HF-STD-004a
September 27, 2016

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

STANDARD PRACTICE

HUMAN FACTORS ENGINEERING REQUIREMENTS

FOREWORD

All programs have processes. Processes can be ad hoc or standardized. The danger of using ad hoc processes is that they can increase risk to the program, increase the chance for confusion and cost overruns, and lead to missed opportunities for lessons learned. This document seeks to standardize the processes used for the human factors engineering of systems, thereby improving the processes overall and reducing risk.

Federal Aviation Administration (FAA) Order 9550.8, *Human Factors Policy*, establishes policy and responsibility for incorporating and coordinating human factors considerations in FAA programs and activities to enhance aviation safety, efficiency, and productivity. The Order states:

> "Human factors shall be systematically integrated into the planning and execution of the functions of all FAA elements and activities associated with system acquisitions and system operations. FAA endeavors shall emphasize human factors considerations to enhance system performance and capitalize upon the relative strengths of people and machines. These considerations shall be integrated at the earliest phases of FAA projects" (Section 8, p. 3).

Human factors should be considered in the context of the total system concept in which the operator, maintainer, and operating environment are integral components of the system. Several benefits can be expected when human factors principles are applied early in the lifecycle acquisition management process: increased performance, safety, and productivity; decreased lifecycle staffing and training costs; and better integration of human factors into the program's strategy, planning, cost and schedule baselines, and technical trade-offs.

Changes in operational, maintenance, or design concepts during the later phases of an acquisition are expensive and often entail high-risk program adjustments. Identifying lifecycle costs and human performance components of system operation and maintenance during investment analysis and requirements definition can decrease program risks and long-term operations costs. These benefits are applicable to commercial-off-the-shelf (COTS) and non-developmental items (NDI), as well as to developmental programs.

This standard has been generated for use by all organizations of the Federal Aviation Administration (FAA), primarily the program office performing an acquisition. It identifies the activities required for a successful human factors program. This standard includes the Data Item Descriptions and contractual language to ensure vendors have a strong human factors program.

This document (HF-STD-004a) describes human factors activities typically performed by vendors during system acquisition. It is written to accommodate a wide range of products, from small or simple equipment items to major or complex systems while avoiding overly restrictive requirements. It is intended to replace the earlier versions of HF-STD-004, as a complement to other FAA documents, including the *Human Factors Design Standard* (FAA-STD-001), the *Human Factors Job Aid* (Federal Aviation Administration, 2012), and other acquisition-related material. HF-STD-004 defines the requirements for a vendor's human factors program. The FAA's *Human Factors Design Standard* (HF-STD-001) contains specific design criteria. This document is intended to work as a complement to and in conjunction with the FAA's Human Factors Job Aid (Federal Aviation Administration, 2012). Whereas the Human Factors

Job Aid is intended to serve as a reference document for the human factors coordinator throughout the Acquisition Management System lifecycle (see FAST.FAA.GOV), this document focuses primarily on the Solution Implementation phase and the human factors concerns that should be addressed by a contractor developing the system. Although it uses language appropriate for contracts, it could also be used to guide government-conducted human factors tasks.

Contact Information

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FAA Human Factors Standards Program

The FAA's Human Factors Division (ANG-C1) under the Assistant Administrator for NextGen, Portfolio Management and Technology Development Office, has program management responsibility and coordinates the development and maintenance of FAA Human Factors standards that are levied in acquisition programs.
ANG-C1 point of contact: Dan Herschler, 202-267-9853

Human Factors and FAA's In-Service Decision Process

ANG-C1 also has a designated human factors subject matter expert who has signature authority for human factors items on the FAA Joint Resources Council (JRC) In-Service Review (ISR) Checklist. The JRC In-Service Decision (ISD) is the final required approval for transition from Solution Implementation to In-Service Management within the FAA's Acquisition Management System (AMS) acquisition program lifecycle. Human factors products developed under an acquisition program, particularly, those that result from performance of the human factors activities required in this standard, are artifacts that support the ISR Checklist signoff and ISD process. Refer to the AMS for additional detail.
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1. INTRODUCTION

1.1. Scope. This standard establishes and defines the requirements for applying human factors engineering to the design, development, and acquisition of systems, equipment, and facilities. These requirements include the work to be accomplished in conducting a human factors engineering effort integrated with the total system engineering and development effort.

Compliance with this standard will help reach the following goals:

a. The system design reflects appropriate consideration of the human component in the context of the task being performed.

b. The personnel- hardware-software combination meets system performance goals through proper design of hardware, software, and environment.

c. The design features will not constitute a hazard to personnel,

d. The system design will neither contribute to nor induce human error during system operations and maintenance.

e. The systems will be easy-to-use, preventing errors, supporting recovery from errors, and reducing task completion time.

f. The procedures for operating and maintaining systems are efficient, reliable, and safe.

g. The layout of the facility and the arrangement of equipment provide adequate access to workspace personnel and promote effective communication among team members.

1.2. Applicability. This standard applies to the development and acquisition of FAA systems, equipment (hardware and software), and facilities including developmental, commercial-off-the-shelf (COTS), and non-developmental items (NDI). However, not every requirement contained in this document may be applicable to every program or in every acquisition management phase. It is intended that these requirements be tailored to address the needs of each individual program or program phase. The level of analysis, breadth, and depth of human factors engineering tasks should be appropriate to the size, criticality, and intended use of the system.

This document is meant to be used as a complement to and in conjunction with the FAA's *Human Factors Job Aid* (Federal Aviation Administration, 2012). Whereas the *Human Factors Job Aid* is intended to serve as a reference document for the human factors coordinator throughout the Acquisition Management System lifecycle, this document focuses primarily on the Solution Implementation phase and the human factors concerns that should be addressed in developing or procuring a system.

2. APPLICABLE DOCUMENTS

2.1. Government Documents. The documents listed below are referenced in later sections of this standard.

Federal Aviation Administration. (2012). *Human factors acquisition job aid*. Washington, DC: Federal Aviation Administration.

Ahlstrom, V., & Longo, K. (Eds.). (2003). *Human Factors Design Standard for the acquisition of commercial-off-the-shelf subsystems, non-developmental items, and developmental systems* (HF-STD-001). Atlantic City International Airport, NJ: Federal Aviation Administration, William J. Hughes Technical Center.

United States Army Aviation and Missile Command. (2004). *Department of Defense Handbook. Definitions of Human Factors Terms* (Mil-HDBK-1908B). Red Stone Arsenal, Alabama.

Vendors should ensure the most up-to-date version is being used to meet design requirements. The latest version of the *Human Factors Design Standard* can be found at http://hf.tc.faa.gov/hfds. The latest version of the Human Factors Acquisition Job Aid can be found on FAST.faa.gov.

Another potentially useful government document:

Cardosi, K. M., & Murphy, E. D. (Eds.). (1995). *Human factors in the design and evaluation of air traffic control systems* (DOT/FAA/RD-95-3). Washington, DC: Office of Aviation Research.

3. OPERATIONAL DEFINITIONS[1]

Acquisition Management Process. The FAA executes its acquisition management policy by means of the lifecycle management process, which is organized into a series of phases and decision points. Key lifecycle phases are Service Analysis and Strategic Planning, Concept Requirements Definition, Initial Investment Analysis, Final Investment Analysis, Solution Implementation, and In-Service Management. More information on the lifecycle phases and decision points can be found in the FAA Acquisition System Toolset (FAST) at http://fast.faa.gov

Commercial-off-the-shelf (COTS). Any item or supply that is a commercial item sold in substantial quantities in the commercial marketplace; and offered to the Government, under a contract or subcontract at any tier, without modification, in the same form in which it is sold in the commercial marketplace.

Contract Data Requirements List (CDRL). A list of data requirements that are authorized for a specific acquisition and made part of the contract.

Contractor. A person or business that provides goods (e.g., systems, subsystems, equipment, components, facilities) or services to the FAA under the terms specified in a contract. It does not include those people or businesses that give administrative or other technical support services to FAA program offices.

Critical Task. A task requiring human performance which, if not accomplished under system requirements, will likely have adverse effects on cost, system reliability, efficiency, effectiveness, or safety. A task is also considered critical whenever equipment design characteristics demand human performance that approaches the limits of human capabilities.

Data Item Description. A description of the content and format of the data that is to be given to the government for a specific acquisition.

Early User Involvement Event (EUIE). An exercise in which users interact with an early iteration or prototype of a product prior to full development to evaluate developed components and identify issues early on in the development process. The process is repeated periodically as the product development progresses.

Hazard. A condition, event, or circumstance, which could lead to an unplanned or undesired event such as injury to personnel, damage to equipment or property, loss of material, or loss of function.

Heuristic Evaluation. A usability inspection method used to help identify design issues. It involves 3-5 trained human factors practitioners evaluating a product against recognized usability principles.

High Driver Task. A task required by the design of the product that is a significant contributor to the "cost of ownership" of the system.

Human-centered. The developmental framework that focuses on the users and the type of procedures, equipment, facilities and other component support they need in order to execute their duties.

Human Factors Engineering. The application of knowledge about human capabilities and limitations to system, equipment, or facility design and development to achieve efficient, effective, and safe system performance at minimum cost, manpower, skill, and training demands. Human factors engineering assures that the system, equipment, or facility design, required human tasks, and work environment are all compatible with the sensory, perceptual, mental, and physical attributes of the personnel who will operate,

[1] These definitions either came from fast.faa.gov (where indicated), from the previous version of HF-STD-004, or were provided by our subject matter experts. They were compared against definitions in MIL-HDBK-1908 (definitions of human factors terms) for consistency.

maintain, control, and support it. In this document, human factors and human factors engineering are used interchangeably.

Human Performance. A measure of human functions and actions in a specified environment, reflecting the ability of operators and maintainers to meet performance standards under the conditions in which the system, equipment, or facility will be employed.

Human Systems Integration. The concept and processes associated with optimizing total system performance via fully incorporating human factors considerations, synergies, and trade-offs (including human factors engineering, performance, and ergonomics; personnel attributes and abilities; safety; training; staffing levels; and occupational health) in program and operational requirements, analysis, design, development, testing, and implementation.

Must. Indicates a statement that it mandatory and must be complied with.

Non-Developmental Item (NDI). An item that is available in the commercial marketplace, including commercial off-the-shelf equipment; any previously developed item that is in use by a department or agency of the United States, a state or local government, or a foreign government with which the United States has a mutual cooperation agreement; or any item that requires only minor modification to meet the requirements of the FAA.

Risk. The expression of the impact of an undesired event in terms of event severity and probability.

Should. Indicates a procedure or statement that is recommended to comply with standard best practices.

Solution Implementation. Solution implementation is the phase of the lifecycle management process that begins after the investment decision authority selects a solution and establishes an investment program. It ends when the new capability goes into service. (http://fast.faa.gov)

System Acquisitions. Encompasses functions related to all FAA major and non- major acquisitions including developmental items, NDI, COTS procurements, research and technical services, product improvements, change proposals, prototypes, and other hardware and software acquisitions.

System Requirements Review (SRR). The SRR occurs when the service team meets with the contractor design team to clarify functional, performance, test, interface, cost, schedule, and deliverable requirements. The SRR is complete when the service team determines that action items resulting from the review are sufficiently completed. (http://fast.faa.gov)

Task Analysis. A systematic method used to develop a time-oriented description of personnel-system interactions, including tasks, actions, and cognitive processes, necessary to achieve an objective.

Vendor. Used synonymously with the term contractor, to indicate the company building the system.

4. GENERAL REQUIREMENTS

Scope and Nature of Work. Human factors engineering must be applied during all phases of system, equipment, and facility development and procurement to effectively support human performance with the design of the system. The human factors engineering effort must support human performance by developing or improving human-system interfaces to ensure consistency with human factors engineering standards; achieving required level of human performance during system operation, maintenance, control, and support; coordinating analyses and information with overall systems engineering and human systems integration efforts; evaluating system design alternatives and issues to ensure that human factors engineering issues are appropriately considered and addressed and that recommended alternatives meet or exceed human factors requirements; balancing demands upon personnel resources, taking into account skills, training, and costs; and participating in system analysis, design and development, and test and evaluation.

4.1. System Analysis. The analysis of a system is an important part of the system development and design process. When analyzing a system, the human factors practitioner must do the following:

a. Identify and describe the functions that the system must perform in achieving its objectives from the perspective of the human user.

b. Determine the allocation of functions to personnel, system, or combinations of personnel and system.

c. Define the specific user tasks that must be performed to accomplish the system objectives and human performance objectives.

d. Analyze each task to determine its human performance parameters; the criticality of the task in accomplishing the objective; and the environmental conditions under which the task is conducted.

e. Collect baseline performance, training, and resource data.

f. Define task requirements with objective, quantifiable metrics and express them in a form that permits effectiveness studies of the human-system interfaces in relation to the total system operation.

g. Apply established techniques, such as risk matrices, to identify and quantify human factors engineering risk areas and associated hazards.

h. Update analyses as required to remain current with the design effort.

4.2. Design and Development. Human factors engineering must be applied to the design and development of the system hardware, software, associated user interfaces, procedures, work environments, and facilities associated with all system functions requiring personnel interaction.

4.2.1. Convert into Detailed Design. The human factors design and development effort must convert the requirements, system, and task analysis data into a design that will operate within human performance capabilities, meet system functional, performance, and maintainability requirements, and accomplish system objectives within the intended operational environment.

4.2.2. Interoperability Requirements. The human factors design of a system must take into account the facility and workspace, as well as dependencies with other systems that affect or are affected by the system. Interoperability must account for physical, hardware, and data requirements.

4.3. Scaling Effort to Match System Size and Criticality. The level and extent of human factors tasks and analysis should be appropriate to the size, criticality, and expected use of the system being developed or procured.

4.4. Early Application of Human Factors Engineering in System Acquisition. In order to optimize performance and minimize costs, human factors engineering activities are required throughout the development process at each point where a user interacts with the system. Human system-performance impacts associated with proposed designs must be identified in order to reduce technical risks and lifecycle costs.

4.4.1. Take into Account Operator and Maintainer Capabilities and Limitations. Program decisions must take into account the operator and maintainer capabilities and limitations to avoid expensive redesign, training, or staffing increases.

4.4.2. Identify and Assess Opportunities. Through the use of human factors principles, practitioners must identify and assess opportunities to reduce lifecycle costs during acquisition or design.

4.5. Establish a Human Factors Program Plan to Structure Activities. Human factors engineering activities must be described in a Human Factors Program Plan (HFPP).

4.5.1. Include These Items in the Human Factors Program Plan. The HFPP must include the following elements

a. Tasks to be performed,

b. Human factors milestones,

c. Level of effort,

d. Methods to be used,

e. Design concepts to be used, and

f. Human factors input for the test and evaluation program.

4.5.2. Description of Human Factors Participation. The HFPP must include a description of human factors participation in system (hardware and software) design and collaboration with other program disciplines, including, but not limited to, safety, facilities, training, systems engineering and test, and personnel selection.

4.5.3. Use Qualified Human Factors Practitioners. The human factors program must be tailored by and executed by a qualified human factors practitioner (or practitioners), who are subject matter experts in the operational field (e.g., air traffic control, aviation, flight deck) working as an integrated member of the system engineering team. The qualifications of the personnel must be specified in the Personnel Qualifications Report.

4.5.4. Use of Existing Data Sources. The human factors engineering program must use existing data sources when available, such as

a. Prior task analyses,

b. Prior task inventories and taxonomies,

c. Job materials and job aids, and

d. Applicable information from Concept and Requirements Definition, Analysis of Alternatives, or Investment Analysis.

4.6. Test and Evaluation. Human factors engineering test and evaluation must be conducted to support design decisions.

4.6.1. Validation. Systems must be validated for operability and maintainability within intended operational environments by examination and provision of objective evidence that the systems conform to user needs and intended uses, and that the particular requirements implemented can be consistently fulfilled.

4.6.2. Verification. Systems must be verified for consistency, completeness, and correctness though objective evidence that the design meet all of the specified requirements for that phase.

4.7. Include Human Factors Engineering in System Reviews. Human factors engineering program and technical status must be reviewed in program, technical, design, subsystem and system reviews, including, but not limited to the following reviews:

a. Integrated Baseline Review (IBR)

b. System Requirements Review (SRR)

c. System Design Review (SDR)

d. System Specification Review (SSR)

e. Preliminary Design Review (PDR)

f. Critical Design Review (CDR)

g. System safety reviews

h. Test Readiness Review (TRR)

i. Production Readiness Reviews (PRR) [2]

[2] [fast.faa.gov AMS standard system milestones]

4.8. Program Integration. The human factors engineering activities must be integrated into the total system program and management.

4.8.1. Non-duplication of Efforts. The efforts performed to apply the human factors engineering principles and practices must be coordinated with, but not duplicate, efforts performed to fulfill other contractual program tasks.

4.8.2. Coordinated with Other Related Functions. Human factors engineering must be coordinated with systems engineering, system safety, facilities engineering, logistics support, and other human factors engineering-related functions including personnel and training functions.

4.9. Human Factors Engineering Data and Deliverables.

4.9.1. Traceability of Human Factors Engineering Data. A human factors practitioner involved in a human factors engineering effort must maintain documentation tracing the identification of human factors engineering requirements during analysis or system engineering, through implementation of such requirements during design and development, to the verification that these requirements have been met during test and evaluation of approved hardware, software, and procedures.

4.9.2. Duration of Data Maintenance. The human factors practitioner must maintain all relevant data that reflects human factors engineering actions and decision rationale for the duration of the effort. This data includes plans, analyses, design review results, drawings, checklists, design notes, and test notes.

4.9.3. Protecting Personally Identifiable Information. Data collection and maintenance must be compliant with FAA rules on protecting Personally Identifiable Information (FAA Order 1280.1B).

4.9.4. Copyrighted Material. All materials required by this standard must be free from all encumbrances that prohibit or limit their reproduction or use by the Government. These encumbrances include, but are not limited to, copyrighted materials, registered documentation, and software. All material developed and produced for the Government must be the sole property of the Government.

4.9.5. Clear, Understandable, and Usable. Materials developed as required by this standard must be clear, understandable, and usable with content that is complete, accurate, and effective in meeting the stated outcomes or purpose.

5. DETAILED REQUIREMENTS

Building upon the more general requirements outlined in the previous sections, this section provides detailed tasks and activities to be conducted as part of the human factors engineering program.

5.1. Human Factors Engineering in Analysis. This section specifies the various analyses that should be conducted to ensure the proper allocation of functions and to ensure that the tasks assigned to the human are within human capabilities and limitations. These analyses may be conducted and updated at any point in the acquisition lifecycle.

5.1.1. Analyze Human-System Performance Requirements. The human factors engineering practitioner must analyze the human-system performance requirements for the functions that must be performed in achieving the objective(s) within specified operational environments.

The analysis of human-system performance requirements is intended to identify how to meet the system performance objectives through proper functional allocation of tasks while considering the limitations and capabilities of the human operators and maintainers.

5.1.2. Use Existing Documents and Data. The human factors engineering practitioner must use existing relevant data on human-system functional requirements (such as from activities earlier in the acquisition lifecycle or similar efforts).

5.1.3. Apply Human Factors Engineering Principles. Based on the human-system performance analysis, human factors engineering principles and criteria must be applied to specify human-system performance requirements for system operation, maintenance, and support functions.

5.1.4. Conduct an Information Flow and Processing Analysis. The human factors engineering practitioner must perform analyses to determine the necessary information flow and processing necessary to accomplish the system objectives without assuming any specific hardware or software implementation or predetermined level of human involvement.

5.1.5. Describe Operator and Maintainer Roles. The human factors engineering practitioner must identify and define the human roles as part of the system and include estimates of performance in terms of productivity, workload, accuracy, rate, and time delay.

5.1.6. Estimate Impact on Operator and Maintainer Performance. The human factors engineering effort must produce estimates of how the decision to implement or not implement human factors engineering design recommendations is likely to affect operator and maintainer performance. Results from studies may act as supportive inputs for these estimates.

5.1.7. Determine the Allocation of Functions. The allocation of functions to hardware, software, or humans must incorporate the following factors:

a. Known constraints, projected human performance, and cost data,

b. The performance risks of making an incorrect decision for each alternative being evaluated,

c. The possibility of enhancing human or equipment capabilities through personnel selection and training, as well as through equipment and procedure design,

d. The results of trade-off analyses, and

e. The costs of personnel selection and training using trade studies and cost-benefit analyses.

5.1.8. Conduct Trade-off Analyses. The human factors engineering practitioner must conduct trade-off analyses.

The nature of trade-off and the magnitude, scope, and level of detail of the analysis will depend on both the acquisition phase and the system complexity. In conducting trade-off analyses, the primary goal is to optimize human performance to support capability and performance requirements for the system and minimize lifecycle cost. For example, a decision to allocate a specific function to the human must be evaluated with respect to the impact on increased staffing, personnel capabilities, additional training, and safety and health considerations. A decision to implement embedded training should consider the impact on system reliability, maintainability and effectiveness. A decision to reduce staffing by combining duties of two or more job categories into one multi-skilled individual should consider the impact on workload, personnel capabilities, and training.

5.1.9. Identify Solutions for Degraded Performance. The human factors engineering practitioner should identify ways to ensure that degraded human performance (e.g., due to fatigue) does not result in degraded system performance.

5.1.9.1. Identify issues that require changes to the system or tasks. The system design should be changed or the tasks restructured if an analysis of tasks, analysis of critical tasks, personnel workload, or other analysis identifies any of the following issues

a. Human-system interface design incompatibilities,

b. Excessive skill or physical requirements,

c. Overly costly staffing or training, and

d. Inadequate task performance.

5.1.9.2. Refine requirements as better information becomes available. Operator and maintainer information requirements—as well as control, display, and communication requirements—must be refined at appropriate times based on updated estimates of operator and maintainer capabilities and equipment capabilities.

5.1.10. Conduct an Analysis of Tasks and Workload. The human factors engineering practitioner must analyze tasks and workload using human factors engineering principles and best practices if an adequate task analysis or workload analysis does not already exist. Changes in job requirements due to the installation or application of new technology, new equipment, process changes, or redistribution of job responsibilities result in the need for a new or updated task analysis.

5.1.10.1. Conduct a task analysis. The task analysis must

a. Evaluate time requirements for tasks, considering time availability, task sequencing, and task simultaneity;

b. Quantify task requirements for criticality, accuracy, precision, and completeness;

c. Evaluate the effects of task feedback and error tolerance, and error recovery on performance;

d. Evaluate effects of sustained or repetitive operation on human performance;

e. Identify any tasks that reflect possible unsafe practices or show potential for improvements in operating efficiency;

f. Identify performance criteria;

g. Identify tasks and define situations where human decisions are made under conditions of uncertainty, time stress, or workload stress; and

h. Capture data for each task related to difficulty to learn, difficulty to perform and frequency of performance.

5.1.10.2. Conduct an analysis of critical tasks. The human factors engineering practitioner must conduct an analysis of critical tasks that identifies the

a. Information required by operator or maintainer, including cues for task initiation;

b. Information available to the operator or maintainer;

c. Information processing and decision evaluation process;

d. Decision reached after evaluation;

e. Action taken;

f. Body movements required by action taken;

g. Workspace envelope required by action taken;

h. Workspace available;

i. Location and condition of the work environment;

j. Frequency of action;

k. Time available for completion of the task;

l. Feedback informing operator or maintainer of the adequacy of actions taken or the failure to take an action;

m. Tools and equipment required, and their availability;

n. Number of personnel required, their skills, and aptitude requirements;

o. Probability and severity of human error;

p. Potential for error recovery and process for error recovery;

q. Job aids, training, or references required, and their availability;

r. Communications required, including type of communication, and channel performance including capacity;

s. Hazards involved;

t. Personnel interaction where more than one person is involved;

u. Performance criteria and performance limits of personnel;

v. Operational limits of hardware and software; and

w. Probability/severity of hazards associated with identified risks.

5.1.10.3. Analyze all operational modes. The human factors engineering practitioner must perform analysis for all operational modes including degraded and emergency modes of operation.

5.1.10.4. Identify problem areas and evaluate corrective actions. Each critical task must 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(s).

5.1.10.5. Conduct a workload analysis. The human factors engineering practitioner must conduct operator and maintainer workload analyses for individuals and teams in an environment as close to the expected operational environment as possible.

5.1.10.5.1. Repeat as needed throughout lifecycle. The workload analysis should be repeated at different phases of the system lifecycle if changes are made that could impact user workload, such as a more complete or improved prototype.

5.1.10.5.2. Compare against performance criteria. The results of workload analyses must

a. Be compared with performance criteria.

b. Evaluate the degree to which the demands of any task or group of tasks tax the attention, capacities, and capabilities of personnel to ensure that overloading and under-loading do not occur.

c. Consider the sensory, cognitive, and physiological limitations of personnel.

d. Define operational sequences and task times.

e. Relate required actions with team tasks for each task component (visual, auditory, motor, and cognitive) specified in terms of time, workload, mental effort, and psychological stress.

f. Define workload estimates that relate individual and team workload to operational procedures.

5.1.10.6. Conduct a personnel skills analysis. The human factors engineering practitioner must conduct an analysis that reports the number and type of personnel and their skills and aptitudes needed to operate, maintain, and support the system if that data does not already exist or if the system changes will impact the number and type or personnel, skills, and aptitudes.

5.1.10.7. Provide data from task and workload analyses. Data from task and workload analyses must be provided to the Government for other uses as required (such as developing preliminary staffing levels; equipment procedures; skill, training, and communication requirements; and integrated logistics support requirements).

5.1.10.8. Provide a basis for design decisions. The results of the task analysis must give a basis for making conceptual design decisions such as whether system performance and maintenance requirements can be met by the combination of anticipated equipment, software, and personnel without exceeding human capabilities.

5.1.10.9. Prepare timely updates. Analyses of tasks must be modified as required to remain current with the design and development effort and must be available to the program office.

5.1.10.10. Consider interaction with other systems. Analyses of tasks must take into consideration not just the interaction between the user and system but also the impact that other systems, facilities, and user actions have on the tasks.

5.1.11. Conduct a Training Analysis. The human factors engineering practitioner must conduct a training analysis to support the development of system training.

5.1.11.1. Content of training analysis. The analysis must identify the personnel who require training; the tasks that require training; training system and aids, including any requirements for embedded training; and training support required for the system including refresher training.

5.1.11.2. Identify methods of assessing training efficacy. The human factors engineering practitioner must identify methods that will be used to assess the efficacy of any training as well as plans for how shortfalls in training efficacy will be addressed.

5.1.12. Human Factors Engineering in Commercial-Off-The-Shelf (COTS) or Non-Developmental Item (NDI) Equipment Selection. Human factors engineering principles and criteria must be applied to identify and select the particular equipment to be operated, maintained, or controlled by personnel.

5.1.12.1. Select based on data. The selection of equipment must be based on the results of the performance, functional, task, and workload analyses.

5.1.12.2. Update selection criteria as new data becomes available. Equipment selection criteria must be updated as the supporting analyses are updated.

5.1.12.3. Design configuration to satisfy human factors engineering criteria. The selected design configuration must reflect human factors engineering

inputs, based on supporting data, to satisfy functional and technical human factors engineering requirements.

5.2. Human Factors Engineering in Design and Development. During design and development, the human factors engineering inputs and results from human factors engineering analyses must be converted into detailed engineering design features.

5.2.1. Design to Meet Performance Requirements. Design of the equipment must satisfy human-system performance requirements and meet the applicable criteria of HF-STD-001 and other human factors engineering criteria specified by the contract, as tailored for the specific system acquisition.

5.2.1.1. Test during design. Human factors engineering testing of the system or equipment must be implemented during design and must include such factors as verifying proper operation (by testing against established performance criteria), maintenance, and allocating adequate space and time for testing.

5.2.1.2. Evaluate during design reviews. Human factors engineering related items must be evaluated for adequacy during design reviews.

5.2.1.3. Maintain design continuity. Human factors engineering practitioners assigned human factors engineering responsibilities must maintain design continuity and participate in design reviews and engineering change proposal reviews of all end items that involve a human-system interface.

5.2.2. Participate in Preliminary System and Subsystem Design. Human factors engineering principles and criteria must be applied to system and subsystem designs.

5.2.2.1. Human factors engineering principles included in system and subsystem documentation. In compliance with contract data requirements, application of human factors engineering principles must be reflected in: design criteria documents; specifications; functional flow diagrams; system and subsystem schematics and block diagrams; interface control drawings; overall layout drawings; and related applicable drawings.

5.2.2.2. System and subsystem compliance with human factors engineering performance requirements and criteria. The preliminary system and subsystem configuration and arrangements must satisfy human-system performance requirements and comply with applicable human factors engineering design criteria as well as other human factors engineering criteria specified by the contract.

5.2.3. Conduct Experiments, Demonstrations, Surveys, and Studies. The human factors practitioner must conduct experiments, demonstrations (such as dynamic simulation and software prototyping), surveys, and studies as required to identify and resolve human engineering problems.

5.2.3.1. Use representative users in realistic environment. Experiments, demonstrations, surveys, and studies must be performed with representative users in the actual (or realistically simulated) user environment to validate design goals and system performance.

5.2.3.2. Conduct studies early and reiterate. Experiments, demonstrations, surveys, and studies must be accomplished as early as possible and reiterated as the design matures so that their results may be incorporated in the equipment design and, if necessary, used to revise initial function allocations.

5.2.3.3. Identify significant issues and effect on system. Any significant human factors engineering problem deemed resolvable only by major experiment, demonstration, survey, or study effort must be brought to the attention of the FAA program office; this notification must include the estimated effect on the system if the problem is not resolved.

5.2.3.4. Avoid duplication of effort if information already exists. To avoid duplication of effort, the applicability and utility of existing human factors engineering and other relevant databases (e.g., general literature, research reports, study reports) must be determined before initiating major efforts.

5.2.4. Use Models, Mockups, and Prototypes. Human factors engineering programs must use three-dimensional computer models, mockups, rapid prototyping, Graphic User Interface prototypes/mockups (e.g., Visio or PowerPoint), or computer-aided design/computer-aided manufacturing (CAD/CAM) methods to support the design of systems, subsystems, equipment, components, or facilities for which human performance will be a determinant of operational performance and maintenance effectiveness.

5.2.4.1. Provide models, mockups, and prototypes. Models, mockups, and prototype designs and analyses must be available during technical meetings and design reviews.

5.2.4.2. Minimize complexity. Models, mockups, and prototypes must be no more elaborate or expensive than is essential to represent those aspects of the human-system interface to be evaluated.

5.2.4.3. Provide a Graphical User Interface Design Document. When Graphical User Interface prototypes or mockups are used, the human factors practitioner must create a Graphical User Interface Design Document to capture the visual mockup and the design decisions stemming from evaluations of the mockup.

5.2.4.4. Incorporate anthropometrics into computer models for physical items. Computer models for physical items must be able to incorporate relevant anthropometric information (such as a suitable range of body sizes, clothing, and postures for evaluating 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 criteria; visual field; and strength).

5.2.4.4.1. Produce accurate, valid, and repeatable output. When used for predictive purposes, models must produce valid, accurate, and repeatable outputs.

5.2.4.5. Use three-dimensional mockups for physical items. At the earliest practical point in the development program, full-scale three-dimensional mockups of equipment involving critical human performance should be constructed.

5.2.4.5.1. Construct three-dimensional mockups early. Three-dimensional mockups must be constructed sufficiently early to ensure that

results of human factors engineering evaluations can influence design.

5.2.4.5.2. Use three-dimensional mockups as a basis for resolving problems. Mockups must give a basis for resolving operational use and maintenance access, workspace, and related human factors engineering problems, and for incorporating solutions into system design.

5.2.4.5.3. Consider functional mockups for critical performance areas. In those design areas that involve critical human performance and for which human performance measurements are necessary, development of functional mockups must be considered.

5.2.4.5.4. Use scale models. Scale models may be used to supplement three-dimensional computer models, rapid prototyping, CAD/CAM, or mockup methods for physical items, but should not be substituted for mockups unless such substitution provides equivalent, valid, repeatable, and accurate information in a cost-effective and timely manner.

5.2.4.6. Use dynamic mockups. Dynamic mockups (full-scale physical models that 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 and maintainer procedures and human-system interfaces, and identify any potentially unsafe procedures or unacceptable workload demands.

b. Evaluate the non-mechanical aspects of a design, such as communications, information requirements, and display formats.

c. Emulate human-system performance to derive estimates of performance for alternate design configurations and cost-effectiveness evaluations of variable staffing, personnel, and training parameters.

d. Evaluate environmental considerations.

e. Validate that the proposed design is suitable for operational use.

5.2.4.6.1. Consider transitioning technology. While the dynamic mockup equipment is intended as a design tool, consideration should be given to transitioning its technology to subsequent training simulators.

5.2.5. Review Engineering Drawings. The design, as reflected in engineering drawings, must comply with applicable human factors engineering design criteria such as that found in HF-STD-001.

5.2.5.1. Review of drawings with potential human impact. Human factors engineering practitioners must review layouts and drawings for all designs with potential impact on human performance or the human-system interface.

5.2.5.2. Identify unsafe or error-inducing designs. Human factors engineering practitioners must identify designs that may induce human error or be unsafe.

5.2.5.3. Reflect human factors engineering principles in drawings. Human factors engineering principles and criteria must be reflected in the engineering drawings and representations to ensure the final product can be used and maintained effectively, efficiently, reliably, and safely.

5.2.6. Participate in Work Environment and Facilities Design. Human factors engineering principles and criteria must be applied to detailed design of work environments and facilities to be used by system personnel.

5.2.6.1. Comply with human factors engineering design criteria. Drawings, specifications, and other documentation of work environments and facilities must reflect compliance with human factors engineering requirements and applicable human factors engineering design criteria such as HF-STD-001.

5.2.6.2. Design for performance under normal, emergency, and degraded conditions. The design of work environments and facilities that affect human performance under normal, emergency, and degraded mode conditions must incorporate at least the following, where applicable:

a. Adequate tactile/haptic, visual, and auditory interfaces between personnel and their equipment, including provision for proper eye position in relation to display surfaces and controls;

b. Provisions for addressing the effects of atmospheric conditions, such as temperature, humidity, and air flow;

c. Provisions for minimizing the effects of weather and climate;

d. Protection from physical and performance effects of acoustic noise (steady state and impulse), vibration, and impact forces;

e. Adequate space for personnel, their movement, and their equipment, including job aids;

f. Safe and efficient walkways, stairways, platforms, and ramps;

g. Provisions for minimizing physiological and psychological stresses;

h. Provisions for minimizing fatigue;

i. Allowance for the effects of clothing and personal protective equipment, such as gloves, masks, and cold weather clothing;

j. Equipment handling provisions, including remote handling provisions and tools when equipment and environment require them;

k. Provisions for safe and error-proof equipment installations;

l. Protection from chemical, biological, toxicological, radiological, thermal, mechanical, electrical, electromagnetic, and directed energy hazards;

m. Adequate illumination commensurate with anticipated visual tasks; and

n. Adequate space, clearance, and layout for normal ingress and egress and emergency escape from workstations and facilities.

5.2.7. Participate in Procedure Development. Based upon the human performance functions and tasks identified by human factors engineering analyses, the human factors practitioner must apply human factors engineering principles and criteria to the development of procedures for operating, maintaining, supporting, or otherwise using the system equipment throughout its intended lifecycle.

5.2.7.1. Human factors engineering must be applied to procedure development to

a. Ensure that the human functions and tasks identified through human factors engineering analyses are organized and sequenced for efficiency, safety, and reliability;

b. Give inputs to integrated logistics support where required; and

c. Give inputs to the development of operation, maintenance, training, and technical publications.

5.2.7.2. Minimize training demands. The development of procedures must minimize training demands.

5.2.7.3. Consider the population. The development of procedures must take into consideration the individual, organizational, and culturally diverse nature of the operational, maintenance, and support population.

5.2.7.4. Consider the interactions within and between groups. Procedures developed for system operations which involve multiple user groups must consider the human performance factors of individual user groups as well as interactions among the various user groups. (For example, procedures for air traffic control systems should address the activities of air traffic controllers, flight crews, dispatchers, and traffic flow managers, as well as the interactions among them.)

5.2.7.5. Use models, simulations, and prototypes to support procedure development. To the degree practical, the use of models, simulations, and prototypes should be used to support development of procedures.

5.2.8. Participate in Software Development. The human factors practitioner must apply human factors engineering principles to software architecture and design in those systems where software determines part of the human interface.

5.2.8.1. Ensure that controls and displays support effective data input and output. Human factors engineering must participate in the development of the function, look, feel, and content of controls and displays, including multifunction displays, to ensure that the human-computer interface supports effective and efficient data input and output, access to required information, and execution of decisions and commands.

5.2.8.2. Include automated system functions that require monitoring. Automated system functions that require human monitoring or intervention must be considered part of the human-system interface.

5.2.8.3. Consider multifunction controls and displays. Multifunction controls and displays that vary in function depending on system software must be considered part of the human-system interface.

5.2.8.4. Use a style guide. The software user interfaces should be developed using a style guide to define the general principles and guide the design and consistency of individual components.

5.2.8.5. Use models, simulations, and prototypes. Models, simulations, and prototypes must be used to support software development and user interface designs.

5.2.8.6. Use heuristic evaluation. Heuristic evaluations should be used to support software development and user interface designs.

5.2.8.7. Use early user involvement events. Early User Involvement Events should be used to support software development and user interface designs.

5.2.9. Review Manuals and Documentation. Human factors engineering principles and criteria must be applied to the development of operational, maintenance, and training manuals and documentation (electronic or hard-copy) to ensure thoroughness, relevance/efficacy, technical accuracy, appropriate reading level, appropriate level of technical sophistication, clarity, and quality of illustrations.

5.3. Establish Human Factors Engineering Test and Evaluation. The human factors practitioner must establish and conduct a human factors engineering test and evaluation program to

a. Verify that the system can be operated, maintained, and supported by the target population with the expected personnel attributes in the intended operational environments.

b. Measure system performance using quantitative metrics that are a function of the human interaction with equipment or software.

c. Confirm compliance with performance requirements.

d. Demonstrate conformance of system, equipment, and facility design to human factors engineering design criteria.

e. Determine whether undesirable design or procedural features have been introduced.

f. Verify efficacy of proposed training, training devices, and job aids.

5.3.1. Use Data from Experiments, Demonstrations, and Studies. The human factors engineering effort must make maximum use of the data (both quantitative and qualitative) collected from experiments, user events, demonstrations, and studies.

5.3.2. Conduct Verification of Complete System. The fact that individual tests and evaluations may occur at various stages in system, subsystem, equipment, or facility development must not preclude final human factors engineering verification of the complete system.

5.3.3. Test Normal, Emergency, and Degraded System Modes. The final system test must investigate operator and maintainer tasks in normal, emergency, and degraded system modes.

5.3.4. Integrate Testing. Human factors engineering testing using operational software must be incorporated into the system test and evaluation program and integrated into engineering design and development tests, demonstrations, and acceptance tests.

5.3.4.1. Test for compliance early. Compliance with human factors engineering requirements must be tested as early as possible.

5.3.4.2. Incorporate earlier findings. Human factors engineering findings from design reviews, mockup inspections, demonstrations, and other early engineering tests must be used in planning and conducting later tests.

5.3.4.3. Consider data from operational testing. Human factors engineering test planning must also consider data from operational testing.

5.3.4.4. Identify data to be collected and methods of analysis. Test planning must identify the data to be collected, the method(s) by which the data will be analyzed, the probability of achieving the stated goals (i.e., power analysis), and how the analysis will be used to support the overall findings of the testing.

5.3.4.5. Identify method of testing. Test planning must include methods of testing (e.g., use of checklists, data sheets, questionnaires, operating procedures, and test procedures), schedules, quantitative measures, test criteria, and reporting processes.

5.3.5. Implement Planned Test and Evaluation. Planned human factors engineering test and evaluation must be implemented upon approval by the program office.

5.3.5.1. Test documentation location. Test documentation (e.g., checklists, data sheets, questionnaires, operating procedures, and test procedures) must be available at the test site.

5.3.5.2. Human factors engineering portions of tests. Human factors engineering portions of all tests must include the following:

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

b. Critical tasks.

c. A representative sample of non-critical scheduled and unscheduled maintenance tasks that do not duplicate the tasks selected for a maintainability demonstration.

d. Proposed job aids, new equipment training programs, training equipment, and special support equipment.

e. Use of personnel who are representative of the range of the intended user populations in terms of aptitudes, skills, experience, relevant training, size, and strength; wearing suitable clothing and equipment appropriate to the tasks (use of personnel from the intended user population is preferred).

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

g. Identification of discrepancies between observed vs. expected task performance.

h. Criteria for acceptable performance.

5.3.6. Conduct Failure and Error Analysis. All failures occurring during test and evaluation must be subjected to a human factors engineering review to differentiate among failures of equipment, failures resulting from human-system incompatibilities, and failures due to human error.

5.3.6.1. Identify reason for occurrence. Human errors occurring in the performance of critical tasks must be analyzed to determine the reason for their occurrence.

5.3.6.2. Propose mitigation. The human factors practitioner must identify design characteristics or procedures that may contribute substantially to human error and propose corrective action.

5.3.6.3. Document failure and error analysis. Human errors occurring in the performance of critical tasks and the proposed corrective action must be documented and given to the Government upon request and upon the completion of the human factors engineering effort.

5.4. Human Factors Engineering Closeout Review. At the end of the Solution Implementation Phase but before the deployment of the system, the human factors practitioner must produce a human factors engineering closeout review document documenting the identified human factors issues and the actions taken to resolve the issues.

5.4.1. Confirm that there are no Outstanding Human Factors Engineering Issues that need to be Resolved Prior to Deployment. The human factors engineering closeout review document must identify and outstanding issues that need to be resolved prior to deployment.

5.4.1.1. Confirm that all identified human factors engineering actions have been closed. The human factors engineering review should confirm that all of the human factors engineering issues have been closed.

5.4.1.2. Include risk mitigation efforts. The human factors engineering review should include documentation of the efforts taken to reduce the risk of human error through engineering and design.

5.4.1.3. Identify any remaining risks. The human factors engineering review should identify open issues or risks that have not been reduced to an acceptable level and that may require additional organizational controls.

5.4.1.4. Identify lessons learned. The closeout review must identify lessons learned in the timing, resources, implementation, and process that may serve to improve the application of human factors engineering in future projects.

6. NOTES

6.1. Intended Use. This standard is intended for use in specifying human factors engineering tasking requirements for FAA systems, equipment (hardware and software), and facilities, cited contractually in statements of work (SOW). The use of this standard for acquisition does not preclude its utilization for in-house efforts.

6.2. Acquisition Requirements. Acquisition documents should specify the title, number, and date of this standard.

6.3. Associated Data Item Descriptions. The FAA Data Item Descriptions (DIDs), listed below, may be beneficial for a human factors engineering effort. Not all DIDs will be applicable to every acquisition. The application of these DIDs should be evaluated on a program-by-program basis.

6.3.1. Access and Ownership of Human Factors Engineering Data. For all of the DIDs, the contractor must give copies of the human factors engineering related data to the Government as requested and must turn over all human factors engineering related data and materials to the government at the end of the effort or the end of the contract, whichever comes first.

6.3.2. Transparency. For all of the tasks related to these DIDs, the relationship between a prime and subcontractor must be transparent to the Government and must not have a negative impact on the products received by the Government or Government data access.

6.3.3. Human Factors Engineering. The DIDs listed in this section are available in the appendices.

FAA-HF-DID-001A, Human Factors Program Plan
FAA-HF-DID-002A, Human Engineering Design Approach Document – Operator
FAA-HF-DID-003A, Human Engineering Design Approach Document – Maintainer
FAA-HF-DID-004A, Critical Task Analysis Report
FAA-HF-DID-005A, Human Factors Simulation Concept
FAA-HF-DID-006A, Human Factors Graphical User Interface (GUI) Design Document
FAA-HF-DID-007A, Human Engineering Systems Analysis Report
FAA-HF-DID-008A, Human Factors Training Analysis Report
FAA-HF-DID-009A, Early User Involvement Event Report
FAA-HF-DID-010A, Personnel Qualifications Report
FAA-HF-DID-011A, Human Factors Heuristic Evaluation

FAA-HF-DID-012A, Human Factors Engineering in System/Subsystem Review
FAA-HF-DID-013A, Human Factors Engineering Closeout Report

6.3.4. System Safety and Health Hazards.

FAA-DI-SAFT-101, Preliminary Hazard Analysis
FAA-DI-SAFT-102, System Safety Program Plan
FAA-DI-SAFT-103, Sub-System Hazard Analysis
FAA-DI-SAFT-104, System Hazard Analysis
FAA-DI-SAFT-105, Operating & Support Hazard Analysis
FAA-DI-SAFT-106, Health Hazard Assessment
FAA-DI-SAFT-107, System Safety Assessment Report
FAA-DI-SAFT-108, Safety Requirements Verification Table

6.3.5. Staffing, Personnel, and Training.

FAA-STD-028, DID-1, Personnel Qualification Report
FAA-STD-028, DID-2, Task and Skills Analysis Report
FAA-STD-028, DID-3, Cognitive Task Analysis Report
FAA-STD-028, DID-4, Commercial-Off-The-Shelf Training Materials Report
FAA-STD-028, DID-5, Training Development Plan

APPENDIX A. ACRONYM LIST

Acronym List

CAD/CAM	Computer-Aided Design/Computer-Aided Manufacturing
CDR	Critical Design Review
CDRL	Contract Data Requirements List
COTS	Commercial-Off-The-Shelf
DID	Data Item Description
EUIE	Early User Involvement Event
FAA	Federal Aviation Administration
FAST	FAA Acquisition System Toolset
GUI	Graphical User Interface
HEDAD-M	Human Engineering Design Approach Document – Maintainer
HEDAD-O	Human Engineering Design Approach Document – Operator
HFDS	Human Factors Design Standard
HFPP	Human Factors Program Plan
HF-STD	Human Factors Standard
IBR	Integrated Baseline Review
NDI	Non-Developmental Item
PDR	Preliminary Design Review
PRR	Production Readiness Reviews
SDR	System Design Review
SOW	Statement of Work
SRR	System Requirements Review
SSR	System Specification Review
TRR	Test Readiness Review

APPENDIX B. HUMAN FACTORS DATA ITEM DESCRIPTIONS

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Human Factors Program Plan (HFPP)	**HF-DID-001A**

3. DESCRIPTION / PURPOSE

3.1 The Human Factors Program Plan is the single document which describes the contractor's entire human factors program, identifies its elements, and explains how the elements will be managed.

3.2 This document is used by the procuring activity as the principal basis for approval of the contractor's program and is one basis for review of the contractor's progress.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)
June 03, 2016	ANG-C1

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the format and content preparation instructions for the Human Factors Program Plan (HFPP) resulting from the work tasks delineated in FAA HF-STD-004.

7. PREPARATION INSTRUCTIONS

7.1 Format. The HFPP format must contain all of the elements below.

7.2 Content. The HFPP must contain the following sections:

7.2.1 Table of contents, list of illustrations and introduction. The introduction must state the purpose of the HFPP and the scope describing the application of the plan and the Human Factors program.

7.2.2 Tailoring. The HFPP must be tailored to reflect the program needs, acquisition strategy, and phase of development.

7.2.3 Strategy. The HFPP must identify the Objectives of the system, the Goals and Requirements, the Constraints, and the Approach to be taken. This section must also describe the method(s) by which the contractor will identify and conduct trade-offs between human factors elements to enhance system performance; reduce total system costs; and ensure the system is designed to accommodate the characteristics of the user population that will operate, maintain, and support the system.

7.2.4 Organization. This section must identify and describe the contractor's primary organizational element responsible for complying with human factors requirements. The functions and internal structure of this element must be defined, including the main human factors point of contact, the human factors organization and roles and responsibilities. Structural definition must include the number of proposed personnel on an annual basis and summary job descriptions for each person. The structural definition must define how the human factors resources will be organized and managed to support the program. In addition, the relationships of this element to other organizational elements responsible for areas impacted by human factors, such as those charged with equipment and software design, safety, training, test and evaluation, integrated logistic support, and other engineering specialty programs (such as availability, reliability, maintainability, configuration management, and risk management) must be fully explained.

7.2.4.1 Human factors in subcontractor efforts. If any work related to system components or software having human interface is to be performed under subcontract, the subcontractor's organizational element responsible for human factors must be described to the same extent as the prime engineering requirements proposed for inclusion in each of these subcontracts. The method(s) by which the prime contractor monitors subcontractor compliance must be fully described and must be transparent to the government.

7.2.5 Program background. This section must describe the program including performance, features, Operational Concepts, the Program Schedule, and the Target Population Description. The contractor should use existing data where available and only include relevant information.

7.2.6 Human factors engineering risks and opportunities. This section should describe the potential human factors risks, problems, or enhancements. This section must describe the approach for identifying, documenting, validating, prioritizing, tracking, reporting, resolving, and mitigating human factors issues and risks over the life of the program. Describe the process for the trade-off of human factors issues and risks among human factors elements, and between human factors and other disciplines. Describe the procedure(s) for communication and conflict resolution.

Block 7, PREPARATION INSTRUCTIONS (continued).

7.2.7 Human factors tasks and activities. This section must identify the tasks and activities that need to be done to support the objectives of the human factors program. The tasks and activities must be described in terms of who, what, when and how and must specify the monitoring process for key requirements and progress points. Not all of the sections below will be applicable to every program.

7.2.7.1 Human factors in system analysis. This section must identify the human factors efforts in system analysis (or, where contractually required, in system engineering), as described in FAA HF-STD-004, which are contractually applicable, and the organizational element(s) responsible for their performance. Human factors participation in system mission analysis; determination of system functional requirements and capabilities; allocation of system functional requirements to human, hardware, or software; development of system functional flows; and performance of system effectiveness analyses, studies, and modeling must be fully described. Describe any analyses to be conducted in support of system definition. Any data required from the procuring activity must also be described.

7.2.7.2 Human factors in system detail design. This section must describe the human factors effort in system detail design to ensure compliance with the applicable provisions of the Human Factors Design Standard (FAA HF-STD-001) and other human factors requirements specified by the contract. Human factors participation in studies, tests, mock-up evaluations, dynamic simulation, detail drawing reviews, systems design reviews and system/equipment/component design and performance specification preparation and reviews must be fully described. Describe the planned involvement of end-user personnel in design activities and assessments. Finally, this section must propose tailoring of the Human Factors Design Standard as specifically applicable to the contract, additional to any tailoring already accomplished by the procuring activity or where exceptions and other tailoring changes are warranted. This proposed tailoring of the Human Factors Design Standard must identify specific provisions, by paragraph, as applicable. If no tailoring of the Human Factors Design Standard is proposed beyond that specified by the procuring activity, this must be stated.

7.2.7.3 Human factors in procedure development. This section must describe the human factors effort in procedure development to ensure compliance with FAA HF-STD-004. The methods must be stated by which the contractor must ensure that:

7.2.7.3.1 Operator and maintainer functions and tasks are allocated, organized, and sequenced for efficiency, safety, and reliability.

7.2.7.3.2 The results of this effort are reflected in operational, technical and training publications, and in training system design.

7.2.7.4 Derivation of staffing, personnel, and training requirements. This section must describe the methods by which the contractor must ensure that operator and maintainer staffing, personnel, and training requirements are based upon human performance requirements developed from system analysis data.

7.2.7.5 Human factors in test and evaluation. This section must describe human factors test and evaluation as an integrated effort within the contractor's total test and evaluation program and must contain specific information to show how and when the contractor will follow human factors test and evaluation requirements of FAA HF-STD-004. Design milestones must be identified at which human factors tests are to be performed to assess compatibility among human performance requirements, personnel aptitude and skill requirements, training requirements, and equipment design aspects of personnel hardware and software interfaces. Major test and demonstration objectives must be identified and proposed test methods must be described. This section must also identify the human factors personnel involved in test and evaluation, and a summary of the human factors test schedule. The summary test schedule must depict major human factors tests, evaluations, analyses, and demonstrations in relationship to major project milestones such as 90 percent design release, project level design reviews, first article demonstration tests, and commencement of procuring activity testing.

7.2.8 Human factors deliverable data products. This section must identify and briefly describe each human factors deliverable data product specified in the contract.

7.2.9 Time-phase schedule and level of effort. This section consists of a milestone chart which identifies each separate human factors effort to be accomplished and must state the level of effort (in person-months) for each task.

7.2.10 HFPP updating. This section must identify the administrative handling procedures for reviewing and revising the HFPP.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Human Engineering Design Approach Document – Operator	**HF-DID-002A**

3. DESCRIPTION / PURPOSE

The Human Engineering Design Approach Document – Operator (HEDAD-O) provides a source of data to evaluate the extent to which equipment having an interface with operators meets human performance requirements and human engineering criteria.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the format and content preparation instructions for the HEDAD-O related to the work tasks delineated in the FAA HF-STD-004.

7. PREPARATION INSTRUCTIONS

7.1 Reference documents. The applicable issues of the documents cited herein (including their approval dates and dates of any applicable amendments, notices, and revisions) must be as specified in the contract.

7.2 General. The HEDAD-O must describe the layout, detail design, and arrangement of workstation equipment having an operator interface; it must also describe operator tasks (see below) associated with the equipment. The HEDAD-O must describe the extent to which human performance requirements, the Human Factors Design Standard (HFDS) (FAA HF-STD-001), and other applicable human engineering documents specified in the contract have been incorporated into the layout, design, and arrangement of equipment having an operator interface. Findings from analysis of operator tasks must be presented as part of the rationale supporting the layout, design, and integration of workstation equipment.

7.3 Content. The HEDAD-O must contain the following workstation and operator-related information:

7.3.1 Equipment list. A list of each item of equipment having an operator interface and a brief statement of the purpose of each item of equipment. Separate lists must be provided for each operator's station.

7.3.2 Specification and drawing list. A list of specifications and drawings approved by human engineering at the time of HEDAD-O preparation. When contractually required to prepare and submit the HEDAD-O early in the development process, the list must also address documents where human engineering approval is planned.

7.3.3 Workstation description. Description(s) of the workstation(s), emphasizing human engineering design features. The following aspects of each workstation must be described:

7.3.3.1 Layout and arrangement. One sketch, drawing, or photograph of each workstation. These sketches, drawings, or photographs must contain operator and equipment related reference points (e.g., operator eye position, seat reference point) and scale. One sketch, drawing, or photograph of each item of workstation equipment must also be provided; the point of reference must be normal to the item of equipment and scale must be indicated.

7.3.3.2 Controls and displays. The layout and detail design of each control/display panel (or control/display areas independent of panels) must be described (e.g., brightness, resolution, contrast, color or other coding, control/display ratio, control force, and range characteristics). Display symbology, display formats, and control/display operation logic must be described with regard to intended use by the operator(s).

7.3.3.3 Operator vision. Operator vision to workstation items of equipment must be described using the operator's normal eye position(s) as the point of reference. When applicable, operator external vision must also be described using the operator's normal eye position(s) as the point of reference; extent of external vision must be related to system mission requirements.

7.3.3.4 Environmental factors. Noise, vibration, radiation, temperature, ambient illumination, climatic effects, and other relevant environmental parameters.

7.3.3.5 Workstation lighting. Workstation lighting characteristics and lighting control systems.

7.3.3.6 Workstation signals. Workstation signals including warning, caution, and advisory signals must be described with regard to signal characteristics, signal meaning, signal consequences, operator procedures, cause of signal activation, and operator control over signal characteristics.

7.3.3.7 Operator posture control. Operator posture control including seating, restraint systems, and other postural control techniques.

7.3.3.8 Communication systems. Communication systems and communication systems control.

7.3.3.9 Special design. Special design, layout, or arrangement features if required by mission or system environment.

7.3.3.10 Multiple operator stations. Multiple operator station design must be described where applicable. Rationale for number of operators, arrangement of operators, and allocation of functions to the operators must also be described.

Block 7, PREPARATION INSTRUCTIONS (continued).

7.3.4 Workstation geometry. Workstation geometry must be described using the seat reference point or operator's eye position(s) as a reference point. The position of each control, display, panel, etc., must be described in terms of three - dimensional space (X, Y, Z coordinates); operator eye position must be described in terms of system design coordinates or as zero (X), zero (Y), and zero (Z). The center of each panel, display, control, etc., must be used as the equipment point of reference. True angle to vision to each item of equipment must also be shown.

7.3.5 Human engineering design rationale. Rationale for human engineering design, layout, and arrangement of each item of workstation equipment having an operator interface must be described. The specific considerations of system function; equipment operation; operator selection, training, and skill requirements; operator task performance requirements; and limitations imposed on designs by the procuring activity or state-or-the-art must be described. The basis for reaching specific design, layout, and arrangement decisions must be presented (e.g., HFDS criteria, other human engineering requirements specified in the contract, system engineering analyses, systems analyses, human engineering studies, trade-off analyses, mock-up results, simulation results, and human engineering results).

7.3.6 Analysis of operator tasks. Results from analysis of operator tasks must be presented as part of the rationale for workstation design, integration, and layout. The following must be described: methodology used to generate task analysis results (e.g., paper and pencil, computer-based simulation, dynamic simulation); system function(s), or other exogenous information used to "drive" the task analysis; human performance data (i.e., time and error) against which task analysis results are compared; and operator assumptions (e.g., level of skill, training). Critical tasks must be clearly identified. If the required data is available through other reporting media, such as a task inventory report or task performance analysis report, they must not be duplicated, but must be referenced or appended to the HEDAD-O along with appropriate supplementary information fulfilling the intent of this provision.

7.3.7 Deviations. Narrative which provides rationale for any need to deviate from, or take exception to, the HFDS or other human factors engineering best practices.

7.3.8 Alternatives to baseline design. Sketch, drawing, or photograph of each item of equipment being considered as alternatives or changes to the selected (baseline) workstation design.

7.3.9 Design changes. Design, arrangement, or layout changes made since the last HEDAD-O preparation.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Human Engineering Design Approach Document – Maintainer	**HF-DID-003A**

3. DESCRIPTION / PURPOSE

The Human Engineering Design Approach Document – Maintainer (HEDAD-M) provides a source of data to evaluate the extent to which equipment (hardware and software) having an interface with maintainers meets human performance requirements and human engineering criteria.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the format and content preparation instructions for the HEDAD-M resulting from the work tasks delineated in FAA HF-STD-004.

7. PREPARATION INSTRUCTIONS

7.1 Reference documents. The applicable issues of the documents cited herein (including their approval dates and dates of any applicable amendments, notices, and revisions) must be as specified in the contract.

7.2 Format. The HEDAD-M format must present the information in two major parts:

7.2.1 Information pertaining to maintenance actions performed at the deployed site.

7.2.2 Information pertaining to maintenance actions performed at other maintenance levels.

7.3 General. The HEDAD-M must describe the characteristics, layout, and installation of all equipment (hardware and software) having a maintainer interface; it also must describe maintainer tasks associated with the equipment. The HEDAD-M must describe the extent to the requirements of the Human Factors Design standard (HFDS), FAA HF-STD-001, and other applicable human engineering documents specified in the contract have been incorporated into the design, layout, and installation of equipment having a maintainer interface. Results from analysis of maintainer tasks must be presented as part of the rationale supporting the layout, design, and installation of the equipment. The requirement for this information is predicated on the assumption that analytic and study information is developed sufficiently early to influence the formulation of other system data such as maintenance allocation charts, special repair parts, tool lists, and logistic support data. If the required data is available through other reporting media, such as those noted above, a task inventory report or task performance analysis report must not be duplicated, but must be referenced or appended to the HEDAD-M along with appropriate supplementary information fulfilling the intent of this provision.

7.4 Content. The HEDAD-M must contain the following:

7.4.1 Equipment list. A list of each item of equipment having a maintainer interface, and a brief statement of the purpose of each item of equipment and types of maintenance required on each item of equipment (e.g., troubleshoot, remove, inspect, test, repair).

7.4.2 Specification and drawing list. A list of specifications and drawings, approved by human engineering at the time of HEDAD-M preparation. The list also must address documents where human engineering approval is planned.

7.4.3 System equipment description. Description(s) of the system equipment, emphasizing human engineering design features. The following aspects of each workstation must be described:

7.4.3.1 Layout and arrangement. The location and layout of all system equipment requiring maintenance with emphasis on human engineering features that facilitate maintenance. Equipment located in areas assessed through common doors, panels, openings, etc., must be indicated. The location of each item of equipment must be noted in terms of three-dimensional space (i.e., X, Y, and Z coordinates); the reference point for each item of equipment must be its center as viewed by the maintainer while gaining access to the equipment.

7.4.3.2 Design of equipment. The design of each item of equipment with emphasis on human engineering features that facilitate maintenance such as handles, self-test capability, labeling, connector spacing, and keying.

7.4.3.3 Installation of equipment. The installation of each item of equipment with emphasis on human engineering features that facilitate maintenance such as fasteners, clearances, relationship between accessibility and failure rate (or scheduled maintenance frequency) of each item of equipment, and visual access afforded.

7.4.4 Rationale. The specific considerations of equipment maintenance requirements (e.g., frequency, criticality, equipment failure rate), maintainer requirements (e.g., personnel selection, training, and skills), maintainer tasks requirements, environmental considerations, safety, and limitations imposed by the procuring activity or state-of-the-art. The bases for reaching specific design, layout, and installation decisions must be presented (e.g., HFDS criteria, other human engineering requirements specified in the contract, human engineering studies, trade-off analyses, mock-up results, and human engineering test results).

7.4.5 Special tools, support equipment, and aids. A list of special tools, support equipment, and job aids/devices required for maintenance of each item of equipment.

Block 7, PREPARATION INSTRUCTIONS (continued).

7.4.6 Analysis of maintainer tasks. Results from analysis of maintainer tasks must be presented as part of the rationale supporting layout, design, and installation of items of equipment. Analysis of maintainer tasks must consist of the following: task number, task title, task frequency (for scheduled maintenance actions) or estimated task frequency (based on equipment mean-time-between-failures for unscheduled maintenance actions), data source used (e.g., drawing number, sketch number, development hardware, actual production equipment), detailed task sequence, support equipment required, tools required, job aids required, estimated task time, estimated personnel requirements (e.g., number of personnel required, skills and knowledge required), and human engineering considerations which reflect specific human engineering requirements incorporated into the design (e.g., maintainer fatigue, potential hazards, safety or protective clothing/equipment required or recommended, access problems, maintainer communication requirements, special task sequence requirements, labeling). As applicable, the following types of maintainer tasks must be addressed by the analyses of maintainer tasks: remove/replace, troubleshoot (fault location), repair, adjust, inspect, service, and test. Tasks requiring critical human performance must be clearly identified.

7.4.7 Deviations. Narrative which provides rationale for any need to deviate from, or take exception to, the HFDS or other contractual human engineering requirements.

7.4.8 Maintainer interface depictions. A sketch, drawing, or photograph of each item of equipment having a maintainer interface. Each item of equipment must be depicted:

7.4.8.1 By itself from top, front, and side (three-view trimetric or exploded trimetric view) and

7.4.8.2 Installed as the maintainer would normally view it during maintenance.

7.4.9 Alternative installations or layouts. A sketch, drawing, or photograph of each item of equipment being considered as an alternative to the selected, or baseline design. A sketch, drawing, or photograph of alternative equipment installations or layouts that exist at the time of HEDAD-M preparation must be provided.

7.4.10 Design changes. Design, arrangement, or layout changes made since the last HEDAD-M preparation.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Critical Task Analysis Report	**HF-DID-004A**

3. DESCRIPTION / PURPOSE

The Critical Task Analysis Report describes the results of analyses of critical tasks performed to provide a basis for evaluation of the design of the system, equipment, or facility, verifying that human factors technical risks have been minimized and solutions are in hand.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the format and content preparation instructions for the data product(s) generated by the specific and discrete task requirements as delineated in FAA HF-STD-004.

7. PREPARATION INSTRUCTIONS

7.1 Process. Existing task analyses, workload models, and other relevant data provided as government-furnished information must be used during the development of the task analysis so that existing data are not duplicated. The analysis must be provided in draft form and the contractors must incorporate FAA comments and submit a revised draft for review until the FAA considers the deliverable adequate. After the analysis has been approved in draft form, the contractors will track all changes made in the sequence of content or training.

7.2 Content. Introductory information. Introductory information must include name of system, date, contractors name and contractor number, applicable source references, purpose and scope of document, organization of document, description of procedures used to conduct the analysis.

7.3 Content. Body of report. The Critical Task Analysis Report must describe the results of the analysis of each critical task including:

7.3.1 Task data including the Job, duty, Task, Subtask, Element, and Subelements that are essential to job performance regardless of the frequency with which they are performed.

7.3.2 The name and description of each critical task for all affected missions and phases including degraded modes of operation. Information on each critical task must be provided to a level sufficient to identify operator and maintainer problem areas that can adversely affect mission accomplishment and to evaluate proposed corrective action. For each critical task, identify the following:

7.3.2.1 Information required by the operator and maintainer, including cues for task initiation.

7.3.2.2 Information available to the operator and maintainer.

7.3.2.3 Actions that each performer must complete to accomplish the critical task, including responses to specific information, responses to combinations of information, and self-initiated actions.

7.3.2.4 Decision evaluation process.

7.3.2.5 Decision reached after evaluation.

7.3.2.6 Action taken.

7.3.2.7 Body movement required by action taken.

7.3.2.8 Workspace envelope required by action taken.

7.3.2.9 Workspace available.

7.3.2.10 Location and condition of the work environment.

7.3.2.11 Frequency and tolerances (permissible limits or limits of variation) of action.

7.3.2.12 Time available for completion of the task.

7.3.2.13 Feedback informing operator or maintainer of the adequacy of action(s) taken.

7.3.2.14 Tools and equipment required.

7.3.2.15 Number of personnel required, their specialties, and experience.

7.3.2.16 Job aids, training, or references required.

7.3.2.17 Communications required, including type of communication.

7.3.2.18 Hazards involved.

7.3.2.19 Operator or maintainer interaction where more than one crewmember is involved.

7.3.2.20 Performance limits of personnel.

7.3.2.21 Operational limits of hardware and software.

7.3.3 Rate the level of criticality for the tasks from 1 (Low) = incorrect or delayed performance does not affect safety or system operations, 2 (Moderate) = incorrect or delayed performance has no direct or indirect effect on extreme critical tasks and/or incorrect or delayed performance could indirectly affect system operations, 3 (High) = incorrect or delayed performance could indirectly affect safety and/or incorrect or delayed performance could directly affect system performance, 4 (Extreme) = incorrect or delayed performance could directly affect safety (result in the loss of life and/or p[property).

7.3.4 Identify the functional consequences and cumulative consequences of each operator or maintainer critical task with respect to the effects upon the immediate subsystem functions and the overall system mission.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Human Factors Simulation Concept	**HF-DID-005A**

3. DESCRIPTION / PURPOSE

The Human Factors Simulation Concept describes the contractor's intended use of mockups and simulators in support of human factors analysis, design support, and test and evaluation.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the format and content preparation instructions for the Human Factors Simulation Concept resulting from applicable tasks delineated in FAA HF-STD-004. This document may be used by the procuring activity to assist and assess simulation approaches when there is a need to resolve potential human performance problems, particularly where government facilities, models, data, or participants are required.

7. PREPARATION INSTRUCTIONS

7.1 Reference documents. Any reference documents used in the development of the simulation concept must be properly cited.

7.2 Content. The Human Factors Simulation Concept must contain the following information:

7.2.1 General description and rationale. The need for a mockup or simulator program, the overall simulation concept, and the anticipated benefits must be described. The interrelationships between mockups, simulators, and other human factors analysis, design support, and test and evaluation techniques must be described.

7.2.2 Techniques. Each simulation technique and procedure proposed by the contractor must be fully described, including the rationale for the selection of the technique(s). The specific contributions of each technique to human factors analysis, design support, and test and evaluation must be identified. Previous efforts conducted by the contractor or others to validate each proposed technique must be described, including a discussion of results.

7.2.3 Intended Use. The intended use of each simulation technique must be described with regard to the following:

7.3.2.1 Human performance and workload analysis, test, and demonstration.

7.3.2.2 System design development, test, and demonstration.

7.3.2.3 System effectiveness studies, operational and use concepts development, and verification.

7.3.2.4 Development and verification of operator skill, knowledge, and other training data.

7.3.2.5 Operator procedures development and verification, including degraded mode and emergency procedures.

7.3.2.6 Training equipment design and verification studies.

7.3.2.7 Development and verification of technical publications.

7.2.4 Schedule. A detailed schedule must be provided. Compatibility between the simulation schedule and the release of program analyses, design, and test products for each area of utilization listed above, must be described.

7.2.5 Facilities and special requirements. Simulation facilities must be described. Any requirements to utilize government facilities, models, data, or other government property must be identified. If the contractor requires participation by government personnel (e.g., as subjects in simulation studies), appropriate information must be provided, such as number and qualifications of personnel, desired level of participation, and schedule of participation.

7.2.6 Scenarios description. The scenarios to be simulated must be described. Information on mission objectives, location, weather conditions, workload, or any other data relevant to system simulation must be presented.

7.2.7 Organizational personnel. The simulation concept must identify the organizational elements responsible for executing the simulation(s). The relationships between the organizational elements must be described, including the authority delegated to each element. The number of personnel, level of effort, and responsibilities and authorities of key personnel must be identified.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Human Factors Graphical User Interface (GUI) Design Document	**HF-DID-006A**

3. DESCRIPTION / PURPOSE

The Human Factors GUI Design Document provides a visual representation of the results of GUI prototyping along with explanations and the documentation of the history behind the decisions.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the format and content preparation instructions for the Human Factors GUI Mockup Walkthrough resulting from applicable GUI prototyping tasks delineated in FAA HF-STD-004.

7. PREPARATION INSTRUCTIONS

7.1 Content. The Human Factors GUI Design Document must contain the following information:

7.1.1. Title, date, description of prototyping methods, description of participants.

7.1.2. Visual representation (such as screen shots) of the graphical user interface.

7.1.3. Identification of relevant graphic element.

7.1.4. Explanation of how the graphical user interface works including the function of the relevant elements.

7.1.5. Relevant history of the graphical user interface elements including design decisions stemming from the evaluation of the prototype, how each element was changed, why it was changed, and relevant tradeoffs that were considered in the decision-making.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Human Engineering Systems Analysis Report	**HF-DID-007A**

3. DESCRIPTION / PURPOSE

3.1 The Human Engineering Systems Analysis Report (HESAR) describes the human engineering efforts conducted as part of system analysis and provides data resulting from that analysis.

3.2 The data are used by the procuring activity to evaluate the appropriateness and feasibility of system functions and roles allocated to operators, maintainers, and support personnel.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the format and content preparation instructions for the data delivered resulting from the work task(s) delineated in the contract statement of work (SOW).

7. PREPARATION INSTRUCTIONS

7.1 Content. The Human Engineering Systems Analysis Report (HESAR) must contain the following sections:

7.1.1. Systems objective(s). The system objective(s) must be described. If the objective(s) are to be met by the system operating in conjunction with other systems not within the scope of the contract, the following must also be described:

7.1.1.1 The overall (or higher level) objective(s) to be met through the combined operation of systems.

7.1.1.2 The sub-objective(s) to be met by the system being developed under the contract.

7.1.1.3 Interactions required between systems to meet the overall objective(s).

7.1.2. System mission(s). The system mission(s) must be described. The mission description(s) must describe the operational and physical environmental context(s) within which the system will meet its objective(s).

7.1.2.1 The organizational structure of the system and required communication with other operators or support personnel must be described. This may include the various system or operational modes and associated environments.

7.1.2.2 For legacy systems, any changes between the current and future mission environment must be identified and described.

7.1.2.3 Any special requirements or considerations due to environmental factors or equipment must be identified.

7.1.3. Scenarios. The system scenarios must be identified as follows:

7.1.3.1 Mission use scenarios. Mission scenarios must be provided that describe the high-level system functionality.

7.1.3.2 Operational use scenarios. Operational use scenarios must be provided that describe the individual operations that are used to fulfill the mission scenarios, either individually or in sequence to complete the mission scenarios. The operational use scenarios must be representative of actual system use. The operational use scenarios must describe the sequence of actions taken by the operator and performed by the system for different system operations, and may include high-level scenarios as well.

7.1.4. System functions. The system functions that must be performed to meet the system objective(s) within the mission context(s) must be described.

7.1.5. Allocation of system functions. The allocation of system functions must be described and must specifically address:

7.1.5.1 Information flow and processing.

7.1.5.2 Estimates of potential operator, maintainer, and support personnel requirements.

7.1.5.3 Allocation of functions to the system and to the human.

7.1.6. Equipment identification. The selected design configuration must be described. Hardware and software component descriptions, including remote or external elements, must be provided.

7.1.7. Subsystems. Any subsystems defined during the system analysis and design process must be identified.

7.1.8. Internal interfaces. The interfaces between internal system elements must be described.

7.1.9. External interfaces. The interfaces to external elements must be described.

7.1.10. Personnel elements. The personnel required to operate, maintain, and support the system must be identified.

7.1.10.1 Personnel descriptions. The numbers and types of operators, maintainers, and support personnel of the system must be identified. This must include the minimum number of personnel required to operate, maintain, and support the system during any given shift.

(a) Any special requirements that personnel must possess must be identified.

(b) Any assumptions made about the system or the personnel that influence the design of the system must be identified.

Block 7, PREPARATION INSTRUCTIONS (continued).

(c) Any derived requirements that are a result of analysis that influence design decisions or that are critical to system performance must be identified.

(d) An estimate (in percent) of the target population, by gender, that the system design will accommodate must be provided.

(e) Any special strength requirements that personnel must possess must be identified.

7.1.10.2 Roles. The specific roles in the system (e.g., supervisor, operator, maintenance technician) must be identified.

(a) The specific function(s) performed for each role must be identified.

(b) Any assumptions made about the personnel roles that affect or influence design decisions must be identified.

(c) Any assumptions made about the roles or the ability of personnel to fulfill these roles must be identified.

7.1.10.3 Profiles and skills. The personnel who will fulfill the system roles, including prerequisites such as rank and years of experience, must be identified and described.

(a) The required skill sets of the system personnel (e.g., education, reading level, technical prerequisites, and occupational specialties) must be identified.

(b) Any assumptions made about the system personnel must be identified.

7.1.11. Operational procedures.

7.1.11.1 Setup. Any required setup operations must be described.

7.1.11.2 Startup. System startup operations must be described.

7.1.11.3 Normal operations. Operations under normal working conditions must be described.

7.1.11.4 Failure modes. Operations when failure conditions occur must be described.

7.1.11.5 Emergencies. Operations under emergency situations must be described.

7.1.11.6 Shutdown. System shutdown operations must be described.

7.1.12 Support. A description of the system support must be provided.

7.1.12.1 Provisioning. The provisioning requirements and operations to fulfill those requirements must be listed.

7.1.12.2 Maintenance. The maintenance requirements and operations that need to be performed on the system must be listed.

(a) Any special maintenance needs, tools, or equipment must be identified.

(b) All assumptions regarding who will complete the maintenance and where the maintenance will be performed must be provided.

(c) If there is a legacy system, any changes in maintenance requirements between the legacy system and the system being developed must be described.

7.1.12.3 Training. Any training that needs to be developed to educate personnel on the use, operation, and maintenance of the system must be described.

(a) The training type, duration, and format must be identified.

(b) Any additional training, specialized training, or prerequisites must be identified.

(c) If there is a legacy system, any changes in training requirements between the legacy system and the system being developed must be described.

7.1.12.4 Deployment. Where the system is to be deployed and in what configuration must be identified.

7.1.12.5 Upgrade methodology. The process for upgrading the system hardware and/or software over the lifecycle of the program must be described.

7.1.13 Security. A description of the physical and information security requirements of the system must be provided. This description must include the security requirements for the operational and non-operational environment (e.g., trusted systems, multi-level security schemes, or multi-tiered physical security levels).

7.1.13.1 The concepts for addressing the security issues in the system must be identified.

7.1.13.2 A description of where security requirements are addressed and met (e.g., when log-on and passwords are required and performed) must be provided.

7.2 Referring to other content. For any section above whose content is substantially covered in another document (e.g., system architecture documentation, concept of operations, system design analyses), the contractor has the option to provide the required content in the HESAR, or to provide a summary of the content and reference or link to the document section(s) that contain(s) the content.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Human Factors Training Analysis Report	**HF-DID-008A**

3. DESCRIPTION / PURPOSE

The Human Factors Training Analysis Report describes the results of the training analysis as described in HF-STD-004.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the format and content preparation instructions for the Human Factors Training Analysis Report resulting from the training analysis tasks delineated in FAA HF-STD-004.

7. PREPARATION INSTRUCTIONS

7.1 Content. The Training Analysis Report must contain the following information:

7.1.1. Personnel who require training.

7.1.2. Tasks that require training.

7.1.3. Training systems and aids, including any requirements for embedded training.

7.1.4. Training support required for the system, including refresher training.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Early User Involvement Event Report	**HF-DID-009A**

3. DESCRIPTION / PURPOSE

The Early User Involvement Event Report describes the results of an Early User Involvement Event.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the content preparation instructions for the Early User Involvement Event Report resulting from tasks delineated in FAA HF-STD-004.

7. PREPARATION INSTRUCTIONS

7.1 Content. The Early User Involvement Event Report must contain the following information:

7.1.1 Date.

7.1.2 System and description of system elements evaluated.

7.1.3 Description and number of participants.

7.1.4 Description of methods.

7.1.5 Page/location or description of element along with description of issue as specific as possible.

7.1.6 Description of why the item is problematic.

7.1.7 Severity of problem (taking into account frequency, impact, and persistence of potential issues).

7.1.8 Recommendation for mitigation.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Personnel Qualifications Report	**HF-DID-010A**

3. DESCRIPTION / PURPOSE

A Personnel Qualifications Report contains a description of the contractor personnel who will be involved in the development, execution, and/or delivery of the Human Factors efforts as described in this Standard. The report includes a description of their minimum experience, education, knowledge, and skills.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

The purpose of this Data Item Description (DID) is to establish the requirements for the content and format of the Personnel Qualifications Report. This DID is applicable to all contract Human Factors Engineering efforts.

7. PREPARATION INSTRUCTIONS

7.1 Process. The deliverable must be submitted as a draft for FAA review. Any deficiencies in the quality of the human factors personnel will be noted and communicated to the contractors. The contractors must correct any noted deficiencies, incorporate the changes into the personnel qualifications report, and submit a revised draft to the FAA. The contractor must notify the FAA if there are any changes in human factors personnel described in the personnel qualifications report and update the personnel qualifications report to reflect changes. The FAA reserves the right to approve changes in personnel for human factors efforts, based on qualification requirements.

7.2 Source material. The source material for the personnel qualifications report includes contract documents, resumes, and other related information.

7.3 Deliverable. The deliverable is the Personnel Qualifications Report.

7.3.1 Content requirements. The Personnel Qualifications Report must contain the following information:

7.3.2 Cover sheet. A Personnel Qualifications Report must contain a cover sheet displaying the following information:

7.3.2.1 Document title.

7.3.2.2 FAA solicitation number.

7.3.2.3 Contract number.

7.3.2.4 Contractor name, address, phone number, and email address.

7.3.2.5 Submission date.

7.3.3 Task and personnel matrix. List of human factors tasks and personnel associated with the tasks, with the amount of time each person will spend on the specific task.

7.3.4 Resumes. Resumes must be provided for all project personnel. Resumes must include:

7.3.4.1 Summary of experience, which includes the number of years of experience in major skill areas relevant to the tasks in this Standard.

7.3.4.2 Education including the year graduated, major, and degree.

7.3.4.3 Work experience, beginning with the most recent and indicating the name of the organization and years of employment with each organization.

7.3.4.4 Professional recognition awards and relevant publications.

7.4 Format requirements. The contactor must use a format agreed upon by the FAA.

7.5 Special instructions. Individual programs may specify minimum or unique personnel qualification requirements. If so, they will be included in the contract.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Human Factors Heuristic Evaluation	**HF-DID-011A**

3. DESCRIPTION / PURPOSE

The Human Factors Heuristic Evaluation identifies the data that should be captured and reported from a Heuristic Evaluation.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the format and content preparation instructions for the Heuristic Evaluation.

7. PREPARATION INSTRUCTIONS

7.1 Content. The Human Factors Heuristic Evaluation must contain the following information:

7.1.1 Date.

7.1.2 Contract number.

7.1.3 Contractor name and address.

7.1.4 Name of evaluators.

7.1.5 System name.

7.1.6 Page/location/description of issue.

7.1.7 Heuristic violated.

7.1.8 Severity (frequency, impact, persistence).

7.1.9 Recommended resolution.

7.1.10 List of heuristics used.

7.1.11 Definition of severity ratings.

7.1.12 Summary data across evaluators.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Human Factors Engineering in System/Subsystem Review	**HF-DID-012A**

3. DESCRIPTION / PURPOSE

The Human Factors Engineering in System/Subsystem Review identifies the data that should be captured and reported from a system or subsystem review.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the format and content preparation instructions for the Human Factors Engineering in system/subsystem reviews.

7. PREPARATION INSTRUCTIONS

7.1 Content. The Human factors engineering in system/subsystem reviews must contain the following information:

7.1.1 Cover page. The report must contain a cover and title page identifying the following:

7.1.1.1 Date of issue.

7.1.1.2 Document number/revision number or letter.

7.1.1.3 Contract number.

7.1.1.4 Contractor name and address.

7.1.1.5 Name of review.

7.1.1.6 Program.

7.1.1.7 Security classification, if classified.

7.1.1.8 Distribution statement.

7.1.2 Revision control. The report must contain a list of all revisions identifying the following information:

7.1.2.1 Each revision number or letter.

7.1.2.2 Date of each revision.

7.1.2.3 Pages affected by each revision.

7.1.3. Table of contents. The table of contents must identify each major section title, paragraph number, and starting page number for each major section.

7.1.4. Main body. The report must address in depth each major section identified below:

7.1.4.1 Introduction

7.1.4.2 Scope.

7.1.4.3 Description of review.

7.1.4.4 Participants.

7.1.4.5 Conditions.

7.1.4.6. Compliance of system with HF-STD-001 or other relevant standards.

7.1.4.7. Human factors issues identified.

7.1.4.8. Recommendations for issue resolution.

DATA ITEM DESCRIPTION

1. TITLE	2. IDENTIFICATION NUMBER
Human Factors Engineering Closeout Report	**HF-DID-013A**

3. DESCRIPTION / PURPOSE

The Human Factors Engineering Closeout Report is used to ensure that human factors issues have been closed or that there are risk mitigation strategies in place prior to system deployment.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6. APPLICATION / INTERRELATIONSHIP

This Data Item Description (DID) contains the format and content preparation instructions for the Human Factors Engineering Closeout Report.

7. PREPARATION INSTRUCTIONS

7.1 Content. The Human factors engineering in system/subsystem reviews must contain the following information:

7.1.1 Cover page. The report must contain a cover and title page identifying the following:

7.1.1.1 Date of issue.

7.1.1.2 Document number/revision number or letter.

7.1.1.3 Contract number.

7.1.1.4 Contractor name and address.

7.1.1.5 Name of review.

7.1.1.6 Program.

7.1.1.7 Security classification, if classified.

7.1.1.8 Distribution statement.

7.1.2. Table of contents. The table of contents must identify each major section title, paragraph number, and starting page number for each major section.

7.1.3. Human factors issues identified.

7.1.4 Status of human factors issues.

7.1.5 Risk mitigation strategies.

7.1.6 Remaining risks.

7.1.7 Lessons learned.