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How to Automate Your Maintenance Work Order System

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State-of-the-art computerized maintenance management techniques coupled with a tested implementation method result in a winning combination: better equipment capability and reliability along with the ability to get 20% to 30% more work done with available maintenance resources.

Thousands of maintenance departments are currently adding a new computerized maintenance management system or updating the current system for processing their work orders. This may seem like a fairly complicated project but it need not be. The main reason it seems complicated is that it is a development project, not a routine operation which is repeated over and over like manufacturing your products. The key is proper planning. With all the decisions involved, where do you start? These are the essential steps your department should take when making this transition.

Assessing the current situation

The best way to start is to look at where you are today. You need to do this because, regardless of the system you select you have to start from where you are and then develop an orderly series of steps to get where you want to end up.

A. Organization. The most essential ingredient in your maintenance management system is the people. An excellent system run by poorly trained or motivated people will be adequate at best; but well trained people with positive attitudes can make an excellent system world class. This is why you start here. You need to know how many requesters (people who request maintenance service) there are; who are the most frequent requesters; what are their needs; how many and what kind (skills) of maintenance personnel do you have.

B. Equipment. The maintenance workload is determined by the equipment and building facilities. Ask what kind of equipment and how many there are. Ask requesters what their top ten equipment or facility problems are. The operations people will tell you what equipment problems they have and the maintenance people will know what building system problems are most frequent. How many equipment numbers are in the current system? How many should be added? How many require revision?

C. Work Orders. You need to know how many work orders are generated each week. A rough rule of thumb is that the average work order takes one hour. If you track that statistic, use your own number. From this and the number of maintenance workers, you can estimate number of work orders per week as follows: If you have a maintenance department of twenty workers, you have twenty times forty, or 800 labor hours a week. That means you generate roughly 800 work orders per week including routine and preventive maintenance.

D. Preventive Maintenance. You will want information on the current PM program. Frequently the reason attention is given to automating the work order system is

that equipment is unreliable. Unscheduled downtime disrupts scheduling and can even result in customer service delays or unacceptable quality. This may be a symptom of need for expanded PM routines. The best PM system does not necessarily cover 100% of the equipment, but it does cover all the essential equipment that can cause problems in quality or production rates or user interruption. PM is best handled as a partnership between the equipment or facility users, the maintenance department and the equipment supplier. The user should have a brief daily list of potential problem areas to check. This is your first line of defense. The earlier a problem is identified, the faster it can be corrected with minimum adverse results. The maintenance department is responsible for periodic PM such as changing gear box oil, lubricating motor bearings and cleaning as well as tightening adjusting and replacing worn parts. The vendor should be called in periodically, usually once a year, to go over the equipment and check that components are working properly and the machine is being used within design limits. Many times substitutes are made -- a ten horsepower motor for the original fifteen horsepower motor, for example -- that restrict the machine capacity and cause frequent trouble.

Find out how many PM routines you have now and assess what improvements and what new PM's are needed. Calculate how many PM procedures you will need to bring the program up to date. Some plants have found that a reduction in the number of PM's resulted. This was because, in the past, new procedures were added to the system but obsolete ones or duplicates were not removed. Now is the time to get this straightened out.

E. Support Functions. The current system for handling work orders should receive careful attention before any attempt to computerize or update it if it is already computerized. How are work requests turned into work orders? Who approves them? Do you have a written work order system? How are priorities determined? A verbal system? What percent of the work is documented so you have an effective equipment history for making decisions about when to overhaul or replace key equipment and when to adjust PM routines? Do you document emergency repairs? These are often handled verbally and are the least documented but the most costly repairs made.

F. Overall Productivity. You should estimate the overall maintenance department productivity. This will be a very important factor in getting management support and getting money in the budget for the improvements you want to make. Two ways to do this are: (1) do a work sampling to find out the present utilization or productive time. This is a statistical technique that can quickly establish productive time and delays you are experiencing, or (2) post-apply predetermined engineered standard times to at least twenty percent of a week's work and compare actual hours taken to the engineered standard times. Either method will require a fair amount of work by knowledgeable maintenance, industrial engineering or manufacturing engineering personnel, but it is worth the effort.

Determining the improvement potential

A. Functional and Cost Improvements. There are two types of improvement that will result from a well designed and integrated system. They are functional

improvements -- improvements in the process for handling maintenance work -- and cost improvements -- savings in the cost of each hour of maintenance performed. The cost improvement is absolutely essential for long term management support. The functional improvements are absolutely essential for employee support. Both types of improvements should be written down in a mission statement that provides a focus for everyone involved. Measurement of results versus the goals will keep management and employees informed of progress and keep them motivated during the various phases of development, training and installation.

A software aid to performing an operational audit of the maintenance department, called Aware.MNT™, guides the user through a series of questions in eight functional areas of the maintenance process, determines the overall productivity and productivity in each of the eight areas, and calculates savings potential which will result from improving productivity to a selected, higher level. See Chart 1 below.

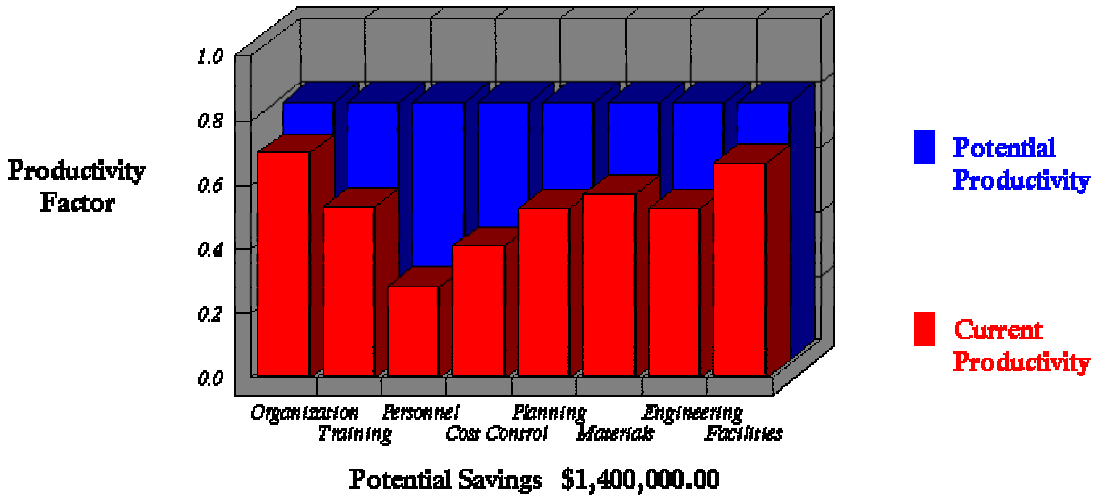

Chart 1. Aware.MNT™ bar chart showing productivity and savings.

B. Cost of Improvements. Your improvement costs will depend on the needs you have uncovered during the assessment of the current situation and determination of the improvement potential above. These costs can be applied to each step as you put together a plan of action describing how you will get the improvement potential. Savings that result from a well-designed maintenance system can pay for the system in less than two years after installation starts. See Chart 2 below.

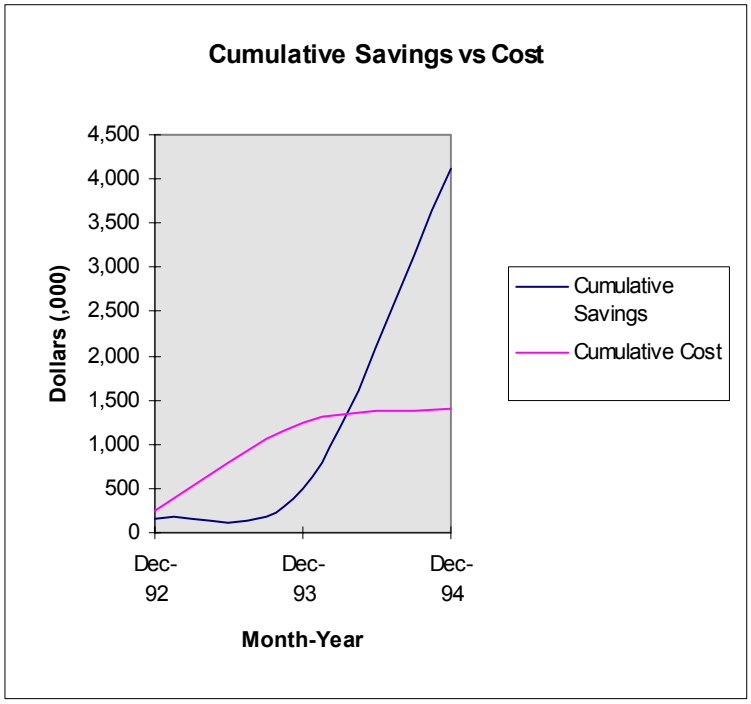

Chart 2. Savings versus cost of maintenance system improvements.

A typical installation scenario is shown below.

Developing a detailed plan to get from here to there

A. Organization. Improvements most frequently needed are better equipment reliability; getting more work done with limited workers, material inventory and supplies; and reducing costs. Operations management is often looking at the problem from the equipment reliability perspective while maintenance looks at it in terms of getting more done. Higher management is trying to reduce costs. It is interesting that all of these objectives are accomplished by focusing on two very important ingredients in the system: a formal planning function and an accurate yardstick for measuring the time it should take to perform the maintenance work. If you do not have a formal planning function in the maintenance department, it is like trying to manufacture your product without a production control system. The maintenance department needs are very similar to MRPII, manufacturing resource planning. You need an order entry system, master schedule, bill of material, routings, standards and capacity planning. Most maintenance departments, in the absence of planners, send the supervisor or the maintenance worker out to find out what is needed, then they go back to the shop and get the tools and material and return to the job site to do the work. If they missed something the first time, they often return again to the shop or stores. The result is about one-third to one half of the time used is unproductive as many delays interrupt the work. In a maintenance department with a formal planning function, there is one planner for every 25 to 30 workers. In a maintenance department with 30 workers, one planner will enable the maintenance workforce to get 20% to 30% more work done, the equivalent of adding six to nine workers at no additional cost. Results that can realistically be achieved for various size maintenance departments are shown in Table 1 below.

No. of Maintenance Employees	No. of Planners	Additional Equivalent Workers Resulting
150	5	30 to 45
100	4	20 to 30
75	3	15 to 22
50	2	10 to 15
30	1	6 to 9
20	1	4 to 6
10	1/2	2 to 3

Table 1. Number of planners for various size maintenance departments and additional work resulting.

These results have actually been achieved by many companies. Their first reaction to the numbers is shock. It's like going from one hour die change times to single-minute exchange of die (SMED). In that case, improved methods can help you achieve absolutely astounding results. In this case improved management processes help you achieve equally astounding results.

B. Training. The introduction of the planner function requires training. The planners are selected from the work force for their maintenance experience. This helps them know what is required to perform the work and also gives credibility to their planning effort. Others will be more likely to follow the plans if they know that a qualified person did the planning. But the formal planning part of their new job requires a different perspective. They need to visualize how someone else will perform the job and they will need training in how to document this information in the work order planning

process. Selection and training of the planners is the most important project step you will take.

Training for requesters and maintenance supervisors is also required to keep them informed of progress and the effect on their respective roles. Benefits are stressed during the training to ensure participation.

C. Systems and Procedures. The planning system must be based on a good planning process and an accurate, consistent yardstick for planning job times. The most frequently used method of applying times to maintenance work is the use of estimates based on experience or history. They are fast to apply but the main disadvantage is that, when compared to engineered standards, they are as much as thirty or forty percent loose. This is because all the delays and unproductive time experienced in the past are included. Estimates are *did-take times*. Engineered standards are *should-take times*. Coupled with an accurate labor distribution and reporting system, engineered standards will tell what is actually happening much more clearly; your scheduling will be much more accurate and consistent; and your plans will be much more credible. The best system available today integrates accuracy and speed of application. It is called Universal Maintenance Standards and has over forty years of application experience in all types and sizes of maintenance departments and industries as well as government, healthcare, education and commercial applications. Rather than individual, precise times, the system is based on ranges of time and work content comparison. The statistically averaged times are within plus or minus five percent of the true time engendered in engineered standards as developed for high volume production work. You will have a good yardstick for

scheduling the work and measuring the backlog. You will also have a tool for performance measurement and program payback analysis as you compare the results from week to week after installing or upgrading the planner function and engineered work measurement.

D. Integration. Up to this point, no mention of the automated system has been made. That is how it should be. Ranked according to priority, attention should be focused first on the people, then on the shop floor control and, finally, on the integration of an automated process for managing using computer technology. Authority should match responsibility and computer capability should match individual responsibility and accountability.

1. Software requirements plan. Most organizations today already have an automated maintenance information system and want to upgrade it to the state-of-the-art or add new capabilities. Some do not have an automated system and want to install one. In either case, when you address the computer requirements, there is again a preferred sequence. That sequence is: organization, process, software and, finally, hardware. If you start with the hardware and work in the other direction, it will be pure random chance if everything fits. You have established certain responsibilities for requesters, planners, supervisors, workers and data entry personnel. Now you need to give them a system that will respond to their responsibilities. These are the software application program modules: work order, preventive maintenance, equipment record, equipment history, scheduling, material and tool control, material inventory, engineered

standards, management controls and reports. In a multi-plant, multi-user system, wide-area network issues need attention. For example, PM procedures developed in one location should be transferable to all locations to avoid duplication. Cost comparisons for the same equipment at different locations should be possible.

2. Hardware requirements plan. Now you can determine the amount of hardware needed. The application program plus database storage tells you the size of your computer. If yours is a microcomputer system, you will likely need at least 8 megabytes (Mb) of random access memory (RAM) for operating the program and several hundred Mb of hard drive space for program and database storage. Your management information systems department or the software vendor can give you this information. Once you know the capacity needed for your system and the number of users with simultaneous access, you can select the right hardware. An allowance for your operating system overhead, network structure and future expansion is added to ensure that the hardware will be of sufficient size. Security is another important consideration. Access to each module and database is according to need and organization responsibilities. System interruptions should be planned for as with any equipment. Computer maintenance functions and backups are scheduled just like they are with other equipment.

If you already have a system, you may have outgrown its capacity -- a common problem with older systems. Symptoms are: slow response time; need to download history to tape backup or microfiche; not enough screens for users; delays in getting reports resulting in

less effective use of the data; duplication of effort, e.g. writing requests and then entering the same information on a computer keyboard; and changes in responsibilities not reflected in changes in the system capabilities. You will have much better success in correcting these problems if you follow the organization-process-software-hardware sequence. Anything short of this sequence will be a patch job that will compound the problems.

Installation. After setting up the planning function and training planners, supervisors and hourly workers as well as requesters, you are ready to install the new system. An installation approach that works well is to select a pilot area, one that has experienced personnel who are adaptable to change, and start there with a complete system integration and installation using all components. Run it for a week or so. Advantages are that management can concentrate attention on problems, if they arise, and resolve them quickly. In addition to the regular staff, key people from other areas where the system will be installed later should be included in the pilot. They will help complete the pilot in a more orderly fashion and will be able to take this hands-on experience to their own area when it is their turn to install. In this fashion, you can get an entire 30- to 90-worker maintenance department installed in one to four weeks after the software is installed. If you try to install all crews at the same time, it will always take longer and some errors in system use may become hard-to-change habits before you detect them. Good policy and procedure manuals are a must. They are prepared as a team project by users and recommended to management. Their approval is tangible evidence of higher

management commitment to the process and will answer in a consistent manner many questions that arise. For current employees and new hires over time, they also communicate goals established jointly by management and the workers.

Project Control

For a project of this size and importance to succeed, project control techniques are a must. A higher management project leader, or champion, is selected and given full-time responsibility if the size of the project warrants it. The project leader's responsibility includes having a project schedule prepared, reporting progress to management, chairing frequent meetings of the working groups, at least weekly when there are matters to consider and decisions to make, and tracking the program budget versus savings.

Conclusion. Automating or updating your maintenance program is complex and requires people, process and systems integration. Using a state-of-the-art maintenance management organization and process and a tried and tested approach to this change can result in improvements in function and cost. These improvements far outweigh the cost of resources required to accomplish the change. The new system will become a platform for continuous improvement that will generate important benefits far into the future.