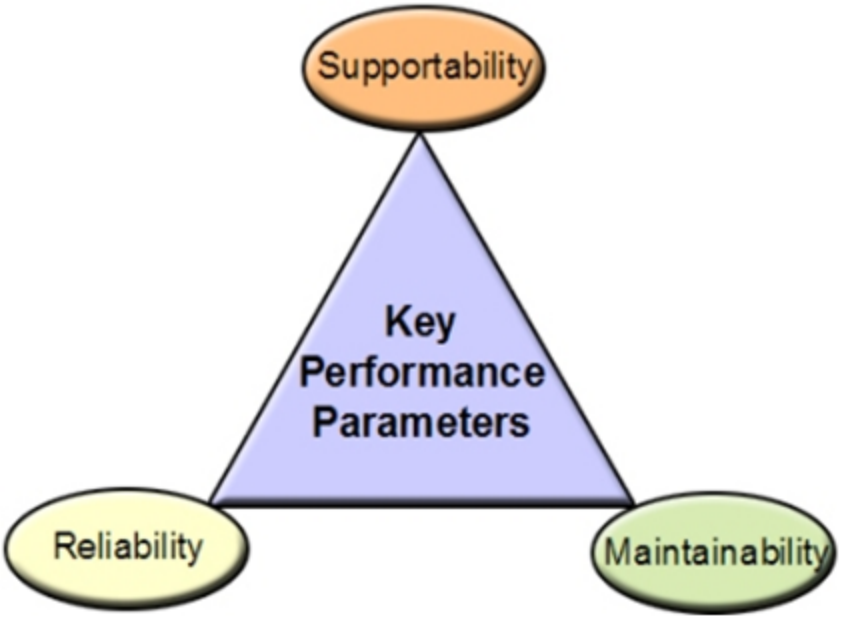
Welcome to Metrics

A metric is a measurable performance indicator that can be used to track progress towards achieving program objectives. When selecting program supportability metrics, the goal is to achieve a balance across the three categories: reliability, maintainability, and supportability. These metrics are important because RMS cannot effectively be "added on" later. These characteristics must be "designed in." This topic addresses why the RMS components of system availability are considered at an early stage in the acquisition life cycle.



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Long Description

Key Performance Parameter triangle showing the metrics categories of reliability, maintainability, and supportability at the angles.

Objectives

Upon finishing this lesson, you will:

- Identify the types of metric categories used to define support objectives.
- Identify the JROC-established mandatory Key Performance Parameter (KPP) and two Key System Attributes (KSAs) relating to Life Cycle Sustainment.
- Define Availability, Materiel Reliability, Ownership Cost and Mean Downtime
- Identify the appropriate mathematical formulas for Availability, Materiel Reliability, Ownership Cost and Mean Downtime
- Identify the characteristics of metrics that effect the definition of supportability objectives

Metrics Categories

There are three major metric categories that the LCL will use when incorporating metrics into a program's supportability objectives. The LCL should understand the mandatory Sustainment Key Performance Parameter (KPP) as it applies to a weapon system. The Sustainment KPP is a function of:

Supportability

In the DoD publication, "Performance Based Logistics: A Program Manager's Product Support Guide", supportability is defined as "the quality of a system – including design, technical support data, and maintenance procedures – to facilitate detection, isolation, and timely repair/ replacement of system anomalies." Supportability at this early stage in the life cycle considers how system design relates to the time and cost of providing logistics support later in the life cycle.

Reliability

According to the Product Support Guide, reliability is "the ability of a system to perform as designed in an operational environment over time without failure." Reliability at this early stage in the life cycle considers the mission and the operational environment, recognizing that there are trade offs between "time to failure," performance, and cost.

Maintainability

Maintainability describes the ability of specified personnel to repair or restore a system to service using documented procedures and allocated resources. There are a number of design factors, including modularity, accessibility, and testability, that contribute to maintainability. Maintainability at this stage of the life cycle considers how system design can influence the cost and time of preventive and corrective repairs.

Popup Text

Key Performance Parameter

KPP encompasses those attributes or characteristics of a system that are considered critical or essential to the development of an effective military capability.

Life Cycle Sustainment Outcome Metrics

A successful acquisition logistics measurement strategy ultimately comes from taking a life cycle view rather than looking at the individual stages or specific individual metrics. Assessing the suitability of a total system design and the proposed support approach (including cost constraints) for the full range of anticipated operational requirements is critical. Therefore, the LCL considers all individual support elements to provide a comprehensive, balanced assessment of the total system's operational status. Other constraints that should be considered when determining a proposed support approach include: affordability constraints, scheduling constraints, technology availability, and human resource constraints.

In July 2006, the Joint Requirements Oversight Council (JROC) established a mandatory warfighter Materiel Readiness/Sustainment Key Performance Parameter (KPP) named Materiel Availability. Subsequently, this term was revised to 'Availability' only. This was done to acknowledge there are two components of this KPP – Materiel Availability and Operational Availability.

Life Cycle Sustainment Outcome Metrics, Cont.

The JROC also:

- Identified Material Reliability and Ownership Cost as related Key System Attributes (KSAs) for new acquisitions.
- Provided a definition of Mean Down Time (MDT) to measure how long a system is unavailable – for either scheduled or unscheduled maintenance including the wait time for other elements of logistics support. This is a key piece in the maintenance/logistics planning process.

Reporting and use of these metrics is required for all ACAT I Acquisition Programs as well as all major legacy systems.

You may read more information about Life Cycle Sustainment Outcome Metrics in a memorandum from the DoD.

Popup Text

Key System Attributes

An attribute or characteristic considered crucial in support of achieving a balanced solution/approach to a KPP or some other key performance attribute.

Materiel Readiness Outcomes

The JROC instituted four materiel readiness outcomes (on the left) that should be established early in the concept decision process, refined throughout the design development process, and carried through as program baseline goals until system retirement. Select each readiness outcome to see a description and formula.

- Materiel Availability KPP
- Materiel Reliability KSA
- Ownership Cost KSA
- Mean Downtime
- Operational Availability KPP

Popup Text

Materiel Availability KPP

Materiel Availability KPP 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 material condition.

This is, in this context, is a system-wide metric – representing the average percentage time that the entire population of systems is materially capable for operational use during a specified period.

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

Materiel Reliability KSA

Materiel Reliability is a measure of the probability that the system will perform without failure over a specified interval. Reliability must be sufficient to support the warfighting capability needed.

Materiel Reliability is generally expressed in terms of a mean time between failure (MTBF) and once operational, can be measured by dividing actual operating hours by the number of failures experienced in a specific interval.

$$\textbf{Materiel Reliability} = \frac{\textbf{Total Operating Hours}}{\textbf{Total Number of Failures}}$$

Ownership Cost KSA

Ownership cost provides balance to the Sustainment solution by ensuring the Operations and Support (O&S) costs associated with materiel readiness are considered in making acquisition decisions.

The Cost Analysis Improvement Group's (CAIG) O&S Cost Estimating Structure will be used in support of

this KSA. Fuel costs will be based on fully burdened cost of fuel. Costs are to be included regardless of funding source.

The KSA value should cover the planned life cycle timeframe, consistent with the timeframe used in the Availability KPP.

Sources of referenced data, cost models, parametric cost estimating relationships and other estimating techniques or tools must be identified in supporting analysis.

Programs must plan for maintaining the traceability of costs incurred to estimates and must plan for testing and evaluation.

Ownership Cost = CAIG O&S Cost Estimating Structure Selected Cost Elements:

- **2.0 Unit Operations (2.1.1 (only) Energy, POL, Electricity)**
- **3.0 Maintenance (All)**
- **4.0 Sustaining Support (All except 4.1, System Specific)**
- **5.0 Continuing System Improvements (All)**

Mean Downtime

Mean Downtime (MDT) is a common supportability metric and is a compilation of the inherent design characteristics of system as well as the external logistics support. MDT is the average Total Downtime required to restore an asset to its full operational capabilities.

MDT includes:

- The time from reporting an asset being down to the asset being given back to operations/production to operate.
- The administrative time of reporting, logistics and materials procurement and lock-out/tag-out of equipment, etc. for repair or preventive maintenance.

Mean Downtime = $\frac{\text{Total Downtime for all Failures}}{\text{Total Number of Failures}}$

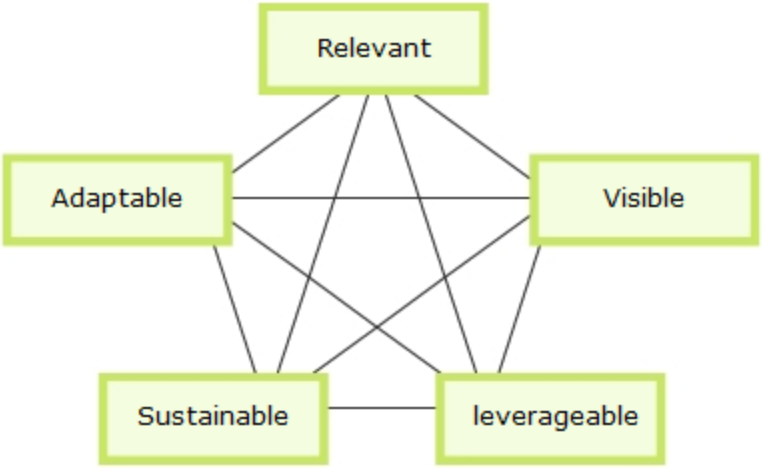
Operational Availability KPP

Operational Availability KPP indicates the percentage of time that a system or group of systems within a unit are operationally capable of performing an assigned mission. Determining the optimum value for Operational Availability requires a comprehensive analysis of the system and its planned use as identified in the CONOPS, including the planned operating environment, operating tempo, reliability alternatives, maintenance approaches, and supply chain solutions.

Operational Availability = $\frac{\text{Uptime}}{\text{Uptime + Downtime}}$

Supportability Objectives and Metrics Characteristics

The LCL defines supportability objectives that can be measured using the categories of reliability, maintainability, and supportability. These specific measurements must have five key characteristics. Select each box below for details:



Popup Text

Relevancy

Metrics support strategic objectives AND provide accurate information in a way that supports these objectives.

Visibility

The right people will have timely access to the results.

Leveragability

Metrics aggregate in a way that makes sense to the stakeholders.

Sustainability

Metrics can be calculated and maintain their credibility.

Adaptability

Metrics can be adjusted as priorities shift and other areas of interest are revealed.

Knowledge Review

Which of the below is the inherent quality of a system – including design, technical support data, and maintenance procedures – to facilitate detection, isolation, and timely repair/ replacement of system anomalies?

- [ ] Reliability
- [x] Supportability
- [ ] Maintainability

Check Answer

Supportability is the inherent quality of a system – including design, technical support data, and maintenance procedures – to facilitate detection, isolation, and timely repair/replacement of system anomalies.

Metrics Summary

You have completed Metrics and should now be able to:

- Identify the types of metric categories used to define support objectives.
- Identify the JROC-established mandatory Key Performance Parameter (KPP) and two Key System Attributes (KSAs) relating to Life Cycle Sustainment.
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Lesson Completion

You have completed the content for this lesson.

To continue, select another lesson from the Table of Contents on the left.

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