NOTE: MIL-STD-46855 has been redesignated as a handbook, and is to be used for guidance purposes only. This document is no longer to be cited as a requirement. For administrative expediency, the only physical change from MIL-STD-46855 is this cover page. However, this document is no longer to be cited as a requirement. If cited as a requirement, contractors may disregard the requirements of this document and interpret its contents only as guidance.

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MIL-HDBK-46855
31 January 1996
SUPERSEDING
MIL-STD-46855
29 May 1994

DEPARTMENT OF DEFENSE HANDBOOK

HUMAN ENGINEERING GUIDELINES FOR MILITARY SYSTEMS, EQUIPMENT AND FACILITIES



This handbook is for guidance only. Do not cite this document as a requirement.

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FOREWORD

1. This Military Standard has been approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to Commander, U.S. Army Missile Command, ATTN: AMSMI-RD-SE-TD-ST, Redstone Arsenal, AL 35898-5270 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

3. MIL-STD-46855 is the primary tasking document used by the services to specify human engineering efforts during system acquisition. It supports the human factors engineering discipline independently or as a part of Human System Integration initiatives. MIL-STD-46855 is also written to accommodate a wide range of products, including small equipment items as well as major systems. This standard intentionally provides reasonable latitude for performing organizations to apply technical/program judgment and innovation consistent with specific procurements.

4. As a result of striving to accommodate all service Human System Integration initiatives, all acquisition phases, and a wide range of products, while avoiding overly restrictive requirements, the standard furnishes somewhat general tasking provisions for analysis, design, test, and related requirements. A collateral result is a lack of detail. While MIL-STD-46855 defines the requirements for a human engineering program, specific design criteria are found in MIL-STD-1472 and related standards. Some guidelines for analysis, design, and test & evaluation procedures are given in DOD-HDBK-763.

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1. SCOPE

1.1 Scope. This standard 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 a 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 in proposals; system, equipment, software, and facility analysis, design and test; and documentation and reporting.

1.2 Applicability. This standard applies to the acquisition of military systems, equipment, and facilities; however, it is not intended that all the requirements contained herein should be applied to every program or program phase.

1.3 Application guidance. 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 standard shall be tailored to specific programs and the milestone phase of the program within the overall life cycle. This tailoring shall selectively apply methods, tables, sections, individual paragraphs, or sentences, or a combination thereof, to be placed on contract in order to impose essential human engineering requirements, consistent with avoiding unnecessary program costs. Guidance for the procuring activity's selection of this standard for contract use, and, when invoked, the partial and incremental application of the requirements provisions, are contained in Appendix A.

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications, standards, and handbooks. The following standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplements thereto, cited in the solicitation (see 6.2)

STANDARDS

MILITARY

MIL-STD-1388-1	-	Logistic Support Analysis
MIL-STD-1472	-	Human Engineering Design Criteria for Military Systems, Equipment, and Facilities
MIL-STD-1478	-	Task Performance Analysis
MIL-STD-1908	-	Definitions of Human Factors Terms

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. Not applicable.

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

3.1 Systems engineering. An interdisciplinary approach to evolve and verify an integrated and life-cycle balanced set of system product and process solutions that satisfy customer needs. Systems engineering: (a) encompasses the scientific and engineering efforts (including human engineering) related to the development, manufacturing, verification, deployment, operations, support, and disposal of system products and processes, (b) develops needed user training equipment, procedures, and data, (c) establishes and maintains configuration management of the system, (d) develops work breakdown structures and statements of work, and (e) provides information for management decision making. Representative human engineering activities in systems engineering may include the following:

a. Prepare operationally realistic mission profiles and mission scenarios.

b. Prepare functional flow block diagrams for the system.

c. Perform a functional analysis of each flow block and define operational and support equipment and facilities requirements.

d. Prepare system and subsystem schematic block diagrams.

e. Study detailed functions, environment and technical design requirements to allocate tasks to personnel, equipment, software, or some combination thereof.

f. Prepare operation and maintenance timeline analyses to determine system reaction time.

g. Prepare and analyze operations and maintenance workload and task data to influence equipment and procedure design and to determine equipment quantities, quantitative and qualitative personnel requirements, and system down-time for scheduled and unscheduled maintenance.

h. Identify training implications.

i. Conduct trade studies.

j. Participate in preparation of specifications for the system.

k. Participate in design reviews, demonstrations, and test/evaluation activities.

l. Influence design of software and hardware user interfaces and applicable ~~processes/~~ procedures.

3.2 System layout drawings. System design drawings which include but are not limited to: (a) the configuration and arrangement of items of equipment for manned stations (such as a pilot's station, astronaut's station, launch control officer's station, shipboard command station, and tank commander's station) and multiple crew stations and positions; and (b) 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.

3.3 Other terms. Other terms are defined in accordance with MIL-STD-1908.

4. GENERAL REQUIREMENTS

4.1 Scope and nature of work - Human engineering shall be applied during development and acquisition of military systems, equipment and facilities to effectively integrate personnel into the design of the system. A human engineering effort shall be provided to (a) develop or improve all human interfaces of the system, (b) achieve required effectiveness of human performance during system operation, maintenance, support, control, and transport, and (c) 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:

4.1.1 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 shall be further dissected to define the specific tasks that must be performed to accomplish the functions. Each task shall be 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 human-system interfaces in relation to the total system operation. The identification of human engineering high risk areas shall be initiated as part of the analysis. Analyses shall be updated as required to remain current with the design effort.

4.1.2 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. This human engineering effort shall convert the mission, system, and task analyses data into (a) detail design and (b) development plans to create a human-system interface that will operate within human performance capabilities, meet system functional requirements, and accomplish mission objectives.

4.1.3 Test and evaluation - Test and evaluation shall be conducted to verify that design of military systems, equipment, and facilities meets human engineering criteria, can be operated and maintained within the intended users' performance capabilities, and is compatible with the overall system requirements.

4.2 Human engineering program planning - Human engineering program planning, in accordance with the requirements of this standard 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.

4.3 Risk management. Risk management procedures shall be planned and implemented for the entire life cycle of the system. Human performance and human engineering design criteria issues that involve potential technical, cost, or schedule risks shall be identified, analyzed, and prioritized as early as possible to establish provisions for eliminating or reducing the associated risks to acceptable levels. Such provisions shall be implemented and monitored during the human engineering program. Risk management shall:

a. identify potential cost, schedule, design, and performance risks that result from design aspects of human system integration.

b. quantify such risks and their impacts on cost, schedule, and performance.

c. evaluate and define sensitivity of risks interrelated with human engineering design,

d. identify alternative solutions to moderate and high risk human engineering problems and define their risks,

e. take actions to avoid, minimize, control, or accept each human engineering risk, and

f. ensure that human performance/design risk is an element of specification requirements.

4.4 Reviews.

4.4.1 Major technical reviews. Human engineering shall participate in the major reviews, as applicable to the acquisition phases indicated (see Table I of Appendix A) and the requirements herein:

a. Alternative System Review (Phase 0)

b. System Requirements Review (Phase I)

c. System Functional Review (Phase I , II, or III, as appropriate to the acquisition)

d. Preliminary Design Review (Phase I , II, III, or IV, as appropriate to the acquisition)

e. Critical Design Review (Phase I , II, III, or IV, as appropriate to the acquisition)

f. System Verification Review (Phase II, III, or IV, as appropriate to the acquisition)

4.4.2 Subsystem reviews. Human engineering shall also participate in subsystem reviews, including, where applicable, software specification, test readiness, and functional reviews (e.g., support, training, systems engineering, test, and manufacturing).

4.5 Cognizance and coordination. The human engineering program shall be coordinated with RAM (reliability, availability, and maintainability), system safety, survivability/vulnerability, facilities engineering, integrated logistic support, and other human factors functions including bio-medical, life support, personnel and training, and shall be integrated into the total system program. Human engineering data shall be provided for incorporation into the Logistic Support Analysis Record (LSAR) as applicable. The human engineering effort shall utilize the LSAR as source data where possible. 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.

4.6 Data

4.6.1 Traceability. Contractor documentation shall provide traceability from initially identifying human engineering requirements during analysis and/or system engineering, through implementing such requirements during design and development, to verifying that these requirements have been met during test and evaluation of approved design, software, and procedures.

4.6.2 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.

4.7 Subcontractors and suppliers. The prime contractor shall ensure that tasks and products obtained from subcontractors and suppliers conform to relevant human engineering requirements herein.

4.8 Nonduplication. The efforts performed to fulfill the human engineering requirements specified herein shall be coordinated with, but not duplicate, efforts performed pursuant to 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.

5. DETAILED REQUIREMENTS

5.1 Analysis. Requirements analysis shall be developed from a baseline mission scenario. Analysis shall include application of human engineering techniques as follows:

5.1.1 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 human-system performance requirements for system operation, maintenance and control functions and to allocate system functions to (1) automated 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.

5.1.1.1 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.

5.1.1.2 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 workload, accuracy, rate, and time delay should be prepared for each potential operator/maintainer information processing function. Comparable estimates of equipment capability shall also be made. 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 or non-implementation of human engineering design recommendations. Results from studies in accordance with 5.2.1 may be used as supportive inputs for these estimates.

5.1.1.3 Allocation of functions. From projected operator/maintainer performance data, estimated cost data, and known constraints, analyses and tradeoff studies shall be conducted to determine which system functions should be machine-implemented or software controlled and which should be reserved for the human operator/maintainer. Allocation of functions shall consider the risks of making an incorrect decision for each alternative being evaluated so that designs may be simplified or enhanced to prevent or minimize situations where human decisions are made under conditions of uncertainty, time stress, or workload stress. The possibility of influencing human or equipment capabilities through personnel selection and training as well as through equipment and procedure design shall be considered, and the costs of such action shall be considered in trade-off and cost-benefit studies.

5.1.2 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 "best estimate" terms, to satisfy the functional and technical design requirements and to ensure that the equipment will meet the applicable criteria contained in MIL-STD-1472, as well as other human engineering criteria specified by the contract.

5.1.3 Analysis of tasks and workload. Human engineering principles and criteria shall be applied to analyses of tasks and workload. As a basis of analysis of tasks, the task inventory, developed in accordance with Task 301 of MIL-STD-1388-1, shall be used, if available. These analyses shall also be provided as basic information for developing preliminary manning levels; equipment procedures; skill, training, and communication requirements; and as Logistic Support

Analysis inputs, as applicable. All analyses of tasks shall utilize the task taxonomy expressed in MIL-STD-1908. The Army's approach for the conduct of an analysis of tasks is through a task performance analysis conducted in accordance with MIL-STD-1478, built upon a task inventory from MIL-STD-1388. (For Army acquisitions, see 40.2.5.)

5.1.3.1 Analysis of tasks. An analysis of tasks shall be conducted and shall provide one of the bases for making design conceptual decisions, e.g., determining, to the extent practicable, before hardware fabrication, whether system performance and maintenance requirements can be met by combinations of anticipated equipment, software, and personnel, and ensuring that human performance requirements do not exceed human capabilities. Time requirements for tasks shall be evaluated with respect to task duration vs. time availability, task sequencing, and task simultaneity. Task requirements shall be evaluated, as applicable, with respect to accuracy, precision, completeness, and the effects of task feedback and error tolerance/error recovery on performance. These analyses shall also consider effects of sustained/continuous operations on human performance. Those 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 human performance (see "Critical task" in MIL-STD-1908), reflect possible unsafe practices or are subject to promising improvements in operating efficiency shall be further analyzed.

5.1.3.2 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/maintainer of the adequacy of actions taken; (13) tools and equipment required; (14) number of personnel required, their specialties, and experience; (15) job aids, training, 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) performance limits of personnel; and (20) operational limits of machine and software. The analysis shall be performed for all affected missions and phases including degraded modes of operation. Each critical task shall be analyzed to a level sufficient to identify operator and maintainer problem areas that can adversely affect mission accomplishment and to evaluate proposed corrective action.

5.1.3.3 Workload analysis. Operator (individual and crew) and maintainer (individual and team) workload analyses shall be performed and compared with performance criteria. To avoid overloading or underloading, the degree to which demands of any task or group of tasks tax the attention, capacities, and capabilities of system personnel (individually and as a crew) and thus affect performance should be evaluated. Sensory, cognitive, and physiological limitations shall be considered, as applicable. The workload analyses shall define operational sequences and task times. Preliminary workload estimates shall correlate mission segments with crew tasks for each task component (visual, auditory, motor, cognitive) related to time, workload, mental effort, and psychological stress. A collective workload estimate for each crew member shall be defined in a fashion permitting crew workload to be related to mission segment(s).

5.1.3.4 Corrective action. Human-system interface design incompatibilities and excessive skill/physical requirements, identified by analysis of tasks, analysis of critical tasks, or workload analysis, shall be corrected by changing design or restructuring tasks to preclude degraded human performance resulting from task or workload factors.

5.1.3.5 Timeliness 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.

5.1.4 Preliminary system and subsystem design. Human engineering principles and criteria shall be applied to system and subsystem designs represented by design criteria documents, 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 should satisfy human-system performance requirements and comply with applicable criteria of MIL-STD-1472 as well as other human engineering criteria specified by the contract.

5.2 Human engineering in detail design. During detail design, the human engineering inputs, made in complying with the analysis requirements of 5.1, as well as other appropriate human engineering inputs, shall be converted into detail engineering design features. Design of the equipment shall satisfy human-system performance requirements and meet the applicable criteria of MIL-STD-1472 and other human engineering criteria specified by the contract. Human engineering requirements for testing the system or equipment shall be considered during design, and shall include such factors as verifying proper operation, defining need for maintenance, and allocating adequate space for test personnel to perform their tasks. 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 the human-system interface.

5.2.1 Experiments, tests, and studies. The contractor shall conduct experiments, tests (including dynamic simulation), and studies required to resolve human engineering and life support problems specific to the system. Experiments, tests, and studies should be performed with actual users in the actual (or realistic simulation of the) user environment in order to validate design goals and system performance. These experiments, tests, and studies shall be accomplished in a timely manner so that their results may be incorporated in equipment design and, if necessary, used to revise initial function allocations. Any significant human engineering or life support problem, deemed to be resolvable only by major experiment, test, or study effort, shall be brought to the attention of the procuring activity and shall include the estimated effect on the system if the problem is not resolved. The performance of any major study effort shall require approval by the procuring activity. To ensure that experiments, tests, and studies do not duplicate current or previously conducted efforts that may be germane to resolving human engineering problems, the applicability and utility of the existing human engineering and other relevant databases (e.g., general literature, research reports, study reports) shall be determined before initiating major efforts.

5.2.1.1 Computer models, three-dimensional mockups, and scale models

5.2.1.1.1 Computer models. When required by the procuring activity, three dimensional computer models, rapid prototyping, and computer-aided design/computer-aided manufacturing (CAD/CAM) techniques shall be used to develop design of equipment where human performance will be a determinant of operational performance and maintenance effectiveness. Computer models should be able to provide a suitable range of body sizes, clothing, and postures for evaluation of proposed designs and design changes in terms of compatibility with whole body fit and access; finger, hand, arm, foot, leg and other access and reach; visual field; and strength. Computer models should not be used for compliance testing of human performance and human engineering design. When used for predictive purposes, such models should produce accurate and empirically repeatable, valid outputs. Computer models, rapid prototyping, and CAD/CAM shall be accessible to the procuring activity and shall, as applicable, be available during design reviews.

5.2.1.1.2 Three-dimensional mockups. 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 mockups shall be

constructed sufficiently early to ensure that results of human engineering evaluations can influence design. The mockups shall be no more elaborate or expensive than is essential to represent those aspects of the human-system interface to be evaluated. These mockups shall provide a basis for resolving operational and maintenance access, workspace, and related human engineering problems, and incorporating solutions into system design. In those design areas involving critical human performance and where human performance measurements are necessary, functional mockups shall be developed only upon approval by the procuring activity. The mockups shall be available for inspection as determined by the procuring activity. Disposition of mockups, after they have served the purposes of the contract, shall be as directed by the procuring activity.

5.2.1.1.3 Scale models. Scale models may be used to supplement three dimensional computer models, rapid prototyping, CAD/CAM, or mockup techniques, but shall not be substituted for mockups without approval by the procuring activity.

5.2.1.2 Dynamic mockups. Dynamic mockups, also known as engineering simulators (full -scale physical models which simulate functions), may be used when static, three-dimensional mockups are inadequate for assessing human performance in the design of complex systems. These mockups may be used to (a) evaluate operator procedures and equipment/operator interfaces, and identify any potentially unsafe procedures and unacceptable workload demands, (b) evaluate the non-mechanical aspects of a design, such as control dynamics, communications, information, electronic displays, and display formats and (c) emulate the user-system performance to derive estimates of performance for alternate design configurations and cost-effectiveness evaluations of variable manpower, personnel, and training parameters. While the simulation equipment is intended for use as a design tool, its design should consider the opportunity to transition technology to subsequent training simulators.

5.2.2 Engineering drawings. Human engineering principles and criteria shall be reflected by the engineering drawings and CAD representations to ensure that the final product can be effectively, efficiently, reliably, and safely used and maintained. The following drawings are included: system layout, panel layout, control, communication system, individual equipment design, and other drawings depicting equipment important to system operation and maintenance by human operators. Design, reflected by such drawings, shall comply with applicable criteria of MIL-STD-1472 and other human engineering criteria specified by the contract. Personnel assigned human engineering responsibility by the contractor shall review all layouts and drawings having potential impact on human performance or interface and shall identify for corrective action those designs which may induce human error or be unsafe.

5.2.3 Work environment, crew stations and facilities design. Human engineering principles and criteria shall be applied to detail 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 considerations, such as composition, volume, pressure and control for decompression, temperature, humidity and air flow.

b. Weather and climate aspects, such as rain, hail, snow, mud, arctic, desert, and tropic conditions.

c. Range of acceleration 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 interface between personnel and their equipment including eye positions in relation to display surfaces, controls, and external visual areas.

i. Safe and efficient walkways, stairways, platforms, and inclines.

j. Provisions for minimizing physiological stresses.

k. Provisions to minimize physical fatigue.

l. Effects of clothing and personal equipment, such as full and partial pressure suits, fuel handler suits, body armor, chemical/biological clothing and equipment, cold weather clothing, and temperature regulated clothing.

m. Equipment handling provisions, including remote handling provisions and tools when materiel and environment require them.

n. Safe and errorproof equipment installations.

o. Protection from chemical, biological, toxicological, radiological, thermal, mechanical, electrical and electromagnetic hazards.

p. Optimum illumination commensurate with anticipated visual tasks.

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

r. 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.

s. Adequate space, clearance, and layout for normal ingress/egress and emergency escape from crew workstations and aircraft crewstations.

5.2.4 Human engineering in performance and design specifications. The provisions of performance, design, and procurement specifications, prepared by the contractor, shall invoke applicable human engineering criteria of MIL-STD-1472 and other human engineering criteria specified by the contract.

5.2.5 Procedure development. Based upon the human performance functions and tasks identified by human engineering analyses (5.1 herein), the contractor shall apply human engineering principles and criteria to the development of procedures for operating, maintaining, or otherwise using the system equipment. This effort shall be accomplished to ensure 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.

5.2.6 Software development. The contractor shall apply human engineering principles to software design in those systems where software determines part of the human interface. Software that affects controls and displays shall be evaluated for its impact on the human-system interface. Automated system functions requiring human monitoring or intervention shall be considered as part of the human-system interface. Mulfifunction controls and displays that vary in function depending on system software shall also be considered to be part of the human-system interface.

5.2.7 Manuals. Human engineering shall be applied to the development of maintenance and training manuals (electronic or hard-copy) to ensure thoroughness, technical accuracy, suitable format of information presentation, appropriate reading level, technical sophistication required, and clarity, including quality of illustrations.

5.3 Human engineering in test and evaluation. The contractor shall establish and conduct a test and evaluation program to: (1) ensure fulfillment of the applicable requirements herein; (2) demonstrate conformance of system, equipment, and facility design to human engineering design criteria; (3) confirm compliance with system performance requirements where personnel performance is a system 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. Maximum use shall be made of the data collected from experiments, tests, and studies (see 5.2.1). (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.)

5.3.1 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, flight tests, acceptance tests and other development tests. Compliance with human engineering requirements shall be tested as early as possible. Human engineering findings from design reviews, mockup 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. Human engineering test planning should also consider data needed or to be provided by operational test and evaluation. Test planning shall include methods of testing (e.g., use of checklists, data sheets, test participant descriptors, questionnaires, operating procedures, and test procedures), schedules, quantitative measures, test criteria and reporting processes.

5.3.2 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, and test procedures) shall be available at the test site. Human engineering portions of all tests shall include the following:

a. Performance of mission or work, or a simulation thereof if actual performance is not possible.

b. Critical tasks as defined in MIL-STD-1908.

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 programs, training equipment, and special support equipment.

e. Use of personnel who are (1) representative of the range of the intended military user populations in terms of skills, size, and strength, (2) wearing suitable military garments and equipment which are appropriate to the tasks, and (3) approved by the procuring activity. (Use of military personnel from the intended user population is preferred.)

f. Collection of task performance data in actual operational environments, or in simulated environments if such collection is not possible in the actual operating environment.

g. Identification of discrepancies between required and obtained task performance.

h. Criteria for acceptable performance of the test.

5.3.3 Failure and error analysis. All failures occurring during test and evaluation shall be subjected to a human engineering review to differentiate between failures (a) of equipment alone, (b) resulting from human-system incompatibilities, and (c) due to human error. Human errors occurring in the performance of critical tasks during test and evaluation shall be analyzed to determine the reason for their occurrence. The contractor shall identify to the procuring activity those design characteristics or procedures which may contribute substantially to human error and shall propose corrective action.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This standard is intended for use to specify human engineering tasking requirements for military systems, equipment, and facilities, cited contractually in statements of work. It may be invoked in its entirety or selectively as prescribed by the procuring activity. The primary use of this standard for procurement does not necessarily preclude its utilization for in-house efforts, where desired. Compliance with this standard 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 ensure 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, and

i. the layout of the facility and the arrangement of equipment affords efficient communication and use.

6.2 Issue of DODISS. When this standard is used in acquisition, the applicable issue of the DODISS must be cited in the solicitation (see 2.1.1 and 2.2).

6.3 Data requirements.

6.3.1 General. The following Data Item Descriptions (DIDs) must be listed, as applicable, on the Contract Data Requirement List (DD Form 1423) when this standard is applied on a contract, in order to obtain the data except where DOD FAR Supplement 227.475-1 exempts the requirement for a DD Form 1423. For tailoring, see Appendix A.

Ref Paragraph	DID Number	DID Title
4.1/4.2	DI-HFAC-80741A	Human Engineering Progress Report
4.2	DI-HFAC-80740A	Human Engineering Program Plan
5.1 thru 5.1.2	DI-HFAC-80745A	Human Engineering System Analysis Report
5.1.2/5.1.4/5.2	DI-HFAC-80746A	Human Engineering Design Approach Document-Operator
5.1.2/5.1.4/5.2	DI-HFAC-80747A	Human Engineering Design Approach Document-Maintainer
5.1.3.2	DI-HFAC-81399	Critical Task Analysis Report
5.2.1.2	DI-HFAC-80742A	Human Engineering Simulation Plan

5.3	DI-HFAC-80743A	Human Engineering Test Plan
5.3	DI-HFAC-80744A	Human Engineering Test Report

The above DIDs were those cleared as of the date of this standard. The current issue of DOD 5010.12L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DIDs are cited on the DD Form 1423.

6.3.2 Army applications. Consistent with the policy to eliminate or significantly reduce functional data requirements, the preferred approach is to state the requirements (e.g., planning information, such as design plan or production plan) in the request for proposal and to require the contractor to describe the approach for satisfying these requirements in his proposal.

6.4 Tailoring guidance. See Appendix A.

6.5 Subject term (key word) listing.

Analysis
Design and development
Equipment procedures
Dynamic simulation
Mockups, dynamic
Mockups, three-dimensional
Models, computer
Models, scale
Simulators, engineering
Task analysis
Test and evaluation
Work environment
Workload analysis

6.6 Changes from previous issue. Marginal notations were not used in this revision to identify changes with respect to the previous issue (MIL-H-46855B) due to the extensiveness of the changes. (Appendix B correlates each paragraph of the standard with topical equivalents of MIL-H-46855B.)

APPENDIX A

SELECTION AND TAILORING GUIDE FOR MIL-STD-46855

10 SCOPE

10.1 Scope. This appendix provides (a) guidance and criteria for the procuring activity's selection of the standard for contract use and, when used, (b) the partial and incremental application of the requirements provisions.

10.2 Applicability. This appendix provides guidance information only and is no way intended to be involved as a contractual document other than by possible use of Table I as a reference.

20 APPLICABLE DOCUMENTS.

20.1 Government documents

20.1.1 Specifications, standards, and handbooks. The following standards form a part of this Appendix to the extent specified.

MILITARY STANDARD

MIL-STD-280	-	Definition of Item Levels, Item Interchangeability, Models, and Related Terms
MIL-STD-1478	-	Task Performance Analysis

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

20.1.2 Other Government documents, drawings, and publications. The following document forms a part of this Appendix to the extent specified:

AD - 1410	-	Aeronautical Data Design for Maintainer Program Requirements

(Application for copies should be addressed to Commander, Naval Air Systems Command, Code 5313, Washington, DC 10361.)

30 APPLICATION OF MIL-STD-46855

30.1 General. Selection of MIL-STD-46855 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-STD-46855 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 or not to use MIL-STD-46855, prescribe it as a guide, or invoke it as a mandatory contract provision. Only after a carefully considered decision is made to

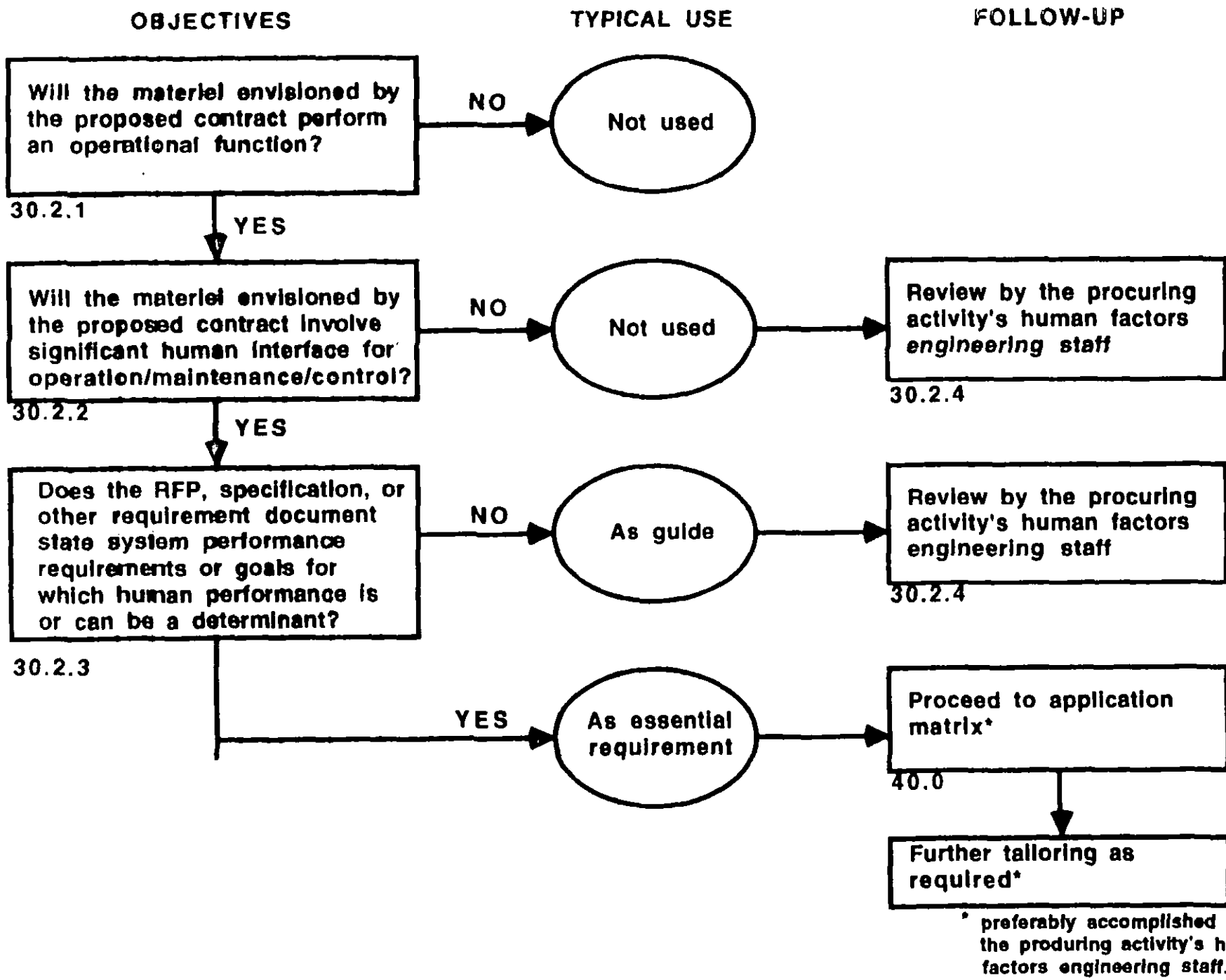


FIGURE 1. Selection guide decision process

invoke MIL-STD-46855 should the application matrix be applied. Selection for use should consider the following provisions, as shown in the selection guide decision process of Figure 1.

30.2.1 Nature of the materiel. Selection of MIL-STD-46855 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 standard:

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

b. should 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 diverse uses to which they will be applied or knowledge of the human performance requirements implicit in such uses. Accordingly, it is not generally reasonable to invoke MIL-STD-46855 for parts, subassemblies, assemblies or units.

30.2.2 Extent of human interface involved. Selection of MIL-STD-46855 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 standard 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 standard should be selected.

30.2.3 Nature of stated performance requirements. If, for a specific RFP or similar procurement action, MIL-STD-46855 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-STD-46855 should be employed. On the other hand, if such performance requirements to which human performance contributes are not stipulated, the standard should be considered for use as a guide.

30.2.4 Selection review. At this point, use of the standard 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 to ensure that the standard is not erroneously involved or waived. Should results of this review disclose that the standard should not be used or should be applied only as a general guide, the process is complete; however, if results of this review conclude that the standard should be invoked, the tailoring process or paragraph 40 must be pursued.

40 TAILORING OF MIL-STD-46855

40.1 General. The primary purpose of a human engineering program and, therefore, MIL-STD-46855 is to influence the design of the system, equipment, and facility--not to generate documentation. Accordingly, with the exception of validation efforts, any extensive or unnecessary tasks or documents that do not contribute to design or that emerge after design cannot be changed are undesirable because they are wasteful and drain resources from accomplishment of

needed effort. Accordingly, every human engineering task must focus on influencing design and test, consistent with the nature of the procurement and the acquisition phase involved.

40.2 Tailoring Matrix. Table I provides guidance to facilitate tailoring the provisions of MIL-STD-46855. The tailoring matrix should be used consistent with the following explanations and guidelines:

40.2.1 Utilization coding. The field of the tailoring matrix utilizes coded symbols to describe use of the general requirements and detailed requirements during this 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

Provisions of the SCOPE, APPLICABLE DOCUMENTS, and DEFINITIONS sections are always considered to be in effect.

40.2.2 Left column. The numbers shown in the left column represent paragraph numbers of the standard.

40.2.3 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.

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

40.2.5 Task analysis for Army acquisitions. For Army acquisitions, if the procuring activity's human engineering, test and evaluation, training, or manpower representative requires extensive task analysis data via a detailed task performance analysis report with prescribed content and format, and requires specified analysis parameters to be included in the report, MIL-STD-1478 and DI-HFAC-81197 should be invoked by the statement of work and the contract data requirements list, respectively. As noted by the asterisks in Table I, when MIL-STD-1478 and DI-HFAC-81197 are specified, 5.1.3.1 (analysis of tasks) and 5.1.3.2 (analysis of critical tasks) do not apply and should be tailored out of the standard.

40.3 Contractual applicability

40.3.1 Standard effectivity. The citation of the application matrix constitutes a required change in application of MIL-STD-46855.

40.3.2 Further tailoring. Procuring activities may alter the matrix field by identifying the specific symbol change in the RFP or contract.

40.3.3 Contractor use. Unless otherwise specified by the procuring activity, contractors shall use the appropriate tailored version of the standard, 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.

40.3.4 Evolutionary development. For evolutionary development of older or existing systems, equipment, software and facilities, the standard will generally apply only to new designs 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 standard 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 engineering staff is considered extremely advisable.

40.3.5 Product improvement. Recognizing that product improvement actions may occur during more than one acquisition phase and that product improvements can involve concept exploration & definition, demonstration & validation, engineering and manufacturing development 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.

40.3.6 Production & deployment/operations and support phases. Design changes affecting human performance during the production and deployment or operations and support phases can, like product improvement actions, involve conceptual concept exploration & definition, demonstration & validation, or 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.

40.3.7 Nondevelopmental item (NDI). Where an NDI is being acquired, applicable provisions of MIL-STD-46855 may be used to guide government in-house efforts (see 6.1). Paragraph 5.1.2 should be considered to ensure that MIL-STD-1472 will be a part of the selection criteria for determining the suitability of the item; paragraph 5.3 and its subparagraphs should be considered, as applicable, to verify human system integration. In addition, the nature of the NDI program will influence tailored, in-house use of the standard. Where an item requires minor modification to meet the requirements of the procuring activity, and where the modification is driven by human performance or will result in significant human performance effects, applicable analysis tasks of 5.1, 5.2, and their subparagraphs may be used for identifying and implementing the modification.

40.3.8 Application of AD-1410. For Naval aviation systems and equipment design for integration within Naval aircraft, design for maintainer analyses and data review processes are required to comply with AD-1410, where applicable.

40.4 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 ensure consistency of the tailored requirements with human performance requirements pursuant to the nature of the objectives of the contract.

TABLE I. Tailoring Matrix

MIL-STD-46855 PARAGRAPH	ACQUISITION PHASE† 0	I	II	MODIFICATION WHERE NOTED BY "M"
4. GENERAL REQUIREMENTS				4.1.1 PHASE I. Delete first three sentences. Change fourth sentence to: "Each task that must be performed to accomplish allocated functions shall be analyzed to determine the human..." Last line: Change "design" to "validation"
4.1 Scope and nature of work	E	E	E	
4.1.1 Analysis	E	M	M	4.1.1 PHASE II. Same change as for 4.1.1 PHASE I, above.
4.1.2 Design and development	M	E	E	4.1.2 PHASE 0. Revise the title to read, "Preliminary design and development." In first line, insert "Preliminary" at the beginning of the first sentence. In fourth line, change "detail" to "preliminary."
4.1.3 Test and evaluation	-	E	E	
4.2 HE program planning	M	M	E	4.2 PHASE 0. Line 2: Delete "equipment specification" and substitute "mission need."
4.3 Risk Management	E	E	E	4.2 PHASE I. Line 2: Delete "equipment specification" and substitute "overall program objectives."
4.4 Reviews	E	E	E	
4.4.1 Major technical reviews	E	E	E	
4.4.2 Subsystem reviews	-	E	E	
4.5 Cognizance and coordination	E	E	E	
4.6 Data	E	E	E	4.6.1 PHASE 0. Lines 3-4: Delete "design and development" to the end of the sentence and insert "concept submission."
4.6.1 Traceability	M	M	E	4.6.1 PHASE I. Line 3. Insert "preliminary" after "through." Lines 3-4: Delete "the verification" through end of sentence and substitute "validation and demonstration."
4.6.2 Access	E	E	E	
4.7 Subcontractors and suppliers	E	E	E	
4.8 Nonduplication	E	E	E	

† Symbol — Provision

E — In Effect

\- — Used at contractor's discretion

M — Modified as noted

Acquisition Phases 0 - IV are defined at the end of the table.

TABLE I. Tailoring Matrix (continued)

MIL-STD-46855 PARAGRAPH	ACQUISITION PHASE † 0	I	II	MODIFICATION WHERE NOTED BY "M"
5 DETAILED REQUIREMENTS	E	E	E	
5.1 Analysis	E	E	E	
5.1.1 Defining and allocating...	E	E	-	
5.1.1.1 Information flow and ...	E	E	-	
5.1.1.2 Estimates of potential ...	M	E	-	5.1.1.2 PHASE 0. Line 10: Delete "design."
5.1.1.3 Allocation of functions	E	E	-	
5 1.2 Equipment selection	M	E	-	5.1.2 PHASE 0. Line 2: Change "design requirements " to "concepts." Line 3: Change "configuration" to "concept"
5 1.3 Analysis of tasks and workload	E	E	E	
5.1.3 1 Analysis of tasks*	E	E	E	
5 1.3.2 Analysis of critical tasks*	E	E	E	
5 1.3.3 Workload analysis	E	E	E	
5.1.3.4 Corrective action	-	E	E	5.1.3.5 PHASE 0. Line 2: Change "design" to "conceptual."
5.1.3.5 Timeliness and availability	M	M	E	5.1.3.5 PHASE I. Line 2: Change "design" to "validation"
5 1.4 Preliminary system and ...	M	M	E	5.1.4 PHASE 0. Line 2: Change "designs" to "concept documentation" and delete so much of lines 2-5 that reads "represented...with contract data requirements."
5.2 HE in detail design	-	E	E	5.1.4 PHASE I. Line 8: Delete all material on line 8 following "MIL-STD-1472."
5.2.1 Experiments, tests, and...	E	E	E	

* Paragraphs 5.1.3.1 and 5.1.3.2 do not apply when MIL-STD-1478 and DI-HFAC-81197 are specified for Army acquisitions.

† Symbol — Provision

- E — In Effect
- - — Used at contractor's discretion
- M — Modified as noted

Acquisition Phases 0 - IV are defined at end of table

TABLE I. Tailoring Matrix (continued)

MIL-STD-46855 PARAGRAPH	ACQUISITION PHASE † 0	I	II	MODIFICATION WHERE NOTED BY "M"
5.2.1.1 Computer graphics ...	E	E	E	
5.2.1.1.1 Comp graphics Models	E	E	E	
5.2.1.1.2 Three-dimens mockups	-	E	E	
5.2.1.1.3 Scale models	-	E	E	
5.2.1.2 Dynamic simulation...	-	E	E	
5.2.2 Engineering drawings...	-	E	E	
5.2.3 Work environment...	M	E	E	5.2.3 PHASE 0. Delete lines 1-6 through "by the contract. Line 6: Delete "Design of." Line 7: Add "concepts" after "facilities."
5.2.4 HE in ... specifications	-	E	E	
5.2.5 Procedure development	E	E	E	
5.2.6 Software development	E	E	E	
5.3 HE in test and evaluation	-	M	E	5.3 PHASE I. Lines 2-4: Change (2) to "demonstrate that human performance technical risks have been identified and that solutions are defined."
5.3.1 Planning	-	M	E	5.3.1 PHASE I. Line 2: Change "engineering design and development tests" to "into validation and demonstration test planning. " Delete line 3 through "development tests."
5.3.2 Implementation	-	E	E	
5.3.3 Failure and error analysis	-	E	E	

† Symbol — Provision

- E — *In Effect*
- \- — Used at contractor's discretion
- M — Modified as noted

Phase

- 0: Concept Exploration & Definition.
- I: Demonstration & Validation.
- II: Engineering and Manufacturing Development.
- III: Production & Deployment (Not covered by Table. See 40.3.6.)
- IV: Operations & Support. (Not covered by Table. See 40.3.6.)

APPENDIX B

MIL-H-46855B/MIL-STD-46855 PARAGRAPH AND DID CORRELATION FOR DOD-HDBK-763 USERS

MIL-H-46855B		MIL-STD-46855	
SUBJECT	PARA	PARA	SUBJECT
SCOPE	1	1	
Scope	1.1	1.1	Scope
Applicability	1.2	1.2	Applicability
		1.3	Application guidance
APPLICABLE DOCUMENTS	2	2	APPLICABLE DOCUMENTS
		2.1	Government documents
Standards	2.1	2.1.1	Specifications, standards, and handbooks
		2.1.2	Other Government documents, drawings.
		2.2	Order of precedence
DEFINITIONS (See Explanation of Terms in Notes, below)		3	DEFINITIONS (See Explanation of Terms in Notes)
REQUIREMENTS	3		
General requirements	3.1	4	GENERAL REQUIREMENTS
Scope and nature of work	3.1.1	4.1	Scope and nature of work
Analysis	3.1.1.a	4.1.1	Analysis
Design and development	3.1.1.b	4.1.2	Design and development
Test and evaluation	3.1.1.c	4.1.3	
Human engineering program planning	3.1.2	4.2	
		4.3	Risk management
		4.4	Reviews
		4.4.1	Major technical reviews
		4.4.2	Subsystem reviews
Cognizance and coordination	3.2.4	4.5	Cognizance and coordination
Data Requirements	3.3	4.6	Data
Traceability	3.3.1	4.6.1	Traceability
Access	3.3.2	4.6.2	Access
Nonduplication	3.1.3	4.8	Nonduplication
		4.7	Subcontractors and suppliers

MIL-H-46855B		MIL-STD-46855	
SUBJECT	PARA	PARA	SUBJECT
Detail requirements	3.2	5.	DETAILED REQUIREMENTS
Analysis	3.2.1	5.1	Analysis
Defining and allocating system functions	3.2.1.1	5.1.1	Defining and allocating system functions
Information flow and processing analysis	3.2.1.1.1	5.1.1.1	Information flow and processing analysis
Estimates of potential operator/maintainer processing capabilities	3.2.1.1.2	5.1.1.2	Estimates of potential operator/maintainer ...
Allocation of functions	3.2.1.1.3	5.1.1.3	allocation of functions
Equipment selection	3.2.1.2	5.1.2	*Equipment selection*
Analysis of tasks	3.2.1.3	5.1.3	Analysis of tasks and workload
Gross analysis of tasks	3.2.1.3.2	5.1.3.1	Analysis of tasks
Analysis of critical tasks	3.2.1.3.2	5.1.3.2	Analysis of critical tasks
Workload analysis	3.2.1.3.3.	5.1.3.3	workload analysis
		5.1.3.4	Corrective action
Concurrence and availability	3.2.1.3.4	5.1.3.5	Timeliness and availability
Preliminary system and subsystem design	3.2.1.4	5.1.4	Preliminary system and subsystem design
Human Engineering in Equipment detail design	3.2.2	5.2	Human engineering in detail design
Studies, experiments, and *laboratory tests*	3.2.2.1	5.2.1	Experiments, tests, and studies
Mockups and models	3.2.2.1.1	5.2.1.1	Computer models, 3D Mockups, and scale models
		5.2.1.1.1	Computer models
		5.2.1.1.2	Three-dimensional mockups
		5.2.1.1.3	Scale models
Dynamic simulation	3.2.2.1.2	5.2.1.2	*Dynamic mockups*
Equipment *detail design drawings*	3.2.2.2	5.2.2	Engineering drawings
Work environment, crew stations, and facilities design	3.2.2.3	5.2.3	Work environment, crew stations, and facilities
Human engineering in performance and design specifications	3.2.2.4	5.2.4	Human engineering in performance and design ...
Equipment procedure development	3.2.2.5	5.2.5	Procedure development
		5.2.6	Software development
		5.2.7	Manuals
Human engineering in test and evaluation	3.2.3	5.3	Human engineering in test and evaluation
Planning	3.2.3.1	5.3.1	Planning
Implementation	3.2.3.2	5.3.2	Implementation
Failure analysis	3.2.3.3	5.3.3	Failure and error analysis
Cognizance and coordination (See general requirements)	3.2.4	4.5	Cognizance and coordination (embedded in)
Data requirements (See general requirements)	3.3	4.6	Data
Traceability (See general requirements)	3.3.1	4.6.1	Traceability
Access (See general requirements)	3.3.2	4.6.2	Access
Drawing approval	3.4	5.2.2	Engineering drawings (embedded in)

MIL-H-46855B		MIL-STD-46855	
SUBJECT	PARA	PARA	SUBJECT
QUALITY ASSURANCE	4		
PREPARATION FOR DELIVERY	5		
NOTES	6	6	
Intended Use	6.1	6.1	Intended use
Explanation of Terms	6.2	3	DEFINITIONS
Analysis of tasks	6.2.5	3.3	Other terms
Critical (human) (performance)	6.2.1	3.3	Other terms
Overall layout drawings	6.2.2	3.2	System Layout drawings
Panel layout drawings	6.2.3	3.3	Other terms
System engineering	6.2.4	3.3	Other terms
Human engineering	6.2.6	3.1	Systems engineering
Human factors	6.2.7	3.3	Other terms
Human performance	6.2.8	3.3	Other terms
Life support	6.2.9	3.3	Other terms
System	6.2.10	3.3	Other terms
		6.2	Issue of DODISS
		6.3	Data requirements
		6.4	Tailoring guidance
		6.5	Subject term (key word) listing
		6.6	Changes from previous issue

DID SUBJECT	DI-H	DI-HFAC	SUBJECT
Human Engineering Program Plan	7051	80740A	Human Engineering Program Plan
Human Engineering Dynamic Simulation Plan	7052	80742A	Human Engineering Dynamic Simulation ...
Human Engineering Test Plan	7053	80743A	Human Engineering Test Plan
Human Engineering System Analysis Report	7054	80745A	Human Engineering System Analysis Report
Critical Task Analysis Report	7055	81399	Critical Task Analysis Report
Human Engineering Design Approach Document-Operator	7056	80746A	Human Eng Design Approach Document-Operator
Human Engineering Design Approach Document-Maintainer	7057	80747A	Human Eng Design Approach Document-Maintainer
Human Engineering Test Report	7058	80744A	Human Engineering Test Report
Human Engineering Progress Report	7059	80741A	Human Engineering Progress Report

CONCLUDING MATERIAL

Custodians:
Army - MI
Navy - AS
Air Force - 11

Review activities:
Army - AR, AT, AV, CR, EA, ER, GL, ME, MD, MR, TE, TM
Navy - EC, MC, OS, PE, SH, TD
Air Force - 13, 15, 19, 24

User activities:
Army - AL
Navy - YD

Civilian agencies:
COM - NIST
DOL - TEC
DOT - FAA
EPA
NASA - MSF

Preparing activity:
Army-MI

(Project HFAC-0059)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
	MIL-STD-46855	940526

3. DOCUMENT TITLE
HUMAN ENGINEERING REQUIREMENTS FOR MILITARY SYSTEMS, EQUIPMENT, AND FACILITIES

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME	b. TELEPHONE (Include Area Code)	c. DATE SUBMITTED (YYMMDD)
	(1) Commercial (2) AUTOVON (If applicable)	

7. PREPARING ACTIVITY

a. NAME	b. TELEPHONE (Include Area Code)	
Mrs. Glenda Rogers	(1) Commercial (205)876-6980	(2) AUTOVON 746-6980
c. ADDRESS (Include Zip Code) Commander U.S. Army Missile Command ATTN: AMSMI-RD-SE-TD-ST Redstone Arsenal, AL 35898-5270	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	

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