required as part of a work plan.

There are a couple of thing that are required to implement look ahead scheduling. First is a long-range plan, second is a "quality" backlog of work, and lastly an organization that is willing to work together to facility and not department priorities.

We'll talk about developing a one week look-ahead schedule (tiny baby steps). Starting with the long range schedule, look at the routine activities that are planned for the following weeks. Using the backlog, look for any work that can be associated with those routine activities. Prepare a list of those activities. Distribute this list to the member of the organization that will attend the weekly planning meeting. In most cases, at a minimum, this will be maintenance foremen, the planner and the on-duty shift supervisor (or his counterpart) representing production. Some organizations choose to increase this list, but a note of caution, don't have too many!

At the weekly planning meeting, the planner presents the list for review and discussion. The **group** concurs on the list (add or delete) and adds any other high priority work that should be accomplished during the next week (remember emergency work is addressed as it occurs). The list is adjusted for resource constraints and committed to by all present. The list is distributed to the appropriate locations, shops, control rooms and plant managers' office. The planner prepares and distributes the work packages to the appropriate foremen. You do have a planner, don't you? The only steps remaining are execution and reporting on success.

There are some points one could argue on. For example, do we schedule to 100% or greater of maintenance capacity? Well this depends on the organization. Normally I would say that when you embark on this journey, if your reactive work load is at 25% or higher, you should set your planning/scheduling sights a little lower. In this case I would recommend setting the scheduling load at about 70% of your total available resources. This will allow you to deal with the reactive load during the work week. This is not to say that you can't place additional "interruptible" work on the daily schedule to accommodate a daily load of 100%. The key indicator is how you comply with the written schedule. As an organization, you should be shooting for 100% compliance against the schedule. As you get better with compliance and execution, you can continue to raise the bar until you reach the 95% one-week-out schedule load.

In the next article, I'll discuss how the "weekly" schedule translates into the "daily" schedule. This step focuses on work execution and adherence to agreed upon work.

If you have any questions or comments on the article, or any aspects of the Work Management process, please feel free to contact me.

The Operational Reliability Maturity Continuum:
Part 5 Materials Management

I was looking for a set of brake shoes for my Triumph TR-6 last Saturday, going through boxes and bins of parts accumulated in my garage over the years. During this search I found a new alternator for a 1986 Alfa, fuel injectors for a '76 Z car, a set of distributor points for a '64 MGB, but never did find the brake shoes. I know they are there, somewhere. This took up most of the daylight hours and I never got to do the job. All of the "extra" parts were for cars that had left my possession over the past twenty years. The "pack rat" in me had struck again.

During a break in my search, I thought of the many clients that experience very similar scenarios in their day-to-day business of executing work. In the last issue of *The SAMI Times,* I discussed the barriers to work productivity; materials barriers are always significant issues. Solving these issues are critical, but doing so requires a sound approach, a managing system, performance indicators, a plan, and a lot of perseverance. Hand-in –hand with materials management barriers are issues in pre-planning work prior to execution. For the purpose of this discussion, we will assume that a proper planning and scheduling process is in place, and the root cause of the barrier is poor materials management.

Materials to perform work come to maintenance from one of two sources: either directly purchased or from an on-site warehouse. Direct materials generally get bogged down due to several problem areas:

- Poor specifications on file: The current system is not updated to give the proper information on the part required leading to excessive time spent searching for this information.
- Cumbersome approvals process: When work is approved in many instances it requires another approval to purchase the materials for the job.
- Poor receiving practices: Parts and materials are received without a reference to a work order and are "lost" on the receiving dock.
- Poor notification procedure: Materials are received but poor communications between maintenance and purchasing introduces delays in applying the materials to the job.

Any of these will lead to less then optimum response of the materials procurement process causing undue delays in getting the job done. Warehouse provided materials introduce a more complex set of problems.

Facility warehouses are generally poorly run. Most managers responsible for this function have forgotten that they are serving two masters. They must provide a good return on the investment in this asset, and they must provide good service levels for the maintenance department. The key process measurements that gauge the effectiveness of both are:

- Annual Inventory Turns: Total annual issues from inventory divided by average annual inventory value. This number should be between 3.0 and 3.5 turns per year. We usually find inventories turning at less then 0.7 turns.
- Service Level: number of items issued divided by number of items requested. A service level of 97% is a good target. Eighty to ninety percent is the range we find.

So why are these values so low? The most common problems are one or more of the following:

- There are no measuring systems to gauge the performance. The measure we most commonly see is inventory value.
- There is no plan in place to improve inventory performance, as it is not viewed as a contributor to poor maintenance efficiency, but rather a cost problem.
- Obsolete parts are seldom purged from the inventory. This clutters the warehouse, compounding space allocation problems for good parts.
- Stock levels are out of line with demand. We find many cases of multi-year quantities in the bins.
- The CMMS (if in place) has not been updated with the proper specifications for the parts or categorization of parts is complex, making it difficult to find items.
- Cycle counting is not performed to match on hand records with on hand quantities.
- Max/min levels have not been adjusted since the parts were initially established.
- Security of the warehouse is poor. Items are removed without notification to those responsible for maintaining proper levels, driving down the service level.
- There is no rationale for establishing an item in the inventory.
- The reorder process is cumbersome and ineffective.
- The location of the facility has not been taken into account when the inventory was established. A warehouse for two identical facilities should vary greatly if one is located on Alaska's north slope versus one just outside of Philadelphia's metro area. Parts availability from local suppliers should significantly drive down the stocking requirements.

And the list goes on. The common theme of poor performing warehousing operations is complacency: it is not until we perform a "Day In The Life Study" and develop the indicator values are our clients fully aware of the impact poor materials management has on their internal productivity.

In this brief space it is difficult to get into much depth about this serious problem, so I've highlighted the major themes. Please contact me at SAMI if you would like to discuss this further. As for me, I'm heading out to the garage to continue my search...

The Operational Reliability Maturity Continuum:
Part 6 Preventive Maintenance

Just so we're clear, when I discuss Preventive Maintenance, I want to make sure that you don't think that I'm talking about some high tech approach to solving all of your reliability problems. I want to discuss PM within the context of Stage 1, or "Core Maintenance" competencies.

All too often, Companies, and alas, managers want to go right to the pinnacle of reliability technology. They go out and beg borrow or steal predictive technologies, condition monitoring, RCFA (Root Cause Failure Analysis), RCM (Reliability Centered Maintenance) and any other myriad of Stage 3 and 4 techniques. In fact, you probably already know about these tools and, if you don't already own them, have been casting an eye at them sort of the same way I look at the Sharper Image Catalog around Christmas.

These initiatives are all well and good, but remember, they will generate new tasks for your maintenance staff. If you're well under control and planning and executing work in accordance with long-range and weekly schedules, then you may be ready for the "big time."

I once remember visiting a client at a large generating facility. They had a crew of people (4 of them) whose only mission in life was to conduct vibration, oil and thermal analysis of rotating equipment and switchgear. One day I sat down and talked with the lead. He told me all the great things they were doing and finding out. When I asked him what they were doing with the results, he sadly stated that "very little" was being done. No one had the time or resources to act on his findings. After all, the equipment wasn't broken yet! I concluded my visit by asking the manager why he didn't reassign those 4 valuable resources, since no one did anything with their input, why waste everyone's time? A perfectly logical question, from my point of view.

At another plant, I was told that they (the maintenance organization) were fully involved in an oil analysis program with one of their suppliers. Samples were dutifully taken for analysis, sent to the supplier and then analyzed. The results were then sent back to the site and filed by the Maintenance Clerk, never to see the light of day again. With nothing better to do, I asked to look at these files. After a few hours of review, I noticed the iron content was getting higher and higher in one of the ball mills. Hmmmmm, what could this be indicating. Over lunch, I mentioned my observation to the Maintenance Superintendent. Lo and behold, the offending mill was scheduled for a major inspection the next week. Results, a damaged gearbox that was getting ready to fail catastrophically.

What does all of this prove? Well, to me, it points out that in order to make the finer points of PM work, you've got to be in touch with the Stage 1 basics. When you are comfortable with planning, scheduling and executing that schedule, it makes it possible to add new activities to your list, without interrupting schedule. Most condition monitoring and predictive activities identify degradations in equipment of systems, prior to failure. Therefore, there is ample time to plan, schedule and execute, prior to failure. That's why we do it.

Next issue I'll talk about starting Preventive Maintenance activities during Stage 1 implementation. It's pretty simple and not all that difficult.

The Operational Reliability Maturity Continuum:
Part 7 Planning & Planners

There is no "Silver Bullet" when it comes to planning. How's that for an opening statement? It amazes me that when I visit facilities all over the globe that there is such a discrepancy in opinions over what constitutes planning. One would think that when it comes to maintenance, work is identified, prioritized, planned, scheduled and executed. Not so!

In order to obtain the most efficiency from the work force, work should be planned. As I have discussed earlier, planned activities provide the feedstock for a healthy schedule of work for the next week. Getting back to basics, what should a work plan consist of? Perhaps this is a more relevant question.

Most likely, what I say from this point on will be a candidate for intense debate. After all these are personal preferences, based on my experience. Experience, you say. Well, when I was wet behind the ears, my first job was that of a planner. Only we didn't quite know it as such. I was a new management assistant in the maintenance department (no, not an engineer) and fresh out of college. I was shown how to walk a job down, talk to the craftpersons for their input, determine the parts required and plan the activity, step-by-step. This was fun! Were mistakes made? You bet, and there were plenty.

What have I learned over all of these years? Primarily, the organization should have a clear, concise, and universal understanding of the roles and responsibilities of the planner. This assumes that the organization has chosen to have a planning function. The very fact that you've taken time to read this article probably means that there are planners somewhere on your site.

What I have found, that is most disturbing, is that planners are mostly misunderstood. In the field, when I have asked the question, "What does the planner do?" answers have been varied. My view of planning is founded on the premise that the planner is a strategic element in your overall maintenance program. The planner should be firmly rooted in the future. Firefighting badges should never be awarded to planners because of their day-to-day routine. Furthermore, planners should not be assigned directly to the line organization. When this happens, the planner soon finds himself deeply immersed in real-time activities. Worse still, the planner often ends up as the "go-for" for the line manager. This further emphasizes the misconceived value that the organization places on the planner's role i.e., the planner is expendable. After all, he isn't working on anything that's important or broke!

We can argue loud and long about the relative position of the planner within the organization. Let me ask you this question, "How important do you think planning is to the future of your company?" If the answer is, "pretty damn important," then you shouldn't be populating those positions with crafts level personnel. This is not to denigrate the importance or knowledge base of craftpersons; however, placing planners at a relatively high level within the organization conveys the message that planning is important. This doesn't mean that the planner needs to be a degreed engineer. Even though engineers have some value and could eventually become a good planner, why not promote someone up from the field, who possesses "subject matter" expertise. Although, depending on the size of the organization, it might make sense to have both types in the planning group. A final word of caution. Please don't assign planning responsibilities to personnel who have failed at other assignments, are retired in place or you can't find any other position for them. Planners and the planning group needs to have the respect of the site community. Enough said!

So, what are the planner's roles and responsibilities. Primary roles are to:

- Manage data
- Plan and coordinate work activities
- Schedule work
- Support the analysis process and
- Look into the future

The planner supports and in some cases is directly involved in all phases of a Stage 1 Work Management Process: identification, prioritization, backlog management, materials management, planning, scheduling, execution and trending, reporting and monitoring performance. If you ever find the planner involved in:

- Supervising people
- Functioning as the foreman's "right hand man"
- Serving as a purchasing agent or expediter
- Living "in the moment"

At this point you should re-examine the relative importance of the planner and the planning function within your organization. It would be clear to me, that someone isn't getting the message.

In the next article, I'll talk a little about what planning should look like. Again, this is from my perspective and is subject to debate. If you'd like to challenge me, or better still discuss tactics to move from reactive to proactive, please give me a call or drop an e-mail. I welcome your input.

The Operational Reliability Maturity Continuum:
Part 8 What is a Plan Anyway?

In the last article I described the role of the Planner within the Work Management process. I never managed to describe the "perfect" work plan. I'll attempt to achieve that now.

If you remember from the last time, the Planner plays a key strategic role in the Work Management process. The responsibility of the Planner is to look into the future and plan for activities down the road. Unless there's a flat out emergency, planners should never involve themselves in day-to-day activities. The first line supervisor can more than adequately take care of that assignment.

So, what is a plan? Let me set a few parameters for this discussion. A plan is not to be confused with a schedule. Schedules are a group of planned activities (corrective, preventive, projects…) that are allocated to specific time periods, for the purpose of sequencing, timing and execution. Work plans are the specific actions required to accomplish a work activity.

Now, there are many different opinions as to what constitutes a work plan. I once conducted a planning workshop with a client where I split the group into two teams and sent them off to plan the same two jobs. The group consisted of individuals with varying degrees of maintenance and operations experience. The results for the same two activities varied greatly, much to their amazement. In fact, we spent the better part of the afternoon debating how those two specific jobs should have been planned. This exercise was extremely instructive to the group as it demonstrated, and became apparent to them, that there should be some level of guidance provided to planners to ensure consistency of planned activities.

Now I'm sure that we'll all agree that there are levels of planning. Dave's 1st Law of Planning states "***Let the plan fit the crime.***" In most mature organizations, it's OK to consider the "skill of the craft" in planning work activities. For example, in most cases I wouldn't expect any planning on a Work Order requesting the adjustment of packing on a valve, unless there were extenuating circumstances. However, if the Work Order describes a broken pump shaft, then the level of planning increases, as you might well imagine. What I'm attempting to tell you is that all activities need not enjoy the same level of planning.

The 2nd Law states "***Don't let yourself become an expediter.***" The whole idea behind planning and scheduling is to extend the planning horizon in order to enable parts and materials to be ordered in a timely manner. Give yourself plenty of time to obtain the parts. Enroll the buyers and warehouse in the endeavor. Don't ever, without endangering your livelihood, allow a Work Order to be placed on the schedule until the required parts are available.

Lastly, the 3rd Law states "***If you need support, you'd best identify it and make sure it's available.***" Not all work activities can be accomplished solely by one craft. Often some sort of support is required to accomplish an activity. Nothing annoys an electrician more than having a mechanic ask for support on the day that the activity is being performed. This is especially true if the electrician has already planned his day out. Work activities can require all sorts of support ranging from craft, specialty contractors, heavy material, lifting equipment, scaffolding, operators, etc. Part of the planner's responsibility is to have those specific support requirements identified and communicated well ahead of time. Think of the planner as an orchestra conductor. In a beautifully played symphony, all the musicians combine at the right time to make the music. The same applies to a well conducted work activity.

Here are some ideas as to what a work plan should contain:

- Estimates
  - o Best guess
  - o Other input
  - o History
- Detailed instructions
  - o May already be contained in a job library within your CMMS tool
  - o May have to be created
  - o May not be required – 1st Law
- Other documents
  - o Drawings
  - o Equipment manuals
  - o Etc.
- Parts or special materials
  - o Location
  - o Availability
- Safety, regulatory or environmental concerns
- Post maintenance testing
- Specific requirements
  - o Staging
  - o Cleaning
  - o Lock-outs
  - o Contractors
  - o Permits
  - o Special equipment
  - o Other crafts
  - o Equipment availability
  - o Special tools
  - o Rigging
- Etc.

This is certainly not a complete list. Each facility, depending upon the experience and skill level of the craft as well as the complexity of equipment will have differing levels of Work Plan content. This is only meant to provide some idea of the requirements that most craft desire.

Again, as always, these ideas are from my perspective and are subject to debate. If you'd like to challenge me, or better still, discuss tactics to move from reactive to proactive, please give me a call or drop an e-mail. I welcome your input.

The Operational Reliability Maturity Continuum:
Part 9 Work Execution

Up until now, we've been discussing Stage 1 activities that lead to work execution. I guess I've always been a little uncomfortable with that term. When I talk with clients and tell them that we're going to talk about the execution phase of the Work Management process, they usually look around the room as if to say, "What did I do now?" What I mean by execution is the actual laying of hands on the equipment. This is the point of a Stage 1 Work Management process where all of the planning and scheduling efforts come together. On the other hand, this is the point where they can fall apart.

All previous Work Management activities are of a strategic, forward-looking nature. Primarily these activities are performed as planning and scheduling responsibilities. Of course, this depends on who's responsible for planning and scheduling and varies from organization to organization. The execution phase is tactical. Whether a supervisor is working to a weekly work list or daily schedule, it is important that he or she be involved in the creation of those schedules. This is not to mean that the supervisor is responsible for the development, only concurrence. As we expect with operations, the "buy in" element is critical.

If any organization is going to reap the benefits of a well-conceived Work Management process, then it is during work execution. However, crisp work execution requires organizational discipline, another of my favorite terms. No, put away the whips and chains. Discipline means sticking to the plan.

Once a work schedule changes hands, the schedule should become the property of the maintenance supervisor. This transfer should take place far enough ahead to allow for preparation of daily activities. Furthermore, if the work is accompanied by detailed work plans, then those plans should also receive an appropriate level of review and approval prior to the schedule date. This allows time for the correction of work plan deficiencies and a review of parts status. Where possible, parts can be staged prior to work commencement. Perhaps, more importantly, the supervisor can share plans with craftpersons, prior to the day of the activity.

Now, an argument can be made for scheduling either by the week, via a list of desired activities (weekly schedule) or by the day, where expectations for each day are laid out in advance. The weekly approach allows the supervisor to decide what will take place each day while the daily schedule is more formal, removes some of the flexibility and can become labor intensive, depending on the CMMS in use. While I personally prefer the weekly work list approach, both approaches can work well. However, in both cases, each day must be scheduled the day prior to execution. This is to allow craftpersons to know what they'll be working on, therefore removing some of their anxiety, and providing them with some semblance of control. Furthermore, this will also allow the supervisor to communicate with operations counterparts and ensure that equipment will be ready for the next day.

When schedules are published and distributed to the workforce, in advance, I have seen some amazing things happen. I remember seeing an electrical and mechanical supervisor discussing a job that was scheduled for the next day. This was after the shift ended and most people were gone. Both electrical and mechanical groups were involved and they were planning how they could integrate their activities. This wasn't a "forced" conversation. They were just planning their day. At another facility, I began to notice that boxes of parts were stacked by work locations and staging and rigging were mysteriously appearing around equipment that was scheduled for repair that week. Again, this was done by workers, on their own initiative.

It is my firm belief that everyone wants to do a good job. Why keep the workers out of the loop? Giving them information and better still, letting them know when the work will occur, provides them with a mechanism to provide valuable input and some control of their workday.

Back to discipline. If a schedule is published, then all attempts should be made to stick to it. We can start by not scheduling more work than is reasonably achievable. If you have an average reactive workload of 20%, then you shouldn't schedule more than 80% of your available time. Why? Well, if you can expect a work group to be spending at least 20% of their time on "break-in" (emergent high-priority) work, how could you expect them to complete all of their scheduled work? They start the week knowing they can't meet all of their schedule goals, so why try. Now, I'm assuming that resource estimates are fairly accurate, or a lot of slop will occur, blowing my argument out of the water. What I recommend, when starting out, is that you set schedule loading for a shop at 5% less than the rate of break-in work. Provide the supervisor with a list of other work that can be interrupted. Then set the expectation that at least 90% of the work that is on the schedule for the first workday of the week, be completed by the last workday of the week. This sets realistic expectations. As the rate of break-in work decreases, estimating gets better, and work capacity increases -- gradually increasing your expectations, but never back away from expecting scheduled work not to be performed.

It will be difficult at first. All maintenance workers, me included, have been trained from the very beginning to be reactive. Some organizations actually measure have quickly work requests are dealt with. Maintenance supervisors are famous for dropping what they're working on to deal with a perceived emergency. My advice is to let the scheduling process work. Encourage workers to stick to the schedule, and discourage them from dropping what they're doing. Plan for the emergencies by holding resources in reserve, assigning them to interruptible jobs. Try it; you might be pleasantly surprised with the results

The Operational Reliability Maturity Continuum:
Part 10 Work Closure & Documentation

At last, the work has been identified, prioritized, scheduled, planned and executed. Whew, finally we're done and on to the next task. Not so fast, I say.

Probably the least understood and under appreciated step in an advanced Stage One Work Management Process is that of Work Closure and Documentation. Why would I say this, you might ask? Well, if you have truly conquered the step of identification, scheduling, planning and execution, you are probably ready to tackle Stage Two objectives (Proactive Maintenance). However, in order to understand and institute proactive strategies for critical equipment, where do we start? The answer lies in understanding equipment history and the how and what of past failures. This information is not generated automatically. Some of you may think that by employing an advanced CMMS (Computerized Maintenance Management Systems) that in fact, this information is readily available. Not without accurate input. This input usually and correctly starts with the craftsmen performing the work.

Think about it, the craftsmen have, if successful, corrected an equipment deficiency. They have analyzed (in spite of the best efforts of planning) the failure and applied the correct adjustment or replaced failed parts. They are in the best position to perform the preliminary failure analysis and identify what it took to correct the problem. We had best make use of their intelligence, if we wish to learn, as an organization, from their experience.

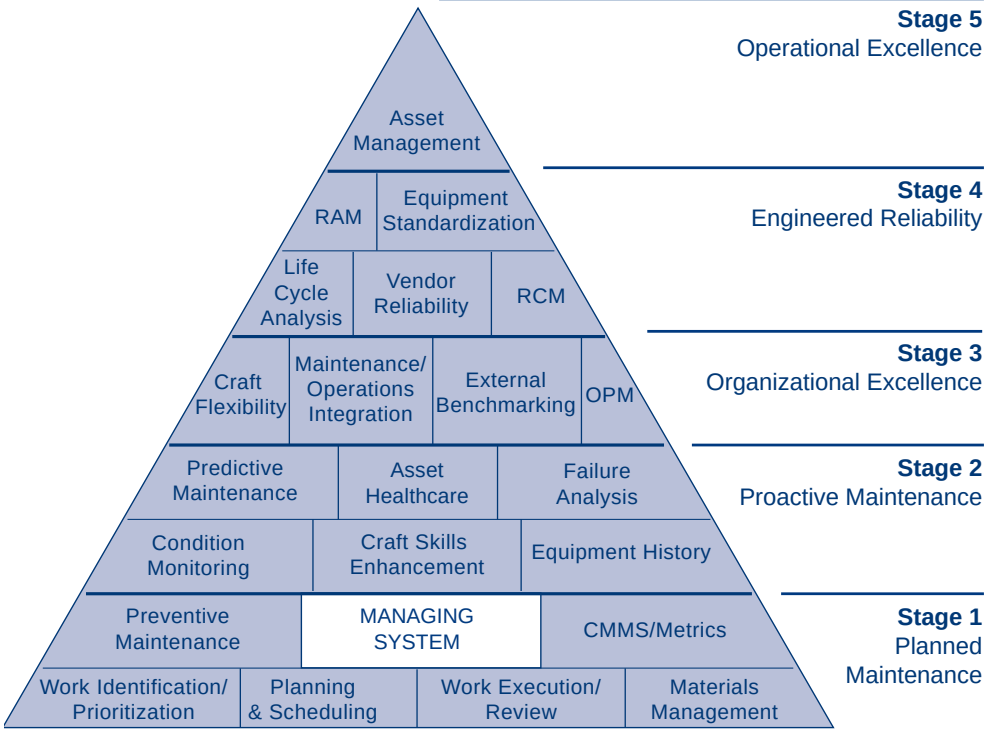
How best to gather this intelligence? Well, there are a couple schools of thought. One says, have them (the craftsmen) write it down somewhere. Then the supervisor attempts to interpret the handwriting, either enter it into the CMMS or have a clerk make the entry. The second school says, have the craftsmen enter the information directly into the CMMS.

I would agree with the second school of thought with some minor revisions. First, organizations have to get over the concern that crafts level employees will only mess up the database. After all, we are living in the 21st Century. Most of us have been using computers for the better parts of our lives. I have seen managers that have accomplished terrifying things with data entry. Anyone born before me should have a good working relationship with computers. The second issue is trust. I strongly feel that if the craftsmen are given the opportunity to understand the importance of appropriate and correct data entry at the end of a job, then they will provide that information. People want to do a good job, but it helps if they understand the how's and why's.

Once we have gotten over that barrier, what do we need (not want) to know? I have developed a pretty short list:

1. What did you find?
2. What did you do to correct the condition?
3. How long did it take?
4. What parts did you use?
5. How can the work plan, procedure, instruction be improved?
6. What was the cause of failure?
7. How did you leave the equipment?

All of this information can be included as part of the closure section of the CMMS. I would strongly recommend that craftsmen be given introductory training in failure cause determination. They need not be trained in rigorous root cause analysis techniques. However, they should understand what the failure codes mean, and how to apply them in a consistent manner. Once trained, expectations should be set and followed up.



Here is a last caution. As with the level of planning, not all activities deserve the same level of documentation. Simple activities can be treated as such with minimum documentation. However, as tasks increase in complexity, so should the documentation. Armed with an understanding of "what happened" to the equipment will make it much easier to determine how to develop the correct proactive strategy for your equipment.

The Operational Reliability Maturity Continuum:
Part 11 CMMS

One of the tools that we, as maintenance professionals, rely on for our day-to-day activities is the CMMS (Computerized Maintenance Management System). You know, the good old maintenance department computer. Without aging myself too much, I recall the first time a computer was made available to me. It was located in purchasing (sound familiar) and based on COBOL language, you remember COBOL, don't you? Well, we were able to enter rudimentary Work Order information and track some of the information. Being technically inclined, I thought this was the greatest thing since sliced bread, although sorely limited. The good news was that I did learn how to map out process flows, a great tool for later in life.

At another facility, I was introduced to a more robust system. This was IBM based, a proprietary, system wide program and alas, required an Information Technology department for support. Here was a rude awakening, another corporate system, obtained for purchasing, payroll and billing with maintenance as an "oh-by-the-way" add-on. Does this sound familiar? There is a theme appearing.

This program was much more robust than any previously used, but still flawed. I noticed that when operators entered a Work Request, they would call the same piece of equipment by different names. Not always would system information be correct. Therefore, sorting and reviewing Work Requests/ Orders was difficult. When asked to help correct these issues, say with a protected table of equipment names and systems, I couldn't wait to jump to the rescue. Unfortunately their idea of jump, was expressed in time units quite different than mine. As for training, there was no training, it was all learn on the job.

Let's fast forward a few years. Now as a consultant with all that experience behind me, I visited a company where an advanced CMMS was in place and all information was dutifully entered. This was in Taiwan and the plant personnel were meticulous about entering Work Order information. That was the good news. Having identified a problem in the field, I asked the maintenance engineers to research the CMMS for previous occurrences. After the appropriate level of open-mouthed wonderment, I discovered that no one had been trained to retrieve data. In this case, it was good information in, nothing out. As it turned out, the real purpose of the CMMS was to collect time-keeping and accounting information. Again, does this sound familiar?

As maintenance professionals, we understand the powerful value of today's CMMS's as enablers for Work Management processes. Previous articles have addressed planning, prioritization, backlog management, scheduling, identification, execution, etc. All made easier with the appropriate application of a CMMS. We can use history to identify chronic problems, a Work Order database to identify and group related work, capture job plans for future use, ties costs to asset registers. The list goes on. We understand this concept. Herein lies the rub, not all do!

CMMS is the key to making your Maintenance Management System more effective. However, a CMMS alone will not solve your problems. The CMMS is not a silver bullet. Once, while visiting a potential client (plant manager) I remarked on the importance of having a well-documented process for scheduling work activities. I was told that this would no longer be an issue. His company had just purchased a brand new, Windows driven CMMS that would solve their scheduling problems. I thanked him for his time and left. How many installations of a CMMS are based on financial requirements, with maintenance as an afterthought?

Often we are strapped with a legacy CMMS or one of the newer versions of CMMS on the market. Whether the system is Corporate based, stand alone, Windows based or any other variation, I have the following recommendations.

First of all, it has been my experience that any CMMS will work, in some manner, shape or form. The issue is that your Maintenance Management System must be adjusted to ensure that field processes are closely aligned to the CMMS. In the case of a new CMMS, if you have the luxury, you might be able to specify a design that matches your existing process. If you're not so lucky, then you will have to carefully map out your process, identify all required CMMS touch points and adjust where necessary. Then, and this is most important, train, train, train. Train not only maintenance personnel, but anyone who may be involved in the process. Operators are often neglected and enter work information as they see fit. Work identification should be structured, priorities understood, etc. In some cases EINs (Equipment Identification Numbers) will require modification. The list goes on. A well designed CMMS, closely linked to your Work Management process, will serve you well. Misalignment is a nightmare.

Terry O'Hanlon of Reliabilityweb.com recently conducted a benchmarking exercise on CMMS software. Some of the information was quite interesting. 40% of the respondents spent >$110,000 on their CMMS software. However, 51% are spending < $25,000 per year on training, upgrades and support. 60% had to revise their Work Management flow to accommodate the CMMS. 57% felt that they didn't achieve the anticipated ROI. 59% have no formalized CMMS training program for new employees that will use the system. Finally, only 22%of 378 respondents rated the CMMS implementation very successful. You can obtain this information by visiting the following link: http://www.maintenancebenchmarking.com/survey/cmms_benchmark_1002.htm

In closing, if you are either considering the purchase of, or have recently purchased, a CMMS, please take the time to identify the linkages with your Work Management process. You may have to make some revisions, but they will be well worth it. Document what you've done, then train tirelessly. A CMMS is a valuable tool if used properly.

The Operational Reliability Maturity Continuum:
Part 12 PWCi

And Now for Something Completely Different

In the past, I have discussed KPIs (Key Performance Indicators) as essential elements in measuring the success of any Asset Healthcare endeavor. Relevant Stage 1 metrics are; total maintenance costs, contractor costs, overtime, backlog, schedule adherence, resource loading, etc. Stage 2 metrics are closely aligned to specific component and system metrics, along with overall facility availability and/or reliability. Implementation metrics are tied to project milestones, training, and sustainability metrics.

In most cases, companies determined to improve or monitor their Asset Healthcare processes use some or all of these metrics. While we may choose to argue over what constitutes a backlog, or what the targets should be, we do agree that knowing the size of the elephant is important. The source and structure of the measurement becomes the focus of heated interactions with IT (Information Technology) groups. Wow, the "World Class" discussion gets even heavier.

Let's go back a few steps. Companies commencing the journey down the Asset Healthcare highway need an easy way to show where they've been, what's achievable short term and finally what an constitutes an ultimate goal.

Like others, I have struggled over the years finding a way to clearly demonstrate the benefits of Stage 1 Asset Healthcare improvements, without the distraction of a host of charts and tables. Thanks to the hard work of my friend and colleague Ralph Hedding, I think the answer has been found. We call it the PWCi™or Proactive Work Capacity index. It combines three metrics in an easily decipherable graphic that even the furthest removed managers can easily understand. The three components are as follows:

1. Wrench Time – Wrench time is determined during DILO (Day in the Life of…) studies undertaken during the Assessment phase of the engagement.
2. Schedule Attainment – The percentage of work scheduled accomplished during the week, based on the schedule published the previous week.
3. Resource Loading – The percentage of available resource (discounting training, vacations, etc.) assigned to scheduled activities published the prior week.

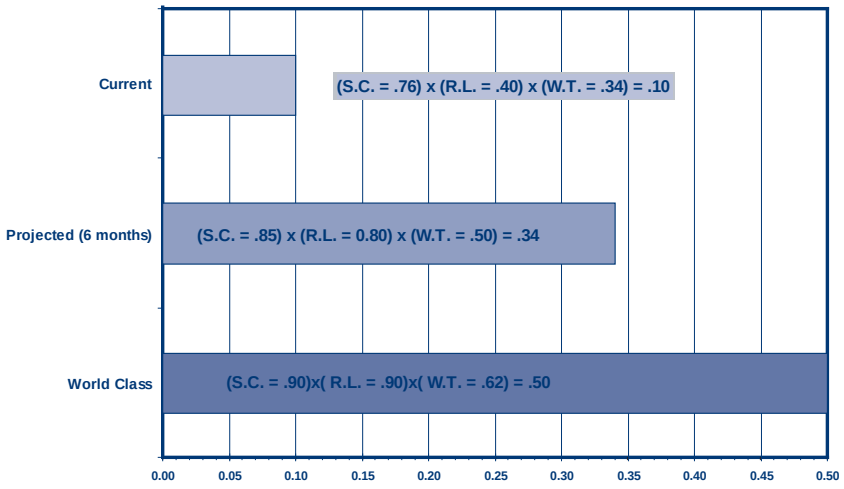
Multiplying the results of the three metrics establishes the PWCi™ We have determined, from experience, that World Class Stage 1 performance looks like this:

- Wrench time = 62%
- Schedule Compliance = 90%
- Resource Loading = 90%

Using these metrics, World Class performance would have a PWCi™of **.50**.

Typically, our clients start down the Stage 1 improvement path with a PWCi™of **.10**, or only 20% of World Class performance. However, six months after the commencement of implementation our clients can

Proactive Work Capacity Index (PWCi)
(Schedule Compliance)x(Resource Loading)x(Wrench Time)



and do attain a PWCi™of **.34**, a three fold improvement!

What I really like about this metric is the fact that it understandable. In addition, the data is easily obtained, if an assessment has been performed. We like to have the client develop the Wrench Time estimates. The PWCi™is updated weekly; however, the Wrench Time is developed quarterly. That means that once a quarter, a team of plant personnel conduct a series of DILOs to create a new Wrench Time standard.

This is a quick and easy way to demonstrate progress. It reinforces new behaviors in the organization by focusing on Proactive activities. Monthly goals can be set, similar to United Way, by showing progress vertically.

I feel that if you can achieve a PWCi™above **.30**, you are firmly on track to your ultimate goal of gaining control of your work and increasing the work capacity of your workforce. You will be ready for Stage 2, "Gaining Control of the Equipment."

I'm interested in your thoughts about this metric.