Host and Oceanic Computer System Replacement (HOCSR) Usability Assessment of Phase 2 Oceanic

Short Report

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1. Introduction

The Federal Aviation Administration Central Computer Complex Host (CCCH or Host), receives, processes, distributes, and tracks information on aircraft movement throughout the National Airspace System (NAS). By 1999, many of the hardware components of the system had reached or were near the end of their commercial support life and were not certified as year-2000 compliant. The Host and Oceanic Computer System Replacement (HOCSR) program will replace all computer-related hardware components of the Host and the connected peripherals at 20 Air Route Traffic Control Centers (ARTCCs). In addition, the HOCSR program will replace the computer hardware components of the Oceanic Display and Planning System (ODAPS) and the Offshore Flight Data Processing System (OFDPS) at the three Oceanic facilities. These computer systems are also facing obsolescence, difficult spare parts availability, and questions of year-2000 compliance.

The HOCSR program is structured into four phases. The first phase of HOCSR has been completed. Phase 1 replaced the main processors of the Host, ODAPS, and OFDPS with the IBM 9672 RA4 computer, commonly known as the G3. Existing system software was run on this new system in emulation mode (emulating the old IBM 370 system architecture). Phase 1 also replaced the Series/1 communications processor at the Oceanic sites.

In Phase 2 the system software is upgraded to operate in the native IBM 390 environment rather than the emulated IBM 370 environment. For the Oceanic sites, Phase 2 also involves updating the software to allow for compatibility with the System 390 architecture and modifying the Series 1 Replacement (S1R) to work as a Peripheral Adapter Module (PAM). The S1R Alarm Panels will be removed, along with all associated hardware and S1R Console Menu options. The Alarm functions will be incorporated into the new NAS Monitor to resemble the En Route alarms. Some of the biggest changes for the users are in the area of NAS Monitor input messages. The syntax of some existing messages will be changed, new messages will be added, and several messages will be deleted. There will also be a change in the format and the information displayed on the configuration summary.

This short report describes a usability assessment of Phase 2 in the Oceanic environment. The assessment was conducted during Operational Testing (OT) of the system at the William J. Hughes Technical Center. It focused on the changes that are being implemented in this phase and how they affect the users in the field.

2. Scope

The system upgrade to 390 Native mode brings with it changes to alarms, device identifiers, existing input and output messages, and the configuration summary. It also introduces several new Monitor input messages.

3. Method

This assessment was conducted in coordination with OT of the system. Three tests were performed during the OT – Monitor Functional Baseline, Failure Recovery and Reconfiguration, and Transition/Certification. During testing, participants completed scripted procedures that

exercised the system, including all of the changed functions and messages. The En Route Test Branch (ACT-230) developed the testing procedures with input from field personnel. Human Factors Specialists (HFSs) collected feedback from the participants throughout the testing process.

3.1 Participants

Three Subject Matter Experts representing three positions participated in the assessment – one NAS Operations Manager (NOM), one Technician, and one Computer Operator. The participants had an average of 5.7 years of experience in their current job and had all completed HOCSR Phase 2 training.

3.2 Materials

The HFSs developed a Human Factors Questionnaire containing 30 questions. The questions addressed changes to the system that are being implemented as part of Phase 2 as well as other usability concerns such as command entry and error reporting. We instructed the participants to answer each question by circling a number on a 5-point scale. The endpoints of the scale represented opposite extremes (e.g., never and always) and the midpoint represented a neutral or average response. The low numbers on the scale represented the more favorable response to the question, and the higher numbers represented the less favorable response. For example, if the question was "Error messages are ___" and the scale endpoints are "concise" and "lengthy", the more favorable response of "concise" was assigned to the lower endpoint.

3.3 Procedure

The OT team conducted a Pretest Briefing during which they provided an overview of the test objectives, schedule, and the hardware and software configuration. At this time the HFSs explained the human factors procedures and discussed participant confidentiality and anonymity. We distributed Background Information Questionnaires, Human Factors Questionnaires, and blank comment forms to the participants. Each participant was assigned a participant code that was used on all forms and questionnaires. We instructed them to fill out one Human Factors Questionnaire after completing each of the three tests and to use the blank comment forms for any additional comments or observations.

The HFSs observed testing and recorded any difficulties users experienced with the computer-human interface (CHI) or human-computer interactions. At the beginning and end of each day, they attended a briefing where participants discussed problems encountered during testing. After testing was completed, the HFSs conducted a Human Factors Closing Briefing. During this briefing, all participants discussed their observations with the HFSs. We focused on issues that were related to human factors rather than system functionality and on the changes that were implemented in this phase of the program.

4. Results

The HFSs reviewed and consolidated all user comments and analyzed the ratings for each questionnaire item. The general findings are discussed below. The final report will describe these results in greater detail.

4.1 Questionnaire Data

Two of the three participants completed three questionnaires each. One participant was not present for the Monitor Test and only completed two questionnaires. This resulted in a total of eight questionnaires. Responses were averaged for all participants. Mean ratings higher than 3.0 represent a response that is less favorable than a neutral response. Only two questions received such ratings. The first question addressed whether error messages propose a solution and received a mean rating of 3.25. The second asked how well the user is able to determine the current status of devices and received a mean rating of 3.38. The mean ratings for all of the other questions were below 3.0.

4.2 Comments and Observations

In general, the participants reported that the Phase 2 upgrade will have minimal impact on their jobs. They identified several advantages that are new in Phase 2. The participants particularly liked the added flexibility in the syntax of changed Monitor input messages and the changes made to the KCNF status display. The KCNF now displays information about off-line channels like the En Route KCNF. Deleted Monitor input messages were rarely used and participants believed they were not needed. New messages were found to be useful and consistent in format with existing messages. The removal of the S/1R alarm panels was not seen as a problem. The information provided through the alarm panels is still available on other status displays.

Several concerns were identified based on participant written and verbal comments and on HFS observations. These concerns were recorded in detail by the OT team as Discrepancy Reports. The general concerns are described below.

- A concern that was reported frequently throughout OT was one of inconsistencies in the information presented on different status displays. On various occasions, status information was not updated to reflect the current state of devices. This interfered with the participants' ability to take proper corrective action.

- There was an approximately 8-minute delay from the time a fault was created to the time the Hardware Management Console (HMC) alarm sounded. This delay is very long, especially for reporting failures of critical devices. Other observed delays were somewhat shorter (e.g. 4 minutes) but the participants reported that this alarm should be as close to immediate as possible in order for it to be effective.

- There was no information on time for recovery when the "USRE" command was used. The time information is necessary to determine which files have to be accessed.

5. Conclusions

Overall, the changes implemented in Phase 2 of HOCSR for the oceanic domain will have minimal impact on the users. This software upgrade brings with it several advantages such as added flexibility in the syntax of Monitor input messages and the availability of new information on the KCNF status displays. In support of this, the questionnaire items received mostly favorable responses.

However, the areas of concern identified in this report should be addressed. The accuracy and reliability of status information is a critical need for the users who monitor and maintain the system. It is imperative that the information that is available to them correctly reflects the current state of equipment. This concern was mirrored in the less favorable responses to the questionnaire item that addressed the users' ability to determine the current status of devices. It is also very important that the information is available in a timely manner. Delayed HMC alarms prevent the users from taking immediate action when a fault occurs. It is not clear whether the delay is a direct result of Phase 2 changes to the system or a pre-existing problem. This issue was identified in an earlier report on Phase 1 of HOCSR (Yuditsky, 1999).

References

Yuditsky, T (1999). *Human factors assessment of phase 1 (en route) host and oceanic computer system replacement (HOCSR).* Atlantic City International Airport, NJ: FAA William J. Hughes Technical Center, NAS Human Factors Branch (ACT-530).