GLOSSARY OF RELIABILITY TERMS

RELIABILITY TERMS

Availability	The ability of an item to be in a state to perform a required function, under stated conditions at a given instant of time or over a given time interval. $\text{Availability} = \frac{Up\ Time[\text{Mean Time Between Failures}]}{Total\ Time[\text{Up time} + \text{MTTR} + \text{Mean Logistic Delay}]}$ It should be noted that the term Production Availability is often used when describing the Production Efficiency of a system. Although this term is not strictly correct, since availability should only be used in the context of time, it is widely used in the industry.
Failure Mode	The effect by which a failure is observed. Within a very detailed model, a valve can have several modes of failure, such as: fails to operate on demand, external leak etc. A high level model of a system may include the following general failure modes: CRT General critical failure resulting in 100% production loss. DEG Degraded equipment performance, resulting in partial production loss whilst waiting for repair and 100% loss during repair. INC Incipient failure. Equipment failure which did not result in immediate production loss. The failure was found during other repair/scheduled maintenance activities. 100% loss during repair. UNK No impact details recorded in database. Assumed to be no impact on failure and 100% loss of equipment item on repair.
Failure Mode and Effects Analysis (FMEA)	A procedure that analyses the ways a system can fail (failure modes) and determines their impact (effect) at both the local and system levels. The analysis can be carried out from the lowest to the highest level within the system under analysis (bottom up) which is commonly referred to as a hardware analysis. Alternatively the analysis can be carried out from the highest level to the lowest level (top down) commonly referred to as a Functional FMEA. The functional FMEA considers the functional failure of components within a system.
Failure Rate	The number of failures of an item per unit time. This can be applied to:

	• Observed failure rate: as computed from a sample. • Assessed failure rate: as inferred from sample information. • Extrapolated failure rate: projected to other stress levels.
Reliability	The probability that an item can perform a required function under stated conditions for a given period of time. NB The term reliability may also be used to denote the probability of success or success ratio.
Maintainability	The probability that a given maintenance action, for an item under stated conditions of use, can be carried out within a given time interval. The maintenance is performed under stated conditions and using stated procedures and resources.
Mean Time To Failure (MTTF)	The average time between consecutive failures – calculated by dividing the cumulative observed time by the total number of failures. This term only applies to components with exponential failure distributions.
Mean Time To Repair (MTTR)	It is a measure of the average time taken to diagnose and restore failed equipment to an operational state. It does not include logistic delays.
Maintenance Resource	Equipment/personnel/spares required to perform maintenance and repair tasks.
Logistic Delay	The waiting time associated with the procurement and transportation of: • Manpower • Tools and special equipment • Spare parts
Reliability Block Diagram	A pictorial representation of the logical interdependencies (parallel or series paths) required for the system under analysis to function correctly.

Absolute Losses	The production deferred or lost due to the specified element or system, as a percentage of the total potential production. $\text{Absolute Losses} = \frac{\text{Production Deferred or Lost}}{\text{Potential Production}} \times 100\%$
Availability of Max Capacity	The percentage of time that the system produced at the maximum capacity (100%).
Boosting	Boosting of production is a method of compensating for losses arising from system failures, by increasing the normal production flow rate of certain parts of the systems. Boosting can be used to compensate during a failure or assist recovery after a failure.
Characteristic Life	The life at which 63.2% of the population will have failed.
Contract Recovery Period	The length of time over which volumes of product sales contracted to be supplied are defined and measured. This parameter may also be defined as the allowable boost recovery period, which defines that time boundary for recovery of losses.
Contract Shortfall	A volumetric shortfall of product, with respect to the predefined contract quota.
Critical Equipment	Equipment whose failure will have an identifiable effect on system performance.
Criticality Analysis	A list of all the events within a model, ranked according to the severity of their individual effect on the performance of the system
Design Capacity	The maximum capacity of the system under analysis. All parallel block capacities are referenced to this figure. It is implicit, within the Jardine's software that the system is capable of operating at design capacity. Any reduction in system throughput during the lifetime of the model will not change the capacity of the parallel blocks.
Downtime	The period of time during which an item is not in a condition to perform its required function. When evaluating or considering the effects of downtime it should be appreciated that: • The downtime of an item will include active maintenance time and delays due to awaiting spares, labour, facilities, movement, etc. • Unless otherwise stated, the downtime due to failure is considered to commence at the instant the item is deemed to have failed.
Efficiency	**Potential Efficiency**

	$$\text{Potential Efficiency} = \frac{\text{Potential Production}}{\text{Design Capacity Production}} \times 100\%$$ Potential Production is production over the field life as determined by the deliverability profile for the system. Design Capacity Production is the total production over the field life when running the facilities at their design capacity. **Required Efficiency** $$\text{Required Efficiency} = \frac{\text{Required Production}}{\text{Potential Production}} \times 100\%$$ The Required Production is the total production over the field life as determined by the input demand profile for the system. **Average Efficiency** $$\text{Average Efficiency} = \frac{\text{Predicted Achieved Production}}{\text{Potential Production}} \times 100\%$$ The Predicted Achieved Production is the total production over the field life as predicted by the model taking into account the impact of all production critical failures. **Production Efficiency** $$\text{Production Efficiency} = \frac{\text{Predicted Achieved Production}}{\text{Required Production}} \times 100\%$$ The Production Efficiency is one of the main system performance indicators expressing the achieved production as a percentage of the required production.
Event	The basic component of models. An event may be unscheduled (equipment failure), scheduled (predefined frequency and duration) or may occur as the consequence of other events (conditional event).
Maximum Capacity	The maximum allowable capacity rating of the branch either expressed as an absolute value as a percentage of the design capacity or as a boost factor (>1) expressed as a multiple of the normal capacity.
Normal Capacity	The capacity rating of the branch relative to the design capacity of the system (which is nominally 100%).
Outage	Period of time during which there is a complete production stoppage.
Performance Analysis	Analysis of the behaviour of an item or system, which includes aspects relating to reliability, maintainability, operability and

	productivity.
Production Losses	Production lost or deferred due to equipment outages caused by events within the model.
Ramp time	When flow in a branch has been completely or partially shutdown, there may be time constraints imposed upon returning to the normal flow rate after correction of the fault. This feature is known as Ramping Time.
Relative Losses	The production deferred or lost due to the specified element or system, as a percentage of the total deferment or losses. $$\text{Absolute Losses} = \frac{\text{Production Deferred or Lost}}{\text{Total Deferment or Loss}} \times 100\%$$
Revealed (Overt) Failure	A failure of a component or system, which is automatically brought to light on its occurrence.
Subsystem Criticality	A list of all the subsystems within a model, ranked according to the severity of their individual effect on the performance of the system. Each subsystem contains several events, grouped into a common system.
Unrevealed (Covert) Failure	A failure of a component or system, which remains undetected until revealed by either proof testing or, more critically, once a demand is placed on the item to function as intended.