Study Plan for a Human Factors Assessment in Support of En Route Phase 1 of the Host and Oceanic Computer System Replacement (HOCSR) Program

Human Factors Branch, ACT-530
Federal Aviation Administration
William J Hughes Technical Center, Bldg. 28
Atlantic City International Airport, NJ 08405

Point of Contact: Tanya Yuditsky (609) 485-5375

1. Introduction

The en route center automation system receives, processes, coordinates, distributes, and tracks information on aircraft movement throughout the nation's airspace. Many of the hardware components of the system have reached or are near the end of their commercial support life and are not certified as Y2K compliant. The Host and Oceanic Computer System Replacement (HOCSR) program will replace the current Host and Oceanic processors and peripherals. The HOCSR program is structured into four phases with impact to domestic and oceanic systems in each phase.

Phase 1 of the HOCSR program replaces the main Host processor with the IBM G3 Processor and runs the existing NAS software under 370 emulation. A Hardware Management Console (HMC) is added for monitor and control capability. This plan describes procedures for the human factors assessment of the HMC and the G3 Processor. The activities are sponsored by ARU-100 and AUA-200/600 and coordinated through AAR-100.

2. Scope and Limitations

The proposed assessment will address the en route portion of Phase 1 and will focus on the ability of the user interfaces to support en route Airway Facilities systems specialist (AFSS) tasks and on ergonomic issues related to hardware accessibility. These activities will not include assessments of performance and workload levels associated with software or hardware design. Three HMC positions will be represented - computer operator, technician, and system administrator. The assessment will also include a preliminary review of upcoming interface changes that will be implemented as part of Phase 2 of the HOCSR program. The purpose of this review is to gather data that will help focus the human factors assessment of Phase 2.

3. Method

The assessment will include a usability evaluation of the HMC CHI, an ergonomic evaluation of user interactions with the G3 Processor, and user feedback on CHI changes being introduced in Phase 2 of the program. During the assessment, we will also collect data on the time needed to troubleshoot faults and on noise levels of alarms.

3.1 Participants

Three Human Factors Specialists (HFSs) and nine AFSSs, three from each of the three positions, will participate in the assessment. The HFSs are engineering research psychologists from the

William J. Hughes Technical Center Human Factors Branch (ACT-530). The AFSSs will be coordinated by AUA-200.

3.2 Materials

The HFSs will use several reference documents, including the Human Factors Design Guide, to develop questionnaires for the assessment. Two questionnaires on usability and impact will be used for the evaluation of the HMC and G3: One will be completed by the AFSSs and the other by the HFSs. Each questionnaire will include a section on CHI and a section on ergonomics. During the execution of the script, participants will be provided with comment forms that will include impact ratings. Comment forms will also be used to collect user feedback on Phase 2 changes.

3.2.1 Script

During the CHI and ergonomic assessment, the AFSSs will use a script to interact with the user interface and the G3 Processor. A non-participating AFSS will select the procedures for the script. The script will contain procedures that are representative of the tasks commonly performed by each of the three positions. For interaction with the G3 Processor, the procedures will include actions such as opening the Processor cabinet and lowering the System Element. The script should take approximately one hour to complete and should include troubleshooting of faults injected into the system.

3.2.2 Description of Phase 2 changes

For the review of Phase 2 changes, AFSSs will be provided with a briefing on all changes that are not transparent to the user. Specific examples will be provided whenever possible. For example, if there is a change to a system message, the new message syntax as well as the old syntax will be presented. These materials will be provided by AUA-200.

3.3 Procedure

The assessment will take place at the William J. Hughes Technical Center (see schedule in Appendix A). It is scheduled to start on March 31,1999, provided that participants are coordinated, the script is completed, and lab facilities are available.

In the Opening Briefing, the HFSs will explain the procedures to be used in the assessment. They will review the schedule and ensure the confidentiality of AFSSs' input. Each AFSS will be assigned a participant code that will be used on all forms and questionnaires.

AFSS participants will be divided into three groups, with three AFSSs (a computer operator, a technician, and a system administrator) in each group. Groups will be tested separately. During each test run, the AFSSs will complete the series of scripted procedures on the HMC and G3. They will be provided with comment sheets and asked to note any comments and rate their impact. HFSs will observe the execution of the procedures with minimal intervention. One HFS will "shadow" one AFSS during each run. The HFSs will rotate through the three operational positions, shadowing a different position during each test run. HFSs will also record troubleshooting times for injected faults and measure noise levels of alarms. After completing

the scripted procedures, the AFSSs and HFSs will complete their questionnaires. They will have access to the HMC and G3 for review purposes while filling out the questionnaires.

AFSSs will be provided with a document describing Phase 2 changes. They will have several hours to review the document and will later be asked to write down any comments or concerns on comment forms. AFSSs will be informed that this is a preliminary review and that the results will be used in planning a human factors assessment of Phase 2. A non-participating AFSS and a development contractor who are knowledgeable about the changes will be available for clarification of the descriptions and to answer questions.

During the Closing Briefing, all participants will discuss their observations. HFSs will focus on understanding and further exploring user comments. As appropriate, human factors issues will be placed into common categories. AFSSs will be asked for information about issue criticality and asked to generate potential solutions. The duration of the Closing Briefing will depend on the number of issues raised.

3.4 Data Analysis and Report

Responses from the questionnaires will be tabulated and the results for each questionnaire item, along with its rated impact, will be reported. AFSS and HFS responses will be reported in separate tables. HFSs will review and consolidate all AFSS and HFS comments and report them and their rated impact in tabular format. Issues will be categorized as 1) design element is not within human factors guidelines, 2) design element is within human factors guidelines but was found to be problematic by users, or 3) user-identified missing function/information.

ACT-530 will deliver an executive summary of the findings to the Program Office and to AAR-100 one week after the completion of the assessment. This summary will contain general findings and comments about the HMC interface and the G3 processor. The final report will be delivered four weeks after the assessment. The report will contain conclusions based on the collected data. Where appropriate, recommendations for issue resolution will be made based on human factors guidelines.

3.5 Resource Requirements

3.5.1 Facilities

Facilities where two HMCs and two G3 Processors are available will be needed for the assessment. A conference room large enough for approximately 15 people will be needed for Opening and Closing briefings.

3.5.2 Personnel

Nine AFSS participants for the assessment; one non-participating AFSS for script preparation, dry runs, and script execution; and one person knowledgeable in Phase 2 changes shall be provided through AUA-200. It will also be beneficial to have a vendor representative (development contractor) available during the assessment in case of system problems.

Appendix A

Schedule

Date	Time	Activity	Location
March 30, 1999		Travel to Technical Center	
March 31, 1999	8:00 – 9:00 9:15 – 10:00 10:15 – 12:00 12:45 – 2:30 2:45 – 4:30	All Participants: PASS meeting All Participants: Opening Briefing Group 1: Run script, complete questionnaires Group 2: Run script, complete questionnaires Group 3: Run script, complete questionnaires	Main Bldg. Atrium Bldg. 28 Briefing Room I2F Lab ↓
April 1, 1999	8:00 – 10:00 1:00 – 2:00 2:15 - ?	All Participants: Alarm demonstration All Participants: Phase 2 review All Participants: Closing Briefing	Red Brick Bldg. Bldg. 28 Briefing Room ↓
April 2, 1999		Travel home	

Appendix B

Proposals for Human Factors Activities in Support of Phase 1 of the HOCSR program

This appendix describes possible follow-up activities that can be conducted by the William J. Hughes Technical Center Human Factors Branch (ACT-530). The need for these activities will be determined by the outcome of the assessments described earlier.

User Interface Prototyping

Provide a recommended interface design. The recommendations shall be based upon the results of a computer-human interface (CHI) assessment, human factors design principles, and inputs from users.

Specific activities include:

- Review the CHI issues that come out of the original assessment and develop solutions based on user input and human factors principles.
- Develop screen prototypes of the redesigned interface.

The results of this task shall be a written report and screen prototypes detailing all changes and the issues they address.

Validation of a Revised User Interface

Conduct a re-evaluation of a user interface that has been revised based on a prototyping activity. The evaluation shall be structured and based on the initial usability assessment.

Specific activities include:

- Prepare a re-evaluation plan based on the CHI portions of the initial assessment. Include a structured review of the issues from the initial evaluation and a determination of their current status.
- Conduct the CHI evaluation in accordance with the above plan.
- Determine the validity of the proposed human factors solutions and identify any new or unresolved human factors deficiencies. Provide recommendations for further improvements to the user interface.

A written report shall be prepared describing the human factors and user issues along with recommendations for corrective actions shall be prepared. The report will also outline the status of the issues that came out of the initial assessment of the HMC.

Performance, Workload, and Situational Awareness Study

Conduct a user-in-the-loop simulation to assess performance, workload, and situational awareness in the new work environment.

Specific activities include:

- Prepare a simulation script of common user tasks that will be performed at different levels of workload.
- Collect data using performance, workload, and situational awareness measurement techniques.

A written report shall be prepared describing performance and situational awareness at various levels of workload. It will identify potential areas of concern and provide recommendations for how those concerns may be addressed.