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Graphic Simulation and the Automated En Route Air Traffic Control Concept: An FAA Technical Center Preliminary Study

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16. Abstract

Air Traffic Controllers function in a demanding and dynamic environment where information management is a key to success. The Automated En Route Air Traffic Control (AERA) Program has been proposed by the Federal Aviation Administration (FAA) to provide controllers with a series of information and decision aides. The FAA Technical Center in Atlantic City has used graphic simulation to take a preliminary look at selected AERA functions and the procedures used to employ them. Unlike dynamic simulation, graphic techniques are not interactive; rather they provide a sequence of predetermined displays from which expert judgment can be drawn. Graphics can be set up quickly, and they require little or no software.

The current study used two round cathode-ray tubes (CRTs) which provided a flight information display and a syncronized planned view display (PVD). Five participant controllers from the Technical Center staff examined forty-four "snapshots" which covered approximately 1 hour of air traffic flow. Participants were asked to comment on what they saw.

The results from the limited sample of controllers indicated that they could have used the procedures which were provided but would have preferred more flexibility. They did not feel that advisory warnings, presented 18 to 20 minutes in advance, were useful. The graphic simulation process itself was well received and participants were willing to work with it as a means of stimulating their thoughts and attitudes.

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EXECUTIVE SUMMARY

Air Traffic Controllers work in a highly dynamic and demanding environment. They must process a large volume of information, make decisions under time pressure, and transmit their control instructions. The Federal Aviation Administration (FAA) anticipates that the airspace will become increasingly crowded and that automated information and decision aides will be necessary.

The Automated En Route Air Traffic Control (AERA) Program proposes a series of such aides. AERA is being designed to provide controllers with new planning and alerting tools which will augment the current National Airspace System (NAS) capabilities. These new tools will require supporting procedures to facilitate their implementation. Procedures can be forced into the system, tested through trial and error, or evaluated through some sort of simulation. This current project employs low-fidelity graphic simulation to take a preliminary look at selected AERA functions and concomitant procedures or user guidelines.

The FAA Technical Center has been using graphic simulations for a number of years. Graphic simulations are useful when time and other resource limitations prevent "full-scale" dynamic tests of new concepts. Graphics require the same care and planning but less software and person-power than dynamics. Previous studies have used pictorial graphics printed on paper to simulate and direct the thinking of subject matter experts serving on a panel for the site selection of airports and the development of terminal procedures.

This current study concerned with AERA was unique in a number of ways. First, it employed a sequence of snapshots presented on actual cathode-ray tubes (CRTs) which provided a dynamic quality to 1-hour's worth of simulated air traffic flow. Second, it employed a sequential panel of experts who each individually examined the snapshots and expressed their opinions.

Five Air Traffic Controllers, who were employees of the Technical Center and who had en route experience, served as volunteer participants. They examined 44 "snapshots" of the air traffic in a simulated scenario. Each snapshot froze the action at one point in time, and they were spaced no less than 2 minutes apart. Radar information was provided on one round CRT. Flight data were also presented in a modified 2-line format on another electronic display. AERA functions which were embedded in the traffic flow included trial plan probe, situation monitor, conformance monitor, reconformance aide, and controller reminders.

Controllers were asked to respond to a brief set of "seed" questions after each AERA snapshot. These questions asked what they had seen in the snapshot and what they would do about it if they had control of the sector. They were also asked if they could use the procedures which had been provided in the training package. Participants also responded to a post-task questionnaire and an interview.

Controllers took between 3 and 6 hours to complete the graphic simulation. They became very involved and provided a free flow of information, attitudes, and opinions. Each had his own style and unique air traffic control background. They varied considerably in their attitudes towards automation. None of the participants were "current" and most had not controlled live traffic in a long time. However, they were all familiar with the NAS and had worked on many simulation projects over the years.

Results, considering the caveats above, demonstrated that the participating controllers felt that they could use the procedures that were suggested for the implementation of AERA, but that they did not believe these procedures would ease that implementation. They preferred more flexibility. The controllers did not like the advisory warnings from the situation monitor 18 to 20 minutes in advance of an event. They usually chose to do nothing and wait to see what would actually happen. Controllers varied considerably in their approach to inter-sector coordination. While their responses were situation dependent to some degree, each tended to demonstrate a preference for either the use of land-line verbal coordination or the avoidance of it whenever possible.

The Air Traffic Control System has historically been dependent on the skills and innovative abilities of the human Air Traffic Control Specialists. As new automation systems are developed, designers should take into consideration the capabilities and needs of the individuals who will have to operate the airspace system. Projects like this preliminary study using graphic simulation provide an opportunity for valuable user input.

INTRODUCTION

BACKGROUND.

The modern Air Traffic Controller working in today's crowded airspace must process a dynamic flow of information (Kirchner and Laurig, 1971). The controller must make decisions on a continuing basis while under time and event pressure. The tools and techniques available to assist the controller have evolved considerably over the years without greatly changing the controller's basic task structure. Given the currently available technology within the National Airspace System (NAS) and the predictions for increased demands on the limited airspace, controllers will likely need additional automated aides to help them manage the airspace.

The Federal Aviation Administration (FAA) has developed the NAS Plan (DOT/FAA, 1984). This plan anticipates an increased traffic load and describes the need for the development of new automation capabilities to facilitate the air traffic control process. It has been well documented in the systems literature that human operators have limitations in terms of the amount of load they can carry (Roscoe, 1978). Any system which depends on human judgment and vigilance is subject to error (Danaher, 1980). A limiting factor in how many aircraft a controller can handle is the number of decisions he can make per unit of time (Jenney and Ratner, 1974). However, human operators in a control loop mean "that the system is adaptable in the context of unpredicted or previously unknown environments" (Singleton, 1974).

The Advanced Automation System (AAS) described in the FAA's plans for the National Airspace System will provide the Air Traffic Controller with a series of automated tools. These proposed automated aides will enhance his capability to deal with the volume of information and will provide him with more lead time for adequate decision making. One key element of the AAS is the Automated En Route Air Traffic Control (AERA) Program.

AERA.

The AERA Program will provide a series of aides which will assist in aircraft tracking and the prediction of airspace events. These aides will also suggest possible resolutions to predicted airspace problems. The goals of AERA include, in a broad sense, providing better service to users, increasing controller productivity, and enhancing airspace safety (Elsaesser, Gisch, Haines, and Swedish, 1984). By using AERA capabilities, it is anticipated that more user preferred routes can be implemented.

According to Elsaesser, et al. (1984), AERA 1, which is the first stage of AERA implementation, "will provide an earlier alert to the controller about future violations of the separation standard as well as other problems which the controller should take into account in planning the traffic flow (page 2-1)." Functional requirements which AERA is expected to serve have been specified in DOT/FAA Order 7032 (1984). These requirements document what the Air Traffic Control (ATC) System using AERA is supposed to accomplish. Out of necessity, they are written in general terms and do not explain how the AERA functions are to be employed by the working-level controller.

The procedures for actually using the powerful predictive capacity of AERA should be developed at some point in the evolution of the AAS. They could be explored once the system is put in the field. However, this would require a trial-and-error method using live aircraft and real airspace as a testing ground. Another alternative is to accomplish the trials and errors within the safety and control of a simulation environment. The advantages of even a low-fidelity simulation become apparent as real controllers have an opportunity to work through their thinking, traditional control styles, and previous experience while exposed to the proposed products of a new state-of-the-art system. This current project involves the use of static or graphic simulation to assist subject matter experts in taking a first look at displays of some selected AERA products and how they might be used.

HISTORICAL PERSPECTIVE.

Graphic or static simulation involves the representation of three-dimensional dynamic events in a two-dimensional nondynamic space. Every simulation is based on a balance between cost and fidelity or realism. Costs include people, hardware, funds, and time. The goals of testing and the resources available influence the degree of realism necessary. The more limited and specific the goals are, the less realism is needed to accomplish them. Graphic simulation represents a low fidelity solution to limited resource requirements.

The use of graphics has had a rich history in applied research. It is a time-honored technique for estimating an individual's spatial orientation ability and is employed in such basic academic measures as the Differential Aptitude Test (DAT) (Anastasi, 1968). In fact, the earliest nonlanguage test of intelligence, the Army Beta, was based entirely on pictorial graphics (Yerkes, 1921). Continuing from World War II to the present time, aircrew selection batteries have employed situational graphics to evaluate potential pilots' ability to relate instrument information to aircraft orientation. In aviation, graphics are used extensively to convey information. Examples include the Flight Training Handbook (AC-61-21A) and the Air Traffic Control Manual (711.65C).

Researchers have tended to favor dynamic simulation when they could afford it, because it does provide direct performance information. However, the use of static displays can be valuable when time and resources are limited. Graphic simulation focuses attention on factors other than those related to performance variability of operators. It forces the participants to concentrate on what they see and critically evaluate the information which is displayed.

The employment of the nonoperational mockup is a classic case of the effective use of low-fidelity simulation. An example is a study reported by Mattes and Asiala (1975) for McDonnel Aircraft. These investigators used what amounted to a cardboard cockpit to evaluate controller-throttle configurations. They collected data from participating pilots concerning their preferred configurations. This was much more economical than actually building a series of workable cockpits.

In the area of air traffic control, there has been a series of studies using two-dimensional noninteractive graphics rather than a dynamic testbed. These studies occurred over a 13-year period beginning in 1968, and they were all conducted by personnel from the FAA Technical Center in Atlantic City, New Jersey.

The first study in this series used graphic simulation to help evaluate alternative sites for an additional airport in the Chicago area (Rossiter, 1968). The author noted that graphic simulation takes as much planning as dynamic simulation, eliminating only those requirements produced by implementation of procedural plans in a dynamic testbed. Graphics still require the development of routes, the identification of control procedures, and the assignment of airspace. Rossiter (1968) noted that dynamic simulation is required for fine tuning procedures and for collecting data on controller workload and system efficiency. The results of Rossiter's (1968) study included both numerical ratings and panel members' verbal comments. The panel was able to clearly separate the alternative airport sites and provide a marked preference for one of the choices.

Rossiter (1970) conducted a similar study using graphic representations of two proposed sites for a second major airport in the Atlanta area. The stated purpose for this study was to evaluate procedural plans for the two alternative sites. The graphic approach was used to assist in the analytical comparison of the sites by a group of selected controllers. Results indicated a high level of interrater reliability. Panel members as a group were again able to separate the choices and provide a clear preference for one of the alternative sites. This project, like its predecessor, used one graphic image plus verbal description for each site plan. The graphics were displayed on paper and were reviewed by the raters as a group. This was the standard process used in this series of studies.

Maurer, Misiewicz, and Tack (1978) conducted the "Las Vegas Graphic Study." Their purpose was to develop and evaluate a number of procedural plans for a group of airports in the Las Vegas terminal area. This was a joint project with the U.S. Air Force. An ATC staff assistance group in 1976 recommended that a dynamic study be conducted. However, the Western Region chose the graphic study method instead. Results indicated a clear preference between the new plans, and both were preferred over current operational procedures. Rater comments generally supported the statistical analysis of numerical questionnaire data.

Maurer (1981), and Maurer, Matos, Rosenberg, Sluka, Lyon, Plisko, and Yulo (1982), described the planning and conduct of the "Mexico City Graphic Study." The purpose of this study was to create and evaluate procedural plans to meet forecasted increases in air traffic in the Mexico City terminal area. Subject matter experts consisted of Mexican Air Traffic Control Specialists (ATCSs) supported by Technical Center personnel. The expert panel rated procedural plans using printed graphical representations. This study, like the others, was a multiple rater scaling effort where group process occurred, but scale values were assigned by individual participants. Graphics were employed as stimuli for thought and opinion generation. Results of the Mexico City study were consistent with previous work. The expert panel was able to separate the alternatives and compare them against current operations. Clear preferences were established both statistically and through an evaluation of panel member comments.

The use of graphic simulation at the Technical Center has served a two-fold purpose. The studies reported here all involved the generation of alternatives, and graphics served as an aide for expert panel decision making. Both numerical and qualitative verbal information were collected and used. All studies used snapshots of airspace printed on paper. In every project, raters were able to clearly separate the alternative choices providing useful information for managerial decision making.

GOALS OF TESTING.

The employment of any new system can actually be a thornier problem than designing the system itself. Implementation of nonoperational concepts, brought about by new hardware or software, is complicated in a human operator sense when operations have been characterized by long established and largely successful practices. Introduction of new systems are often complicated by operator resistance and untested procedures. A great deal of storm and stress can be avoided by taking a serious look at the products of a new system using the safe and controlled environment of simulation.

How well AERA works will depend in part on the strategy and technique used to employ the AERA tools. The controller will function in a role very similar to what he or she does now during initial AERA implementation. "...No matter how sophisticated or effective automation may be, a minimum of manual interface and control will be necessary to retain ultimate control and ensure supervision and validation of automated activities" (McKinley and Jago, 1984).

This graphic simulation study formed what amounted to a panel of experts. This was an unusual panel in that its members served sequentially rather than simultaneously. Panel participants individually drew upon their experience and training to provide an orderly set of opinions concerning the AERA functions.

This study provided an opportunity to gather information, ideas, and opinions in a low pressure environment. The time base was expanded or contracted to meet the needs of the participants. Each controller has an opportunity to take as long as necessary to fully develop ideas on each AERA function being considered.

LIMITATIONS.

Since this was a graphic simulation, controller participants did not interact with the displays they observed. Only their attitudes and opinions were collected, and their performance could not be measured. Therefore, this was neither an operational suitability nor a validation of AERA. Participants were drawn from those controllers who were available and these personnel may or may not be representative of the entire body of air traffic controllers. Any generalization of the results should take this into account. Products may well serve as indicators or road markers rather than as final solutions.

METHOD

PARTICIPANTS.

All panel members were controllers who have had enough en route experience so that they felt knowledgeable about the current en route ATC environment. Participants were volunteers who received an introductory project briefing and gave their informed consent. All responses by individual controllers were recorded anonymously. Elecronic recordings were accomplished with the permission of the participants. Protecting the identity of participants reduces inhibition and improves the probability of honest and direct answers. Each participant received an arbitrary code number which was only used to organize his responses and not for identification.

All five participants in this graphic simulation were Technical Center employees who had en route experience when they were active controllers. Table 1 provides a summary of their backgrounds and experience. None are currently active and they ranged from 2 to 20 years since they last "worked the boards." They ranged in age from 49 to 54 years and they had a medium experience level of 10 years (120 months). All participants were involved in the study as volunteers. Number 12, however, seemed somewhat ambivalent, providing a "5" on a 10-point scale of volunteerism. All participants, except number 12, expressed favorable attitudes towards automation. Most participants had little prior knowledge of AERA (question 7, table 1). Four of the participants viewed research as positive with number 12 again being the exception. Their self-ratings of ATCS skill ranged from five (5) to eight (8) where ten (10) was high skill. All participants had worked in previous simulation studies and all were familiar with current NAS practices, procedures, and information displays.

DISPLAYS AND SCENARIO.

This project used a single sector graphic simulation without dynamic interaction capability for participants. Traffic information was overlayed on a sector map presented on a round Sanders planned view display (PVD). AERA information was presented on the same PVD. Flight data appeared on an additional cathode-ray tube (CRT) using a modified "flight strip" format. These "strip" displays were synchronized with the traffic and AERA information presented on the PVD.

The graphic simulation provided a series of snapshots sequenced in the order of a hypothetical traffic flow. Each snapshot was stored as an element of a disk file. Files drove both PVD and flight data displays. Software in this study amounted to little more than "front of the panel" recall routines, which allowed the experimenter to access the snapshots in the predetermined sequence. The experimenter controlled the recall speed manually by requesting each display using a keyboard. Displays could only be accessed in sequence and there was no capability to backstep to a previous snapshot.

The traffic scenario designed for this study was custom-crafted to demonstrate a subset of AERA functions as they might be displayed. The nature of the displays and how the information was coded for communication to the controller were simply a logical first estimate. They were not presented as the definitive answer. The traffic snapshots were produced by a combination of automation and manual effort.

The traffic scenario was written as a cooperative effort by research team members. The aircraft and their proposed flight paths were entered into the National System Support Facility (NSSF). This is a computer-driven ATC simulation, which is capable of fast-time operation. A series of fast-time, "hands-off" simulations were conducted to see if the aircraft flight paths actually created the situations necessary to employ AERA functions. By adjusting aircraft start times in the system and by modifying flight plans slightly, the traffic flow was gradually brought into line with expectations. The simulator operator (simop) capability of the NSSF was used to fine tune the traffic flows. The flight paths of the aircraft were then recorded and a sequence of "frozen frames" was marked. Each frame stops the traffic at that point in time where desired events occur. AERA information is overlayed on this frame by manually creating files showing what and where to "print" AERA data and flight data tags.

TABLE 1. CONTROLLER PARTICIPANT BACKGROUND SUMMARY

	Participant Number	10	11	12	13	14	Median
	Question:						
1.	Control Experience (months)	70	144	120	120	114	120
2.	Currently Active	No	No	No	No	No	No
3.	Period Since Last Control (months)	168	240	36	252	24	168
4.	Age (years)	50	52	49	54	51	51
5.	Volunteer Status	10	10	5	10	8	10
6.	Attitude Towards Automation	10	7	2	10	8	8
7.	Knowledge About AERA	3	1	1	7	5	3
8.	Self-Assessment of Currency	1	1	1	1	3	1
9.	Attitude Towards Research	8	10	3	10	8	8
10.	Self Assessment ATCS Skill	8	8	5	8	5	8

Note: Items 5 thru 10 are on a 10-point scale with "10" being most positive, experienced or current.

RESEARCH DESIGN.

This graphic simulation project was not an experiment and involved no experimental control of independent variables. It could be referred to as a "one shot case study" as described by Campbell and Stanley (1963). Such studies employ no control group or standardized comparisons. Inferences are based upon expectations and participant recall. The purpose was to collect the opinions of subject matter experts about a system which remains conceptual, and such an approach was all that was realistically available, given time and resource constraints.

The design involved two phases: training/familiarization and testing. The purpose of familiarization was to instill an accurate comprehension of AERA functions and information display formats. Familiarization included the provision of written material and a project briefing. The testing phase began when training/familiarization was completed.

PROCEDURE.

Each study has its own unique way of proceeding through a series of key events. Figure 1 is a schematic description of the procedural flow in this graphic simulation project.

Every participant began with an inbriefing during which the nature of the project was explained and the participants' role as a subject matter expert was clarified. This briefing was an opportunity for the experimenter/interviewer to establish rapport. Also the doctrine of informed consent was explained. This meant that the participant must be truly a volunteer and had the right of termination at any time.

If the experimenter is doing his/her job, participants seldom, if ever, exert this right, and in this project none did. At the conclusion of the inbriefing, a preliminary questionnaire was administered (see appendix). This instrument collected background information and attitudes (see table 1). It also verified that the participant had granted informed consent. Questionnaire data and verbally expressed attitudes/opinions were collected anonymously.

Participants received a training package and were familiarized with its contents. Most of this training effort was accomplished with individually paced self-study. The package contained details on the airspace being used; the Gordonsville High Sector of Washington Center. Participants reviewed appropriate standard operating procedures and related letters of agreement. Participants read descriptions of AERA functions, and the trainer discussed these functions in detail with each of them.

The conclusion of the training involved a review of the graphic simulation concept and the process to be used in the "test" portion of this project. This brought the participant controller to the checkpoint. Did he know enough about the airspace and AERA to go on and provide informed responses? The checkpoint decision was based on two factors.

The trainer's evaluation was first. The controller was or was not adequately familiar with the concepts and displays. Second was the participant's self-expression of readiness to go on. Both factors were achieved prior to moving on to the air traffic scenario.

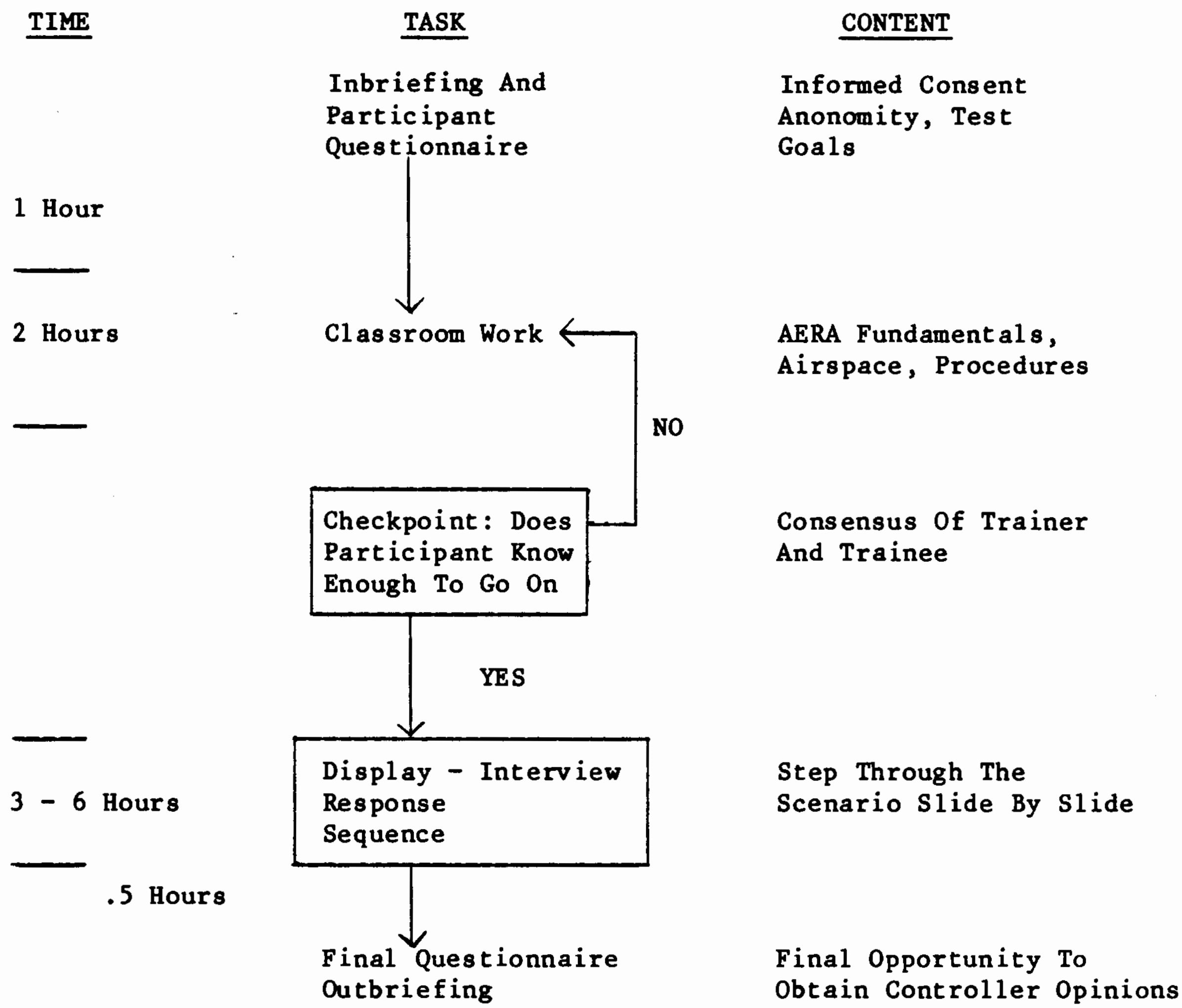

FIGURE 1. PROCEDURAL FLOW FOR GRAPHICS TESTING

Finally, the participants arrived at the display, interview, and response sequence as indicated in figure 1. During this project, graphic simulation was accomplished in a way that has not been done before. Instead of using preprinted two-dimensional images, stimuli were presented on several electronic displays. The stimuli represented the ebb and flow of 1 hour's air traffic in the Gordonsville High Sector of Washington's Air Route Traffic Control Center (ARTCC). Controllers were given time to study and become immersed in the "snapshots" of this traffic flow. They were asked to try to achieve and maintain a coherent "picture." Visual stimuli were supplemented by additional information presented verbally by one of the interviewers. For example, during initial snapshots, the interviewer indicated aircraft reporting on frequency as they are handed off and accepted by Gordonsville High. A verbal description of the scenario and what occurred during the 44 snapshots is depicted in the appendix.

Snapshots depicted traffic flow and the display of AERA functions. Those functions included were: (1) Trial Plan Probe, (2) Situation Monitor, (3) Conformance Monitor, (4) Reconformance Aide, and (5) Controller Reminders. Specifically not included were: Workload Probe and Limited Resolution Aides. The scenario was written on a moderate taskload level with a goal of an average air traffic count of 10 aircraft. This level of traffic was chosen based on previous research at the Technical Center (Buckley, et al., 1983; Stein, 1985).

This was an interview study, and the primary source of "data" was the verbal responses of the controllers who composed the sequential panel of experts. The interview model emphasized an attitude of professionalism (for both interviewers and interviewees) and the importance of rapport maintenance. A team approach to the interview process was accomplished. A psychologist and an air traffic control specialist worked in tandem as interviewers. The psychologist focused on the consistency of the interview technique, maintenance of rapport, and response recording/data collection. The controller-interviewer was responsible for clarification of controller responses and reexplanation of AERA concepts if necessary.

As each snapshot-stimulus was presented in the predetermined sequence, the controller participant was asked to study the display. The interview proceeded in a semistructured manner with a goal of keeping the process as simple and straightforward as possible. For those snapshots which included AERA functions, the interviewer asked a brief sequence of five "seed" questions as indicated in table 2. The purpose of these five questions was to stimulate thinking and avoid having to probe further. If in the flow of the interview, the participant answered a question before it was asked, the interviewers proceeded on to the next question.

A joint working group of Mitre Corporation and Technical Center personnel established a list of information acquisition goals. This list is much more comprehensive and detailed than the five seed questions and is available in the appendix of this plan. These goals were formulated as questions for which an answer would be desirable as an outcome of this project. The series of information goal questions was presented to each participant in an interview after completing the snapshot presentations. The format of these questions is in the appendix. This process of snapshot and interview presentation took between 3 and 6 hours. Time varied based on the verbal and observational abilities of the participants. Most AERA functions were exhibited more than once during the test. During each exposure, the interviewer attempted to obtain as much information as possible.

TABLE 2. AERA FUNCTION SEED QUESTIONS

What do you see in this slide?

What decisions are necessary?

What coordination is involved?

What additional information would you like?

Can you use the user guidelines which we have given you?

Once the snapshot sequence was completed, the participant received a final questionnaire and an outbriefing. The questionnaire examined participant opinion concerning the graphic simulation process. (See appendix for format.) It also requested feedback concerning the expected utility of the AERA functional guidelines as presented to the controller during training/familiarization. The outbriefing served two purposes. It was the participants' last opportunity to express any attitudes not yet stated. Also, the interviewer could close out the participants' AERA experience by thanking him and by emphasizing participant ownership considerations in the results of this research.

MEASUREMENT CONSIDERATIONS.

It has been said that measurement involves the application of numbers to objects or events in some systematic way. The project design focused on qualitative information produced by the verbally expressed attitudes/opinions of participants. Measurement in a traditional sense was limited to numerical questionnaire responses and to some tallies of participant response frequencies. Results consisted of response summaries and questionnaire analyses.

This design was not structured to prove or validate AERA. Since no systematic sampling of the controller population was accomplished, generalization of results was limited essentially to the participant group which may or may not have been representative of any other group.

RESULTS

SCOPE.

There were essentially three sources of information from which results could be drawn. The first source was participant responses to the five seed questions (table 2). These questions were administered to all snapshots which included AERA information and to a select set of transition slides which preceded some of those containing AERA functions. Table 3 summarizes the AERA functions called out by the snapshots. Table 4 clusters the snapshots under functional categories. A number of the snapshots had multiple functions activitated and, therefore, appear under several headings. Each function which followed the primary AERA activity in a snapshot has that snapshot coded with an "s" for "secondary." The other two sources of information were the post-simulation interview templates and the questionnaire.

TABLE 3. SUMMARY OF AERA FUNCTIONS BY SNAPSHOTS PRESENTED

Snapshot Number	AERA Function	Seed Questions Asked
1	Transition	
2	Transition	X
3	TPP/No Conflict	X
4	Transition Pre-TPP	X
5	TPP/Showroute/Conflict	X
6	TPP/No Conflict	X
7	Transition Pre-TPP	X
8	TPP/No Conflict	X
9	Transition	
10	Transition Pre-TPP	X
11	TPP/Showroute/No Conflict	X
12	Conformance Monitor	X
13	Conformance Monitor	X
14	TPP/Showroute/No Conflict	X
15	Transition	
16	Transition	
17	Transition	
18	Situation Monitor Advisory	X
19	Showroute	X
20	Situation Monitor Advisory/TPP/No Conflict	X
21	Transition Pre-Situation Monitor Advisory	X
22	Situation Monitor Advisory/Showroute	X
23	Transition	X
24	TPP/Showroute/Conflict/TPP/No Conflict	X
25	Situation Monitor Priority Conflict	X
26	TPP/Showroute/No Conflict	X
27	Situation Monitor Advisory	X
28	Showroute	X
29	Situation Monitor Advisory	X
30	TPP/No Conflict	X
31	TPP/No Conflict	
32	TPP Conflict with Airspace	X
33	Situation Monitor Priority Conflict/Showroute	X
34	TPP/No Conflict	X
35	Situation Monitor Advisory/TPP/No Conflict	X
36	Situation Monitor Priority Conflict/Showroute	X
37	TPP/No Conflict	X
38	Transition	
39	Transition	
40	Transition Pre-TPP	
41	TPP/No Conflict	X
42	Transition	
43	Transition	
44	Controller Reminder	X

TPP - Trial Plan Probe

TABLE 4. SNAPSHOTS ORGANIZED BY AERA FUNCTION

Trial Plan Probe (no conflict)

3	24 s	37
6	26	41
8	30	
11	31	
14	34	
20 s	35 s	

Trial Plan Probe (conflict)

5
24
32

Conformance Monitor

12
13

Situation Monitor

Advisory	Priority
18	25
20	33
22	36
27	
29	
35	

Showroute

5 s
11 s
14 s
19
22 s
24 s
26 s
28

Controller Reminder

44

Transitions with Seeds Asked

2	Pre-Trial Plan Probe
4	Pre-Trial Plan Probe
7	Pre-Trial Plan Probe
10	Pre-Trial Plan Probe
21	Pre-Situation Monitor
23	Pre-Trial Plan Probe

Note: Those snapshots coded with an "s" presented that AERA function secondary to another function.

An examination of table 4 reveals a heavy emphasis of trial plan probe resulting in no predicted conflicts. Also stressed were situation monitor advisories. Showroutes, which appeared in 10 snapshots, were almost always used to support other functions. The showroute was not technically a function but rather served as a means of displaying the results of the function employed. Seed questions were asked during six transition slides which served to set up the initiation of AERA functions. It was thought that posing the seeds at these points might shed light on controller thinking prior to the output of AERA results.

The varied emphases on the AERA functions, as reflected by the number of snapshots devoted to each, evolved based on a number of factors. One reason was the requirement to have a traffic flow which could be followed by participants and yet develop situations where AERA could be used. This was no simple task and did require considerable controller and computer systems specialist effort. Another reason was related to the values and interests of the AERA system developers who effectively had the final editing responsibility for the scenario. It was they who created the final adjustments and balance of the various AERA functions.

ANALYSES OF SEED RESPONSES.

The five seed questions were asked after every snapshot which contained AERA information. They were also applied to six preparatory snapshots which led up to the use of AERA functions. As indicated in table 4, snapshots could be organized by the AERA activities they evolved. Examination of results was accomplished by sorting all responses to each snapshot under each AERA function. The analyst then reviewed the responses for common themes and summarized the contents of each snapshot under each AERA functional heading. Where there was a diversity of opinion expressed, the frequency of responses was tallied and was described in the summaries as a fraction of the participating controllers. These summaries follow directly. The reader may wish to refer to the scenario descriptions in the appendix while reviewing these summaries. Because of the nature of these summaries, they make very dull reading. The reader may wish to skip to the Overview of Seed Responses if he/she does not require this level of detail.

SEEDS ASKED PRELIMINARY TO A TRIAL PLAN PROBE OR SITUATION MONITOR.

Snapshot 2. Prior to a trial plan probe on a direct routing (where no conflict existed), four of the five controllers saw no problem (without trial plan probe) and would have granted the routing anyway. Controllers were working to attain and maintain the picture. They commented on the activities of other aircraft besides those at center stage. Coordination would have been limited to situations where the controller induced a change into the traffic flow.

Snapshot 4. Prior to a trial plan probe on a direct routing (where a conflict would occur), none of the controllers anticipated the oncoming conflict and all would have granted the direct routing. There was no flight strip on the aircraft (AA199) which would conflict with the aircraft requesting the direct flight. Three of the controllers felt some interphone coordination would be required. One controller indicated a desire for a range bearing on the requesting aircraft along with a vector line on the aircraft target.

Snapshot 7. Prior to a trial plan probe on an altitude change (where a conflict would occur if the change was made immediately but no conflict if the change was delayed), all controllers identified the problem of head-on traffic at the new altitude (without the trial plan probe). Three of the respondents suggested a delay in the new clearance would solve the problem. Three would have used interphone coordination. One controller expressed an interest in receiving the results of a trial plan probe.

Snapshot 10. An adjacent sector asks for help in resolving an advisory conflict. The controller is asked to analyze the situation (prior to a trial plan probe for a new conflict-free route). All controllers expressed a willingness to help the adjacent sector. Most saw no immediate problem and would have liked more information, because they had no flight plan on one of the two aircraft potentially in conflict. Two controllers suggested the use of a probe. Four of the controllers stressed the importance of coordination/communication with the sector making the request to try and find out what their needs were.

Snapshot 21. Prior to a situation monitor advisory, the controller receives a call from the adjacent sector of an advisory in his sector which is resolved by handing off AC009 and AA914 in a conflict status. Controllers had difficulty in visualizing this situation and all five indicated there was no immediate problem. They indicated that there was adequate time to resolve the situation, whatever it might be. Two participants indicated a desire for their own probe, and one expressed interest in seeing a showroute.

Snapshot 23. Prior to a trial plan probe and showroute, an aircraft (Tabboo 82) on a celestial navigation flight plan requests a complex route change. There was a considerable spread in the responses to this situation. Two controllers expressed some problems in visualizing the new route and both wanted a visual display of the routing. Two controllers would have granted the new route based on the information available. The last controller offered to develop an alternative route and he also wanted a visual route display. Two controllers would coordinate the new routing because of an altitude change. One would coordinate because of the path change. One would let the computer updates of new routes suffice, and one controller was uncertain about coordination requirements.

CONFORMANCE MONITOR.

Snapshot 12 (Vertical Conformance Deviation). All controllers identified the deviation from assigned altitude. Two stated that they did this using the data block of aircraft DL547. The other three controllers noted the red "B" located near the data block. Four of the controllers would advise the pilot immediately while one said he would wait for one more radar sweep. Three of the controllers felt no coordination was required based on the information. Two of the controllers would notify the downstream sectors if pilots reported problems with their transponders. Three of the participants believed that the procedures were adequate for use of the conformance monitor information. One said the procedures were not applicable, and the last controller indicated that the procedures could be applied if the system provided more information (i.e., the status of the Mode C transponders). Two controllers commented that the red "B" from AERA was located too far away from the designated aircraft's data block.

Snapshot 13 (Lateral Deviation From Course). All controllers identified the deviation from course of AA123. Two participants specifically cited the red "R" near the data block. The others did not indicate the information they employed to find the deviation. Four of the controllers would have advised the pilot immediately. Three of these controllers would attempt to reclear the aircraft direct to the Newton VOR and hand it off to the next sector. One controller would have attempted the handoff without reclearing the aircraft. One controller stated he would reconform the aircraft prior to handoff and only he indicated that no coordination was required if reconformation was achieved. The other four controllers indicated that direct interphone coordination was necessary with the downstream sector either to negotiate the direct routing or inform the accepting sector that AA123 was off course. Three of the participants felt the procedures could be used; one said they were not applicable; one had no opinion.

SITUATION MONITOR ADVISORY.

Snapshot 18. An advisory conflict was predicted in 18 minutes. Four of the participants did not initially identify the advisory prediction on the data display. This was their first exposure to this function during the scenario. Of these four, three eventually noted the conflict coding on the flight data display. Four of the controllers, including all those who did not originally see the conflict, felt that 18 minutes' warning on an advisory was too far in advance. All the participants indicated that no decisions were currently necessary other than to wait and see. Two controllers indicated that no coordination was necessary, the other three would have called the sector in control to ask for more information. Four of the controllers stated that there was inadequate information in the flight strips, which could have been resolved if departure/arrival locations were specified so that the controller would know if the aircraft were climbing or descending. Three of the controllers stated that they could use the procedures, one said that he did not have enough information to use them, and one controller stated that the aircraft were not currently his responsibility so the procedures did not apply.

Snapshot 20. An advisory airspace conflict was predicted and a trial plan probe was introduced for an alternative routing. All the controllers noticed something initially. For three, it was the advisory conflict and for the remaining two, it was the results of the probe. Introducing the probe results into the same slide as the situation monitor may have clouded the waters somewhat. Four controllers accepted the results of the probe for a new routing. One controller specified that he would not have probed so far in advance. Three of the controllers indicated no coordination was required. One of these explained that no interphone coordination was necessary because the route change was induced more than 10 nmi from the sector boundary. The other two participants felt that coordination was necessary for the downstream sectors. Two participants were uncomfortable with the physical display of the restricted airspace and would have liked more information. Three felt that the procedures were adequate as specified; one said they were not applicable; one had no opinion (he would not have employed the AERA functions in the first place since the conflict was not in his area).

Snapshot 22. An advisory conflict is predicted and a showroute is displayed. All the participants take note of the predicted conflict but they do so using the showroute rather than via the information in the flight data display. Four of the controllers chose to wait rather than make a decision at this time. One controller would vector an aircraft to resolve the problem. Three saw no need for coordination. The other two would contact the sector currently in control of the aircraft to see if they could resolve the problem. Four of the controllers had enough information, but one would have liked digital trial plan probe information along with the showroute. All the controllers indicated they could use the procedures for AERA situation monitor advisory. However, one felt they were too rigid.

Snapshot 27. An advisory conflict is predicted in 18 minutes between an aircraft on a celestial navigation flight plan, Taboo 82, and another aircraft, DL840. All controllers noted the advisory conflict information. All chose to wait and see, rather than decide anything now. One controller commented that an advisory 18 minutes in advance was "ridiculous" and created extra work. None of the controllers felt any coordination was necessary and none wanted anymore information. One suggested, however, that a showroute might have been useful. Two controllers said they could use the procedures; two said they were not applicable; one felt the advisory was unnecessary and the procedures were, therefore, not useful.

Snapshot 29. A situation monitor advisory conflict is predicted near Gordonsville. All of the controllers identified the predicted conflict. Three had predicted the conflict at snapshot 27 prior to any advisory warning. Of the remaining two participants only one used the red "C's" from the flight data display; the other controller used PVD information. All chose to wait and see. Two discussed possible options for resolving the conflict. Three participants saw no need for coordination. One would have asked the inbound sector for control of an aircraft, not even cited in the advisory, which he was concerned about. One would coordinate if he acted to resolve the situation by changing an outbound flight path. None of the controllers wanted more information. All the controllers felt comfortable with using the procedures in this situation.

Snapshot 35. A situation monitor advisory conflict with a refuel route is predicted and a trial plan probe of a new route is presented. Three of the controllers did not identify the airspace conflict initially. All did notice the results of the trial plan probe which was conflict-free. Two wondered why the probe was initiated until they finally picked up the conflict information. No one expressed a need for any coordination. Four did not want any further information. One would have liked the final assigned altitude for an aircraft other than the one currently in anticipated conflict. Four of the participating controllers indicated that they could use the procedures; but one of these individuals stated that the trial plan probe was unnecessary, and he could have resolved the problem himself. One controller felt the procedures did not apply.

SITUATION MONITOR PRIORITY CONFLICT.

Snapshot 25. A priority conflict is predicted between two aircraft in 8 minutes. Four of the controllers took note of the priority conflict message on the PVD. Of these four, one indicated that he had almost missed it. One participant did not see the conflict message at all. Three of the participants stated that they would resolve the problem by vectoring one aircraft. Two controllers would have asked for an inbound handoff of AA914 but one did not suggest a resolution strategy. Three of the controllers saw no need for coordination. Three of the controllers wanted no more information. One suggested a showroute so he could better visualize the point of predicted impact. One controller suggested a trial plan probe to check an alternative altitude for conflict resolution. The four controllers who noticed the conflict felt the procedures could be used. One of these men stated, however, that he would have preferred to use vector length tools in the current NAS to help resolve the problem rather than AERA.

Snapshot 33. A priority airspace conflict with a refuel route is predicted near the boundary of the sector. A showroute is presented. All the controllers took note of the showroute and the conflict. Several stated that the adjacent sector should have notified them that the refuel route was active. A number of possible solutions were suggested. Two controllers suggested vectoring the aircraft, while one felt an altitude correction was the best choice. One controller would not change anything since the conflict occurs in the next sector. One controller felt that the letters of agreement should contain the procedures for dealing with the situation. All the participants felt that some coordination was necessary for a conflict near the border. Two said they would act and advise the downstream sector. Three would ask the other sector for input on the solution. Three of the respondents wanted no further information. One controller suggested a probe of the conflicting aircraft and another aircraft which he was concerned about (which as it turned out latter (snapshot 36) would appear in a priority conflict message). One controller would have liked a destination point indicated on the flight strips. Four of the controllers indicated they could use the procedures and one stated that the procedures did not apply.

Snapshot 36. A priority conflict between aircraft is predicted in the adjacent (Atlanta sector) with the conflict zone crossing the boundary. A showroute is presented. Four of the controllers took note of the conflict. However, two of them had problems in interpreting the displayed information. The last controller noted that there was a conflict but thought it was a one-aircraft incident in conflict with the refuel route in the adjacent sector. There was a diversity of opinion on how to deal with the situation as displayed. The controller who interpreted the situation as an airspace conflict felt it was not his responsibility. Two of the controllers would have stopped the climb of one aircraft. The other two were vague in their responses and proposed no specific alternatives. Four of the controllers expressed a need for coordination with the Atlanta sector. The other controller did not want to coordinate because it was not his problem. None of the controllers wanted additional information. Three of the respondents said the procedures using the AERA function were adequate. One said the procedures did not apply because the situation was unrealistic. One indicated the boundary situation was not covered by these procedures.

TRIAL PLAN PROBE (CONFLICT).

Snapshot 5. Following a trial plan probe, a conflict is predicted between aircraft if the probed route is activated. A showroute is presented. Four of the controllers identified the results of the probe immediately and one controller did so after some initial confusion. Two of the controllers took note that the conflict would not occur for 18 minutes. Possible decisions based on the information varied considerably. Two said they would grant the requested direct route anyway. Two did not describe a clear-cut alternative and one controller felt that the decision belonged to the controller in whose sector the conflict would occur. Three said they would coordinate the requested routing with the sector in which the conflict was predicted. One controller who would have granted the direct route would simply enter the update into the computer. The other controller was vague about desired coordination. Three of the controllers wanted more information on AA199, one of the aircraft in the predicted conflict on which they had no flight strip. Three of the controllers could use the procedures covering this situation. Two of these three indicated that they would enhance procedures with additional landline coordination. One controller believed that the procedures were too rigid and that there was no reason to deny the direct routing at this time. Another controller echoed this position indicating that he would advise the pilot and abide by his decision.

Snapshot 24. Following a trial plan probe, a conflict is predicted between aircraft if the probed route is activated. A showroute is presented. Following another trial plan probe, an alternative route is conflict free. This was a very noisy snapshot which may account for some of the confusion and difficulty in the responses. Four of the controllers identified the conflict most probably using the showroute rather than the probe digital output. Only two, however, initially saw the results of the second conflict-free probe. Three of the participants described a scenario error which put one aircraft (Taboo 82) at the wrong altitude for direction of flight. Since most of the participants did not see the results of the second probe, they offered a variety of decisions. They all indicated that they would try to accommodate Taboo 82's route request but modify the altitudes to avoid the predicted conflict. Four of the controllers would coordinate the new flight plan using interphone communications. One controller indicated that no additional coordination was required. No one stated a need for further information. Four of the participants were comfortable with the procedures for trial plan probe where a conflict was predicted. However, three of these individuals had comments. One felt that a route readout, as in the current NAS, would have been adequate. One noted again that the requested altitude was incorrect for the direction of flight. The third controller in this group emphasized that he would not have used the second probe because he had come to a solution without it.

Snapshot 32. Following a trial plan probe, a conflict with restricted airspace is predicted. Three of the controllers initially noticed the results of this trial plan probe. The other two eventually saw the trial plan probe output and interpreted its meaning. Three indicated they would deny the direct routing requested by the pilot of E700. One controller offered to grant the direct route and radar vector the aircraft around the restricted area. One controller suggested a standby on the clearance to be activated or denied after a time delay. Three of the controllers stated that no coordination was necessary. One would have coordinated with outbound sectors and another controller would have called the inbound sector to determine if he had control of E700. Four of the controllers wanted no additional information. One controller wanted to probe the routes of DL880 and Dl840, aircraft not in focus for this particular snapshot. Three of the participants said they could use the procedures. One stated "no;" his solution was contrary to procedures. (He was the one who would have cleared E700, direct, then used radar vectors.) One felt the whole situation was unrealistic since the pilot would have known the standard routing and would not have made the request in the first place.

TRIAL PLAN PROBE (NO CONFLICT).

Snapshot 3. An aircraft requests a direct route, and a trial plan probe is implemented. This was the first use of trial plan probe in the scenario. Only two took any initial notice of the probe results. Three of the controllers determined that there were no conflicts with the direct route using only radar information. Those that saw the probe results accepted them and would have granted direct routing. The others came to the same decision without the trial plan probe. Three of the controllers once they saw the probe results felt the downstream sector should be notified via landline. The other two believed that the coordination could be done automatically. Only one controller wanted more information and that was concerning an aircraft not in focus on this snapshot (UA007). Four of the controllers had no problem with the procedures and one had no opinion. Three of the controllers felt using the probe was unnecessary, and two of these expressed concern that probing would increase workload or slow the decision process.

Snapshot 6. The trial plan probe is implemented on the original flight plan of aircraft DL547 after a previous probe of an alternative route demonstrated a conflict. All five of the controllers observed the results of the probe and everyone of them commented that the probe was done on the original route. Four of the controllers stated that they would maintain the aircraft on the original route; one said he would give the pilot whatever he requested. Four of the controllers would not have coordinated. One would have forwarded the pilots request downstream. All five accepted the procedures. However, three said they would not have used the probe.

Snapshot 8. The trial plan probe was implemented after an aircraft requested a change of altitude. The probe was done from Gordonsville downstream since the scenario controller identified a possible conflict prior to Gordonsville. Four of the controllers initially noticed the probe results. However, one of this group was somewhat confused by the results since the probe was activated from Gordonsville rather than from present aircraft position. All five of the controllers would have cleared the requesting aircraft to descend after Gordonsville. Only two of the controllers felt that landline coordination was necessary. No one wanted additional information about the air traffic, but one controller was concerned about how soon the data base would be updated once he keyed in an altitude change. Four of the controllers felt they could use the procedures that had been provided. One stated they were not applicable because he would not have used the probe; it would have delayed his control actions.

Snapshot 11. The trial plan probe was employed to evaluate an alternative route for an aircraft that would have had a conflict in an adjacent sector. A showroute was presented. All five of the controllers saw the showroute immediately and four identified the conflict-free results of the probe. Four of the controllers accepted the results of the probe and would have cleared the aircraft on the probed route. Four of the controllers indicated that coordination was necessary due to the rerouting of the aircraft. Two of the controllers wanted flight data on the other aircraft cited in the original conflict advisory. One of these men stated that he would have liked a showroute on the new route. (The one displayed was on the old route.) Four of the participants said they could use the procedures. One controller stated that the procedures were not as versatile as the controller could be.

Snapshot 14. A trial plan probe was employed to examine a direct route as a resolution to a lateral conformance violation. A showroute was presented. All of the controllers saw the results of the probe. All accepted the results and would have recleared the aircraft on the new route. Three of the participants would have called downstream to either coordinate the new route or inform the other controller that the aircraft was right of the course. Four expressed no need for additional information. Four said they could use the procedures, but one of these men stated he would not have used a probe because it would be extra work. One controller had no opinion on the procedures.

Snapshot 26. A trial plan probe was employed to examine a new route as a resolution to a priority conflict. A showroute on the new route was presented. Three identified the results of the probe immediately, and one eventually noticed it. Two of the controllers who saw the probe results quickly expressed satisfaction with the solution; four of the controllers accepted the results of the probe. One, who did not, said he would delay implementation until the aircraft came under his control. Four of the controllers stated that the procedures were acceptable, but two of these individuals stressed that they would not have used the probe. They preferred their own methods which were more expeditious. When asked if he could use the procedures, the fifth controller stated that using the probe would increase his workload. So three of the controllers would have preferred no probe in this situation.

Snapshot 30. A trial plan probe was used to examine a new altitude for an aircraft which had an advisory conflict predicted. The probe was begun 3 minutes downstream to avoid what might be head-on traffic. Four of the controllers saw the results of the probe initially and the other controller eventually saw it. Three did not like the solution expressed by the probe and no one accepted the results. This clouded the remainder of their responses. Four indicated no coordination was necessary if they implemented the probes solution. Three wanted no additional information. One expressed concern that the head-on traffic would have passed in 3 minutes. One wanted to probe an alternative solution to the conflict. Four said they could use the procedures (assuming that they could live with the solution). One said he wouldn't have used the probe.

Snapshot 34. A trial plan probe is accomplished to evaluate a new altitude as a resolution to an airspace conflict. All five controllers took notice of the probe and four accepted the results. Two controllers cited a possible conflict between two aircraft not currently in focus (DL840 and PA880). One controller did not like the probe's results, indicating that he would not have probed in the first place. Only two of the participants would have coordinated and four did not want any further information. One controller stated that the requested altitude for a transitioning aircraft (DL461) was not on the flight strip. All five of the controllers stated that they could use the procedures that were provided.

Snapshot 37. A trial plan probe was used to examine a direct route suggested by the adjacent sector controller as a resolution to a priority conflict. Four of the controllers noted the results of the probe of PI137 on a direct route to Gordonsville. The other controller focused on the radar portion of the PVD and was only concerned with a possible conflict between two other aircraft. Only one of the controllers accepted the probed solution. Three expressed uncertainty and other alternatives. The controller who expressed concern about another possible conflict, would not redirect his attention to the results of the probe. Three of the participants indicated no landline coordination was necessary. One controller felt that landline contact with the Atlanta sector, where the priority conflict existed, should be maintained until resolution. The last controller noted that any change of flight path on PI137 would have to be called in to the Atlanta sector. No one wanted any additional information. Four of the five controllers stated that they could use the procedures. The fifth controller felt the situation was not covered in the procedures, and he was not satisfied with the solution the scenario offered.

Snapshot 41. A trial plan probe was employed to examine a new altitude as a resolution to an advisory conflict in an adjacent sector. All of the controllers saw the results of the probe on aircraft DL840. Two of the controllers identified a possible conflict between DL840 and another aircraft (UA326). None of the controllers were comfortable with the proposed solution. They offered alternatives which ranged from telling the adjacent sector controller "to eat it" to suggesting speed adjustments. Four of the controllers indicated that they would have coordinated. The contents of these calls also covered considerable ground from informing the adjacent sector of an aircraft's altitude change to suggesting that the adjacent sector do his own separation. No one wanted any additional information, but one controller commented that there was too much clutter on the display. Four of the participants said they could have used the procedures. One controller said no because the situation was unrealistic.

SHOWROUTES PRESENTED WITHOUT OTHER FUNCTIONS.

Snapshot 19. A showroute was presented on aircraft DL461 following a previous snapshot in which a situation monitor advisory conflict appeared. All five of the controllers identified the showroute but most were confused by what they saw. The lack of flight data blocks on the aircraft in question made "getting the picture" very difficult. Four of the controllers would have taken no action immediately since 18 minutes remained until conflict. One controller would contact the adjacent sector and try to gather more information. Four of the controllers would have limited coordination to finding out what was going on and what the pilot intentions were. Four of the controllers felt there was inadequate information presented and wanted more. In terms of using the AERA procedures, two said they could but were not happy about it. One said he did not like the "procedural" solution offered and the other of this pair commented that the showroute alone was not adequate. Three of the controllers stated that the procedures could not be used for the following reasons: (1) They would not have used the showroute, (2) The situation might not occur as predicted; or (3) They would prefer not having the information rather than as currently displayed.

Snapshot 28. A showroute was presented on aircraft Taboo 82 following a snapshot in which a situation monitor advisory conflict appeared. Taboo 82 was on a complex celestial navigation flight plan. All of the controllers noted the results of the showroute. All would have chosen to take no action at this time since 18 minutes remain until conflict. Three of the controllers felt that some coordination would be necessary if they implemented the prescribed solution. Four of the controllers wanted no additional information. One would have probed an alternative altitude for DL840, the other aircraft in the predicted conflict. Two of the controllers thought the procedures were acceptable but both disagree with the proposed (Mitre selected) solution. Three of the controllers indicated that the procedures were not applicable.

CONTROLLER REMINDER.

Snapshot 44. The controller receives a reminder to monitor the descent of aircraft N715NB to flight level 290. This was the resolution of an airspace conflict predicted earlier (snapshot 35) by a situation monitor advisory. All participant controllers noted the reminder message. One controller accepted the reminder without comment. One controller indicated that he did not need to take immediate action because 5 to 8 minutes remained. One controller commented that it was unrealistic for the adjacent sector to ask for help so far in advance. One controller felt no decisions were necessary, and one controller was concerned about an incorrect altitude listed for an aircraft (UA114). Four of the controllers indicated no coordination was necessary. No one wanted any additional information. (There were no specified procedures given to participants concerning the controller reminders.)

OVERVIEW OF SEED RESPONSES.

Participant controllers responded to the seed questions on six preparatory snapshots prior to receiving any AERA results. These snapshots represented a diversity of situations and the pattern of responses was not very clear. Table 5 provides a simple frequency tally of controller comments based on categories that emerged during the interview process. Of the six snapshots involved, all the participants failed to identify an airspace problem that would occur soon in three situations. However, in two of these situations, the problems that would occur were based on advisories in other sectors that our participants could not have anticipated. During these preparatory snapshots, the majority of controllers would have done some landline coordination to alert adjacent sectors and/or seek information. The AERA procedures did not apply in these preparatory snapshots and the question was not asked.

Table 6 summarizes what controllers said about the two conformance monitor deviations. All the controllers identified the departures from conformance. However, about half the time they identified the deviations using the data blocks as they had been trained to do rather than the AERA red letter near the block. Several commented on the distance of the red letter from the block. Three of the five, a simple majority, thought that the procedures were acceptable.

The situation monitor advisory responses are tallied in table 7. There were mixed results on taking note of the advisories themselves. Everyone did this quickly on only half the slides. This occurred because controllers were focusing their primary attention on the PVD rather than on the data display. In all cases where the advisory was not confounded with a showroute, controllers chose to take no immediate action. There were many comments that the time-to-conflict on the advisories was too long. With the exception of snapshot 27, the majority of the controllers indicated they could use the procedures.

TABLE 5. SUMMARY OF PREPARATORY SNAPSHOTS

	Snapshots					
	2	4	7	10	21	23
Saw no problem and none existed	4	*	*	*	*	*
Would have granted clearance	4	5	*	*	*	2
Saw no problem where one existed	*	5	*	5	5	2
Saw problem	*	*	5	0	0	0
Coordination desired	3	3	3	4	0	3
Desired further information	0	0	1	5	3	3
Felt time was more than adequate	*	*	*	5	5	0

* Not applicable

TABLE 6. SUMMARY OF CONFORMANCE MONITOR

	Snapshots	
	12	13
Identified the conformance deviation	5	5
Used AERA code	3	2
Used data block	2	3
Advise the pilot	4	4
Reclear the aircraft	*	3
Coordination desired	2	4
Procedures acceptable	3	3

* Not applicable

TABLE 7. SUMMARY OF SITUATION MONITOR ADVISORY

	Snapshots					
	18	20	22	27	29	35
Noted the conflict advisory message	1	5	0	5	5	2
Eventually noted the conflict message	3	*	*	*	*	2
Identified conflict using showroute	*	*	5	*	*	*
Chose to wait before acting	5	C	4	5	5	C
Desired coordination	3	2	2	0	2	0
Desired more information	4	2	1	0	0	1
Procedures acceptable	3	3	5	2	5	4

* Not applicable

C Responses to the advisory confounded by the presence of a trial plan probe of an alternative route in the same snapshot.

Responses to trial plan probes which predicted a conflict are described in table 8. The majority, but not all, of the controllers identified the results of the probes. It is likely that if they had been in actual control and had themselves initiated these probes, they would have anticipated and found the results more frequently. In two of the three situations, the majority of controllers would have used landline coordination. The majority found the procedures were usable.

The most frequently presented situation in the air traffic scenarios was the trial plan probe with no conflict predicted. Table 9 summarizes the responses. In most cases, the participants identified the probe output quickly and would have granted the pilots requests if possible. They had few requirements for any landline coordination and were satisfied with the amount of information available. In all cases at least four of the five participants found the procedures usable. In six of the snapshots one or more of the controllers expressed the opinion that using the probe was unnecessary.

TABLE 8. SUMMARY OF TRIAL PLAN PROBE (CONFLICT PREDICTED)

	Snapshots		
	5	24	32
Noted the results of the probe	4	4	3
Noted time to conflict	2	*	*
Would grant requested route anyway or try to accommodate aircrew	2	5	2
Desired coordination	3	4	2
Desired more information	3	0	1
Procedures acceptable	3	4	3
Saw scenario error	*	3	*

* Not applicable

TABLE 9. SUMMARY OF TRIAL PLAN PROBE (NO CONFLICT PREDICTED)

	Snapshots									
	3	6	8	11	14	26	30	34	37	41
Noted the results of the probe	2	5	4	5	5	3	4	5	4	5
Made a determination of no conflict without probe	3	0	*	*	*	*	*	*	*	*
Would grant direct routing or accommodate pilot requests	5	5	5	4	5	4	0	4	1	0
Desired coordination	3	1	2	4	3	0	1	2	0	4
Desired more information	1	0	0	2	1	0	2	1	0	0
Procedures acceptable	4	5	4	4	4	4	4	5	4	4
Probe use unnecessary	3	3	1	0	1	3	1	0	0	0

* Not applicable

Showroutes were used in two snapshots without any other AERA information (table 10). All controllers took rapid note of the results and almost all indicated the time-to-conflict was 18 minutes in both cases. The majority chose to wait before acting and most felt some coordination was required. In snapshot 19 most felt more information was necessary, and in snapshot 28 most felt it was not. The majority of participants did not find the procedures usable. However, there were no procedures in the functional user guidelines specifically tied to the showroute, since it is only a display option rather than an AERA function.

Table 11 describes the responses to the (one) controller reminder. The results are self-explanatory. There were no procedures provided in the functional user guidelines.

TABLE 10. SUMMARY OF SHOWROUTES (PRESENTED WITHOUT OTHER FUNCTIONS)

	Snapshots	
	19	28
Noted results of the showroute	5	5
Noted the time to a conflict	4	5
Chose to wait before acting	4	5
Coordination desired	4	3
Desired further information	4	1
Procedures acceptable	2	2

TABLE 11. SUMMARY OF CONTROLLER REMINDER

	Snapshot
	44
Noted the results of the controller reminder	5
Coordination desired	1
Desired further information	0
Procedures acceptable	*

* Not applicable

THE EXIT QUESTIONNAIRE RESPONSES.

At the end of the graphic simulation, each participant controller completed a short questionnaire (see appendix for the format). They were asked to scale their attitudes about AERA functions, the functional user guidelines, and the simulation itself. The first question requested a rating of how frequently participants thought they might use AERA functions if they were available. Their responses were somewhat less than enthusiastic concerning controller reminders, trial plan probe, and reconformance (table 12). Using a scale ranging from 1 (never) to 5 (very often) controllers reported most frequently (2) seldom and (3) occasionally.

Questions 2 through 8 were based on a ten-point strength of agreement scale with end points of 1 (strongly disagree) to 10 (strongly agree). When asked if they knew much about AERA, they tended to disagree (median of 2). They generally did not feel that AERA would lower their workload (median of 2). They indicated that the functional user guidelines, the procedures, were clear and understandable (median of 7) with one dissenting vote. They generally (three out of five) did not feel that the user guidelines would ease implementation of AERA (median of 3). There was mixed opinion on whether the graphic simulation was a waste of time (median 5). However, there was strong consensus that the simulation had been professionally conducted (median of 10). They did not agree that AERA would enhance productivity (median 2).

Questions 9 and 10 asked controllers to express their opinions on the usefulness of AERA functions and the functional user guidelines. Their median responses tended towards the middle of the range. Both conformance and reconformance aides were not seen as very useful. There was a mild positive relationship between responses to the functions and to the guidelines r =.53. Controller responses tended to form patterns. For example, participants 11 and 13 tended to be more positive and rated higher than the other controllers for most functions and guidelines. Such a pattern indicates a halo effect on this series of questions. Both participants 11 and 13 rated their attitudes towards research in the entry questionnaire at the top of the scale, "10." It is possible that overall their responses may have been somewhat inflated.

TABLE 12. GRAPHIC SIMULATION EXIT QUESTIONNAIRE

		Participants					
		10	11	12	13	14	Median
1.	Would use AERA functions (1 never - 5 very often)						
	Controller reminders	2	3	2	-	3	2.5
	Trial plan probe	2	4	3	3	1	3
	Reconformance aide	1	2	2	2	1	2
2.	Know about AERA (1 no - 10 yes)	2	8	1	6	1	2
3.	AERA would lower my workload (1 no - 10 yes)	1	5	2	6	1	2
4.	User guidelines clear and understandable (1 no - 10 yes)	3	7	7	6	10	7
5.	User guidelines would ease implementation	2	7	3	6	1	3
6.	Graphic simulation a waste of time	3	5	8	4	5	5
7.	Graphic simulation was conducted professionally	9	10	9	10	10	10
8.	AERA would enhance productivity	2	8	2	5	1	2
9/10	Rate usefulness of AERA functions and guidelines (in parentheses)						
	Controller reminders	3(2)	6(6)	2(5)	7(5)	5(5)	5(5)
	Trial plan probe	2(2)	9(7)	3(5)	8(5)	1(1)	3(5)
	Situation monitor						
	Aircraft conflict	4(2)	9(9)	5(5)	7(7)	5(5)	5(5)
	Airspace conflict	4(2)	7(5)	3(5)	9(7)	1(1)	4(5)
	Flow control conflict	4(2)	—	3(5)	8(5)	5(1)	4.5(3.5)
	Conformance aide	2(2)	9(7)	3(5)	3(3)	1(1)	3(3)
	Reconformance aide	2(2)	7(7)	2(5)	3(3)	1(1)	2(3)

Scales

Question 1	1 Never	2 Seldom	3 Occasionally	4 Frequently	5 Very Often					
Questions 2 - 8	1 Strongly Disagree	2	3	4	5	6	7	8	9	10 Strongly Agree
Questions 9/10	1 Not Useful	2	3	4	5	6	7	8	9	10 Very Useful

RESPONSES TO TRIAL PLAN TEMPLATES.

TP-1: When must an air traffic control specialist coordinate direct routes?

The majority of controllers stated that landline coordination was necessary when flight plan changes could not be passed forward "quickly enough" using computer updates. They varied in terms of criteria concerning what was meant by "quickly enough." Time from the sector boundary was usually cited (i.e., 15 to 30 minutes). One controller felt all direct routes should be coordinated.

TP-2: If the trail plan probe predicts no conflicts, should coordination still be accomplished?

The majority of controllers felt that coordination was necessary based on the same criteria as in TP-1 — time from the sector boundary. This meant that direct routes approved far enough in advance could be simply entered into the computer system. One controller noted that letters of agreement between the sectors should be considered.

TP-3: Should procedures vary based on the type of conflict?

TP-3A: Aircraft to aircraft.

Generally, the controllers considered this the most important situation. The closer aircraft approached each other, the more serious the situation was perceived. One controller noted that direct routes should be denied if the aircraft were close; if not, then there was more flexibility. Another controller stated that procedures should take into account where the aircraft are going and whether altitude changes are involved.

TP-3B: Aircraft to airspace.

There was little consensus on this other than it was a valid problem. Several controllers indicated that radar vectors could be used to deal with this situation, and probes were unnecessary unless the problem might occur in another sector. One controller stated that there should be preestablished procedures for dealing with this.

TP-3C: Aircraft to flow restrictions.

This was not shown in the graphic simulation. Several controllers indicated that procedures necessary to deal with a flow restriction conflict would have to be preestablished and would not allow much flexibility for controller choices.

TP-4: What is the influence of the location of the predicted conflict?

TP-4A: Number of sectors involved.

Opinions on this question varied considerably from the isolationist view that only your own sector was important to the observation, that the further ahead you look then the more time there is to solve any problem. Generally, controllers indicated that the more sectors involved, the more complicated the implementation of any solution would be.

TP-4B: Predicted conflict near sector boundary.

Controllers agreed that this is a very complicated situation and that coordination with the adjacent sector would be necessary. One controller noted that many variables had to be considered and the conflict might not have occurred as probed.

RESPONSES TO SITUATION MONITOR TEMPLATES.

SM-1: What criteria should be used to determine whether a predicted conflict is presented as "advisory" or "priority?"

Four controllers agreed that time-to-conflict was the appropriate metric for discriminating between the types of conflict. One of these four felt that aircraft type was important. There was only one vote for distance and aircraft type as the criteria. Several participants felt that 8 minutes may be too long for a priority conflict. Another controller suggested 10 to 12 minutes as the criterion for an advisory conflict. He commented that "in this business things change too fast; warning too far in advance may lead to complacency!"

SM-2: How might procedures vary based on the nature of the conflict message — priority versus advisory?

There was consensus that advisory conflicts serve an alerting function but that the primary strategy was to wait and see what happened. With priority conflicts you might be able to wait a short while but will have to take some action almost immediately. One controller noted that advisory conflicts might be distracting during peak traffic.

SM-3: How does conflict type affect the control procedures?

SM-3A: Aircraft to aircraft conflicts.

This is the most serious situation and the controller has the option of moving one or both aircraft to resolve the problem. Alternatives include altitude change, route change, and speed control. One controller noted that you use whatever you can to employ the easiest solution.

SM-3B: Aircraft to airspace conflicts.

The solution is limited to one aircraft using route and/or altitude changes. This type of conflict, as one controller commented, is rare because most pilots know the locations of restricted airspace.

SM-3C: Aircraft to flow control restrictions conflict.

Only one controller had a comment on this. He noted that options for resolution were limited to speed control or holding.

SM-4: What is the impact of predicted conflicts which involve multiple sectors?

SM-4A: Does coordination needed vary based on the number of sectors?

Four of the controllers indicated that as the number of sectors increased so would the coordination requirements.

SM-4B: How does a conflict on a sector boundary influence decisions?

Communication must be maintained between the sectors concerned. One controller pointed out that sector controllers must determine who will make the decisions to resolve the conflict. Another controller felt that the type of conflict (i.e., overtaking, crossing, head-on) was important.

SM-4B1: Should an adjacent sector which does not have a point of violation be notified?

There was diverse opinion expressed on this one. Several controllers said yes if they had to change a flight plan of any outbound traffic. One controller gave an unqualified "no." One controller said yes if he changed a flight plan within 10 miles of the boundary. By implication, respondents appeared to be saying that if they did not change anything which would affect the adjacent sector, then notification was unnecessary.

SM-5: When a priority conflict is displayed on the PVD, should it also be indicated on the data display. Four controllers said no, it was not necessary.

SM-6: Given AERA, does the radar controller have enough information to resolve priority conflicts using available displays?

All five controllers said yes. One controller commented that there was enough information based on current training and skills.

SM-7: Given that you have a "D" controller, can he/she solve advisory conflicts using only the flight data display?

Four controllers said yes, given that the "D" person had communications and the experience and ability. One controller said no, the "R" controller was in charge.

SM-8: Would a graphic representation on a planning display aid the "D" controller in solving advisory conflict problems?

Four controllers said no, it was unnecessary. One of these four felt it would increase the workload. One controller said that a planning display might help but he could do without it.

RESPONSES TO CONFORMANCE MONITOR TEMPLATES.

CA-1: Should the use of reconformance aide be required or optional?

All five controllers stated they thought it should be optional. One controller noted that reconformance is based on pilot requests or feedback. Another controller's view was that "a controller has a brain and can work out a solution with his pilots."

CA-2: When would the air traffic control specialists want feedback from the reconformance aide?

There was no consensus on this item. One controller was uncertain and several indicated that they did not want it at all. Another controller said he would look at the feedback if it was available but it must be left to him how he would use it.

DISCUSSION

This was the first time graphic simulation was accomplished using actual displays and a scenario which had underlying continuity. The fact that the snapshots were drawn from a realistic traffic flow gave the series a dynamic quality, which participants became involved in and attempted to reach and maintain the "picture." It took from 3 to 6 hours for each of the 5 controllers to move through the 44 snapshots. The difference in time was based largely on controller style and decisiveness.

Each participant controller came to the situation with his own unique background, skills, knowledges, and abilities. Each had his own style, preferences, and biases. Some of this was apparent based on the results of the preliminary questionnaire. Despite their sincere efforts, these controllers of the 1950's, 60's and occasionally the 70's thought and perceived in the terms of which they were familiar. While some were intrigued by the possibilities of automation and others might have felt threatened, they were all bound by their experience and the ATC control models that they knew. Unlike test pilots who are trained to accept innovation, controllers tend to evaluate change against what has worked for them in the past — the tried and true standards which might or might not apply in the future state of things.

During this review of graphic simulation snapshots, some participants were more impressed with the potential of automation than others. They varied in the degree to which they were comfortable with transferring flight data automatically and some were most comfortable with landline coordination. They varied in their emphasis on accommodating pilot requests. To some, the ability to satisfy the aircrews in their airspace was the prime reason for their jobs. To others, this was secondary to maintaining a smooth orderly flow of traffic.

All the controllers shared a similar concept of time. There was the "here and now" when actions had to be taken tactically, and everything else could be evaluated with more deliberation. Advisory warnings 20 minutes before an event "might" happen did not impress them. Several felt that such advisories were actually distracting and could add to the workload.

As the controllers reviewed the snapshots, it was evident that they were processing information on a broader scope than that of immediate focus. Repeatedly, they took note of other aircraft and anticipated situations that had not yet occurred. They expressed interest and concern about peripheral aircraft which had been designed into the scenario as filler. Despite the low fidelity of the simulation, controllers were exerting effort to maintain the picture. Such anecdotal results lead to the speculation that graphic simulation may have a higher internal fidelity than would appear on the surface and certainly more fidelity than previous projects which depended on paper and pencil displays. One problem which did occur with the graphic simulation was that solutions and choices were forced on the participants. This led to a number of incidences where they did not identify the information resulting from the display of AERA output. Had the controller, for example, initiated a request for a given probe, he would have been self-alerted to look for the results. Then, the rate of response would have been much higher. Another problem with forcing the solution on controllers was that when it violated their personal style and/or experience they were annoyed which doubtlessly influenced the rest of their judgments on that situation.

Graphic simulation has served as a simple, direct, and basic way to collect subject matter opinion in a short time. It is not a substitute for the dynamic interplay available in a full-fledged "free play" simulation model. It has provided a first cut examination of controller reactions to AERA functions and the procedures necessary to use them. It has served as an attitude and opinion stimulus to assist subject matter experts in opening themselves to new concepts in information and decision-aiding for air traffic control. Graphic simulation could be viewed as sort of a window through which these new concepts could be viewed.

CONCLUSIONS

1. Given an opportunity to examine a series of air traffic snapshots containing new information and decision aides, controllers were willing and able to openly express their opinions and attitudes.

2. For the majority of situations, most controllers indicated that they could use the Automated En Route Air Traffic Control (AERA) "functional user guidelines." However, they did not feel that these first draft procedures would ease implementation.

3. Controllers were consistent in their dislike of advisory warnings 18 to 20 minutes in advance. Their response was usually to wait and see what would happen.

4. Controllers vary considerably in terms of professional style and their preferred method of accomplishing tasks. An example of this is the attitude towards verbal coordination. Some would avoid it whenever possible and others were not comfortable without it.

5. The Air Traffic Control (ATC) System has historically been dependent on professionalism and initiative. Any new innovations in the system should take this into consideration if controller acceptance is desired.

6. Controllers unanimously agreed that the graphic simulation was professionally conducted.

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APPENDIX A

SUPPORTING AND BACKGROUND DOCUMENTS

AERA FUNCTION USER GUIDELINES

Regardless of the complexity or simplicity of any new system, procedural guidelines provide a starting point for user implementation. What follows is essentially a first draft estimate of what those guidelines might look like. The estimate is based on those questions generated as goals or test objectives in the AERA static test program. Guidelines are presented on a function-by-function basis for those AERA capabilities evolved in the Static Test Scenario.

1.0 TRIAL PLAN PROBE

1.10 The controller, who employs trial plan probe and finds no conflicts in own or adjacent sector will coordinate, where necessary direct routes with the adjacent downstream sector. (Controller discretion of distance from border.)

1.20 Given that trial plan probe predicts a conflict in the adjacent downstream sector the following applies:

1.21 Aircraft-Aircraft Conflict

The controller will coordinate with the adjacent sector prior to implementation and determine if the adjacent sector controller's plan for his airspace might rule out the conflict. If not, the following applies:

1.21.1 If the probe was initiated for direct routing, the routing will be denied and an alternative, if applicable, will be probed.

1.21.2 If the probe was initiated for an altitude change, the requested altitude would be denied.

1.21.3 If the probe was initiated for a speed change, the aircraft would be maintained at current airspeed.

1.22 Aircraft to Airspace Conflict

The controller will disapprove the clearance change and advise the aircraft of the reason. No coordination is required with the adjacent sector controller.

1.23 Aircraft to Flow Restrictions

A trial plan probe which indicates a flow restriction conflict advisory in adjacent sector requires coordination if implementation is desired in order to determine a course of action. The controller will disapprove direct routing and/or altitude change request, unless a satisfactory alternative can be negotiated with the adjacent sector.

1.24 When the trial plan probe indicates a predicted conflict, the location of that conflict applies as follows:

1.24.1 The controller of the sector where the conflict will occur is responsible for resolving it. If he accepts the new flight plan probe, initiating controller must coordinate.

1.24.2 In the event that the conflict occurs in the adjacent sector, the initiating controller will coordinate any flight plan changes or probe an alternate route if time is available.

1.24.3 In the event that a conflict occurs in a sector beyond the next adjacent sector, the initiating controller may coordinate with the downstream sector where the conflict is predicted. If the flight plan change is approved, then the controller must back-coordinate with intervening sectors. This process is on a time-available basis and the controller may disapprove flight plan changes leading to conflicts if they occur more than one sector downstream.

1.25 In the event that a conflict is predicted within 5 minutes flying time of a sector boundary the initiating controller will deny the user request for flight plan change. If time allows, the request would be forwarded to the sector in which the conflict occurs.

1.26 Under the following conditions the trial plan probe would be suggested:

1.26.1 User request for a change in flight plan.

1.26.2 At the conclusion of trial plan build when the flight plan is air filed.

1.26.3 The controller desires an alternate route/altitude/ speed as part of his continuous planning process. User request for direct or preferred route.

1.26.4 The controller may initiate trial plan build and probe to examine alternatives for conflict resolution.

2.0 SITUATION MONITOR

2.1 Given a conflict message from Situation Monitor (either advisory or priority), the controller will review both flight data and planned view displays.

2.1.1 The controller determines whether or not conflict is an immediate hazard.

2.1.2 In the event of an immediate hazard, the controller will take whatever he believes are the necessary actions to avoid the conflict. If necessary, an amendment to the flight plan will be entered.

2.2 When Situation Monitor predicts a conflict, it will only be displayed in the sector(s) where the conflict occurs.

2.2.1 When the predicted conflict occurs within 10 NM of an adjacent sector, the controller may resolve the conflict by vectoring, altitude change, speed change, or holding.

2.2.1.1 If this represents a change of flight plan into an adjacent sector, it must be coordinated with the adjacent sector controller prior to implementation.

2.2.1.2 The controller also may request that the adjacent sector controller modify the flight plan of an incoming aircraft.

2.3 In the event of a predicted conflict by situation monitor the following applies:

2.3.1 Coordination is only required if conflict resolution alters the flight plan of an aircraft proceeding to/from an adjacent sector.

2.3.2 The above applies to both priority and advisory conflict messages.

3.0 CONFORMANCE MONITOR

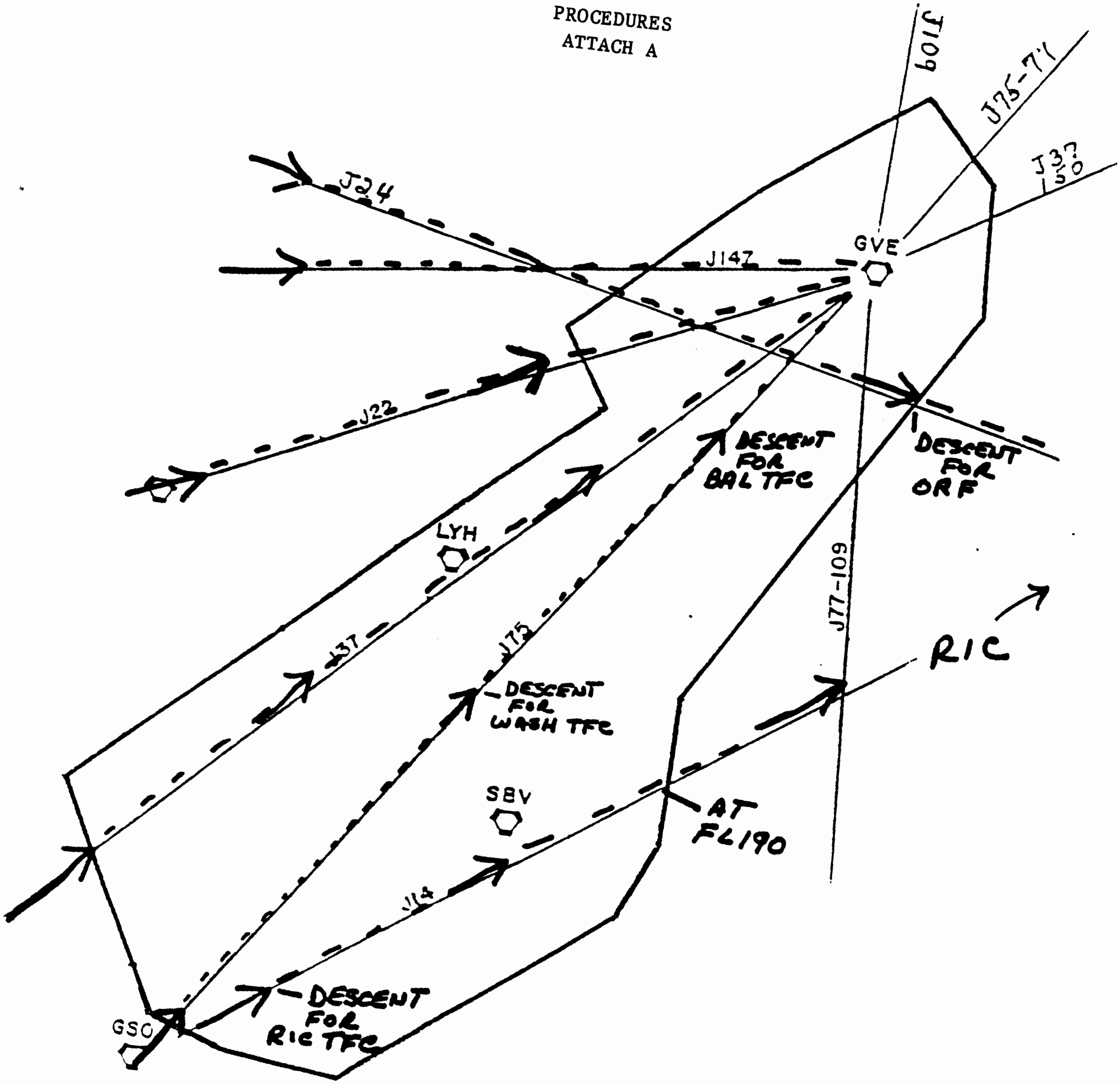
3.1 In the event of a conformance deviation alert, the controller will do one of the following:

3.1.1 May monitor the aircraft's progress and take no action, if in his estimation the aircraft will reconform before reaching the sector boundary.

3.1.2 (Using information from the planned view display) direct the aircraft to reconform.

3.1.3 Request a reconformance aide and then direct the aircraft to reconform.

3.1.4 Request a new TPP for an alternative route.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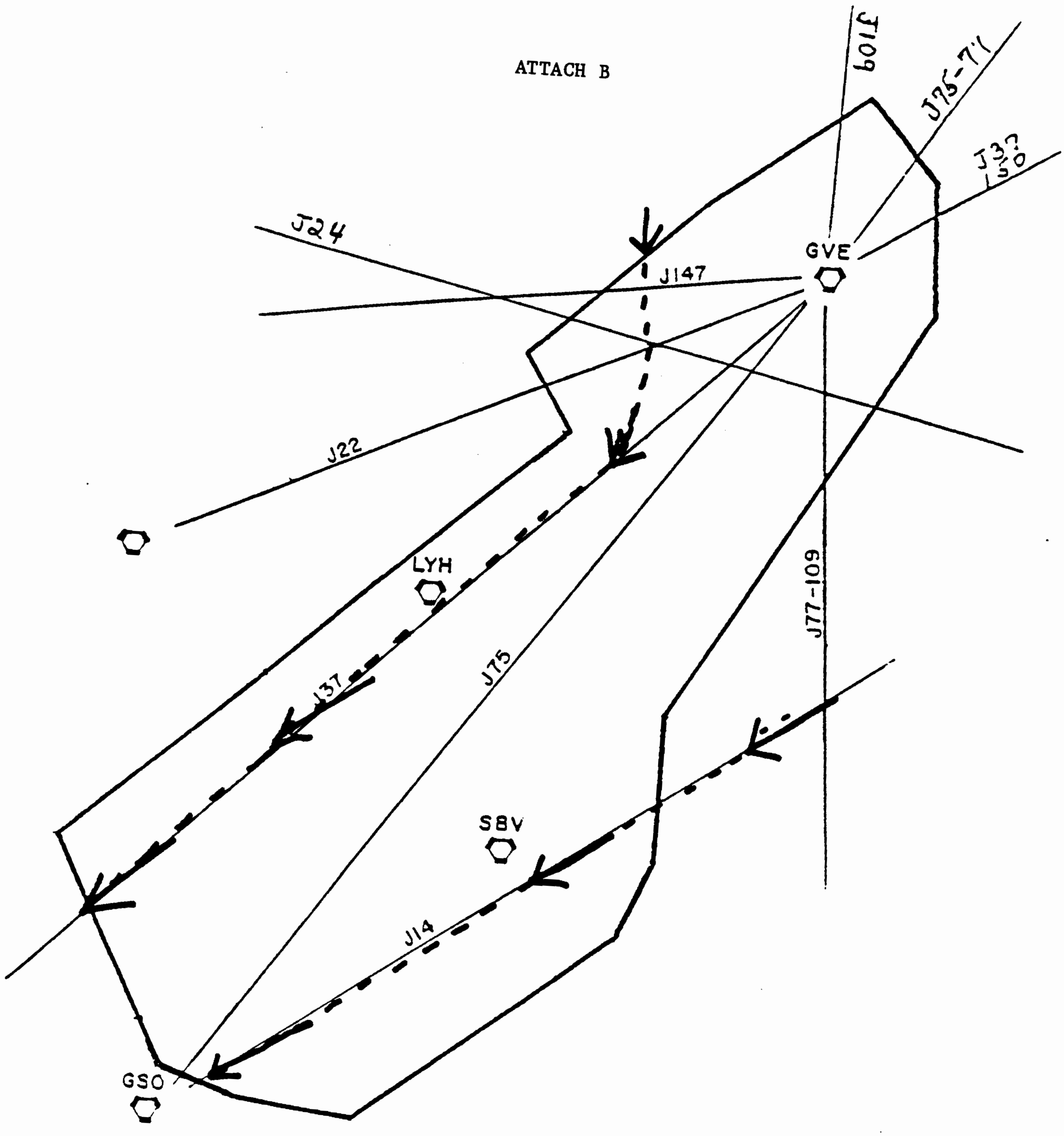

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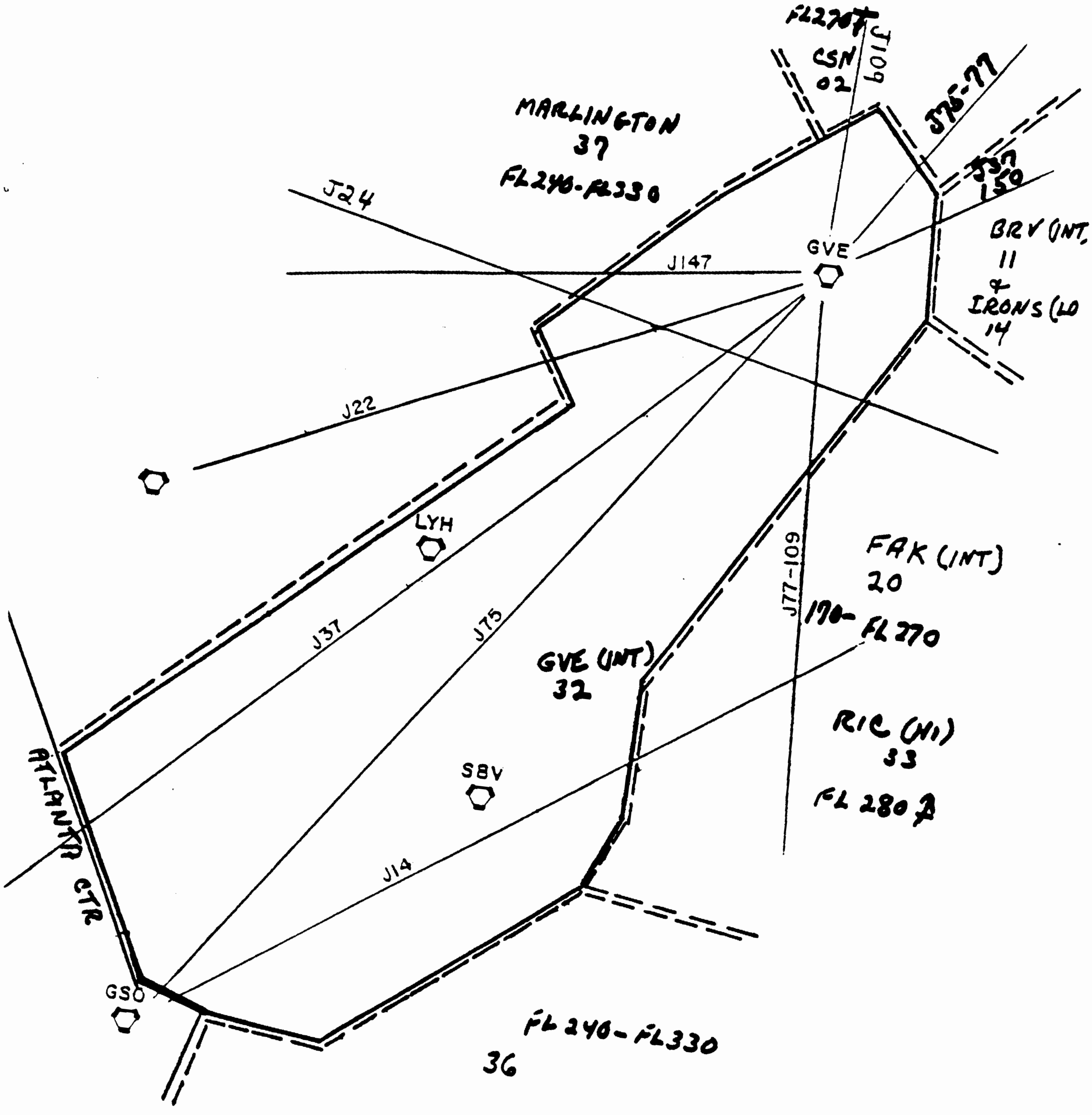
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AERA PROGRAM
PARTICIPANT ENTRY QUESTIONNAIRE

PARTICIPANT CODE ____________ DATE MONTH ____ DAY ____

INSTRUCTIONS: The purpose of this questionnaire is to obtain some information concerning your experience and current attitudes. The information will be used to describe participants as a group. All responses are anonymous. Please be as accurate as you can.

1. DURING YOUR CAREER AS AN AIR TRAFFIC CONTROLLER, WHAT WAS THE TOTAL NUMBER OF YEARS DURING WHICH YOU ACTUALLY CONTROLLED TRAFFIC?

   ______ YEARS ______ MONTHS

2. ARE YOU CURRENTLY AN ACTIVE CONTROLLER? _____YES _____NO
   (If yes, skip to item 4 below.)

3. HOW LONG HAS IT BEEN SINCE YOU LAST CONTROLLED LIVE TRAFFIC?

   ______ YEARS ______ MONTHS

4. PLEASE STATE YOUR AGE IN YEARS ______. (You may delete this if responding would cause you discomfort.)

The next series of questions will ask you to examine statements of opinion and determine to what extent you agree or disagree with them. Circle the one number which best discribes your level of agreement with each statement.

5. "I FREELY VOLUNTEERED TO PARTICIPATE IN THIS STUDY."

STRONGLY DISAGREE 1 2 3 4 5 6 7 8 9 10 STRONGLY AGREE

6. AUTOMATED INFORMATION AIDES ARE VERY IMPORTANT FOR THE CONTROL OF AIR TRAFFIC.

STRONGLY DISAGREE 1 2 3 4 5 6 7 8 9 10 STRONGLY AGREE

7. "I KNOW A GREAT DEAL ABOUT AERA."

STRONGLY DISAGREE 1 2 3 4 5 6 7 8 9 10 STRONGLY AGREE

8. "I AM A CURRENT FIELD CONTROLLER."

STRONGLY DISAGREE 1 2 3 4 5 6 7 8 9 10 STRONGLY AGREE

9. RESEARCH PROJECTS LIKE THIS ONE ARE IMPORTANT FOR AIRSPACE SYSTEM DEVELOPMENT.

STRONGLY DISAGREE 1 2 3 4 5 6 7 8 9 10 STRONGLY AGREE

AERA PROGRAM
PARTICIPANT ENTRY QUESTIONNAIRE
(CONTINUED)

PARTICIPANT CODE __________ DATE__________

10. CIRCLE THE NUMBER BELOW WHICH BEST DESCRIBES YOUR CURRENT SKILL AS AN ATCS.

AVERAGE 1 2 3 4 5 6 7 8 9 10 HIGH

IS THERE ANYTHING ELSE WE (THE STAFF) SHOULD KNOW WHICH MIGHT INFLUENCE YOUR PARTICIPATION OR ATTITUDES IN THIS STUDY?

GRAPHIC SIMULATION PROJECT TRAINING AIDE #1

AERA 1 FUNCTIONS OUTLINE SUMMARY

DESCRIPTION	PRODUCTS
TRIAL PLAN:	
TP BUILD	
CONSTRUCTION OF A DATA BASE UPDATE AIRFILE; ALTITUDE, ROUTE (UPR), OR SPEED CHANGE HAS DIFFERENT ENTER BUTTON (DOES NOT CHANGE CURRENT DATA BASE)	CONSTRUCTION OF A POSSIBLE AMENDMENT
TP PROBE	
EXECUTION OF THE VARIOUS CONFLICT PROBES AIRCRAFT TO AIRCRAFT AIRCRAFT TO AIRSPACE (MOAs, MSAWs, ETC.) FLOW RESTRICTION VIOLATIONS PREFERRED ROUTINGS & STARS METERING AND FLOW RESTRICTION	CHECK FOR CONFLICTS WITHOUT DESTROYING CURRENT DATA BASE.
SITUATION MONITOR:	
CHECK FOR CONFLICTS PRIORITY CONFLICTS	PROBE 20 MINUTES DOWNSTREAM
HIGH PROBABILITY OF OCCURRENCE AN INDICATOR ("C") IS DISPLAYED IN DATA BLOCK FOR EACH A/C. A GRAPHIC DISPLAY OF THE PRIORITY CONFLICT MAY BE REQUESTED.	OF INTEREST TO RADAR CTRLR OF (NEAR OR SHORT TERM).
ADVISORY CONFLICT PREDICTED CONFLICTS WHICH ARE IMPORTANT TO "D" CONTROLLER HELPS DATA CONTROLLER PREVENT FUTURE PROBLEMS. PREVENTIVE ACTION IMPROVES THE WORKLOAD FOR THE R-CONTROLLER.	MORE THAN 8 MINUTES REPRESENTS AN ADVISORY CONFLICT
"AERA" - INFORMATION AID TO CONTROLLER	
CONFORMANCE MONITOR:	
COMPARES THE A/Cs RADAR POSITION TO ITS PROJECTED TRAJECTORY IT ADVISES THE R-CONTROLLER WHEN OUT OF CONFORMANCE.	PROVIDES FLIGHT PLAN ROUTE. CONFORMANCE CODES: RED: A-ABOVE ASSIGNED B-BELOW ALTITUDE R-RIGHT OF L-LEFT FPR

CONTROLLER ISSUES A CLEARANCE TO RECONFORM OR ENTERS UPDATE TO FLIGHT PLAN

IMPORTANT: CONTROLLER'S RESPONSIBILITY TO UPDATE TRACK

OUT-OF-CONFORMANCE INVALIDATES DOWNSTREAM USE OF AERA TOOLS

OUT-OF-CONFORMANCE SITUATIONS ARE: LATERAL DEVIATIONS FROM FLIGHT PLAN ROUTE AND VERTICAL DEVIATIONS FROM ESTIMATED TRAJECTORY.

RECONFORMANCE AID:

RECONSTRUCTS TRAJECTORY WHEN CONTROLLER ENTERS ROUTE UPDATE.

ONLY CAPABLE TO RECONFORM DIRECT TO NEXT FIX.

CONTROLLER REMINDERS:

USED AS A REMINDER THAT A PLANNED AIRCRAFT MANUEVER NEEDS TO BE ACCOMPLISHED.

AUTOMATED TOP OF DESCENT REMINDER.

GORDONSVILLE (GVE) INTERMEDIATE SECTOR CONDENSED PROCEDURES

ALTITUDES - FL240 THRU FL330

PRIMARY FLOW - NORTHEAST BOUND ON J22, J37, AND J75 OVER GORDONSVILLE.
ARRIVALS TO DCA, BAL, IAD, & PHL OVER GVE (NOT IN SCENARIO)
SECONDARY FLOWS - NORTHEAST BOUND ON J14
EAST-WEST DIRECT FLIGHTS.
ARRIVALS AND DEPARTURES TO CLT OVER GSO.
NORFOLK ARRIVALS AND DEPARTURES ON J24.
LIMITED SOUTHWEST BOUND OVER GVE.

FIXED POSTINGS
ONLY USING GVE.

AERA PROGRAM GRAPHIC SIMULATION EXIT QUESTIONNAIRE

PARTICIPANT CODE_______ Month ____ Day ____

INSTRUCTIONS: The purpose of this questionnaire is to obtain your attitudes/opinions concerning your experiences with AERA during this project. This information will be used for the continued development of AERA user guidelines. All responses are anonymous. Please be as accurate and open as you can.

1. You have just had the opportunity to examine the use of a number of AERA functions, some of which are automatic and others are controller invoked. Consider the invoked functions below and estimate how often you would use them if they were available.

ESTIMATE SCALE

1	2	3	4	5
NEVER	SELDOM	OCCASIONALLY	FREQUENTLY	VERY OFTEN

CIRCLE ONE NUMBER FOR EACH FUNCTION

a. Controller Reminders	1	2	3	4	5
b. Trial Plan Probe	1	2	3	4	5
c. Reconformance Aide	1	2	3	4	5

For the next series of questions (2-10) circle the one number for each question which best describes your level of agreement with the statement provided.

2. I know a great deal about AERA.

CIRCLE ONE

STRONGLY DISAGREE 1 2 3 4 5 6 7 8 9 10 STRONGLY AGREE

3. I feel that the use of AERA functions would lower my workload.

CIRCLE ONE

STRONGLY DISAGREE 1 2 3 4 5 6 7 8 9 10 STRONGLY AGREE

4. The user functional guidelines (procedures), which were provided, were clearly stated and understandable.

CIRCLE ONE

STRONGLY DISAGREE	1	2	3	4	5	6	7	8	9	10 STRONGLY AGREE

5. The user functional guidelines would make the implementation of AERA functions easier.

CIRCLE ONE

STRONGLY DISAGREE	1	2	3	4	5	6	7	8	9	10 STRONGLY AGREE

CIRCLE ONE

6. The process of graphic simulation that I have just experienced is a waste of time.

CIRCLE ONE

STRONGLY DISAGREE	1	2	3	4	5	6	7	8	9	10 STRONGLY AGREE

7. The process of graphic simulation was conducted in a professional manner.

CIRCLE ONE

STRONGLY DISAGREE	1	2	3	4	5	6	7	8	9	10 STRONGLY AGREE

8. The use of AERA functions would enhance my productivity.

CIRCLE ONE

STRONGLY DISAGREE	1	2	3	4	5	6	7	8	9	10 STRONGLY AGREE

9. Rate the following functions in terms of their usefulness to you.

RATING SCALE

NOT USEFUL	1	2	3	4	5	6	7	8	9	10 VERY USEFUL

CIRCLE ONE NUMBER FOR EACH LINE

a. Controller Reminders	1	2	3	4	5	6	7	8	9	10
b. Trial Plan Probe	1	2	3	4	5	6	7	8	9	10
c. Situation Monitor Alert:										
1) Aircraft Conflict	1	2	3	4	5	6	7	8	9	10
2) Airspace Conflict	1	2	3	4	5	6	7	8	9	10
3) Flow Control Conflict	1	2	3	4	5	6	7	8	9	10
d. Conformance Aide	1	2	3	4	5	6	7	8	9	10
e. Reconformance Aide	1	2	3	4	5	6	7	8	9	10

10. Rate the user functional guidelines (procedures) in terms of their usefulness to you.

CIRCLE ONE NUMBER FOR EACH LINE

a. Controller Reminders	1	2	3	4	5	6	7	8	9	10
b. Trial Plan Probe	1	2	3	4	5	6	7	8	9	10
c. Situation Monitor:										
1) Aircraft Conflict	1	2	3	4	5	6	7	8	9	10
2) Airspace Conflict	1	2	3	4	5	6	7	8	9	10
3) Flow Control Constraint	1	2	3	4	5	6	7	8	9	10
d. Conformance Aide	1	2	3	4	5	6	7	8	9	10
e. Reconformance Aide	1	2	3	4	5	6	7	8	9	10

The guidelines or procedures that were provided to you are tentative examples. Below, please comment on those procedures which apply to each function listed. Indicate changes, additions or deletions, which you would recommend. You have a copy of the guidelines in front of you.

a. CONTROLLER REMINDERS

b. TRIAL PLAN PROBE

c. SITUATION MONITOR

d. CONFORMANCE/RECONFORMANCE AIDE.

THIS CONCLUDES THE QUESTIONNAIRE. Please review the questions and ensure that you answered them all. Thank you for your cooperation.

PARTICIPANT CODE ________ DATE ________

SNAPSHOTS ______________

SEED QUESTION TEMPLATE

S1. WHAT DO YOU SEE IN THIS SLIDE?

S2. WHAT DECISIONS ARE NECESSARY?

S3. WHAT COORDINATION IS INVOLVED?

S4. WHAT ADDITIONAL INFORMATION WOULD YOU LIKE?

S5. CAN YOU USE THE USER GUIDELINES (PROCEDURES) WHICH HAVE BEEN PROVIDED?

PARTICIPANT CODE ________ DATE ________

SNAPSHOTS ______________

TRIAL PLAN TEMPLATE

TP1. WHEN MUST AN ATCS COORDINATE DIRECT ROUTES?

TP2. IF THE TPP PREDICTS NO CONFLICTS, SHOULD COORDINATION STILL BE ACCOMPLISHED?

TP3. SHOULD PROCEDURES VARY BASED ON THE TYPE OF CONFLICT?

TP3A. AC TO AC

TP3B. AC TO AIRSPACE

TP3C. AC TO FLOW RESTRICTIONS

TP4. WHAT IS THE INFLUENCE OF THE LOCATION OF THE PREDICTED CONFLICT?

TP4A. NUMBER OF SECTORS INVOLVED.

TP4B. PREDICTED CONFLICT NEAR SECTOR BOUNDARY.

PARTICIPANT CODE ________

DATE ________

SNAPSHOTS ______________

SITUATION MONITOR TEMPLATE

SM1. WHAT CRITERIA SHOULD BE USED TO DETERMINE WHETHER A PREDICTED CONFLICT IS PRESENTED AS "ADVISORY" OR "PRIORITY." (I.E., TIME, DISTANCE, AC TYPE, ETC.)

SM2. HOW MIGHT PROCEDURES VARY BASED ON THE NATURE OF THE CONFLICT MESSAGE: "PRIORITY VS ADVISORY.?"

SM3. HOW DOES CONFLICT TYPE AFFECT THE CONTROL PROCEDURES?

SM3A AC TO AC

SM3B AC TO AIRSPACE

SM3C AC TO FLOW RESTRICTIONS

SM CONTINUED

SM4. WHAT IS THE IMPACT OF PREDICTED CONFLICTS WHICH INVOLVE MULTIPLE SECTORS?

SM4A DOES THE COORDINATION NEEDED VARY BASED ON THE NUMBER OF SECTORS?

SM4B HOW DOES A PREDICTED CONFLICT ON A SECTOR BOUNDARY INFLUENCE PROCEDURES?

SM4B1 SHOULD AN ADJACENT SECTOR WHICH DOES NOT HAVE A POINT OF VIOLATION BE NOTIFIED?

SM5. WHEN A PRIORITY CONFLICT IS DISPLAYED ON THE PVD SHOULD IT ALSO BE INDICATED ON THE DATA DISPLAY?

SM6. GIVEN AERA, DOES THE RADAR CONTROLLER HAVE ENOUGH INFORMATION TO RESOLVE PRIORITY CONFLICTS USING AVAILABLE DISPLAYS?

SM7. GIVEN THAT YOU HAVE A "D" CONTROLLER, CAN HE (SHE) SOLVE ADVISORY CONFLICTS USING ONLY THE FLIGHT DATA DISPLAY?

SM8. WOULD A GRAPHIC REPRESENTATION ON A PLANNING DISPLAY AID THE "D" CONTROLLER IN SOLVING ADVISORY CONFLICT PROBLEMS?

PARTICIPANT CODE ________ DATE ________

SNAPSHOTS ______________

CONFORMANCE MONITOR RECONFORMANCE AIDE TEMPLATE

CA1. SHOULD THE USE OF THE RECONFORMANCE AIDE BE REQUIRED OR OPTIONAL?

CA2. WHEN WOULD THE ATCS WANT FEEDBACK FROM THE RECONFORMANCE AIDE? (I.E., ALTITUDE AND/OR LATERAL NONCONFORMANCE)

PARTICIPANT CODE ________

DATE ________

SNAPSHOTS ______________

CONTROLLER REMINDERS TEMPLATE

CR1. ARE THERE CONDITIONS UNDER WHICH REMINDERS SHOULD BE MANDATORY?

CR2. ARE THERE CONDITIONS UNDER WHICH REMINDERS SHOULD BE RECOMMENDED BUT NOT BE MANDATORY?

CR3. WHO ENTERS A REMINDER REQUEST, THE "R" OR "D" CONTROLLER?

TIME	EVENT	CONTROLLER INPUT	SYSTEM RESPONSE	CONTROLLER ACTION
2000 SLIDE #1	N213BC and AA123 report on frequency at FL250 and FL330 respectively			
2001	TWA093 handed off to FAK Intermediate Sector			
2002 SLIDE #2	EA440 reports on frequency at FL290 at GSO			
2003	UA754 handed off to Marlington Sector			
2004 SLIDE #3	AA123 requests Direct ENO/FP	TPB/TPP Direct ENO/FP	TPP is Conflict Free	Clears AA123 Makes current
2005	AA413 handed off to Marlington			
2005:10	C016 reports on frequency at FL290 west of GVE			
2005:30	UA007 handed off to Casanova Sector			
2006 SLIDE #4	DL547 reports on frequency at FL310 over MARBY Request Direct ATL			
2006:10 SLIDE #5		TPB/TPP/Show Route DL547 Direct ATL	Reject TPP - Conflict in Marlington Sector with AA199 currently in Casanova Sector	Builds another trial plan
2006:30 SLIDE #6		TPB/TPP DL547 GVE J22 PSK ATL	TPP is Conflict Free	Clears DL547 Makes current

TIME	EVENT	CONTROLLER INPUT	SYSTEM RESPONSE	CONTROLLER ACTION
2008 SLIDE #7	AA216 reports on frequency at FL330 at GSO			
2009:30	AL454 handed off to Sector 36			
2010 SLIDE #8	DL547 requests FL260			Controller notices possible conflict with C016 so decides to make probe for GVE downstream
		TPB/TPP DL547 current flight plan at FL 260 from GVE downstream	TPP is Conflict Free	Checks with pilot Clears DL547 to descend to FL 260 at GVE Makes current
2012 SLIDE #9	C016 handed off to Brooke High Sector			
2013 SLIDE #10	Adjacent Sector (11) informs GVE of Advisory Alert for a conflict in its sector between N149AA currently in Casanova Sector with N213BC in GVE sector and asks GVE to help resolve			
2013:30 SLIDE #11		Show Route N213BC TPB/TPP N213BC Direct SBY	TPP N213BC Direct SBY is Conflict Free	Clears N213BC Makes current
2015	DAISY81 reports on frequency north of GVE at FL260			
2015:30 SLIDE #12	Conformance Monitor Alert DL547 out of conformance 300 ft below FL260			Controller requests pilot to return to assigned altitude and hands off DL547 to Marlington High Sector
2017:10	AA216 handed off to FAK Intermediate Sector			

TIME	EVENT	CONTROLLER INPUT	SYSTEM RESPONSE	CONTROLLER ACTION
2017:20 SLIDE #13	Conformance Monitor Alert AA123 east of course			
2017:50 SLIDE #14		Show Route AA123 Invokes Reconformance Aid Direct to next fix TPP Direct to ENO	AA123 Direct to ENO is Conflict Free	Gives AA123 heading direct to ENO (next fix) Makes current
2019	AC009 Reports on frequency north of GVE at FL310			
2019:20 SLIDE #15	AA123 handed off to Brooke High Sector			
2021:10 SLIDE #16	EA440 handed off to Brooke Intermediate Sector			
2022	BN120 reports on frequency south of GSO at FL330			
2023 SLIDE #17	TAB0082 reports on frequency at FL330 south of GSO on a celestial navigation leg			
2024:50 SLIDE #18	Situation Monitor Advisory Conflict DL461/N715WB (18 min). Both in other sectors but conflict would occur in GVE Sector near GVE; N715WB at FL260, DL461 climbing to FL310			
2025:10 SLIDE #19		Show Route DL461		Coordinate with Sector controlling DL461 (Brooke Intermediate) who advises DL461 to level off at FL240 and await new clearance beyond GVE.

TIME	EVENT	CONTROLLER INPUT	SYSTEM RESPONSE	CONTROLLER ACTION
2026	N213BC handed off to FAK Intermediate Sector			
2027 SLIDE #20	Situation Monitor Advisory Conflict BN120 will be in conflict with Airspace R4005 in Sector 11	Checks with pilot for alternate route Pilot suggests J14 CORDS J55/FP TPB/TPP BN120 J14 CORDS J55/FP	TPP is Conflict Free	Clears BN120 Makes current
2029 SLIDE #21	Upstream controller (Sector 36) advises GVE controller that he has advisory conflict concerning AA914 in his sector with another aircraft also in his Sector. The best possible trial plan will put AA914 in conflict with AC009 in GVE sector. GVE says OK and accepts responsibility for resolving AC009/AA914 conflict (see 2033)			
2029:30 SLIDE #22			Advisory Conflict Message of AC009/AA914 (after Sector 36 makes new flight plan current)	Show route AC009
2030:30	BN120 handed off to Richmond High Sector			
2031 SLIDE #23	TAB0082 requests flight plan change: Current position SBV133010 GVE185010 GVE252032 PSK120020 SPA MCN WRB at FL270			

TIME	EVENT	CONTROLLER INPUT	SYSTEM RESPONSE	CONTROLLER ACTION
2031:30 SLIDE #24		TPB/TPP and show route TAB0082 new route at FL270	Reject TPP due to conflict with AL121 at FL270 currently in Atlanta Sector 22	Checks with pilot to see if he will accept new route but maintain FL330 Pilot says OK
		TPB/TPP TAB0082 new route at FL330	TPP TAB0082 is Conflict Free at FL330	Clears TAB0082 for new flight plan but maintain FL330 Makes current
2032	N213BC handed off to Brooke Intermediate Sector			
2032:30	PA880 reports on frequency at FL290 northwest of GSO and UA326 reports on frequency at FL290 south of GSO			
2033 SLIDE #25	PRIORITY CONFLICT AC009/AA914 (see 2029) (By the time GVE controller can act the conflict will occur in 8 min.) GVE controller takes early handoff of AA914 from Sector 36			
2033:20 SLIDE #26		Chooses to vector AA914 15° to the right TPB/TPP AA914 Show route AA914 GS0030030 RNL/FP	TPP AA914 is Conflict Free	Clears AA914 Makes current
2034 SLIDE #27	Situation Monitor Advisory Conflict TAB0082/DL840 (18 min) (DL840 in Atlanta Sector 22)			
2034:30 SLIDE #28		Show Route TAB0082 Coordinates with Atlanta Sector 22 to change DL840	Atlanta Sector 22 controller descends DL840 to FL290	

TIME	EVENT	CONTROLLER INPUT	SYSTEM RESPONSE	CONTROLLER ACTION
2036 SLIDE #29	Situation Monitor Advisory Conflict: PA880/UA326 will be in conflict near GVE			
2036:30 SLIDE #30		Decides best choice would be to climb UA326 but must wait until UA326 has passed AC009 TPB/TPP UA326 at FL330 beginning in 3 minutes	TPP UA326 is Conflict Free	Informs pilot to expect new altitude in 3 minutes. Makes current
2038 SLIDE #31	N715WB and DL461 report on frequency northeast of GVE at FL260 and FL240, respectively			
2039:40	Issues clearance to UA326 to climb to FL330			
2039:50	AC009 handed off to ATL Center			
2040 SLIDE #32	EA700 reports on frequency west of GSO at FL250 and requests new route: direct SIE/FP	TPB/TPP EA700 Direct SIE/FP	Reject TPP due conflict with Airspace R4005 (Sector 11)	Advises pilot who cancels request
2040:40 SLIDE #33	PRIORITY CONFLICT DAISY81 in conflict with "pop-up" airspace (refuel route) located near boundary between GVE Sector and ATL Center (Atlanta Sector 21 gets message and asks GVE to resolve	Show Route DAISY81		

TIME	EVENT	CONTROLLER INPUT	SYSTEM RESPONSE	CONTROLLER ACTION
2041:20 SLIDE #34		Informs pilot of situation Pilot requests FL240 TPB/TPP DAISY81 at FL240	TPP DAISY81 is Conflict Free	Informs pilot Makes current
2043:20 SLIDE #35	Situation Monitor Advisory Conflict N715WB with refuel route	Informs pilot of "pop-up" airspace. Pilot requests lower altitude in 15 minutes. TPB/TPP N715WB FL240 in 15 minutes.	TPP N715WB is Conflict Free	Informs pilot to expect instructions to descend to FL240 in 15 min. Makes current
2043:50	AA914 handed off to ATL Center			
2045 SLIDE #36	PRIORITY CONFLICT DAISY81/PI137 in ATL Sector but conflict zone crosses boundary so both controllers get message (conflict discovered late by system due to transponder outage on PI137 so resynchroniza- tion could not occur and PI137 is ahead of schedule)	Show Route DAISY81		
2045:30 SLIDE #37		ATL controller takes initiative, coordinates with GVE controller and directs PI137 to proceed direct GVE. Informs GVE controller and offers handoff with proviso that direct to GVE is all right TPB/TPP PI137 Direct GVE	TPP is Conflict Free	Replies to ATL controller that new route is OK. Accepts handoff (after ATL controller informs pilot and makes current).
2046	AL121 reports on frequency at FL270 west of GVE			

TIME	EVENT	CONTROLLER INPUT	SYSTEM RESPONSE	CONTROLLER ACTION
2047 SLIDE #38	TAB0082 handed off to Marlington High Sector			
2048:10	DAISY81 handed off to ATL Center			
2049 SLIDE #39	UA114 reports on frequency climbing to FL350 southeast of GVE			
2049:30	DL840 reports on frequency at FL350 west of GVE			
2051 SLIDE #40	Adjacent Sector (11) receives Advisory Conflict that DL840/PA880 (both in GVE sector) will be in conflict in his Sector in 20 min. Asks GVE controller to resolve.			
2051:30 SLIDE #41		TPB/TPP DL840 at FL330	TPP is Conflict Free	Informs pilot Informs Sector 11 of resolution Makes current
2051:50	Controller issues clearance to DL461 to climb to FL310			
2053 SLIDE #42	AL121 and PA880 handed off to Brooke Intermediate Sector			
2055 SLIDE #43	UA326 handed off to Brooke High Sector			
2057 SLIDE #44	Controller receives reminder message to monitor N715WB's descent to FL240			
2059 SLIDE #45	End of scenario			