HUMAN FACTORS PERFORMANCE AID

1. INTRODUCTION

1.01 **Purpose:** This performance aid describes the human factors work for a system development effort for each phase of system development. It describes the human factors-related goals, tasks, activities, and documentation involved within the Total System Development (TSD) framework. It does not provide detailed instructions on *how* to perform human factors tasks.

1.02 Whenever this appendix is reissued, the reason(s) for reissue will be given in this paragraph.

1.03 **Use:** This performance aid can be used for the development of all new information systems and for enhancements of existing systems which affect human performance. It can be used for systems of any size, complexity, and type. It may be tailored to best fit the circumstances of each project.

1.04 **Audience:** This performance aid is designed to assist people assigned to those functional roles which have a major impact on human performance (eg, system design, system analysis, Personnel Subsystem [PSS] design). The successful completion of the tasks indicated in the performance aid requires experience and training in the area of human factors. The appendix can be used by project managers and other personnel who want a better understanding of human factors-related work. It also will be useful for the development of work plans.

Note: It is recommended that information resulting from the performance of system development work be documented and filed under a set of categories called developmental components (described in *Developmental Documentation*, Section 007-227-310). The "Documentation of Results" column in this performance aid shows those developmental components affected by human factors tasks and activities. The developmental components are shown adjacent to the activity or at the end of a group of activities from which they receive input.

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PROPOSAL PHASE

Phase Description: The sponsoring or user organization identifies the need for a system development project via a Project Initiation Request. Prior to the Proposal Phase, a performance problem analysis has been completed.

HF Overview: Examine corporate problems/opportunities which may require a system development effort. Present human factors considerations to the project team and incorporate into the documented results.

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that basic human performance solutions have been examined before starting a system development effort.	1. Examine corporate problems or opportunities to identify basic human performance solutions.	a. Review reports and studies concerning the current situation (eg, trouble reports, performance reviews, marketing studies, executive appeals). b. List identified corporate problems and opportunities within the work entity. c. Briefly check each problem and opportunity to see if a new manual procedure, form design, performance aid, etc, will solve the problem or take advantage of an opportunity.	
B. Assure that the proposal does not cause serious human performance problems.	1. Evaluate the impact of the proposal on human performance.	a. Review current major information-handling functions. b. Discuss proposal with existing system users, managers, subject matter experts, training personnel. c. Research similar systems and compare data. d. Evaluate data collected and identify any extreme human performance problems identified in the proposal. e. Document the human performance aspects of the problems/opportunities for the Project Initiation Request.	Project Initiation Request (1.01)

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FEASIBILITY PHASE

<u>Phase Description</u>:   Define information and operational needs and develop conceptual alternatives that will satisfy those needs. Transform ideas and broad problem statements into system objectives. Establish the scope of the effort necessary to build the system by determining the schedule, budget, and staffing requirements.

<u>HF Overview</u>:   Find out what the people need. Identify and evaluate the possible system solutions which will meet these needs. Present human factors considerations to the project team and incorporate into the documented results.

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that all valid user needs are addressed in the system objectives.	1. Study how the work is done to-day.	a. List all people who now do the work in the area under study. b. Plan how user data will be collected (eg, interviews, questionnaires, sampling techniques). c. Collect and document data, such as: • Workflows and procedures • Inputs and outputs • Attitudes • Skills/knowledge • Organizations' responsibilities • Current performance standards • Future information needs.	Existing Environment (2.01)
		d. List problems, opportunities, assumptions, and con-straints identified during data collection.	Problem/Opportunity Statement (2.02) Assumption and Constraints (2.04)
	2. Find out what the users really need.	a. List and describe the users' current and anticipated needs (eg, data accuracy, timeliness) based upon prob-lems, opportunities, and constraints. b. Determine the benefit (financial/nonfinancial) of ful-filling the users' needs. c. Identify which needs, when met, will have the greatest benefit to the company.	User Needs (2.03)

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FEASIBILITY PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that all valid user needs are addressed in the system objectives. (Contd)	2. Find out what the users really need. (Contd)	d. Determine if there are means other than a system development effort to satisfy individual users' needs (eg, training, reorganization).	Findings and Recommendations (2.14)
		e. Develop tentative system objectives based on the selected needs.	System Objectives (2.05)
B. Assure that human resource costs are considered in evaluating alternative solutions.	1. Propose alternative solutions that optimize human performance.	a. Review tentative system objectives and other documentation outlining the requirements of the system. b. Review state-of-the-art technologies. c. Consult with diverse and experienced people. d. Conceptualize alternative solutions. (Be creative!) e. Consider how well the users are likely to adjust to each alternative solution. f. Document the general structure of each alternative solution in terms of inputs, outputs, and processes.	System Output Description (2.06) System Input Description (2.07) System Data Description (2.08) System Model (2.09) Business Objectives (2.10)
	2. Consider cost of manual operations for each alternative.	a. Make a preliminary decision about the type and number of people needed to staff each alternative solution (eg, skill, salary level). b. Estimate the manual cost of operating each alternative in terms of accuracy, worktime, training, and user satisfaction. c. Estimate how much human factors development work will be needed to build each alternative solution. d. Consider these "people" costs when recommending an alternative solution.	System Resources Estimates (2.11) Economic Analysis (2.13) Developmental Estimates (2.12) Findings and Recommendation (2.14)
Prepare inputs for the human factors-related activities in the Definition Phase Workplan.		See Function 2.4, Build Phase Plans, in Section 007-208-310, Project Management.	

HUMAN FACTORS PERFORMANCE AID

DEFINITION PHASE

Phase Description: Define in detail the information and functional requirements of the new system. These requirements present the factual framework within which the system must be built. Specify the required outputs, necessary inputs to produce the outputs, data-processing requirements, and control and reliability requirements. These requirements will be reflected in the Systems Requirements Document.

HF Overview: Examine the impact of the proposed system on human performance. Present human factors considerations to the project team and incorporate into the documented results. Establish system requirements so that they reflect human factors considerations.

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that for the proposed system, any potential human performance problem areas have been defined.	1. Define potential human performance problems related to system constraints.	a. Further describe how system constraints affect human performance (eg, time, corporate policy, labor contracts, government regulations).	
		b. Negotiate adjustments to eliminate potential human performance problems due to system constraints.	System Constraints (3.01)
	2. Define potential human performance problem areas which could cause system degradation.	a. Identify and define potential human performance problem areas within the proposed system.	
		b. Identify and define potential human performance problem areas at the proposed system's boundaries.	
		c. Evaluate the possible impact of such problem areas (eg, time, cost, errors, user satisfaction).	
		d. Negotiate adjustments to the proposed system to eliminate the potential problem areas.	
		e. Prepare recommendations for adjustments to systems and procedures outside the proposed system's boundaries.	
		f. Document any potential human performance problem areas.	Potential Problem Areas (3.09)
B. Assure that the defined system data requirements are consistent with the identified user needs.	1. Participate in describing the system output requirements.	a. Further define system outputs in terms of: • Purpose/usage • Users • Human performance criteria • Volume/frequency • Information content • Retention policy • Format • Medium, destination.	

HUMAN FACTORS PERFORMANCE AID

DEFINITION PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
B. Assure that the defined system data require- ments are consis- tent with the identified user needs. (Contd)	1. Participate in des- cribing the system output require- ments. (Contd)	b. Evaluate output for: • Usefulness to users • Satisfying identified purpose/usage • Meeting performance criteria • Constraints imposed by interfacing systems. c. Negotiate adjustments, if requied.	System Output Requirements (3.02) Group/Element Definition (3.05)
	2. Participate in des- cribing the system input require- ments.	a. Further define system inputs in terms of: • Source • Quality of input (eg, accuracy, timeliness) • Volume/frequency • Information content • Format • Medium. b. Evaluate input for possible impact on human perfor- mance in terms of: • Accuracy/timeliness • Volume/frequency/ source • Potential manual processing requirements • Constraints imposed by interfacing systems. c. Negotiate adjustments, if required.	System Input Requirements (3.03) Group/Element Definition (3.05)
	3. Participate in des- cribing the data processed by the system.	a. Further define system data in terms of: • Present and future needs they will satisfy • Human performance-related criteria • Codes, abbreviations, acronyms, mnemonics, range of values.	

HUMAN FACTORS PERFORMANCE AID

DEFINITION PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
B. Assure that the defined system data requirements are consistent with the identified user needs. (Contd)	3. Participate in describing the data processed by the system. (Contd)	b. Evaluate system data in terms of: • Satisfying user needs • Ability to meet performance criteria (eg, accuracy, security) • Meaningfulness (eg, translation not necessary) • Adverse effects during human processing. c. Identify potential system data to be retained in a manual storage environment: • Type • Quantity • Security • Duration.	System Data Requirements (3.04) Group/Element Definition (3.05)
C. Assure that any manual processing is within the capabilities of the anticipated work force.	1. Finalize the human aspects of the system model definition.	a. Analyze the processing required to convert inputs to outputs for the selected system model. b. Describe functions and subfunctions in the system model, especially: • Conditions under which the function is performed • Formulas/algorithms • Considerations for allocation with potential human performance problem impact (eg, work force capabilities, constraints) • Dependencies and interrelationships.	Function Structure (3.07) Function Description (3.08)
	2. Establish human performance considerations for conversion.	a. Identify potential manual processing that may be required for data conversion. b. Define the data's: • Source and responsibility • Current media and formats • Current condition • Performance requirements.	

DEFINITION PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
C. Assure that any manual processing is within the capabilities of the anticipated work force. (Contd)	2. Establish human performance considerations for conversion. (Contd)	c. Identify potential human performance considerations for conversion: • Dummy data base for testing, training, and/or auditing • One-time personnel requirements • PSS strategies.	Data Conversion Considerations (3.06)
D. Assure that manual control and reliability requirments are within the capabilities of the anticipated work force.	1. Analyze the system control requirements affecting human performance.	a. Identify processing areas where manual controls should be applied. b. Evaluate performance criteria for identified controls and compare with human capabilities. c. Identify control requirements outside the range of human capabilities.	System Control Requirements (3.10)
	2. Analyze the human aspects of system reliability requirements.	a. Identify potential system failures affecting human performance. b. Identify potential human performance recovery activities. c. Evaluate performance criteria for identified manual recovery procedures and compare with human capabilities to satisfy those criteria. d. Identify recovery activities outside the range of human capabilities.	System Reliability Requirements (3.11)
E. Assure that the end of phase documentation reflects human performance considerations.	1. Provide input to the overview of the defined system and the end-of-phase report.	a. Prepare a general description of the system's purpose and usage related to user needs. b. Identify all assumptions and constraints which impact human performance.	System Overview (3.12) Findings and Recommendations (3.13)
Prepare input to the System Requirements Document.		See Appendix 2 of this Bell System Practice (BSP).	
Prepare inputs for the human factors-related activities in the Preliminary Design Phase Workplan.		See Function 2.4, Build Phase Plans, in Section 007-208-310, Project Management.	

HUMAN FACTORS PERFORMANCE AID

PRELIMINARY DESIGN

Phase Description: Design the general architecture of the system. Expand the information developed in the preceding phases to the point where the system's functions can be allocated to humans or machines. After function allocation, further develop the details of the manual and machine functions along two parallel, interacting paths. Perform design reviews that focus on the operational, technical, and economic characteristics of the system.

HF Overview: Allocate functions to people and machines. Continue definition of manual functions and perform detailed analysis of work activities. Begin design of work modules and human/machine interfaces and plan for the testing and training of the human factors design. Consider the human factors aspects of workspace design and conversion.

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that the work assigned to people is meaningful and efficient.	1. Allocate the system functions.	a. Assign each system function to either people or machines based on allocation criteria, such as: • Human versus machine capabilities • Cost • Existing system constraints • System performance.	
		b. Verify that the potential work force is capable of performing the functions assigned to them.	
		c. Verify that the functions allocated to people are not trivial, unnecessarily repetitive, or meaningless.	
		d. Verify that the functions allocated to people can be organized into logical workflows.	
		e. Consider both people and machine allocations for those system functions that are difficult to allocate (eg, verifying that all transactions were processed).	
		f. Recommend the best alternative based on the allocation criteria established.	Function Allocation Description (4.01)
B. Assure that the design of procedures and workflows optimizes human performance.	1. Determine major flow of work. (Start task analysis.)	a. List the inputs and outputs for each function assigned to people.	
		b. Chart the major groupings of work (tasks) needed to convert the inputs of each function into the outputs of the function.	
		c. Flowchart or describe the activities needed to complete each task.	
		d. Make sure activities are complete and do not overlap.	

HUMAN FACTORS PERFORMANCE AID

PRELIMINARY DESIGN (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
B. Assure that the design of procedures and workflows optimizes human performance. (Contd)	2. Perform an analysis of all activities in which a decision has to be made (decision analysis).	a. List all activities in which the user must make a decision. b. Find out on what basis a decision is made. c. Show how each decision is made (eg, construct a decision table). d. Rework task analysis so that all decisions can be made.	
	3. Perform an analysis of potential problems (contingency analysis).	a. Consider and plan for consequences that may occur for the following situations: • Wrong inputs • Special environmental conditions (eg, blackout, job action) • Degraded human performance • Degraded machine performance b. Rework task analysis to minimize the impact of any potential problem that may degrade system performance.	
	4. Develop human performance objectives (eg, time, accuracy).	a. Describe the skills and knowledge required to perform each activity. b. Establish standards of performance for each task (eg, accuracy, quantity, timeliness, security). c. Document the consequences of poor performance for each activity. d. Identify any activities which may be difficult to complete within the specified performance standard.	Subsystem Function Structure (4.04) Subsystem Function Description (4.05) Task Description (4.06) Position Description (4.07)
	5. Begin design of work modules.	a. Organize tasks into meaningful groupings based on such things as: • Skill and knowledge requirements • Job enrichment • Sequence of the tasks • Criticality of the tasks. (These task groupings are referred to as work modules or positions.)	

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
B. Assure that the design of procedures and workflows optimizes human performance. (Contd)	5. Begin design of work modules. (Contd)	b. Consider alternative grouping(s). c. Determine the best configuration and document the reasons for each choice. d. Verify that work module groupings are reasonable from a human performance standpoint (eg, that the various work modules interface smoothly, and that each work module has clear-cut responsibilites). e. For each work module, identify interdependencies with other work modules and with machine functions. f. Determine the types (eg, skill/knowledge level) and number of people that will be required to perform the work modules.	Position Description (4.07) Support Position Description (4.08) Personnel Requirements (4.17)
		g. Describe for each work module: • Location where it will be performed • Equipment and support material required • Time required to complete the work module.	Position Description (4.07) Support Position Description (4.08)
	6. Begin design of human/human and human/machine interfaces.	a. Identify interfaces by reviewing the Subsystem Function Structure and Description (4.04, 4.05). b. Define the inputs and outputs for each interface. c. For each interface: • List all tasks requiring an interface. • List each information item to be transferred between people/machines and people/people. • Determine volumes, frequency, accuracy, timeliness, destination, and transportation. • List all available media (eg, form, printout, display). • Select the appropriate media. • For each medium determine what conventions/standards should be followed and document these conventions.	

HUMAN FACTORS PERFORMANCE AID

PRELIMINARY DESIGN (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
B. Assure that the design of procedures and workflows optimizes human performance. (Contd)	6. Begin design of human/human and human/machine interfaces. (Contd)	• Document the specifications for each interface and include frequency of use, importance, etc. • Evaluate alternative or competing interface designs through simulation or controlled experimentation techniques.	System Output Specifications (4.02) System Input Specifications (4.03) PSS/CSS Interface Specifications (4.14)
C. Assure that the conversion plan is in harmony with other user responsibilities.	1. Define the manual portions of system conversion requirements.	a. Determine the manual functions required to convert system data. b. Perform task analysis for the manual functions required to convert the data. c. Specify the procedures to be followed to manually convert the data. d. Estimate the number of people required for data conversion and the support materials and equipment they will require. e. Identify training needs for data conversion, such as: • Number of people to be trained • When training should begin. f. Identify all factors that will place limitations on the conversion, such as: • Availability of skilled personnel • Peak periods for user departments affected by conversion • Availability of software ready for training. g. Identify any special conversion requirements (eg, volatile data to be converted and then maintained/updated in new and old formats). h. Participate in establishing a plan for verifying the accuracy of the data conversion and controlling the process. i. Identify transportation requirements for converted data.	 System Conversion Requirements (4.15) Transportation Requirements (4.20)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
D. Assure that plans are developed to test the Personnel Subsystem for reasonable human performance.	1. Develop an overview plan for testing the work modules, human/machine interfaces, and other PSS products.	a. Identify the PSS products to be tested (eg, work module instructions, job aids, displays). b. Specify what objectives should be achieved by the test. c. Determine the types of test data needed. d. Identify the need for procedures to evaluate the results (eg, for comparing the actual results with the expected results). e. Estimate the numer of people required for testing and describe what their backgrounds should be (eg, skills, knowledge, organizational affiliation). f. Describe the environment in which the test is to be conducted. g. Identify the equipment, materials, and facility requirements for testing and for observing results.	System Test Plan (4.16)
E. Assure that plans are developed for introducing the new system to the workers.	1. Prepare a general overview of training requirements.	a. Determine the goal(s) of training. b. Determine whether formal training is required (a performance aid might be a suitable alternative). c. Identify the subject matter areas that training should cover. d. Identify the characteristics of the student population (eg, skill/knowledge, user group, educational background). e. Estimate the number of people to be trained and number of training days required.	Personnel Requirements (4.17) Position Description (4.07)

HUMAN FACTORS PERFORMANCE AID

PRELIMINARY DESIGN (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
E. Assure that plans are developed for introducing the new system to the workers. (Contd)	2. Determine the workspace requirements for people.	a. Identify the equipment required to support human performance. b. Establish criteria for selecting equipment (eg, height of tables, features on Computer Display Terminal [CDT]). c. Estimate the space requirements for personnel and equipment. d. Determine the general environmental factors (eg, lighting level, maximum noise level for performing the work).	Equipment Requirements (4.18) Facility Requirements (4.19)
	3. Define transportation requirements for materials, such as magnetic tapes, printouts, etc.	a. Identify all material (eg, printouts, tapes) that must be physically transported. b. Describe the characteristics of the material (eg, size, weight, volume). c. Define the method of transportation. d. Determine how frequently each item is to be transported. e. Identify any special security and handling requirements. f. Determine if any transport aids (eg, handtrucks) are needed.	Transportation Requirements (4.20)
F. Assure that human factors activities are addressed in end-of-phase reports.	1. Provide input to the system overview.	a. Prepare a general description of the purpose of the new system and its impact on human performance. b. Participate in preparing a diagram of the system that includes the functions, how they are allocated, system inputs and outputs, and the flow of data. c. Summarize design decisions that will impact the workers.	System Overview— Preliminary Design (4.24)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
F. Assure that human factors activities are addressed in end-of-phase reports. (Contd)	2. Summarize the status of the Personnel Subsystem at the end of Preliminary Design.	a. Estimate the costs for the following: • Further development of the manual portion of the system • Conversion to an operation of the manual portion of the system. b. Identify the human performance benefits of the new system.	Refined Economic Analysis (4.25)
		c. Describe any human performance-related changes to the system objectives, scope of the project, etc, made during this phase.	System Overview— Preliminary Design (4.24)
		d. Make recommendations for the disposition of the project (eg, continue development, defer).	Status and Recommendations (4.26)
Prepare inputs for human factors-related activities for the Detail Design Phase Workplan.		See Function 2.4, Build Phase Plans, in Section 007-208-310, Project Management.	

HUMAN FACTORS PERFORMANCE AID

DETAIL DESIGN PHASE

Phase Description: Complete the design of the manual and machine functions. Develop specifications for practices and training required for the operation of the system. Develop specifications for computer programs and testing plans. Develop initial data conversion plans. Continue design reviews that focus on the operational, technical, and economic characteristics of the system.

HF Overview: Complete all design by translating logical design into physical design. Establish standards of measurement for human performance. Develop detailed test plans based on these standards. Develop detailed training and conversion plans.

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that work module designs are sufficiently refined to allow system personnel to meet human performance standards.	1. Finalize the design of all human/human and human/machine interfaces.	a. Complete the design of all required forms. For each form: • Design a prototype. • Describe condition(s) when prepared. • Specify retention/destruction requirements. • Test and modify, if necessary. • List quantity to stock, and reorder level.	Form Specification (5.07)
		b. Complete the design of input/output displays. For each display: • Design a prototype. • Describe condition(s) when issued. • Identify response, if necessary. • Test and modify, if necessary. c. Specify the controls associated with each human/human and human/machine interface (eg, transaction editing and validation, logs).	Messages and Codes (5.17) System Controls Description (5.32) System Reliability Measures Description (5.33)
		d. Specify the organization of manual files. For each file describe: • Method of organization • Physical size • Retention/destruction requirements • Access restriction.	Manual File Specification (5.08)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that work module designs are sufficiently refined to allow system personnel to meet human performance standards. (Contd)	2. Complete design of human work modules.	a. Review the Task and Position Descriptions to ensure that: • Activities are at a level appropriate for the identified work force. • Work modules are organized logically. • All decision points and contingencies have been identified. • Controls, recovery, and backup procedures are included in the design. b. Modify work module design, as required.	Position Specification (5.01) Support Position Specification (5.02)
B. Assure that the Personnel Subsystem support needs are met.	1. Determine the best means to achieve human performance.	a. Select the most effective method of conveying skills, knowledge, and procedures: • Training • Performance aids • Reference documentation. b. Determine if personnel possessing specific skills should be utilized. c. Prepare specifications for work module instructions, guides, performance aids, etc. Include such items as: • Contents • Frequency of use • Conditions under which the document will be used.	Position Specification (5.01) Support Position Specification (5.02)
	2. Develop detailed training specifications.	a. Define how each course supports the system.	Training Specification (5.23)
		b. Identify the positions/ tasks to be addressed, the skills to be trained, and the expected type of audience.	Training Overview (5.24)

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B. Assure that the Personnel Sub-system support needs are met. (Contd)	2. Develop detailed training specifications. (Contd)	c. State the objective(s) of each course. d. Prepare an outline for each course. e. Define expected trainee performance criteria and methods to evaluate its achievement. f. List all reference documentation needed for training. g. Define the types of courses to be developed (eg, self-paced, instructor-lead, computer-aided).	Training Specification (5.23)
C. Assure that jobs can be integrated into the users' organizational structure.	1. Recommend grouping of work modules into jobs.	a. Identify possible work module groupings (jobs). Consider such items as: • Job enrichment • Human stress • Efficiency of operation • Workflow • Skill and knowledge compatibility. b. Determine the best configurations and document the reasons for each choice. c. Verify that jobs are reasonable from a human performance standpoint.	Position Grouping Into Jobs (5.03)
	2. Describe the personnel required to staff the system.	a. Identify the number of personnel required by organization and job level. b. Identify the required skill/knowledge levels for all personnel. c. Recommend strategies for personnel placement and organizational structure. d. Describe the impact of the new system's personnel requirements on existing organization.	System Personnel Guidelines (5.04) Organizational Considerations (5.05)

DETAIL DESIGN PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIÉS	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
C. Assure that jobs can be integrated into the users' organizational structure. (Contd)	3. Develop procedures to evaluate and maintain training packages.	a. Outline a process for student feedback. b. Outline a process for instructor evaluation. c. Define methods to evaluate training effectiveness after the trainee returns to the job. d. Outline a process for maintenance request procedures	Course Evaluation and Maintenance (5.25)
	4. Complete the design of workspace layouts for the people operating the system.	a. Finalize the choice of equipment required to support human performance.	Equipment Specifications (5.26)
		b. Design the required workstations (eg, layout of equipment, space allowance). c. Complete all necessary floor plans to indicate placement of all equipment, including necessary desks, tables, chairs, etc. d. Specify all environmental requirements (eg, power, light, space). e. Define all required physical security provisions (eg, restricted entry).	Facility Planning (5.31)
D. Assure that planned human performance testing will help identify any design flaws.	1. Develop the detailed plans for Personnel Subsystem Testing.	*Note:* There are three levels of PSS-related testing: • Verification—Test the individual work modules (PSS Unit Test) and groups of related work modules (PSS Integration Test). • Validation—Test PSS products in conjunction with the CSS (System Test). • Certification—Test the system (PSS and CSS) in the operational environment (Acceptance Test). The activities below should be performed for each level of testing.	

DETAIL DESIGN PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
D. Assure that planned human performance testing will help identify any design flaws. (Contd)	1. Develop the detailed plans for Personnel Subsystem Testing. (Contd)	a. Define the human performance standards to be verified by each test. b. List all PSS products to be tested (tasks, work modules and instructions, CDT displays, training materials, etc). c. Prepare a description of the techniques to be used in each test. d. Define the time required for each test and any dependencies of one test on another. e. Identify the overall PSS testing resource requirements: • People • Material/equipment • Software. f. Define data required for each test (inputs and stored data).	PSS Verification Test Plan (5.06) System Validation Test Plan (5.35) System Certification Test Plan (5.36)
E. Assure that cost effective manual procedures are planned to convert the system.	1. Design the manual portions of the system conversion plan.	a. Describe the PSS conversion effort, highlighting the impact which the new system will have on the organization and its personnel. b. Prepare detailed schedules for reorganizations, personnel availability and training, and position installation. c. Prepare guidelines for accomplishing organization changes and for converting positions. d. Prepare guidelines for implementing physical planning (eg, workspace, environment, equipment acquisition and/or installation). e. Identify and define all interdependencies with other conversion activities.	

DETAIL DESIGN PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
E. Assure that cost effective manual procedures are planned to convert the system. (Contd)	1. Design the manual portions of the system conversion plan. (Contd)	f. Define the temporary procedures to bridge from the current environment to the new system (eg, transcribing data from old forms to new data base).	System Conversion Plan (5.37)
	2. Complete the design of all transportation requirements for the Personnel Subsystem.	a. Describe the necessary transportation service and the system requirements that will be met by the service (eg, mode, frequency, timing). b. Specify contracts/agreements which must be entered or altered, including performance requirements and associated penalties. c. Specify all information which must be supplied to the provider of the transportation service (eg, scheduling, media to be transported, size, weight, and any special security or handling required).	Transportation Specifications (5.27)
F. Assure that the human factors aspects of the new system are measurable in terms of the total system's objectives and performance specifications.	1. Develop a plan for evaluating human performance after installation.	a. Describe human performance to be measured, the performance levels that are acceptable, and the penalties for failing to maintain them. b. Describe the system's capabilities for monitoring key human performance criteria. c. Prepare guidelines for interpreting all human performance information and statistics which are produced.	System Performance Monitoring Capabilities (5.34)
G. Assure that human factors activities are addressed in end-of-phase reports.	1. Summarize the status of the PSS at the end of Detail Design.	a. Redefine the statement of the new system's impact on the organization, its personnel, and operating procedures. b. Prepare a general overview of the strategies and schedules for converting positions and implementing organization changes. c. Prepare an overall resource requirement list for personnel, facilities, etc.	System Overview— Detail Design (5.38)

HUMAN FACTORS PERFORMANCE AID

DETAIL DESIGN PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
G. Assure that human factors activities are addressed in end-of-phase reports. (Contd)	1. Summarize the status of the PSS at the end of Detail Design. (Contd)	d. Prepare a detailed description of the PSS as seen at the end of Detail Design, highlighting and explaining any major modifications to the System Requirements.	Status and Recommendations (5.39)
Provide input to the Development Letter.		See Appendix 2 of this BSP.	
Prepare inputs for the human factors-related activities in the Implementation Phase Workplan.		See Function 2.4, Build Phase Plans, in Section 007-208-310, Project Management.	

HUMAN FACTORS PERFORMANCE AID

IMPLEMENTATION PHASE

Phase Description: Construct system components and test individually and together. Build the system according to the plans developed in the previous phase. Select required operational software and code the machine-executable programs. Test the system to ensure that it meets its objectives and performance specifications. Complete detailed conversion plans and their implementation. Conduct design reviews to evaluate the test results.

HF Overview: Prepare remaining deliverable documentation. Participate in test activities. Analyze the test results and make relevant changes in the system. The implementation of the PSS takes place concurrently with the CSS.

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that all support materials for the system personnel are clear, complete, concise, legible, and easy to use.	1. Prepare reference documents (eg, work module instructions, performance aids, administrative and operational references).	a. Review material from previous phase for completeness (eg, task description, position specification). b. Determine the level of detail for each reference document. (If extensive training is provided, less detail is usually required.) c. Prepare content outline for each document, including table of contents, overview, procedures, exhibits, etc. d. Review user characteristics to determine appropriate style for each document (eg, reading level, user terminology). e. Determine the layout of the documents based on existing practices (if any) and such human factors considerations as: ● Adequate white space ● Typeface size ● Placement of cautions/warnings ● Placement of exhibits ● Numbering schemes ● Accessibility ● Use of color.	

HUMAN FACTORS PERFORMANCE AID

IMPLEMENTATION PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that all support materials for the system personnel are clear, complete, concise, legible, and easy to use. (Contd)	1. Prepare reference documents (eg, work module instructions, performance aids, administrative and operational references). (Contd)	f. Write reference documents that directly support human performance using good writing techniques, for example: • Short, concise sentences • Familiar terminology • Active voice • Positive statements • Action verbs • Imperative mood for procedures. g. Arrange for production and distribution of documentation, such as: • Computer-stored information • Printed materials • Microfilm, microfiche • Cassettes.	Position Procedures (6.05) Support Position Procedures (6.06) Administrative Requirements(6.07) Recovery Procedures (6.15) DPC Job Media Distribution (6.10) Operating Agreements (6.26)
	2. Prepare training material as required.	a. Review Position and Training Specifications (5.01 and 5.23). b. Prepare unit objectives. c. Prepare criterion tests for course objectives and each unit objective. d. Verify that unit objectives meet course goals. e. Determine instructional strategy, including: • Sequence of topics • Use of simulated/live practice material • Use of feedback • Aids for presenting material (eg, slides, computer programs, videotapes). f. Prepare student material: • Texts • Computer displays • Case problems • Tests.	

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that all support materials for the system personnel are clear, complete, concise, legible, and easy to use. (Contd)	2. Prepare training material as required. (Contd)	g. Prepare instructor material, including detailed lesson plans and information for administering the course, such as: • Maximum class size, workgroup size • Estimated times for each training module • Instructions for using student materials, programs, audio/visual aids, etc • Material, equipment, and space requirements. h. Prepare training administrative requirements, such as: • Instructor qualifications • Number of instructors • Ordering information for course materials and equipments • Course prerequisites • Course evaluation methods • Training program schedule.	Training Course Description (6.19) Student Course Material (6.20) Instructor Course Material (6.21) Training Administrative Requirements (6.22)
B. Assure that the Personnel Subsystem will operate within the system specifications.	1. Prepare instructions for testing the Personnel Subsystem.	*Note:* There are three levels of PSS-related testing. • Verification—Test the individual work modules (PSS Unit Test) and groups of related work modules (PSS Integration Test). • Validation—Test PSS products in conjunction with the CSS (System Test). • Certification—Test the system (PSS and CSS) in the operational environment (Acceptance Test).	

HUMAN FACTORS PERFORMANCE AID

IMPLEMENTATION PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
B. Assure that the Personnel Subsystem will operate within the system specification. (Contd)	1. Prepare instructions for testing the Personnel Subsystem. (Contd)	The activities below should be performed for each level of testing. a. Review PSS test plans developed in Detail Design. b. Prepare test cases for each level of testing including inputs and expected results. c. Prepare instructions for performing and analyzing each test. d. Specify resources required for each test: • People • Materials/equipment • Software. e. Define stored data required for each test.	PSS Verification Test Instructions (6.01) System Validation Test Instructions (6.03) System Certification Test Instructions (6.04)
	2. Test the Personnel Subsystem.	a. Conduct tests of all PSS products (work modules and instructions, CRT displays, training materials, etc) separately and then combined with the CSS. b. Analyze results of each test and: • Compare results with performance standards. • Isolate problem areas. • Investigate cause of problems. c. Make necessary corrections and retest as required.	PSS Verification Test Results (6.23) System Validation Test Results (6.25)
Provide input to the deliverable documents produced during the Implementation Phase.		See Appendix 2 of this BSP.	
Prepare inputs for human factors-related activities in the Conversion Phase Workplan.		See Function 2.4, Build Phase Plans, in Section 007-208-310, Project Management.	

HUMAN FACTORS PERFORMANCE AID

CONVERSION PHASE

Phase Description: Install the new system in its actual operating environment and test using real data. If the new system is replacing an existing one, phase out the old system and phase in the new system. Create or convert records to new forms and train system personnel. Review the cost and time incurred for project development and system performance testing from an operational and cost/benefit standpoint.

HF Overview: Prepare all personnel involved for conversion to the new system. Participate in operational tests. Coordinate training and make sure field personnel are capable of operating the new system. Analyze the results and make relevant recommendations.

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that all personnel involved in the system are prepared to perform the work assignment.	1. Arrange for conversion of the Personnel Subsystem.	a. Review conversion schedules and plans for: • Converting files • Obtaining new data for the system • Purifying existing data • Installing and testing the PSS. b. Coordinate with line/office management concerning: • Schedules and space for training workers and supervisors • Quantity of documentation needed • Installation of workstations and work modules • Acquisition of required personnel.	
	2. Prepare personnel to operate the system.	a. Coordinate/conduct the training of personnel to: • Convert records and data. • Operate the new system. b. Convert work modules and monitor the following: • Equipment installation • Workstation installation • Reference and support materials delivery • Phase in of new responsibilities while the old ones are phased out. c. Provide support to personnel during conversion.	

HUMAN FACTORS PERFORMANCE AID

CONVERSION PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that all personnel involved in the system are prepared to perform the work assigned. (Contd)	3. Resolve differences between actual and expected human performance.	a. Participate in conducting operational testing with emphasis on the PSS. b. Analyze deviations to determine cause (eg, PSS or CSS design problem). c. List and schedule PSS deviations requiring further development. *Note:* Those items involving PSS/CSS interfaces require coordination with the CSS project leader.	System Certification Test Results (7.01) Completion Agreement (7.02)
	4. Summarize the status of the PSS.	a. Describe any major conversion problems encountered, proposed solutions, and implementation schedule. b. Identify any modifications to the PSS design made during conversion. c. Summarize the impact of PSS changes on system objectives, cost, and worth. d. Evaluate the PSS procedures used during conversion.	Status and Recommendations (7.03)

HUMAN FACTORS PERFORMANCE AID

PERFORMANCE REVIEW PHASE

Phase Description: Review the system after it has been operating for a period of time. Evaluate the degree to which the system meets the definition and design objectives and the cost/benefit analysis. Evaluate the development, performance, efficiency, and effectiveness of the system.

HF Overview: Compare the actual performance of the overall manual portion of the system with the expected performance stated in the System Requirements. Analyze any human performance-related deficiencies and make recommendations. Review the development process and identify areas for future improvement. Participate in the preparation of the performance review findings and recommendations.

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that any operational deficiencies attributable to human performance are identified.	1. Identify opportunities and/ or problems involving human error, organization of work, compliance with procedures, etc.	a. Review system's operations with: • System's operations personnel • Supporting staff • System users. b. Review procedural documentation. c. Compare system performance to the system objectives and corporate goals. d. Measure manual processing time, errors, training time, and any other performance measures described in the human performance objectives. e. Identify human performance-related deficiencies.	
	2. Isolate the point(s) in the workflow where each problem originates.	a. Analyze the workflow for possible problem areas. b. Indicate the steps in which the problem occurs (eg, a high error rate may be caused by data entry errors or errors in source documents).	
	3. Determine if the problem is caused by a deficiency in skill/knowledge or job engineering.	a. Interview and observe individuals involved in the workflow that produces the problem.	

HUMAN FACTORS PERFORMANCE AID

PERFORMANCE REVIEW PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
A. Assure that any operational deficiencies attributable to human performance are identified. (Contd)	3. Determine if the problem is caused by a deficiency in skill/knowledge or job engineering. (Contd)	b. Classify the cause of the problem as a skill/knowledge deficiency when: • The individual does not know a step is supposed to be completed. • The individual has never done the work correctly. • An experienced individual can complete the work successfully while novices fail. c. Classify the cause of the problem as "job engineering" if: • Information is not available to do the work (eg, field missing from CDT display). • There are unnecessary or confusing procedures. • The flow of work involves backtracking, bottlenecks, and duplication of work. • Efficiency is impaired by poor workplace design. • The employee receives negative consequences for doing the work correctly. • There is a lack of job enrichment (eg, only a few skills used, no clear start or end to work, no responsibility, no feedback about quality of work).	
3. Assure that a solution for each problem is found and evaluated.	1. Select solution.	a. To solve deficiences in knowledge, select one or more of the following: • Performance aids • Written instructions • Training • Personnel selection. b. To solve deficiencies in job engineering, select one or more of the following: • Change in workflow • New procedures • System design changes • New tools • Workspace redesign • Job enrichment.	System Effectiveness Evaluation (8.01) System Performance Evaluation (8.02) User Attitude evaluation (8.05)

HUMAN FACTORS PERFORMANCE AID

PERFORMANCE REVIEW PHASE (Contd)

HUMAN FACTORS GOALS	HUMAN FACTORS TASKS	HUMAN FACTORS ACTIVITIES	DOCUMENTATION OF RESULTS (SECTION 007-227-310)
B. Assure that a solution for each problem is found and evaluated. (Contd)	1. Select solution. (Con:d)	c. Perform a cost/benefit analysis for the proposed solution.	System Economic Evaluation (8.03)
C. Assure the human factors portion of the systems development process is assessed.	1. Evaluate the human factors development methods used during the system's development.	a. Review developmental documentation used during the development process. b. Identify and evaluate the tools and methods used to produce the PSS. c. Identify any deficiencies in methodologies and tools used during the development pr ·e : (eg, procedures completed incorrectly, proced.res inherently wrong, improper training). d. Identify any resource constraints on PSS development that may have been encountered during the development process. e. Make recommendations for improvements in the development process.	Development Effort Evaluation (8.04)
D. Assure that the Performance Review includes any relevant human performance findings.	2. Participate in production of the Findings and Recommendations for the Performance Review Phase.	a. Describe system's effectiveness from human performance and user satisfaction point of view. b. Make recommendations for improving human factors portions of the system's operations and future development efforts.	Findings and Recommendations (8.06)