



TECHNICAL REPORT	HEB1™	REV. C
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Superseding HEB1B		
Human Engineering - Principles and Practices		

RATIONALE

During the five-year review of the HEB1B document, the SAE G-45 Committee determined that the HEB1B is largely duplicative with MIL-STD-46855A and no longer serves its original purpose. Despite this, the document does contain an historical record that is worth saving. Thus, the G-45 Committee decided that the best option going forward is to discontinue maintenance of the HEB1 document, while keeping it in the SAE inventory as an historical document. This revision C serves as the baseline for stabilization.

NOTICE

This revision of the document has been formed from the previous version through 1) maintaining the Forward section with clarifying edits, 2) providing a few minor editorial, formatting, and visual changes to the technical content, and 3) eliminating the Acknowledgement and Preface sections. The intent is to preserve the historical record of the document while discontinuing maintenance of the technical material, as MIL-STD-46855A stands as the authoritative source of Human Engineering (HE) principles and practices.

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FOREWORD

This Bulletin was originally prepared by Government Electronics & Information Technology Association (GEIA) G-45 Committee under the guidance of both government and industry members of the Department of Defense (DoD) Human Factors Engineering (HFE) Technical Advisory Group (TAG). Authority for the document was later transferred to the G-45 Committee of SAE International.

The purpose is to issue a Human Engineering Best Practices document in support of the DoD's acquisition reform as expressed in Department of Defense Directive (DoDD) 5000.1 [1], Department of Defense Instruction (DoDI) 5000.2 [2], and the Defense Acquisition Guidebook [3].

This document was based on the cancelled MIL-H-46855, which was originally a consolidation of one Army, one Air Force, and two Navy specifications first issued in February 1968. In May 1994, following a re-definition of the term standard, MIL-H-46855B was revised and converted to a military standard, MIL-STD-46855. In January 1996, as part of standardization reform, MIL-STD-46855 was redesignated as MIL-HDBK-46855, Human Engineering Guidelines for Military Systems, Equipment, and Facilities. Because MIL-HDBK-46855 and its companion guideline, DoD-HDBK-763, were now both handbooks, it was decided to consolidate them into a new handbook: MIL-HDBK-46855, Human Engineering Program, Process, and Procedures. This document was used to guide DoD and contractor program managers and practitioners regarding analysis, design, and test aspects of the human engineering program.

This bulletin is based upon Section 4 of MIL-HDBK-46855A (May 1999) [4]. It has been edited to address both government and industry needs, and to include a list of, and links to, current Data Item Descriptions (DIDs) developed at the DoD and by the Federal Aviation Administration (FAA). A list of acronyms used in the document and the terms they represent is provided in Annex A (INFORMATIVE) Acronyms. A list of documents that give more information is provided in Annex B (INFORMATIVE) Bibliography.

MIL-HDBK-46855A was reinstated as a military standard in 2011, and HEB-1B serves to compliment that document.

1. SCOPE

This Engineering Bulletin and its annexes provide guidance on the application of Human Engineering principles and practices to the analysis, design, development, testing, fielding, support, accident investigation, and training for military and commercial products throughout their intended life cycles.

2. GENERAL GUIDELINES

2.1 Application and Nature of Work

Human Engineering (HE) should be applied during pre-development, development, and acquisition of commercial and military systems, equipment, and facilities to integrate humans effectively into the design of the system. An HE effort should be provided to:

- Develop or improve all human interfaces of the system;
- Achieve required effectiveness of human performance during system operation, maintenance, support, control, and transport;
- Make economical demands upon personnel resources, skills, training, and costs; and
- Improve human performance to maximize system performance.
- Effect safe, efficient life support, escape, search and recovery of personnel.

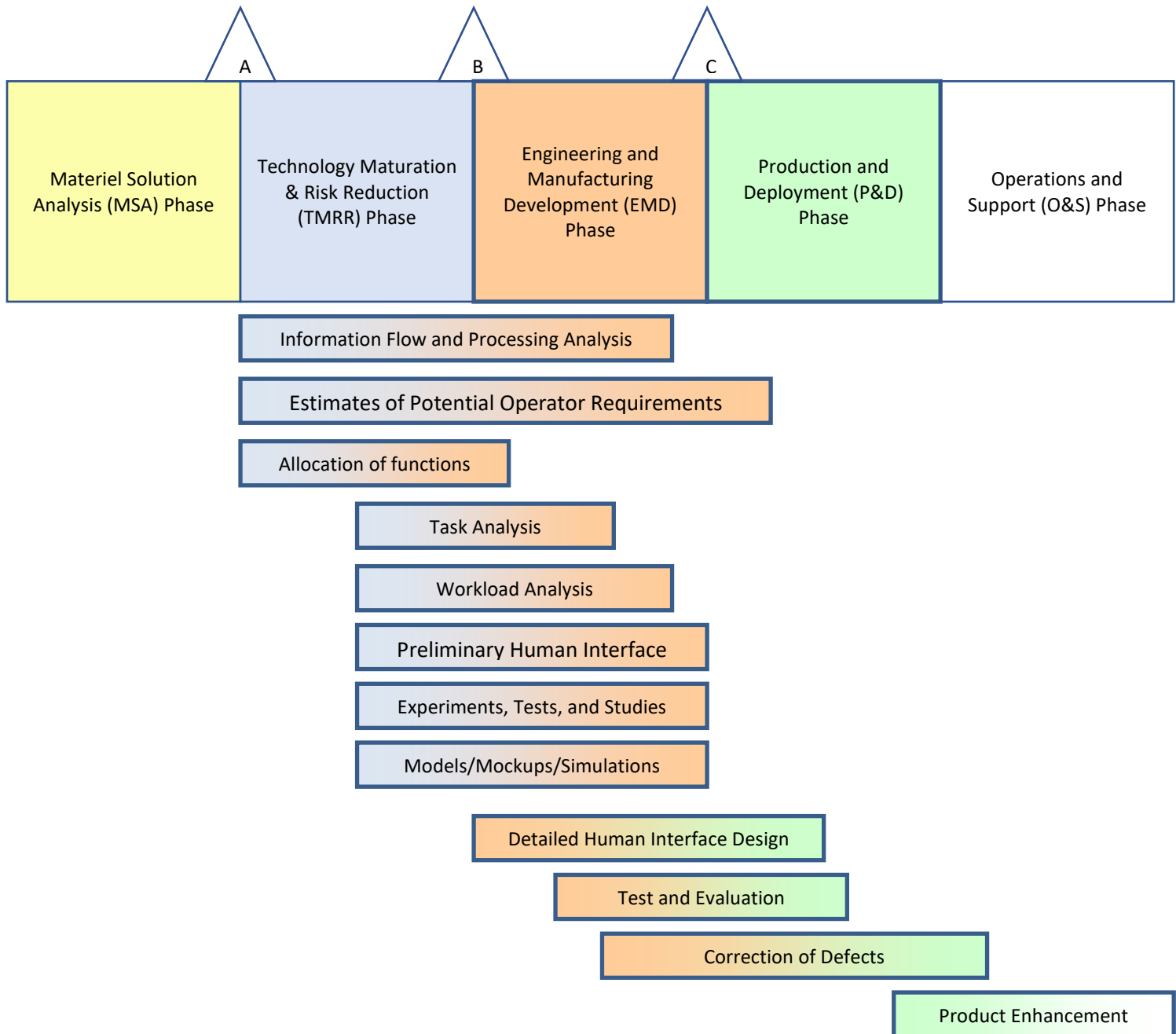


Figure 1 - Human engineering in the system acquisition process

The HE effort should include, but not necessarily be limited to, active participation in the following three major interrelated areas of system development.

2.1.1 Analysis

Starting with a mission analysis developed from a baseline concept of operations and operational scenario, the functions that must be performed by the system in achieving its mission objectives should be identified and described. These functions should be analyzed to determine their best allocation to personnel, hardware, software, or combinations thereof. Allocated functions should be further dissected to define the specific tasks that must be performed to accomplish the functions. Each task should be analyzed to determine the human performance parameters; the system, equipment, and software capabilities; and the tactical/environmental conditions under which the tasks will be conducted. Task parameters should be quantified where possible, and should be expressed in a form that permits effectiveness studies of the human-system interfaces in relation to the total system operation. HE high-risk areas should be identified as part of the analysis. Analyses should be updated as required to remain current with the design effort.

2.1.2 Design and Development

HE should be applied to the design and development of the system hardware, software, procedures, work environments, and facilities associated with the system functions that require personnel interaction. This HE effort should convert the mission, system, and task analysis data into (a) detailed 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. The HE design of a system should also take into account any requirements to interoperate with other systems and untrained personnel.

Human interface design is a multi-disciplinary task requiring the participation and coordination of experts from both sides of the interface. In order to develop a good human interface the people or organization involved should have demonstrated expertise in Human Engineering and the technical operating principles and procedures of systems for which the interface is being designed. Full design authority should reside within the team responsible for the user interface.

2.1.3 Test and Evaluation (T&E)

T&E should be conducted to validate and verify that commercial and military systems, equipment, and facilities can be operated and maintained in its intended operational environment, within the intended users' performance capabilities.

2.2 HE Program Planning

HE activities are described in a Human Engineering Program Plan (HEPP). The HEPP should be in accordance with the system specification, and should include the following elements: tasks to be performed, HE milestones, level of effort, methods to be used, design concepts to be used, and the T&E program. The HEPP components must be part of an integrated effort within the total project, and must be coordinated with related program disciplines.

2.3 Risk Management

Risk management procedures should be planned and implemented for the entire life cycle of the system. Human performance and HE design criteria issues that involve potential technical, cost, or schedule risks should be identified, analyzed, and prioritized as early as possible to establish provisions for eliminating the associated risks or reducing them to acceptable levels. Such provisions should be implemented and monitored during the HE program. HE should participate in defining the criteria for system acceptance to achieve operational suitability. Risk management should:

- Identify potential cost, schedule, design, and performance risks that result from design aspects of human-system integration;
- Quantify such risks and their impacts on cost, schedule, and performance;
- Evaluate and define the sensitivity of such risks to HE design;
- Identify alternative solutions to moderate- and high-risk HE problems and define the associated risks of each alternative;
- Take actions to avoid, minimize, control, or accept each HE risk.

- Document the identified risks, their impact, and the actions taken; and
- Ensure that human performance/design risk is an element of management awareness/control specification requirements.

2.4 Reviews

2.4.1 Major Technical Reviews

HE practitioners should participate in the major technical reviews, as applicable to the acquisition phases indicated, which include:

- Analysis of Alternatives
- System Requirements Review
- System Design Review
- Preliminary Design Review (PDR)
- Critical Design Review (CDR)
- System Verification Review

HE practitioners should also participate in other important technical activities that further HE efforts (e.g., mission analysis, and test and evaluation planning).

2.4.2 Subsystem Reviews

HE practitioners should also participate in subsystem reviews, including, where applicable, software specification, test readiness, and functional reviews (e.g., support, training, systems engineering, test, and manufacturing reviews).

2.5 Cognizance and Coordination

The HE program should be integrated into the total system program. In particular, HE should be coordinated with systems engineering, software engineering, RAM (reliability, availability, and maintainability), system safety, survivability/vulnerability, facilities engineering, Integrated Logistic Support (ILS) and Logistics Support Analysis (LSA), and other HE-related functions, including biomedical, life support, personnel survivability, habitability, personnel, and training functions. (See International Standards Organization (ISO) 13407 [5] for information on a human-centered design process for interactive systems). HE data should be provided for incorporation into Logistic Management Information (LMI). The HE effort should utilize the LMI reports as source data where possible. The HE portion of any analysis, design, or T&E program should be conducted under the direct cognizance of qualified HE practitioners assigned HE responsibility by the contractor.

2.6 Data

2.6.1 Traceability

Contractor documentation should provide traceability from initial identification of HE requirements during analysis or system engineering, through implementation of such requirements during design and development, to verification that these requirements have been met during T&E of approved hardware, software, and procedures.

2.6.2 Access

All data, such as plans, analyses, design review results, drawings, checklists, design and test notes, and other supporting background documents reflecting HE actions and decision rationale, should be maintained at the contractor's facilities and made available to the customer for meetings, reviews, audits, demonstrations, tests and evaluations, and related functions.