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Atlantic City International Airport, NJ 08405

En Route Information Display System Benefits Study

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Technical Report

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16. Abstract

The Federal Aviation Administration (FAA) is deploying the En Route Information Display System (ERIDS) as an interactive electronic information display system to replace the current Air Traffic Control (ATC) information display system that consists mostly of paper materials. The purpose of this study is to research the benefits of ERIDS to controllers in terms of service efficiency and to the FAA in terms of potential cost savings of personnel labor. We visited the Jacksonville Air Route Traffic Control Center (ARTCC) where ERIDS is deployed and the Houston ARTCC where controllers are using paper reference manuals. We observed controllers during live operations, conducted a simulation to collect access times to ATC information, administered a questionnaire, obtained quarterly reports of ERIDS usage, and interviewed staff personnel who support both systems. Thirty-seven supervisors and traffic management coordinators participated in the simulation and provided questionnaire responses. In simulation, participants were generally not faster to access information using ERIDS compared to paper reference manuals. However, our simulation was limited in that all paper reference manuals were within reach of participants. In actual operations, ERIDS can be quickly accessed, whereas, it can take several minutes to find paper reference manuals. Interviews indicated that ERIDS can reduce the labor spent on disseminating paper reference materials.

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Executive Summary

The Federal Aviation Administration (FAA) is currently deploying the En Route Information Display System (ERIDS) as an interactive, real-time, electronic information display system to replace the current Air Traffic Control (ATC) information display system. The current display system consists mostly of paper sources of information. ERIDS provides controllers, supervisors, and traffic management personnel with access to aeronautical data, weather data, airspace charts, ATC procedures, notices to airmen, pilot reports, and other sources of ATC information.

The purpose of this study was to research the benefits of ERIDS to air traffic controllers in terms of service efficiency and to examine the potential cost savings for the FAA in terms of personnel, pay grade, and labor hours. To evaluate the benefits of ERIDS, we collected data on how controllers access ATC information using the current information delivery system as a baseline. Then, we collected data on how controllers access information using ERIDS for comparison. We visited two Air Route Traffic Control Centers (ARTCCs) for 3 days of data collection at each facility. The first facility was Jacksonville ARTCC (ZJX), where the FAA has deployed ERIDS and controllers are using the system. The second facility was Houston ARTCC (ZHU), where the FAA has not deployed ERIDS, yet, and controllers are using mostly paper reference manuals.

Thirty-seven Supervisory Air Traffic Control Specialists (SATCSs) and Traffic Management Coordinators (TMCs) participated in this study. Seventeen participants were SATCSs and TMCs from ZJX who had experience with ERIDS. Twenty participants were SATCSs from ZHU. We collected data at each facility using five different methods. First, we observed controllers on position during live operations and collected time and motion data. Second, we conducted simulations with supervisors at each facility and collected response times to access ATC information. Third, we asked supervisors to complete a questionnaire and provide data on accessing ATC information. Fourth, we obtained the 2005 Quarterly Reports of ERIDS usage at ZJX to understand how frequently controllers accessed the different sources of ATC information. Fifth, we interviewed support staff personnel and collected data on the level of effort required to support both systems. We selected the following seven reference manuals for our simulation questions: Air Traffic Control (7110.65), Location Identifiers (7350.7), Contractions (7340.1), Aeronautical Information Manual, Approach Plates, Facility Standard Operating Procedures (SOPs), and Letters of Agreement (LOAs). The questionnaire focused on the same seven reference manuals we used in simulation as well as the Special Military Operations Manual (7610.4) and Facility Operations & Administration Document (7210.3).

In our simulation task, we were surprised to learn that ZJX participants were generally not faster to access information using ERIDS compared to paper reference manuals. However, the ZJX participants in our study were SATCSs and TMCs who do not use ERIDS every day, as line controllers do. Also, we noticed that participants used different search techniques with paper reference manuals compared to ERIDS. For paper reference manuals, participants used the index of keywords to find the information. In ERIDS, there is no index of keywords and participants used the Table of Contents instead, which seemed to be a slower search technique. As two exceptions, ZJX participants were faster to access information using ERIDS from Location Identifiers and Contractions. The ERIDS interface is very well designed for finding the

types of information in these two manuals. The most important idea to stress about our simulation task, however, is that it was limited to collecting access times whenever the paper reference manuals were within reach of the participants. In realistic operating conditions, reference manuals are almost never located so conveniently for controllers and finding the manuals can take several minutes.

In their questionnaire responses, the participants took into account that it is often difficult to find paper reference manuals, and they always estimated access times to be faster using ERIDS. Also, the participants estimated access frequency to be greater using ERIDS compared to paper reference manuals. Participant ratings indicated that ERIDS made it less difficult to access ATC information and decreased their workload for accessing information. Finally, the results of the ERIDS usage quarterly reports indicated that LOAs, Approach Plates, and SOPs were the most frequently accessed documents.

Our interviews with support staff personnel indicated that ERIDS can reduce labor costs compared to the paper reference manuals system. At ZHU, the support staff spent a great deal of labor hours printing, copying, and disseminating local documents throughout the facility. In ERIDS, labor hours spent scanning local documents were much less and up-linking electronic information was much easier at ZJX. Also, there were no labor costs for disposal of documents with the ERIDS. However, initial ERIDS setup was a labor-intensive task that was necessary only once.

1. INTRODUCTION

The Federal Aviation Administration (FAA) En Route Automation Modernization (ERAM) program plan replaces the current Host Computer System and backup system. ERAM will modernize the en route air traffic control (ATC) environment and infrastructure needed to efficiently handle traffic growth and ensure a more stable and supportable system into the future. The En Route Information Display System (ERIDS) is part of the ERAM program. ERIDS is an interactive, real-time, electronic information display system that replaces the current ATC information display system, which consists mostly of paper sources of information. ERIDS provides controllers, supervisors, and traffic management personnel with access to aeronautical data, weather data, airspace charts, ATC procedures, notices to airmen, pilot reports, and other sources of ATC information (Computer Sciences Corporation [CSC], 2005). Figure 1 shows ERIDS sources of information, and Figure 2 shows ERIDS functions and search features.

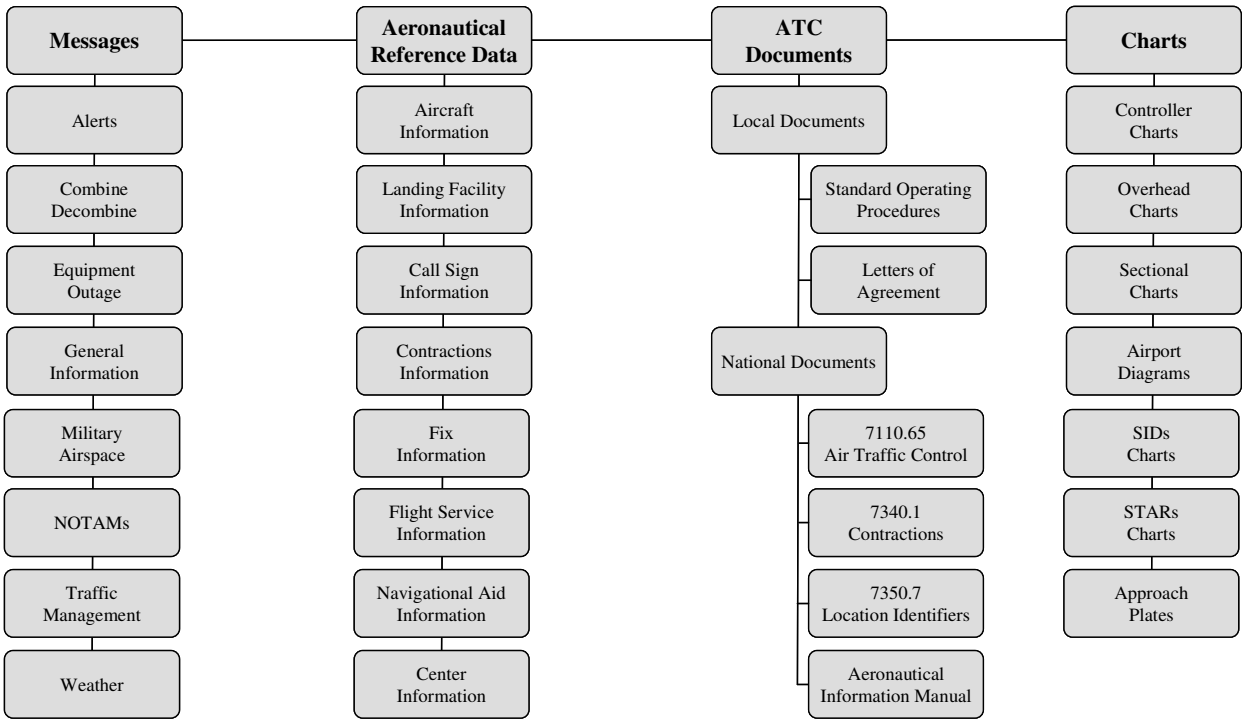

Figure 1. ERIDS sources of information.

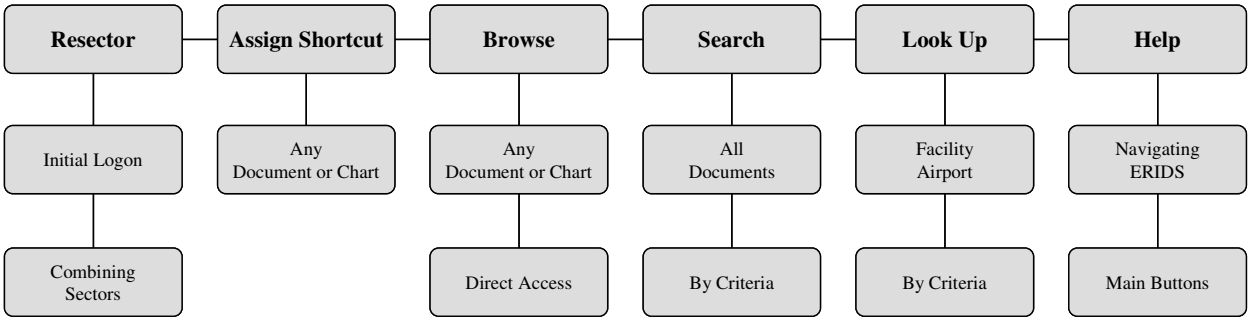

Figure 2. ERIDS functions and search features.

Figure 3 shows one possible configuration of ERIDS at the controllers' Display System Replacement (DSR) console. At the Radar (R)-side and Data (D)-side controller positions, articulated arms hold 15″ touchscreen displays. The articulating arms allow controllers to pull the display closer when they need to access ERIDS and to push it out of the way when they are done. Controllers can operate the system by using their fingertips on the touchscreen displays, a supplemental pointing device, or an electronic keyboard.

Figure 3. ERIDS integration into DSR console.

1.1 Purpose

The purpose of this study was to research the benefits of ERIDS to air traffic controllers in terms of service efficiency and to examine the potential cost savings for the FAA in terms of personnel labor.

1.2 Approach

To evaluate the benefits of ERIDS, we collected data on how controllers access ATC information using the current information delivery system as a baseline. Then, we collected data on how controllers access information using ERIDS for comparison.

1.3 Specific Objectives

The specific objectives of the data collection effort were as follows.

1. Examine the current information delivery system to determine the level of effort required by controllers to access this information in terms of time and motion.
2. Examine ERIDS to determine level of effort required by controllers to access this information in electronic format.
3. Determine the level of effort required to support the current information delivery system and ERIDS in terms of support staff personnel and labor hours.

2. METHOD

In this initial study, we asked Supervisory Air Traffic Control Specialists (SATCSs) and Traffic Management Coordinators (TMCs) to participate in our study. We collected data at each facility using five different methods.

1. We observed controllers on position during live operations and collected time and motion data.
2. We conducted simulations with supervisors at each facility's training laboratory and collected response times to access ATC information.
3. We asked supervisors to complete a questionnaire and provide data on accessing ATC information.
4. We examined quarterly reports of ERIDS usage to determine how controllers were using the system.
5. We interviewed support staff personnel and collected data on the level of effort required to support both systems.

Each method has different strengths and weaknesses as a practical technique for data collection. By using all five methods, we obtained a better understanding of the benefits of ERIDS.

2.1 Participants

Thirty-seven SATCSs and TMCs ranging in age from 35 to 61 years old (mean age = 46.6) participated in this study. The participants had from 1 to 25 years of experience (mean years = 7.4) as SATCSs or TMCs and from 6 to 30 years of experience (mean years = 14.6) as line controllers before promotion. Seventeen participants were SATCSs and TMCs from ZJX who had experience with ERIDS. Twenty participants were SATCSs from ZHU.

The SATCSs and TMCs completed an Informed Consent Form (see Appendix A) prior to participating in the study. The consent form described the study, stated that participation was voluntary, and that they could withdraw from the study at any time. In addition, the SATCSs and TMCs completed a Background Questionnaire (see Appendix B) to describe their demographic characteristics and experience.

2.2 Facilities

We visited two Air Route Traffic Control Centers (ARTCCs) for 3 days of data collection at each facility. The first facility we visited was ZJX where ERIDS is already deployed and being used by controllers. We collected data on how controllers are currently using ERIDS. In addition, we collected data in simulations and a questionnaire about how controllers accessed ATC information before ERIDS was deployed. We also visited ZHU, where the FAA has not deployed ERIDS yet. At this facility, we collected data on how controllers access ATC information using the current information delivery system.

2.3 Procedure

At each ARTCC, the research team split into three groups to collect data in different locations of the facility. A Human Factors researcher and a Subject Matter Expert (SME) observed controllers during live operations. One researcher conducted simulations in the facility's training laboratory, while another researcher administered a questionnaire to supervisors in another room. A fourth researcher assisted by the SME interviewed support staff personnel and digitally recorded the sessions.

The research team observed controllers in different operational areas of the facility to collect data during live operations. We used stopwatches whenever possible to record the time it took controllers to access ATC reference manuals. We also documented how frequently controllers accessed the information and the motion required to obtain the information.

For simulations, we used a private room at each facility where ERIDS was accessible and a meeting room configured with several ATC reference manuals. We selected the following seven FAA reference manuals for our simulation questions: Air Traffic Control (7110.65), Location Identifiers (7350.7), Contractions (7340.1), Aeronautical Information Manual (AIM), Approach Plates, Facility Standard Operating Procedures (SOPs), and Letters of Agreement (LOAs). The questions from Air Traffic Control (7110.65), Contractions (7340.1), and the AIM were the same for both facilities. We customized the questions from Location Identifiers (7350.7), Approach Plates, SOPs, and LOAs to reference site-specific information. Appendix C lists the actual questions presented to the participants. We selected these seven manuals because SMEs advised us that controllers use these manuals the most.

We used a laptop computer to present the questions and record the time it took the participants to access the required information using ERIDS or the manuals. After the participants read the question, they used ERIDS or searched for the information in a manual. In the simulation with reference manuals, we placed the manuals on a table in front of the participants. We put clear labels on each reference source.

We asked the participants to complete a questionnaire to obtain data on how frequently controllers use different sources of ATC information, how much time and effort it takes to access it, and how important the information is (see Appendix D). The questionnaire focused on the same seven reference manuals we used in simulation as well as the Special Military Operations Manual (7610.4) and the Facility Operations & Administration Document (7210.3). We did not expect that controllers used these two additional reference manuals very often, but we wanted to confirm that we had a complete list of the most frequently used manuals. Our questionnaire also included questions about ATC information that changes rapidly compared to static reference materials, such as traffic management, weather status, and special use airspace (SUA) information. We also obtained the 2005 Quarterly Reports of ERIDS usage at ZJX to understand how frequently different sources of ATC information were accessed. Last, we interviewed the Airspace & Procedures Specialists as well as the Administrative Assistants to obtain data on the number of employees, their pay band, labor hours, and activities required to support ERIDS and the current information delivery system.

3. RESULTS

3.1 Observing Live Operations

The research team observed controllers during live operations for several hours over a 3-day period at both ZHU and ZJX. We were hoping to see controllers using the paper reference manuals at ZHU and ERIDS at ZJX. We were prepared to use a stopwatch to record their access times as they searched for ATC information during their normal work routine on position. However, the controllers did not use reference manuals or ERIDS very often during live operations. The participants in our study told us that controllers rarely access paper reference manuals during live operations because there is not time while working traffic. Usually, controllers ask a supervisor to find the reference manual, search for the required information, and return to tell the controller on position. Sometimes, a D-side controller will find the reference manual and search for the information, if the traffic is not busy. The R-side controllers will almost never search for paper reference manuals while working traffic.

The participants also told us that the reference manuals are difficult to find because they are not returned to their assigned location after controllers have used them. The search for a reference manual may take 1 or 2 minutes if the manual is in its assigned location or more than 10 minutes if the manual is not properly located. Sometimes controllers search for reference manuals when dismissed from their position. Controllers reported that they are accustomed to searching in several places within and outside of their area before finding the manuals. We confirmed these reports ourselves by trying to find the reference manuals in each operational area at ZHU. Some areas were neatly organized and complete with reference sources. In other areas, we could not find all the manuals that were supposed to be in the area. Sets of approach plates were frequently scattered in different locations, and we noticed that sometimes pages were damaged or missing. Controllers also reported that manuals are not always current.

3.2 Simulation Access Times

Table 1 shows the mean times (in seconds) and standard deviations (*SDs*) to access the required ATC information using paper reference manuals by ZHU and ZJX participants and ERIDS by ZJX participants. We show the questions in a shorthand notation for display purposes. We show the actual questions in Appendix C.

Table 1. Mean Times (in seconds) and Standard Deviations to Access ATC Information in Paper Reference Manuals and ERIDS

QUESTION	ZHU PAPER		ZJX PAPER		ZJX ERIDS	
	Mean	*SD*	Mean	*SD*	Mean	*SD*
Air Traffic Control (7110.65)	**106.1**	**(95.79)**	**89.8**	**(74.35)**	**102.3**	**(68.08)**
1. Conflict Alert Procedure	172.6	(136.25)	139.1	(100.50)	145.9	(72.65)
2. Emergency Beacon Code Assignment	72.5	(38.53)	52.0	(22.84)	79.9	(57.74)
3. Radio Communications Transfer	73.1	(38.14)	77.4	(46.86)	81.1	(53.53)
Location Identifiers (7350.7)	**66.8**	**(67.39)**	**64.8**	**(46.02)**	**50.4**	**(68.76)**
4. Identifier for Airport	61.5	(92.26)	52.2	(23.93)	48.9	(48.81)
5. Fix Latitude/Longitude	95.5	(61.44)	91.7	(63.26)	88.6	(97.07)
6. Fix Name for Identifier	43.3	(18.35)	49.6	(28.17)	13.7	(3.89)
Contractions (7340.1)	**64.6**	**(44.81)**	**72.6**	**(45.78)**	**65.1**	**(58.43)**
7. Designator for Aircraft Company	61.5	(53.64)	66.6	(35.71)	55.9	(53.53)
8. Aircraft Company for Designator	50.2	(30.67)	52.8	(42.59)	57.2	(58.12)
9. Manufacturer of Aircraft Type	82.0	(43.24)	100.0	(47.61)	82.3	(63.09)
Aeronautical Information Manual	**105.5**	**(97.37)**	**70.8**	**(51.71)**	**96.6**	**(88.46)**
10. Search & Rescue Services for Pilots	77.5	(37.42)	51.5	(26.28)	54.4	(63.85)
11. Pilots Receiving a Traffic Advisory	77.4	(53.62)	62.3	(37.56)	87.2	(55.35)
12. Pilots Special Navigation Rules	161.6	(142.09)	100.5	(71.04)	148.2	(111.99)
Approach Plates	**55.4**	**(41.15)**	**34.0**	**(16.81)**	**48.9**	**(39.91)**
13. Specific Airport Runway	77.0	(53.92)	33.1	(14.09)	30.9	(21.30)
14. Specific Airport Runway	54.6	(32.88)	43.9	(18.85)	65.3	(51.18)
15. Specific Airport Runway	34.8	(18.19)	24.5	(11.13)	50.3	(35.85)
Standard Operating Procedures	**47.0**	**(31.03)**	**43.1**	**(23.53)**	**77.6**	**(44.27)**
16. Special Airspace in Specific Area	53.1	(27.27)	60.9	(25.72)	79.7	(53.49)
17. Departures in Specific Area	55.2	(41.36)	37.3	(18.83)	91.4	(39.91)
18. Arrivals in Specific Area	32.8	(14.61)	30.4	(12.48)	61.8	(34.85)
Letters of Agreement	**29.5**	**(16.32)**	**24.5**	**(12.57)**	**37.2**	**(56.90)**
19. With Another ARTCC	27.8	(14.31)	32.6	(16.81)	23.6	(21.44)
20. With Terminal Facility	30.7	(19.37)	22.1	(8.13)	69.3	(89.30)
21. With Another ARTCC or Tower	30.1	(15.59)	18.5	(4.88)	18.7	(6.88)

Overall, there were only small differences between paper and ERIDS access times by ZJX participants. The mean access times ranged from 18.5 to 139.1 seconds for paper and from 13.7 to 148.2 for ERIDS. However, ZJX participants were generally slower using ERIDS relative to finding the information in paper reference manuals, except for Location Identifiers (7350.7) and Contractions (7340.1). ZJX participants accessed information from reference manuals slightly faster than ZHU participants, although ZJX has not been using paper manuals since the ERIDS deployment. For ZHU participants, the mean access times ranged from 27.8 to 172.6 seconds.

3.3 Air Traffic Control Information Questionnaire

In this questionnaire, we hoped to collect data to supplement our live operations and simulation activities. We wanted to obtain information from ZHU and ZJX participants about static reference information and dynamic ATC information, such as traffic management, weather status, and SUA. However, ZJX was not using ERIDS for traffic management, weather, or SUA information. Therefore, ZJX participants did not provide data on these additional sources of information, except for importance ratings.

Table 2 shows the mean frequency ratings (in times/shift) for accessing ATC information using paper reference manuals by ZHU and ZJX participants and reference manuals and ERIDS by ZJX participants. ZJX participants rated the sources of information as more frequently accessed using ERIDS compared to paper reference manuals, except for the AIM. Participants rated Approach Plates as the most frequently accessed source of information using either display system. ZJX participants rated Contractions (7340.1) and Location Identifiers (7350.7) as more frequently accessed using ERIDS.

Table 2. Mean Frequency Ratings (in times/shift) for Accessing ATC Information in Paper Reference Manuals and ERIDS

SOURCE OF INFORMATION	ZHU PAPER		ZJX PAPER		ZJX ERIDS	
	Mean	***SD***	**Mean**	***SD***	**Mean**	***SD***
Air Traffic Control (7110.65)	1.2	(1.36)	1.8	(4.66)	3.9	(7.24)
Location Identifiers (7350.7)	3.6	(5.81)	2.7	(4.58)	9.2	(14.60)
Contractions (7340.1)	0.7	(1.17)	1.7	(2.60)	10.9	(19.98)
Aeronautical Information Manual	0.2	(0.23)	0.4	(0.98)	0.4	(0.85)
Approach Plates	9.3	(12.96)	10.5	(24.09)	11.2	(32.81)
Standard Operating Procedures	1.3	(2.92)	1.0	(1.67)	2.2	(3.36)
Letters of Agreement	1.6	(2.02)	1.4	(2.64)	2.1	(3.26)
Special Military Operations (7610.4)	2.3	(7.68)	0.4	(0.87)	0.8	(1.99)
Facility Operations & Administration (7210.3)	0.3	(0.75)	0.1	(0.16)	0.4	(0.78)

As expected, ZHU participants rated traffic management, weather, and SUA information as frequently accessed compared to the static sources of information. The participants' frequency ratings for traffic management, weather, and SUA information were 18.5, 29.2, and 24.2 times per shift, respectively, or between 2 and 3 times per hour.

Table 3 shows the mean time ratings (in minutes) for accessing ATC information using paper reference manuals by ZHU participants and reference manuals and ERIDS by ZJX participants. ZJX participants clearly rated all sources of information as more quickly accessed using ERIDS as compared to paper reference manuals. ZJX participants rated Location Identifiers (7350.7), Contractions (7340.1), and Approach Plates as very quickly accessed information using ERIDS. ZJX participants rated access times as longer for most sources of information compared to ZHU participants, except for Air Traffic Control (7110.65) and the AIM.

Table 3. Mean Time Ratings (in minutes) for Accessing ATC Information in Paper Reference Manuals and ERIDS

SOURCE OF INFORMATION	ZHU PAPER		ZJX PAPER		ZJX ERIDS	
	Mean	***SD***	**Mean**	***SD***	**Mean**	***SD***
Air Traffic Control (7110.65)	6.4	(6.71)	5.1	(3.92)	2.2	(2.00)
Location Identifiers (7350.7)	3.3	(2.31)	4.0	(2.78)	0.6	(0.30)
Contractions (7340.1)	4.0	(3.36)	5.2	(4.00)	1.2	(1.29)
Aeronautical Information Manual	6.5	(4.88)	5.5	(3.67)	2.2	(1.84)
Approach Plates	2.2	(1.39)	2.5	(3.15)	1.3	(2.06)
Standard Operating Procedures	5.3	(4.81)	7.5	(5.24)	2.1	(3.05)
Letters of Agreement	4.5	(4.46)	6.3	(4.59)	2.3	(2.77)
Special Military Operations (7610.4)	5.4	(3.80)	7.4	(5.41)	2.4	(2.27)
Facility Operations & Administration (7210.3)	5.7	(4.36)	6.9	(3.81)	2.1	(2.17)

As expected, ZHU participants rated traffic management, weather, and SUA information as very quickly accessed information compared to the static sources of information. The participants' access time ratings for traffic management, weather, and SUA information were 2.3, 1.2, and 1.1 minutes, respectively. These dynamic sources of information are continuously displayed on large screens for controllers in the operational areas and on monitors for SATCSs and TMCs.

Table 4 shows the mean difficulty ratings for accessing ATC information using paper reference manuals by ZHU participants and reference manuals and ERIDS by ZJX participants. The participant ratings were made on a 10-point scale ranging from 1 (*not difficult*) to 10 (*very difficult*). Most ZJX participants rated the sources of information as less difficult to access using ERIDS compared to paper reference manuals. ZHU and ZJX participants were generally similar in their difficulty ratings for accessing paper reference manuals. However, ZHU participants rated Air Traffic Control (7110.65), the AIM, and Approach Plates as more difficult to access compared to ZJX participants.

Table 4. Mean Difficulty Ratings for Accessing ATC Information in Paper Reference Manuals and ERIDS

SOURCE OF INFORMATION	ZHU PAPER		ZJX PAPER		ZJX ERIDS	
	Mean	*SD*	Mean	*SD*	Mean	*SD*
Air Traffic Control (7110.65)	5.9	(2.32)	5.0	(2.19)	3.8	(2.19)
Location Identifiers (7350.7)	4.9	(2.92)	6.2	(2.48)	2.2	(2.07)
Contractions (7340.1)	5.1	(2.56)	6.9	(2.56)	2.2	(1.74)
Aeronautical Information Manual	6.8	(2.63)	6.7	(2.55)	2.7	(1.91)
Approach Plates	4.9	(2.73)	4.8	(2.77)	2.3	(2.14)
Standard Operating Procedures	5.8	(2.72)	6.2	(2.65)	2.7	(1.84)
Letters of Agreement	5.2	(2.73)	6.4	(2.32)	2.8	(1.79)
Special Military Operations (7610.4)	6.1	(2.78)	6.7	(3.09)	3.2	(1.94)
Facility Operations & Administration (7210.3)	5.7	(2.77)	5.9	(2.47)	2.8	(2.24)

Table 5 shows the mean workload ratings for accessing ATC information using ERIDS by ZJX participants. The participants made ratings on a 10-point scale ranging from 1 (*decreases workload a great deal*) to 10 (*increases workload a great deal).* ZJX participants clearly rated ERIDS as decreasing workload to access all nine sources of information with ratings less than 4. The participants rated using ERIDS to access Location Identifiers (7350.7) as decreasing workload the most.

Table 5. Mean Workload Ratings for Accessing ATC Information using ERIDS by ZJX Participants

SOURCE OF INFORMATION	Mean	*SD*
Air Traffic Control (7110.65)	3.2	(1.75)
Location Identifiers (7350.7)	1.9	(0.93)
Contractions (7340.1)	2.9	(1.85)
Aeronautical Information Manual	3.5	(1.85)
Approach Plates	2.7	(1.90)
Standard Operating Procedures	3.3	(1.69)
Letters of Agreement	3.1	(1.96)
Special Military Operations (7610.4)	3.3	(1.85)
Facility Operations & Administration (7210.3)	3.7	(1.91)

Table 6 shows the mean importance ratings of ATC information for safety and efficiency and the correlations between safety and efficiency by all participants. The participants made ratings on a 10-point scale ranging from 1 (*not critical*) to 10 (*very critical*). Importance ratings for different sources of information were very comparable for ATC safety and efficiency. The Pearson correlation coefficients ranged between $r = .67$ and $r = .90$ with an overall correlation of $r = .83$. The participants rated Approach Plates as the most important source of information and Facility Operations & Administration (7210.3) as the least important source for ATC safety and efficiency. The participants rated traffic management, weather, and SUA information as very important sources of dynamic information.

Table 6. Mean Importance Ratings of ATC Information for Safety and Efficiency by ZHU and ZJX Participants

SOURCE OF INFORMATION	ATC SAFETY		ATC EFFICIENCY		Pearson Corr.
	Mean	*SD*	Mean	*SD*	*r*
Air Traffic Control (7110.65)	7.2	(3.14)	7.6	(2.61)	.67
Location Identifiers (7350.7)	6.1	(3.03)	7.6	(2.65)	.76
Contractions (7340.1)	5.6	(2.99)	6.2	(3.03)	.87
Aeronautical Information Manual	5.6	(2.81)	5.9	(2.74)	.86
Approach Plates	9.4	(1.24)	9.1	(1.56)	.82
Standard Operating Procedures	7.1	(2.81)	7.6	(2.61)	.87
Letters of Agreement	7.9	(2.49)	8.3	(2.14)	.81
Special Military Operations (7610.4)	6.7	(2.73)	6.8	(2.97)	.90
Facility Operations & Administration (7210.3)	4.9	(3.23)	5.5	(3.40)	.76
Traffic Management	7.6	(2.84)	8.6	(2.22)	.82
Weather Status	8.8	(1.93)	8.7	(1.83)	.77
Special Use Airspace	9.0	(1.65)	8.7	(1.91)	.77

Note: *r* is the Pearson correlation coefficient.

3.4 ERIDS Quarterly Reports

Table 7 shows the 2005 Quarterly Reports of ERIDS usage from ZJX. The ERIDS records address data for each document hit from all terminals in the facility, and the quarterly reports show the number of hits for the top 200 addresses. The results indicated that LOAs, Approach Plates, and SOPs were the most frequently accessed documents. However, we had some difficulty in determining the number of hits for Location Identifiers because there was no obvious address for this document. We talked to an ERIDS support person from ZJX who helped us understand how the Location Identifiers' information is referenced in the system. Controllers do not usually access the Location Identifiers document directly. Instead, we learned that controllers display Location Identifiers' information by using an ERIDS facility look-up function that records one of several addresses in the system according to how it was used by controllers. Therefore, we counted the facility lookup address hits for Location Identifiers as best we could, but we may have missed some of the references.

Table 7. Quarterly Reports of ERIDS usage from ZJX Showing Number of Document Hits for each Quarter and Daily Mean

SOURCE OF INFORMATION	QUARTER				DAILY MEAN
	1st	2nd	3rd	4th	
Letters of Agreement	4,715	3,227	6,427	6,739	58.6
Approach Plates	5,119	3,478	3,897	4,517	47.3
Standard Operating Procedures	3,214	2,827	5,705	3,996	43.5
Air Traffic Control (7110.65)	411	[a]	1,913	2,416	17.6
Location Identifiers (7350.7)	[a]	[a]	1,458	1,511	16.5
Contractions (7340.1)	719	418	854	626	7.3

[a] Missing data

3.5 Interviews with Support Staff

The research team interviewed support staff personnel at ZHU to gain a basic understanding of the costs associated with supporting paper reference materials as a baseline. We also interviewed support staff personnel at ZJX to document the costs of supporting ERIDS as a comparison. The focus of these interviews was on the labor costs of supporting both systems and not the cost of materials or computer hardware and software. Also, we began tracking the employees and labor costs at each ARTCC. System costs that were incurred outside of each facility are beyond the scope of this report.

At ZHU, we interviewed an Airspace & Procedures Specialist for 2 hours about the tasks required to support paper reference materials. His office staff consisted of three specialists and a manager responsible for handling all of the local documents at the facility. The local documents include Approach Plates, SOPs, LOAs, and Charts. These documents are updated every 28 or 56 days. His office staff keeps the local documents current, disseminates the documents to six operational areas and 12 additional areas of the facility, and disposes of outdated materials. He reported that all three specialists in his office work full-time supporting the local documents of ZHU. The pay band of Airspace & Procedures Specialists at ZHU is ATC-11.

The Airspace & Procedures Specialist reported that the most time-consuming tasks for the personnel in his office are to edit the documents for currency and to print and copy the documents for all the areas of the facility. He estimated that the volume of these documents is about 50,000 pages requiring about 48 labor hours every month. He estimated that 16 labor hours every month are spent disseminating the documents throughout the facility. The dissemination process includes removing outdated documents from binders and replacing them with current documents. He reported that about 3 labor hours every month are spent disposing of the outdated materials, which is a nonsecure recycle process.

We also interviewed the Administrative Assistant at ZHU for about 1 hour. We learned that part of her responsibilities is to take care of the national documents at the facility. She gets some assistance from the mail clerk. The national documents include Air Traffic Control (7110.65), Local Identifiers, Contractions, and the AIM. She updates these documents every 112 days. She takes delivery of the national documents, disseminates them throughout the facility, and disposes

of the outdated manuals. She reported that she and the mail clerk work only part-time processing these national documents at ZHU. The remainder of her time is spent on duties other than supporting paper reference manuals. The pay band of the Administrative Assistant is GS-6, and she thought the mail clerk was a GS-3.

She reported that the most time-consuming task she performs is disseminating the documents to the operational areas and controllers at the facility. She estimated that she and the mail clerk spend only 3 labor hours every month on this task. However, this seemed to be a conservative estimate given that there were over 500 copies of Air Traffic Control (7110.65) alone that she had to deliver to controllers' mail slots at the facility. She reported that sometimes she does some photocopying for about 2 labor hours every month if they need a few more manuals to circulate. She also estimated that she requires about 2 labor hours every month to dispose of the outdated manuals, which is a nonsecure recycle process.

At ZJX, we interviewed for about 2 hours an Airspace & Procedures Specialist who was the most knowledgeable person regarding ERIDS at the facility. His office staff consisted of three specialists and a manager responsible for handling the local documents in ERIDS. His office keeps the local documents current in ERIDS to support five operational areas and several other areas of the facility. He reported that all three specialists in his office work only part-time supporting the local documents in ERIDS. The remainder of their time is spent on other duties. The pay band of Airspace & Procedures Specialists at ZJX is ATC-11.

The Airspace & Procedures Specialist reported that the most time-consuming task for the personnel in his office was the initial ERIDS setup. He described the initial setup as a huge effort that took all four specialists 3 months to complete. The setup task required scanning all the local documents at the facility and building the links within ERIDS. He stressed that this is a one-time-only setup process and that maintaining the system is very easy. He reported that maintaining the currency of local documents in ERIDS consists of minor edits in a word processor, some document scanning and manual correction of Optical Character Recognition errors, and a file conversion routine. He uses a simple uplink procedure to complete the maintenance process. He estimated that scanning and editing documents takes about 44 labor hours and uplinking only 4 labor hours every month. In ERIDS, no disposal of manuals is necessary.

The CSC ERIDS Specialist supports the national documents and performs hardware system administration at ZJX. This computer specialist works as a full-time contract employee, but we were unable to obtain salary information for this person. Maintaining the currency of national documents in ERIDS consists of uploading the information from a CD every 112 days. This process requires no more than 10 labor hours every month. The remainder of this CSC employee's time is spent maintaining the hardware and answering trouble calls. Figure 4 summarizes the major support personnel tasks and monthly labor hour estimates for supporting the paper reference manuals system compared to ERIDS.

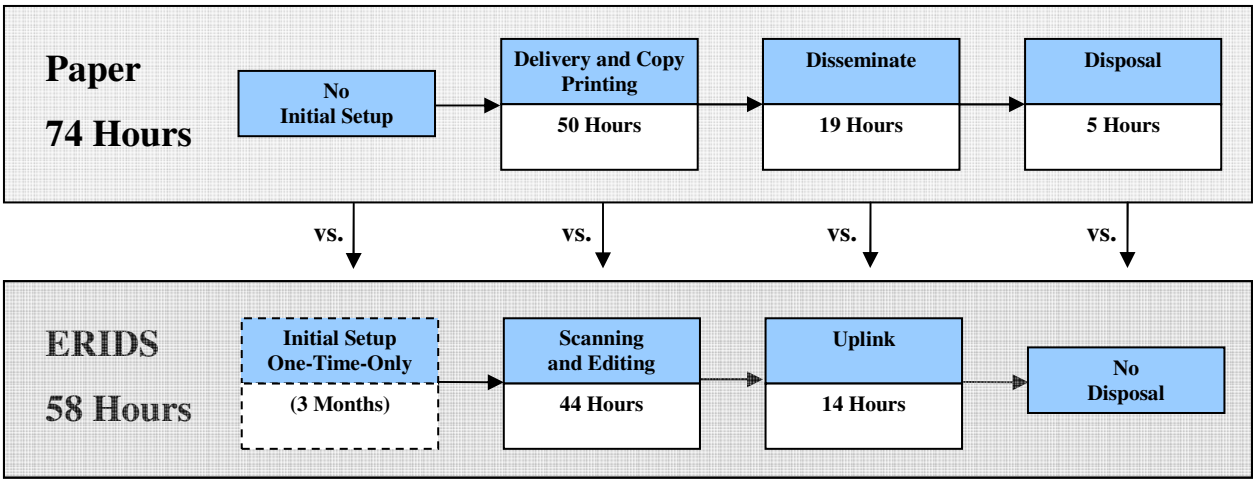

Figure 4. Task and labor estimates for supporting paper reference manuals vs. ERIDS.

4. DISCUSSION

During our visit to ZHU and ZJX, we were not surprised to learn that controllers did not use paper reference manuals or even ERIDS very often. Prior to the site visits, SMEs told us that controllers do not have the time to search through paper reference manuals while working traffic. The participants in our study and our actual observations confirmed the SME opinions. This was the reason why we needed an alternative method for collecting data on controller access times and why we designed the simulation task as a key component of our study.

Our expectation for the simulation task was that ERIDS access times would be much faster than searching for information in paper reference manuals. It was surprising that ZJX participants were generally not faster to access information using ERIDS. Our observations of the participants searching through paper reference manuals and using ERIDS to find the same information helped us understand why access times were not faster for ERIDS.

For most of the simulation questions with paper reference manuals, the participants used one of two search techniques. In the first technique, the participants would find the appropriate manual on the table, use the manual's index of keywords in the back to find the appropriate page, and then turn to the listed page for the information. The other search technique involved using the manual's Table of Contents to find the appropriate section, and then searching through the pages of the section until they found the correct answer. Often, the participants would not find the appropriate information with their first attempt, and they repeated either technique until they found the correct answer.

ERIDS does not provide an index of keywords with hyperlinks for the electronic manuals in the system. Instead, ERIDS has a keyword-entry search feature. For many of the simulation questions, however, the participants did not use the ERIDS search feature designed for the system. Instead, they used a method identical to the Table of Contents search technique described for paper reference manuals using the ERIDS interface.

There are two possible reasons why the participants avoided the ERIDS keyword-entry search feature. First, it could be a training issue. The ZJX participants in our study were SATCSs and TMCs, not line controllers who use ERIDS every day. However, it could be a design issue. The

keyword-entry search feature may operate very differently from an index of keywords in the back of a paper reference manual. It seemed that when the participants used the ERIDS keyword-search feature, the system presented a long list of references and pages for each keyword. The participants would have to determine which item in the list of references was appropriate, and then follow the page link. This is a process that the participants may have felt was not their most efficient search strategy, and an actual index of keywords with hyperlinks may be a better design.

Although ERIDS access times were generally slower than using paper reference manuals, there were two notable exceptions. ZJX participants were faster to access information using ERIDS for the simulation questions from Location Identifiers and Contractions. The participants always used the ERIDS keyword-entry search feature to access information from these two manuals. The ERIDS interface is well designed for finding the types of information in these two manuals. Alternatively, manually searching through pages in the paper reference manuals is a slow and tedious process.

The most important idea to stress about our simulation task, however, is that it was limited to collecting access times whenever the paper reference manuals were within an arm's reach from the participants. As the participants commented to us and as we observed during live operations, reference manuals are almost never located conveniently for controllers. Under realistic conditions, finding the appropriate manual can be a lengthy process taking 10 or more minutes, especially when materials are not properly returned to their assigned location. It is clear that finding the appropriate manual during live operations accounts for more of the total search time than does finding the correct page in the manual. A key benefit of ERIDS for service efficiency is that the system is always available to the controllers.

The data we collected in our ATC Information Questionnaire added to the simulation findings and helped us to understand the differences between using ERIDS and paper reference manuals. The participants estimated access times to be faster using ERIDS compared to paper reference manuals. For ERIDS, the participants estimated their access times to be between 30 seconds and 3 minutes. For paper reference manuals, the participants estimated their access times to be between 2 and 7 minutes, depending upon the information required. The range of access times for paper reference manuals suggests that participants based their estimates on realistic operating conditions.

The participants estimated their access frequency to be greater using ERIDS compared to paper reference manuals. For ERIDS, the participants estimated their access frequency to be between 1 and 12 times every shift, depending upon the information required. For paper reference manuals, the participants estimated their access frequency to be between 1 and 4 times every day (with as much as 10 times for Approach Plates). Also, participant ratings indicated that it was less difficult to access information using ERIDS compared to using paper reference manuals. Participant workload ratings indicated that ERIDS decreased their workload for accessing ATC information. These findings are consistent with the idea that controllers do not use paper reference manuals very often because they are difficult to use while working traffic. However, controllers may use ERIDS more often because it is less difficult to find the information they need while working traffic and may reduce their workload compared to using paper reference manuals.

Our interviews with support staff personnel indicated that ERIDS could reduce labor costs compared to the paper reference manuals system. Personnel spent a great deal of labor hours printing, copying, and disseminating local documents throughout ZHU. In ERIDS, labor hours spent scanning documents were much less and up-linking electronic information was much easier at ZJX. Also, there were no labor costs for disposing documents with ERIDS. However, the initial ERIDS setup was a labor-intensive task that was necessary only once.

In this ERIDS research, we were able to design experimental techniques for collecting data and testing the practicality and effectiveness of these techniques in a field study at two ARTCCs. We learned about the limitations of observing live operations and of our simulation techniques.

In future research, we plan to visit more ARTCCs to confirm our results with Certified Professional Controllers as participants in our study. We need to expand our data collection methods to better understand how long it takes controllers to find paper reference manuals in actual field conditions. Finally, we need to investigate the flow of ATC information at an ARTCC, the tasks, and the labor required to support paper reference manuals and ERIDS in more detail.

Reference

Computer Sciences Corporation. (2005). *System/subsystem design description for the ERIDS* (CSC/E3-04/0405). El Segundo, CA: Author.

Acronyms

AIM	Aeronautical Information Manual
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
CSC	Computer Sciences Corporation
D-side	Data-side
DSR	Display System Replacement
ERAM	En Route Automation Modernization
ERIDS	En Route Information Display System
FAA	Federal Aviation Administration
LOA	Letter of Agreement
R-side	Radar-side
SATCS	Supervisory Air Traffic Control Specialist
SD	Standard Deviation
SME	Subject Matter Expert
SOP	Standard Operating Procedure
SUA	Special Use Airspace
TMC	Traffic Management Coordinator
ZHU	Houston Air Route Traffic Control Center
ZJX	Jacksonville Air Route Traffic Control Center

Appendix A

Informed Consent Form

Informed Consent Form

I, _____ (please print), understand that this project, entitled "En Route Information Display System (ERIDS) Benefits Study" is sponsored by the Federal Aviation Administration and is being directed by Dr. Randy Sollenberger. Dr. Sollenberger is an engineering research psychologist working at the FAA William J. Hughes Technical Center.

Nature and Purpose:

I have been recruited to volunteer as a participant in this project. The purpose of this study is to investigate the benefits of ERIDS primarily to air traffic controllers, but also to supervisors and traffic management personnel. The study will also examine the impact of ERIDS on support staff personnel. The researchers will use the results of this study to provide ERIDS costs and benefits data to guide FAA program office sponsors.

Study Procedures:

A group of researchers will arrive at each air traffic control facility for three days of data collection with personnel from the facility. The researchers will conduct four different data collection activities on each day in different locations of the facility. In the first activity, researchers will observe controllers on position during live operations. The researchers will record data describing the time and motion required by controllers to use ERIDS or access data from reference manuals and other sources of ATC information. In the second activity, researchers will conduct simulations with controllers in reserved rooms. The researchers will ask controllers to find specific information using ERIDS or accessing data from reference manuals and other sources of ATC information. A laptop computer will be used to present questions to controllers asking for specific information and timing their responses. In the third activity, researchers will ask controllers to complete a questionnaire. The questionnaire will collect data about how frequently controllers access specific ATC information, how much time it takes, and how critical is the information. In the last activity, researchers will interview staff personnel who are responsible for supporting ERIDS or the current information delivery system The researchers will collect data from the staff describing the number of employees, their pay grade, labor hours, and activities required to support ERIDS or the current information delivery system.

Discomfort and Risks:

I understand that I will not be exposed to any foreseeable risks or intrusive measurement techniques.

Confidentiality:

My participation is strictly confidential, and no individual names or identities will be recorded or released in any reports.

Benefits:

I understand that the only benefits to me are that I will be able to provide the researchers with valuable feedback and insight into ERIDS costs and benefits.

Participant Responsibilities:

I am aware that to participate in this study I must be a certified professional controller, supervisor, or traffic management employee who is qualified at an air traffic control facility and holds a current medical certificate. I may also be a staff employee who is responsible for ERIDS support or processing other sources of ATC information. I will answer any questions asked during the study to the best of my abilities.

Participant's Assurances:

I understand that my participation in this study is completely voluntary and I have the freedom to withdraw at any time without penalty. I also understand that the researchers in this study may terminate my participation if they feel this to be in my best interest. I understand that if new findings develop during the course of this research that may relate to my decision to continue participation, I will be informed.

I have not given up any of my legal rights or released any individual or institution from liability for negligence.

Dr. Sollenberger has adequately answered all the questions I have asked about this study, my participation, and the procedures involved. I understand that Dr. Sollenberger or another member of the research team will be available to answer any questions concerning procedures throughout this study.

If I have questions about this study or need to report any adverse effects from the research procedures, I will contact Dr. Sollenberger at (609) 485-7169.

Compensation and Injury:

I agree to immediately report any injury or suspected adverse effect to Dr. Randy Sollenberger at (609) 485-7169. Local clinics and hospitals will provide any treatment, if necessary. I agree to provide, if requested, copies of all insurance and medical records arising from any such care for injuries/medical problems.

Signature Lines:

I have read this informed consent form. I understand its contents, and I freely consent to participate in this study under the conditions described. I understand that, if I want to, I may have a copy of this form.

Research Participant:_____ Date:_____

Investigator:_____ Date:_____

Witness:_____ Date:_____

Appendix B

Background Questionnaire

Background Questionnaire

Instructions:
This questionnaire is designed to obtain information about your background and experience. The information will be used to describe the participants in this study as a group. You will not be identified by name. Indicate your response by specifying the information in the blank line provided or by filling in (or mark with an X) the circle.

1. What is your job position?

○ Certified Professional Controller ○ Supervisor ○ TMC ○ Support Staff

2. What area do you work? _____ specify

3A. If you are a Certified Professional Controller:

How many years of experience do you have at your current position? _____ years

3B. If you are a Supervisor / TMC:

How many years did you work as a Certified Professional Controller? _____ years

How many years have you worked as a Supervisor / TMC? _____ years

3C. If you are a Support Staff Employee:

How many years have you worked at your current position? _____ years

4. Who do you work for? ○ FAA ○ Contractor

5. What is your gender? ○ Male ○ Female

6. What is your age? _____ years

Appendix C

Jacksonville ARTCC and Houston ARTCC Simulation Questions

Jacksonville ARTCC Simulation Questions

7110.65 Air Traffic Control

What is the procedure for a Conflict Alert or Mode C Intruder Alert?
What is the procedure for emergency beacon code assignment?
What is the procedure for radio communications transfer?

7350.7 Location Identifiers

What is the three-letter identifier for Tallahassee Regional Airport?
What is the latitude/longitude of the WEBB NAS fix?
What is the NAS fix identified by AYS?

7340.1 Contractions

What is the three-letter designator for the aircraft company Jet Blue Airways?
What is the aircraft company designated by NKS?
Who is the aircraft manufacturer of the A748?

Approach Plates

Find the approach plate for Jacksonville International ILS RWY 25
Find the approach plate for Orlando International ILS RWY 35R
Find the approach plate for Daytona Beach International ILS RWY 07L

Facility Standard Operating Procedures

What are the ZJX SOPs for Military Operations SUA Intrusion/Spill Out Procedures?
What are the ZJX SOPs for Central Area, Sector 34 Seminole?
What are the ZJX SOPs for South Area, Sector 76 Keystone?

Letters of Agreement

What are the LOA general procedures between ZJX and ZMA?
What are the LOA procedures between ZJX and Augusta TRACON?
What are the LOA responsibilities between ZJX and Daytona Beach Tower?

Houston ARTCC Simulation Questions

7110.65 Air Traffic Control

What is the procedure for a Conflict Alert or Mode C Intruder Alert?
What is the procedure for emergency beacon code assignment?
What is the procedure for radio communications transfer?

7350.7 Location Identifiers

What is the three-letter identifier for Laredo International Airport?
What is the latitude/longitude of the ROKIT NAS fix?
What is the NAS fix identified by VUH?

7340.1 Contractions

What is the three-letter designator for the aircraft company Jet Blue Airways?
What is the aircraft company designated by NKS?
Who is the aircraft manufacturer of the A748?

Approach Plates

Find the approach plate for Houston George Bush Intercontinental RWY 33R
Find the approach plate for New Orleans Louis Armstrong International RWY 28
Find the approach plate for San Antonio International RWY 12R

Facility Standard Operating Procedures

What are the ZHU SOPs for Special Use Airspace in the New Orleans Specialty?
What are the ZHU SOPs for Departures in the Corpus Christi Specialty?
What are the ZHU SOPs for Arrivals in the Austin Specialty?

Letters of Agreement

What are the LOA general procedures between ZHU and ZFW?
What are the LOA procedures between ZHU and Lafayette TRACON?
What are the LOA procedures between ZHU and Brownsville Tower?

Appendix D

Air Traffic Control Information Questionnaire

Air Traffic Control Information Questionnaire

Instructions:
For the source of information at the top of each page, indicate your response by specifying a number in the blank line provided or indicate your rating by filling in (or mark with an X) a numbered circle.

7110.65 Air Traffic Control

1. How frequently do controllers access this information? (specify number of times per minute, per hour, per 8-hour day, or once every number of days)

Without ERIDS _____ Using ERIDS _____

2. How long does it take controllers to access this information? (specify number of seconds or minutes)

Without ERIDS _____ Using ERIDS _____

3A. How difficult is it to access this information **without** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

3B. How difficult is it to access this information **using** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

4. Does **using** ERIDS to access this information decrease or increase controller workload?

Decreases A Great Deal ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Increases A Great Deal

5. How important is this information for ATC safety?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

6. How important is this information for ATC efficiency?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

7350.7 Location Identifiers

1. How frequently do controllers access this information? (specify number of times per minute, per hour, per 8-hour day, or once every number of days)

Without ERIDS _____ Using ERIDS _____

2. How long does it take controllers to access this information? (specify number of seconds or minutes)

Without ERIDS _____ Using ERIDS _____

3A. How difficult is it to access this information **without** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

3B. How difficult is it to access this information **using** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

4. Does **using** ERIDS to access this information decrease or increase controller workload?

Decreases A Great Deal ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Increases A Great Deal

5. How important is this information for ATC safety?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

6. How important is this information for ATC efficiency?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

7340.1 Contractions

1. How frequently do controllers access this information? (specify number of times per minute, per hour, per 8-hour day, or once every number of days)

Without ERIDS _____ Using ERIDS _____

2. How long does it take controllers to access this information? (specify number of seconds or minutes)

Without ERIDS _____ Using ERIDS _____

3A. How difficult is it to access this information **without** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

3B. How difficult is it to access this information **using** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

4. Does **using** ERIDS to access this information decrease or increase controller workload?

Decreases A Great Deal ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Increases A Great Deal

5. How important is this information for ATC safety?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

6. How important is this information for ATC efficiency?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

Approach Plates

1. How frequently do controllers access this information? (specify number of times per minute, per hour, per 8-hour day, or once every number of days)

Without ERIDS _____ Using ERIDS _____

2. How long does it take controllers to access this information? (specify number of seconds or minutes)

Without ERIDS _____ Using ERIDS _____

3A. How difficult is it to access this information **without** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

3B. How difficult is it to access this information **using** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

4. Does **using** ERIDS to access this information decrease or increase controller workload?

Decreases A Great Deal ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Increases A Great Deal

5. How important is this information for ATC safety?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

6. How important is this information for ATC efficiency?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

Facility Standard Operating Procedures

1. How frequently do controllers access this information? (specify number of times per minute, per hour, per 8-hour day, or once every number of days)

Without ERIDS _____ Using ERIDS _____

2. How long does it take controllers to access this information? (specify number of seconds or minutes)

Without ERIDS _____ Using ERIDS _____

3A. How difficult is it to access this information **without** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

3B. How difficult is it to access this information **using** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

4. Does **using** ERIDS to access this information decrease or increase controller workload?

Decreases A Great Deal ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Increases A Great Deal

5. How important is this information for ATC safety?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

6. How important is this information for ATC efficiency?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

Letters of Agreement

1. How frequently do controllers access this information? (specify number of times per minute, per hour, per 8-hour day, or once every number of days)

Without ERIDS _____ Using ERIDS _____

2. How long does it take controllers to access this information? (specify number of seconds or minutes)

Without ERIDS _____ Using ERIDS _____

3A. How difficult is it to access this information **without** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

3B. How difficult is it to access this information **using** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

4. Does **using** ERIDS to access this information decrease or increase controller workload?

Decreases A Great Deal ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Increases A Great Deal

5. How important is this information for ATC safety?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

6. How important is this information for ATC efficiency?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

Traffic Management Information

1. How frequently do controllers access this information? (specify number of times per minute, per hour, per 8-hour day, or once every number of days)

Without ERIDS _____ Using ERIDS _____

2. How long does it take controllers to access this information? (specify number of seconds or minutes)

Without ERIDS _____ Using ERIDS _____

3A. How difficult is it to access this information **without** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

3B. How difficult is it to access this information **using** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

4. Does **using** ERIDS to access this information decrease or increase controller workload?

Decreases A Great Deal ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Increases A Great Deal

5. How important is this information for ATC safety?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

6. How important is this information for ATC efficiency?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

Weather Status Information

1. How frequently do controllers access this information? (specify number of times per minute, per hour, per 8-hour day, or once every number of days)

Without ERIDS _____ Using ERIDS _____

2. How long does it take controllers to access this information? (specify number of seconds or minutes)

Without ERIDS _____ Using ERIDS _____

3A. How difficult is it to access this information **without** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

3B. How difficult is it to access this information **using** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

4. Does **using** ERIDS to access this information decrease or increase controller workload?

Decreases A Great Deal ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Increases A Great Deal

5. How important is this information for ATC safety?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

6. How important is this information for ATC efficiency?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

Special Use Airspace Status Information

1. How frequently do controllers access this information? (specify number of times per minute, per hour, per 8-hour day, or once every number of days)

Without ERIDS _____ Using ERIDS _____

2. How long does it take controllers to access this information? (specify number of seconds or minutes)

Without ERIDS _____ Using ERIDS _____

3A. How difficult is it to access this information **without** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

3B. How difficult is it to access this information **using** ERIDS?

Not Difficult ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Difficult

4. Does **using** ERIDS to access this information decrease or increase controller workload?

Decreases A Great Deal ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Increases A Great Deal

5. How important is this information for ATC safety?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical

6. How important is this information for ATC efficiency?

Not Critical ① ② ③ ④ ⑤ / ⑥ ⑦ ⑧ ⑨ ⑩ Very Critical