DEFINITIONS

A

ACCEPTABLE ENVIRONMENTAL RANGE TEST – A test considered capable of indicating the ability of a component, system, or assembly to perform with specified reliability in a given environmental range.

ACCEPTANCE TEST – A test to determine conformance with design criteria or specifications as a basis for acceptance.

ACCESSIBILITY – A measure of the relative ease of admission to the various areas of an item for the purpose of operation or maintenance.

ACHIEVED – Obtained as the result of measurement.

ACHIEVED RELIABILITY – Reliability based on the demonstrated performance of nominally identical items under equivalent environmental conditions; or the product f inherent equipment reliability and use reliability, sometimes called operational reliability.

ALIGNMENT – Performing the adjustments that are necessary to return an item to specified operation.

ANALYSIS OF VARIANCE – The separation of sum-of-square variations from the mean into components which can be assigned to variations between classes, or sub-classes, of appropriate data. Constituent portions of sums of squares indicate, through mean squares, the magnitude of class differences. The extent to which they vary from the residual mean square is a test of the hypothesis that such differences are governing the situation.

ARITHMETICAL OR ARITHMETIC MEANS – The sum of a set of values divided by the number in the set. See AVERAGE.

ARTICLE - A part, component, assembly, subsystem, system, airplane or missile, (U.S. Military definition).

ASSEMBLY – A combination of parts of subassemblies which may be taken apart without destruction; which has limited application or use of its own yet is essential for the completeness of a more complex item wherein it is an element.

ATTRIBUTE – A characteristic of property which is appraised in terms of whether it exists,

(e.g., flammable or non flammable, radioactive or non-radioactive, rugged or fragile, waterproof or water soluble).

ATTRIBUTE TESTING – A procedure intended to classify items according to quantitative, rather than qualitative, characteristics.

ATTRIBUTES, METHOD OF – The quality of an item described by classification in one of two classes.

AVAILABILITY – A measure of the degree to which an item is in an operable and committable state at the start of a mission, when the mission is called for at an unknown (random) time. (Item state at start of a mission includes the combined effects of the readiness-related system R&M parameters, but excludes the mission time; See DEPENDABILITY.

- The probability that the system is operating satisfactorily at any point in time when used under stated conditions where the interval being considered included operating time, active repair time, administrative time, and logistics time. Alternatively, availability can be the fraction of total time in which equipment is actually operating. Availability may further be expressed as

$$A = \frac{\text{MTBF}}{\text{MTBF} + \text{Mean Downtime}}$$

AVERAGE – A value which represents or summarizes some relevant feature of a set of values. Average is sometimes a synonym for ARITHMETICAL MEAN.

AVAILABLE TIME – The period that elapses between intervals when corrective action or preventative maintenance is required.

AVERAGE LIFE – The mean value for a normal distribution of longevity; generally applicable to mechanical failures due to wear.

AVERAGE SAMPLE NUMBER – The average number of sample units per lot in a sequential test, purpose of which is to determine whether the lot should be acceptable or rejected.

B

BINOMINAL DISTRIBUTION – A discrete distribution of one random variable with one parameter. If f(X) is the probability of obtaining exactly x successes in n trials, and p is the probability of success in a single trial, then

$$f(x) = \frac{n!}{xl\ (n-x)\ 1}\ p^{x}\ (1-p)^{(n-x)}$$

for

$$x = 0, 1, \ldots n$$

BREADBOARD MODEL – An assembly of circuits and parts to prove the feasibility of a device, circuit, equipment, system or principles in rough form without regard to the eventual overall design.

BURN-IN (PRE-CONDITIONING) – The operation of an item under stress to stability its characteristics. Not to be confused with DE-BUGGING.

C

CALIBRATION – A comparison of a measuring device with a known standard. Not to be confused with an ALIGNMENT. Reference MIL-STO-45662 or ISO 9000-9004.

CASUALTY – A failure or malfunction which is so severe or extensive that it precludes the possibility of rework, or a cessation of ability to perform a specified function within established limits in the areas of interest. In the latter capacity, casualty is a synonym for FAILURE.

CATASTROPHIC FAILURE – A sudden failure without warning, as opposed to degradation failure; or a failure whose occurrence can prevent the satisfactory performance of an entire assembly or system.

CHANCE FAILURE – A failure whose probability of occurrence is invariant with time. See RANDOM FAILURE.

CHARACTERISTIC – A property, trait, or quality off a specific item, type of item, or group of items.

CHARGEABLE – Within the responsibility of a given organizational entity. (applied to terms such as FAILURES, MAINTENANCE TIME, etc. – U.S. Military definition.)

CHECKOUT – Tests or observations of an item to determine its conditions or status.

CHI-SQUARED FUNCTION – A gamma function which expresses a distribution of many independent standardized variables. Forms of the chi-squared function differ in accordance with the number of degrees of freedom. Chi-square is the sum of squares of n independent normal variates divided by their common variance.

CIRCLE OF EQUAL PROBABILITY (CEP) – The design CEP is a circle within which 50% of the shots are designed to land.

CIRCLE OF PROBABLE ERROR – See CIRCLE OF EQUAL PROBABILITY

CIRCULAR OF ERROR PROBABLE – See CIRCLE OF EQUAL PROBABILITY

CIRCULAR PROBABLY ERROR – See CIRCLE OF EQUAL PROBABILITY

COEFFICIENT OF CORRELATION – A single number which indicates the way two things are related. (i.e. compares relationship of variations of two distributions. Reference linear regression or joint probability distribution.)

COEFFICIENT OF VARIATION – A relative measure of dispersion in a distribution, or a standard deviation divided by the mean.

COMPLEXITY RELATIONSHIP – The comparative significance of complexity and failure rate which can be expressed as

$$\lambda_P = nr$$

Where λ_P is the failure rate for equipment containing a given (n) number of parts, each of which has the same probable failure rate (r_p). For assemblies of systems with many different parts, each of which is used in circumstances that are conductive to varying failure rates, complexity relationships can be expressed as

$$\lambda_P = n_1 r_1 + n_2 r_2 + \ldots\ldots n_p r_p$$

where n is the number of parts with failure rate r_1, n_2 is the number of parts with failure rate r_2 , etc., and n_p is the number of parts with failure rate r_p.

COMPLEXITY UNIT – An arbitrary statistic which indicates the relative merit of a product in terms of its complexity. In the electronic equipment, for instance, it may be the sum of the number of transistors plus the number of relays divided by ten, since the total number of parts in such equipment approximates ten times the number of complexity units.

COMPONENT – Usually a combination of parts, subassemblies, or assemblies. However, it may be any self contained element with a specific function.

CONFIDENCE – See CONFIDENCE LEVEL

CONFIDENCE INTERVAL – The numerical ranged in which an unknown is estimated to be.

CONFIDENCE LEVEL – The probability that an unknown is within a stated confidence level.

CONFIDENCE LIMITS – The extremes of a confidence interval. In reliability, only the lower limit is usually stated. For example, a stated 0.90 reliability with 0.60 confidence means there is a 0.60 probability that the actual reliability is at least 0.90.

CONSTANT FAILURE RATE – See EXPONENTIAL FAILURE DISTRIBUTION

CONSUMER'S RISK – The probability (Beta, β) that an actually unsatisfactory product will be accepted following an acceptance test.

CONTINUOUS VARIABLE – A variable that may assume any value within a defined range.

CONTRACTOR'S INSPECTION – Any inspection of articles or services by a contractor before the items are submitted to a customer for acceptance. A contractor's inspection may be either (1) in the manufacturing process to facilitate quality production or (2) after production to determine whether manufactured items meet specifications.

CORRECTIVE ACTION – A documented design, process, procedure, or materials change implemented and validated to correct the cause of failure or design deficiency.

CORRELATION – A relationship between two occurrences, expressed as a number between minus one and plus one.

CRITICALITY – A relative measure of the consequences of a failure mode and its frequency of occurrences.

CRITICAL DEFECT – See DEFECT

CRITICAL FAILURE – See FAILURE

CUMULATIVE DISTRIBUTION FUNCTION – The probability that random variable x will take on any value less than or equal to the stated value of x. Thus

$$F(Xi) = Pr\ (X \leq Xi)$$

Where

$$0 \leq F(Xi) \leq 1$$

CURTAILED INSPECTION – Sampling inspection in which testing is halted as soon as a decision is certain. Thus when the rejection number for defectives is reached, a decision is certain and no further inspection is necessary.

D

DEBUGGING – A conditioning procedure; it involves the operation of equipment in specified environmental test conditions for the purpose of elimination early failures by aging of stabilizing the equipment prior to final test and shipment. This should not be confused with BURN-IN, FAULT ISOLATION or SCREENING.

DEBUGGING PHASE – The operating time needed under specified conditions to eliminate initial failures due to faulty parts or workmanship.

DEFECT – A potentially hazardous or operationally unsatisfactory condition which requires attention to correct. This includes such things as poor packaging of hardware as well as part and equipment discrepancies. Synonyms include DEFICIENCY, FAULT and FLAW. It is often desirable to categorize effects within a system according to severity as follows:

CRITICAL – A defect that could result in hazardous or unsafe conditions for individuals using or maintaining a product; or a defect that could prevent performance of a tactical operation if used in the military sense.

MAJOR – A defect, other than critical, that could result in failure or severe reduction in the usability of an item.

MINOR – A defect that does not materially reduce the usability of an item, yet is a departure from the established standards.

DEFICIENCY – See DEFECT

DEGRADATION – A gradual loss of quality or a gradual impairment in the ability to perform within established limits. Synonym of DRIFT.

DEGRADATION FACTOR – A factor by which reliability is reduced in processing, handling, usage, etc.

DEGRADATION FAILURE – A failure which can be attributed to a loss of quality over a relatively long period of time.

DEMONSTRATED – That which has been measured by the use of objective evidence gathered under specified conditions.

DEPENDABILITY – A measure of the degree to which an item is operable and capable of performing its required function at any (random) time (or during a specified mission profile, if military), given item availability at the start of the specified time (or mission).

DERATING – 1. Using an item in such a way that applied stresses are below rated values. 2. The lowering of the rating of an item in one stress field to allow an increase in another stress field.

DESTRUCTIVE TEST – A procedure during which a test specimen is intentionally damaged or destroyed to determine its characteristics.

DEVELOPMENT MODEL – A model built to meet performance requirements of a specification, or to establish technical requirements for production equipment. This model does not necessarily have the required final form or contain parts of final design.

DEVICE – Any subdivision of a system. Synonym for ITEM.

DIRECT MAINTENANCE MAN HOURS PER MAINTENANCE ACTION (DMMH/MA) – A measure of the maintainability parameter related to item demand for maintenance man power.

The sum of direct maintenance man hours, divided by the total number of maintenance actions, both preventative and corrective, during a stated period of time. (mainly military use.)

DISASSEMBLE – Opening an item and removing a number of parts or subassemblies to make the item that is to be replaced accessible for removal. This does not include the actual removal of the item to be replaced.

DISCRETE VARIABLE – A variable which can take only certain isolated values.

DISTRIBUTION – The arrangement of a set of numbers. Also, a mathematical model used to describe the arrangement of a set of numbers.

DISTRIBUTION FUNCTION OF LIFETIMES – F(t), or the probability that a product new at time 0 will fail at time t; also, that fraction of an original population which has been removed by time t.

DOUBLE SAMPLING PLAN – A procedure during which first and second sample sizes are associated with acceptance and rejection criteria. With such a plan, results of an initial inspection of the first sample of a lot may be inconclusive and the inspection of a second sample may be required to determine acceptability.

DOWNTIME – The time during which equipment is nonoperational due to failure. Downtime can, in turn, be subdivided into a number of categories such as:

ACTIVE REPAIR TIME – An interval in which one or more technicians are working on a system to affect a repair. This included preparation time, fault location time, fault correction time, final check out time for the system, etc.

LOGISTICS TIME – A period in which repair is delayed solely due to the absence of a replacement part or some other subdivision of a system.

ADMINISTRATIVE TIME – Virtually any interval which cannot be classed as active repair time or logistics time.

DORMANT – See NOT OPERATING

DOWNING EVENT – The event which causes an item to become unavailable to initiate its intended purpose. (mission) The transition from UPTIME to DOWNTIME.

DRIFT – See DEGRADATION

DURABILITY – A measure of useful life (a special case of reliability).

E

EARLY FAILURE PERIOD – An interval immediately following final assembly, during which the failure rate of certain items is relatively high.

ELEMENT – A substructure such as a component, part or subassembly. Also, a portion of a part which cannot be renewed without destroying the part.

END USE – The way the device is used by its ultimate consumer.

ENVIRONMENT – The total of all external and internal conditions, either natural or man-made, self induced or external, that influences the form, performance, reliability or survival of an item. Conditions can include temperature, humidity, radiation, magnetic and electrical field, shock, vibration, dust, sand, etc.

ENVIRONMENTAL RANGE – The maximum and minimum conditions in which a component, system or assembly can function with a specified degree of reliability. See ENVIRONMENT.

ENVIRONMENTAL STRESS SCREENING (ESS) – A series of tests conducted under environmental stresses to disclose weak parts and workmanship defects for correction.

ENVIRONMENTAL TOLERANCE – The ability to operate within a specified environmental range.

EQUIPMENT - An item with a complete function independent of being a substructure of a system. Sometimes called a SET.

EQUIPMENT FAILURE – A cessation of ability to meet minimum acceptable performance standards; or a condition in which performance cannot be restored through a permissible operator adjustment of controls.

EQUIPMENT FAILURE RATE - ($\dot{+}$) The ratio of the number of equipment's which fail or malfunction (f) within a given period of time (t) to the total number of equipment's (N) at the start of a test period.

$$\lambda = f / N$$

EQUIPMENT RELIABILITY – The probability of performing a function under specified conditions for a given period of time.

EXPECTED VALUE – Mean worth over the population of all possible values.

EXPERIMENTAL MODEL – An equipment model which demonstrated the technical soundness of a basic idea. This model does not necessarily have the final form or parts of a final design.

EXPONENTIAL DISTRIBUTION – A random variable x has an exponential distribution if its cumulative distribution function F(x) has the form

$$F(x) = 1 - \exp(-\lambda t) \quad \text{for } t \geq 0$$

EXPONENTIAL FAILURE DISTRIBUTION – A condition due to a population with a constant failure rate. See EXPONENTIAL DISTRIBUTION.

EXPRESSION OF NONCONFORMANCE – The extent of product nonconformance expressed in terms of percent defective or the number of defects per hundred units. (Parts per million, PPM or Parts per billion, PPB are also examples).

EXTERNALLY CAUSED FAILURE – A failure due to an environment beyond design limitations such as an excessive high voltage load, etc. It may be the result of operator error, accident, or failure of another part.

F

FAILURE – The event, or inoperable state, in which any item of part of an item does not, or would not, perform as previously specified. A cessation of the ability to perform a given been established to define satisfactory performance. Failures are often categorized according to the severity of the resultant system failure. The most common categories are

CRITICAL – A failure that causes a system to operate outside of limits designated in performance specifications, or creates a safety hazard.

MAJOR – Any failure that is not critical and can degrade the performance of a system due to cumulative tolerance build up.

MINOR – A failure which has no significant effect on the ability of a system to perform satisfactorily.

Failures are also categorized according to cause

PRIMARY – A failure or human error that is the initiating primary cause

SECONDARY – Any failure which is the direct or indirect result f a primary failure.

Other terms used to describe or classify failures are catastrophic, dependent or independent.

FAILURE ANALYSIS – Subsequent to a failure, the logical systematic examination of an item, its construction, application, and documentation to identify the failure mode, determine the failure mechanism and its basic cause.

FAILURE EFFECT – The consequence(s) a failure mode has on the operation, function or status of an item. Failure effects are classified as local effect, next higher level and end effect.

FAILURE, INTERMITTENT – Failure for a limited period of time, followed by the item's recovery of its ability to perform within the specified limits without any remedial action.

FAILURE MECHANISM – The physical, chemical, electrical thermal or other process which results in failure.

FAILURE MODE – The characteristic of a given type of failure, or the specific operation conditions, existent at the time a failure occurs. See also MECHISM OF FIALURE

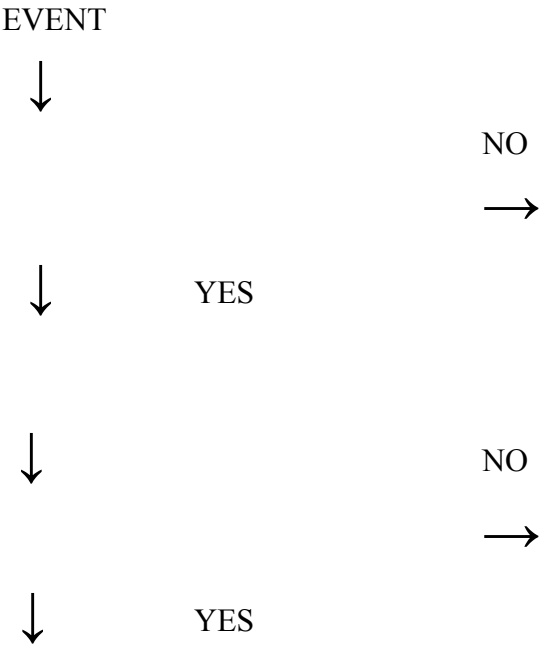
FAILURE MODE AND EFFECTS ANALYSIS (FEMEA) – A procedure by which each potential failure mode in a system is analyzed to determine the results or effects on the system and to classify each potential failure mode according to its severity. Usually this method is a team brainstorming method.

FAILURE, NONCHARGEABLE – 1. A non-relevant failure, or 2. A relevant failure caused by a condition previously specified as not within the responsibility of a given organization entity.

(This term is from military type reliability definitions and obviously has use with the CYA syndrome. i.e. Cover Your Ass)

FAILURE, NON-RELEVANT – 1. A failure verified as having been caused by a condition not present in the operational environment, or 2. A failure verified as peculiar to an item design that will not enter the operational environment. NOTE: This is again a military definition and any manufacturer should be aware that they may be liable for "non-relevant" failures in their equipment.

FAILURE CATEGORIES



FAILURE RANDOM – Failure whose occurrence is predictable only in a probabilistic or statistical sense. This applies to all distributions.

FAILURE RATE – The total number of failures with an item population, divided by the total number of life units experiences by that population, during the measured time interval, under stated conditions. Stated another way, The probability of failure per unit of time of items in operation; sometimes called HAZARD. The Greek symbol lambda (λ) is used and failure rate can be estimated by

$$\lambda = r / t$$

r = # of failures

t = Accumulated operating time for items under test

Failure rates are usually expressed at % failures per 1000 hours.

FAULT – Immediate cause of failure. (misalignment, maladjustment, etc.)

FAULT ISOLATION – The process of determining the location of a fault to the extent necessary to affect repair.

FAULT LOCALIZATION – The process of determining the approximate location of a fault.

FREQUENCY DISTRIBUTION FUNCTION – The relative probability of the rate of which a variable will occur. Also known as the PROBABILITY DENSITY FUNCTION.

FUNCTIONAL PERFORMANCE – Operation within specified limits.

G

GAUSSIAN DISTRIBUTION – See NORMAL DISTRIBUTION

GROUP – A combination of modules, assemblies, and subassemblies which is a subdivision of a subsystem or system, but which is not capable of performing an operational function. Examples are indicator groups.

H

HAZARD – See FAILURE RATE

HUMAN INITIATED FAILURE – Any failure due principally to human error. See also PRIMARY FAILURE.

I

INDEPENDENCE – A condition in which one event can occur without altering the probability that a second event will take place.

INDEPENDNT FAILURE – A failure which has no significant relationship to prior failures in any given device.

INFANT MORTALITY – The failure rate which occurs early in the life of an item. See EARLY FAILURE PERIOD.

INHERENT RELIABILITY – A measure of reliability that includes only the effects of an item design and its application, and assumes an ideal manufacturing, operation and support environment.

INHERENT MAINTAINABILITY – A measure of maintainability that includes only the effects of an item design and its application, and assumes an ideal manufacturing, operation and support environment.

INHERENT EQUIPMENT RELIABILITY – The probability of equipment performing properly when operated under contractually stated conditions with prescribed supporting equipment and procedures.

INTERCHANGE – Removing an item that is to be replaced, and installing the replacement item.

INVENTORY, ACTIVE – The group of items assigned to an operational status.

INVENTORY, INACTIVE – The group of items held in reserve for possible future assignments to an operational status.

ITEM – An all inclusive term which may denote an assembly, subassembly, accessory, part, etc.

K

KURTOSIS – A statistical quantity which expresses the peakedness of a probability function.

L

LIFE CHARACTERISTIC – A graphical representation of the life of an item as a function of time.

LIFE PROFILE – A time phased description of the events and environments an item experiences from manufacture to final use or removal from the end product.

LIFE UNITS – A measure of use duration applicable to the item. (Hours, cycles, distance, rounds fired, etc.)

M

MAINTABILITY – The measure of the ability of an item to be retained or in restored to specified condition when maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair.

MAINTAINABILITY, MISSION – The measure of the ability of an item to be retained in or restored to specified condition when maintenance is performed during the course of a specified mission profile.

MAINTENANCE – All action necessary for retaining an item in, or restoring it to, a specified condition.

MAINTENANCE ACTION – An element of a maintenance event. One or more tasks necessary to retain an item in, or restore it to, a specified condition.

MAINTENANCE, CORRECTIVE – All action performed as a result of failure, to restore an item to a specified condition. Can include: localization, isolation, disassembly, etc.

MAINTENANCE EVENT – One or more corrective or preventative maintenance actions.

MAINTENANCE, PREVENTATIVE – All actions performed in an attempt to retain an item in specified condition by providing systemic inspection, detection, and prevention of incipient failures.

MAINTENANCE RATIO – A measure of the total maintenance manpower burden required to maintain an item. It is equal to the cumulative number of man hours of maintenance in direct labor during a given period of the life, divided by the cumulative number of end item life units during the same period.

MAINTENANCE, SCHEDULED – Preventative maintenance performed at prescribed points in the items life.

MAINTENANCE TIME – An element of down time which excludes modifications and delay time.

MAINTENANCE, UNSCHEDULED – Corrective maintenance required by item conditions.

MAJOR DEFECT – See DEFECT

MAJOR FAILURE – See FAILURE

MALFUNCTION – Same as FAILURE. Any unsatisfactory performance.

MEAN – Usually refers to ARITHMETIC MEAN

MEAN MAINTENANCE TIME – The measure of item maintainability taking into account maintenance policy. The sum of preventative and corrective maintenance times, divided by the sum of scheduled and unscheduled maintenance events, during a stated period of time.

MEAN TIME BETWEEN DEMANDS (MTBD) – A measure of the system reliability parameter related to demand for logistic support. The total number of system life units divided by the total number of item demand n the supply system during a stated period of time. Units are: Shop Replaceable Unit (SRU), Weapon Replaceable Unit (WRU), Line Replaceable Unit (LRU); and Shop Replaceable Assembly (SRA).

MEAN TIME BETWEEN DOWNING EVENTS (MTBDE) – A measure of the system reliability parameter related to availability and readiness. The total number of system life units divided by the total number of events in which the system becomes unavailable to initiate its mission(s), during a stated period of time.

MEAN TIME BETEEN FAILURE (MTBF) – A measure of the system reliability for repairable items. The mean number of life units during which all parts of the item perform within their specified limits, during a stated period of time, under stated conditions. MTBF is valid only during the constant failure rate period of life of a product, or when an exponential (constant failure rate) failure distribution can be assumed.

MEAN TIME BETWEEN MAINTENANCE (MTBM) – A measure of the system reliability taking into account maintenance policy. The total number of life unites expended by a given time, divided by the total number of maintenance events (scheduled or unscheduled) due to that item.

MEAN TIME BETWEEN MAINTENANCE ACTION (MTBMA) – A measure of the system reliability parameter related to maintenance man power. The total number of system life units divided by the total number of maintenance actions (preventative or corrective) during a stated

period of time.

MEAN TIME BETWEEN REMOVALS (MTBR) – A measure of the system reliability parameter related to demand for logistic support. The total number of system life units divided by the total number of items removed from the system during a stated period of time. Removals to get to failed items are not considered.

MEAN TIME TO FAILURE (MTTF) – A measure of the system reliability for non-repairable items. The total number of life units of an item divided by the total number of failures within that population, during a particular measurement interval under stated conditions.

MEAN TIME TO FIRST FIALURE (MTTFF) – A special case of MTBF where time t is accumulated operating time to first failure for each of a number of items.

MEAN TIME TO REPAIR (MTTR) – A measure of the system maintainability. The sum of corrective maintenance times at any specific level of repair, divided by the total number of failures within an item repaired at that level, during a particular interval, under stated conditions.

MEAN TIME TO RESTORE SYSTEM (MTTRS) – A measure of the system parameter related to availability and readiness. The total corrective maintenance time, associated with downing events, divided by the total number of downing events, during a stated period of time.

MEAN TIME TO SERVICE (MTTS) - A measure of an on system maintainability characteristic related to servicing that is calculated by dividing the total scheduled crew/operator/driver servicing time by the number of times the item is serviced.

MECHANISM OF FAILURE – The physical process which lead to a part of equipment failure. See also FAILURE MODE.

MEDIAN – The middle unit in a set of values.

MINIMUM ACCEPTABLE RELIABILITY – Reliability which must be achieved prior to approval of first articles of operational configuration.

MINOR DEFECTS – See DEFECT

MINOR FAILURE – See FAILURE

MISSION PROFILE – A time phased description of the events and environments an item

experiences from initiation to completion of its intended task. It usually includes criteria of success or failure at each time in the product life.

MISSION TIME BETWEEN CRITICAL FAILURES (MTBCF) – A measure of mission reliability. The total amount of mission time, divided by the total number of critical failures during a stated series of missions.

MISSION TIME TO RESTORE FUNCTIONS (MTTRF) – A measure of mission maintainability. The total corrective critical failure maintenance time, divided by the total number of critical failures, during the course of a specified mission profile.

MODE – The unit in a set of values which occurs most often.

MODULE – An easily replaceable combinations of assemblies, subassemblies, or part common to one mounting.

MOMENT – The mean value of the power of a variate, such as the mean value of a power of deviation of a variate from a fixed value.

MONTE CARLO METHOD (MCM) – A technique that permits computer simulation of a brute force empirical approach. This empirical approach involves the mathematical construction of a number of possible models under study from constituents selected at random from representative populations.

N

NORMAL DISTRIBUTION – A distribution defined by

$$f(x) = 1/\sigma \sqrt{2\pi} \exp\left(- (x - w)^2 / 2\sigma^2 \right)$$

with u = to the arithmetic mean and σ equal to the standard deviation. Also called the Gaussian distribution.

NORMALITY – 1. The state of being perpendicular, or
2. The state of a variate having a normal probability distribution, or
3. The state of reduction to a common standard.

NORMAL OPERATING PERIOD – Total operating time between debugging and wear out.

NOT OPERATING – The state where an item is able to function but is not required to function. This is not to be confused with DOWN TIME. This is equal in meaning to DORMANT.

NULL HYPOTHESIS – A negative proposition used in connection with a statistical test.

O

OPERABLE – The state of being able to perform the intended function.

OPERATING TIME – The time during which a system is functioning in a manner acceptable to its operator.

OPERATIONAL READINESS – The probability that, at any point in time, a system will be either operating satisfactorily or ready to be placed in operation under stated conditions, including stated allowable warning time. Total calendar time is the basis for computing operational readiness.

OPERATIONAL MAINTAINABILITY – A measure of maintainability that includes the combined effect of item design, installation, quality, environment, operation, maintenance and repair.

OPTIMUM RELIABILITY – The value of reliability which minimizes total successful mission cost.

P

PARENT POPULATION – A prototype of initial batch of articles under consideration. See POPULATION

PART – The least subdivision of a system, of an item which cannot ordinarily be disassembled without being destroyed. Examples are resistors, stampings, etc.

PART FAILURE – An ir-repairable breakdown which ends the life of the part.

PART FAILURE RATE – The number of occasions on which a given quantity of identical parts will not function properly in a specified period of time.

POISSON DISTRIBUTION – A discrete random variable distribution defined by

$$P(x=k) = u\,k / k!\ \exp(u) \qquad k = 0, 1, 2 \ldots$$

with a mean of $k^u \geq 0$

POPULATION – The total number of units being considered. Also referred to a universe.

PRECONDITIONING – See BURN IN

PREDICTED – That which is expected at some future time, postulated on analysis of past experience or tests

PREVENTATIVE MAINTENANCE – See MAINTENANCE, PREVENTATIVE

PRIMARY FAILURE – See FAILURE

PROBABILITY – The degree or extent of reliability of an occurrence.

PROBABILITY DENSITY FUNCTION – In reliability this corresponds to a histogram of population life times.

PROBABILITY DISTRIBUTION – A mathematical model which represents the probabilities for all possible values a given random variate may take.

PROBABILITY OF FAILURE – The likelihood that an item will fail during a specified period of time in a given environment. Also equal to one minus the probability of success.

PROBABILITY OF SUCCESS – The likelihood that an item will function satisfactorily during a specified period of time in a given environment. Also equal to one minus the probability of failure.

PROBABILITY OF SURVIVAL – A numerical expression of reliability. It is typically represented by Ps.

PRODUCERS RELIABILITY RISK – The probability (alpha) that an actually satisfactory product will be rejected following an acceptance test.

QUALITY – 1. The extent to which a device conforms to specifications.
2. Fitness for use.
3. The presents of value in a product or service.

QUALITY ASSURANCE – A broad term used to cover quality control and the quality assurance science.

QUALITY CONTROL – Any operation, system or method used to assure the conformance of a product to specifications.

QUALITY ENGINEERING – The engineering related activities of the quality sciences.

R

RANDOM FAILURE – Any failure who probable occurrence is invariant with time.

RANDOMNESS – An equal chance for any possible outcome.

RANDOM SAMPLE – A specimen chosen by chance from a population.

RANDOM VARIABLE – A variable which may assume any of a number of values, each of which has a fixed probability of occurrence.

RANGE – The difference between eh largest and smallest value in a set of values.

REASSEMBLY – Assembling the items that were removed during disassembly and closing the reassembled items.

REDUNDANCY – The existence of more than on e means of accomplishing a given function. Each means of accomplishing the function does not necessarily have to be identical. This is done to improve reliability.

REDUNDANCY, ACTIVE – All redundant items are operating simultaneously.

REDUNDANCY, STANDBY – Alternate means of performing the same function are not operating until it is activated by a failure of the primary means of performing the function.

RELEVANT – That which can occur or recur during the operational life of an item.

RELIABILITY –

1. The duration or probability of failure free performance under stated condition.
2. The probability that an item can perform its intended function for a specified interval of time under stated condition.
3. The ability of a product or service to maintain the presence of value in itself, or a related system, over its intended useful life, in its intended application.
4. The time rate entropy of a defined system.

RELIABILITY GROWTH – The improvement in a reliability parameter caused by the successful correction of deficiencies in item design or manufacture.

RELIABILITY, MISSION – The ability of an item to perform its required functions for the duration of a specified mission profile.

R&M ACCOUNTING – That set of mathematical tasks which establish and allocate quantitative R& M requirements, and predict and measure quantitative R&M requirements.

R&M ENGINEERING – That set of design, development and manufacturing tasks by which reliability and maintainability are achieved.

REPAIR – See CORRECTIVE MAINTENANCE

REPAIR TIME – See DOWNTIME

REPAIRABLE ITEM – An item which can be restored to perform all of its required functions by corrective maintenance.

S

SAFETY FACTOR – The margin of safety designed into an item to assure its proper functioning.

SAMPLE – A product specimen chosen to represent all units in a batch for inspection purposes.

SAMPLING PLAN – A program for acceptance or rejection, based on tests or inspections which indicate the quality of predetermined sample sizes.

SCHMOO PLOT – A graphical representation of circuit failure points as the input parameters

are varied from a nominal two at a time. The purpose is to furnish a picture of the safe operating envelope for two at a time parameter variation combination.

SCREENING – Any process for inspecting items to remove those that are unsatisfactory or those likely to exhibit early failure.

SECONDARY FAILURE – Any failure which is the direct or indirect result of a primary failure.

SEQUENTIAL TEST – Any sampling plan with criteria for acceptance, rejection, or additional samples.

SERVICING – The performance of any act needed to keep an item in operating condition, but not including preventative maintenance of parts or corrective maintenance tasks. Examples are lubricating, fueling, oiling, cleaning, etc.

SET – An item which has a complete function independent of being a substructure of a system.

SHELF LIFE – The maximum period in which a material or item can be stored in specified circumstances without appreciable degradation.

SIGMA LIMITS – An interval of a distribution expressed in terms of a standard deviation.

SIGNIFICANCE LEVEL – The probability that a hypothesis will be rejected during a statistical test, even though it is actually true.

SINGLE POINT FAILURE – The failure of an item which would result in failure of the system and is not compensated for by redundancy or alternative operational procedures.

SKEWNESS – A statistical measure of asymmetry in a distribution

SNEAK CIRCUIT ANALYSIS – A procedure conducted to identify latent paths which cause occurrence of unwanted functions or inhibit desired functions assuming all components are functioning properly.

STANDARD DEVIATION – A statistical measure of dispersion in a distribution, the square root of the variance. The small Greek letter sigma is used as a symbol.

STATISTICS – The collection, analysis, interpretation and presentation of numerical data where randomness of the data is a consideration.

STORAGE LIFE – See SHELF LIFE

SUBSYSTEM – A combination of groups, modules, and assemblies capable of performing an operational function.

SYSTEM – Any combination of components of structures with a complete operational function.

SYSTEM FAILURE RATE – The number of occasions on which a given quantity of identical systems will not function properly in a specified period of time.

SYSTEM MAINTAINABILITY PARAMETER – A measure of maintainability in which the units of measurement are directly related to operational readiness, mission success or logistic support cost.

SYSTEM RELIABILITY PARAMETER – A measure of reliability in which the units of measurement are directly related to operational readiness, mission success, or logistic support cost.

TEST, ACCEPTANCE – A test conducted under specified conditions by, or on the behalf of, the government, using delivered or deliverable items, in order to determine the items compliance with specified requirements.

TEST ANAYLZE AND FIX (TAAF) – An abbreviation for the general procedure of reliability growth. See also TESTING, DEVELOPMENT

TEST MEASUREMENT AND DIAGNOSTIC EQUIPMENT (TMDE) – Any system or device used to evaluate the conditions of an item to identify or isolate any actual or potential failures.

TEST QUALIFICATION – (Design Approval) – A test conducted under specified conditions by, or on the behalf of, the government, using items representative of production configuration, in order to determine the items compliance with specified design requirements as a basis for production approval.

TEST, DEVELOPMENT (GROWTH) – A series of tests conducted to disclose deficiencies and to verify that corrective actions will prevent recurrence in the operational inventory. NOTE: The repair of test items does not constitute correction of the deficiencies.

TIME – If I could define this one I'd be famous!! But for our purposes, the universal measure of

duration. The units may e hours, days, years, cycles, missions, etc.

TIME, ACTIVE – That time during which an item is in an operational inventory.

TIME, ADMINISTRATIVE – That element of delay time, not included in the supply delay time.

TIME, ALERT – That element of up time during which an item is assumed to be in specified operating condition and is waiting a command to perform it intended mission.

TIME, CHECKOUT – That element of maintenance time during which performance of an item is verified to be at a specified condition.

TIME, DELAY – That element of down time during which no maintenance is being accomplished on the item because of either supply or administrative delay.

TIME, DOWN (DOWNTIME) – That element f active time during which an item is not in condition to perform its required functions. This reduced availability and dependability.

TIME, INACTIVE – That time during which an item is in reserve.

TIME, MISSION – That element of up time required to perform a stated mission profile.

TIME, MODIFICATION- The time necessary to introduce any specific changes to an item to improve its characteristics or to add new ones.

TIME, NOT OPERATING – That element of uptime during which the item is not required to operate.

TIME, REACTION – That element of uptime needed to initiate a mission, measured from the time command is received.

TIME, SUPPLY DELAY – That element of delay time during which a needed replacement item is being obtained.

TIME, TURN AROUND – That element of maintenance time needed to replenish consumables and check out an item for recommitment.

TIME, UP (UPTIME) – That element of active time during which an item is in condition to perform its required function. This improves availability and dependability.

U

UNIT – Any one part of combination of parts with a specific function. Denotes a single element more implicitly than component, which is a synonym.

UNIVERSE – See POPULATION

UPTIME RATIO – A composite measure of operational availability and dependability that includes that combines effects of an item design, installation, quality, environment, operation, maintenance, repair and logistics support. Numerically equal to the quotient of uptime divided by the uptime plus downtime.

USEFUL LIFE – The number of life units from time of manufacture to when the item has an unrepairable failure or unacceptable failure rate.

USE RELIABILITY – The most practical measure of reliability, being based on actual experience with field maintenance and applicational factors.

UTILIZATION RATE – The planned or actual number of life units expended, or missions attempted during stated interval of calendar time.

V

VARIABLE – A quantity that may assume a number of values. Also called a variate.

VARIABLES, METHOD OF – The quality of an item described by the measurement f some characteristic along a continuous scale or by counting a long a discrete scale.

VARIANCE – A statistical measure of dispersion in a distribution, or the square of standard deviation.

VARIATE – See VARIABLE

W

WEAROUT – The point at which the continued operation and repair of an item is uneconomical, due to the frequency of failure.

FAILURE THAT COULD OCCUR IN THE FIELD

NON-RELEVANT

CLASSIFIED RELEVANT

INDEPENDENT OR DEPENDENT

NON CHARGEABLE

CHARGEABLE