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Man-Materiel Systems  
**HUMAN FACTORS ENGINEERING PROGRAM**

Effective 15 March 1983

*This revision implements the requirement to integrate human factors engineering throughout the materiel life cycle and correlates with current acquisition and other related policies. Policies, responsibilities, and procedures to achieve this integration are specified.*

*Supplementation of this regulation is prohibited, unless prior approval is obtained from HQDA (DAPE-HRI), WASH DC 20310.*

*Interim changes to this regulation are not official unless they are authenticated by The Adjutant General. Users will destroy interim changes on their expiration dates unless sooner superseded or rescinded.*

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\*This regulation supersedes AR 602-1, 1 June 1976.

## CHAPTER 1

### INTRODUCTION

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**1-1. Purpose.** This regulation prescribes policies and procedures and assigns responsibilities for human factors engineering (HFE) in the Department of the Army (DA).

**1-2. Applicability.** *a.* This regulation applies to Headquarters, Department of the Army, all Army agencies, and major field commands with responsibilities for—

- (1) Mission area analyses.
- (2) Organization and doctrine.
- (3) Materiel requirements.
- (4) Research, development, test, and evaluation of materiel.
- (5) Production and procurement of materiel.
- (6) Management of personnel resources.
- (7) Development of manpower skills.
- (8) System safety engineering.
- (9) Health hazards assessment.
- (10) Integrated logistic support.
- (11) System reliability.

*b.* This regulation does not apply to the Army National Guard or the US Army Reserve.

**1-3. Impact on the New Manning System.** This regulation does not contain information that affects the New Manning System.

**1-4. References.** Required and related publications are listed in appendix A.

**1-5. Explanation of abbreviations.** Abbreviations are listed in the glossary.

**1-6. Responsibilities.** *a.* The Deputy Chief of Staff for Personnel (DCSPER) will—

(1) Review and monitor materiel objectives, requirements, documents, acquisition plans, and activities in materiel development which affect personnel or training to assure the proper application of HFE in the development of human performance requirements.

(2) Coordinate actions with the Deputy Chief of Staff for Research, Development, and Acquisition (DCSRDA); the Deputy Chief of

Staff for Operations and Plans (DCSOPS); the Deputy Chief of Staff for Logistics (DCSLOG); and The Surgeon General (TSG).

(3) Provide behavioral sciences research support to insure a necessary scientific basis for HFE. This human factors program is executed through two developing agencies, the US Army Research Institute (ARI), a field operating agency of DCSPER and the US Army Materiel Readiness and Development Command (DARCOM), through the US Army Human Engineering Laboratory (HEL). ARI focuses on manpower, personnel, and training. HEL focuses on human engineering.

(4) Insure that HFE is coordinated with the Integrated Logistic Support Policy (AR 700-127 and AR 700-129).

(5) Provide for professional coordination among human factors specialists and behavioral scientists.

(6) Develop instructions which will insure expeditious revision of authorization documents to reflect new or changed military occupational specialty/specialty skill identifiers (MOS/SSI) required by the system(s) being developed.

(7) Approve or verify data contained in provisional qualitative and quantitative personnel requirements information (PQQPRI) submissions.

(8) Provide an overall systems safety policy for developing systems (AR 385-16).

(9) Prepare assessments of safety aspects for inclusion in the human factors engineering analysis (HFEA).

*b.* The DCSLOG will insure that—

(1) HFE considerations and design criteria are integrated into the development of logistics systems (such as packaging, handling, storage, maintenance, identification, transportation, and disposal).

(2) Integrated Logistic Support Policy is implemented with consideration of the HFE program for developmental, non-developmental, and product improved materiel systems.

c. The DCSRDA, together with DCSPER, DCSLOG, and TSG will—

(1) Include research, development, test, and evaluation (RDT&E) funds for human factors in the annual submission of the Program 6 budget.

(2) Insure proper and systematic application of HFE throughout the materiel development and acquisition cycle.

(3) Verify the adequacy of HFE before production of materiel.

(4) Insure application of HFE in system modification or product improvement actions.

d. The DCSOPS, together with the DCSPER and the DCSLOG will insure—

(1) The application of HFE in combat developments during the preparation of the justification of major systems new starts (JMSNS) and requirements documents and in the review of acquisition objectives for total feasibility.

(2) The inclusion of relevant HFE data in establishing requirements for training devices for new equipment training, institutional training, unit training, and in developing tables of organization and equipment and tables of distribution and allowance.

(3) The inclusion of HFE in the Operational Test (OT) Program, First Article Testing, and follow-on evaluations.

e. TSG will—

(1) Provide proper consultation and advice on the medical aspects of HFE to the Army staff and developing agencies, including health hazard analyses.

(2) Monitor the application of biomedical and health standards within HFE throughout the materiel development and acquisition cycle.

(3) Develop medical data bases and consequent health standards required to support HFE or Army systems.

(4) Perform the proper medical RDT&E tasks for non-medical development and acquisition programs.

(5) Prepare system health hazard assessments for inclusion in the HFEA.

f. The CG, DARCOM will maintain comprehensive HFE program to—

(1) Integrate HFE (including inputs from Army personnel, training, testing, medical, and research activities through the US Army Human

Engineering Laboratory) into the materiel research, development, and acquisition cycle.

(2) Develop, coordinate, and implement HFE design and performance specifications, standards, and procedures.

(3) Provide for HFE orientation of system, program, project, and project managers.

(4) Insure the inclusion of HFE in the development testing (DT) programs and First Article Testing.

(5) Provide human factors engineering specialists to materiel development programs.

(6) Insure that program/project managers monitor materiel system development contractors in the performance of HFE in accordance with their contracted HFE plan and with MIL-H-46855 and MIL-STD-1472.

(7) Improve the Army's capability for HFE management.

(8) Perform appropriate human factors engineering RDT&E tasks.

(9) Actively pursue efforts to insure the fullest coordination with Commanding General, US Army Training and Doctrine Command (CG, TRADOC) and Commanding General, US Army Operational Test and Evaluation Agency (CG, OTEA) relative to HFE in test integration working groups and during planning for and conduct of OT.

(10) Prepare through HEL, in cooperation with other commands, a HFEA for designated personnel materiel systems.

g. Chiefs of other agencies/major Army commands assigned responsibilities for development of materiel items (such as Commanding General, US Army Communications Command; Commanding General, US Army Intelligence and Security Command; US Army Computer Systems Command; the Chief of Engineers; and TSG), will—

(1) Establish HFE programs which incorporate the above provisions as appropriate to their development/acquisition responsibilities and as are compatible with the program of DARCOM.

(2) Obtain the review and concurrence of TSG during the concept exploration phase as well as subsequent phases where potential hazards are identified. This will minimize potential for health hazards in materiel development.

(3) Submit to TSG a written proposal for studies involving the use of volunteers in accordance with AR 70-25. (TSG has final approval authority for all studies using volunteers except research with nuclear or chemical warfare agents, which are approved by the Secretary of the Army. Chemical warfare agents are restricted to type-classified and developmental lethal and incapacitating agents. TSG retains final approval authority for experiments involving the use of simulant agents and standard riot control agents.)

*h.* The CG, TRADOC will—

(1) Insure that HFE is considered in mission area analyses (MAA), combat developments, training developments, doctrinal studies, and in planning for future system development programs.

(2) Insure that letters of agreement (LOA), required operational capability (ROC), letter requirement (LR), training device requirement (TDR), training device letter requirement (TDLR) include adequate specification of HFE requirements (particularly desired/required personnel performance reliability) and that these requirements are realistic in terms of the state-of-the-art, doctrine, life-cycle effectiveness, anticipated user requirements, and personnel capabilities and limitations.

(3) Insure that user input to HFE is provided to developing agencies.

(4) Participate in the development of HFE programs in support of materiel developments.

(5) Establish requirements for human performance and information necessary for the development of training devices and aids for training plans and programs.

(6) Evaluate these data in developing a command position for system evaluations.

(7) Recommend, when appropriate, to the DA DCSPER research and development projects in the field of education and training brought about by HFE considerations involving unusual skills or learning processes.

(8) Furnish training experience inputs and training advisors as needed to the HFE effort.

(9) Prepare assessments of manpower and personnel implications for inclusion in the HFEA.

**1-7. Policies.** *a.* During all phases of the life cycle of materiel systems, accepted principles of HFE will be used to integrate materiel development with personnel resources and capabilities.

*b.* HFE will be accorded relative priority with all other system characteristics to insure effective soldier-materiel operational interface.

*c.* Personnel implications will be considered throughout all development activities.

*d.* Human factors, bio-medical, or behavioral research will be initiated to address gaps which exist in the HFE data base and when novel human factors problems are identified in Army development programs. (See AR 70-8.)

**1-8. Scope.** The HFE includes—

*a.* The part of a MAA which determines projected manpower, personnel and training capabilities, limitations, and provides preliminary function analysis of human resource requirements for a given mission area.

*b.* Those aspects of system analysis which determine the human role in a soldier-materiel system.

*c.* Selecting, defining, and developing soldier-materiel interface characteristics, workspace layout, work environment, and commonality of operator controls for similar equipment. The process of developing and defining a work environment includes a detailed analysis of the impact of the proposed environment on the health and safety of operator and maintenance personnel.

*d.* Coordinating with other agencies in determining the requirements of, and then developing and evaluating job and task procedures and skill performance aids including training devices, aids, equipment, and technical publications.

*e.* Providing basic soldier-materiel task sequence data used to describe, develop, and assess the feasibility of human performance required in a soldier-materiel system.

*f.* Developing equipment which will permit effective soldier-materiel interaction within the established allowable limits of training time, soldier aptitudes and skill, physical endurance, physiological tolerance limits, and soldier physical standards.

*g.* Determining the numbers and types of soldiers and civilians needed for manning of the

personnel-materiel system to provide for subsequent personnel planning; provide data needed for establishing new MOS/SSI for new materiel systems, doctrine and force/unit structure.

*h.* Assessing the training burden which competing materiel design/development concepts may impose on the Army.

*i.* Developing HFE information needed for new or revised training plans, or courses of instruction as required by new or modified materiel, doctrine, or organization.

*j.* Confirming the effectiveness of HFE by evaluating the completed personnel-materiel system.

*k.* Conducting research required to resolve HFE problems encountered in materiel development programs, as disclosed through systems analyses in *b* above.

**1-9. Objectives.** The objective of the HFE program are to—

*a.* Insure that Army materiel systems and concepts of their use conform to the capabilities and limitations of the fully equipped soldier to operate, maintain, supply, and transport the materiel in the operational environment consistent with tactical requirements and logistic capabilities.

*b.* Insure that materiel systems are developed so that the personnel tasks involved in operation, maintenance, supply, and transportation do not exceed available or achievable soldier capabilities.

*c.* Assist the Army trainer in determining, designing, developing, and conducting sufficient, necessary, and integrated Army training.

*d.* Improve control of total life cycle costs of soldier-materiel systems by assuring consideration of the costs of personnel resources and training for alternative systems during the conceptual stages and for the selected system during subsequent stages.

*e.* Optimize the relationship and trade-off among skill levels, training and personnel required to operate and maintain materiel systems.

*f.* Insure, through basic and applied studies and research in HFE, soldier-materiel system analysis and psychophysiology, that equipment designs and operational concepts are compatible with the capabilities and limitations of operators and maintenance personnel.

*g.* Develop data bases to define ranges of human performance, compare them against systems performance requirements, and provide for the timely development of the necessary trained personnel resources.

*h.* Insure that systems engineering is consistent with safety and health standards.

*i.* Provide HFE data for the development of technical manuals, training manuals, field manuals, and other training media and technical publications. Insure that the use of these publications does not require aptitudes, education, or training beyond the requirements set to perform the tasks they describe.

*j.* Apply HFE concepts and current educational technology to analysis, design and development of training devices and skill performance aids.

## CHAPTER 2

### THE HUMAN FACTORS ENGINEERING PROGRAM

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**2-1. General.** For the purpose of this regulation, HFE is defined as a comprehensive technical effort to integrate into Army doctrine, materiel development, and materiel acquisition (to insure operational effectiveness) all relevant information concerning—

- a. Human characteristics.
- b. Skill capabilities.
- c. Performance.
- d. Anthropometric data.
- e. Biomedical factors.
- f. Safety factors.
- g. Training.
- h. Manning implications.

**2-2. Human factors engineering analysis (HFEA).** An HFEA will be conducted, as applicable, where relevant data and human performance measurements are available to provide supportable conclusions and recommendations. The HFEA is an analysis, performed in support of the Army Systems Acquisition Review Council (ASARC) preliminary reviews, to identify any HFE problems which may be sufficient criticality to preclude the system's proceeding into the next phase of the acquisition process. A secondary objective of the HFEA is to identify HFEA concerns which, while not critical in terms of program decisions, are resolvable, and must be addressed during the subsequent phase of the acquisition cycle.

**2-3. HFE in mission area analysis and JMSNS.** HFE will be initiated in the MAA and will be integrated into the JMSNS. HFE in this stage of mission definition and recommendation will consider the human element in relation to needs in terms of manpower capabilities and skills available or achievable (in the target timeframe), forecasted training capabilities and training burden, and conduct of the preliminary HFE function analysis. HFE data will be integrated into the JMSNS decision process.

**2-4. HFE in the concept exploration phase. a.**

During the concept exploration phase, HFE will be integrated into the technical and management plans. HFE data will be developed during the concept exploration phase to—

(1) Determine probable human performance, health and safety requirements, and projected personnel requirements.

(2) Develop planning of personnel support and training programs.

(3) Support organizational and operational concepts and provide all requisite HFE input to the Program Management Plan.

b. In the case of materiel with a very prominent human interface, it is critically important to develop HFE data in the concept exploration phase to be used in thorough human performance and system design and evaluation during the demonstration and validation phase. An HFEA will be conducted at the end of this phase.

**2-5. HFE in the demonstration and validation phase.** HFE will be integrated throughout the materiel acquisition process during all applicable phases of the life cycle (AR 70-1) for materiel systems with specific soldier-materiel interface. The demonstration and validation phase is a critical phase of development in which detailed HFE must be accomplished and be sufficient to establish HFE requirements for inclusion in the ROC, LR, TDR, and TDLR documents. During this phase, sufficient information concerning the proposed design is available for a detailed HFE evaluation while the design is still sufficiently flexible to accommodate any changes determined necessary by the HFE evaluation. HFE standards, measures, issues, and testing requirements will be provided to the coordinated test program (CTP), test design plans (TDP), and detailed test plans (DTP).

a. Training requirement analysis (TRA). The requirement to conduct continuing TRA as a part of the demonstration and validation phase will be documented in the LOA. It will also include the designation of the agency with recog-

nized HFE expertise responsible for conducting the TRA. The following will be completed by the end of this phase:

(1) Development of a training requirement concept for the user, based on tentative identification, allocation, and sequencing of tasks and the user's role in operating, maintaining, or controlling the materiel.

(2) Identification of human factors research required to support the training requirement consistent with its operational concept. The need for this research will be documented as a separate research and development requirement under AR 70-8. The requirement and any supporting documentation will be provided the agency, command, or laboratory designated to provide such support.

(3) Identification of training devices and aids, and special training requirements.

*b. When to conduct HFEA.* An HFEA will be conducted at the end of the demonstration and validation phase.

**2-6. HFE in full-scale development phase.** *a. HFE requirements documents.* Special human engineering characteristics, male and female soldier characteristics, and training considerations peculiar to the system but not covered in AR 702-3 will be specified in the ROC, LR, TDR, or TDLR (AR 71-9). These documents will reflect previous HFE analyses. The HFE portion of the ROC, LR, TDR, or TDLR will provide soldier performance specifications, consider maximum and minimum personnel skills that can be required and identify major HFE, safety, health, and biomedical tests to be conducted. HFE standards, which embody tested or consensus human factors principles, may be appropriate as guidelines for ROCs, LRs, TDRs, and TDLR; however, application of such standards should not preclude design approaches which can lead to improved performance of the soldier-materiel system.

*b. When to conduct HFEA.* An HFEA will be conducted at the end of the full scale development phase.

*c. HFE in the program management plan.*

(1) *General.* HFE will be progressively refined and applied to design and development phases. HFE requirements and considerations

will be included in the appropriate section of the Program Management Plan. Development of HFE inputs requires a thorough systems engineering analysis of system requirements. Personnel and training planning will describe actions, decisions, processes, and procedures necessary to staff the organizations which will employ or support the system. Training development plans will address all training support required for the specific system including personnel requirements, training device requirements, and the impact of the system on other training, if any. The project manager charter will indicate resources which will be used to accomplish HFE and personnel and training planning.

(2) *Integrated logistics support (ILS).* Throughout the development of new materiel systems, the HFE effort will be considered and applied to the ILS Program (AR 700-127 and AR 700-129).

(a) *Maintenance plan (AR 750-1).* HFE will be applied to insure that the identified maintenance tasks can be accomplished by the personnel/equipment available to the maintaining organization, or, to identify the additional training requirements needed to achieve desired skill levels.

(b) *Support and test equipment.* HFE will be applied to insure that support and test equipment concepts interface efficiently and effectively with operator/maintainer requirements.

(c) *Supply support.* HFE will be applied to the design of packaging and preservation materiel defined under supply support.

(d) *Transportation and handling.* HFE will be applied to the development and evaluation of procedures for packing, crating, handling, and transporting the system.

(e) *Technical publications.* HFE will be applied in determining or evaluating the kind, quality, format, reading level, and comprehension of technical publications, technical training, and field manuals for system development.

(f) *Facilities.* HFE will be considered in the design of all buildings, shelters, and similar mobile or fixed facilities required to support a new system.

(g) *Personnel and training.* PQQPRI will be based on—

—Analysis of planned task sequences.

—The skills or knowledge required by these tasks.

—The personnel performance standards necessary to meet system objectives.

—Special personnel implications identified during the preceding phases of the research development and acquisition cycle. PQPFI and Army capability to man organizations to these requirements will be considered in determining and approving initial basis of issue and unit structure.

(h) *Logistic support resources funds.* Estimates of life cycle personnel costs, including training costs and projections of personnel availability, will be explicitly considered in cost effectiveness analyses. Cost effectiveness of training devices will be specifically addressed to determine savings occasioned by reduced wear and tear on operational equipment (with associated maintenance costs), reduction in fuel usage, training area requirements reductions, and ap-

plicability for use by Reserve and National Guard forces.

(i) *Logistics support management information.* HFE information and data needs will be collected for integration into analyses supporting the development of logistic support plans.

(3) *Coordinated test program.* Plans for DT/OT will include an evaluation of HFE as described in AR 70-10, AR 71-3, and provide the human referenced test and evaluation data. DT will include human factors testing to demonstrate an acceptable technical soldier-machine interface to establish both system and personnel performance reliability or to confirm previous personnel performance reliability predictions. OT will operationally examine the personnel-machine interface in an operational environment manned with personnel representative of those who will operate and maintain the system when it is fielded.

## APPENDIX A

### REFERENCES

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#### Section I. Required Publications

- AR 70-1 (Army Research, Development, and Acquisition). Cited in paragraph 2-5.
- AR 70-10 (Test and Evaluation During Development and Acquisition of Materiel). Cited in paragraph 2-6c(3).
- AR 71-3 (User Testing). Cited in paragraph 2-6c(3).
- MIL-H-46855 (Human Engineering Requirements for Military Systems, Equipment and Facilities). Cited in paragraph 1-6f(6). (This publication is available from the Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.)
- MIL-STD-1472 (Human Engineering Design Criteria for Military Systems, Equipment and Facilities). Cited in paragraph 1-6f(6). (This publication is available from the Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.)

#### Section II. Related Publications\*

- AR 70-8 (Personnel Performance and Training Program (PPTP))
- AR 70-25 (Use of Volunteers as Subjects of Research)
- AR 71-9 (Materiel Objectives and Requirements)
- AR 385-16 (System Safety Engineering and Management)
- AR 700-127 (Integrated Logistics Support (ILS))
- AR 700-129 (Integrated Logistics Support Management of Multi-Service Communications-Electronics Systems and Equipment (AFR 400-46; OPNAVINST 4105.2))
- AR 702-3 (Army Materiel Reliability, Availability, and Maintainability (RAM))
- AR 750-1 (Army Materiel Maintenance Concepts and Policies)
- AR 1000-1 (Basic Policies for Systems Acquisition)

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\*A related publication is merely a source of additional information. The user does not have to read it to understand this regulation.

## GLOSSARY

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### ABBREVIATIONS

ARI .....	US Army Research Institute for the Behavioral and Social Sciences
ASARC ...	Army Systems Acquisition Review Council
CTP .....	coordinated test program
DA .....	Department of the Army
DARCOM ..	US Army Materiel Readiness and Development Command
DCSLOG ..	Deputy Chief of Staff for Logistics
DCSOPS ..	Deputy Chief of Staff for Operations and Plans
DCSPER ..	Deputy Chief of Staff for Personnel
DCSRDA ..	Deputy Chief of Staff for Research, Development, and Acquisition
DT .....	development testing
DTP .....	detailed test plans
HEL .....	US Army Human Engineering Laboratory
HFE .....	human factors engineering
HFEA .....	human factors engineering analysis
ILS .....	integrated logistics support
JMSNS ....	justification of major system new starts
LOA .....	letter of agreement
LR .....	letter requirement
MAA .....	mission area analysis
MOS .....	military occupational specialty
OT .....	operational testing
PQQPRI ...	provisional qualitative and quantitative personnel requirement information
RDTE .....	research, development, test, and evaluation
ROC .....	required operational capability
SSI .....	specialty skill identifiers
TDLR .....	training device letter requirement
TDP .....	test design plans
TDR .....	training device requirement
TRA .....	training requirement analysis
TSG .....	The Surgeon General

The proponent agency of this regulation is the Office of the Deputy Chief of Staff for Personnel. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to HQDA(DAPE-HRI), WASH DC 20310.

By Order of the Secretary of the Army:

E. C. MEYER  
*General, United States Army*  
*Chief of Staff*

Official:

ROBERT M. JOYCE  
*Major General, United States Army*  
*The Adjutant General*

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