HUMAN FACTORS PLANNING GUIDELINES

Guidance for planning a Human Factors Program is offered in six categories:

- General comments on the process of planning a Human Factors Program

- Contextual comments on planning a Human Factors Program

- Recommended contents of plans for the Human Factors Program

- References for additional information

- Where to seek assistance

- A planning checklist

I. HUMAN FACTORS PLANNING PROCESS. To ensure human factors considerations are fully incorporated in the system development, the Integrated Product Team (IPT) or Program Manager initiates a Human Factors Program (HFP) that addresses the human performance and human resource parameters for system design and development alternatives. The HFP (which is documented in a human factors plan or incorporated into an Integrated Program Plan) is first developed during the Investment Analysis Phase and updated during each subsequent acquisition phase. Initial planning for the HFP outlines the issues, tasks, and strategies associated with human considerations in the operation, maintenance, and support of system options. Subsequent updates to the HFP will further define and refine the human parameters of the program and ensure identification and remediation of human factors problems and issues in the program. The HFP is a dynamic entity, tailored to the specific program requirements, procurement strategy, and acquisition phase as well as customer considerations of the program. It imposes only the necessary and reasonable requirements to achieve: 1) the objective effectiveness of human performance during system operation, maintenance, and support, and 2) the efficient use of personnel resources, skills, training, and funds.

The following steps are necessary to plan the human factors effort:

Step 1: **Designate a Human Factors Coordinator.**   Appoint someone to coordinate human factors who will be integral to the Integrated Product Team (IPT). This person will develop, direct, and monitor the human factors program and its activities for the system acquisition.

Step 2: **Identify Operational and Maintenance Concepts.**   These are the concepts of employment for the system that drive human resource requirements and user tasks and should include considerations of opportunities and constraints that impact on human performance such as:

- Location, physical environment, and workspace

- Operational conditions and limitations for the system

- Operational scenarios in the employment of the system

Step 3: **Describe the Users.** Describe the operators and maintainers of the system as well as the relevant characteristics of the population that may affect system performance including biographical data, training history, anthropometry, aptitudes, task-related experience, supervisory relationships, and organizational structure.

Step 4: **Identify the User Tasks.** Focus early on what operators, maintainers, and supervisors will have to do. Consider:

- Functions to be performed by the system

- Predecessor systems

- Configurations of the system

Step 5: **Identify Issues.** Having defined what people must do (and under what conditions), identify the potential risks to and opportunities for human and system performance as well as resource costs (e.g., staffing, training). Human factors issues monitored during the program development should consider:

- key human engineering design goals (addressing those for the individual and for the user population as an entity)

- potential problem areas, constaints, and resource limitations

- critical unknowns

As the system develops, refine these goals in operational terms (especially time and accuracy) that relate to performance. Devise the measures of effectiveness or measures of performance that one needs to verify the system's operational performance. (Later in the program, data elements that support the evaluation of these measures will be defined.) If the measures are known early enough, they should be put in program documentation (e.g., specifications, SOW, program baselines, program plans).

Step 6: **Describe Human Factors Program Tasks and Activities.**   List and describe the tasks and activities that must be accomplished during the execution of the Human Factors Program. There are two dimensions to this:

- Key human factors engineering activities (these should include studies, assessments, analyses, research, demonstrations, etc. that need to be conducted to answer the unknowns and resolve the higher risks).

- Activities to integrate human performance in the program (in addition to designating a Human Factors Coordinator and writing a planning document). Identify what the government must do to direct and monitor the human factors effort. Identify how the program's contractual efforts will be influenced and assessed.

Step 7: **Devise a Strategy.** Develop a concept and approach for achieving the Human Factors Program objectives. This strategy should establish how the Human Factors Program will be controlled and fulfilled.

Step 8: **Tailor and Iterate the Planning.**   Because each system acquisition program is unique in its pace, cost, size, complexity, and human-system interaction; the human factors program will vary between system acquisition programs. Also, as development occurs, some system and human factors requirements will change. Tailor the planning steps and their sequence as necessary. Human factors planning must be iterative. Make the human factors planning a dynamic process that responds to the changes in the acquisition program. Adjust the human factors program as appropriate -- but focus on how the government manages the human factors efforts and how the human performance and human resource issues are resolved.

II. CONTEXT OF HUMAN FACTORS PLANNING.

1. **Intent of Planning the HFP.** The intent of planning the HFP is to focus the government's attention on human factors concerns, issues, tasks, analyses, objectives, and strategies that will integrate human performance considerations throughout the program. Documenting the HFP planning is not intended to provide specifications or work statements (although it should lead the government to include certain specifications or work requirements in program contractual documentation). It is intended to specify how the government will direct and control the identification and resolution of human performance and ergonomic issues in the program.

2. **Use of Planning the HFP.** Planning the HFP should serve to enumerate the efforts to be undertaken to achieve human factors integration. The planning should begin to sort out the priority issues, refine them, separate what is known and what needs to be known, translate unknowns into contractual tasks, shape managerial requirements, stimulate input to program documentation, and, then, follow the progress of issue resolution during design, development, and acquisition activities.

3. **Planning Emphasis.** Emphasis in planning the HFP should be placed on government controls, products of the human factors effort, and performance requirements:

      A. Government Controls. Deciding how the government will control the human factors endeavors entails outlining the people, methods, and process that the government will employ to get the work done; influence the integration of human factors in design; and integrate human factors in each step of the acquisition process.

      B. Products. Determining the products of the human factors effort entails identifying what needs to be known and how that information will be acquired. Greater specificity in identifying these tasks/activities will improve the human factors focus in the specifications and SOW, and achieve a better quality response from the developer.

      C. Performance Requirements. Planning the HFP should assist in determining the performance requirements of the system with people-in-the-loop. System performance requirements (with the human involved) should be derived from source documentation to include the Mission Analysis information, acquisition planning, life cycle costing, alternative analyses, requirements documentation, and other analyses and documents containing concepts for operation and maintenance.

      1) System's design requirements for human factors should be expressed in terms of time to accomplish, tolerable errors, time to train, numbers and types of people available, etc. These requirements should not be arbitrary or capricious; they should be derived from the system performance that is expected when the equipment is employed in the operational setting intended.

      2) Performance requirements (with the human in the loop) are the basis for including human factors engineering during need, concept, and system analysis; procurement preparation and source selection; system design activities; testing; documentation; and program reporting. These requirements are not only needed to convey human factors system requirements to contractors for full development projects; but, under a COTS strategy, they can serve as criteria for product selection during market surveys, etc. They will also serve as the basis for assessing training development and for establishing test and evaluation acceptance criteria.

III. PLANNING CONTENT FOR THE HUMAN FACTORS PROGRAM.

Documentation of the planning for the HFP should contain the items identified below. When the planning is incorporated within an Integrated Program Plan, paragraphs descibing the program may be abbreviated or omitted as appropriate.

1. **BACKGROUND:** Provide a brief description of the program, the equipment (including concepts for operation and maintenance), its schedule, and the people (target audience) who will be affected by the operation and maintenance of the system.

     A. **Program Summary.** Provide a brief description of the acquisition program (including relevant concepts for operation and maintenance).

     B. **Program Schedule.** Provide an overview of the major milestones for the acquisition program schedule that affect the HFP.

     C. **Target Audience.** Identify the population that will be affected during the operations and maintenance of the system. Include a description of any relevant demographics, biographical information, training background, aptitudes, task-related experience, anthropometric data, physical qualifications, organizational relationships, and work space requirements. (Lengthy descriptions may be included in an appendix.)

     D. **Guidance.** Summarize any decisions, direction, or previous guidance that will impact the human factors approach or results.

     E. **Constraints.** Identify the known or anticipated limitations (e.g. technical, manpower, training time available) that will impact upon human performance, personnel resources, training, and human factors engineering goals and requirements of the system. It is useful to be as specific as possible about what the human factors related constraints are for the system and how they might impact the program. For example, there may be an assumption about no additional staffing being required and that the system will be operated and maintained with existing AT and AF positions personnel. If so, this should be viewed as a constraint. Therefore, detailed assessments will be required to determine training requirements, impacts on current functions, etc. This assumption would likely affect job design, workload, etc. Training time available is another resource constraint that would affect operator, maintainer, or certification tasks and system design. Availability of simulation capabilities may provide a constraint to the analysis. There are others that may be enumerated in the section below as they apply to specific issues.

2. **ISSUES AND ENHANCEMENTS.** List and describe the problems, concerns, deficiencies, risks, and opportunities to be addressed by human factors efforts during the system development. (As this list and description of issues become more lengthy, the details may be included in an appendix.) It may be useful to divide the human factors issues into areas (or domains, as some people refer to them). These domains might include personnel resources (manpower and staffing),

training, human engineering, and safety (including health). Other organizational structures for the issues are acceptable.

A. **Issue Description.** Describe the issue or problem background, importance, and consequence.

B. **Issue Objectives.** Identify the objectives to be met, obstacles to be overcome, and the planned solution. Provide performance measures and criteria that will be used to evaluate resolution of the issue.

1) The objectives should provide quantifiable operational measures, that is, with the human involved. For example, if alerts are to be sounded, it is important to determine how quickly and with what error rate a person must recognize and react to such an alert. The documentation should specify the performance thresholds that make a difference in accomplishing the task, function, or mission.

2) If the human performance thresholds are unknown, then the documentation should identify a task for the developer (or an approach for the government) that will produce the required information (at the right time during the development) to influence the requirements, design, development, and testing in a positive way.

3) The major human factors performance requirements and criteria may be reflected in existing systems, baselines, or processes that are being replaced. For example, one major human factors challenge associated with the program may be to accommodate the new "XYZ System" in the NAS without degrading co-existing systems during the transition period.

C. **Issue Actions and Status.** Identify the actions to be taken in remediation of the issue and current status of the issue.

3. **ACTIVITIES.** Provide a list and description of each activity (e.g., tasks, studies, analyses) to be performed during the acquisition in support of resolving the issues and controlling the human factors program. Identify what the government and the system developer must do to satisfy human factors concerns.

A. **Activity Description.** For each phase, describe the activities to be performed; the rationale (i.e., reasons for the activity to be conducted); the technical information needed, data requirements, and data sources; the estimated resources (e.g., time, personnel, funding) required to complete the activity; and the agency expected to perform the activity. Address those tasks, analyses, and studies that must be done by the developer in support of the human considerations. For example, one deliverable should be a Human Factors Program Plan (such as that addressed in MIL-HDBK-46855) which delineates the contractor's approach in terms of what and how human factors will be executed to meet contractual requirements. Another example, a Functional Analysis may need to be conducted to allocate equipment vs people functions. A Task Analysis

may be done to delineate tasks for which operators and maintainers will be responsible. A Manpower Assessment may be considered to verify that there is no additional staffing required. There are others.

       B. **Activity Schedule.** Display the activities to be undertaken and their relationship to each other and to other significant program activities, events, and decision points. Show how things that need to be done in support of the human factors effort are to be integrated in the acquisition program, especially in relation with other program activities and with major milestones of the program. Identify the relationships (feeds, dependencies) with other efforts (e.g., market surveys, logistics support, training, test and evaluation).

4. **STRATEGY:** The HFP strategy should be addressed from the top down, but built from the "ground" up. It should be derived from the major concerns, issues, schedule, tasks, guidance, constraints, objectives, and approach for human factors in the program. This is the place to identify the concepts used to guide the government's control of the human factors effort.

       A. **Goals and Requirements.** Identify the major human factors performance objectives necessary to achieve compatibility and suitability with the operational and maintenance concepts. While a "motherhood and apple pie" objective may help guide the effort, it is not likely to be sufficient to define the human factors activities adequately. Greater specificity will help. The key questions become, "What objectives does the government wish to achieve?" and "How will the government accomplish these objectives?"

       B. **Approach.** Describe the general approach to be taken to achieve the human factors goals and requirements, meet customer operational needs, and resolve major issues. Delineate who will be responsible for the human factors effort and what direction they are going to take. That is, how will the program office proceed with the human factors effort? Who is responsible? To what degree will the program office use contractor support to monitor or assess the system developer's design? How will the IPT's human factors representative participate in the program (conducting market surveys, preparing the SOW, evaluating offerors during source selection, identifying critical operational issues and criteria, drafting the test plans, conducting preliminary design reviews, briefing program reviews, collecting data during testing (DT and OT), etc.). What will the representative do in resolving the major issues that will or may emerge? Will research need to be done? How much government simulation or analysis will be required? How will this be assessed? Who will do it? Is there to be an effort directed toward modelling human performance? Are mockups to be developed? What is the human factors role in them? Is useful information available from other programs or agencies? What analyses might need to be done by the developer of the system? What coordination is necessary to link up with the logistics or training people and their efforts to avoid redundancies and to capitalize upon work already performed? Will experience with other systems be useful in identifying the general scope of the issues before they are clarified and resolved by the contractor for the specific FAA environment? What processes will be used to fulfill the human factors program objectives?

C. **References.** Identify relevant references needed for the full understanding of the HFP. If there is a lengthy list, it may be addressed in an appendix.

5. **REVIEW, APPROVAL, and DISTRIBUTION.** Identify how the planning documentation is to be administratively handled. Generally, the IPT or Program Manager causes the coordination among the appropriate engineering representatives on the IPT, program sponsor, and relevant organizations.

A. **Review/Approval.** Indicates the review process established for the HFP documentation. If no other arrangement is made, assistance is available from AAR-100, (202) 267-7125. The paragraph should indicate where and when the initial HFP planning documentation (and all updates) will be submitted for review/approval. Normally, the cognizant development Integrated Product Team member or Service Director (as applicable) is appropriate.

B. **Distribution.** Show where copies of human factors program documentation (initial and updates) will be forwarded. Copies might be provided to:

No. of Copies	Addressee
1	IPT Human Factors Coordinator
1	IPT System Engineering
1	IPT Lead
1	AAR-100

IV. INFORMATION REFERENCES. Useful general references for planning a HFP include:

- FAA Order 9550.8, Human Factors Policy

- Human Factors in the Design and Evaluation of Air Traffic Control Systems, dated April 1995

- Human Factors Job Aid, dated September 1997

- MIL-HDBK-46855, Human Engineering Requirements for Military Systems, Equipment, and Facilities, dated May 26, 1994.

- MIL-STD-1472, Human Engineering Design Criteria for Military Systems, Equipment, and Facilities.

- FAA Human Factors Design Guide, dated January 1996.

- FAA Human Factors in the Design and Evaluation of Air Traffic Control Systems, dated April 1995

V. ASSISTANCE. For more information or assistance, call the FAA Human Factors Division, AAR-100, (202) 267-7125, FAX (202) 267-5797.

HUMAN FACTORS PLANNING CHECKLIST

The following criteria may be used to evaluate the planning for the Human Factors Program:

CRITERIA FOR HUMAN FACTORS PLANNING	GREEN	AMBER	RED
Designates a Human Factors Coordinator for the government?			
Identifies critical known human factors (HF) issues and work to be done?			
Identifies HF unknowns to be answered/assessed?			
Designates responsibilities for who and how the gov't will develop and control the HF work (i.e., who will execute and monitor the efforts)?			
Identifies process, procedures, and organizational structure for how the gov't will direct, control, and monitor the HF work?			
Describes system constraints for personnel resources, training, ergonomics, and safety?			
Describes system objectives for personnel resources, training, workload, ergonomics, and safety?			
Identifies tasks/analyses to be conducted by government or developer in support of defining, analyzing, evaluating and reporting system performance requirements (with the human in the loop)?			
Proposes schedules for accomplishing the human factors work?			