

MIL-H-46855B
31 January 1979
Superseding
MIL-H-46855A, 2 May 1972

MILITARY SPECIFICATION

HUMAN ENGINEERING REQUIREMENTS FOR MILITARY SYSTEMS, EQUIPMENT AND FACILITIES

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope - This specification establishes and defines the requirements for applying human engineering to the development and acquisition of military systems, equipment and facilities. These requirements include the work to be accomplished by the contractor or subcontractor in conducting a human engineering effort integrated with the total system engineering and development effort. These requirements are the basis for including human engineering during proposal preparation, system analysis, task analysis, system design (including computer software design), equipment and facilities design, testing, and documentation and reporting.

1.2 Applicability - It is not intended that all the requirements contained herein should be applied to every program or program phase. In accordance with DoD principles, directives and regulations governing the application and tailoring of specifications and standards to achieve cost effective acquisition and life cycle ownership of defense materiel, this specification shall be tailored to specific programs and the milestone phase of the program within the overall life cycle. This tailoring shall be the selected application of methods, tables, sections, individual paragraphs or sentences, or a combination thereof, to be placed on contract in order to impose only the minimum essential needs to preclude unnecessary and unreasonable program costs. Guidance for selection by the procuring activity of this specification for contract use, and, when invoked, the partial and incremental application of the requirements provisions, is contained in the Appendix.

2. APPLICABLE DOCUMENTS

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

STANDARDS

MIL-STD-1472 - Human Engineering Design Criteria for
Military Systems, Equipment and Facilities

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army Missile R&D Command, ATTN: DRDMI-ESD, Redstone Arsenal, AL 35809) by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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(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. REQUIREMENTS

3.1 General Requirements

3.1.1 Scope and Nature of Work - Human engineering shall be applied during development and acquisition of military systems, equipment and facilities to achieve the effective integration of personnel into the design of the system. A human engineering effort shall be provided to develop or improve the crew-equipment/software interface and to achieve required effectiveness of human performance during system operation/maintenance/control and to make economical demands upon personnel resources, skills, training and costs. The human engineering effort shall include, but not necessarily be limited to, active participation in the following three major interrelated areas of system development.

a. Analysis. - Starting with a mission analysis developed from a baseline scenario, the functions that must be performed by the system in achieving its mission objectives shall be identified and described. These functions shall be analyzed to determine the best allocation to personnel, equipment, software, or combinations thereof. Allocated functions are further dissected to define the specific tasks which must be performed to accomplish the functions. Each task is analyzed to determine the human performance parameters, the system/equipment/software capabilities, and the tactical/environmental conditions under which the tasks are conducted. Task parameters shall be quantified, where possible, and in a form permitting effectiveness studies of the crew-equipment/software interfaces in relation to the total system operation. The identification of human engineering high risk areas shall be initiated as part of the analysis.

b. Design and Development. - Design and development of the system equipment, software, procedures, work environments and facilities associated with the system functions requiring personnel interaction shall include a human engineering effort that will convert the mission, system and task analyses data into detail design or development plans to create a personnel-system interface that will operate within human performance capabilities, meet system functional requirements, and accomplish mission objectives. The final developed design is the culmination of all of the initial planning, system analyses, criteria and requirements application, and engineering effort.

c. Test and evaluation. - Test and evaluation shall be conducted to verify that design of equipment, software, facilities and environment meets human engineering and life support criteria and is compatible with the overall system requirements.

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3.1.2 Human Engineering Program Planning - Human Engineering Program Planning, in accordance with the requirements of this specification and the equipment specification, shall include the tasks to be performed, human engineering milestones, level of effort, methods to be used, design concepts to be utilized, and the test and evaluation program, in terms of an integrated effort within the total project.

3.1.3 Nonduplication - The efforts performed to fulfill the human engineering requirements specified herein shall be coordinated with, but not duplicate efforts performed in accordance with other contractual requirements. Necessary extensions or transformations of the results of other efforts for use in the human engineering program will not be considered duplication. Instances of duplication or conflict shall be brought to the attention of the Contracting Officer.

3.2 Detail Requirements - The contractor shall perform the following:

3.2.1 Analysis - Mission analysis shall be developed from a baseline scenario. Analysis shall include application of human engineering techniques as follows:

3.2.1.1 Defining and Allocating System Functions - The functions that must be performed by the system in achieving its objective(s) within specified mission environments shall be analyzed. Human engineering principles and criteria shall be applied to specify personnel-equipment/software performance requirements for system operation, maintenance and control functions and to allocate system functions to (1) automatic operation/maintenance, (2) manual operation/maintenance, or (3) some combination thereof. Function allocation is an iterative process achieving the level of detail appropriate for the level of system definition.

3.2.1.1.1 Information Flow and Processing Analysis - Analyses shall be performed to determine basic information flow and processing required to accomplish the system objective and include decisions and operations without reference to any specific machine implementation or level of human involvement.

3.2.1.1.2 Estimates of Potential Operator/Maintainer Processing Capabilities - Plausible human roles (e.g., operator, maintainer, programmer, decision maker, communicator, monitor) in the system shall be identified. Estimates of processing capability in terms of load, accuracy, rate and time delay shall be prepared for each potential operator/maintainer information processing function. These estimates shall be used initially in determining allocation of functions and shall later be refined at appropriate times for use in definition of operator/maintainer information requirements and control, display and communication requirements. In addition, estimates shall be made of the effects on these capabilities likely to result from implementation

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or nonimplementation of human engineering design recommendations. Results from studies in accordance with 3.2.2.1 may be used as supportive inputs for these estimates.

3.2.1.1.3 Allocation of Functions - From projected operator/maintainer performance data, estimated cost data, and known constraints, the contractor shall conduct analyses and tradeoff studies to determine which system functions should be machine-implemented or software controlled and which should be reserved for the human operator/maintainer.

3.2.1.2 Equipment Selection - Human engineering principles and criteria shall be applied along with all other design requirements to identify and select the particular equipment to be operated/maintained/controlled by personnel. The selected design configuration shall reflect human engineering inputs, expressed in quantified or "best estimate" quantified terms, to satisfy the functional and technical design requirements and to insure that the equipment will meet the applicable criteria contained in MIL-STD-1472, as well as other human engineering criteria specified by the contract.

3.2.1.3 Analysis of Tasks - Human engineering principles and criteria shall be applied to analyses of tasks.

3.2.1.3.1 Gross Analysis of Tasks - The analyses shall provide one of the bases for making design decisions; e.g., determining, to the extent practicable, before hardware fabrication, whether system performance requirements can be met by combinations of anticipated equipment, software, and personnel, and assuring that human performance requirements do not exceed human capabilities. These analyses shall also be used as basic information for developing preliminary manning levels; equipment procedures; skill, training and communication requirements; and as Logistic Support Analysis inputs, as applicable. Those gross tasks identified during human engineering analysis which are related to end items of equipment to be operated or maintained by personnel and which require critical (see 6.2.1) human performance, reflect possible unsafe practices or are subject to promising improvements in operating efficiency shall be further analyzed, with the approval of the procuring activity.

3.2.1.3.2 Analysis of Critical Tasks - Further analysis of critical tasks shall identify the: (1) information required by operator/maintainer, including cues for task initiation; (2) information available to operator/maintainer; (3) evaluation process; (4) decision reached after evaluation; (5) action taken; (6) body movements required by action taken; (7) workspace envelope required by action taken; (8) workspace available; (9) location and condition of the work environment; (10) frequency and tolerances of action; (11) time base; (12) feedback informing operator/

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maintainer of the adequacy of actions taken; (13) tools and equipment required; (14) number of personnel required, their specialty and experience; (15) job aids or references required; (16) communications required, including type of communication; (17) special hazards involved; (18) operator interaction where more than one crew member is involved; (19) operational limits of personnel (performance); and (20) operational limits of machine and software. The analysis shall be performed for all affected missions and phases including degraded modes of operation.

3.2.1.3.3 Workload Analysis - Individual and crew workload analysis shall be performed and compared with performance criteria.

3.2.1.3.4 Concurrence and Availability - Analyses of tasks shall be modified as required to remain current with the design effort and shall be available to the procuring activity.

3.2.1.4 Preliminary System and Subsystem Design - Human engineering principles and criteria shall be applied to system and subsystem designs represented by design criteria documents, performance specifications, drawings and data, such as functional flow diagrams, system and subsystem schematic block diagrams, interface control drawings, overall layout drawings and related applicable drawings provided in compliance with contract data requirements. The preliminary system and subsystem configuration and arrangement shall satisfy personnel-equipment/software performance requirements and comply with applicable criteria specified in MIL-STD-1472 as well as other human engineering criteria specified by the contract.

3.2.2 Human Engineering in Equipment Detail Design - During detail design of equipment, the human engineering inputs, made in complying with the analysis requirements of paragraph 3.2.1 herein, as well as other appropriate human engineering inputs, shall be converted into detail equipment design features. Design of the equipment shall meet the applicable criteria of MIL-STD-1472 and other human engineering criteria specified by the contract. Human engineering provisions in the equipment shall be evaluated for adequacy during design reviews. Personnel assigned human engineering responsibilities by the contractor shall participate in design reviews and engineering change proposal reviews of equipment end items involving personnel interfaces. Human engineering requirements during equipment detail design are specified in paragraphs 3.2.2.1, 3.2.2.2, 3.2.2.3, 3.2.2.4 and 3.2.2.5 herein.

3.2.2.1 Studies, Experiments and Laboratory Tests - The contractor shall conduct experiments, tests (including dynamic simulation per paragraph 3.2.2.1.2), and studies required to resolve human engineering and life support problems specific to the system. Human engineering and life support problem areas shall be brought to the attention of the procuring activity, and shall include the estimated effect on the system.

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if the problem is not studied and resolved. These experiments, tests, and studies shall be accomplished in a timely manner, i.e., such that the results may be incorporated in equipment design. The performance of any major study effort shall require approval by the procuring activity.

3.2.2.1.1 Mockups and Models - At the earliest practical point in the development program and well before fabrication of system prototypes, full-scale three-dimensional mockups of equipment involving critical human performance shall be constructed. The proposed Human Engineering Program Plan shall specify mockups requiring procuring activity approval and modification to reflect changes. The workmanship shall be no more elaborate than is essential to determine the adequacy of size, shape, arrangement, and panel content of the equipment for human use. The most inexpensive materials practical shall be used for fabrication. These mockups and models shall provide a basis for resolving access, workspace and related human engineering problems, and incorporating these solutions into systems design. Upon approval by the procuring activity, scale models may be substituted for mockups. In those design areas where systems/equipment involve critical human performance and where human performance measurements are necessary, functional mockups shall be provided, subject to prior approval by the procuring activity. The mockups shall be available for inspection as determined by the procuring activity. Disposition of mockups and models, after they have served the purposes of the contract, shall be as directed by the procuring activity.

3.2.2.1.2 Dynamic Simulation - Dynamic simulation techniques shall be utilized as a human engineering design tool when necessary for the detail design of equipment requiring critical human performance. Consideration shall be given to use of various models for the human operator, as well as man-in-the-loop simulation. While the simulation equipment is intended for use as a design tool, its potential relationship to, or use as, training equipment shall be considered in any plan for dynamic simulation.

3.2.2.2 Equipment Detail Design Drawings - Human engineering principles and criteria applied to the design of systems and equipment shall be reflected by the detail design drawings for these systems and equipment to assure that the final product can be efficiently, reliably and safely operated and maintained. The following drawings are included: panel layout drawings, communication system drawings, overall layout drawings, control drawings and other drawings depicting equipment important to system operation and maintenance by human operators. Design shall comply with applicable criteria of MIL-STD-1472 and other human engineering criteria specified by the contract.

3.2.2.3 Work Environment, Crew Stations and Facilities Design - Human engineering principles and criteria shall be applied to detail

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design of work environments, crew stations and facilities to be used by system personnel. Drawings, specifications and other documentation of work environment, crew stations and facilities shall reflect incorporation of human engineering requirements and compliance with applicable criteria of MIL-STD-1472 and other human engineering criteria specified by the contract. Design of work environment, crew stations and facilities which affect human performance, under normal, unusual and emergency conditions, shall consider at least the following where applicable:

- a. Atmospheric conditions, such as composition, volume, pressure and control for decompression, temperature, humidity and air flow.
- b. Weather and climate aspects, such as hail snow, mud, arctic, desert and tropic conditions.
- c. Range of accelerative forces, positive and negative, including linear, angular and radial.
- d. Acoustic noise (steady state and impulse), vibration, and impact forces.
- e. Provision for human performance during weightlessness.
- f. Provision for minimizing disorientation.
- g. Adequate space for personnel, their movement, and their equipment.
- h. Adequate physical, visual, and auditory links between personnel and personnel and their equipment, including eye position in relation to display surfaces, control and external visual areas.
- i. Safe and efficient walkways, stairways, platforms and inclines.
- j. Provisions for minimizing psychophysiological stresses.
- k. Provisions to minimize physical or emotional fatigue, or fatigue due to work-rest cycles.
- l. Effects of clothing and personal equipment, such as full and partial pressure suits, fuel handler suits, body armor, polar clothing, and temperature regulated clothing.
- m. Equipment handling provisions, including remote handling provisions and tools when materiel and environment require them.
- n. Protection from chemical, biological, toxicological, radiological, electrical and electromagnetic hazards.

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o. Optimum illumination commensurate with anticipated visual tasks.

p. Sustenance and storage requirements (i.e., oxygen, water and food), and provision for refuse management.

q. Crew safety protective restraints (shoulder, lap and leg restraint systems, inertia reels and similar items) in relation to mission phase and control and display utilization.

3.2.2.4 Human Engineering in Performance and Design Specifications - The provisions of performance and design specifications, prepared by the contractor, shall conform to applicable human engineering criteria of MIL-STD-1472 and other human engineering criteria specified by the contract.

3.2.2.5 Equipment Procedure Development - Based upon the human performance functions and tasks identified by human engineering analyses (3.2.1 herein), the contractor shall apply human engineering principles and criteria to the development of procedures for operating, maintaining or otherwise using the system equipment. For computer systems where operating and maintenance procedures are largely determined by software programs, human engineering shall be applied throughout the software program planning and development. This effort shall be accomplished to assure that the human functions and tasks identified through human engineering analysis are organized and sequenced for efficiency, safety and reliability, to provide inputs to the Logistic Support Analysis where required, and to assure that the results of this effort shall be reflected in the development of operational, training and technical publications..

3.2.3 Human Engineering in Test and Evaluation - The contractor shall establish and conduct a test and evaluation program to: (1) assure fulfillment of the applicable requirements herein; (2) demonstrate conformance of system, equipment and facility design to human engineering design criteria; (3) confirm compliance with performance requirements where personnel are a performance determinant; (4) secure quantitative measures of system performance which are a function of the human interaction with equipment; and (5) determine whether undesirable design or procedural features have been introduced. (The fact that these functions may occur at various stages in system, subsystem, or equipment development shall not preclude final human engineering verification of the complete system. Both operator and maintenance tasks shall be performed as described in approved test plans during the final system test.)

3.2.3.1 Planning - Human engineering testing shall be incorporated into the system test and evaluation program and shall be integrated into engineering design and development tests, contractor demonstrations,

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flight tests, R&D acceptance tests and other development tests. Compliance with human engineering requirements shall be tested as early as possible. Human engineering findings from design reviews, mock-up inspections, demonstrations and other early engineering tests shall be used in planning and conducting later tests. Human engineering test planning shall be directed toward verifying that the system can be operated, maintained, supported and controlled by user personnel in its intended operational environment. Test planning shall include methods of testing (e.g., use of checklists, data sheets, test participant descriptors, questionnaires, operating procedures and test procedure), schedules, quantitative measures, test criteria and reporting processes.

3.2.3.2 Implementation - The human engineering test and evaluation plan, shall be implemented upon approval by the procuring activity. Test documentation (e.g., checklists, data sheets, test participant descriptors, questionnaires, operating procedures, test procedures) shall be available at the test site. Human engineering portions of all tests shall include the following:

- a. A simulation (or actual conduct where possible) of mission or work cycle).
- b. Tests in which human participation is critical as defined in paragraph 6.2.1.
- c. A representative sample of non-critical scheduled and unscheduled maintenance tasks that do not duplicate the tasks selected for the maintainability demonstration.
- d. Proposed job aids, new equipment training (NET) programs, training equipment, and special support equipment.
- e. Utilization of personnel who are representative of the range of the intended military user populations in terms of skills, size and strength and wearing suitable military garments and equipment which are appropriate to the tasks, and approved by the procuring activity. (Use of military personnel from the intended user population is preferred where feasible.)
- f. Collection of task performance data in simulated or, where possible, actual operational environments.
- g. Identification of discrepancies between required and obtained task performance.
- h. Criteria for acceptable performance of the test.

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3.2.3.3 Failure Analysis - All failures occurring during test and evaluation shall be subjected to a human engineering review to differentiate between failures due to equipment alone, personnel-equipment incompatibilities and those due to human error. The contractor shall notify the procuring activity of design conditions which may contribute substantially to human error and shall propose appropriate solutions to these conditions.

3.2.4 Cognizance and Coordination - The human engineering program shall be coordinated with maintainability, system safety, reliability, survivability/vulnerability, facilities engineering, integrated logistic support, and other human factors engineering functions including biomedical, life support, personnel and training, and shall be integrated into the total system program. Results of human engineering test and evaluation shall be incorporated into the Logistic Support Analysis Record (LSAR) as applicable. The human engineering portion of any analysis, design or test and evaluation program shall be conducted under the direct cognizance of personnel assigned human engineering responsibility by the contractor.

3.3 Data Requirements - All human engineering data requirements shall be as specified by the contract.

3.3.1 Traceability - The contractor shall appropriately document his human engineering efforts to provide traceability from the initial identification of human engineering requirements during analysis and/or system engineering through design and development to the verification of these requirements during test and evaluation of approved design, software and procedures.

3.3.2 Access - All data, such as plans, analyses, design review results, drawings, checklists, design and test notes, and other supporting background documents reflecting human engineering actions and decision rationale, shall be maintained and made available at the contractor's facilities to the procuring activity for meetings, reviews, audits, demonstrations, test and evaluation, and related functions.

3.4 Drawing Approval - Personnel assigned human engineering responsibility by the contractor shall approve all layouts and drawings having potential impact on human interface with the system, equipment, or facility.

4. QUALITY ASSURANCE

Compliance with the requirements of this specification and other human engineering requirements specified by the contract will ultimately

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be demonstrated by the system's ability to meet its mission and operational objectives. During the development program, compliance with the human engineering requirements, as they pertain to system design and effectiveness, will be demonstrated at the scheduled design and configuration reviews and inspections as well as during development test and evaluation inspections, demonstrations and tests.

5. PREPARATION FOR DELIVERY

This section is not applicable to this specification.

6. NOTES

6.1 Intended Use - This specification may be invoked in its entirety or selectively as prescribed by the procuring activity. The primary use of this specification for procurement does not necessarily preclude its utilization for in-house efforts, where desired. Compliance with this specification will provide the procuring activity with assurance of positive management control of the human engineering effort required in the development and acquisition of military systems, equipment and facilities. Specifically, it is intended to assure that:

- a. System requirements are achieved by appropriate use of the human component.
- b. Through proper design of equipment, software and environment, the personnel-equipment/software combination meets system performance goals.
- c. Design features will not constitute a hazard to personnel.
- d. Trade-off points between automated vs manual operation have been chosen for peak system efficiency within appropriate cost limits.
- e. Human engineering applications are technically adequate.
- f. The equipment is designed to facilitate required maintenance.
- g. Procedures for operating and maintaining equipment are efficient, reliable and safe.
- h. Potential error-inducing equipment design features are minimized.
- i. The layout of the facility and the arrangement of equipment affords efficient communication and use.

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j. The contractors provide the necessary manpower and technical capability to accomplish the above objectives.

6.2 Explanation of Terms - For purposes of this specification, the following definitions are applicable.

6.2.1 Critical - That human performance which, if not accomplished in accordance with system requirements, will most likely have adverse effects on cost, system reliability, efficiency, effectiveness, or safety. Critical performance is usually part of a "single" line of flow in the operation or maintenance cycle of the system. An example of a "single" flow involving human performance is the transmission of a message which must be passed for operations or maintenance cycles to commence or to continue, such as an order to prepare a missile for launching. If this order is not passed, or if it is garbled, the entire missile operation cycle may cease to function as required. Human performance shall also be considered critical whenever equipment design characteristics demand performance which exceeds human capabilities or approaches limitations (e.g., human performance functions and tasks are too demanding, information presented to personnel is inadequate to meet human performance requirements, appropriate information displayed is not perceived, or controls provided cannot be efficiently operated) and thereby significantly contributes to the occurrence of one or more of the following conditions but not necessarily limited thereto:

- a. Jeopardized performance of an authorized mission.
- b. Degradation of the circular error probability (CEP) to an unacceptable level.
- c. Delay of a mission beyond acceptable time limits; e.g., human time to react will not meet required system reaction time.
- d. Improper operation resulting in a system "no-go," inadvertent weapons firing, or failure to achieve operational readiness alert.
- e. The exceeding of predicted times for maintenance personnel and maintenance ground equipment (MGE) to complete maintenance tasks. As a rule, performance times will be considered critical if the total maintenance response time significantly exceeds maintenance analysis estimates, and affects MGE quantitative requirements.
- f. Degradation of system equipment below reliability requirements; i.e., mean time between failures (MTBF) is reduced.
- g. The damaging of system equipment, resulting either in a return to a maintenance facility for major repair, or in unacceptable costs, spare requirements, or system downtime.

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- h. A serious compromise of weapon system security.
- i. Injury or illness to personnel.

6.2.2 Overall Layout Drawings - System design drawings which include but are not limited to: (1) the configuration and arrangement of major items of equipment for manned stations, such as a pilot's or astronaut's station, or launch control officer's station, or shipboard command station; (2) the configuration and arrangement of items of equipment, such as modular rack or maintenance ground equipment, which may not be a part of a manned station for operation, but require human access for maintenance; (3) the arrangement of interior lighting for operating or maintaining the equipment; and (4) labels identifying general panel content (e.g., flight mission panel, countdown status panel, communications panel, or malfunction status panel).

6.2.3 Panel Layout Drawings - Equipment detail drawings which include, but are not necessarily limited to: (1) a scale layout of the controls and displays on each panel or an item of equipment, such as an astronaut's, pilot's or launch control officer's console, or shipboard command console; (2) a description of all symbols used; (3) identification of the color coding used for displays and controls; (4) the labeling used on each control or display; and (5) the identification of control type (e.g., alternate action or momentary) and a clear differentiation between controls and indicators.

6.2.4 System Engineering - A basic tool for systematically defining the equipment, personnel, facilities and procedural data required to meet system objectives. It is an iterative process, requiring updating, and having feedback loops to insure that each component developed contributes to the system in meeting mission objectives. A system engineering analysis may include, but is not necessarily limited to, the following:

- a. Preparation of operationally realistic mission profiles and mission scenarios.
- b. Preparation of functional flow block diagrams for the system.
- c. Functional analysis of each flow block.
- d. Preparation of system and subsystem schematic block diagrams.
- e. Study of detailed functions, environment and technical design requirements to allocate assignment of tasks to personnel, equipment, software, or some combination thereof.
- f. Preparation of timeline analyses (operation/maintenance/control) to determine system reaction time.

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g. Preparation and analysis of operational and maintenance workload data to determine equipment quantities, personnel loads and system down-time for scheduled and unscheduled maintenance.

h. Training implications.

6.2.5 Task Analysis - A time-oriented description of personnel-equipment/software interactions brought about by an operator, controller or maintainer in accomplishing a unit of work with a system or item of equipment. It shows the sequential and simultaneous manual and intellectual activities of personnel operating, maintaining or controlling equipment, rather than a sequential operation of the equipment. It is a part of system engineering analysis where system engineering is required.

Custodians

Army - MI
Navy - AS
Air Force - 11

Review Activities

Army - EL - GL - MD - MR
Navy - MS - OS - PE - SH - TD
Air Force - 11 - 14 - 19 - 26

User Activities

Army - WC - AT - AV - ME - TM
Navy - YD
Air Force -

Preparing Activity

Army - MI

Project Number:

HFAC-0004

Civilian Agencies

NASA - MSFC
DOT - RDS
GSA - FSS

APPENDIX

APPLICATION TAILORING GUIDE FOR MIL-H-46855B

NOTE: THIS APPENDIX PROVIDES GUIDANCE INFORMATION ONLY AND IS IN NO WAY INTENDED TO BE INVOKED AS A CONTRACTUAL DOCUMENT OTHER THAN BY POSSIBLE USE OF TABLE 1 AS A REFERENCE.

10.0 SCOPE

This appendix provides (a) guidance and criteria for selection by the procuring activity of the specification for contract use and, when invoked, (b) the partial and incremental application of the requirements provisions.

20.0 APPLICABLE DOCUMENTS

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

STANDARDS

MIL-STD-280 - Definition of Item Levels, Item Inter-Changeability, Models and Related Terms

30.0 SELECTION GUIDE (See Figure 1)

30.1 General - Selection of MIL-H-46855B for application to contracts for military systems, equipment and facilities is dependent upon the nature of the materiel in terms of operational and mission maintenance/support functions, the degree to which human interface is involved with materiel, including software, and the acquisition phase involved. Selection of MIL-H-46855B is generally independent of system complexity, branch of military service involved, equipment duty cycles and, within practical limits, contract type, cost and duration, and size of production lots.

30.2 Selection for Use - Prior to applying the application guide, described by paragraph 40, a decision must first be made whether to not use MIL-H-46855B, prescribe it as a guide, or invoke it as a mandatory contract provision. Only after a carefully considered decision is made to invoke MIL-H-46855B should the application matrix be applied. Selection for use by the procuring activity should consider the following provisions, as shown in Figure 1.

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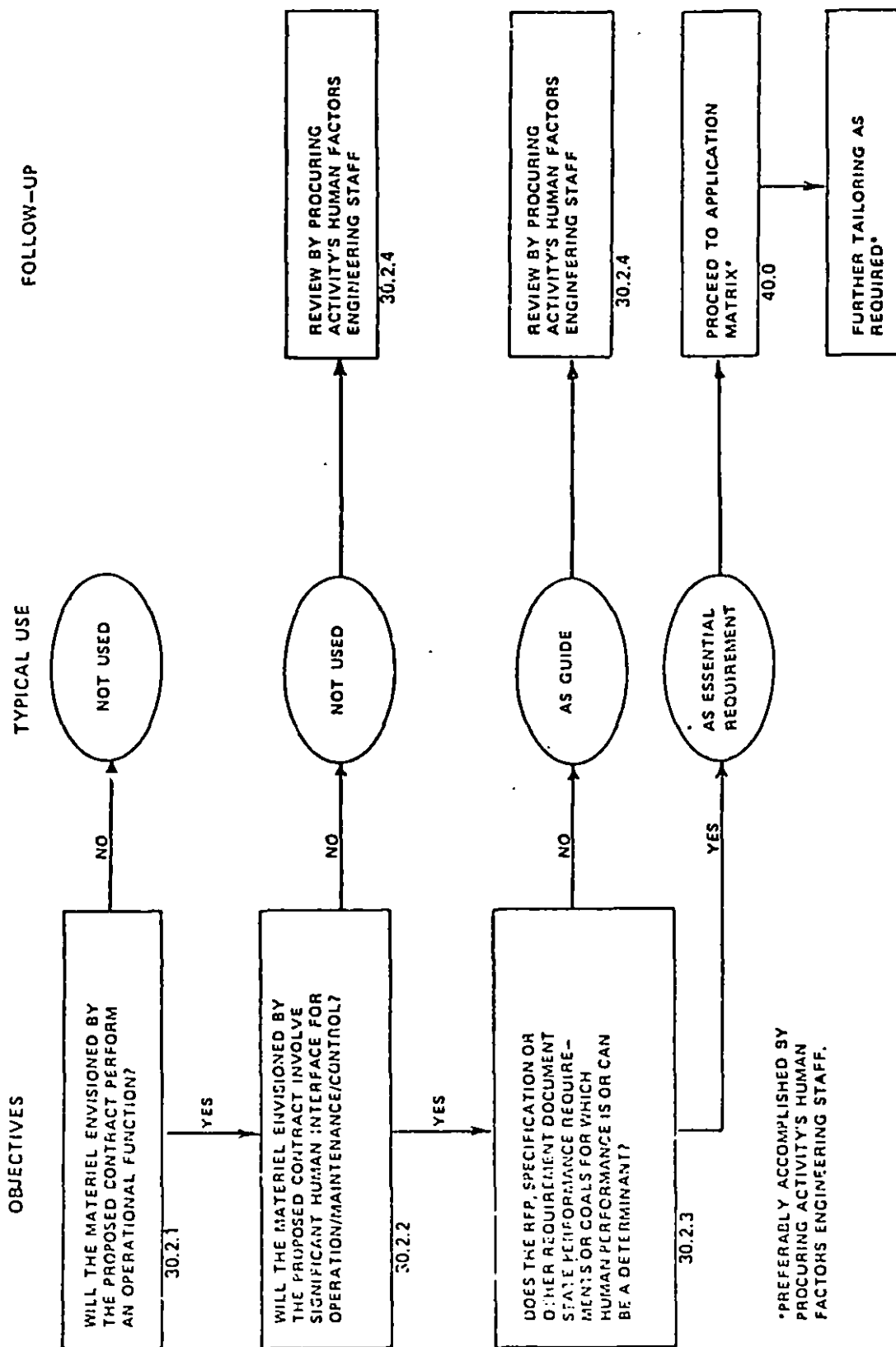


FIGURE 1. SELECTION GUIDE DECISION PROCESS

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30.2.1 Nature of the Materiel - Selection or non-selection of MIL-H-46855B for a specific contract is dependent upon the nature of the end-item, materiel or system in terms of its ability to perform operational and mission maintenance/support functions. Generally, the specification:

a. Should not be considered for use in contracts for parts, subassemblies, assemblies or units as defined in MIL-STD-280.

b. Should generally be considered for use in contracts for sets, subsystems and systems, as defined in MIL-STD-280, and for facilities.

The rationale for this initial screening is that parts, subassemblies, assemblies and units typically are not produced to perform an operational function, but can be used as elements of different sets, subsystems, etc., which produce different desired operational functions. The contractor furnishing such items (e.g., transformers, wheel bearings, amplifiers) has no control over the myriad uses to which his products will be applied or knowledge of the human performance requirements implicit in such uses. Accordingly, it is not generally reasonable to invoke MIL-H-46855B for parts, subassemblies, assemblies or units.

30.2.2 Extent of Human Interface Involved - Selection or non-selection of MIL-H-46855B for application to a specific contract is sensitive to the extent of human involvement or interface for operation, maintenance, control, transport and/or shelter. Generally, the specification should not be considered for use in contracts for materiel where human involvement or interface is not anticipated or is obviously insignificant. Where human involvement or interface is anticipated and is not obviously insignificant, the specification should be selected.

30.2.3 Nature of Stated Performance Requirements - If, for a specific RFP or similar procurement action, MIL-H-46855B has survived the tests of 30.2.1 and 30.2.2, its selection or non-selection should be based on stated performance requirements. If the RFP, specification or other requirement document states performance requirements or goals, such as time and error, for which human performance can reasonably be considered as a determinant or contributor, MIL-H-46855B should be employed. On the other hand, if such performance requirements to which human performance contributes are not stipulated, the specification should be considered for use as a guide.

30.2.4 Selection Review - At this point, utilization of the specification as a requirement, citation as a guide, or non-selection as being not applicable shall have been tentatively determined. If the procuring activity's human engineering specialists have not already been involved in this decision-making process, they must be consulted at this point

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to insure that the specification is not erroneously invoked or waived. Should results of this review disclose that the specification should not be used or should be employed only as a general guide, the process is complete; however, if results of this review conclude that the specification should be invoked, the tailoring process of paragraph 40.0 must be pursued.

40.0 APPLICATION MATRIX (Table 1)

40.1 Description and Use

40.1.1 The field of the tailoring matrix utilizes coded symbols to describe use of the general requirements and detailed requirements during the acquisition phase indicated by the location of the symbol. These symbols are defined as follows:

- a. E Provision in effect.
- b. - Provision used at contractor's option.
- c. M Modification of provision.

40.1.2 Left Column - The numbers shown in the left column represent paragraph numbers of the specification.

40.1.3 Top - The top of the matrix provides a description for grouping of requirements. The acquisition phase designators establish a basis for determining applicability to each phase of the acquisition process.

40.1.4 Right Column - The right column shows the modifications of provisions applicable to the acquisition phase for which "M" is shown in the field.

40.2 Contractual Applicability -

40.2.1 Specification Effectivity - The citation of the application matrix constitutes a required change in application of MIL-H-46855B.

40.2.2 Further Tailoring - Procuring activities may alter the matrix field by identifying the specific symbol change in the RFP or contract.

40.2.3 Contractor Use - Unless otherwise specified by the procuring activity, contractors shall utilize the appropriate tailored versions of the specification, as indicated by the matrix, as a baseline in the preparation of RFP responses and human engineering program planning. This does not preclude the contractor's proposing further tailoring.

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40.2.4 Evolutionary Development - For evolutionary development of older or existing systems, equipment, software and facilities, the specification will generally apply only to new design and procedures involving human interfaces and old designs, procedures and interfaces which may be impacted thereby. Old systems undergoing improvement through evolutionary means will generally not have the specification applied to components retained and unaffected by such evolutionary development techniques. It is important to understand that there may be exceptions to this general rule; therefore, evaluation by the human factors engineering staff is considered extremely advisable.

40.2.5 Product Improvement - Recognizing that product improvement actions may occur during more than one acquisition phase and that product improvements can involve conceptual, validation or full-scale engineering tasks or a combination of these, the procuring activity should tailor applicable portions of the matrix to the specific performance objectives of the product improvement program.

40.2.6 Production and Deployment Phase - Design changes affecting human performance during the production and deployment phase, can, like product improvement actions, involve conceptual, validation or full-scale engineering development human engineering tasks; therefore, the procuring activity should tailor applicable portions of the matrix to the specific performance objectives of the design changes. Particular attention should be directed toward failure analysis, quality assurance, drawing review and software considerations.

40.3 Human Engineering Review - Procuring activities are responsible for assuring that the matrix to be applied to specific contracts has been subjected to human engineering review to insure consistency of the tailored requirements with human performance requirements pursuant to the nature of the objectives of the contracts.

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TABLE 1. APPLICATION MATRIX

SIGNIFICANT PROGRAM FACTOR	MODIFICATION WHERE NOTED BY "M"			
	CONCEPTUAL PHASE	VALIDATION PHASE	FULL SCALE DEV PHASE	PRODUCTION & DEPLMT PHASE
MIL-H-46855 PARAGRAPH				
1. SCOPE				
1.1 Scope	E	E	E	
1.1 Applicability	E	E	E	
2. APPLICABLE DOCUMENTS				
2.1 The following ...	E	E	E	
3. REQUIREMENTS				
3.1 General Requirements				
3.1.1 Scope & Nature of Work	E	E	E	
3.1.1.a. Analysis	E	M	M	See Section 40.2.6
3.1.1.b. Design & Devel.	M	E	E	
3.1.1.c. Test & Evaluation	-	E	E	
3.1.2 HE Program Planning	M	H	E	
3.1.3 Nonduplication	E	E	E	
3.2 Detail Requirements	E	E	E	
3.2.1 Analysis	E	E	E	
3.2.1.1 Defining & Allo- cating	E	E	-	

VALIDATION 3.1.1a. Delete first three sentences. Change seventh line to: Each task which must be performed to accomplish allocated functions shall be analyzed to determine the human."

FULL SCALE DEV. 3.1.1a. Same change as for VALIDATION 3.1.1a.

CONCEPTUAL 3.1.1b. Revise title to read "Preliminary design and development". In first line, insert "Preliminary" at the beginning of the first sentence. In fifth line, change "detail" to "preliminary".

CONCEPTUAL 3.1.2. line 3. Delete "equipment specification" and substitute "mission need."

VALIDATION 3.1.2 line 3. Delete "equipment specification," and substitute "overall program objectives."

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TABLE 1. APPLICATION MATRIX (CONTINUED)

SIGNIFICANT PROGRAM FACTORS	MODIFICATION WHERE NOTED BY "M"				
	CONCEPTUAL PHASE	VALIDATION PHASE	FULL SCALE DEV PHASE	PRODUCTION & DEPLMT PHASE	
MIL-H-46855 PARAGRAPH					
3.2.1.1.1 Info Flow ..	E	E	-		CONCEPTUAL 3.2.1.1.2. line 12. delete "design."
3.2.1.1.2 Estimates of ..	M	E	-		CONCEPTUAL 3.2.1.1.2. line 2. change "all other design" to "concepts." line 4. change "configuration" to "concept."
3.2.1.1.3 Allocation ..	E	E	-		CONCEPTUAL 3.2.1.3.1. line 7. change "used" to "available for use." Lines 14 and 15, delete "with the approval of the procuring activity."
3.2.1.1.2 Equipment Selection	M	E	-		CONCEPTUAL 3.2.1.3.4. line 2. change "design" to "conceptual."
3.2.1.1.3 Analysis of Tasks	E	E	E		VALIDATION 3.2.1.3.4 line 2. change "design" to "validation."
3.2.1.3.1 Gross Analysis ..	M	E	E		CONCEPTUAL 3.2.1.4. line 2. change "designs" to "concept documentation" and delete so much of lines 3-7 which read "represented... with contract data requirements." Line 10. add "can" before "comply".
3.2.1.3.2 Analysis of Crit.	-	E	E		VALIDATION 3.2.1.4 line 9. change "comply" to "facilitate compliance." Delete line 10.
3.2.1.3.3 Workload Analysis	E	E	E		CONCEPTUAL 3.2.2. Revise title to read "Human Engineering in Conceptual design." Delete lines 1-11 through "personnel interfaces." Line 12. revise "equipment detail" to "conceptual."
3.2.1.3.4 Concurrence and .	M	M	E		
3.2.1.4 Preliminary System	M	M	E		
3.2.2 HE in Equipment Detail	M	E	E		
3.2.2.1 Studies, Experiments	E	E	E		
3.2.1.1 Mockups & Models	-	E	E		
3.2.2.1.2 Dynamic Simulation	-	E	E		
3.2.2.2 Equipment Detail Design ...	-	E	E		

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TABLE 1. APPLICATION MATRIX (CONTINUED)

SIGNIFICANT PROGRAM FACTORS		CONCEPTUAL PHASE	VALIDATION PHASE	FULL SCALE DEV PHASE	PRODUCTION & DEPLMT PHASE	MODIFICATION WHERE NOTED BY "M"
MIL-H-46855 PAHAGRAPH						
3.2.2.3 Work Environment	M	E	E	E		CONCEPTUAL 3.2.2.3. delete lines 2-7 and words "by the contract. Design of" in line 8. Add "concepts" after facilities" in line 9.
3.2.2.4 HE in ... Specs	-	E	E	E		
3.2.2.5 Equipment Procedures Development	-	E	E	E		
3.2.3 HE in T&E	-	M	E	E		VALIDATION 3.2.3 lines 3-5. Change (2) to "demonstrate that human performance technical risks have been identified and that solutions are identified.
3.2.3.1 Planning	-	M	E	E		
3.2.3.2 Implementation	-	E	E	E		VALIDATION 3.2.3.1 change line 3 to "into validation and demonstration test planning" and delete line 4.
3.2.3.3 Failure Analysis	-	E	E	E		
3.2.4 Cognizance & Coord.	E	E	E	E		
3.3 Data Requirements	E	E	E	E		
3.3.1 Traceability	M	M	E	E		CONCEPTUAL 3.3.1 lines 4-6. Delete "design and development" to the end of the sentence and insert "concept submission."
3.3.2 Access	E	E	E	E		VALIDATION 3.3.1 line 4. Insert "preliminary" after "through. lines 4-6, delete "the verification" through end of sentence and substitute "validation and demonstration."
3.4 DRAWING APPROVAL E	E	E	E	E		
4. QUALITY ASSURANCE	E	E	E	E		
5. PREPARATION FOR DELIVERY	-	-	-	-		
6. NOTES						
6.1 Intended Use	E	E	E	E		

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TABLE 1. APPLICATION MATRIX (CONCLUDED)

SIGNIFICANT PROGRAM FACTORS	MODIFICATION WHERE NOTED BY "M"				
	CONCEPTUAL PHASE	VALIDATION PHASE	FULL SCALE DEV PHASE	PRODUCTION & DEPLMT PHASE	
MIL-H-46355 PARAGRAPH					
6.2 Explanation of terms	E	E	E	See Section 40.2.6	
6.2.1 Critical	E	E	E		
6.2.2 Overall Layout Drw	E	E	E		
6.2.3 Panel Layout Drw	E	E	E		
6.2.4 System Eng.	E	E	E		
6.2.5 Task Analysis	E	E	E		

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