MILITARY STANDARD

SYSTEM ENGINEERING MANAGEMENT

FSC MISC

AFLC-WPAFB-DEC 69 500

1. This standard has been approved by the Department of Defense and is published to establish system engineering management techniques.

2. This standard is being tested by the Air Force for possible conversion to a fully coordinated document mandatory for use by all Department of Defense agencies.

3. Recommended corrections, additions, or deletions should be addressed to:

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CONTENTS

CONTENTS (Continued)

Paragraph

CONTENTS (Continued)

1. SCOPE

1.1 Purpose. The purpose of this standard is to provide a set of criteria that will serve as a guide to (a) contractors preparing proposed Systems Engineering Management Plans (SEMPs) for the conduct and management of their systems engineering effort on a particular program; and (b) Government personnel when either tailoring a bid work statement calling for SEMPs or competitively evaluating and validating proposed SEMPs and negotiating them into contract statements of work. It also provides the basis for validating the contractor's SEM capability.

1.1.1 Government objectives. This standard is intended to serve the following principal government objectives:

(a) Efficient engineering definition of a complete system which reflects government objectives for the system.

(b) Efficient planning and control of the technical program for the design, development, test and evaluation of the system.

1.2 Applicability.

1.2.1 Applicability to contractor's operations. This standard is applicable to the total process by which a contractor plans and controls his engineering effort to achieve objectives of 1.1.1 herein. Specifically included are:

(a) Identification of the elements of the contract work breakdown structure.

(b) Development of the design and related test requirements included in performance specifications and the allocation of requirements to subordinate product elements of the contract work breakdown structure. Both initial requirements and all changes are included.

(c) Identification of critical areas and definition of the requirements to be met by technical program tasks of design, development, test and evaluation.

(d) Monitoring the conduct of the technical program, providing design and associated technical program alternatives for the resolution of problems identified through cost, schedule, or technical performance measurement.

1.2.2 Applicability to products and program effort. By tailoring, this standard may be applied to any system or major equipment program or project, and to any life cycle phase during which design and technical program tasks are being defined, evaluated or changed. Once applied, this standard

should be used for planning subsequent phases. The requirements of this standard, as tailored in the request for proposal (RFP) statement of work, shall be the basis for preparation of the contractor System Engineering Management Plan which becomes the system engineering management segment of his proposal.

1.2.2.1 Tailoring. The procuring activity will make the initial decision regarding application of this standard and will perform initial tailoring of the requirements of this standard to suit project needs, which will be reflected in the request for proposal. Subsequent tailoring will be done by the contractor in his proposal and during contract negotiation. The tailored requirements of this standard will be reflected in the System Engineering Management Plan included in the contract. The objective of the tailoring process is to insure that the contractual engineering effort efficiently promotes the specific program objectives. Tailoring adapts the standard to the peculiarities of particular systems and system segments and the program contractual structure, such as number of associates and interfaces, assignment of interface responsibilities, technical and/or management complexity, program life cycle phase, one of a kind system (e.g. AN FPS-95) vs. large production (e.g., MINUTEMAN missiles), degree of program risk, etc.

Tailoring may take the form of deletion, alteration or addition of requirements in sections 4 and 5 of this standard. Changes may be made to whole sections, paragraphs, sentences or parts of sentences, as appropriate. The chart in para. 6.5 provides guidance for the tailoring of paragraph requirements to the system with respect to the nature of the work and type of contract. Tailoring should also include the depth of effort required.

1.2.3 Control of contractor's operations. This standard does not prescribe or imply a specific contractor system engineering process or management methodology, organizational structure or form of contractor internal documentation. Data to be delivered as an output of the engineering effort or for visibility of contractor performance will be described on DD Forms 1664 and entered on the Contract Data Requirements List, DD Form 1423. An important distinction is that the standard sets criteria for contractor system engineering management capabilities and use which apply to all levels of the work breakdown structure. On the other hand, it does not call for government control over product or program decisions resulting from applying this process below the levels prescribed in the contract.

1.2.4 Relationships to cost/schedule control system criteria (CSCSC). Relationships of system engineering management to cost/schedule planning and control are described in 6.4.

2. REFERENCED DOCUMENTS

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

SPECIFICATIONS

MILITARY

MIL-E-6051	Electromagnetic Compatibility Requirements, Systems
MIL-D-26239	Data, Qualitative and Quantitative Personnel Requirements Information (QQPRI)
MIL-S-38130	Safety Engineering of Systems and Associated Sub-systems and Equipment; General Requirements for
MIL-M-38310	Mass Property Control Requirements for Missile and Space Vehicles
MIL-H-46855	Human Engineering Requirements for Military Systems, Equipment, and Facilities
MIL-W-83123	Weight and Balance System, Aircraft, Integral General Requirements for
MIL-S-83490	Specifications, Types & Forms
MIL-Q-9858	Quality Program Requirements

STANDARDS

MILITARY

MIL-STD-280	Definition of Terms for Equipment Divisions
MIL-STD-461	Electromagnetic Interference Characteristics Requirements for Equipments
MIL-STD-462	Electromagnetic Interference Characteristics, Measurement of
MIL-STD-463	Definition and System of Units, Electromagnetic Interference Technology
MIL-STD-470	Maintainability Program Requirements
MIL-STD-471	Maintainability Demonstration
MIL-STD-480	Configuration Control - Engineering Changes, Deviations and Waivers
MIL-STD-481	Configuration Control - Engineering Changes, Deviations and Waivers (Short Form)

MIL-STD-482	Configuration Status Accounting Data Elements and Related Features
MIL-STD-490	Specification Practices
MIL-STD-721	Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors, and Safety
MIL-STD-756	Reliability Prediction
MIL-STD-757	Reliability Evaluation from Demonstration Area
MIL-STD-781	Reliability Test (Exponential Distribution)
MIL-STD-785	Requirements for Reliability Program (for Systems and Equipments)
MIL-STD-881	Work Breakdown Structure for Defense Materiel Items
MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment and Facilities

MANUALS: The following manuals are listed for possible use as appropriate to the system/project.

MILITARY

AFSCM 207-1	System Security Engineering
AFSCM/AFLCM 310-1	Management of Contractor Data and Reports
AFSCM 375-5	Systems Engineering Management Procedures
AFLCM/AFSCM 375-6	Optimum Repair Level Analysis

HANDBOOKS

MILITARY

MIL-HDBK-217	Reliability Stress and Failure Rate Data for Electronic Equipment
MIL-HDBK-472	Maintainability Prediction
AFSC DH 1-3	Personnel Subsystems (Design guide only)
AFSC DH 1-6	System Safety (Design guide only)

AFSC DH 2-4	Electronic Warfare
AFSC DH 2-7	System Survivability (Design guide only)
4100.35-G	Integrated Logistics Support Planning Guide for DOD Systems and Equipment
5010.8-H	Value Engineering

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

3. DEFINITIONS. The definitions included in MIL-STD-280 and MIL-STD-721, and those included in applicable documents listed in Section 2 shall apply. Additional definitions established by this document, as well as others repeated for convenience, are listed in subsequent paragraphs.

3.1 System. A system is a composite of equipment, skills, and techniques capable of performing and/or supporting an operational role. A complete system includes all equipment, related facilities, material, software, services, and personnel required for its operation and support to the degree that it can be considered a self-sufficient unit in its intended operational environment.

3.1.1 Contractual scope. In defining contractor responsibilities under this standard the term "System" is restricted to the segment of a system as defined above which is encompassed by the contract, including interfaces with other system segments for which the contractor will be contractually responsible.

3.1.2 System element. A discrete portion of a system is a system element. A product element of the Work Breakdown Structure at any level is a system element.

3.1.3 Configuration item (CI). A configuration item is an aggregation of hardware/software or any of its discrete portions which satisfies an end-use function and is designated for configuration management. During development and initial production, configuration items are only those specification items that are referenced directly in a contract (or an equivalent in-house agreement). A configuration item is also any reparable item designated for separate procurement during operation and maintenance periods.

3.1.4 System definition. Determination of qualitative and quantitative performance and physical requirements which are adequate for design of a system element.

3.2 Technical program. The total technical program effort for a system includes all design/development/test/evaluation tasks to progress from an operational requirement to the system in operational use, including interfaces with production, operation by user, logistic support and training. The technical program includes the management functions of planning and controlling as well as the accomplishment functions. System engineering management is a part of the technical program.

3.2.1 Contractual scope. In defining contractor responsibilities under this standard, the term "Technical Program" is restricted to the total technical program to progress from the beginning of a contractual effort to the delivered products of that effort. It relates to a contractual system segment as defined in 3.1.1.

3.2.2 Technical program element. The technical program element is a discrete portion of the technical program consisting of a task or aggregation of tasks either completing work related to an element of the contract work breakdown structure or contributing an intermediate product.

3.2.3 Technical program planning. Determination of the requirements for the technical program effort which will provide adequate assurance that system element requirements will be met on schedule within budget is considered technical program planning.

3.3 System engineering. System engineering is the application of scientific and engineering efforts to (a) transform an operational need into a description of system performance parameters and a system configuration through the use of an iterative process of definition, synthesis, analysis, design, test and evaluation; (b) integrate related technical parameters and assure compatibility of all physical, functional and program interfaces in a manner which optimizes the total system definition and design; (c) integrate reliability, maintainability, safety, survivability (including Electronic Warfare considerations), human and other such factors into the total engineering effort.

3.4 System engineering management (SEM). The planning and control of a totally integrated engineering effort related to a system program. It includes the system engineering effort to define the system and the integrated planning and control of the program efforts of design engineering, system support engineering, production engineering, test and evaluation engineering.

3.4.1 Integration. The timely and appropriate intermeshing of engineering efforts and disciplines to ensure their full influence on the system design and the technical program.

3.4.2 Optimization. Optimization is the process of identifying the relative operational and/or support effectiveness of alternative system and technical program elements which have been defined by system engineering, relating cost and schedule implications, and selecting a preferred alternative or set of alternatives.

3.4.3 Technical performance measurement (TPM). TPM is the continuing demonstration and prediction of the degree of actual or anticipated achievement of selected technical goals or objectives of a system or part thereof, together with a causal analysis of the variance between the achievement and the objective. The purpose of TPM is to help appropriate managers to take timely action on indicated problems.

3.4.3.1 Planned value. The anticipated value of a parameter at a given point in the development cycle. A plot of these versus time is known as the Planned Value Profile.

3.4.3.2 Demonstrated value. The demonstrated value of a technical parameter is the value which is estimated or measured in a particular test and/or analysis.

3.4.3.3 Specification requirement. The specification requirement for a technical parameter is the value or range of values contained in a contractual performance specification or allocated from such a specification, with a verification requirement for the end product.

3.4.3.4 Current estimate. The value of a parameter predicted for the end product of the contract.

3.4.3.5 Technical variance. Technical variance is the difference between a demonstrated value and the corresponding planned value (demonstrated variance), or between a specification requirement and the current estimate for the end product (predicted variance).

3.5 Completeness. Completeness is the identification and fulfillment of all requirements necessary to design, fabricate, deploy, operate, maintain and support a system/equipment in its intended environment.

3.6 Correlation. Correlation is the maintenance of the integrity of design parameters of interrelated system elements according to valid functional, physical and environmental dependency relationships as system definition progresses. Typical examples are the integrity of reliability values between configuration items and subordinate system elements, maintenance of a valid weight budget, or the assignment of accuracy values to test equipment that correspond to the tolerances to which mission equipment must be calibrated.

3.7 Traceability. Traceability is the capability to track system requirements from (a) a system function to all elements of the system which collectively or individually perform the function; (b) an element of the system to all functions which it performs; and (c) a specific requirement to the source analysis or contractual constraint which originated the requirement. Traceability includes tracking allocated design and technical program requirements through the work breakdown structure between the system level and the lowest level of assembly requiring logistic or maintenance consideration.

3.8 System effectiveness. System effectiveness is a measure of the degree to which a system achieves a set of specific mission requirements. It is a function of availability, dependability, and capability.

3.9 Figure(s) of merit. Figure(s) of merit is a measure of effectiveness through which quantitative system requirements and characteristics can be related to mission objectives in optimizing the system design.

3.10 Life cycle costs. Life cycle costs are the costs of acquisition plus operation and logistic support costs for the specified operational life-time.

4. GENERAL REQUIREMENTS

4.1 General criteria. The contractor shall plan and execute a fully integrated system engineering management effort which encompasses the scope of responsibilities for total system definition and technical program planning and control specified in the contract. This effort shall be tailored to the particular program requirements, type of contract, and the phase of program activity. The paragraphs which follow list general criteria for the adequacy of the contractor's system engineering management.

(a) Assure that elements of the contract work breakdown structure and associated technical tasks are identified and controlled in accordance with this standard and MIL-STD-881.

(b) Assure completeness of the design from a total system viewpoint (hardware, facilities, personnel, software, support equipment, etc.).

(c) Assure efficient convergence on optimum requirements for system elements and associated technical program elements.

(d) Assure the integration of all system performance factors and related disciplines impacting system effectiveness and life cycle costs such as survivability/vulnerability (including infrared radiation reduction, radar cross section reduction and other Electronic Warfare considerations), electromagnetic compatibility, reliability, maintainability, safety, personnel subsystems/human factors, producibility, standardization, speed, range, accuracy, etc.

(e) Assure the integration of engineering efforts such as design engineering, system support engineering, test and demonstration and production engineering.

(f) Assure intra-system and inter-system design adequacy and compatibility of all engineering interfaces.

(g) Assure consistency and correlation of all system and program technical requirements from the system specification throughout the contract work breakdown structure.

(h) Assure continuous traceability of system and technical program requirements throughout the contract work breakdown structure so that the impact of technical variances of a system element on all affected elements and on contractual performance requirements can be promptly and accurately determined.

(i) Assure traceability of significant engineering decisions to system engineering management activities on which they were based, such as functional requirements analysis and allocation, trade studies, TPM, etc.

(j) Assure that engineering decisions regarding design alternatives reflect consideration of system/cost effectiveness analysis based on the specified figure(s) of merit, performance parameters, program and resource constraints as appropriate.

(k) Assure that engineering decisions regarding technical program effort reflect consideration of the cost effectiveness of alternative technical program measures in satisfying program objectives.

(l) Assure technical performance measurement of progress in achieving contract technical requirements/goals and early identification of problems and high risk areas, which provides management visibility to all affected participants.

(m) Assure timely and appropriate redefinition of system and program requirements in response to changes directed by the procuring activity or problems identified through performance measurement.

(n) Assure the continuing optimization of the technical program as the program effort progresses.

(o) Assure compatibility of functions such as configuration management, data management, quality assurance and value engineering with system engineering management.

(p) Assure compatibility of systems engineering data outputs with management and information systems employed in the program.

4.1.1 The contractor shall manage his engineering effort through the SEM process proposed in his SEM plan and approved by the procurement action as adequate to fulfill the criteria of 4.1 and the contract requirements.

4.2 System requirements. The goals and minimum acceptable system functional requirements, technical performance, physical resources or other restraints, and figure(s) of merit shall be as stipulated in the request for proposal and finally agreed to in the contract negotiation. These goals and requirements are subject to continual refinement and definitization through trade-studies and effectiveness analysis as the program progresses through its successive phases. The performance requirements for the system, major subsystems, and equipments shall be included in appropriate sections of the system and configuration item specifications.

4.3 System engineering management plan (SEMP) (General). A system engineering management plan for satisfying the requirements of this standard

shall be submitted as a separate and complete entity within the contractor's proposal for his portion of the total system program. This plan shall describe how the contractor intends to conduct and manage the fully integrated engineering effort necessary to satisfy the general and specific requirements of this standard and the statement of work. It must permit rapid and efficient response to overall program changes in order to assure optimum controls.

5. SPECIFIC REQUIREMENTS. This section states the specific requirements for the contractor's system engineering management effort to be conducted in fulfilling the terms of his contract. All elements under this section shall be planned and executed in accordance with the criteria of the General Requirements of Section 4.

5.1 System engineering management plan (SEMP). The SEMP shall constitute the contractor's system engineering management proposal in response to the RFP. The SEMP shall be composed of three major parts, (1) System engineering, (2) Technical program planning and control, and (3) Engineering integration. The proposed SEMP shall conform in paragraph sequence and headings to the specific requirements of Section 5 of this standard and to the numbering stipulated in the RFP. The SEMP shall indicate non-applicable paragraphs and any specific deviations or proposed supplements to applicable paragraphs. Subparagraphs may be added as required. These requirements correspond to those of DD Form 1664 Number US-586 for preparation of the SEMP as a data item when included on the DD Form 1423, the Contract Data Requirements List per AFSCM/AFLCM 310-1.

5.1.1 Basis for verification and surveillance. The SEMP as proposed by the contractor and accepted by the procuring activity should be sufficiently comprehensive to enable the procuring activity to (a) ascertain with a high degree of confidence that the contractor will meet the applicable requirements of this standard, and (b) monitor the contractual effort to determine the extent the SEMP is being executed. Details not necessary for these purposes should not be included.

5.1.2 Contractual provisions. The contractor shall indicate the items in his SEMP which are proposed for inclusion in the contract in response to the RFP. Contractual items will normally include work tasks which are part of the technical program effort such as the technical performance measurement plan, and similar portions of subplans such as the reliability plan which are integrated by SEM. Only those items will be placed on contract which are sufficiently basic to the satisfaction of program objectives and the applicable portions of this standard, that changes in them could significantly impact technical performance, schedule or cost, or necessary government visibility of these program parameters.

5.1.3 Non contractual provisions. The contractor shall indicate the items in his proposed SEMP which are included to supplement the information afforded by the contractual items in sufficient detail to support the

procuring activity verification and surveillance as provided in 5.1.1. Non contractual items will normally include the details of SEM procedures proposed to satisfy the criteria of this standard, organization and key personnel and other coverage not appropriate for change control by the procuring activity.

5.1.4 Update changes. The contractor shall maintain a current SEMP reflecting changes to both the contractual and non contractual portions. Update changes proposed for contractual items shall be submitted to the procuring activity for approval in accordance with contract change procedures. Update changes made by the contractor to non contractual items should be submitted periodically to the procuring activity to facilitate surveillance of contractor SEM activity.

5.1.5 Acceptance. Acceptance of a contractor SEMP by the procuring activity does not constitute proof of compliance with the general requirements of this standard, which are the principal criteria for contractor SEM performance. The SEMP describes how the contractor proposes to meet these criteria. Proof of compliance will be established by verification during contract performance.

5.2 System engineering. The contractor's system engineering process shall be a logical sequence of activities and decisions leading to the definition of the configuration, usage and support of a system, and the technical program for acquiring the system. This process shall be conducted in the initial definition of the system requirements and continued throughout the program for updating and reassessment when changes of requirements are considered or directed. The system engineering must be a closed-loop, iterative process. The closed-loop must feed the design solutions back to the system for functional analysis to determine that the requirements are met, or to assess the impact the various solutions might have on the original set of requirements. The depth to which the elements of a system engineering process are to be applied to particular contracts shall be determined by the contractor taking into consideration such factors as objectives and outputs of the contractual effort, contract phase, extent of prior definition, program constraints, number and complexity of interfaces, functional uniqueness of the system element, and contractor experience relative to technical difficulty. Succeeding paragraphs describe system engineering elements normally employed in the engineering definition of a system. Contractors are not restricted to these elements in developing internal measures for satisfying the requirements of this standard. All requirements described are not necessarily appropriate to all contractors or to all contractual efforts. While the various elements of the system engineering process are described separately in the following sections, their accomplishment shall represent an integrated effort.

5.2.1 Mission and requirements analysis. The mission objectives, threat and other environmental factors, minimum acceptable system functional requirements, technical performance, and system figure(s) of merit as stipulated in the request for proposal shall be examined for consistency, desirability, and for attainability with respect to current technology, physical resources, or other constraints. The contractor shall notify the government of any problem detected or insufficient information furnished to conduct these analyses.

5.2.2 Functional analysis. System functions shall be analyzed on the basis of established set of system requirements and the time frame in which they must be accomplished. Each function, i.e., characteristic action, of the system shall be depicted for all contractually specified mode of operational usage and support in the specified or anticipated environments. No-go emergency and consequent alternative functions shall also be depicted. Each function of the system shall be described, including a statement of beginning and end conditions, i.e., inputs, outputs, and interface requirements from both intra- and inter-system viewpoint. Functions shall be indentured and identified from top down so that subfunctions are recognized as part of larger functions. Functions shall be arranged in their logical sequence so that any specified operational usage or logistics support of the system can be traced in an end-to-end, closed-loop path. Paths which are operational alternatives shall be identified. When more than one candidate functional arrangement is under evaluation, i.e., subject to subsequent selection, each shall be depicted and identified. Historical records shall be maintained and be traceable in order to determine the rationale for acceptance or rejection of each alternative. Similar functions shall be suitably cross-referenced to assist the recognition of a common design solution. Sub-functions shall be derived in an iterative process concurrent with the establishment of performance requirements, the development of effectiveness models, and the synthesis of progressively lower-level system elements. Gross functions of the system shall be developed to sufficient detail to depict additional functions to be performed by the system and subordinate functions to be performed by subsystems. Gross level of functions to be performed by the system will be developed during the concept formulation phase. More detailed analysis of functions during concept formulation will be required only for those areas critical to project success. Detailed analysis of sub-functions will be conducted during the contract definition phase while further definition and updating effort is to be conducted during the acquisition phase.

5.2.3 Requirements allocation. Each function or subfunction shall be allocated a set of requirements from top down. These requirements represent the minimum acceptable levels of performance for the accomplishment of the functions. These performance requirements shall be derived in an iterative process with the system requirements, development of the functions, synthesis of the system design, and evaluation performed through trade studies and application of effectiveness model(s). Such requirements shall be continuously reviewed against the operational and support requirements established for the system, to assure that these requirements are adequately fulfilled. All requirements shall be stated in sufficient detail for direct use as criteria for hardware design as well as for equipment operation, personnel skills and task analyses, facility operation, computer programming, display of procedural instructions/data, and logistic support. Requirements shall be dimensioned in measurable terms and/or stated in go/no-go criteria which can be verified by analysis, test, and/or demonstration. Time requirements which are prerequisites for a function or set of functions affecting mission success, safety, utilization/down time, and/or availability shall be specified with tolerances and shall be allocated to subfunctions so as to determine that sequential and

concurrent actions will collectively meet the criteria time requirement. Performance requirements shall be traceable to the analyses by which they were derived. In allocating the requirements to lower level functions and subsequent equipment design, the contractor's process shall effect integration and optimization to achieve completeness and compatibility of all engineering efforts.

5.2.4 Trade studies. At each level of functional indenture from the top down, appropriate trade studies shall be conducted to postulate design alternatives to satisfy the functional performance requirements allocated. Trade-off studies shall consider all factors bearing significantly on operational and logistic support functions of the system.

5.2.5 Design optimization/effectiveness analysis. Engineering decisions shall be arrived at after consideration of the cost effectiveness of alternatives identified through the system engineering process. To the extent practicable, optimization shall be focused on achievement of established system figure(s) of merit; however, the contractually specified individual minimum acceptable requirements for configuration items shall be preserved. Figure(s) of merit shall either be furnished by the procuring activity or proposed by the contractor and approved by the procuring activity. Optimization shall take into consideration the resource and schedule constraints and incentives stipulated in the contract, with costs being based on life cycle costs to the extent stated in the contract. The contractor shall identify situations in which a decision, based on system cost effectiveness considerations, would provide significantly different system effectiveness or costs than the decision which is to the contractor's advantage based upon contract requirements, incentives, and penalties.

5.2.5.1 Effectiveness analysis modeling. System effectiveness model(s) shall be used in the optimization process to the extent they contribute to identifying dependency of system effectiveness on specific design options. The model(s) shall allow the input parameters to be varied individually so that their relative effect on total system performance and life cycle costs can be determined. Parameters in the effectiveness model(s) shall be correlatable to parameters expressed in the performance requirements allocated to system functions. The model(s) once established shall be maintained, updated, and modified, as required as the program progresses.

5.2.5.2 Concept formulation phase. During the concept formulation phase, the optimization effort will lead to the selection of the technical approach and conceptual system. Major trade-off studies will be conducted with the criteria for optimization being the best combination of system effectiveness and total life cycle cost of the system. The back-up data that provided the basis for these major decisions, along with the underlying rationale, shall be the input to each subsequent phase as a basis for that effort.

5.2.5.3 Contract definition phase. During the contract definition phase, optimization shall be applied to allocate performance requirements for equipment, facilities, personnel skills, computer programs, and other software. This process shall be carried out only to the extent necessary to provide confidence of system performance cost and schedule and provide the basis for contractual specifications for development. This optimization shall stress the consideration and integration of all technical factors such as reliability, maintainability, safety, survivability/vulnerability, electronic warfare considerations, personnel and manpower requirements, human factors, logistic support, and so forth. Expected technical performance at any level shall be the optimized combination of contributions from all engineering specialties whose parameters affect performance and cost at that level.

5.2.5.4 Acquisition phase. During the acquisition phase the contractor will make decisions among design alternatives after consideration of the projected full impact on the system and life cycle costs as revealed by cost/effectiveness analysis. The contractor shall notify the procuring activity of the results of these analyses.

5.2.5.5 Operational phase. System/cost effectiveness analysis shall be continued and models maintained into the operational phase by the contractor when a contractor technical service (CTS) contract or equivalent contract requirement exists.

5.2.6 Synthesis. Sufficient preliminary design shall be conducted to confirm and assure completeness of the requirements allocated for detail design. The performance, configuration and arrangement of a chosen system and its elements and the technique for their use shall be portrayed in a suitable form such as a set of schematic diagrams. These portrayals shall be capable of depicting a complete response to the functional need; depict compatibility between elements of the system and interfacing systems; permit traceability between the elements and their functional origin in the operational usage; and provide means for complete and comprehensive change control. Co-functioning equipment, support equipment, personnel, facilities, computer programs, and procedural information/data needed in each specific mode of operation shall be grouped and identified as a system/subsystem corresponding to the function which they collectively accomplish. This portrayal shall be the basic source of data for generating the system specification, configuration item specifications, critical item specifications, interface control documentation; consolidated facility requirements; contents of procedural handbooks, placards, and similar forms of instruction/data; task loading of personnel; operational computer programs; the specification tree; and dependent elements of the work breakdown structure. This synthesis data shall be traceable to figure(s) of merit through the system/cost effectiveness models.

5.2.7 Technical interface compatibility. The contractor system engineering shall continuously assure the adequacy and compatibility of all engineering

interfaces within his system segment; and, between this system segment and systems or equipments with which it will operate in the anticipated operational environments. This interface effort shall also achieve compatibility of the system segment with installation requirements.

5.2.8 Logistics support analysis. Support analyses and definition must be accomplished as an integral part of the system engineering process. These analyses shall encompass maintenance analysis including optimum repair level analysis and the determination of spares requirements. The ground equipment, special test equipment, installation and checkout equipment, special transportation and handling equipment, etc., should be identified and requirements for their design should be established in the same manner as all other equipments. Requirements for manpower, personnel skills and training devices for support shall be determined through personnel subsystems as a part of the system engineering process. (See 5.4).

5.2.9 Producibility analysis. Producibility considerations must be an integral part of the system engineering process. These analyses shall include consideration of the materials, tools, test equipment, facilities, personnel, and procedures which support the production cycle. Critical or special producibility requirements will be reflected in equipment design specifications. Long lead time items, material limitations, transition from development to production, special processes and manufacturing constraints shall also be considered in the system engineering process. (See 5.4).

5.2.10 Generation of specifications. System engineering shall produce data that define the configuration, arrangement, and usage of all system elements. The means of representing these system characteristics may take any form selected by the contractor, including physical and mathematical models, computer simulations, and/or schematics, layouts, detailed drawings, and similar engineering graphics. Specific outputs of this effort shall be translated into configuration item specifications in accordance with MIL-STD-490 and MIL-S-83490. The specifications effort shall be compatible with the configuration management program requirements of the contract.

5.3 Technical program planning and control. The technical program tasks shall be planned and developed using the concepts and iterative process employed in system engineering for system definition. The planning and controlling of the technical program must be dynamic and responsive to all changes in the factors which influence the balance among system design parameters and program cost and schedule, whether these changes arise from within the contractual program, such as unforeseen technical problems or opportunities, or are introduced by the procuring activity as a result of changes in a design interface, the threat, funds availability, etc. Technical program tasks shall be planned and scheduled as finite increments of work whose completion is signified by accomplishment of specific final or interim technical objectives. These objectives shall be stated quantitatively whenever possible, and the target dates for their attainment shall be identified as milestones on contractual or supporting schedules. Resources planned in support of the technical

tasks shall be budgeted to the scheduled increments of work, with start and completion dates for resource application marked by start and completion dates of the increments of technical effort.

5.3.1 Program risk analysis. The contractor's program definition and redefinition effort shall include analysis of system functional requirements and possible solutions. This analysis should identify critical areas and design, development, or technical performance measurement tasks which will reduce the known risks, and effect early identification of other risks as the work progresses.

5.3.2 Engineering program integration. The system engineering management shall assure the conduct of a totally integrated engineering effort to include the integration of all specialty efforts and the integration of these into the mainstream engineering. (See 5.4).

5.3.3 Contract work breakdown structure (CWBS). The contractor's system engineering management shall develop the technical elements of the contract work breakdown structure, and assure the inclusion of the other contractual tasks to form a complete CWBS in accordance with MIL-STD-881.

5.3.4 Assignment of responsibility and authority. The contractor shall identify his organizational elements responsible for the conduct of the system engineering management effort. Responsibilities shall be assigned, and lines of communications defined for the application and control of resources and the decision-making necessary to accomplish the system engineering management in keeping with this standard and the statement of work. The procuring activity shall be kept informed of changes made by the contractor during the contract effort.

5.3.5 Program reviews. The contractor's program reviews shall include determining whether the planned technical program effort should be reoptimized as the program progresses. This shall be a planned part of the program review effort, not a reaction to program exigencies. It shall seek opportunities to redirect program effort to effect economies of budget and time. These program reviews may be scheduled to coincide with design reviews.

5.3.6 Design reviews. The contractor's program shall include provisions for design reviews. These reviews will be conducted on a periodic basis to assess the degree of completion of technical efforts related to major milestones before proceeding with further technical effort associated with a particular element of the system. The schedule and plan for conduct of design reviews will be included in the contractor's system engineering management plan.

5.3.6.1 Technical scope. Design reviews shall be conducted as an integrated whole that considers all aspects of the design. They shall cover all performance requirements, technical performance measurements to date, and

the engineering integration efforts covered in 5.4. Special attention shall be afforded the design integration, engineering specialty integration, test integration, and coordination with other program management functions. Design reviews shall include the following as appropriate:

(a) Statement of requirements and/or allocated requirements.

(b) Design synthesis and evidence of meeting the requirements.

(c) Drawings, schematic diagrams, models and other data, if any.

(d) Development and qualification testing plan progress, and data, if any.

(e) Cost and schedule status, as reflected in cost and schedule measurements of all tasks contributing to completion of the design phase.

(f) Problem analyses, anticipated changes, and corrective action plans for deficiencies, if any.

5.3.6.2 Reviews to be accomplished. Specific reviews to be contractually required shall be identified in the System Engineering Management Plan. The technical scope and frequency of each shall be established through the RFP and proposal negotiation process. Additional design reviews may be conducted on contractor initiative. The following sequential categories of design reviews are normally required. For each category, configuration items may be reviewed individually or collectively as appropriate.

(a) System requirements review. The objective of this review is to ascertain the adequacy of the contractor's efforts in defining system requirements. It will be conducted when a significant portion of the system functional requirements has been established, normally in contract definition phase 1B (or equivalent effort).

(b) System design review. This review will be conducted when the definition effort has proceeded to the point where system requirements and the design approach are more precisely defined (i.e. alternate design approaches and corresponding test requirements have been considered and the contractor has defined and selected the required equipment, logistic support, personnel, procedural data, and facilities). This will normally be late in contract definition phase 1B (or equivalent effort). This review will be in sufficient detail to ensure a technical understanding between the contractor and the procuring activity on (1) the system segments identified in the system specification, and (2) the configuration items (CIs) identified in the CI performance specifications.

(c) Preliminary design review (PDR). These reviews shall be conducted for each CI prior to the detail design process to (1) evaluate the progress and technical adequacy of the selected design approach; (2) determine

its compatibility with the performance requirements of the CI development specification; and (3) establish the existence and compatibility of the physical and functional interfaces between the CI and other items of equipment or facilities.

(d) Critical design review (CDR). This review shall be conducted by the contractor for each CI when detail design is essentially complete and fabrication drawings are ready for release. The purpose of this review will be to (1) determine that the detail design of the CI under review satisfies the design requirements established in the CI specification, and (2) establish the exact interface relationships between the CI and other items of equipment and facilities.

5.3.6.3 Subcontractor/vendor equipment. The contractor shall assure that equipment developed by his subcontractors is reviewed in accordance with the requirements of this standard. These reviews may be accomplished by the contractor or by his subcontractor, as desired. The contractor shall assure that actions required as a result of these design reviews are accomplished.

5.3.6.4 Contractor responsibilities. The contractor shall be responsible for the following specific actions in the conduct of design reviews:

(a) Develop a schedule and agenda for accomplishing the required reviews.

(b) Provide chairmanship for each review.

(c) Coordinate with the SPO the review, schedule, agenda and SPO participation.

(d) Assure participation by subcontractor, vendors, and suppliers as necessary.

(e) Organize and present briefings as necessary.

(f) Provide appropriate facilities and administrative services.

(g) Provide schedule, test and design data and analysis supporting the review.

(h) Support the review with knowledgeable technical personnel.

(i) Record, publish and distribute minutes of the design review.

(j) Assure that decisions made as a result of the design review are implemented.

(k) Maintain files of records and documentations from all reviews.

5.3.7 Technical performance measurement.- The contractor shall plan and execute a technical performance measurement (TPM) effort as a part of the planned technical program. TPM will constitute the assessment and validation portion of the design, development, test and evaluation program for the system and its elements. TPM will include all efforts to compare performance, physical characteristics and figure(s) of merit being achieved by the contractor with the allocated and contractually specified values, including any incentive goals. TPM effort prior to the acquisition phase shall be restricted to the development of a TPM plan. TPM will integrate all engineering analyses and tests for this purpose from the time design requirements are initially established for a system element in the acquisition phase through qualification and Category III testing, as appropriate to the item, as well as similar assessment efforts related to modification programs. TPM will employ tests supplemented by analyses rather than just paper analyses to the extent practicable.

5.3.7.1 Extent of application of TPM by contractor.- TPM shall be conducted in terms of the natural units of work in which performance is logically managed for the specific contractual effort. Contractors shall propose, for TPM, the elements of the contract WBS and their related technical parameters which are considered critical to the program's success. These elements and parameters, and others required in the RFP or contract by the procuring activity, will be subject to TPM reporting. They may be revised as necessary as the program progresses.

5.3.7.1.1 WBS elements and parameters shall not be excluded from TPM requirements because their achievement is not quantifiable. The contractor shall propose a method for assessing performance and progress on non-quantifiable elements, to the extent that they are critical or otherwise selected.

5.3.7.1.2 The contractor's internal TPM shall be capable of identifying technical variances at levels of the contract work breakdown structure below the critical elements where, if adjustments are not made, such variances will cause the performance of the selected critical elements to fall below the required minimum values. Similarly, the contractor shall plan and impose TPM requirements on subcontractors using these same criteria.

5.3.7.2 Technical performance measurement plan.- The contractor shall develop a TPM plan as part of his SEMP in accordance with 5.1. The TPM plan will include a description of contractor's TPM process to reveal capability to satisfy requirements of this standard. The TPM plan shall list the system elements and their parameters proposed for TPM. For each parameter to be measured and reported the TPM plan shall include:

(1) Specific measurement milestones;
(2) Specification requirement;
(3) Time phased planned value profile with a tolerance band when applicable, satisfying the specification requirement in the delivered product;
(4) Program events significantly related to the achievement of the planned value profile; and
(5) Conditions of measurement.

The planned value profile will represent the locus of expected value of the parameter. The lower boundary of the tolerance band will represent the improvement considered possible within the baseline budget and time established for the system element and maintained per CSCSC. The upper boundary will represent performance beyond which reallocation of budget or parameter values should be considered.

5.3.7.3 Specific technical performance measurement.- For each parameter selected for TPM and reporting, the contractor shall determine the demonstrated value and demonstrated variance for the design as it stands when the TPM is made, and the

current estimate, the current specification requirement and the predicted variance for the end product. For determining demonstrated variance, the planned values shall be taken from the planned value profile. Determination of the current estimate shall be based on the demonstrated value and the changes to the parameter value which can be attained within the remaining schedule and the cost baseline maintained by CSCSC. A revised planned value profile will be developed to support this determination. Variances will be determined against the current planned profile, tolerance band and specification requirement but traceability shall be maintained to the original baseline. The contractor will analyze variance beyond the tolerance band to determine causes and assess impacts on higher level parameters, on interface requirements and on system cost effectiveness if appropriate. For performance deficiencies, alternate recovery plans will be developed with the performance, cost and schedule implications of each. For performance in excess of requirements, possibilities for reallocation of parameter requirements and budget will be assessed. In instances of subcontract impact, the subcontractor's evaluation shall be obtained. Reports will be rendered using DD Form 1664 No. (U)S-102-1. When included on DD Form 1423, the Contract Data Requirements List for AFSCM/AFLCM 310-1.

5.3.7.4 Relating TPM to cost and schedule performance measurement. The contractor shall indicate how he proposes to relate TPM with cost and schedule performance measurement. As a minimum, cost, schedule and technical performance measurement will be made against elements of a common work breakdown structure; and, to the extent practicable, common milestones will be used for measurement points. Inability to fully integrate TPM with cost and schedule shall not be a basis for excluding a bidder from being awarded a contract; however, demonstrated ability to establish an integrated system will be considered a comparative source selection factor when indicated in the RFP.

5.3.8 Interface control. The contractor shall establish interface control during the definition, design and development phases of the program. Interface control documents, specification, and/or drawings related to (1) the major system elements of his contractual responsibility; (2) other equipment, facilities, software and personnel furnished by the government; and/or (3) other program participants shall be coordinated, established and maintained. Clear line of communication and timely dissemination of the changes to these documents shall be maintained (see 5.2.7).

5.3.9 Documentation control. The contractor's control of changes to technical data shall be consistent with the configuration management/change control requirements of the contract.

5.3.10 Technical order control. The contractor shall assure the adequate and timely preparation and delivery of installation, operation, maintenance and training manuals or instructions as required by the contract. These data shall be prepared and updated in accordance with technical order publication procedures.

5.4 Engineering integration. The contractor system engineering shall determine the values of engineering specialty parameters to be proposed for CIs using system and cost effectiveness models and other constraints provided by the procuring activity. The integration of the program efforts (see 5.3.2) for the engineering specialty areas to achieve the performance values incorporated in the contract shall be described in the system engineering management plan with the detailed speciality programs being included as subplans. These specialty efforts as covered by the applicable documents shall be applied to the extent necessary to assure achievement of contractually specified minimum acceptable

performance values. A partial list of these specialties and their governing documents is given for special attention:

(a) Reliability - MIL-STD-785, 756, 757, 781; MIL-HDBK-217

(b) Maintainability - MIL-STD-470, 471; MIL-HDBK-472

(c) Personnel Subsystems/Human Factors - MIL-STD-1472, MIL-H-46855, MIL-D-26239, AFSC DH 1-3

(d) Survivability/Vulnerability - AFSC DH 2-7

(e) Security engineering - AFSCM 207-1

(f) Safety - MIL-S-38130 (to be superseded by MIL-STD-882); AFSC DH 1-6

(g) Standardization

(h) Integrated Logistic Support - ILS Planning Guide 4100.35-G (see 5.2.8).

(i) Electromagnetic compatibility - MIL-STD-461, MIL-STD-462, MIL-STD-463, and MIL-E-6051

(j) System mass properties - MIL-W-83123

(k) Producibility (see 5.2.9).

(l) Transportability

(m) Electronic Warfare - AFSC DH 2-4.

5.4.1 Integrated design. The above programs shall be integrated into the considerations of system design as early as possible to assure they receive proper emphasis at the most opportune times during the system/equipment evolution. Weighting and emphasis of the individual efforts shall be based upon the over-all mission performance requirements and as allocated to the lower levels of design effort. A balance of these factors shall be sought in optimizing performance, schedule, and total cost while preserving minimum acceptable performance requirements.

5.4.2 Integrated system test planning. The contractor's system engineering management shall generate requirements for system/equipment test planning. The objectives, scope and type of system/equipment testing shall be products of system engineering management wherein all engineering specialties are integrated to define an effective and economical total system/equipment test program. Whenever practicable tests for different objectives shall be combined. Procedural data and personnel skill requirements shall also be integrated into the system test program.

5.4.3 Compatibility with supporting activities. The contractor's program

shall assure compatibility of system engineering and such supporting activities as quality assurance (MIL-Q-9858) and value engineering (5010.8-H).

6. NOTES

6.1 Intended use. In applying this standard, the procuring activity will consider the applicability of deviations to or needed supplementary requirements for each paragraph (see 1.2). The requirements of the documents referenced in Section 2 will be subjected to this same tailoring action. When submission of a system engineering management plan (see 5.1) is not required in the request for proposal, the procuring activity will ordinarily specify the minimum acceptable system engineering management tasks.

6.1.1 Documents replaced. This standard is intended for contractual use in lieu of AFSCM 375-5 system engineering management procedures.

6.2 Compliance provisions.

6.2.1 Validation. Contractor system engineering management processes will be validated by the procuring activity to determine their capability to satisfy the requirements of this standard which are appropriate to the types of systems or other defense materiel items for which the contractor has, or expects to seek contracts. Validations will consist of a combined demonstration and analysis of the features of a contractor system engineering management process which are key to satisfaction of particular requirements of this standard. A contractor's system engineering management capability may be validated for the purpose of reaching a basic agreement between the DOD and a contractor regarding the acceptability of that capability for DOD contracts. Also, validations may be conducted in connection with specific contracts in which case the contractor's system engineering management plan will be used to describe the means by which the contractor will meet the provisions of the standard. Once validated the contractor's basic SEM process need not be described again in a particular SEMP except to identify changes to the validated process. Specific validation criteria and procedures are being developed and will be separately published.

6.2.1.1 Validation team. The contractor's system engineering management process may be validated in conjunction with the validation of his cost/schedule, planning and control system. The validating authority will be the DCS/Systems, Headquarters AFSC.

6.2.2 Verification/compliance. The SPO and DCASO/AFPRO/NAVPRO will verify compliance of the contractor's efforts against the approved system engineering management plan and the achievement of the results in conformance with the general criteria of this standard. Specific compliance criteria will be issued in a separate document. The SPO and DCASO/AFPRO/NAVPRO will attend program and design reviews as necessary to the accomplishment of this task.

6.3 Data requirements. The selected data requirements in support of this standard will be reflected in a contractor data requirements list (DD Form 1423) attached to the request for proposal, invitation for bids, or the contract as appropriate.

6.4 Relationships to cost/schedule control system criteria.

6.4.1 Relationship of technical program planning to cost and schedule planning. The technical program planning function of system engineering management defines the requirements for detailed planning of the technical program and is the basis for allocation of resources and schedule for these task elements down to the levels necessary to meet contractual requirements, including the specified cost schedule control system criteria (CSCSC). The allocated schedule becomes the planned schedule and the costs of allocated resources become their planned cost. This relationship pertains both to initial program definition, and to the redefinition which precedes program change decisions.

6.4.2 Relationship of technical performance measurement to cost and schedule performance measurement. The purpose of all performance measurement is the early detection or prediction of problems which require management attention as well as visibility of technical, schedule and cost status. TPM identifies problems through engineering analyses or tests which indicate performance being achieved for comparison with performance values allocated or specified in contractual document. TPM assesses the technical characteristics of the product. Cost/ schedule performance measurement (C/SPM), on the other hand, assesses the program effort from the point of view of schedule of increments of work and the cost of accomplishing those increments. C/SPM identifies problems by comparing the timing and actual cost of completing tasks, of which many are required to produce a system element, with planned schedules and costs. C/SPM assumes design sufficiency of the system element to which a task is contributing. TPM is the complementary function to verify design sufficiency. Further, by assessing design adequacy, TPM can deal with the work planned to complete major design and development milestones which needs to be changed and thereby provide the basis for forecasting cost and schedule impacts. TPM assessment points should be planned to coincide with planned completion of significant design and development tasks or aggregation of tasks to facilitate verification of results achieved in the completed task in terms of performance requirements. C/SPM can surface technical problems as well as problems due to unrealistic cost and schedule planning. The problems illuminated by TPM are largely technical, but design insufficiency can stem from inadequate budget of dollars or time. Thus TPM and C/SPM are complementary in serving the purpose of program performance measurement.

Custodian:
Air Force - 11

Preparing activity:
Air Force - 10

Reviewer activities:
Air Force - 13, 19

6.5 Guidance on applicability of paragraphs to types of efforts and contracts:

A - Generally applicable

P - Possibly applicable

N - Generally not applicable

* - When not a part of concept formulation

Note: This guidance has no contractual status and also should not be construed as restrictive to the bidder's proposal.

		Adv* Dev	CF	CD	Engr Dev		Op Sys Dev	
		CPFF	CPFF	FP	CPIF	FPIP	CPIF	FPIF
4.1	General criteria	A	A	A	A	A	A	A
4.1.1	Contractor's process	P	A	P	A	A	A	A
4.2	System requirements	N	N	A	A	A	A	A
4.3	SEMP general	P	N	A	A	A	A	A
5.1	SEMP	P	N	A	A	A	A	A
5.1.1 to 5.1.5	Contractual coverage	P	N	A	A	A	A	A
5.2	System engineering	P	N	A	A	A	A	A
5.2.1	Mission and requirements analysis	A	A	A	A	A	A	A
5.2.2	Functional analysis	A	A	A	A	A	A	A
5.2.3	Requirements allocation	A	A	A	A	A	A	A
5.2.4	Trade studies	A	A	A	A	A	A	A
5.2.5	Design/optimization effectiveness analysis	P	A	A	A	A	A	A
5.2.5.1	Effectiveness analysis modeling	P	A	A	A	A	A	A
5.2.5.2	Concept formulation phase		A					

		Adv* Dev	CF	CD	Engr Dev		Op Sys Dev	
		CPFF	CPFF	FP	CPIF	FPIP	CPIF	FPIF
5.2.5.3	Contract definition phase			A				
5.2.5.4	Acquisition phase				A	A		
5.2.5.5	Operational phase						P	P
5.2.6	Synthesis	P	P	A	A	A	A	A
5.2.7	Technical interface compatibility	P	P	A	A	A	A	A
5.2.8	Logistic support analysis	P	A	A	A	A	A	A
5.2.9	Producibility analysis	P	P	A	A	A	A	A
5.2.10	Generation of specifications	A	A	A	A	A	A	A
5.3	Tech program planning & control	P	N	Plan Only	A	A	A	A
5.3.1	Program risk analysis	P	A	A	A	A	A	A
5.3.2	Engineering program integration	P	N	A	A	A	A	A
5.3.3	Contract work breakdown structure	P	N	N	A	A	A	A
5.3.4	Assignment of respon & authority	P	N	P	A	A	A	A
5.3.5	Program reviews	P	N	A	A	A	A	A
5.3.6	Design reviews	N	N	A	A	A	A	A
5.3.7	Technical performance measurement	N	N	Plan Only	N	N	A	A
5.3.8	Interface control	P	P	A	A	A	A	A
5.3.9	Documentation control	P	N	A	A	A	A	A
5.3.10	Technical order control	P	N	N	A	A	A	A
5.4	Engineering integration	P	N	A	A	A	A	A
5.4.1	Integrated design	P	N	A	A	A	A	A
5.4.2	Integrated sys test planning	P	N	A	A	A	A	A

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SPECIFICATION ANALYSIS SHEET

Form Approved Budget
Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

SPECIFICATION MIL-STD-499(USAF) SYSTEM ENGINEERING MANAGEMENT

ORGANIZATION | CITY AND STATE

CONTRACT NO. | QUANTITY OF ITEMS PROCURED | DOLLAR AMOUNT $

MATERIAL PROCURED UNDER A
( ) Direct Government Contract ( ) Subcontract

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?
   A. GIVE PARAGRAPH NUMBER AND WORDING.

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID.

3. IS THE SPECIFICATION RESTRICTIVE?
   ( ) YES ( ) NO IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.)

SUBMITTED BY (Printed or typed name and activity) DATE

DD Form 1426

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