Supportability Metrics

Army acquisition policy states that supportability is integral to the success of a system and will be considered equal in importance with cost, schedule, and performance. The tables below provide examples of supportability-related metrics for each element of ILS. These metrics can be used to provide a quantitative means of ensuring the attainment of supportability goals for acquisition end items. These metrics are not mandatory. Supportability metrics must be tailored for each individual acquisition program. There are other metrics which have not been included in theses tables.

Column 1, ‘Supportability Metric Title', contains the name of the integrated logistics support (ILS) or supportability metric.

Column 2, 'Evaluation Phase', identifies the first phase during which adequate data should be available and analysis/ evaluation is conducted to determine if the supportability goals, set at program inception, have been or will be achieved. It is Army policy to address supportability throughout the development, acquisition, production, fielding, and operation phase of the system.

Column 3, 'Source Document', provides likely places where the supportability requirement has been or will be documented. The requirements may be recorded in other documents.

Column 4, 'Data Source', indicates the best data sources for deriving the actual values of the supportability-related parameters being measured.

The abbreviations used in the tables are explained below the table.

Also below the table are definitions for each of the supportability metrics listed.

Maintenance

Supportability Metric Title	**Evaluation Phase**	**Source Document**	**Data Source**
Mean Time To Repair	SD&D	ORD/Spec	LMI/LD/LIW
Mean Restoral Time	SD&D	ORD/Spec	LMI/LD/LIW
Maintenance Ratio	SD&D	ORD/Spec	LMI/LD/LIW
Max Time To Repair	SD&D	ORD/Spec	LMI/LD/LIW
Repair Cycle Time	SD&D	ORD/Spec	LMI/LD/LIW
O&S Cost/Operating Hour	SD&D	AS/Spec	LMI/LD/LIW
Maintenance Task Elimination	SD&D	SS/Spec	LMI
Maintenance Downtime	O&S	SS/Spec	LIW
Customer Wait Time-NMCM	O&S	PM	LIW
Repairs Requiring Evacuation	SD&D	SS/Spec	LMI/T&E/LIW
Percent Organic Support	P&D	SS/Spec	LIW
Maintenance Test Flight Hours	O&S	PM	LIW
Mean Down Time	SD&D	ORD/Spec	LMI/LD/LIW

Manpower and Personnel

Supportability Metric Title	Evaluation Phase	Source Document	Data Source
Crew Size	SD&D	ORD/Spec	LMI/T&E/LIW
Maintenance Cost /Operating Hour	SD&D	AS/Spec	LMI/T&E/LIW
Skill Level Limit	SD&D	ORD/SS/Spec	LMI/T&E
Maintenance Hours By MOS	SD&D	ORD/SS/Spec	LMI/LIW
Annual Maintenance Manhours	P&D	ORD/Spec	LMI/LD/LIW
Maint Manhours/Operating Hour	SD&D	ORD/PM/Spec	LMI/T&E/LIW
Personnel Cost/O&S Cost	SD&D	AS/Spec	LMI/LIW
Personnel On-hand/Required	P&D	MFP/QQPRI	LMI/QQPRI
Personnel Required/Authorized	SD&D	SS/MFP/QQPRI	LMI/LIW
Mechanic Utilization	O&S	SS/PM	LMI/LIW

Supply Support

Supportability Metric Title	Evaluation Phase	Source Document	Data Source
Wait Time-NMCS	O&S	PM	LIW
Parts Availability	O&S	SS/Spec	LMI/LIW
Backorder Rate	O&S	PM	LIW
Backorder Duration Time	O&S	PM	LIW
Controlled Substitution Rate	O&S	SS/PM	LIW
Failure Factor Accuracy	O&S	SS/Spec	LMI/T&E/LIW
Order Ship Time	O&S	PM	LIW
Spares Cost to LCC Ratio	P&D	AS/Spec	LMI/LIW
Unit Load-Supply	P&D	ORD/Spec	LMI/T&E/LIW
Parts Standardization	SD&D	SS/Spec	LMI
Float Utilization Rate	O&S	SS/PM	LIW
Recyclability	SD&D	AS/Spec	LMI/LIW
Percentage Parts Reduction	SD&D	SS	LMI

Support Equipment

Supportability Metric Title	Evaluation Phase	Source Document	Data Source
On System Diagnostics	SD&D	ORD/SS/Spec	LMI/LD/LIW
Unit Load-Support Equipment	SD&D	ORD/Spec	LMI/T&E/LIW
Diagnotics Effectiveness	SD&D	ORD/SS/Spec	T&E/LIW
Tools Effectiveness	SD&D	SS/Spec	LMI/LD/LIW
Support Equipment Reduction	SD&D	ORD/SS/Spec	LMI/T&E/LIW
Support Equipment Available	P&D	SS/Spec/MFP	LMI/T&E/LIW
ASIOE Available	P&D	SS/Spec/MFP	LMI/T&E/LIW

Technical Data

Supportability Metric Title	Evaluation Phase	Source Document	Data Source
Technical Manual Quality	P&D	SS/Spec	LMI/Val-Ver/LD
Percent On-board/Embedded TMs	SD&D	SS/Spec	T&E/LIW
TMs Effectiveness	SD&D	SS/Spec	Val-Ver/LD/Field
TMs Available	P&D	SS/Spec/MFP	T&E/LIW

Training and Training Support

Supportability Metric Title	Evaluation Phase	Source Document	Data Source
Time to Achieve Proficiency	SD&D	NETP/STP	LMI/T&E/LIW
Student Failure Percent	P&D	STP/Spec	T&E/LIW
Percent Embedded Training	SD&D	STP/SS/Spec	LMI/T&E
Training Costs	SD&D	Spec/NETP	LMI/T&E/NET
No. Trained/No. Required	P&D	NETP/QQPRI	LMI/NET/LIW
Training Systems Available	P&D	STP/MFP	LMI/LIW

Computer Resources

Supportability Metric Title	Evaluation Phase	Source Document	Data Source
Fault Density	P&D	CRLCMP/Spec	LMI/T&E/Field
Software Reliability	SD&D	CRLCMP	LMI/T&E/Field
Software Modification Costs	O&S	CRLCMP	Contractor/LIW
Computer Resources Available	P&D	CRLCMP/MFP	Contractor/LIW
Minimize PDSS Requirements	SD&D	CRLCMP/Spec	LMI

Facilities

Supportability Metric Title	Evaluation Phase	Source Document	Data Source
Facilities Limitation	SD&D	SS/Spec	LMI/LIW
Facilities Funded	SD&D	SS/Spec	Budget/Fund Doc
Facilities Utilization Rate	O&S	SS/Spec	LIW

PHS&T

Supportability Metric Title	Evaluation Phase	Source Document	Data Source
Percent Packaging Data	P&D	SS/Spec	LMI/LIW
Percent Damage Free Deliveries	P&D	SS/Spec	LMI/QDR
Percent Reusable Container	P&D	SS/Spec	LMI/LIW

Minimize Weight & Cube	SD&D	ORD/SS/Spec	LMI/T&E/LIW
Minimize Special Storage	SD&D	ORD/SS/Spec	LMI/T&E/LIW
Reduced Handling Requirements	SD&D	ORD/SS/Spec	LMI/T&E/LIW
Hazardous Materials Limit	SD&D	ORD/SS/Spec	LMI/T&E
Transport-Load/Unload Time	SD&D	ORD/SS/Spec	LMI/T&E/LIW
Transport - Reconfiguration Rqmts	SD&D	ORD/SS/Spec	LMI/T&E/LIW
Minimize Transportability Equip	SD&D	ORD/SS/Spec	LMI/T&E/LIW
MTMC Rating-Air Transport	SD&D	ORD/SS/Spec	LMI/T&E/MTMC Rpt
MTMC Rating - Ocean Transport	SD&D	ORD/SS/Spec	LMI/T&E/MTMC Rpt
MTMC Rating - Highway Transport	SD&D	ORD/SS/Spec	LMI/T&E/MTMC Rpt
MTMC Rating - Rail Transport	SD&D	ORD/SS/Spec	LMI/T&E/MTMC Rpt
MTMC Rating - Lifting & Tiedown	SD&D	ORD/SS/Spec	LMI/T&E/MTMC Rpt

Design Interface

Supportability Metric Title	**Evaluation Phase**	**Source Document**	**Data Source**
Reliability	SD&D	ORD/Spec	LMI/T&E/LIW
Mission Success	SD&D	ORD/Spec	LMI/T&E/LIW
Operational Readiness	O&S	ORD/Spec	LMI/T&E/LIW
Availability (A_o,A_a,A_i)	SD&D	SS/Spec	LMI/T&E/LIW
LORA Progress	SD&D	SS/Spec	LMI/Progress Rpt
Life Cycle Cost Comparison	SD&D	AS/Spec	LMI/History/APB
Interoperability	SD&D	ORD/Spec	LMI/T&E/Field
QDR Rate	O&S	PM/Warranty	QDRs
Materiel Availability	O&S	ORD/Spec	LMI/T&E/LIW
Ownership Cost	O&S	ORD/Spec	LMI/T&E/LIW

Key To Abbreviations:

AS - Acquisition Strategy
APB - Acquisition Program Baseline
CRLCMP - Computer Resources Life Cycle Management Plan
Fund Docs - Funding documents
LD - Logistics Demonstration or Supportability Demonstration
LIW - Logistics Integrated Data Base
LMI - Logistics Management Information
MFP - Materiel Fielding Plan
MFT - Materiel Fielding Team
MTMC Rpt - Military Transportation Management Command Report
NET - New Equipment Training
NETP - New Equipment Training Plan
O&S - Operations and Support

ORD - Operational Requirements Document
PM - Program Manager
P&D - Production and Deployment
QDR - Quality Deficiency Report
QQPRI - Qualitative and Quantitative Personnel Requirements Information
SD&D - System Development and Demonstration
Spec - Performance or contract specification
SS - Supportability Strategy
STP - System Training Plan
T&E - Test and Evaluation
Val-Ver - Validation and Verification

Supportability Metrics Definitions

Maintenance Metrics

Mean Time to Repair

Mean Time to Repair

A basic measure of maintainability. The sum of corrective maintenance times divided by the total number of failures within a particular measurement interval under stated conditions. The measurement interval can be units of time, miles, rounds, cycles, or some other measure of life units.

$$\frac{\text{Sum of corrective maint times}}{\text{Number of failures}}$$

Mean Time to Perform Scheduled (Periodic) Maintenance

A measure of the elapsed time from the start of scheduled maintenance where the systems is not ready for use to the time the system is restored to its operational state.

$$\frac{\text{Sum of Scheduled maint times}}{\text{Number of scheduled maint actions}}$$

Mean Time to Repair By Echelon

A basic measure of maintainability. The sum of corrective maintenance times at any specific level or echelon of repair, divided by the total number of failures within an item repaired at the level during a particular interval under stated conditions.

$$\frac{\text{Sum of corrective DS maint times}}{\text{Number of DS maint actions}}$$

MAMDT

Mean Active Maintenance Downtime (MAMDT) is the statistical mean of the individual elapsed times for all maintenance tasks during a specified period of time (clock hours). The MAMDT is the weighted average of the mean-time-to-repair (MTTR) and mean preventive maintenance action time (MTPM). When the number of corrective maintenance actions (NC) and the number of preventive maintenance actions (NP) have been determined for a common reference item, the following formula may be used:

$$\text{MAMDT} = \frac{(\text{MTTR X NC}) + (\text{MTPM X NP})}{\text{NC} + \text{NP}}$$

Mean Time to Restore

Mean Restoral Time

A mean of the elapsed times from the occurrence of a system failure or degradation requiring maintenance to the time the system is restored to its operational state. It is derived by dividing the sum of the elapsed times for all events when the system required maintenance by the total number of maintenance events. This metric includes more than just direct maintenance time. This top level metric embeds some logistics response times or an indication of the availability of supportability resources such as mechanics, support equipment, and facilities.

$$\frac{\text{Sum of times to restore system to operation}}{\text{Number of restoral events}}$$

Mean Time to Restore (with PLL Spares)

The average amount of time including maintainability to restore the system when spares are available in the Prescribed Load List (PLL). To determine mean time to restore (with PLL parts), add government-induced repair delay time to the equipment Mean Time to Repair. Repair delay time factors account for the non-availability of personnel, the non-collocation of spares with equipment, etc.

$$\frac{\text{Sum of times to restore system when spares are available}}{\text{Number of restoral events}}$$

Maintenance Ratio

MR is the cumulative number of manhours of maintenance expended in direct labor during a given period of time, divided by the cumulative number of end item operating hours, miles, or rounds during that same time period. The MR is expressed at each maintenance level and summarized for all levels of maintenance.
Both corrective and preventive maintenance are included. The MR is a useful measure of the relative maintenance burden associated with a system. It provides a means of comparing systems and is useful in determining the compatibility of a system with the size of the maintenance organization.

$$\text{For a maintenance level (Org, DS, GS, or depot)} = \frac{\text{Sum of the direct maint manhours}}{\text{Sum of the system operating units}}$$

Maximum Time to Repair

The Maximum Time to Repair is the maximum corrective maintenance downtime within a specified percent (normally

90 or 95 percent) of all corrective maintenance actions which can be accomplished. A variation of this metric could be a target time to repair.

Repair Cycle Time

Repair cycle is the elapsed time (days or hours) from the receipt of a failed item at a repair facility (at DSU, GSU, or organizational maintenance unit) until the item is ready for reissue. The average elapsed amount of time from an item failure to the time the item failure is repaired and placed in stock or reissued. To determine Repair Cycle Time add the Retrograde Ship Time to the maintenance echelon and the Turnaround Time at the maintenance echelon. Retrograde Ship Time is the average elapsed time from an item failure to the receipt of the item by the maintenance echelon specified to repair it.

$$\text{Retrograde Ship Time (RST)} = \frac{\text{Sum of elapsed times from failure to maint echelon}}{\text{No. of retrograde incidents}}$$

$$\text{Turnaround Time (TAT)} = \frac{\text{Sum of the elapsed times to make repairs}}{\text{Number of repair jobs}}$$

Repair Cycle Time = RST + TAT

O&S Cost Per Operating Hour

The sum of all costs required to operate and support a system divided by the number of system operating hours. If more applicable, miles, cycles, or rounds can be substituted for hours. This metric may be used to compare the supportability cost rate for a planned system with a predecessor or similar system based on system usage. It may also be used to monitor the supportability cost rate for a given fleet of systems at different points during its operational life.

A similar type of metric could be used to calculate Maintenance Cost Per Operating Hour. The costs considered would be restricted to maintenance-related costs only. This cost would then be divided by the number of system operating hours.

Maintenance Task Elimination

This metric provides an indication of the relative reduction in maintenance burden in terms of quantity of maintenance tasks when compared to the number of tasks required for the baseline comparative system (BCS). The metric is derived by dividing the number of maintenance tasks which are not required for the planned system by the total number of tasks required in the BCS. Goals for maintenance task elimination can be built into requirements and contract documentation. This metric must be used with caution since elimination of many minor tasks may not reduce maintenance burden as much as a single major task. But, generally, less maintenance is considered better.

Maintenance Downtime (MDT)

a. Maintenance Down Time (MDT)

MDT is the total time during which a system/equipment is not in a condition to perform its intended function. MDT includes active maintenance time, logistics delay time and administrative delay time.

Total time during which a system/equipment is not in a condition to perform its intended function. MDT includes active maintenance time, logistics delay time and administrative delay time.

b. Logistics Delay Time (LDT)

LDT refers to that maintenance downtime that is expended as a result of delay waiting for a resource to become available in order to perform active maintenance. A resource may be a spare part, test or maintenance equipment, skilled personnel, facility for repair, etc.

c. Administrative Delay Time (ADT)

ADT refers to that portion of maintenance downtime during which maintenance is delayed for reasons of an administrative nature (e.g. personnel assignment priority, organizational constraint, transportation delay, labor strike, etc.).

Customer Wait Time – NMCM

Customer Wait Time is the time (days or hours) the system is inoperable due to delays in maintenance turnaround that are attributable to delays in direct maintenance-related resources such as availability of mechanics, support equipment, or facilities.

Repairs Requiring Evacuation

Repairs Requiring Evacuation is the number of repair tasks which cannot be accomplished without system evacuation versus the total number of repair tasks applicable to the system. This metric would be used to get an indication of the maintenance burden. Evacuation adds time to the repair process and consumes limited manpower and equipment resources.

Percent Organic Support

A measure of the proportion of the system support, usually maintenance, which is being provided organically and conversely, the proportion of the support being provided through agreements with contractors. This metric may be used as a means of comparison of the strategy used for supporting the predecessor or a baseline system. The proportion of support being provided organically versus contractor support may also need to be tracked over the life of the system after fielding. One specific means of measurement may be used by dividing the number of work orders organically supported by the total number of work orders.

Maintenance Test Flight Hours

One means of determining if maintenance requirements are increasing in a fleet of aircraft is to track the number of test flight hours due to maintenance being flown per aircraft per month. This number may be used as a means of comparison over a series of previous reporting periods to identify any trends within a fleet of aircraft.

Mean Down Time

Mean Downtime (MDT) is the average Total Downtime required to restore an asset to its full operational capabilities. MDT includes the time from reporting of an asset being down to the asset being given back to operations / production to operate. MDT includes administrative time of reporting, logistics and materials procurement and lock-out/tag-out of equipment, etc. for repair or preventive maintenance.

$$\text{Mean Down Time (MDT)} = \frac{\text{Total Down Time for All failures}}{\text{Total Number of Failures}}$$

Supply Metrics

Customer Wait Time – NMCS

The time (days or hours) the system is inoperable due to delays in maintenance that are attributable to delays in obtaining parts.

A similar measure is Logistics Response Time (LRT) - the amount of time (measured in mean days) that elapses from the date a customer establishes a requisition to the date the customer receives the material that was ordered.

Parts Availability

High-Priority Fill Rate

A measure of the effectiveness of supply support. This metric can be calculated by dividing the number of high-priority requisitions filled (01-04 based on FAD) within a specified time limit by the total number of high-priority requisitions submitted. Any high-priority requisition must be met within the specified time limit to be considered a fill. This metric should concentrate on critical item stock availability (i.e., maintenance and readiness drivers).

Stock Availability

The percentage of requisitions that is filled immediately from stock on hand. The calculation for stock availability is: Backorders established divided by net demands with the quotient subtracted from 100 percent. Stock availability does not apply to subsistence or fuel.

ASL Percent Fill

Percentage of time that demands are satisfied on the first pass from items on-hand within the Authorized Stockage List (ASL) stocks. Divide demands successfully filled from the ASL by the total ASL demands and multiply by 100.

Or the percentage of parts in stock at the ASL location versus the required stockage level. Example:

ASL Stockage Level	= 10 Main Rotor Blades
ASL Actual Stock On-Hand	= 9
ASL Percentage Fil	9/10 = .9 = 90%

Backorder Rate

A measure of effectiveness of supply support. The number of repair parts or spares for a given weapon system/end item which are not in stock at the time they are requisitioned divided by the total demands for parts. This metric may be calculated by dividing the number of workorders awaiting parts by the total number of workorders which required parts. Backorders cause delays in maintenance.

Backorder Duration Time

The average amount of time elapsed between a requisition placed for a spare not in stock to receipt of the spare part to fill the order. The Backorder Duration Time accounts for the time to receive a procurement previously ordered, and the Administrative and Production Lead Times are contributing factors to this wait time.

Controlled Substitution Rate

An additional means of identifying possible problems in supply is by tracking the total number of controlled substitutions per month for a fleet of vehicles. This number may be used as a means of comparison over a series of previous reporting periods to identify any trends in supply within a fleet of systems.

PMR Failure Factor Accuracy

The number of changed failure factors during the two year period after Provisioning Master Record (PMR) load compared to total number of PMR failure factors. This metric measures the accuracy of part usage predictions based upon failure factor data incorporated during the initial PMR build. The number of updates or changes of a given magnitude to PMR failures factors reflect the degree of accuracy of the provisioning process regarding determining the range and quantity of required spare and repair parts. This metric may be used as an incentive for a contractor to create an accurate PMR.

Order/Ship Time

The time elapsed between the initiation of stock replenishment action for a specific activity and the receipt by the activity of the materiel. OST is applicable only to materiel within the supply system and is composed of the distinct elements, order time, and shipping time. It includes many segments such as order processing, shipping from depot to the consolidation point, consolidation point to the port of debarkation, intransit, arrival at destination port, distribution to a supply point, and finally delivery to the requiring unit.

Spares Cost to LCC Ratio

The total estimated cost of spares and repair parts divided by the total estimated life cycle cost for the system. This metric may be used to compare the supply support cost for a planned system with a predecessor or similar system. It may also be used to monitor the supply support cost for a given system at different points during its operational life to identify any changes or potential problems. A high proportion of spares costs may signal the need for reengineering or change to the support concept.

Unit Load – Supply

The total weight, cube, or quantity of repair parts and spares required to support the system in a given type unit. This metric may be used to compare the supply support burden on a unit of a planned system with a predecessor or similar system in terms of extra materiel which a unit must manage, upload, and haul. It may also be used to monitor the supply support burden on a unit of a given system at different points during its operational life to identify any changes.

Parts Standardization

A measure of how well standardization criteria for use of standard parts/components have been met. One way of calculating this metric is to divide the number of standard new National Stock Numbers (NSNs) by the total number NSNs for the for the system.
Compare the percent of new lines to the historical average minus an improvement factor (i.e. 5%) as a standard for judging improvement/accomplishment.

$$\frac{\text{\# New NSNs X 100}}{\text{\# Total NSNs}} = \text{Percent of New Lines}$$

Another way of calculating this metric is to divide the number of standard National Stock Numbers (NSNs) in the Bill of Materials (BOM) by the total number NSNs in the BOM for the system.

Float Utilization Rate

A means of optimizing the number of systems reserved as floats by tracking the percentage of time the float systems are on loan to customer units. The utilization ratio can be calculated by dividing calendar time during which the float items are on loan by the total amount of calendar time during which the float items are available. A high ratio may indicate the need for more float items while a low ration may reveal that less float items are required.

Recyclability

This metric may be used as a means of determining how well environmental design goals are being met. Project managers are being encouraged to set recycling goals for their acquisition systems. Recycling helps reduce disposal problems for systems and components. Recyclability can be quantified by simply counting the number of parts or components which can be recycled. The number can then be compared to the number of recylable parts of similar or predecessor systems. If it is necessary to take into account the difference in total number of parts for the compared systems, then the percentage of recyclable parts can be used.

Percentage Parts Reduction

This metric may be used as a means of determining if goals have been achieved in reducing the number of different part numbers applied to a given system. It is derived by comparing the number of part numbers required for supporting the system against the number of part numbers required to support a similar or predecessor system. This metric may also be evaluated by comparing the number of system part numbers with a specific threshold or a goal which represents a specific percentage reduction from the total parts count on a predecessor system.

Support Equipment Metrics

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On-System Diagnostics/Prognostics

Built-In-Test Detectability Level Percentage

A BIT consists of an integral capability of the mission equipment which provides an onboard automated test capability to detect, diagnose, or isolate system failures. The fault detection/isolation capability is used for momentary or continuous monitoring of a system's operational health, and for observation/diagnosis as a prelude to maintenance action. BIT subsystems may be designed as an analysis tool for the overall system,
integrated with several subsystems, or may be designed as an integral part of each removable component. Detectability Level Percentage is the probability that the malfunction or failure of the UUT will be detected by BIT multiplied by l00.

Percent BIT Fault Detection

A measure of the percentage of total system fault diagnostic capability which is performed via built-in test equipment/ software embedded within the system itself. Such diagnostic capability is typically computer-based and is often incorporated within the system along with other system software. This metric can be used to set threshold and objective goals for the percentage of imbedded diagnostics which should be incorporated into the system. A requirement may also be established for an increase in imbedded diagnostics over that contained within a similar or predecessor system. It is important to specify the level of ambiguity or the level of detail to which the BIT must

diagnose faults.

Percent Prognostic Aids

A measure of the percentage of total system prognostic capability which is performed via equipment/software embedded within the system itself. Such prognostic capability is typically computer-based and is often incorporated within the system along with other system software. This metric can be used to set threshold and objective goals for the percentage of imbedded prognostics which should be incorporated into the system. A requirement may also be established for an increase in imbedded prognostics over that contained within a similar or predecessor system.

Unit Load-Support Equipment

The total cube or weight of support equipment required to maintain the system in a given type unit. This metric may be used to compare the maintenance burden on a unit of a planned system with a predecessor or similar system in terms of extra materiel which the unit must deal with. It may also be used to monitor the maintenance burden on a unit of a given system at different points during its operational life to identify any changes.

Fault Diagnostic Effectiveness

Test Accuracy Ratio

A measure of the accuracy of the test, measurement, and diagnostic equipment (TMDE) by dividing the number of system faults accurately diagnosed by the system TMDE by the total number of system faults tested by the TMDE. This metric is typically used in a requirements or contract document to set an objective and/or threshold level of performance for accurate fault diagnosis/isolation. The diagnostic performance is usually verified during development, operational, production verification, and follow-on test and evaluation. It may be used as a means of comparison with a predecessor or baseline system.

NEOF Rate

The No Evidence Of Failure rate is a measure of the effectiveness of fault diagnostics and fault isolation. The number of components which were falsely diagnosed as faulty divided by the total number of components diagnosed. Another way of measuring this metric would be to divide the number false removal by the total number of removals. Excessive rates of NEOF cause unnecessary delays in maintenance and extraordinarily high demands for spares and repair parts. High NEOF can be a symptom of such shortcomings as poorly designed support equipment or ineffective training. This metric is typically used in a requirements or contract document to set an objective and/or threshold level of performance for accurate fault diagnosis/isolation. It may be used as a means of comparison with a predecessor or baseline system. It can also be used to identify changes in the NEOF rate for a given system at different points in its life cycle.

$$\frac{\text{\# NEOF Items X 100}}{\text{Total \# Items Tested}} = \text{Percent NEOF}$$

A comparison could be accomplished using the average number of NEOFs added for a large, medium, and small systems which could serve as an indicator of the adequacy of engineering and maintenance planning. Compare the percent of NEOFs to the historical average minus an improvement factor (i.e. 5%) as a standard for judging adequacy of engineering and maintenance procedure designs.

Fraction of Faults Isolatable (FFI)

A measure of the fault isolation coverage of the test, measurement, and diagnostic equipment (TMDE) which is calculated by dividing the total number of system faults which can be consistently isolated by the system TMDE by the total number of system faults testable by that TMDE. This metric can be used in a requirements or contract document to set an objective and/or threshold level of testability with regard to fault isolation. During system development, the isolation capability can be verified DT&E, OT&E, and the logistics demonstration.

Tools Effectiveness

The total number of tasks performed successfully using the specified tools divided by the total number of tasks performed. This metric provides an indication of how well the tools contribute to the optimization of the maintenance task by reducing time and effort to accomplish the task. This metric can be used in a requirements or contract document to set an objective and/or threshold level of effectiveness for tools. Typically, the requirement should always be 100% effectiveness. It may be used as a means of comparison with a predecessor or baseline system. It can also be used to identify changes in the tools effectiveness for a given system at different points in its life cycle.

Support Equipment Reduction

Minimize Special Tools and TMDE

The number of items eliminated during a given life cycle phase divided by the total number of item at the start of the life cycle phase. The Support Equipment Recommendation Data (SERD) list may be used as the source document to collect the data for this metric. Support equipment can be reduced in terms of number of different types of support equipment and in terms of the ratio of number of a given item of support equipment required per end item supported.

Support Equipment Reduction

The number of items eliminated during a given life cycle phase divided by the total number of items at the start of the life cycle phase. The Support Equipment Recommendation Data (SERD) list may be used as the source document to collect the data for this metric. Support equipment can be reduced in terms of number of different types of support equipment and in terms of the ratio of number of a given item of support equipment required per end item supported.

Tools and TMDE Available

The total number of items of Test, Measurement, and Diagnostic Equipment (TMDE) required compared to the total number of items of TMDE available. This metric would typically be used to set goals or requirements for percentage of range of quantity of TMDE available at the time of system fielding.

ASIOE Available

The total number of Associated Support Items of Equipment (ASIOE) required compared to the total number of ASIOE available. This metric would typically be used to set goals or requirements for percentage of range of quantity of ASIOE available at the time of system fielding.

Manpower and Personnel Metrics

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Crew Size

The number of personnel required to operate a given system and perform all required mission functions. From a cost and supportability view, it is typically better to minimize crew size. This metric is typically used in a requirements or contract document to set an objective and/or threshold crew size required to operate and/or maintain a system. The quantitative goal is typically derived by comparing the crew size requirements for predecessor or similar systems.

Maintainer Cost Per Operating Hour

Used to obtain an indication of the cost of maintenance personnel for a given system. The total cost of maintainer personnel divided by the total number of operating hours. This metric may be used to compare the labor cost maintainers for a planned system with a predecessor or similar system. It may also be used to monitor the maintenance labor cost for a given system at different points during its operational life to identify any changes or revise budget requirements.

Skill Level Limit

A measure of the level of expertise required for system operators to competently operate the system or for maintainers to competently repair or service the system. This metric is typically used in a requirements or contract document to set an objective and/or threshold reduction in the skills required to operate and/or maintain a system. The quantitative goal is typically derived by comparing skill level requirements for predecessor or similar systems.

Direct Annual Maintenance Manhours

The sum of the working time of each skill specialty code required for the performance of a unit of work on the system accumulated for a period of one year.

Mean Maintenance Manhours Per Operating Hour (MMH/OH)

This metric is derived by dividing the number of maintenance manhours required to keep a system operational by the number of operating hours of that system. This metric provides an indication of the maintenance burden of a system. It would typically be used to compare the maintenance burdens of similar systems or to track the maintenance burden of a given type of system over time.

Maintenance Manhour Requirements for Each MOS

The number of manhours required to support the system for a given Military Occupational Specialty (MOS). This metric gives an indication of the maintenance workload for a system by MOS. It would typically be used to compare the support of a planned system with that of a predecessor or baseline system.

Ratio of Personnel Cost to O&S Cost

An estimate of total cost for personnel (pay, benefits, and overhead) to operate and support the system divided by the total estimated operating and support costs of the system. The metric can be used to compare the relative cost of personnel between planned and current systems. It can also be used to identify changes in the relative cost of personnel for a given system at different points in its life cycle.

Number of Personnel On-hand vs Number Personnel

The number of personnel of a given Military Occupational Specialty (MOS) on-hand divided by the number of personnel of that MOS type which are required at the site of fielding to operate or support the system. This metric

provides an indication of how well the system will be supported. Requirements for the same MOS horizontally across several different types of weapons systems/end items in the same unit must often be considered.

Number of Personnel Required vs Authorized

A comparison of personnel required to operate and support a weapon system to the number of personnel authorized for that weapon system. This metric provides an indication of the capability of the system to be properly operated and supported.

Manpower (or Mechanic) Utilization

A measure of the workload for a specified maintainer or group of maintainers. This metric can be derived by dividing actual hours worked by the total hours which the mechanic was available for work. This metric can be used to monitor changes in the utilization rates of maintenance personnel over time or as means of comparison with predecessor systems.

Training Metrics

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Time to Achieve Proficiency

The average time required for operator and/or support personnel to become proficient in effectively, efficiently, and correctly performing the required tasks associated with operation or maintenance of the system. This metric would typically be used to compare the time to train operators and maintainers to perform tasks on a new system with the time required on a predecessor or baseline system. Care must be taken in using this metric. The goal is to provide effective training in all required tasks in the least amount of time.

Student Failure Rate or Student Pass Rate

The percentage of students who are not able to achieve or, conversely, who do achieve the training objectives after completion of the training course. This metric provides an indication of the effectiveness of the training in helping the target audience to learn the training objectives. This metric would typically be used to set threshold and objective goals for failure or pass rates. The content and length of programs of instruction (POIs) should be determined based on the training required to prepare soldiers to successfully perform their MOS-related tasks with minimal on-the-job training in the field.

Percentage Embedded Training

A measure of the percentage of total operator and/or support personnel training which is available within the system itself. Such training is typically computer-based and is simply incorporated within the system along with other system software. This metric can be used to set threshold and objective goals for the percentage of imbedded training which should be incorporated into the system. A requirement may also be established for an increase in imbedded training over that contained within a similar or predecessor system. The advantage of imbedded training is that it allows frequent review and is available to the user upon demand.

Ratio of Training Costs to LCC Costs

A simple measure of the relative cost of training to the total system life cycle cost. The total training costs divided by the total life cycle costs. This metric may be used to compare the relative cost of training between planned and current

systems. It can also be used to identify changes in the relative cost of training for a given system at different points in its life cycle.

Number of Personnel Trained vs Number Required

Provides a measure of the amount of training which has been accomplished for a given Military Occupational Specialties (MOS) at the site where the system is being fielding currently. Number of trained personnel of a given MOS divided by the total number of personnel of that type MOS at the site of fielding.

Training Systems Available

The number of training systems available at a given training facility versus the number of training systems required. This metric would provide an indication of how well training requirements can be met.

Technical Data Metrics

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Technical Data Quality

Technical Manual (TM) Quality

An indicator of the quality of technical manuals (TMs) and equipment publications can be obtained by comparing the number of change pages required to correct errors with the total number of TM pages or the total number of change pages for all reasons. For electronic TMs it is necessary to track individual changes instead of change pages. Given the fluid nature of equipment publications, this metric may be difficult and non-cost effective to track.

TMs Quality (DA Form 2028s)

An indicator of the quality of technical manuals (TMs) and equipment derived by tracking the quantity of DA Form 2028s submitted from the field which are used to correct errors in the TMs. As a practical matter, the users seldom send in 2028s.

Documentation Rewrite

A measure of the quality of the technical manuals (TMs) and equipment publications derived by tracking the number of hours spent rewriting documentation to correct errors as a percentage of original document preparation time. A high rate of rewrite would indicate poor quality.

Percentage of On-board or Embedded TMs

A measure of the percentage of the technical manuals (TMs) and equipment publications which are available within the system itself. Such technical documentation is computer-based and may be incorporated within the system along with other system software. This metric can be used to set threshold and objective goals for the percentage of on-board or imbedded technical documentation which should be incorporated into the system. A requirement may also be established for an increase in on-board or imbedded technical documentation over that contained within a similar or

predecessor system. The advantage of on-board and embedded technical documentation is that it is available to the user upon demand.

TMs Effectiveness

TMs Effectiveness Rate

The total number of tasks performed successfully using the specified technical manuals (TMs) divided by the total number of tasks performed. This metric provides an indication of how well the TMs contribute to the optimization of the maintenance task by reducing time and effort to accomplish the task. This metric can be used in a requirements or contract document to set an objective and/or threshold level of effectiveness for TMs. Typically, the requirement should always be 100% effectiveness. It may be used as a means of comparison with a predecessor or baseline system. It can also be used to identify changes in the TMs effectiveness for a given system at different points in its life cycle.

NEOF Rate

The No Evidence Of Failure metric used for measuring the effectiveness of fault diagnostics and fault isolation with regard to support equipment can also be used as an indicator of problems with the equipment publications. High NEOF can be a symptom of such shortcomings as ineffective TMs, poorly designed support equipment, and ineffective training. This metric is further described under the Support Equipment ILS element.

Availability of Technical Data

TMs Available

The total number of Technical Manuals (TMs) available compared to the total number of TMs required. This metric would typically be used to set goals or requirements for percentage of range of quantity of TMs available at the time of system fielding.

TMs Produced vs Required

The total number of Technical Manuals (TMs) produced versus the total number of TMs required. This metric would typically be used to set goals or requirements for percentage of range of quantity of TMs actually published and distributed at the time of system fielding.

Facilities Metrics

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Facilities Limitation

An objective and threshold percentage or specified reduction in facilities requirements may be incorporated into requirements documents and contracts. This metric is typically used in a requirements or contract document to set a goal for facilities required to support the system. Some project managers have set a requirement for no new facilities. The quantitative goal is typically derived by analyzing the facilities requirements for predecessor or similar systems.

Facilities Funded

A metric used to determine if sufficient funding is programmed to support facility addition/upgrade**.** It is necessary to

compare programmed funding to estimated funding requirements on a fiscal year basis. The formula is expressed as Military Construction (Army) Programmed Funding divided by facilities funding requirements.

Facilities Utilization Rate

A measure of the workload for a specific type of facility. This metric can be derived by dividing actual capacity of the facility used by the total capacity available during a given time period. This metric can be used to monitor changes in the utilization rates of facilities over time or as means of comparing facilities utilization rates with that of predecessor systems. The type of units to be used for capacity will depend upon the type of facility being tracked. For a storage facility, square feet may be the best measure of capacity. A maintenance facility may require capacity to be measured in terms of the number of hours a day during which the maintenance bays are filled with systems under repair. A more production-oriented facility may have capacity measured in units output per unit of time.

Computer Resources Support Metrics

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Defect Density

A measure of the number of errors found in newly developed software. The defect or fault density is derived by dividing the number of software faults which are identified by the number of lines of code in the software program. A specific defect or fault density goal may be included in the software specification to provide a quantitative measure by which to determine whether the government will accept delivery of the software.

Software Reliability

Software Mean Time Between Defect

A basic measure of the reliability of software. The total functional life (time, rounds, hours, cycles, events, etc.) of a population or fleet of end items divided by the total number of software defects or failures within the population during the measurement interval given the end items are operated within normal mission profiles and under specified operating conditions and environments.

Software Modification Rate

A measure of the quality of the software development effort. The rate is derived by counting the frequency with which the system software must be modified over a specified interval of time. This metric may have some value when compared to a predecessor or baseline system. Caution must be used in using this metric. Software enhancements must be differentiated from software fixes and those driven by hardware modifications, etc.

Ratio of Software Modification Costs to LCC Cost

A simple measure of the relative cost of software modifications compared to the total system life cycle cost. The total software modification costs divided by the total life cycle costs. This metric may be used to compare the relative cost of software modification between planned and current systems. It can also be used to identify changes in the relative cost of software modification for a given system at different points in its life cycle. Caution must be used in using this metric. Software enhancements must be differentiated from software fixes.

Computer Resources Available

The total range and quantity of computer resources (hardware, software, firmware, documentation, support items) available versus the total range and number of computer resources required. This metric would typically be used to set goals or requirements for percentage of range of quantity of computer resources available at the time of system fielding.

Minimize Post Deployment Software Support Requirements (PDSS)

An objective and threshold percentage or specified reduction in the number of different types of support equipment, software, and firmware required to support the software of an acquisition end item after fielding. This metric may be incorporated into requirements documents and contracts. This metric can be used to set a goal for the PDSS burden required to support the software of a materiel system. The quantitative goal can be derived by using the support requirements for predecessor or similar systems as a baseline.

Packaging, Handling, Storage, and Transportation Metrics

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Percentage of Packaging Data

This is a measure of the percentage of repair parts (that will be used to support the end item in a forward deployed scenario) which have the packaging engineering data developed. It is the relationship between the number of repair parts provisioned to the number of repair parts with military packaging data. The quantitative goal is 100%.

Percentage of Damage Free Deliveries

This is a measure of the adequacy of the packaging used for storage and shipping of the system and its components. It is calculated by dividing the number of systems/system components delivered without damage by the total number of deliveries. There are industry percentages which can be used as a guide.

Percentage Long Life Reusable Container (LLRC)

This is a direct measure of the impact of the packaging methodology on the soldier. The higher the percentage, the less packaging training and equipment required by the soldier. It is the relationship between the number of repair parts that require evacuation for overhaul to the number of these parts provided with a LLRC. A high number is also a direct indicator of a lower life cycle cost for packaging and a lower environmental impact. The quantitative goal is 100%.

Reduced Weight and Cube

An objective and threshold percentage or specified reduction in system weight and cube as well as the weight and cube of the system support package may be incorporated into requirements documents and contracts. This metric (or set of metrics) may be used to set a requirement for minimizing the transport burden of the system. The actual quantitative requirements are derived by analyzing the weight and cube of predecessor or baseline systems.

Reduced Special Storage Requirements

An objective and threshold percentage or specified reduction in special storage requirements may be incorporated into requirements documents and contracts. This metric is typically used to set a requirement or goal for conditions under which the system can be efficiently and effectively stored. Some project managers have set a requirement for no special storage requirements. The goal is typically derived by analyzing the special storage requirements for predecessor or baseline systems.

Reduced Handling Requirements

Minimize Preparation for Shipment

An objective or specified reduction in time (manhours and total elapsed time) required to prepare a weapon system for shipment. The quantitative goal is typically derived by analyzing the time required for preparation for shipment for predecessor or similar systems.

No Special Handling

An objective and threshold percentage or specified reduction in special handling requirements may be incorporated into requirements documents and contracts. This metric is typically used to set a requirement or goal for the ease of handling for the system when being prepared for shipment. Some project managers have set a requirement for no special handling requirements. The goal is typically derived by analyzing the special handling requirements for predecessor or baseline systems.

Hazardous Material Limits

Objective and threshold percentages set to represent reduction in types and/or quantity of hazardous materials associated with the operation, sustainment, or disposal of an acquisition system. The baseline may be a predecessor system. Total elimination of hazardous materials may be the goal.

Transportability

Time to Load/Unload From Transport Vehicle

A metric which compares the load and unload times for a proposed system to the load and unload times of a predecessor or baseline system.

Time to Configure System for Transport

A requirement of a time limit (such as one hour) within which the system must be able to be configured for transport by a given mode of transport (e.g., air, ocean, or rail).

Minimize Transportability Equipment

An objective and threshold percentage or specified reduction in transportability peculiar equipment required to prepare a weapon system for shipment. The quantitative goal is typically derived by analyzing the transportability peculiar equipment requirements for predecessor or similar systems.

Military Traffic Management Command (MTMC) Rating

Transportability Quantifiers are numerical determinations of the relative transportability of systems, based on predetermined values. These quantifiers measure the transportability of one system versus another to give a better idea to decision makers just how good or how poor is the transportability of various systems. The quantifiers are based upon a rating of 0% to 100% transportable for each of the methods of transport: fixed-wing air, rotary-wing air, ocean,

logistics-over-the-shore, highway, and rail, as well as lifting and tiedown provisions. Each of the methods has predetermined values based upon varying levels of transportability within each of the methods. These levels are based upon numbers of restrictions the item would face during transport as well as the number of transportation assets available to transport the item. The fewer the restrictions and the greater the number of available transportation assets, the higher the score.

Transportability quantifiers only measure the ability of a single item to move through the Defense Transportation System. They do not measure the impact that an item will have on the deployability of the force. It is possible that an item can be as transportable as another item, yet have a completely different impact on the deployability of the force. Therefore, transportability quantifier values must not be used in a vacuum. They need to be used in conjunction with a deployability analysis.

Fixed-Wing Air Transport

Item	Total No. Aircraft	Rating
C-130 Airdrop	366	100%
C-130 Transport*	366	90%*
C-17 Airdrop	102	36%
C-17 Transport*	102	32%*
C-5 Airdrop	104	18%
C-5 Transport*	104	16%*
Not Air Transportable	0	0%

*Subtract 10% if crew prep time > 15 min. for C-130 or 60 min. for C-17 and C-5.
Subtract 10% of value if equipment is required for loading or vehicle preparation.
Subtract 10% of value if approach or sleeper shoring is required.

Rotary-Wing External Air Transport

Item	Total No. Aircraft	Rating
UH-60L:High-Hot (6,630 lb. lift)*	780	100%*
UH-60L: 2K ft. AGL–70 F (9K lb. lift)*	780	74%*
CH-47D:High-Hot (16,644 lb. lift)*	400	34%*
CH-47D: 2K ft. AGL–70 F (23,396 lb. lift)*	400	24%*
No Helicopter External Lift	0	0%

Ocean Transport

Item	Total No. Ships	Rating
Container Ships	2	100%**
Breakbulk/Combination Ships	17	96%**
Roll-on/Roll-off Ships	38	67%**
Not Ocean Transportable	0	0%

** Subtract 10% of value if length exceeds 432 inches.
Subtract 10% of value if width exceeds 180 inches.
Subtract 10% of value if height exceeds 132 inches.
Subtract 10% of value if weight exceeds 50 tons.
Subtract 10% of value if item can not negotiate a 15 degree ramp.

Logistics-Over-The-Shore Transport

Item	Total No. Lighters	Rating
LCM-8	52	100%
LARC-LX	12	56%
LCU-1646	9	46%
LCU-2000	38	39%

LSV	8	7%
Not LOTS Transportable	0	0%

Highway Transport

Item	Total No. Transporters	Rating
M172 Series*	1,500	100%*
M871 Series*	8,200	93%*
M872 Series*	8,500	58%*
M870 Series*	2,400	21%*
M1000 Series*	2,300	10%*
Not Highway Transportable	0	0%

* Note: Use only the highest applicable subtraction from the following four categories.
Subtract 10% of value if permits required in NATO countries.
Subtract 20% of value if CONUS length or width permits are required.
Subtract 50% of value if CONUS height or weight permits are required.
Subtract 90% of value if Certification as Essential to Natl Defense is required.

Self Deployable Vehicles

No highway permits required at GVW, CONUS or NATO	100%
No highway permits at GVW in CONUS, Permits for NATO	90%
CONUS Length or Width Permits Required	80%
CONUS Height or Weight Permits Required	50%
Certification As Essential To National Defense Required	10%
Not Highway Transportable	0%

Rail Transport

Item	Rating
Fits within GIC Envelope*	100%*
Fits within Envelope B	85%
Fits within AAR Diagram	75%
Fits within DOD Diagram	35%
Fits within width of DOD Diagram and double stack	10%
Not rail transportable.	0%

Subtract 10% of value if length exceeds 492 inches (GIC only).
Subtract 10% of value if width exceeds 101 inches (GIC only).
Subtract 10% of value if weight exceeds 22 tons (GIC only).

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Lifting & Tiedown Provisions

Lift provisions meet MIL-STD-209 strength requirements	35%*
Plus	
Lift provisions meet -209 dimension & location rqmts	15%*
Plus	
Tiedown provisions Meet -209 strength rqmts	35%*
Plus	
Tiedowns prov meet MIL-STD-209 rqmts	15%*
Total Value:	100%*

Subtract 20% of total lift values if common, lateral spreader bars reqrd.
Subtract 50% of total lifting values if special spreader bars are required.

Subtract 10% of total lifting values if special slings are required.
Subtract 10% of total lifting/tiedown values if provisions are removable.
Subtract 10% of total tiedown values if more than 4 tiedown provisions required.
Subtract 50% of total lifting/tiedown values if item is a cargo carrier and tiedown provisions do not meet the size, number, or strength rqmts of MIL-STD-209.

Design Interface Metrics

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Reliability

Mean Time Between Failure

A basic measure of reliability for weapon systems and end items. The total functional life (time, rounds, hours, cycles, events, etc.) of a population or fleet of end items divided by the total number of failures within the population during the measurement interval. Typically there is a requirement for the end items to be operated within normal mission profiles and under specified operating conditions and environments.

Mean Time Between Critical Failure

A basic measure of reliability which provides an indication of the probability that the system will perform essential mission functions. The total functional life (time, rounds, hours, cycles, events, etc.) of a population or fleet of end items divided by the total number of critical failures within the population during the measurement interval. Typically there is a requirement for the end items to be operated within normal mission profiles and under specified operating conditions and environments.

Mean Time Between Maintenance Actions (MTBMA)

The mean of the distribution of the time intervals between actions or groups of actions required to restore an item to, or maintain it in, a specified condition. This entry will be composed of the MTBF, Mean Time Between Maintenance Induced (MTBM Induced), Mean Time Between Maintenance No Defect (MTBM No Defect), and Mean Time Between Preventive Maintenance (MTBPM) values. MTBMA may be calculated by the following formula:

$$\text{MTBMA} = \left(\frac{1}{\text{MTBF}} + \frac{1}{\text{MTBM Induced}} + \frac{1}{\text{MTBM No Defect}} + \frac{1}{\text{MTBPM}} \right)^{-1}$$

Mean Time Between Removal

A measure of the system reliability parameter related to demand for logistics support. The total number of operational units (e.g., miles, rounds, hours) divided by the total number of items removed from that system during a stated period of time. This term is defined to exclude removals performed to facilitate other maintenance and removals for product improvement. Note: For a particular task to be applicable, it must meet ALL of the following criteria:

1). It must be either a "remove" or a "remove and replace" task.
2). It must be categorized as either an "emergency" or an "unscheduled" task.
3). The task must be performed by "operator/crew/unit-crew" or "organizational/on equipment/unit-organizational" or by a maintenance contact team.
4). The task can not be performed to facilitate other maintenance or for product improvement.

Mean Time Between Preventive Maintenance

The mean of the distribution of intervals, measured in hours, rounds, etc., between preventive maintenance actions. This is one of the four categories of maintenance events contributing to the mean time between maintenance actions value.

Mission Failure

Mean Time Between Mission Abort

The mean of the distribution of intervals, measured in hours, rounds, etc., between events which render a system incapable of performing its mission. The emphasis for this metric is on system failures which directly impact the mission functions rather than non-mission critical failures or preventive maintenance actions.

Mean Calendar Time Between Mission Failure

The mean of the distribution of calendar hours between events causing a system to be less capable in performing its mission. The emphasis of this metric is on system failures that cause aborts or directly reduces mission effectiveness. In addition to mission aborts, this measure accounts for the loss of interoperability or loss of equipment use that improves the system capability to perform a mission without causing a mission abort.

Failure Free Operating Period (FFOP)

FFOP is defined as a period of time (or appropriate unit of operation) during which no failures, resulting in a loss of system functionality occur. It is a measure of reliability which can offer the user an increase in system effectiveness and enhanced operational availability above that reflected in the traditional mean time between failure (MTBF). The emphasis for this metric is on reducing the probability of system failures which directly impact the mission functions.

Mission Completion Success Probability (MCSP)

The probability that an end item will perform all essential mission functions and complete its mission successfully. This probability can be derived by dividing the number of missions successfully completed by the total number of missions attempted by the population of end items.

Combat Rate

Combat rate is the average number of consecutive scheduled missions completed before an end item experiences critical failures.

$$\text{Combat Rate} = \frac{\text{No. of successful missions}}{\text{No. of scheduled missions - aborts}}$$

Operational Readiness

Measure of a system's ability to perform all of its combat missions without endangering the lives of crew or operators. The metric is best used when comparing the readiness rates of a new system to rates of the predecessor (baseline) system.

Availability

Operational Availability (A_o)

The probability that, when used under stated conditions, a system will operate satisfactorily at anytime. This differs from achieved availability in that Ao includes standby, administrative, and logistics delay times.

Achieved Availability (A_a)

The probability that, when used under stated conditions in an ideal support environment, a system will operate satisfactorily at any time. This differs from Inherent Availability only in its inclusion of consideration for preventive action. Aa excludes supply downtime and administrative downtime. Aa may be expressed by the following formula:

$$Aa = \frac{MTBM}{MTBM + M}$$

where $MTBM = \left(\frac{1}{MTBF} + \frac{1}{MTBM\text{-}ND} + \frac{1}{MTBPM} \right)^{-1}$

M = Summation of the Event Tasks (ETi) multiplied by task frequency (TFi) for N tasks divided by the summation of the task frequency (TFi) for N tasks.

M = Mean active maintenance downtime (both corrective and preventive actions)
ETi = Elapsed time for task i
TFi = Task frequency for task i
N = Total number of tasks performed
Note: The measurement bases for MTBF, MTBM-ND, and MTBPM must be consistent when calculating the MTBM parameter.

Inherent Availability (A_i)

The probability that, when used under stated conditions in an ideal support environment without consideration for preventive action, a system will operate satisfactorily at any time. The "ideal support environment" referred to exists when the stipulated tools, parts, skilled manpower, manuals, SE and other support items required are available. Ai excludes whatever ready time, preventive maintenance downtime, supply downtime, and administrative downtime may be required. Ai may be expressed by the following formula:

$$Ai = \frac{MTBF}{MTBF+MTTR}$$

where MTBF = Mean Time Between Failures
MTTR = Mean Time To Repair

Training System Availability

A measure of the reliability and maintainability of the training system(s) associated with a given acquisition system. This metric is a measure of how many mission hours that a training system is available.

$$Avail = \frac{\text{(mission available time)}}{\text{(mission avail time)} + \text{(mission non-avail time)}}$$

LORA Progress

A measure of the rate of progress toward completion of all the Level of Repair Analysis (LORA) computer runs required for determining optimum allocation of repair candidate components and maintenance policies.

Life Cycle Cost Comparison

Life Cycle Cost (LCC) Differential

A measure of the LCC of a system compared with the LCC of its predecessor or baseline system. This metric is the projected LCC of the new system divided by the LCC of the current system or baseline system. Goals can be established for incorporation into requirements and contract documentation to reduce LCC for a new system.

Operating and Support (O&S) Cost Comparison

The goal in fielding a new system should be that the O&S costs for the new system, generally, should be no more than the costs of the displaced system. Knowledge of the costs of the displaced system will provide a benchmark early on in the development of the new system that the developer can aim for in planning the new system. Although the O&S costs for the new system will be based on engineering estimates, having a benchmark will help the Material Developer to consider supportability more nearly equally with cost, performance and schedule. Historical data for the system to be displaced must be available.

Interoperability

Interoperability is the ability of systems to provide services to and accept services from other systems to enable them to operate effectively together. The goal of this metric is to provide a level of certainty that a given acquisition end item is able to support or operate with other predefined systems in specified functional areas. Interoperability is a difficult metric to measure quantitatively. Interoperability with other systems is verified through testing or simulation. Often, interoperability is measured simply by identifying whether or not the system is interoperable. A ratio for interoperability may be derived by dividing the number of systems with which the acquisition system is interoperable by the total number of systems with which the acquisition system should be interoperable. It may also be useful to compare the number of systems which the acquisition system is interoperable with the number of systems that the predecessor system was interoperable.

Quality Deficiency Report (QDR) Rate

One means of identifying possible problems in the fielding process is to track the number of QDRs during a specified time interval (e.g., each month). This number may be used as a means of comparison over a series of previous reporting periods to identify any trends in submission of customer/user complaints. This metric helps to confirm the effectiveness of the design effort. Number of QDRs/Interval of Time

Materiel Availability (Key Performance Parameter (KPP))

Materiel Availability is a measure of the percentage of the total inventory of a system operationally capable (ready for tasking) of performing an assigned mission at a given time, based on materiel condition. This can be expressed mathematically as (the number of operational end items divided by the total population). Materiel Availability also indicates the percentage of time that a system is operationally capable of performing an assigned mission, and can be expressed as (uptime divided by (uptime plus downtime)).

Materiel Availability (MA) is a number between 0 and 100 that provides the average percentage of time that the entire population of systems is materially capable for operational* use during a specified period.

$$\text{Materiel Availability} = \frac{\text{Number of End Items Operational}}{\text{Total Population of End Items}}$$

OWNERSHIP COST (Key System Attribute (KSA))

Ownership Cost provides balance to the Sustainment solution by ensuring that the Operations and Support (O&S) costs associated with materiel readiness are considered in making decisions. For consistency and to capitalize on existing efforts in this area, the Cost Analysis Improvement Group's O&S Cost Estimating Structure will be used in support of this KSA: unit operations (Energy, fuel, petroleum, oil, lubricants, electricity); maintenance; sustaining Support (all except system training); continuing system improvements.

Ownership Cost = O&S costs associated with Materiel Readiness