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MIL-STD-1543 (USAF)
15 JULY 1974

MILITARY STANDARD

RELIABILITY PROGRAM REQUIREMENTS

FOR

SPACE AND MISSILE SYSTEMS

FSC MISC

THIS DOCUMENT CONTAINS 16 PAGES.

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DEPARTMENT OF THE AIR FORCE
Washington, D.C. 20301

Reliability Program Requirements for Space and Missile Systems

MIL-STD-1543 (USAF)

1. This Military Standard is approved for use by all Agencies of the Department of the Air Force.

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FOREWORD

The reliability achieved by military systems is directly dependent upon the emphasis put on reliability during the initial design, fabrication and test of such hardware. Government and contractor management emphasis on reliability throughout the system life cycle will assist in achieving the desired levels of system/cost effectiveness. The reliability program requirements herein have been established to aid in the timely and economical attainment of system reliability as an integral part of the acquisition process.

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MIL-STD-1543 (USAF)
Notice 2
22 July 1977

MILITARY STANDARD

RELIABILITY PROGRAM REQUIREMENTS FOR
SPACE AND MISSILE SYSTEMS

TO ALL HOLDERS OF MIL-STD-1543 (USAF):

1. Make the following pen and ink changes:

a. Front cover, lower left corner, add AMSC/OMB No. 22-R0345

b. Page 1, paragraph 1.3, delete "MIL-STD-891 and", and after "MIL-Q-9858" add "and Parts, Materials, and Processes (PMP) control and standardization requirements."

c. Page 1, paragraph 2, under "Military Standards" delete "MIL-STD-891" and its title.

d. Page 2, paragraph 2, under "Other Documents" after "MIL-HDBK-217" delete the title and substitute "Reliability Prediction of Electronic Equipment".

e. Page 4, paragraph 4.4, ninth line, after "critical item list" delete "(5.7)".

f. Page 9, paragraph 5.7, third line, change "operating time of cycles" to "operating time or cycles".

2. RETAIN THIS PAGE AND INSERT BEFORE THE TABLE OF CONTENTS

3. Holders of MIL-STD-1543 will verify that the changes indicated above have been entered. This page shall be retained as a check sheet. This issuance is a separate publication. Each supplement is to be retained by stocking points until it or the military standard is completely revised or cancelled.

Custodian
Air Force - 19

Preparing activity:
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MIL-STD-1543 (USAF)
NOTICE 1
10 May 1976

MILITARY STANDARD

RELIABILITY PROGRAM REQUIREMENTS FOR SPACE AND MISSILE SYSTEMS

TO ALL HOLDERS OF MIL-STD-1543 (USAF):

1. Make the following pen and ink changes:

a. Page 1, paragraph 2, after "MIL-STD-721...." add "MIL-STD-1521 (USAF) Technical Reviews and Audits for Systems, Equipment, and Computer Programs"

b. Page 2, paragraph 2, after "MIL-HDBK-217...." add "Publications SAMSOR 800-3 Planning and Program Review Process"

c. Page 2, paragraph 3, after "MIL-STD-480" delete "and", and after "MIL-STD-721" insert ", MIL-STD-1521 and SAMSOR 800-3".

d. Page 6, paragraph 5.2.3:

(1) Add to end of first sentence ", technical audits, and mission readiness reviews."

(2) Third sentence, delete "if practical." and substitute "or their mission effects reduced to the lowest practical level."

(3) Add to end of last sentence "and the action taken to eliminate or reduce the mission effects of each."

e. After paragraph 5.2.5 add a new paragraph 5.2.6 as follows:

"5.2.6 FMEA update and review. The FMEA shall be updated whenever design changes are incorporated or whenever testing reveals a failure mode that was not included in the FMEA analysis. After CDR, the FMEA shall be reviewed for each spacecraft and launch vehicle manufactured on this contract. These FMEA reviews shall be conducted in conjunction with each applicable hardware technical audit and mission readiness review. As a result of each FMEA review, the FMEA shall be updated as necessary to include an analysis of all changes to the design, test results to date, and the as-built configuration of each spacecraft/launch vehicle. All new single point failures shall be listed and reviewed to assure each is eliminated or the mission effects reduced in accordance with paragraph 5.2.3 of this standard. The effectiveness of each single point failure correction shall also be reviewed and the residual risk reported."

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MILITARY STANDARD

RELIABILITY PROGRAM REQUIREMENTS FOR SPACE AND MISSILE SYSTEMS

1. SCOPE

1.1 Purpose. This standard establishes uniform reliability program practices and procedures for use during design, development, fabrication, test and operation of space and missile systems.

1.2 Application. This standard applies to all prime, associate and subtier contractors involved in the design, development, fabrication, test and initial operation of equipment for space and missile systems applications. The contractor(s) and his subtier contractors' requirements documentation shall reflect the requirements of this standard. The contractor(s) requirements documentation shall be subject to review and disapproval of the procuring activity. This standard may be limited to new developments or major modifications at the prerogative of the procuring activity.

1.3 Relationship to other requirements. This standard is intended to complement the requirements of MIL-STD-891 and MIL-Q-9858.

1.3.1 Integration with other activities. The reliability program effort shall be closely coordinated with the design engineering and test programs as well as configuration management and integrated logistic support. The reliability program shall also be closely integrated with the related disciplines of quality assurance; maintainability; human engineering; system safety; and parts, materials and processes control to preclude duplication of effort and produce integrated cost effective results.

2. REFERENCED DOCUMENTS

The following documents, of the issue in effect on the date of invitation for bid or request for proposal, form a part of this standard to the extent specified herein:

Military Specifications

MIL-Q-9858	Quality Program Requirements.

Military Standards

MIL-STD-280	Definitions of Item Levels, Item Interchangeability, Models, and Related Terms.
MIL-STD-480	Configuration Control, Engineering Changes, Deviations and Waivers.
MIL-STD-721	Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors and Safety.
MIL-STD-756	Reliability Prediction.
MIL-STD-891	Contractor Parts Control and Standardisation Program.

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Other Documents

MIL-HDBK-217 Reliability Stress and Failure Rate Data for Electronic Equipment.

Copies of specifications, standards, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.

3. DEFINITIONS

The definitions of MIL-STD-280, MIL-STD-480 and MIL-STD-721 are applicable to this standard. The following definitions also apply:

3.1 Assessment. A critical appraisal including qualitative judgments about an item, such as importance of analysis results, design criticality, and failure effect.

3.2 Item. Use the definition in MIL-STD-280.

3.3 Level of indenture. An identifiable portion of a completed configuration item (CI) defined by the level of assembly completed. For example, a printed circuit board is a lower level of indenture than a component unit or black box. A CI is defined as comprising one or more lower indenture level items.

3.4 Critical items. Critical items are those items which require "Special Attention" because of complexity, application of state-of-the-art techniques, the impact of potential failure or anticipated reliability problems. An item is to be considered critical if it meets any of the following criteria:

a. A failure of the item would critically affect system operation or cause the system to not achieve specified objectives.

b. A failure of the item would prevent obtaining data to evaluate accomplishment of mission objectives.

c. The item has stringent performance requirement(s) in its intended application relative to state-of-the-art techniques for the item.

d. The item is a single point failure.

e. The item is stressed in excess of recommended derating criteria.

f. The item has a known operating, shelf life and/or environmental exposure such as vibration, thermal, propellant; limitation which warrants controlled surveillance under specified conditions.

g. The item is known to require special handling, transportation, storage, and/or test precautions.

h. The item is difficult to procure and/or manufacture relative to state-of-the-art techniques.

i. The item has exhibited an unsatisfactory operating history.

j. The item does not have sufficient history of its own, or similarity to other items having demonstrated high reliability, to provide confidence in its reliability.

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k. The item's past history, nature, function or processing has a deficiency warranting total traceability.

3.5 Single point failure. Any piece part, assembly, component, or element of construction, such as printed circuit board layout; the failure of which would result in irreversible degradation of item mission performance below contractually specified levels, such as failure of an item in operation which could be catastrophic to a mission objective.

4. GENERAL REQUIREMENTS

The contractor shall implement and maintain a reliability program that is planned, integrated, and developed in conjunction with other design, development, and production functions in accordance with the requirements of this standard and the procuring activity approved reliability program plan. The contractor shall establish and maintain an internal system of directives, procedures, instructions, specifications and manuals to implement the requirements of the reliability program. The program level of effort shall be adequate to fulfill the contractual quantitative and qualitative reliability requirements.

4.1 Quantitative requirements. The minimum acceptable item reliability shall be as stated in the CI specification. Quantitative hardware reliability requirements for all major items shall be stated in the appropriate section of each item specification. The quantitative values not defined by the procuring activity and those to be allocated by the contractor from the major item specification requirements shall be established by the contractor through item level trade-off analysis prior to the Preliminary Design Review (PDR) and shall be updated for the Critical Design Review (CDR) and subsequent formal reviews.

4.2 Reliability testing and demonstration. The contractor shall implement and maintain a reliability test and demonstration program that is planned, integrated, and developed with the sytem and/or equipment test program; such as performance and flight testing, item testing, and maintainability demonstration; to avoid duplicate testing. This program shall include the requirements of this standard and receive procuring activity approval prior to implementation. The program shall include all reliability testing and demonstration to be performed for the program. Tests shall be designed to make maximum use of reliability data from all sources. Unless otherwise specified by the contract, the contractor shall analytically demonstrate the achievement of minimum acceptable hardware reliability requirements at the Physical Configuration Audit (PCA). The analytical methods, assumptions and piece part failure rates to be used shall have specific approval of the procuring activity. The contractor shall use the results of program tests, Failure Mode and Effect Analyses (FMEAs), and item failure reports to qualitatively evaluate the demonstration results as part of the assessment of the item predictions.

4.3 Design reviews. For new design or redesign, the contractor's reliability personnel shall participate in procuring activity, subcontractor PDRs and CDRs and internal design review(s), such as pre-PDR, post-PDR or pre-CDR of an item. Results of these design reviews shall be recorded and shall be available to the procuring activity for detailed examination at the contractor's or subcontractor's facilities during the term of the contract. Procuring activity, subcontractor PDRs and CDRs, and internal design reviews and design audits should include: (1) a review of current reliability estimates and achievements for each mode of operation; (2) a review of potential design or manufacturing problem areas; (3) an analysis of mode(s) and effect(s) of failure; (4) a sensitivity analysis including worst-case effects on the item design; (5) identification of the principal items affecting the reliability requirements; (6) the effects of engineering decisions and trade-offs upon the item reliability; (7) a thorough assessment of the item

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reliability at that point in time, including a listing of those items not meeting derating requirements; (8) a review of test requirements and results; (9) a review of program schedule compatibility; and (10) procedures to assure that decisions made as a result of design review are reflected in the design of the item. The contractor shall follow-up design review decisions, action items and agreements to assure that the design reflects the results of such decisions. The contractor shall notify the procuring activity of any design reviews at least five working days prior to the review. The procuring activity reserves the right to have representative(s) attend the internal and subcontractor reviews as an observer.

4.3.1 Design trade-offs. Whenever design trade-offs are performed, or engineering change proposals are generated, the contractor shall define the effects of the proposed change(s) on the entire system. The details of the trade-offs involving system reliability and the results of any design change on reliability shall be evaluated, recorded and reflected in the reliability analysis.

4.4 Critical items. The contractor shall establish and maintain an effective method for identification, control and test of critical items from initial design through final acceptance. The method(s) the contractor uses for critical item control shall be described in the contractor's formal policies and procedures to assure that all affected personnel such as, design, purchasing, manufacturing, inspection, test, handling; are aware of the essential and critical nature of such items. Periodic reviews at PDR, CDR, Functional Configuration Audit (FCA),and PCA, as a minimum, shall be used by the contractor and the procuring activity to determine if additions or deletions to the critical item list (5.7) and control plan(s) and procedures are warranted, and to assess the effectiveness of the critical item controls and tests. Each critical item control method and plan to be used shall be subject to on-going review and evaluation by the procuring activity.

4.5 Reliability test and evaluation. The contractor shall identify to the procuring activity items which are candidates for reliability evaluation or life tests. As a minimum, these shall include items that have limited documented history of previous usage to support the life requirements of the program. Reliability evaluation or life tests shall be performed as directed by the procuring activity. The contractor's reliability evaluation or life test plans shall be included in the Program Test Plan and be detailed with sample sizes, test duration, confidence level, test conditions and accept/reject criteria as a minimum. The FMEA shall be used as an aid in the design of the test plans and procedures. Test results shall be used to ascertain the item's capability to comply with program reliability requirements.

4.5.1 Development and qualification testing. The results of contractors' functional and environmental testing of items during the design and development phases shall be analyzed to estimate achieved reliability, to provide confidence in the predicted reliability and to provide feedback to support design changes that impact reliability. A log book shall be maintained for each item identified on the program equipment listing to record its operating times during assembly, test and operation. The development testing program shall be used to confirm the following factors, down to the piece part level: adequacy of item selection, safety margins, parameter drifts with time, failure modes, and establishment of human performance operation and maintenance variability criteria.

4.5.2 Statistical methods. The contractor shall use statistical analysis to extract usable design and management information from the discrepancy and failure reports, failure analysis records, and corrective action records. The contractor shall make use of statistical planning and analysis in his test program. This may include application of such methods as design of experiments, analysis of variance and other methods applicable to design, development, production and operational phases.

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4.6 Circuit and item stress analysis. During the development and design phase the contractor shall perform sensitivity analyses which relate the parts stress to circuits, modules, components, subsystems and system performance as they are influenced by parametric variations, environmental effects, radiation effects and input and output limits, due to such factors as operating points, aging and initial tolerances. The sensitivity analyses shall account for worst-case part stress and include all derating factors in the approved derating criteria, such as part derating, part end-of-life and part stresses due to application effects. Analysis shall be performed for steady state and known transient conditions occurring during turn-on, turn-off and performance state change. Worst-case operations shall be included for:

a. Maximum input signal variation.

b. Maximum line voltage variations and line transients.

c. Maximum part parameter variation.

d. Maximum performance demands.

e. Maximum and minimum temperatures.

f. Fail safe provisions.

g. Redundancy provisions.

h. Radiation effects, as applicable.

These analyses shall be scheduled and performed as an integral part of the design effort and be presented at design reviews. The contractor shall correlate the results of these analyses with the FMEA. Results of these analyses shall be available for procuring activity review prior to item CDR.

5. DETAILED REQUIREMENTS

5.1 Design for reliability. The contractor shall give preference to hardware and hardware designs that have performed successfully in the intended actual mission environment. Non-proven designs shall be validated by analysis and test as part of the design process. Standard derating criteria, including radiation effects as applicable, shall be established for use by designers and deviations to the criteria shall require joint approval of the contractor's system engineering, parts engineering, and reliability managers. The contractor shall use part standardization and minimization, stress derating, redundancy, fault isolation, single point failure minimization and stress-strength analysis in his design. These program peculiar criteria shall be developed for and used by the designers.

5.2 Failure mode and effect analysis (FMEA). The contractor shall perform a detailed FMEA. This analysis shall be scheduled and completed concurrently with the design effort so that the design will reflect analysis conclusions and recommendations. The results and current status of FMEAs shall be presented at all design reviews and shall be used as inputs to design trade-offs and test planning activities. Previous FMEAs on existing designs shall be reviewed for program applicability and adequacy by PDR and shall be updated commensurate with design and manufacturing schedules. Safety, maintainability, and human engineering design and operational criteria shall be developed and implemented as a result of the FMEA. The contractor shall use the results of his FMEA in his reliability assessment and for updating his critical item control plans (4.4). The FMEA shall be updated as design changes are made.

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5.2.1 Functional FMEA. The contractor shall perform a functional FMEA as the first part of his analysis. The mission functions of each item shall be classified by criticality to enable prioritization of the action to be taken in performing and using the results of each FMEA. The functional FMEA shall make provisions for different levels of analysis based on the mission phase and function criticality for which the function is being analyzed. The contractor shall emphasize FMEA aspects of critical portions of the mission where reliability estimates provide little information, such as launch portion of a satellite and/or missile mission.

5.2.2 Piece part level FMEA. As the design progresses, the contractor shall perform a more detailed FMEA, based on the physical layout of the item being analyzed, down to the piece part level in the priority established by the criticality classification of the mission functions. The contractor shall analyze the manufacturing documentation, such as circuit board layouts, wire routings, connector keying, and hardware implementation of the design to determine if new failure modes have been introduced that were not in circuit schematics. Critical items and single point failure items shall require detailed piece part level FMEAs.

5.2.3 Single point failures. The contractor shall identify all single point failures, classify each by criticality of mission function and present the results at all design reviews. The contractor shall also determine the effects of failure of these items and present those actions he proposes, such as eliminate from the design or use special operational procedures. Mission critical single point failures shall be eliminated from the design, if practical. The contractor shall develop and maintain a current listing of all single point failure items.

5.2.4 Failure detection by telemetry. The contractor shall verify that the means have been defined by which a failure can be detected through use of telemetry data. For vehicles where command and control is possible, time limits from detection of a problem to implementation of corrective actions shall be defined. Particular emphasis shall be placed on those conditions which, if left alone, would progress to an uncorrectable state and cause mission failure. When the same telemetry indicator is used to represent more than one potential problem condition, the contractor shall define the effect of misinterpreting the indicator and correcting for the wrong condition.

5.2.5 FMEA procedures. The contractor shall make maximum usage of existing design documentation such as block diagrams, circuit schematics, sketches, cutaway drawings; and perform the FMEA to obtain the following as a minimum:

a. A brief description of the function of each item being analyzed.

b. An itemization of the possible modes of failure of each item.

c. An itemization of the effects on item operation of all failure modes.

d. An itemization of the causes of each failure mode.

e. An estimate of the probability of occurrence of each failure mode.

f. An itemization of known methods of control for the identified failure mode.

g. An itemization of known primary and secondary effects for each identified failure mode.

5.3 Reliability analysis. The contractor shall perform a reliability analysis of the system as an integral part of the overall system engineering analysis in order to optimize the balance between effectiveness, schedule and total resources. Criteria for the analysis shall include operational and support concepts and requirements and environmental conditions of use. The results of these reliability analysis shall be used during

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design, development and test to evaluate the achievement of the reliability design requirements. The contractor shall not compromise reliability related criteria such as maintainability, quality assurance, safety or parts control in an attempt to exceed contractually specified performance criteria.

5.4 Reliability modeling and prediction.

5.4.1 Reliability modeling. The contractor shall develop and maintain a reliability mathematical model based on design schematics and drawings for each configured item required to perform the mission functions. A reliability block diagram shall be developed and maintained for the system with associated allocations and predictions for all items in each reliability block. Allocations and predictions shall be made down to the component level as a minimum and shall include probability of success with associated failure rate. The reliability block diagram shall be keyed and traceable to the functional block diagram, schematics and drawings. Switching circuit physical locations shall be clearly identified. The current reliability prediction determined by use of the updated mathematical model shall be presented during item design reviews along with the current parts counts. Nomenclature of items used in reliability block diagrams shall be consistent with that used in block diagrams, drawing and schematics, weight statements, power budgets and specifications. The reliability mathematical model shall be capable of being readily updated with information resulting from reliability and other relevant tests as well as changes in item configuration, mission parameters and operational constraints. Inputs and outputs of the reliability mathematical model shall be compatible with the input and output requirements of the system, subsystem and component level analysis models.

5.4.2 Reliability predictions. The contractor shall perform reliability predictions for all items using the methods defined in his approved reliability program plan. Predictions shall account for and differentiate between each mode of item operation as defined in the item specification and the reliability program plan. The probability that the system will operate within specified limits at some point in time shall be computed for the total mission profile including any subphases. The contractor shall perform these predictions for the associated reliability block diagram using methods contained in MIL-STD-756, MIL-HDBK-217 or alternatives established prior to contract go-ahead and/or failure rate data approved by or provided by the procuring activity.

Results of the FMEAs shall be reflected in the predictions. Items excluded from the predictions as mission non-essential shall have substantiating FMEAs which verify that the item failure cannot cause mission failure. Prior to such exclusions from the predictions, an assessment shall be made and approval shall be obtained from the procuring activity. Usage of operational duty cycles of less than 100 percent shall require prior approval of the procuring activity and be clearly identified in all analyses and predictions.

Failure rates other than those established at or prior to contract go-ahead may be used only upon approval of the procuring activity. When the individual part operating conditions become definitized, the failure rates shall be adjusted for applied stress using MIL-HDBK-217 procedures. The minimum permissible failure rate adjustment factor for standby operation is as specifically agreed to by the procuring activity. Standby failure rate adjustment factor is normally 0.5 for failure rates of one in 10^8 hours or lower.

These reliability predictions will be used by the procuring activity as a basis for determination of contractual compliance with and demonstration of the quantitative reliability requirements and shall be subject to the approval of the procuring activity.

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5.4.2.1 Mean mission duration (MMD). The MMD for the system and selected items shall be presented as follows: untruncated, truncated at the end of the expected mission life and truncated at the point in time the contractor estimates wearout or depletion of expendables, e.g., end of useful life, shall occur. The MMD shall be calculated using the following equation:

$$MMD = \int_{O}^{T} R(t)dt$$

where R(t) = Mission reliability model function
T = Time at truncation

5.5 Discrepancy and failure recording, analysis and corrective action. The contractor shall maintain and shall require subcontractors to maintain a closed loop system for collecting, recording and analyzing the information derived from all discrepancies and failures that occur at all phases of test, fabrication and inspection commencing with research and development model components. Summary information and charts reflecting discrepancy and failure trends at all levels of inspection shall be developed for review and corrective action.

5.5.1 Problem investigation. The failure and discrepancy recording system shall include procedures for documenting the investigation of the cause of each failure and type of discrepancy. Failure analysis shall be conducted to the lowest level of hardware necessary to identify the failure cause and mechanism and shall begin with an on-the-spot review by reliability and quality engineering and the responsible test engineer prior to removal of the failed hardware from the test set-up. Parts failure analysis shall be performed by parts engineers.

5.5.2 Corrective action. The contractor's failure and discrepancy recording system shall include provisions to assure and verify that effective corrective actions; appropriately coordinated with design engineering, quality assurance and manufacturing; are taken on a timely basis to reduce or prevent repeated failures. The methods and responsibilities for corrective action shall include initiating, assigning, follow-up, and close out functions. The contractor shall establish and maintain an automatic suspense audit procedure to review all open reports, analyses, and corrective action suspense dates and report all delinquencies to the Failure Review Board (FRB) and the procuring activity at prescribed time intervals (5.5.3). Closeout shall not be accomplished until corrective action is implemented.

5.5.3 Failure review board (FRB). A FRB shall be established and maintained to review failure trends, significant failures, delinquent corrective actions, and assure adequate corrective actions (5.5.2). The FRB shall meet regularly, normally monthly, after development testing is started. The FRB shall review data on all failures from all levels of inspection and testing including subcontractor qualification and acceptance test failures. All failure occurrence information shall be available to the FRB. Minutes of FRB activity shall be recorded and kept on file for detailed examination by the procuring activity during the term of the contract. Contractor FRB members shall include representatives from design engineering, reliability, parts engineering and quality engineering as a minimum. The procuring activity reserves the right to appoint a representative to the FRB as an observer.

5.5.4 Failure and discrepancy data collection and recording. Commencing with testing of advanced development model components, failure and discrepancy data collection and recording shall be equivalent to that for qualification, production of components and higher indenture level items (5.5.4.1). The contractor shall maintain logs of

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significant events, discrepancies and failures on research and advanced development hardware prior to component level testing. These logs shall be used to complete the history of each such item.

5.5.4.1 Qualification and production hardware. Qualification and production system hardware discrepancy data collection and recording shall start at the module functional test level for manufactured items. Qualification and production piece part discrepancies at receiving inspection shall be integrated into the data collection and recording system. Discrepancies occurring at all levels of test and inspection shall be recorded and shall require corrective action in accordance with an established policy based on criticality and trends. Failures occurring at all levels of test and inspection after power is applied to qualification and production hardware shall be recorded separately and each shall require investigation for cause and corrective action. An unscheduled adjustment, other than a calibration made during other maintenance actions because of convenience, shall be defined as a failure for recording purposes. Analysis and recording of failures shall differentiate between but not be restricted to those that occur in development, qualification and acceptance test; those due to equipment failure; and those due to human error in designing, processing, handling, transporting, storing, maintaining and operating the equipment. The data collection and recording system shall provide visibility for recurrence control based on causes as well as hardware configuration at all levels of assembly. Failures occurring during test at subcontractors' facilities shall also be integrated into the contractors' data gathering, recording, problem investigation and corrective action system.

5.5.5 Notices of suspect parts, materials, and processes (PMP) and specifications. When the adequacy of a program PMP is suspect, the contractor shall have procedures for: (1) recording the suspected deficiency with supporting evidence; (2) failed part diagnosis and analysis of those PMP suspected to be deficient; (3) notifying the procuring activity and other subtier contractor members (normally within ten days) after the suspected deficiency has been confirmed or when it has been concluded that a PMP specification is suspect. The contractor shall also have procedures for responding to notices of suspect PMP specification deficiencies received by the contractor either internally or from the procuring activity and other government agencies, such as the Government/Industry Data Exchange Program (GIDEP). He shall notify the procuring activity of the usage of any suspect PMP specification, describe its location and usage in the system, and state the effects its failure or usage would have on the system. He shall be capable of locating specific supplier lots and performing further analysis and corrective action as required.

5.5.6 Failure impact planning. The contractor shall estimate the number of failures expected during the program by program phase. The basis for this estimate shall be defined. Scaled data from other program experience may be used with detailed backup data. This estimate shall be established early in the program, prior to PDR, and shall include the total number of failures expected at the module level and above, as well as the expected number of failure analyses required. This estimate shall be updated at CDR. These estimates shall not relieve the contractor from performing failure analysis in excess of his estimates.

5.6 Integrated equipment. Where other items such as government furnished equipment are to be integrated, known or estimated reliability predictions and analyses for these items shall be used in the contractor's reliability predictions and other analyses. When such empirical data are not available, reliability related problems introduced by inclusion of such items shall be identified to the procuring activity.

5.7 Maximum preacceptance operation. The contractor shall establish and maintain a current list of items having critically limited useful life, total operating time or operating cycles. The derivation of the maximum allowable operating time of cycles of operation shall be clearly defined along with the elements of data and computational methods used. The contractor shall maintain a record for each such item that contains

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its total operating time or number of equivalent operating cycles, starting with and including its initial functional testing, whether at the contractor's or supplier's facility. These operating time records shall become part of the acceptance documentation.

5.8 Effects of testing, storage, shelf-life, packaging, transportation, handling, and maintenance. The contractor shall establish, maintain and implement procedures to determine by test and analysis, or estimation, the effects of repeated exposure to testing, storage, shelf-life, packaging, transportation, handling and maintenance on the design and reliability of a product. The results of this analysis shall be used to support design trade-offs, definition of allowable test exposures, retest after storage decisions, special handling or storage requirements and refurbishment plans.

6. NOTES

6.1 Tailored application. Each time this standard is used the procuring activity should review each paragraph for program applicability, required deviations or supplementary requirements. Such addenda to this standard should be included in the Request for Proposal and subsequent contract. Particular attention should be given to program tailoring regarding the requirements of paragraphs 3.3, 4.3, 5.2, 5.4.2, 5.5, 5.6, 5.7, and 5.8.

6.2 Data requirements. Data requirements of this standard are not deliverable to the procuring activity unless specified by the contract Data Requirements List (DD Form 1423). The data normally required for delivery under this standard includes:

a. DI-R-3533 - Reliability/Maintainability Program Plan.

b. DI-R-3535 - Reliability and Maintainability Allocations, Assessments and Analysis Report.

c. DI-R-3537 - Reliability/Maintainability Data Reporting and Feedback: Failure Summary Reports.

d. DI-R-3538 - Reliability/Maintainability Demonstration Plan.

e. DI-R-3544 - Reliability/Maintainability Assessment and Demonstration Reports.

f. DI-R-3548 - Suspect Material Deficiency Notice and Response.

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