DATA ITEM DESCRIPTION

Title: RELIABILITY AND MAINTAINABILITY (R&M) BLOCK DIAGRAMS AND MATHEMATICAL MODELS REPORT

Number: DI-SESS-81496A
AMSC Number: 9508
DTIC Applicable: Yes
http://www.dtic.mil/dtic/submit
Preparing Activity: AS
Applicable Forms: N/A

Approval Date: 20141219
Limitation: No
GIDEP Applicable: Yes
http://www.gidep.org/data/submit.htm

Use/relationship:

The Reliability and Maintainability (R&M) Block Diagrams and Mathematical Models Report documents the data used to support R&M allocations, predictions, assessments, design analyses, and trade-offs associated with configuration items of the work breakdown structure.

This Data Item Description (DID) contains the format, intended use information, and content preparation instructions for the data product generated by the specific and discrete task described in the contract.

This DID should be tailored appropriately.

This DID supersedes DI-RELI-81496.

Requirements:

1. Format. The R&M block diagrams and mathematical models report shall be in the contractor's format.

2. Content. The report shall include the R&M block diagrams and mathematical models and supplementary information suitable for allocation, prediction, assessment, and Failure Mode, Effects, and Criticality Analysis (FMECA) analysis related to the configuration items (including software configuration items) of the system's work breakdown structure. The R&M block diagrams and math models shall be developed to the level required and contain the detail required to support these analyses, in order to avoid duplication of effort across analyses. The report shall include:

    a. The type of reliability model (mission or logistics) and the modeling method.

    b. The type of functional level maintainability block diagram depicting the levels at which the repair can be made.

    c. A reference designation list when warranted by system complexity. The list shall be provided when block diagrams include elements which require correlation

between block diagram reference numbers, work breakdown structure identification, or location of specific elements on a diagram set or diagram sheet. The list shall be a composite cross-reference and item element locator (both by name and designation).

d. An excluded equipment list which describes system elements not shown on the block diagram. Rationale for each exclusion shall be provided.

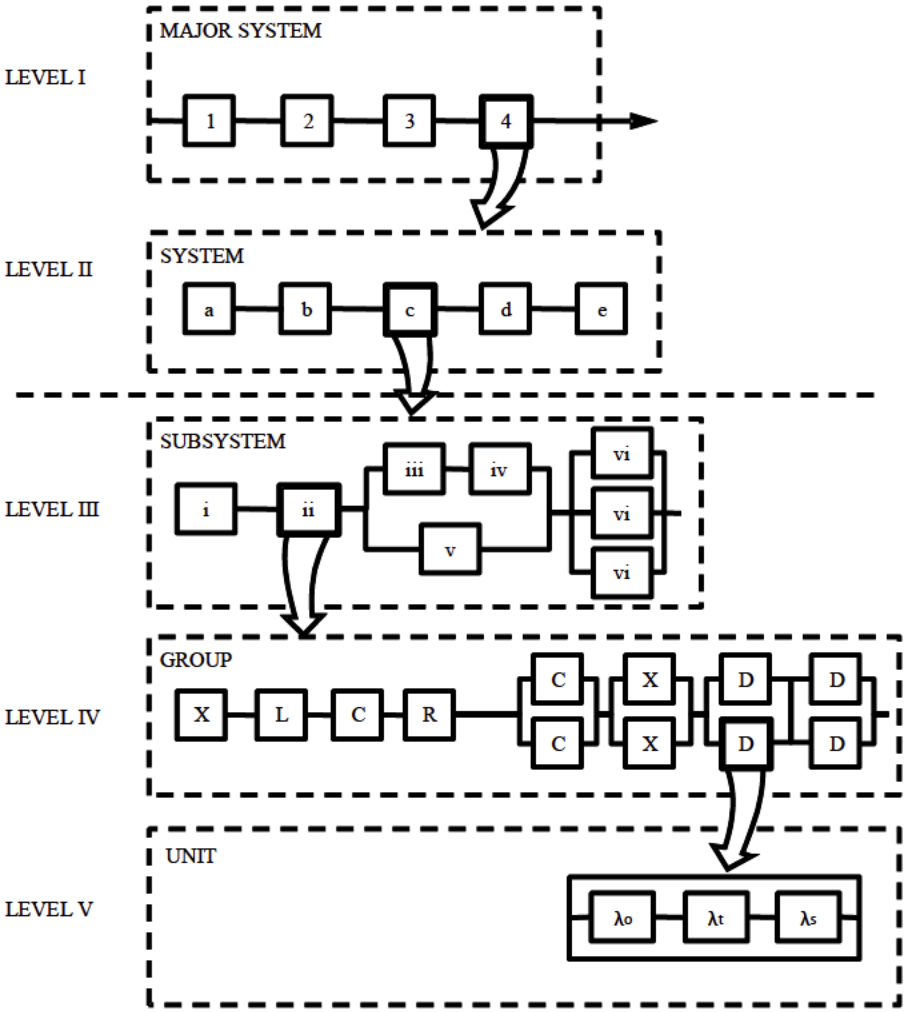
e. Identification of the technical assumptions used, including:
   (1) Service use profile, mission profile, environmental profile
   (2) Operational and maintenance concepts and requirements
   (3) Levels to which fault detection and fault isolation is to be extended
   (4) Redundancy, alternate modes of degraded operation
   (5) Tradeoff considerations
   (6) Human interface and software

f. R&M block diagrams that:
   (1) Represent the system specification and are segmented to represent variables such as: mission type, mission phase, functional mode(s) of operation, duty cycle, maintenance concept, or other factors. When information is limited in the early phase of item development, functional level block diagrams shall be constructed. Diagrams constructed at this level shall contain blocks representing the lowest identifiable function consistent with item element definition (name and designation).
   (2) Include and identify blocks representing Government Furnished Equipment (GFE), Non-Developmental Items (NDI), and Commercial Off The Shelf (COTS) items. Information shall be included to reflect the use of designated GFE, NDI, and COTS into the design.
   (3) Are partitioned to agree with the work breakdown structure. Partitioning shall provide diagrams for each configuration item subdivision which reflect and emphasize interfaces with the next lower level of the breakdown structure. In this manner, the block diagram consists of a series of models which are logically derived and capable of being combined to any level of complexity (Sample provided as Figure 1).
   (4) Indicate interfaces both external to the physical boundary of the item and internal to the item. Particular attention should be paid to interfaces of functional significance including GFE, NDI, and COTS. Interfaces shall be consistent with end item specification, intended purpose, mission use, or higher order functions when the item is used in conjunction with other items.
   (5) Identify critical items in the system design.
   (6) Identify in maintainability diagrams which elements are to be designed as repairable or replaceable items for maintainability enhancement. In addition, BIT design expectations (e.g. fault detection, fault isolation), along with test equipment needs for on-line and off-line testing, shall be indicated. (Sample provided as Figure 2).

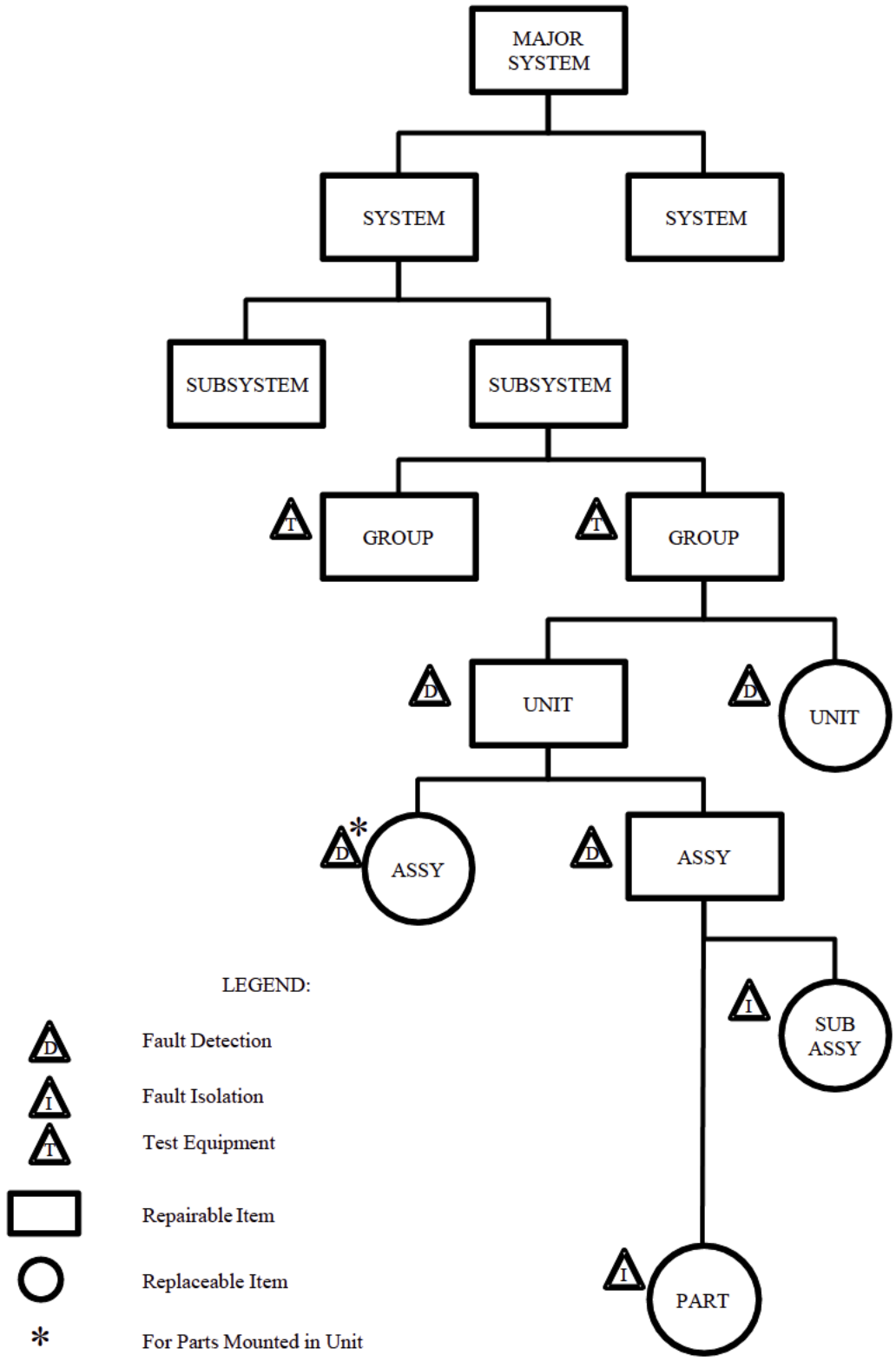
g. Configurations identified during redundancy studies, allocations, or tradeoff studies related to item reliability improvement. Reliability problems leading to the inclusion of redundant elements shall be identified. Additional information describing redundancy considerations not obvious from the block diagrams shall be included. Typical redundancy considerations include:
   (1) Level (e.g., subsystem, part)
   (2) Type (e.g., active, standby, M out of N)
   (3) Element monitoring (e.g., continuous, interval monitored)
   (4) Rationale (e.g., repair without downtime, prolong operating life)
   (5) Alternatives with/without redundancy
   (6) Elements which can be checked
   (7) Elements which can be inspected
   (8) Elements whose failure stresses alternate path elements
   (9) Elements whose failure degrades performance

h. Mathematical models that:
   (1) Include technical assumptions necessary for model interpretation, model completeness, and model clarity. Assumptions shall be consistent with the phase of item definition, such as frequency distributions (failure rate, time to repair), mathematical approximations, statistical techniques, single mode/multimodal failure, wearout factors/characteristics, failure independency, and operating time.
   (2) Represent the system specification the level of details, and be organized consistent with the R&M block diagrams. Charts, tables, or other methods may be used to indicate which equation, model, or sets of models apply to specific mission(s) or other variables. The method used shall be the same used for block diagrams, and may include provisions for both the diagram and mathematical model.
   (3) Supplementary information necessary for proper understanding and use of the model shall be included when specific method(s) of mathematics employed extend beyond the basic rules, practices, and procedures of reliability mathematics (e.g., rules of Boolean algebra, classical laws of reliability, etc.).

i. Conclusions and recommendations based upon the data developed. Interpretation and comments concerning diagrams, models, and courses of action to resolve R&M problems shall be included. Consideration should be given to data deficiencies, Government Furnished Equipment (GFE) problems, tradeoffs, assumptions, risks, interpretations affecting R&M planning, qualitative or quantitative information affecting the program, and other pertinent factors related to the diagrams or models.



Sample Figure 1. Block Diagram Model Partitioning



Sample Figure 2. Functional Level Maintainability Diagram

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