

# Diagnostic metrics task

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# Diagnostic Metrics Task Statement

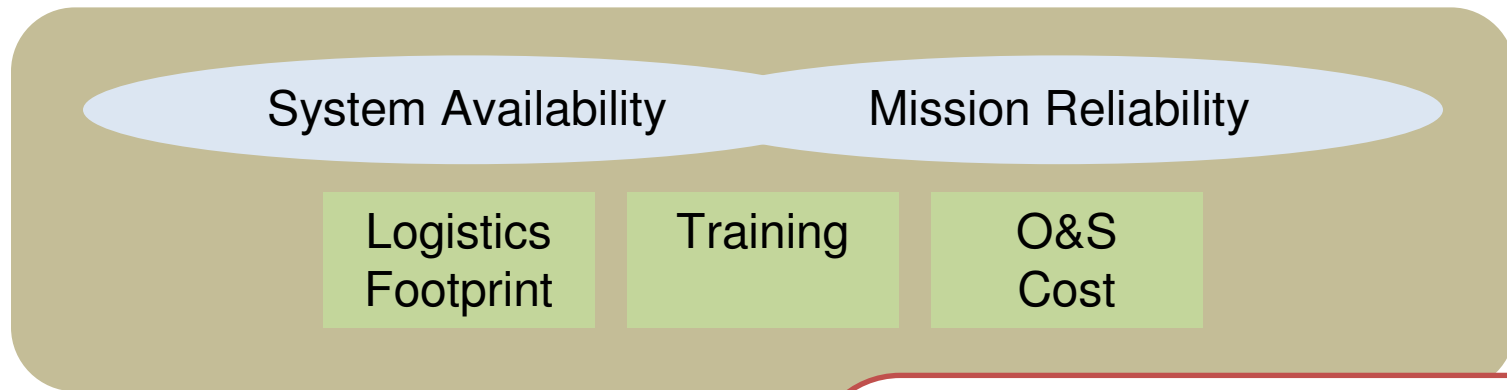
- **OVERVIEW:**

- OSD is interested in being able to diagnose a weapon system the first time quickly in order to get tanks and other platforms back into the fight as soon as possible.
- For maintenance folks accurate diagnostics are the holy grail.
- Problems with diagnostics is one reason why readiness is a problem.
- What metrics are available to measure the effectiveness of embedded diagnostics, prognostics and training?
- Are there tools available, or is tool development to measure it required?
- How do commercial companies like Ford or Boeing commercial aircraft measure it?
- Where should limited funds be applied to improve systems and to increase readiness?

# DoD Policy and Guidance

- 3.3.4. Maintenance programs for materiel maintained for the Department of Defense shall facilitate, collect, and analyze maintenance-related reliability data. The programs shall include sufficient analytic capability for identifying needed adjustments based on operating experience, materiel condition, and requirements for reliability, maintainability and supportability modifications, and changes to training curricula or delivery methods. The programs shall provide maintenance activities the means for assessing information generated by prognostic and diagnostic capabilities and for taking appropriate maintenance actions. The programs shall also establish and evaluate performance metrics that promote continuous improvement in maintenance, ensuring responsiveness and best value to operating forces.
  - DoD Directive 4151.18; 31 mar2004 Maintenance of Military Materiel USD(AT&L)
- RCM analysis determines the optimum maintenance approaches that will achieve planned materiel readiness, which is measured by the life-cycle sustainment outcome metrics of **materiel availability, materiel reliability, ownership cost, and mean downtime.**
  - DoDI 4151.22; 02 Dec 2007 Condition Based Maintenance Plus (CBM+) for Materiel Maintenance USD(AT&L)

# EHM Metrics



## Reliability

- Mean Time between failure
- Mean Time between Maintenance Event
- Mean Time Between Removal

## Maintainability

- Mean Time to Repair

## Health Management

- Can Not Duplicate / No Fault Found
- Fault isolation Accuracy (5%/90%/5%)
  - 5% missed detection
  - 90% correct isolation
  - 5% false alarm
- Fault Detection
- Fault Isolation

## Logistics

- Mean Time between Demand
- Spares (components / vehicles)
- Support Equipment
- Manpower
- Training (crew / maintenance)

# Materiel Availability

- 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.
  - (operational end items divided by the total population).
- Also indicates the percentage of time that a system is operationally capable of performing an assigned mission,
  - (uptime divided by (uptime plus downtime)).
- Materiel Availability includes system use, op tempo, reliability, maintenance approach, and supply chain.
- The Materiel Availability Key Performance Parameter (KPP) must address the total population of end items planned for operational use, including those temporarily in a non-operational status once placed into service (such as for depot-level maintenance).
  - The total life cycle timeframe, from placement into operational service through the planned end of service life, must be included.

# Material Reliability

- Probability that the system will perform without failure over a specific interval. (mean time between failure(s) (MTBF), measured by dividing actual operating hours by the number of failures experienced during a specific interval).
- Reliability may initially be expressed as a desired failure-free interval, which can be converted to MTBF for use as a KSA. (e.g. 95% probability of completing a 12 hour mission, free from mission-degrading failure; 90% probability of completing 5 sorties without failure, etc.)

# Mean Downtime (MDT)

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

# Ownership Cost

- Provides balance to the Sustainment solution.
- Cost Analysis Improvement Group's O&S Cost Estimating Structure will be used in support of this KSA.
  - Only the following cost elements are required:
    - 2.0 Unit Operations (2.1.1 (only) Energy (fuel, petroleum, oil, lubricants, electricity));
    - 3.0 Maintenance (All);
    - 4.0 Sustaining Support (All except 4.1, System Specific Training);
    - 5.0 Continuing System Improvements (All).