

Glossary of Maintenance Terms

A

Actuarial analysis - Statistical analysis of failure data to determine the age-reliability characteristics of an item.

APL - See Applications Parts List

Applications Parts List - A list of all parts required to perform a specific maintenance activity. Typically set up as a standard list attached to a Standard Job for Routine Tasks. Not to be confused with a Bill of Materials.

Apprentice - a tradesperson (or craftsperson) in training

Asset - unlike in the accounting definition, in maintenance this is commonly taken to be any item of physical plant or equipment.

Asset Management - the systematic planning and control of a physical resource throughout its life. This may include the specification, design, and construction of the asset, its operation, maintenance and modification while in use, and its disposal when no longer required.

Asset Register - a list of all the Assets in a particular workplace, together with information about those assets, such as manufacturer, vendor, make, model, specifications etc.

Availability - the proportion of total time that an item of equipment is capable of performing its specified functions, normally expressed as a percentage. It can be calculated by dividing the equipment available hours by the total number of hours in any given period. One of the major sources of disagreement over the definition of availability is whether downtime should be divided by total hours, or by Scheduled Operating Time. For example, if your plant is only scheduled to operate 5 days a week, should downtime incurred over the weekend be included in the calculation of availability? The view I take is that one of the prime goals of any organization should be to maximize its Return on Assets. This can only be achieved by reducing the total downtime, regardless of whether this downtime was scheduled or not. For this reason, I prefer to use a definition of downtime that considers **all** downtime, as a proportion of total time, not scheduled operating time.

Available Hours - the total number of hours that an item of equipment is capable of performing its specified functions. It is equal to the total hours in any given period, less the downtime hours.

Average Life - how long, on average, a component will last before it suffers a failure. Commonly measured by Mean Time Between Failures.

B

Backlog - Work which has not been completed by the nominated 'required by date'. The period for which each Work Order is overdue is defined as the difference between the current date and the 'required by date'. All work for which no 'required by' date has been specified is generally included on the backlog. Backlog is generally measured in "crew-weeks", that is, the total number of labor hours represented by the work on the backlog, divided by the number of labor hours available to be worked in an average week by the work crew responsible for completing this work. As such, it is one of the common Key Performance Indicators used in maintenance.

Benchmarking - the process of comparing performance with other organizations, identifying comparatively high performance organizations, and learning what it is they do that allows them to achieve that high level of performance.

Bill of Materials - a list of all the parts and components that make up a particular asset. Not to be confused with an Applications Parts List.

BOM - see Bill of Materials.

Breakdown - a specific type of failure, where an item of plant or equipment is completely unable to function.

Breakdown Maintenance - see No Scheduled Maintenance

C

Call-out - To summon a tradesperson to the workplace during his normal non-working time so that he can perform a maintenance activity (normally an emergency maintenance task)

CBM - see Condition Based Maintenance

CMMS - see Computerized Maintenance Management System

Component - a subassembly of an Asset, usually removable in one piece and interchangeable with other, standard components (eg. Truck engine).

Computerized Maintenance Management System - a computerized system to assist with the effective and efficient management of maintenance activities through the application of computer technology. It generally includes elements such as a computerized Work Order system, as well as facilities for scheduling Routine Maintenance Tasks, and recording and storing Standard Jobs, Bills of Materials and Applications Parts Lists, as well as numerous other features.

Condition Based Maintenance - an equipment maintenance strategy based on measuring the condition of equipment in order to assess whether it will fail during some future period, and then taking appropriate action to avoid the consequences of that failure. The condition of equipment could be monitored using Condition Monitoring, Statistical Process Control techniques, by monitoring equipment performance, or through the use of the Human Senses. The terms Condition Based Maintenance, On-Condition Maintenance and Predictive Maintenance can be used interchangeably.

Condition Monitoring - the use of specialist equipment to measure the condition of equipment. Vibration Analysis, Tribology and Thermography are all examples of Condition Monitoring techniques.

Conditional Probability of Failure - The probability that an item will fail during a particular age interval, given that it survives to enter that age.

Contract Acceptance Sheet - A document that is completed by the appropriate Contract Supervisor and Contractor to indicate job completion and acceptance. It also forms part of the appraisal of the contractors performance.

Corrective Maintenance - Any maintenance activity which is required to correct a failure that has occurred or is in the process of occurring. This activity may consist of repair, restoration or replacement of components.

Craftsperson - Alternative to Tradesperson. A skilled maintenance worker who has typically been formally trained through an apprenticeship program.

Criticality - The priority rank of a failure mode based on some assessment criteria.

D

Defect - A term typically used in the maintenance of mobile equipment. A defect is typically a potential failure or other condition that will require maintenance attention at some time in the future, but which is not currently preventing the equipment from fulfilling its functions.

Discard task - The removal and disposal of items or parts.

Downtime - the time that an item of equipment is out of service, as a result of equipment failure. The time that an item of equipment is available, but not utilized is generally not included in the calculation of downtime.

E

Economic Life - the total length of time that an asset is expected to remain actively in service before it is expected that it would be cheaper to replace the equipment rather than continuing to maintain it. In practice, equipment is more often replaced for other reasons, including: because it no longer meets operational requirements for efficiency, product quality, comfort etc., or because newer equipment can provide the same quality and quantity of output more efficiently.

Emergency Maintenance Task - a maintenance task carried out in order to avert an immediate safety or environmental hazard, or to correct a failure with significant economic impact.

Engineering Work Order - the prime document used to initiate an engineering investigation, engineering design activity or engineering modifications to an item of equipment.

Environmental Consequences - a failure has environmental consequences if it could cause a breach of any known environmental standard or regulation.

Equipment Life - this term often isn't very useful, in a practical sense. For example, if I was to tell you that my Aunt has an axe that she uses for chopping firewood, and in the last 40 years it has had 2 new axeheads and 5 new handles, how would you define the life of the axe? Perhaps it makes more sense to talk about Component Life. Also see Economic Life, Useful Life and Average Life for some more practical definitions.

Equipment Maintenance Strategies - the choice of routine maintenance tasks and the timing of those tasks, designed to ensure that an item of equipment continues to fulfill its intended functions.

Estimated Plant Replacement Value - the estimated cost of capital works required to replace all the existing assets with new assets capable of producing the same quantity and quality of output. This is a key value often used in benchmarking activities.

Estimating Index - the ratio of Estimated Labor Hours required to complete the work specified on Work Orders to the Actual Labor Hours required to complete the work specified on those Work Orders, commonly expressed as a percentage. This is a commonly used measure of Labor productivity, particularly when there are well-defined Estimating standards. A figure of greater than 100% for the Estimating Index indicates a higher than standard level of productivity, while a figure of less than 100% indicates a lower than standard level of productivity.

EWO - see Engineering Work Order

Expert System - a software based system which makes or evaluates decisions based on rules established within the software. Typically used for fault diagnosis.

F

Fail-safe - an item is fail-safe if, when the item itself incurs a failure, that failure becomes apparent to the operating workforce in the normal course of events.

Failure - an item of equipment has suffered a failure when it is no longer capable of fulfilling one or more of its intended functions. Note that an item does not need to be completely unable to function to have suffered a failure. For example, a pump that is still operating, but is not capable of pumping the required flow rate, has failed. In Reliability Centered Maintenance terminology, a failure is often called a Functional Failure. Would you classify a planned equipment shutdown as a failure? Would you classify a routine equipment shutdown at shift change as a failure? Under this definition, the answer in the first case would be yes, but in the second case would be no. The justification for the inclusion of planned shutdowns as failures is that a failure, as defined, causes a disruption to the desired steady-state nature of the production process, and therefore should, ideally, be avoided.

Failure Cause - see Failure Mode

Failure Code - a code typically entered against a Work Order in a CMMS which indicates the cause of failure (eg. lack of lubrication, metal fatigue etc.)

Failure Consequences - a term used in Reliability Centered Maintenance. The consequences of all failures can be classified as being either Hidden, Safety, Environmental, Operational, or Non-Operational.

Failure Effect - a description of the events that occur after a failure has occurred as a result of a specific Failure Mode. Used in Reliability Centered Maintenance, FMEA and FMECA analyses.

Failure Finding Interval - the frequency with which a Failure Finding Task is performed. Is determined by the frequency of failure of the Protective Device, and the desired availability required of that Protective Device.

Failure Finding Task - Used in Reliability Centered Maintenance terminology. A routine maintenance task, normally an inspection or a testing task, designed to determine, for Hidden Failures, whether an item or component has failed. A failure finding task should not be confused with an On-Condition Task, which is intended to determine whether an item is **about** to fail. Failure Finding tasks are sometimes referred to as Functional Tests.

Failure Mode - any event which causes a failure.

Failure Modes, Effects and Criticality Analysis - a structured method of assessing the causes of failures and their effect on production, safety, cost, quality etc.

Failure Modes and Effects Analysis - a structured method of determining equipment functions, functional failures, assessing the causes of failures and their failure effects. The first part of a Reliability Centered Maintenance analysis is a Failure Modes and Effects Analysis.

Failure Pattern - the relationship between the Conditional Probability of Failure of an item, and its age. Failure patterns are generally applied to Failure Modes. Research in the airline industry established that

there are six distinct failure patterns. The type of failure pattern that applies to any given failure mode is of vital importance in determining the most appropriate equipment maintenance strategy. This fact is one of the key principles underlying Reliability Centered Maintenance.

FFI - pronounced "Fifi", but has nothing to do with a French maid. See Failure Finding Interval

FMECA - see Failure Modes, Effects and Criticality Analysis

FMEA - see Failure Modes and Effects Analysis

Forward Workload - All known backlog work and work which is due or predicted to become backlog work within a pre-specified future time period.

FTA - Fault Tree Analysis

Function - The definition of what we want an item of equipment to do, and the level of performance which the users of the equipment require when it does it. Note that an item of equipment can have many functions, commonly split into Primary and Secondary Functions. Note also that the level of performance specified is that required by the users of the equipment, which may be quite different to the original design, or maximum, performance capability for the equipment.

Functional Failure - Used in Reliability Centered Maintenance terminology. The inability of an item of equipment to fulfil one or more of its functions. Interchangeably used with Failure.

Functional Test - see Failure Finding Task

G

Gantt Chart - A bar chart format of scheduled activities showing the duration and sequencing of activities.

Go-line - Used in relation to mobile equipment. Equipment which is available, but not being utilized is typically parked on the Go-line. This term is used interchangeably with Ready Line.

H

Hazop - a structured process, originally developed by ICI following the Flixborough disaster, intended to proactively identify equipment modifications and/or safety devices required in order to avoid any significant safety or environmental incident as a result of equipment failure. Similar, in some respects to Reliability Centered Maintenance, but not as rigorous as Reliability Centered Maintenance in identifying underlying causes of failure, and does not consider, in any depth, the possibility of avoiding such incidents through applying appropriate Proactive Maintenance tasks.

Hidden Failure - a failure which, on its own, does not become evident to the operating crew under normal circumstances. Typically, protective devices which are not fail-safe (examples could include standby plant and equipment, emergency systems etc.)

I

Infant Mortality - The relatively high conditional probability of failure during the period immediately after an item returns to service.

Inherent Reliability - A measure of the reliability of an item, in its present operating context, assuming adherence to ideal equipment maintenance strategies.

Inspection - Any task undertaken to determine the condition of equipment, and/or to determine the tools, labour, materials, and equipment required to repair the item.

J

K

Key Performance Indicators - A select number of key measures that enable performance against targets to be monitored.

KPI - see Key Performance Indicators

L

Life - that strange experience you have all day, every day. In a maintenance context, you may want to look at Equipment Life.

LCC - see Life Cycle Costing

Life Cycle Costing - a process of estimating and assessing the total costs of ownership, operation and maintenance of an item of equipment during its projected equipment life. Typically used in comparing alternative equipment design or purchase options in order to select the most appropriate option.

Logistic support analysis (LSA) - A methodology for determining the type and quantity of logistic support required for a system over its entire lifecycle. Used to determine the cost effectiveness of asset based solutions.

LSA - see Logistic Support Analysis

M

Maintainability - the ease and speed with which any maintenance activity can be carried out on an item of equipment. May be measured by Mean Time to Repair. Is a function of equipment design, and maintenance task design (including use of appropriate tools, jigs, work platforms etc.).

Maintainability Engineering - The set of technical processes that apply maintainability theory to establish system maintainability requirements, allocate these requirements down to system elements and predict and verify system maintainability performance.

Maintenance - any activity carried out on an asset in order to ensure that the asset continues to perform its intended functions, or to repair the equipment. Note that modifications are not maintenance, even though they may be carried out by maintenance personnel.

Maintenance Engineering - a staff function whose prime responsibility is to ensure that maintenance techniques are effective, that equipment is designed and modified to improve maintainability, that ongoing maintenance technical problems are investigated, and appropriate corrective and improvement actions are taken. Used interchangeably with Plant Engineering and Reliability Engineering.

Maintenance Policy - a statement of principle used to guide Maintenance Management decision making

Maintenance Schedule - a list of planned maintenance tasks to be performed during a given time period, together with the expected start times and durations of each of these tasks. Schedules can apply to different time periods (i.e. Daily Schedule, Weekly Schedule etc.)

Maintenance Strategy - a long-term plan, covering all aspects of maintenance management which sets the direction for maintenance management, and contains firm action plans for achieving a desired future state for the maintenance function.

Mean Time Between Failures - a measure of equipment reliability. Equal to the number of failures in a given time period, divided by the total equipment uptime in that period.

Mean Time To Repair - a measure of maintainability. Equal to the total equipment downtime in a given time period, divided by the number of failures in that period.

MIL-HDBK- United States Military Handbook

MIL-STD- United States Military Standard

Model Work Order - A Work Order stored in the CMMS which contains all the necessary information required to perform a maintenance task. (see also Standard Job)

Modification - any activity carried out on an asset which increases the capability of that asset to perform its required functions.

MTBF - see Mean Time Between Failures

MTTR - see Mean Time To Repair

N

NDT - see Non-Destructive Testing

No Scheduled Maintenance - an Equipment Maintenance Strategy, where no routine maintenance tasks are performed on the equipment. The only maintenance performed on the equipment is Corrective Maintenance, and then only after the equipment has suffered a failure. Also described as a Run-to-Failure strategy.

Non-Destructive Testing - testing of equipment, which does not destroy the equipment, to detect abnormalities in physical, chemical or electrical characteristics. For some reason which escapes me, vibration analysis and tribology are not generally considered to be NDT techniques, even though they meet the above criteria. Techniques which **are** considered to be NDT techniques are ultrasonic thickness testing, dye penetrant testing, x-raying, and electrical resistance testing.

Non-Operational Consequences - a failure has non-operational consequences if the only impact of the failure is the direct cost of the repair (plus any secondary damage caused to other equipment as a result of the failure).

Non-routine Maintenance - Any maintenance task which is not performed at a regular, pre-determined frequency.

O

Oil Analysis - see Tribology

On-Condition Maintenance - see Condition Based Maintenance

Operating Context - the operational situation within which an asset operates. For example, is it a stand-alone piece of plant, or is it one of a duty-standby pair? Is it part of a batch manufacturing process or a continuous production process? What is the impact of failure of this item of equipment on the remainder of the production process? The operating context has enormous influence over the choice of appropriate equipment maintenance strategies for any asset.

Operating Hours - the length of time that an item of equipment is actually operating.

Operational Consequences - a failure has operational consequences if it has a direct adverse impact on operational capability (lost production, increased production costs, loss of product quality, or reduced customer service)

Operational Efficiency- used in the calculation of Overall Equipment Effectiveness. The actual output produced from an asset in a given time period divided by the output that would have been produced from that asset in that period, had it produced at its rated capacity. Normally expressed as a percentage.

Outage - a term used in some industries (notably power generation) which is equivalent to a shutdown.

Overall Equipment Effectiveness - a term initially coined in connection with Total Productive Maintenance. It provides a measure of overall asset productivity. Is generally expressed as a percentage, and can be calculated by multiplying Availability by Utilization by Operational Efficiency by Quality Rate.

Overhaul - a comprehensive examination and restoration of an asset to an acceptable condition.

P

P-F Interval - a term used in Reliability Centered Maintenance. The time from when a Potential Failure can first be detected on an asset or component using a selected Predictive Maintenance task, until the asset or component has failed. Reliability Centered Maintenance principles state that the frequency with which a Predictive Maintenance task should be performed is determined solely by the P-F Interval.

PdM - see Predictive Maintenance

Percent Planned Work - the percentage of total work (in labor hours) performed in a given time period which has been planned in advance.

PERT Chart - see Project Evaluation & Review Technique (PERT) Chart

Planned Maintenance - any maintenance activity for which a pre-determined job procedure has been documented, for which all labour, materials, tools, and equipment required to carry out the task have been estimated, and their availability assured before commencement of the task.

Plant Engineering - - a staff function whose prime responsibility is to ensure that maintenance techniques are effective, that equipment is designed and modified to improve maintainability, that ongoing maintenance technical problems are investigated, and appropriate corrective and improvement actions are taken. Used interchangeably with Maintenance Engineering and Reliability Engineering.

PM - see Preventive Maintenance

Potential Failure - a term used in Reliability Centered Maintenance. An identifiable condition which indicates that a functional failure is either about to occur, or in the process of occurring.

PRA - see Probabalistic Risk Assessment

Predictive Maintenance - an equipment maintenance strategy based on measuring the condition of equipment in order to assess whether it will fail during some future period, and then taking appropriate action to avoid the consequences of that failure. The condition of equipment could be monitored using Condition Monitoring, Statistical Process Control techniques, by monitoring equipment performance, or through the use of the Human Senses. The terms Condition Based Maintenance, On-Condition Maintenance and Predictive Maintenance can be used interchangeably.

Preventive Maintenance - an equipment maintenance strategy based on replacing, overhauling or remanufacturing an item at a fixed interval, regardless of its condition at the time. Scheduled Restoration tasks and Scheduled Discard tasks are both examples of Preventive Maintenance tasks.

Primary Function - a term used in Reliability Centered Maintenance. The primary functionality required of an asset - the reason the asset was acquired. For example it is likely that the primary function of a pump is to pump a specified liquid at a specified rate against a specified head of pressure.

Priority - the relative importance of a task in relation to other tasks. Used in scheduling work orders.

Proactive Maintenance - Any tasks used to predict or prevent equipment failures.

Probabalistic Risk Assessment - A "top-down" approach used to apportion risk to individual areas of plant and equipment, and possibly to individual assets so as to achieve an overall target level of risk for a plant, site or organization. These levels of risk are then used in risk-based techniques, such as Reliability Centered Maintenance and Hazop, to assist in the development of appropriate equipment maintenance strategies, and to identify required equipment modifications.

Probabalistic Safety Assessment - Similar to Probabalistic Risk Assessment, except focused solely on Safety related risks.

Project Evaluation & Review Technique (PERT) Chart - Scheduling tool which shows in flow chart format the interdependencies between project activities.

Protective Device - Devices and assets intended to eliminate or reduce the consequences of equipment failure. Some examples include standby plant and equipment, emergency systems, safety valves, alarms, trip devices, and guards.

PSA - see Probabalistic Safety Assessment

Purchase Requisition - The prime document raised by user departments authorizing the purchase of specific materials, parts, supplies, equipment or services from external suppliers.

Purchase Order - The prime document raised by an organization, and issued to an external supplier, ordering specific materials, parts, supplies, equipment or services.

Q

Quality Rate - used in the calculation of Overall Equipment Effectiveness. The proportion of the output from a machine or process which meets required product quality standards. Normally specified as a percentage.

R

RCM - see Reliability Centered Maintenance

Ready Line - Used in relation to mobile equipment. Equipment which is available, but not being utilized is typically parked on the Ready Line. This term is used interchangeably with Go-Line.

Redesign - a term which, in Reliability Centered Maintenance, means any one-off intervention to enhance the capability of a piece of equipment, a job procedure, a management system or people's skills

Reliability - the capability of an asset to continue to perform its intended functions. Normally measured by Mean Time Between Failures

Reliability Centered Maintenance - A structured process, originally developed in the airline industry, but now commonly used in all industries to determine the equipment maintenance strategies required for any physical asset to ensure that it continues to fulfill its intended functions in its present operating context. A number of books have been written on the subject, but none better than Moubray's book, RCM II.

Reliability Engineering - a staff function whose prime responsibility is to ensure that maintenance techniques are effective, that equipment is designed and modified to improve maintainability, that ongoing maintenance technical problems are investigated, and appropriate corrective and improvement actions are taken. Used interchangeably with Plant Engineering and Maintenance Engineering.

Repair - any activity which returns the capability of an asset that has failed to a level of performance equal to, or greater than, that specified by its Functions, but not greater than its original maximum capability. An activity which increases the maximum capability of an asset is a modification.

Restoration - any activity which returns the capability of an asset that has **not** failed to a level of performance equal to, or greater than, that specified by its Functions, but not greater than its original maximum capability. Not to be confused with a modification or a repair.

Return on Assets - an accounting term. Let's not get into a lengthy discussion of the relative merits of various accounting standards, how assets should be valued (book value, replacement value, depreciation rates and methods etc.), and differences between tangible and intangible assets. This is the stuff that accountants have wet dreams over, but not maintenance engineers. In practical terms, as it impacts on maintenance, Return on Assets is the profit attributable to a particular plant or factory, divided by the amount of money invested in plant and equipment at that plant or factory. It is normally expressed as a percentage. As such, it is roughly equivalent (in principle - please excuse the pun!) to the interest rate that you get on money invested in the bank, except that in this case the money is invested in plant and equipment.

Risk - The potential for the realization of the unwanted, negative consequences of an event. The product of conditional probability of an event, and the event outcomes.

Rotable - a term often used in the maintenance of heavy mobile equipment. A rotatable component is one which, when it has failed, or is about to fail, is removed from the asset and a replacement component is installed in its place. The component that has been removed is then repaired or restored, and placed back in the maintenance store or warehouse, ready for re-issue.

Routine Maintenance Task - any maintenance task that is performed at a regular, predefined interval.

Run-to-Failure - No Scheduled Maintenance - an Equipment Maintenance Strategy, where no routine maintenance tasks are performed on the equipment. The only maintenance performed on the equipment

is Corrective Maintenance, and then only after the equipment has suffered a failure. Also described as a No Scheduled Maintenance strategy.

S

Safety Consequences - a failure has safety consequences if it causes a loss of function or other damage that could hurt or kill someone.

Schedule Compliance - one of the Key Performance Indicators often used to monitor and control maintenance. It is defined as the number of Scheduled Work Orders completed in a given time period (normally one week), divided by the total number of Scheduled Work Orders that should have been completed during that period, according to the approved Maintenance Schedule for that period. It is normally expressed as a percentage, and will always be less than or equal to 100%. The closer to 100%, the better the performance for that time period.

Scheduled Maintenance - any maintenance work that has been planned and included on an approved Maintenance Schedule.

Scheduled Discard Task - a maintenance task to replace a component with a new component at a specified, pre-determined frequency, regardless of the condition of the component at the time of its replacement. An example would be the routine replacement of the oil filter on a motor vehicle every 6,000 miles. The frequency with which a Scheduled Discard task should be performed is determined by the Useful Life of the component.

Scheduled Operating Time - the time during which an asset is scheduled to be operating, according to a long-term production schedule.

Scheduled Restoration Task - a maintenance task to restore a component at a specified, pre-determined frequency, regardless of the condition of the component at the time of its replacement. An example would be the routine overhaul of a slurry pump every 1,000 operating hours. The frequency with which a Scheduled Restoration task should be performed is determined by the Useful Life of the component.

Scheduled Work Order - a Work Order that has been planned and included on an approved Maintenance Schedule.

Secondary Damage - Any additional damage to equipment, above and beyond the initial failure mode, that occurs as a direct consequence of the initial failure mode.

Secondary Function - a term used in Reliability Centered Maintenance. The secondary functionality required of an asset - generally not associated with the reason for acquiring the asset, but now that the asset has been acquired, the asset is now required to provide this functionality. For example a secondary function of a pump may be to ensure that all of the liquid that is pumped is contained within the pump (ie. the pump doesn't leak). An asset may have tens or hundreds of secondary functions associated with it.

Shutdown - that period of time when equipment is out of service.

Shutdown Maintenance - Maintenance that can only be performed while equipment is shutdown

Standard Job - A Work Order stored in the CMMS which contains all the necessary information required to perform a maintenance task. (see also Model Work Order)

Standing Work Order - a work order that is left open either indefinitely or for a pre-determined period of time for the purpose of collecting labor hours, costs and/or history for tasks for which it has been decided that individual work orders should not be raised. Examples would include Standing Work Orders raised to collect time spent at Safety Meetings, or in general housekeeping activities.

Stores Issue - the issue and/or delivery of parts and materials from the store or warehouse.

Stores Requisition - The prime document raised by user departments authorizing the issue of specific materials, parts, supplies or equipment from the store or warehouse.

T

Terotechnology - the application of managerial, financial, engineering and other skills to extend the operational life of, and increase the efficiency of, equipment and machinery.

Thermography - the process of monitoring the condition of equipment through the measurement and analysis of heat. Typically conducted through the use of infra-red cameras and associated software. Commonly used for monitoring the condition of high voltage insulators and electrical connections, as well as for monitoring the condition of refractory in furnaces and boilers, amongst other applications.

Total Asset Management - an integrated approach (yet to be developed!) to Asset Management which incorporates elements such as Reliability Centered Maintenance, Total Productive Maintenance, Design for Maintainability, Design for Reliability, Value Engineering, Life Cycle Costing, Probabilistic Risk Assessment and others, to arrive at the optimum Cost-Benefit-Risk asset solution to meet any given production requirements.

TPM - see Total Productive Maintenance

Tradesperson - Alternative to Craftsperson. A skilled maintenance worker who has typically been formally trained through an apprenticeship program.

Tribology - the process of monitoring the condition of equipment through the analysis of properties of its lubricating and other oils. Typically conducted through the measurement of particulates in the oil, or the measurement of the chemical composition of the oil (Spectrographic Oil Analysis). Commonly used for monitoring the condition of large gearboxes, engines and transformers, amongst other applications.

ToSS - see Total System Support

Total Productive Maintenance - a company-wide equipment management program, with its origins in Japan, emphasizing production operator involvement in equipment maintenance, and continuous improvement approaches. Numerous books have been written on the subject, including Nakajima's authoritative introduction, and a more recent Western hemisphere update by Willmott.

Total System Support (ToSS) - The composite of all considerations needed to assure the effective and economical support of a system throughout its programmed life-cycle.

U

Unplanned Maintenance - any maintenance activity for which a pre-determined job procedure has **not** been documented, or for which all labor, materials, tools, and equipment required to carry out the task have been **not** been estimated, and their availability assured before commencement of the task.

Unscheduled Maintenance - any maintenance work that has **not** been included on an approved Maintenance Schedule prior to its commencement.

Uptime - strangely enough, the opposite of downtime. It is defined as being the time that an item of equipment is in service and operating.

Useful Life - the maximum length of time that a component can be left in service, before it will start to experience a rapidly increasing probability of failure. The Useful Life determines the frequency with which a Scheduled Restoration or a Scheduled Discard task should be performed. Note that for the concept of the Useful Life of a component to hold true, components must, at some consistent point in time, experience a rapidly increasing probability of failure. Research in the airline industry showed that, in this industry at least, this was only true for 11% of the components in modern aircraft.

Utilization - the proportion of available time that an item of equipment is operating. Calculated by dividing equipment operating hours by equipment available hours. Generally expressed as a percentage

V

Value Engineering - a systematic approach to assessing and analyzing the user's requirements of a new asset, and ensuring that those requirements are met, but not exceeded. Consists primarily of eliminating perceived "non-value-adding" features of new equipment.

Vibration Analysis - - the process of monitoring the condition of equipment, and the diagnosis of faults in equipment through the measurement and analysis of vibration within that equipment. Typically conducted through hand-held or permanently positioned accelerometers placed on key measurement points on the equipment. Commonly used on most large items of rotating equipment, such as turbines, centrifugal pumps, motors, gearboxes etc.

W

Work Order - The prime document used by the maintenance function to manage maintenance tasks. It may include such information as a description of the work required, the task priority, the job procedure to be followed, the parts, materials, tools and equipment required to complete the job, the labor hours, costs and materials consumed in completing the task, as well as key information on failure causes, what work was performed etc.

Work Request - The prime document raised by user departments requesting the initiation of a maintenance task. This is usually converted to a work order after the work request has been authorized for completion.

Workload - the amount of labor hours required to carry out specified maintenance tasks.