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Recommendations for R-Side Evolution: Initial Candidates for Evaluation

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Dr. Celesta G. Ball
Gretchen J. Jacobs

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Center for Advanced Aviation System Development
McLean, Virginia

MITRE Department Approval:

Barbara C. MacDonald, F061

Program Manager

MITRE Project Approval:

Urmila C. Hiremath, F061

Project Team Manager

MITRE Project Approval:

Wesley B. Link, F020

NAS Architecture Implementation Outcome Leader

Abstract

This report provides initial candidate alternatives for the evolution of R-side capabilities beyond Free Flight Phase 1 (FFP1) to those capabilities necessary to fully implement the FAA's 2005 National Airspace System (NAS) Concept of Operations. A set of R-side capabilities was implemented in a laboratory setting and a companion set of operating guidelines was developed and used in evaluations conducted in July and August of 1999. The refined candidate capabilities and operating guidelines are documented in this report. This document also contains proposed functional and interface requirements and specifications for the evaluated capabilities and a proposed evolution strategy. The results of this study will serve as the basis for additional evaluations and analyses of future R-side capabilities and evolution strategies.

KEYWORDS: Free Flight Phase 1, conflict probe, trial planning, automated replan, automated coordination, operating guidelines

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Floyd S. (Woody) Woodward provided three sets of traffic data from which the training and evaluation scenarios were generated for laboratory evaluations. Kyle Jaranson wrote software to automate several all-other R tasks, making this position easier to staff. Frank Sogandares and Kyle Jaranson spent many long days in the laboratory during the scenario fine-tuning process making sure that all the software and hardware operated properly.

Frank Sogandares and David Chaloux designed and wrote data collection and reduction software, making the job of analyzing evaluation data much easier.

CAASD volunteers patiently trained in support positions and staffed evaluation exercises. These volunteers included all-other R's James W. (Sonny) Krantz and Chrissy Padgett and sim-pilots Patrick D. Butler, Leang Y. (Yec) Chea, Randy L. McGuire, John H. Moran, and Chrissy Padgett. Solender (Sol) Chea installed the communications and voice recording system for the evaluation. John F. (Jack) Brennan trained the subject controllers in DYSIM, Memphis Center airspace, and R-side capabilities for the evaluation.

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Ruth E. Lydard carefully reviewed the report for compliance with MITRE and CAASD documentation standards. Together, Mary M. Twombly and Ruth Lydard made sure the report got through the publishing process.

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Executive Summary

The Federal Aviation Administration (FAA) has tasked the Center for Advanced Aviation System Development (CAASD) of the MITRE Corporation to investigate the evolution of en route sector team capabilities beyond Free Flight Phase 1 (FFP1), with emphasis on the R-side (radar) position. The R-side controller in FFP1 is supported by prior infrastructure improvements including the following:

- An upgraded Host Computer System (HCS) - the host/oceanic computer system replacement (HOCSR)
- An upgraded display capability - the display system replacement (DSR)
- An improved weather display - the next generation radar (NEXRAD) data available via the Weather and Radar Processor (WARP)

FFP1 provides a conflict probe capability (described in Section 2.1) to help the en route sector team in managing user requests for flight plan changes and in handling potential aircraft conflicts with other aircraft and with special use airspaces (SUAs). However, the functions, displays, and interface associated with this tool are logically and physically dedicated to the D-side (radar associate) position. The R-side controller can access the tool and its capabilities only through the D-side: by requesting the D-side controller to perform a particular task, by physically turning attention to the D-side displays to scan for information, or by physically handling the D-side interface devices when the D-side position is not staffed.

The question arises whether the R-side controller should have a more direct access to this tool and its capabilities via the R-side displays and interface. After all, the R-side position is the one that communicates directly with the pilot to receive requests and to deliver all clearances, whether or not they were derived by using the new D-side tool. More immediate access to the capabilities could reduce workload while improving service to users.

The capabilities that might benefit the R-side controller include the following:

- Improved access to flight data
- Improved access to conflict probe information
- Trial planning
- Automated replan
- Automated coordination between and within sector teams

This report documents a first step in evaluating whether and how to provide the capabilities of the new D-side tool to the R-side controller. A set of R-side capabilities was

implemented in a laboratory setting and a companion set of operating guidelines was developed and used in limited evaluations conducted in July and August of 1999, using four former controllers as evaluation subjects. The evaluations considered a subset of capabilities and operating guidelines in one operational condition: the en route sector staffed only by the R-side controller. The limited number of controllers and capabilities were insufficient to draw any firm conclusions, so the results are preliminary, implying that more evaluations are needed to fully explore the R-side concepts.

The specific questions motivating the evaluations were as follows:

- Is a strategic conflict probe needed by the R-side controller? If so, how should conflict probe support the R-side controller? Can direct access to conflict probe (and associated capabilities) via R-side displays and interactions benefit air traffic control? Under what types of conditions would such access be beneficial?

Ancillary questions included the following:

- Procedures: How should the R-side controller interact with the new capabilities?
- Information requirements: What information should be available to the R-side controller to facilitate use of the new capabilities?

The subjective results of the limited evaluation are summarized below:

- All of the evaluation subjects considered the information provided in the proposed R-side controller's Flight Data List to be adequate. All subjects recommended including the Flight Data List as an R-side capability, particularly when flight progress strips are absent.
- All evaluation subjects considered conflict probe to be potentially very useful and thought that the information in the proposed R-side controller's Conflict Probe List was adequate; a suggestion was made regarding integration of conflict information and flight data information. The evaluation subjects were consistent in indicating that they were aware of problems earlier, and took action earlier to resolve the problems because of conflict probe information. There was agreement that conflict probe should be recommended for inclusion as an R-side capability.
- All evaluation subjects considered trial planning to be very useful in helping to evaluate user requests, and most subjects considered trial planning to be very useful in helping to resolve conflicts. All were in agreement that trial planning should be recommended as an R-side capability.
- Most subjects considered the automated replan information in the Plans List to be adequate, and half of the subjects felt that automated replan was very useful in helping to handle user requests. There was agreement among all subjects that automated replan should be recommended as an R-side capability.

- Several sector team interactions and workload issues were suggested by the evaluation subjects:
  - Possible increase in verbal communication with the D-side controller because of the lack of strip marking
  - Possible workload increase for the R-side controller because of trial planning by the R-side controller (creating one or more trial plans) for user requests
  - Possible decreased communication workload with other sectors because of automated replan.

Recorded data from the limited evaluation show that controllers reacted in different ways to the same traffic and beginning conditions, making different tradeoffs between solving conflicts and satisfying user requests, and adjusting their workload by accelerating or delaying the initiation and acceptance of handoffs. Although observation of the subjects clearly captured that each subject conscientiously handled conflicts and user requests, even trying many approaches when necessary, the use of the new tools was reduced in favor of familiar capabilities as traffic and associated workload increased. How much of this response was a result of limitations in experience and training is not known, but the subjects' willingness to use the capabilities was certainly strong.

As suggested by evaluation results, CAASD refined the candidate capabilities and operating guidelines and developed candidate requirements and strategies for evolving from FFP1 to an environment including these R-side capabilities. CAASD also developed proposed functional and interface requirements and specifications and a proposed evolution strategy. CAASD recommends that extensive evaluations be conducted to validate the following:

- Proposed operating guidelines for the R-side position, both working independently and interacting with a D-side position, in using FFP1 plus R-side capabilities
- Proposed functional requirements and specifications for R-side functions and for internal interfaces between the Host and external processors, and proposed CHI requirements and specifications for the R-side user interface, to support new R-side capabilities
- Proposed strategies for the functional and architectural evolution from FFP1 to FFP1 plus R-side capabilities (e.g., Host modifications, two-way interface)

The proposals and evaluation results represented in this report provide a starting point from which to conduct further analysis to investigate questions posed by new en route operational concepts, particularly with respect to R-side capabilities. FFP1 will provide capabilities that are expected to provide operational benefits for the sector team. Of particular importance will be controller feedback from the use of the D-side URET CCLD,

which includes a flat panel display capability that could improve R-side controller access to D-side information. In addition, if the enhancement of DSR to provide a more Operational Display and Input Development (ODID)-like CHI is accelerated, then the results of this year's R-side capabilities evaluation will need to be reassessed. Further studies involving more operational personnel and a comparison against the FFP1 baseline are needed to fully explore the proposed evolution strategies.

Section 1

Introduction

1.1 Purpose

The Federal Aviation Administration (FAA) has tasked the Center for Advanced Aviation System Development (CAASD) of the MITRE Corporation to investigate the evolution of en route sector team capabilities beyond Free Flight Phase 1 (FFP1), with emphasis on the R-side (radar) position. The R-side controller in FFP1 is supported by prior infrastructure improvements including the following:

- An upgraded Host Computer System (HCS) - the host/oceanic computer system replacement (HOCSR)
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FFP1 provides a conflict probe capability (described in Section 2.1) to help the en route sector team in managing user requests for flight plan changes and in handling potential aircraft conflicts with other aircraft and with special use airspaces (SUAs). However, the functions, displays, and interface associated with this tool are logically and physically dedicated to the D-side (radar associate) position. The R-side controller can access the tool and its capabilities only through the D-side: by requesting the D-side controller to perform a particular task, by physically turning attention to the D-side displays to scan for information, or by physically handling the D-side interface devices when the D-side position is not staffed.

The question arises whether the R-side controller should have a more direct access to this tool and its capabilities via the R-side displays and interface. After all, the R-side position is the one that communicates directly with the pilot to receive requests and to deliver all clearances, whether or not they were derived by using the new D-side tool. More immediate access to the capabilities could reduce workload while improving service to users. Such benefits must be evaluated in light of new sector team relationships that are developed from deployment of FFP1 capabilities.

This report documents a first step in evaluating whether and how to provide the capabilities of the new D-side tool to the R-side controller.

This report provides initial candidate alternatives for the evolution of R-side capabilities beyond FFP1 to those capabilities necessary to fully implement the FAA's 2005 National Airspace System (NAS) Concept of Operations. [1] A set of R-side capabilities was

implemented in a laboratory setting and a companion set of operating guidelines was developed and used in evaluations conducted in July and August of 1999. The refined candidate capabilities and operating guidelines are documented in this report. This document also contains proposed functional and interface requirements and specifications for the evaluated capabilities and a proposed evolution strategy.

Evaluations in July and August of FY99 considered a subset of capabilities and operating guidelines in one operational condition: the en route sector staffed only by the R-side controller. The results of this evaluation were used to refine the concept of R-side capabilities evolution.

1.2 Background

In September 1997, the FAA issued the *ATS*[1] *Concept of Operations for the National Airspace System in 2005* [1], describing an air traffic environment that provides increased user flexibility and operating efficiencies under increased levels of system capacity and safety. A lower-level companion document describing operational tasking in en route facilities was issued as *Addendum 1: Operational Tasks and Scenarios* [2] in September 1998. The en route tasks described in the lower-level concept for the R-side controller are summarized in Sections 2.2 and 5.1 below. In FY98, CAASD developed a more detailed operational description [3] for the en route sector team, based on the 2005 vision.

In early FY99, CAASD was directed by the FAA to conduct analysis and research to develop en route functional capabilities that will enable the evolution from FFP1 to the FAA's 2005 NAS Concept of Operations. This multi-year research effort will address and validate concepts posed by this operational concept and possible enhancements suggested by the use of the en route FFP1 capabilities. The research will include laboratory and (possibly) field evaluations of the proposed new capabilities, with the participation of FAA service providers and the user community.

In FY99, CAASD developed candidate requirements and strategies for evolving from FFP1 to R-side capabilities necessary to implement the 2005 NAS Concept of Operations. This included assessing enhanced capabilities (e.g., making conflict probe information more readily available to the R-side) to support the evolution of sector team operations toward the 2005 vision.

This report proposes requirements, operating guidelines, and an evolution strategy, considering a subset of FFP1 capabilities as a starting point and a subset of 2005 capabilities ("R-side capabilities") as the goal. The capabilities considered are discussed further in Section 2.

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1 ATS = Federal Aviation Administration Air Traffic Services

This report does not address the following:

- System test requirements or integration requirements for site, display, procedural, component, or end-to-end testing for non-interference
- Resource issues associated with those activities (e.g., platforms, tools, laboratories, controllers, technicians)
- End-to-end system architecture for en route centers to ensure required performance can be delivered

1.3 Report Organization

Section 2 of this report contains operational overviews of FFP1 in en route airspace and the NAS en route capabilities expected in 2005, as well as a description of the approach taken to define and evaluate possible near-term enhancements to en route capabilities for the R-side controller. Appendix A contains the evaluation plan developed to guide laboratory evaluations. Appendix B contains the pre-evaluation briefing for evaluation subjects, and Appendix C contains the post-evaluation questionnaires for these subjects.

Section 3 proposes operating guidelines for the use of a candidate set of en route R-side capabilities. It describes each capability and a "philosophy of use" by the R-side controller. It concludes with a description of the integrated use of the capabilities in several common situations. Appendix D provides a quick reference to the proposed operating guidelines for the use of each capability.

Section 4 provides the results of the evaluation conducted in July and August of 1999.

Section 5 proposes an evolution strategy from both the functional and architectural viewpoints. Appendix E provides the proposed functional and computer-human interface (CHI) specifications for those functions that appear to provide benefit, based on laboratory evaluations. Appendix F contains proposed interface specifications to support those functions described in Section 5.

Section 6 summarizes the document.

Section 2

Operational Overview

This section describes Free Flight Phase 1[2] capabilities as a baseline and capabilities described in the 2005 NAS Concept of Operations as a target, as well as the approach used to develop requirements and strategies for evolving from Free Flight Phase 1 to R-side capabilities that may be necessary to implement the 2005 NAS Concept of Operations.

2.1 Free Flight Phase 1 in En Route Airspace

FFP1 in en route airspace consists of existing NAS capabilities plus the following core capabilities deployed to a limited number of sites:

- User Request Evaluation Tool Core Capability Limited Deployment (URET CCLD)
- Traffic Management Advisor Single Center [TMA(SC)]

This report considers only one of the core capabilities, URET CCLD. However, not all en route centers will have URET in FFP1 although one of the enhancements proposed in this report (i.e., improved access to flight data) does not depend on the availability of URET.

URET CCLD is a conflict probe decision support tool that assists air traffic controllers in managing en route traffic with an awareness of future conflict situations and in granting user requests or resolving conflicts through the use of the trial planning capability and other planning aids. At the current time, Free Flight Phase 1 is expected to provide URET at seven en route centers: Atlanta (ZTL), Chicago (ZAU), Cleveland (ZOB), Indianapolis (ZID), Kansas City (ZKC), Memphis (ZME), and Washington (ZDC).

URET CCLD is considered a D-side tool during FFP1. The URET CCLD display is located at a redesigned D-side console, with an integrated D-side position interface and a modified flight strip bay configuration.

URET CCLD provides the following functions in FFP1:

- Conflict probe - the automatic prediction of loss of separation between an aircraft and an adapted airspace or another aircraft (a "conflict")
- Trial planning - the checking of a proposed flight plan amendment for conflicts. A conflict-free trial plan is a "resolution" to a conflict in the original flight plan

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[2] See the RTCA publication *Government/Industry Operational Concept for the Evolution of Free Flight, Addendum 1: Free Flight Phase 1, Limited Deployment of Select Capabilities* dated 20 August 1998 [4] for a description of the FFP1 concept of operations and detailed scenarios illustrating FFP1 capabilities.

- Automated replan - the periodic rechecking of a proposed flight plan amendment for conflicts
- Automated coordination - non-voice coordination of a proposed flight plan amendment between sectors

2.2 NAS En Route Capabilities in 2005

According to *Addendum 1 of the ATS Concept of Operations for 2005, Operational Tasks and Scenarios* (hereafter referred to as *Addendum 1*), the most operationally significant changes in the en route environment in 2005 are the task performance aids (such as input selection options, slaved datalink messaging, and silent coordination), datalink, and the system's conflict detection and resolution capabilities.

Addendum 1 describes the sector team in 2005 as consisting of up to three team members: co-located tactical and associate tactical controllers and a non-co-located area supervisor who may be associated with more than one sector. However, for consistency with today's NAS, this R-side evolution document refers to the tactical controller as the R-side controller and the associate tactical controller as the D-side controller.

Addendum 1 places the tasks to be performed in 2005 into three general categories:

- Situation awareness - "activities required to remain aware of environmental and traffic conditions and to make and prioritize control decisions"
- Sector entry - "flight-specific tasking from the time data is received on a flight until it enters the sector"
- Sector transit - "the general handling of a flight through the sector, including the implementation of control decisions and transferring the flight to the next sector"

The specific tasks performed in each category are described in *Addendum 1* and are also listed in Section 5.1of this report.

2.3 Approach

The concepts and tasks described in *Addendum I* call for increased reliance on automation tools in detecting and resolving conflict situations. According to Addendum 1,

> "On-request trial planning is provided at selected sectors to test mentally-generated or pilot-requested control actions for aircraft, SUA, terrain, and weather conflicts. Simple inputs and succinct system responses make trial planning feasible at a single-controller sector under high traffic volume and complexity. After executing a trial-planned action that is considered problem-free by the system, the controller is generally able to perform less complex mental trajectory analysis of the resulting traffic interactions.
>
> [The] Tactical Controller [is responsible for] near-term conflict resolution (e.g., aircraft, SUA, terrain, and weather). [The] Associate Tactical Controller [is responsible for] inter-sector coordination required to implement near-term conflict resolutions. [The] Area Coordinator and/or [Traffic Manager is responsible for] long-range SUA, terrain, and weather conflict resolution."

This increased reliance on automation tools, which is a change from existing operations especially for the R-side (tactical) controller, necessitates the need for an evolution strategy.

This report's approach to defining an evolution of R-side capabilities addresses the following:

1. Proposed operating guidelines for the R-side position, both working independently and interacting with a D-side position, in using FFP1 plus R-side capabilities
2. Proposed functional requirements and specifications for R-side functions and for internal interfaces between the Host and external processors (e.g., URET), and proposed CHI requirements and specifications for the R-side user interface, to support new R-side capabilities
3. Proposed strategies for the functional and architectural evolution from FFP1 to FFP1 plus R-side capabilities (e.g., Host modifications, two-way interface). For this study, a conservative architecture with little modification to the DSR CHI by the year 2005 was assumed.

The initial version of this report addressed only operating guidelines, while this version of the report also includes initial requirements, specifications, and an evolution strategy.

2.3.1 Capabilities

This report addresses only the following candidate R-side capabilities:

- Improved access to flight data
- Improved access to conflict probe information

- Trial planning
- Automated replan
- Automated coordination between and within sector teams

The first capability listed provides quick access to a subset of flight data normally found on flight progress strips; this capability could be useful in the reduced-strip environment of FFP1.[3] The remaining capabilities listed represent R-side versions of D-side capabilities available with URET.

2.3.2 Operating Guidelines

This report proposes operating guidelines for the use of each capability for six distinct situations determined by the staffing at the sector (R-side only vs. R-side and D-side) and the capabilities available at the R-side, as illustrated by Table 2-1. In each situation, it is assumed that the D-side position has direct access to the D-side capability (i.e., URET). However, this document does not propose operating guidelines for the D-side controller's use of URET in FFP1 or for tasks performed independently of the R-side; these guidelines are being developed as part of FFP1. In addition, it is assumed that the R-side and D-side positions are physically co-located.

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[3] Current procedures for Indianapolis and Memphis Centers [5] allow fewer strips to be posted than previously without URET.

Table 2-1. Situations Requiring Operating Guidelines

Tasking	Staffing and Capability Availability			
	R-Side Does Not Have Capability		R-Side Has Capability	
	R- and D-Side Both Staffed	R-Side Only Staffed	R- and D-Side Both Staffed	R-Side Only Staffed
R-Side	R-side monitors URET displays at D-side position	R-side uses URET via D-side interface	R-side uses R-side capability via R-side interface and monitors URET displays at D-side position	R-side uses R-side capability via R-side interface and uses URET via D-side interface
D-Side (Assists R-Side)	D-side uses URET capability at R-side request	Not Applicable	D-side uses URET capability at R-side request	Not Applicable

Two cells of Table 2-1 are filled in with "Not Applicable," indicating that the R-side controller cannot request assistance from the D-side controller when the D-side position is not staffed. The operating guidelines discussed below are therefore concerned only with the remaining six situations.

URET is considered a D-side tool in FFP1 with operating guidelines tailored to D-side use. The three situations under the heading "R-Side Does Not Have Capability" represent proposed procedural enhancements to FFP1. The proposed operating guidelines corresponding to the left side of the table govern how the R-side controller uses the D-side capability in evolving beyond FFP1 in situations when URET is only available on the D-side. When the sector is staffed by both an R- and a D-side controller, the R-side controller can either physically turn toward and observe the D-side displays or request the D-side controller to perform a task using the tool. When only the R-side controller is present, it is possible for the R-side controller to physically access the tool via the D-side interface devices.

The three situations under the heading "R-Side Has Capability" represent proposed procedural, functional, and CHI enhancements to FFP1. The proposed operating guidelines corresponding to the right side of the table govern how the R-side controller uses either the R-side capability or the D-side capability or both. Again, when the sector is staffed by both an R-side and a D-side controller, the R-side controller can either physically turn toward and observe the D-side displays or request the D-side controller to perform a task using the tool. When only the R-side controller is present, it is possible for the R-side controller to

physically access the tool via the D-side interface devices. In either staffing case, the R-side controller can access the capability directly via the R-side displays and interface.

The operating guidelines that are proposed in this report are consistent with those for the D-side use of URET at ZID and ZME [5] for the use of flight data, the analysis of problem information, and the use of trial planning, automated replan, and automated coordination.

2.3.3 Evaluations

CAASD evaluated the set of R-side capabilities listed in Section 2.3.1, except for automated coordination, as candidate near-term follow-on enhancements to FFP1. The capabilities were implemented in a laboratory setting and the candidate operating guidelines given in this report were used as part of the evaluation. R-side capabilities excluding automated coordination were evaluated in an R-side only environment where the R-side controller was not able to access or observe D-side displays. Results of the evaluation were used to refine the requirements and operational guidelines. The detailed evaluation plan is given in Appendix A, and the results of the limited evaluation are given in Section 4.

The specific questions motivating the evaluation were as follows:

- Is a strategic conflict probe needed by the R-side controller? If so, how should conflict probe support the R-side controller beyond the level of support provided by FFP1? Can direct access to conflict probe (and its associated capabilities) via R-side displays and interactions benefit air traffic control?[4] Under what types of conditions would such access be beneficial?

Ancillary questions included the following:

- Procedures: How should the R-side controller interact with the new capabilities?
- Information requirements: What information should be available to the R-side controller to facilitate the performance of his/her duties?

The measures that were used are categorized by safety, workload, operational acceptability, and benefits. Criterion measures test the validity of any benefits observed. Outcome measures provide direct quantifiable estimates of benefits, such as (for users) flexibility, access, delay, and predictability. These measures are discussed in more detail in Appendix A.

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4 Anticipated benefits are listed with the discussion of measures below.

Section 3

Operating Guidelines

This section proposes operating guidelines for an R-side controller, both working independently and interacting with a D-side controller, in using FFP1 capabilities and in using R-side capabilities when they are available. The section includes a description of the data and interactions available to the R-side controller for each capability, a brief description of the philosophy for the capability's use, and operating guidelines. An example of how these capabilities might be used together in an operational situation is included at the end of the section. Appendix D contains tables summarizing the operating guidelines for each capability in a quick reference format.

As stated in Section 2.3.2, the proposed operating guidelines were developed with the assumption that URET is available at the D-side position and that the R-side and D-side positions are physically co-located, so that the R-side controller can monitor URET displays and physically access URET interface devices. The R-side capabilities evaluation was limited to a single controller (no D-side) staffing situation in which URET displays were not available to the R-side; therefore, only the operating guidelines applicable to this subset of conditions were exposed to experimental investigation and modified as a result.

3.1 Flight Data

The guidelines in this section apply to the R-side controller's use of enhanced access to flight data in the post-FFP1 timeframe.

3.1.1 Capability

The R-side controller can access flight data information through the Flight Data List (FDL) on the R-side and the Aircraft List (ACL) on the D-side. Each list is updated automatically when amendments are entered into the HCS.

The FDL contains data elements that are normally printed on the flight progress strip; for evaluation purposes, these data items include the following for each list entry:

- Computer identification (CID)
- Aircraft identification (AID, or callsign)
- Assigned altitude (proposed altitude before departure; assigned altitude after departure)
- Destination (i.e., code for destination)
- Discrete beacon code

- Aircraft data (number of aircraft (for formation flights), aircraft type, equipage, and heavy/TCAS[5] indicator)
- Route of flight (tailored)
- Remarks indicator (if remarks are present)

A simple set of posting rules was selected for evaluation. An entry (flight data for a flight) is first added to the FDL when the aircraft is offered for inbound handoff. Entries are automatically posted to the FDL, regardless of handoff status or distance from sector boundary, when a conflict is detected for the aircraft and loss of separation is predicted to occur in the sector. An entry can be hidden (removed from the list) or unhidden (placed back in the list) at controller request. An entry is automatically removed permanently from this sector's FDL a parameter time after outbound handoff is accepted.

The ACL on the D-side includes the following flight data items:

- CID
- AID, or callsign
- Control designator (sector identification), if the aircraft is under the control of another sector
- Assigned altitude, interim altitude, blocked altitude, or visual flight rule (VFR) indicator, if applicable
- Remarks indicator (if remarks are present)
- Aircraft data (number of aircraft (for formation flights), aircraft type, equipage, and heavy/TCAS indicator)
- Route of flight (truncated)
- Destination (as part of tailored route)

The ACL contains data items in addition to flight data; the other data items are described where appropriate in the following sections.

The posting rules for the ACL are described in [6].

It is assumed that the flight strip posting rules are in accordance with the current operating guidelines for operation of URET during sector operations at both ZID and ZME [5]; that is, that all sectors operating URET post all strips meeting certain criteria. At the time this document was written, those criteria include the following:

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5 TCAS: Traffic Alert and Collision Avoidance System.

- All "red routing" strips, until it is ensured that the aircraft has been issued the appropriate routing
- All proposal and arrival strips at nonapproach control airports
- All strips containing block altitude information
- All strips for emergency and special interest flights
- All strips indicating information not passed on line to the next facility
- Any strips that the controller deems necessary for sector operations

3.1.2 Philosophy

In general, the FDL is a capability for the R-side controller and the ACL is a tool intended for the D-side controller. Both of these lists contain information similar but not limited to information currently found on flight progress strips, and are used for similar controller tasks. Flight information contained in the FDL is directly available to the R-side controller and is displayed on the situation display at that position; flight information contained in the ACL on the D-side may be available to the R-side controller as well, whether or not the D-side position is staffed. In order to access the ACL, the R-side controller may have to either physically move in order to view the display and use the keyboard, or request assistance from the D-side controller. The R-side controller will primarily use these capabilities, separately or together, in the following ways:

- To maintain awareness of flight data for aircraft currently in the sector or approaching the sector boundary
- To correlate that data with flight data on the radar display
- To monitor changes in flight data
- As a reminder or indicator of action that should be or has been taken
- To correlate that data with information from other R-side and D-side tools (e.g., TMA(SC))

3.1.3 Proposed Operating Guidelines

3.1.3.1 R-Side Position Alone

When the FDL is available, it will be a primary source of flight information for the R-side controller when working alone (without a D-side controller). The R-side controller will use the FDL to maintain situation awareness and to monitor changes, including additions, to flight information. Entries on the FDL may be sorted by the R-side controller. The R-side controller will use the FDL to correlate flight information with data presented on the radar

display; she/he and may also use the ACL when working alone. When there is an indication that remarks are included in the flight data from the FDL or the ACL, the R-side controller will use the flight plan readout on the R-side position's Controller Readout Device (R-CRD). If the FDL is not available, the R-side controller will take advantage of the information on the ACL, if it is positioned so that it is visible. The checkbox available on the ACL may be used by the R-side controller when working alone.

3.1.3.2 R-Side Position When D-Side Position Is Staffed

When a D-side controller is available, the R-side controller will use the FDL only and request that the D-side controller scan the ACL to maintain situation awareness and monitor changes to flight information. Entries on the ACL may only be sorted by the D-side controller when that position is staffed. To correlate flight information with data presented on the radar display when the D-side staffed, the R-side controller will use only the FDL but may request that the D-side controller use the ACL. When the D-side is staffed and there is an indication that remarks are included in the flight data from either of these lists, the R-side controller will use the flight plan readout on the R-CRD, or request that the D-side controller use the D-side Response Display (RD) for this purpose. The R-side controller should not make entries to or alter the ACL display without the concurrence of the D-side controller. The checkbox available on the ACL should not be used by the R-side controller when a D-side controller is present.

Table D-2 summarizes the operating guidelines proposed in this section for the R-side controller's use of enhanced access to flight data.

3.2 Analysis of Problem Information

The guidelines in this section apply to the R-side controller's analysis of problem information in the post-FFP1 timeframe.

3.2.1 Capability

The R-side controller accesses conflict probe information through the Conflict Probe List (CPL), Full Data Block (FDB), and graphic display of conflicts on the R-side and on the ACL, Plans Display (PD), and Graphic Plan Display (GPD) on the D-side.

The CPL contains alerts for flight plans from continuous conflict probe. For evaluation purposes, only red alerts[6] were posted. Each CPL entry contains the following data items:

- Identification of both aircraft (or the aircraft and airspace) in conflict

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6 An alert is coded red when the predicted loss of separation is less than a procedural separation defined by a parameter (e.g., five nautical miles).

- Identification of the sector with track control, when it is not the current sector, for each aircraft in conflict
- Initial time of loss of separation

Entries are automatically posted at conflict detection and removed when the conflict is no longer detected. The threshold for notification is controller-selectable as a parameter time in the future (all conflicts with initial time of violation within a parameter time), up to the conflict probe lookahead time.

When the sector is to be notified of a conflict, an indicator (a red C) appears in the FDB of each aircraft in conflict. The FDB of an aircraft in conflict is forced to the display if it is not already visible.

For aircraft conflicts, the R-side controller can display the conflict graphically, showing the routes of both aircraft with the route areas in violation highlighted in red.

The D-side ACL (with respect to conflict information), the PD (with respect to conflict information) and the GPD are described in [6]. Conflict information displayed in the ACL includes a count of red, yellow, and blue (muted and unmuted) alerts[7] for each aircraft in conflict.

3.2.2 Philosophy

The CPL, FDB indicator, and graphic display of conflicts on the situation display are capabilities that the R-side controller will use for problem identification and analysis. The ACL and GPD associated with URET CCLD are primarily used by the D-side controller. However, when the R-side capabilities are not available, the R-side controller will in some cases use the ACL directly if the information is visible to him/her, particularly if the D-side position is not staffed. By scanning the CPL and FDB, the R-side controller will be notified of predicted losses of separation between aircraft and predicted penetrations of restricted airspaces. Since the threshold for these R-side notifications is selectable by the controller (up to the conflict probe lookahead time), the R-side controller will tend to set the lookahead for a relatively short time when assisted by a D-side controller, and for a longer time when working alone. By graphically displaying a conflict, the R-side controller can easily understand the geometry and distances involved in an aircraft or airspace conflict. These

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[7] An alert is coded yellow when the predicted loss of separation is greater than procedural separation and within the problem detection threshold defined by a parameter. A red alert or yellow alert is muted red or muted yellow, respectively, when loss of separation is predicted to occur on a portion of the route where an altitude transition is planned but not yet cleared. An alert is coded blue when separation is predicted to be lost with a special use airspace (SUA).

capabilities inform the R-side controller that a problem is predicted and provide information about the problem to assist him/her in making informed, timely decisions to resolve conflicts.

3.2.3 Proposed Operating Guidelines

3.2.3.1 R-Side Position Alone

When the R-side controller is working alone (without a D-side controller) and the CPL and FDB indicator are available, the R-side controller will include them in normal scanning for notification of conflicts. When they are not available and the D-side position is not staffed, the R-side controller will use the ACL if it is visible. The R-side controller will adjust the threshold for notification time, depending on whether or not the D-side position is staffed. The R-side controller will use the information in the CPL and, when it is needed and if time permits, graphically display a conflict on the situation display to analyze and visualize the conflict notification. When an airspace conflict is indicated to the controller from either the CPL or FDB indicator on the R-side or from the ACL on the D-side, the R-side controller will determine activation times for relevant airspaces. When working alone, the R-side controller will be proactive in taking action to resolve conflicts.

3.2.3.2 R-Side Position When D-Side Position Is Staffed

When the D-side position is staffed and the CPL and FDB indicator are not available, the R-side controller may use the ACL, if it is visible. When an airspace conflict is indicated to the controller from either the CPL or FDB indicator on the R-side or from the ACL on the D-side, the R-side controller may request that the D-side controller determine activation times for relevant airspaces. When assisted by a D-side controller, the R-side controller may request assistance in determining solutions for proactive conflict resolution.

Table D-3 summarizes the operating guidelines for the use of the enhanced conflict notification and analysis capabilities.

3.3 Trial Planning

Trial planning is available to assist in the formulation of flight plan amendments and also to check planned amendments for conflicts. The guidelines in this section apply to the R-side controller's use of trial planning in the post-FFP1 timeframe.

3.3.1 Capability

The Trial Plans List (TPL) contains results of trial planning by the R-side. For evaluation purposes, each TPL entry contained the following data items:

- Trial plan identifier (aircraft identifier plus trial plan suffix)
- Amendment in clearance language

- Expiration time [a parameter time (e.g., two minutes) after trial plan creation]
- When the trial plan contains one or more conflicts, information about the conflict in the trial plan with the earliest initial time of violation
  - Identification of the other aircraft or the airspace in conflict
  - Time of initial loss of separation
  - Count of additional conflicts in the trial plan

The simple posting rules selected for evaluation are as follows: A trial plan is automatically posted when it is created and removed when it expires.

Graphic trial planning is available to assist the R-side controller in formulating a route trial plan by drawing it on the situation display. Any trial plan created either textually or graphically by the R-side controller can be displayed graphically, and the display will also show any area of the route that is in conflict with the flight plan for another aircraft, as well as the route of that other aircraft.

Trial planning capabilities for the D-side position are described in [6].

3.3.2 Philosophy

Trial planning capabilities on the R-side allow the R-side controller (as time permits) to evaluate the potential impact of possible flight plan changes. The R-side controller will use trial planning in any of the following situations:

- When a conflict is detected
- When a pilot request is received
- In response to a request from another controller

When trial planning is not available on the R-side, the R-side controller may use the D-side PD and GPD, but will request the use of those capabilities by the D-side controller if that position is staffed. After the controller has entered the proposed altitude, speed, or route amendment to the flight plan, a trial plan is generated by the automation and is checked for conflicts. By using this capability, the R-side controller can avoid issuing control instructions that may, while solving the immediate problem or request, introduce other problems in the future. Graphic trial planning allows the R-side controller to quickly create a route amendment trial plan directly on the situation display.

3.3.3 Proposed Operating Guidelines

3.3.3.1 R-Side Position Alone

When working alone (no D-side controller), the R-side controller should construct trial plans using the R-side capabilities to investigate the impact of potential flight plan changes, when needed and if time permits. Obviously, imminent tactical situations take precedence. The R-side controller will generate trial plans in response to a conflict displayed on the CPL or FDB indicator on the R-side or identified by the controller, a pilot request, or a request from another controller or supervisor. When trial planning is not available on the R-side and the D-side position is not staffed, the R-side controller may use the D-side trial planning capabilities. When trial planning capabilities are available on the R-side, the R-side controller may use the R-side graphic display of conflicts to analyze trial plan results. When trial planning capabilities are not available on the R-side, the R-side controller may use GPD on the D-side to investigate trial plan results. The R-side controller should use good judgement when considering the implementation of trial plans with one or more associated conflicts.

3.3.3.2 R-Side Position When D-Side Position Is Staffed

When the D-side position is staffed, the R-side controller may use the R-side trial planning capabilities or may request assistance from the D-side controller using the PD and GPD. When trial planning is not available on the R-side, the R-side controller should request trial planning assistance from the D-side controller if the position is staffed. When the D-side controller is present and trial planning capabilities are available on the R-side, the R-side controller may use the R-side graphic display of conflicts to analyze trial plan results, or may request that the D-side controller use GPD. When trial planning capabilities are not available on the R-side, the R-side controller may request that the D-side controller use GPD to investigate trial plan results.

Table D-4 summarizes the operating guidelines proposed in this section for the R-side controller's use of trial planning capabilities.

3.4 Automated Replan

Automated replan enables the controller to specify that a trial plan be checked periodically for conflicts. The guidelines in this section apply to the R-side controller's use of automated replan in the post-FFP1 timeframe.

3.4.1 Capability

The TPL contains the status of automated replan actions by the R-side controller, including the same information that is available for any trial plan (listed in Section 3.3) plus

an indication when the trial plan is conflict-free. In addition, the FDB contains an indicator (a green R) when an automated replan trial plan is conflict-free.

The simple posting rules selected for evaluation are as follows: An automated replan trial plan is automatically displayed for as long as automated replan is active for the flight. Since the automated replan trial plan is "owned" by the sector with track control of the aircraft, it is displayed in the TPL of the owning sector. An automated replan trial plan is automatically posted in the TPL of a new sector when the track control of the aircraft is transferred to that sector upon handoff. Automated replan is terminated for a flight when the controller either deletes the current version of the automated replan trial plan or implements it as the flight plan, or when the automation determines that the trial plan is no longer operationally suitable (e.g., the trial plan results in a route direct to a fix that the aircraft has already passed).

Any automated replan trial plan created by the R-side controller can be displayed graphically on the situation display. The display will also show any area of the route that is in conflict with the flight plan for another aircraft, as well as the route of that aircraft.

Automated replan capabilities for the D-side are described in [6]. Note that only one automated replan request can be active for a flight at any given time. Therefore, the R-side controller and the D-side controller cannot simultaneously use automated replan for the same aircraft.

3.4.2 Philosophy

Automated replan is a capability that maintains and continually checks trial plans that cannot immediately be implemented and notifies the controller when the trial plan status has changed. Trial plans created in response to pilot requests, automation-predicted conflict detection, or conflicts identified by the controller may be submitted to automated replan. For example, the R-side controller may generate a trial plan that cannot be implemented because it would create a conflict with another aircraft. When the R-side controller submits the trial plan to automated replan, the automation will continue to check the trial plan and notify the controller by an indicator in the FDB or TPL on the R-side when the trial plan is conflict-free. This capability reduces the need for the controller to remember requests that cannot immediately be granted, and may reduce the amount of coordination and the number of control instructions issued to solve a problem.

3.4.3 Proposed Operating Guidelines

3.4.3.1 R-Side Position Alone

When the R-side controller is working alone (no D-side controller), and automated replan is available on the R-side, the R-side controller should use it when trial plans created in response to an automation-predicted or controller-identified conflict, a pilot request, or a

request from another sector team member or another operating position cannot be immediately granted. The trial plans may be submitted to automated replan when the R-side controller has the intention, for any reason, to issue a clearance in the future (e.g., is currently involved in a tactical situation or in communication tasks) and wishes to retain the trial plan. When automated replan is not available to the R-side controller and the D-side position is not staffed, the R-side controller should use the D-side capability, if it is accessible, for trial plans created in response to automation-predicted or controller-identified conflicts; the R-side controller may use the D-side capability, if it is accessible, for trial plans created for any other reason. When automated replan is available on the R-side and the D-side position is not staffed, the R-side controller should monitor the TPL and FDBs for indicators of automated replan trial plan status changes. Similarly, the R-side controller should monitor the TPL for receipt of automated replan trial plans at handoff. When automated replan is not available on the R-side and the D-side position is not staffed, the R-side controller should use the PD on the D-side to monitor status changes, if the display is visible.

3.4.3.2 R-Side Position When D-Side Position Is Staffed

When the D-side position is staffed, the R-side controller may use automated replan, or may request assistance from the D-side controller. When automated replan is not available to the R-side controller and the D-side position is staffed, the R-side controller should request assistance from the D-side controller. When the D-side position is staffed, the R-side controller should request the D-side controller to monitor the PD for trial plan status changes. When automated replan is not available on the R-side and the D-side position is staffed, the R-side controller should request assistance from the D-side controller in using automated replan, and may monitor the D-side PD, if it is accessible, for status changes in automated replan trial plans. When automated replan is available on the R-side and the D-side position is staffed, the R-side controller should request the D-side controller to monitor the PD for receipt of automated replan trail plans at handoff. When automated replan is not available on the R-side and the D-side position is staffed, the R-side controller should request assistance from the D-side controller, and may monitor the D-side PD, if it is accessible, for status changes in automated replan trial plans.

Table D-5 summarizes the operating guidelines proposed in this section for the R-side controller's use of automated replan capabilities.

3.5 Automated Coordination

Automated coordination enables the controller to send a trial plan to another sector controller for action or for approval. Automated coordination between D-side positions is provided by URET in FFP1. The guidelines in this section apply to the R-side controller's use of automated coordination in the post-FFP1 timeframe.

3.5.1 Capability

The R-side controller can initiate or be the recipient of an automated coordination request. The other party in the request can be any other R-side or any D-side controller. The purpose of an automated coordination request can be either (1) to request the receiving controller to approve a clearance or (2) to request the receiving controller to issue a clearance to the pilot and amend the flight plan. In the former case, the requesting controller is currently controlling the aircraft; in the latter case, the receiving controller is currently controlling the aircraft. The receiving controller may decide to comply with the request, to reply "unable," or to do nothing at all. In the last case, a "no response" message is automatically returned to the requesting controller.

The R-side controller initiates an automated coordination request by designating an existing trial plan for coordination. The request then appears in the Automated Coordination List (CL) as an outstanding request. For evaluation purposes, the entry in the requestor's CL contains the following data items:

- Aircraft identification
- Identification of the receiving position
- Trial plan in clearance language
- Description of any problems associated with the trial plan
- Countdown clock indicating how much time remains until the automated coordination request will automatically "time out"

The entry in the requestor's CL is updated with any response from the receiving position.

The R-side controller becomes aware of an automated coordination request from another position when the request appears in the CL or when an automated coordination indicator (a D) appears in the FDB. For evaluation purposes, the entry in the receiver's CL contains the following data items:

- Aircraft identification
- Identification of the requesting position
- Trial plan in clearance language
- Description of any problems associated with the trial plan
- Countdown clock indicating how much time remains until an automatic "no response" message will be returned to the requesting position

The CL request entry and the FDB indicator remain displayed until the controller responds or until the request "times out." The two responses possible for the receiving

R-side controller are (1) "made current" if that controller is currently controlling the aircraft and (2) "approved" if the controller does not control the aircraft. The former response conveys to the requesting controller that the receiving controller has issued the clearance to the pilot and amended the flight plan. The latter response conveys an approval of a proposed change to the aircraft's clearance and flight plan.

Automated coordination capabilities for the D-side position are described in [6].

Note that only one automated coordination request can be active for a flight at any given time. Therefore, multiple controllers cannot simultaneously use automated coordination for the same aircraft.

3.5.2 Philosophy

Automated coordination is a capability that will allow (1) a controller (the requesting controller) to easily request approval from another sector controller (the receiving controller) for a clearance the requesting controller wants delivered and (2) a receiving controller to acknowledge an intended flight plan change from a requesting controller for an aircraft that will enter the receiving controller's sector in the future. This will reduce the time and attention required for voice communication and support the controller's ability to respond to user requests that affect other sectors.

3.5.3 Proposed Operating Guidelines

When the automated coordination capability is available on the R-side, the R-side controller should use it in preference to verbal coordination for non-time-critical requests for clearance delivery and clearance approval and should request the D-side controller to use it when that position is staffed. When automated coordination is not available on the R-side, the R-side controller may use the automated coordination capabilities on the D-side, if accessible, and should request the D-side controller to use it when the D-side position is staffed.

Controllers should avoid coordinating trial plans with red alerts unless there is an operational reason to do so.

The R-side controller should monitor the R-side CL for the disposition of requests sent. When automated coordination is not available on the R-side, the R-side controller should monitor the D-side ACL if the D-side position is not staffed and may monitor the ACL even if the position is staffed; the R-side controller should request the D-side controller to monitor the ACL if he/she is present. When "no response" to an automated coordination request is received, the R-side controller should call the sector position to follow up; when automated coordination is not available on the R-side, the radar controller may request the D-side controller to follow up, when the D-side position is staffed.

When the automated coordination capability is available on the R-side, the R-side controller should monitor the CL and FDB automated coordination indicator for receipt of requests sent to his/her position. When the capability is not available on the R-side and the D-side position is not staffed, the R-side controller should monitor the D-side ACL, GPD, and PD if accessible; he/she should request the D-side controller to do so when the position is staffed. The R-side controller may monitor the D-side displays for automated coordination requests when the D-side position is staffed.

Controllers should always give automated coordination clearance delivery requests priority similar to that for notification of alerts.

The R-side controller may use the R-side graphic display of conflicts and/or the D-side GPD, if it is accessible, and may request the D-side controller to use the GPD to investigate automated coordination requests. The R-side controller should approve or issue clearance for conflict-free automated coordination requests unless there is an operational reason not to. When responding "deny" or "unable" to an automated coordination request, the R-side controller should call the sending sector position; if the D-side position is staffed, the R-side controller may request the D-side controller to call the sending sector position.

Table D-6 summarizes the operating guidelines proposed in this section for the R-side controller's use of automated coordination.

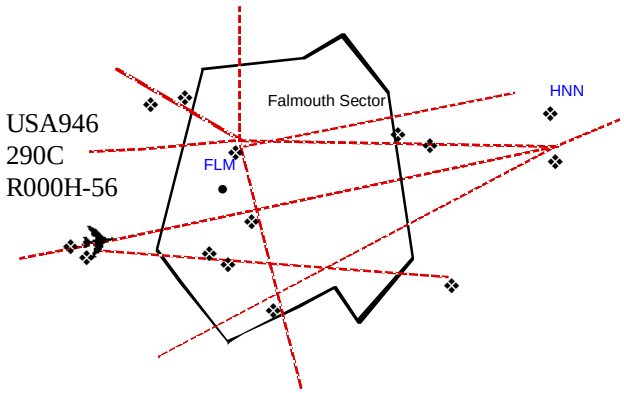
3.6 Operational Scenario: Use of R-Side Capabilities

The following scenario is an example of how the proposed enhanced R-side capabilities would be used together in a realistic operational scenario. It illustrates the operating guidelines and roles and responsibilities of the R-side controller with respect to the use of the enhanced R-side capabilities.

In this scenario, Sector 56 (Falmouth sector) of ZID is staffed by a single R-side controller, since traffic is light. Falmouth is a high altitude sector (FL240 to FL330) that is composed mainly of south- and westbound streams transitioning from Cincinnati and Lexington airports, east- and northbound streams into Cincinnati and Lexington, and overflights along jetways. Falmouth is in the interior of ZID airspace: it has no boundaries with other centers.

For this example, the D-side position is not staffed, and the enhanced D-side capabilities are not available or visible to the R-side controller. In the absence of a D-side controller, the R-side controller handles all sector operations, including separation, resolution of tactical situations, strategic planning, initiating and accepting handoffs, issuing clearances, coordination and communication with adjacent sector controllers, and management of pilot requests and flight data. The scenario includes an inbound handoff, a pilot request, a predicted aircraft conflict, and an automated coordination request to illustrate how enhanced flight data information, problem analysis information, trial planning capability, automated replan, and automated coordination could be used.

Event 1



As USA946 is about to enter Sector 56, a full data block for this aircraft is displayed flashing handoff, and an entry for this flight appears in the Flight Data List. Having scanned the list entry, correlated it with information on the radar display, and accepted the handoff, the R-side controller has the option to suppress the entry in the Flight Data List. If the entry had indicated flight plan remarks, the controller would view the flight plan readout, including flight plan remarks, on the R-CRD response area.

FLIGHT DATA

. 000 USA946 A290 PIT 0201
FK10/E T426 MEM./.MEM J29 PXV HMN JPU V117 ***PIT

Event 2

The pilot of USA946 requests a route change to fly direct to Raleigh. The R-side controller redisplays the flight data entry (if it had been suppressed) for the aircraft making the request. The flight data entry appears in the Flight Data List. The R-side controller makes a decision to create a trial plan, which is automatically checked for conflicts with other aircraft and special use airspaces. The trial plan appears on the Trial Plans List and is problem-free.

TRIAL

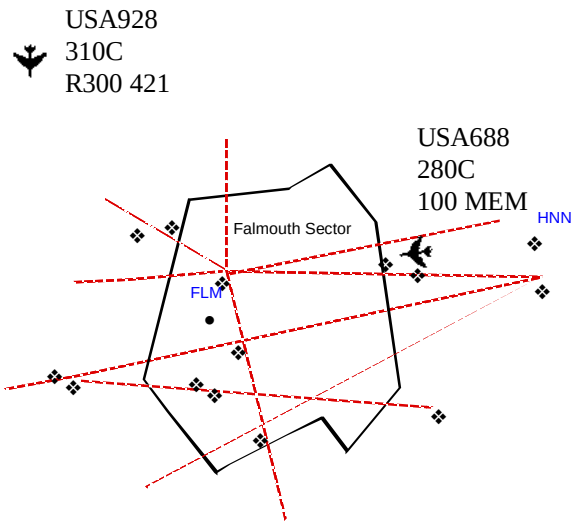
.USA946.T1 1740 CLRD RDU

The R-side controller clears the aircraft direct to Raleigh and makes the plan current. The flight data entry in the Flight Data List is updated to show the newly-cleared route. The controller may again suppress the flight data entry from the Flight Data List.

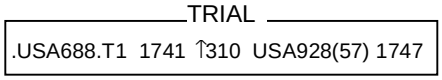
FLIGHT DATA

. 000 USA946 A290 PIT 0201
FK10/E T426 MEM./. RDU

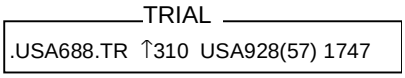
Event 3



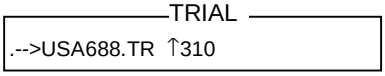
Upon checking in with the R-side controller on sector entry, the pilot of USA688 requests an altitude change to FL310, and the R-side controller, having reviewed the flight data for this aircraft in the Flight Data List, creates a trial plan. The automation checks the trial plan for conflicts: the entry in the Trial Plans List indicates that, if implemented, the trial plan would create a conflict with USA928, an aircraft not under the control of this sector although its target is currently visible to this controller on the radar display.



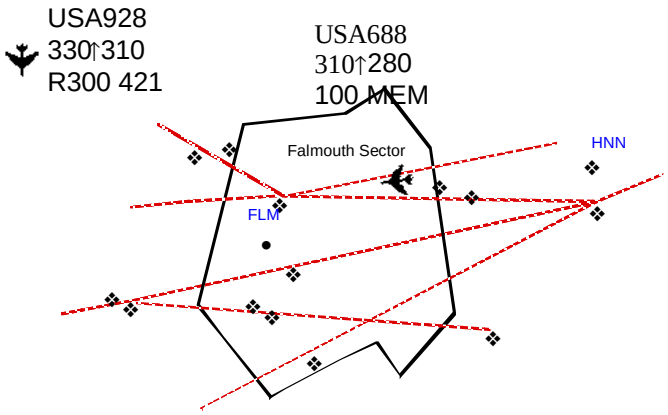
The R-side controller makes a decision to submit this trial plan to automated replan, where it will be continuously maintained and checked. The original entry for this trial plan is removed, and the automated replan trial plan with conflict information appears in the Trial Plans List.



The controller monitors the Trial Plans List and the FDB of USA688 for an indicator that the trial plan status has changed. Several minutes later, the automated replan trial plan for USA688 to climb to FL310 is available. USA928, in another sector, had requested and received FL330, freeing up FL310. The automated replan indicator (R) in the FDB for USA688 and the automated replan entry in the Trial Plans List show that the problem-free plan is available.



The R-side controller clears USA688 to FL310 and makes the plan current. The automated replan indicator is removed from the FDB and the automated replan entry is removed from the Trial Plans List. The altitude amendment appears in the FDB as the cleared altitude, and the flight data entry is updated to show the newly-cleared altitude.



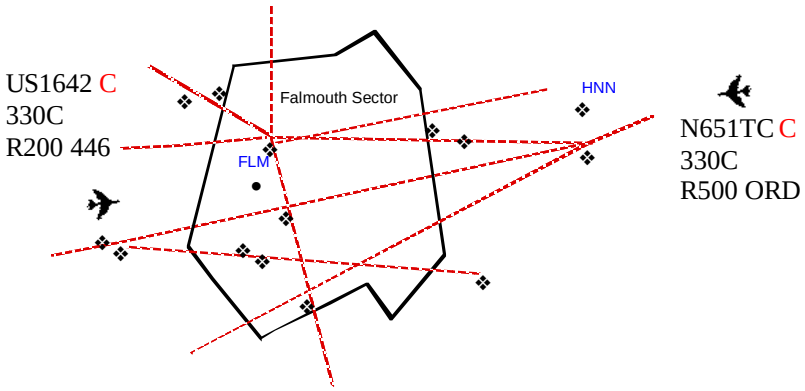
Event 4

Scanning the Conflict Probe List, the R-side controller is notified of conflict information for aircraft not yet in the sector. Conflict probe has detected a conflict between USA1642 and N651TC, both aircraft currently outside the control of sector 56. Loss of separation is predicted to occur in 15 minutes in this sector. Since the R-side controller is staffing the sector alone, the notification time for the Conflict Probe List was previously set to 20 minutes.

PROBE

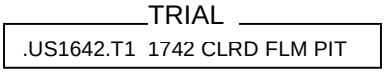
. N651TC (57) US1642(58) 1759

Full data blocks with conflict indicators (C) are forced for both aircraft and an entry for each aircraft is forced in the Flight Data List. The R-side controller scans for both aircraft in the conflict and displays their routes, possibly increasing the display range to find them.



The controller decides to delay solving this problem until US1642 enters the sector.

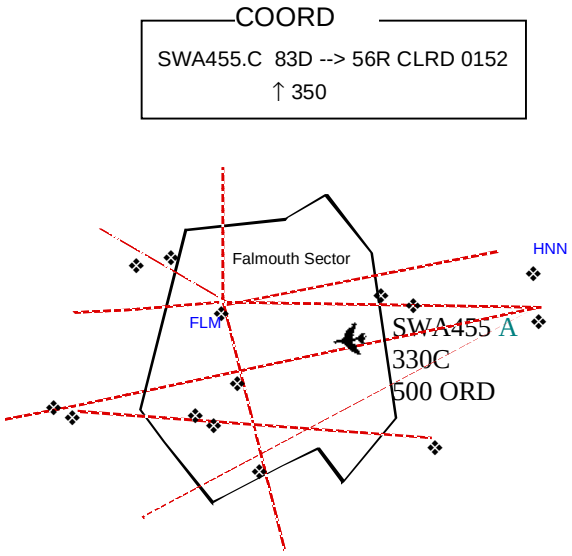
As US1642 is about to enter the sector, conflict information is still in the Conflict Probe List, and conflict indicators (C) are still in the full data blocks. After accepting handoff of this flight, the R-side controller creates a trial plan: direct Falmouth direct Pittsburgh. The conflict-free trial plan appears on the Trial Plans List.



The controller issues the clearance to the aircraft, and makes the plan current. Conflict information is removed from the Conflict Probe List, conflict indicators (C) are removed from both full data blocks, and the flight data entry for US1642 is updated in the Flight Data List.

Event 5

The R-side controller of Sector 56 receives an automated coordination request from the D-side controller of Sector 83 to clear SWA455 to FL350 to resolve a conflict that has been predicted to occur in that sector 18 minutes in the future. An entry for SWA455 appears in the Automated Coordination List at Sector 56, and the full data block includes an automated coordination indicator (A). Less than two minutes remain for this controller to take action on this request. Since the trial plan generated by the requesting controller has been checked for problems and is conflict-free, the receiving controller clears the aircraft to FL350 and makes the plan current. The requesting controller receives indication of action taken. Verbal coordination would only have been necessary if the request had timed-out or been denied.



Section 4

Results of FY99 Evaluation

Evaluation exercises were conducted in July and August of 1999, following the evaluation plan documented in Appendix A. The laboratory capability used for the evaluation consisted of a DSR/Host emulation, which allowed access to all normal HCS functions, plus access to new functions and displays representing the capabilities to be evaluated. See Section A.3 for a detailed description of the laboratory capabilities. The two evaluation scenarios consisted of traffic flowing through and around two adjacent sectors of Memphis center; user requests for climbs to cruise altitude and shorter routings were scripted. See Section A.4.1 for a detailed description of the scenarios. Four former controllers recruited from CAASD staff served as evaluation subjects for these exercises.

Even though measure values were collected, these values were based upon a limited number of observations, and can only suggest the magnitude or relative magnitude of an activity. Thus, the results of the evaluation are qualitative rather than quantitative. It was not possible to establish conclusively benefits or costs. However, it was possible to gain insight into information needs and to improve upon proposed operating guidelines for more rigorous evaluations. The revised operating guidelines are contained in Section 3 and Appendix D of this report. Other results are described in this section.

Each evaluation session consisted of two evaluation scenario runs, with data collected for each of two staffed sectors. Table 4-1 summarizes the runs; data was collected for each of the two staffed sectors in each run.

Table 4-1. Evaluation Session Runs

Scenario	Session		
	1	2	3
Eval 1	Run 1	Run 2	Run 3
Eval 2	Run 4	Run 5	Run 6

Data is presented for each run, but not in aggregate: individual work styles and different levels of en route experience are evident in the data as presented. Because there were only a limited number of subjects, no inference should be drawn about the “average” controller. The presentation of results is intended to suggest only a pattern of behavior in recognizable situations.

Section 4.1 characterizes the workload presented to the controller of each staffed sector. Section 4.2 describes the controller's use of the new R-side capabilities in responding to the workload presented. Sector 4-3 summarizes controller subjective responses to the new capabilities, as stated during the post-run interviews.

4.1 Workload

Figure 4-1 suggests the workload presented to each of the evaluation subjects in Run 1 of the evaluation, measured here by the instantaneous count of aircraft under track control. The horizontal axis in the Figure represents elapsed time, with zero being the time the scenario began.

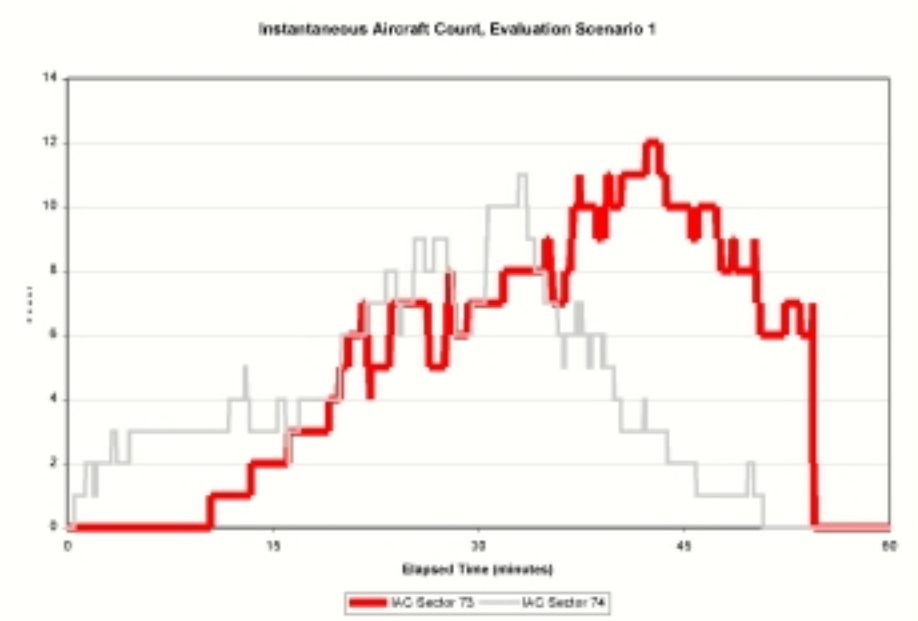


Figure 4-1. Instantaneous Aircraft Count, Evaluation Scenario 1

Each scenario also presented conflict situations to be solved; the controller reaction to each conflict, of course, altered the remainder of the scenario so that each evaluation run resulted in a different set of circumstances that were handled. In addition, many of the aircraft entered the sector with a user request, causing additional controller workload.

4.2 Observed Use of R-Side Capabilities

The evaluation subjects were provided with operating guidelines to follow, as appropriate, including the use of the new R-side capabilities. One measure of the operational

acceptability of a new capability is the frequency of its use in prescribed situations. Subjects were advised to construct trial plans in response to conflicts displayed in the Conflict Probe List and in response to pilot (user) requests. Subjects were also encouraged to use automated replan when a trial plan was not immediately available, for example, to satisfy a user request.

Figures 4-2 and 4-3 compare the instantaneous count of aircraft under track control with the number of conflicts and trial plans under consideration (measured by the changing length of each new list presented to the controller). This data is shown for each run of evaluation scenario 1, for each staffed sector. (Data for evaluation scenario 2 is similar.) The data are graphed as the sum of the instantaneous aircraft count (IAC), the number of conflicts in the Conflict Probe List, the number of trial plans in the Plans List, and the number of automated replan trial plans in the Plans List.[8] The horizontal axis in each Figure represents elapsed time, with zero being the time the scenario began. Since each scenario was stopped at a predetermined time, the data are truncated, even though flights might still have been active in a sector.

The data show that controllers reacted differently to the same traffic and beginning conditions, making different tradeoffs between resolving conflicts and satisfying user requests, and adjusting their workload by accelerating or delaying the initiation and acceptance of aircraft handoffs. Although observation of the subjects clearly captured that each subject conscientiously handled conflicts and user requests, even trying many approaches when necessary, the use of the new tools was reduced in favor of familiar capabilities as traffic and associated workload increased. How much of this response was a result of limitations in experience and training is not known, but the subjects' willingness to use the capabilities was certainly strong.

Figure 4-4 shows the count of trial plans constructed in each run, characterized by the purpose of the trial plan – in response to a conflict posted, in response to a user request, or for some other reason. Other reasons for constructing trial plans included checking an altitude transition before clearing an aircraft into or out of the sector, checking to see if the aircraft could be cleared to the requested altitude in the flight plan (as seen in the Flight Data List), and checking to see if the aircraft could be cleared direct to destination (again as seen in the flight plan data in the Flight Data List).

While in most evaluation runs the data clearly shows that more trial plans were created for user requests than for conflicts, it is also true that there were many more user requests than conflicts in all runs.

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[8] For example, the Count value of 12 at minute 45 in Run 1 in Figure 4-2 represents one displayed conflict, one displayed trial plan, and ten aircraft under the track control of sector 73.

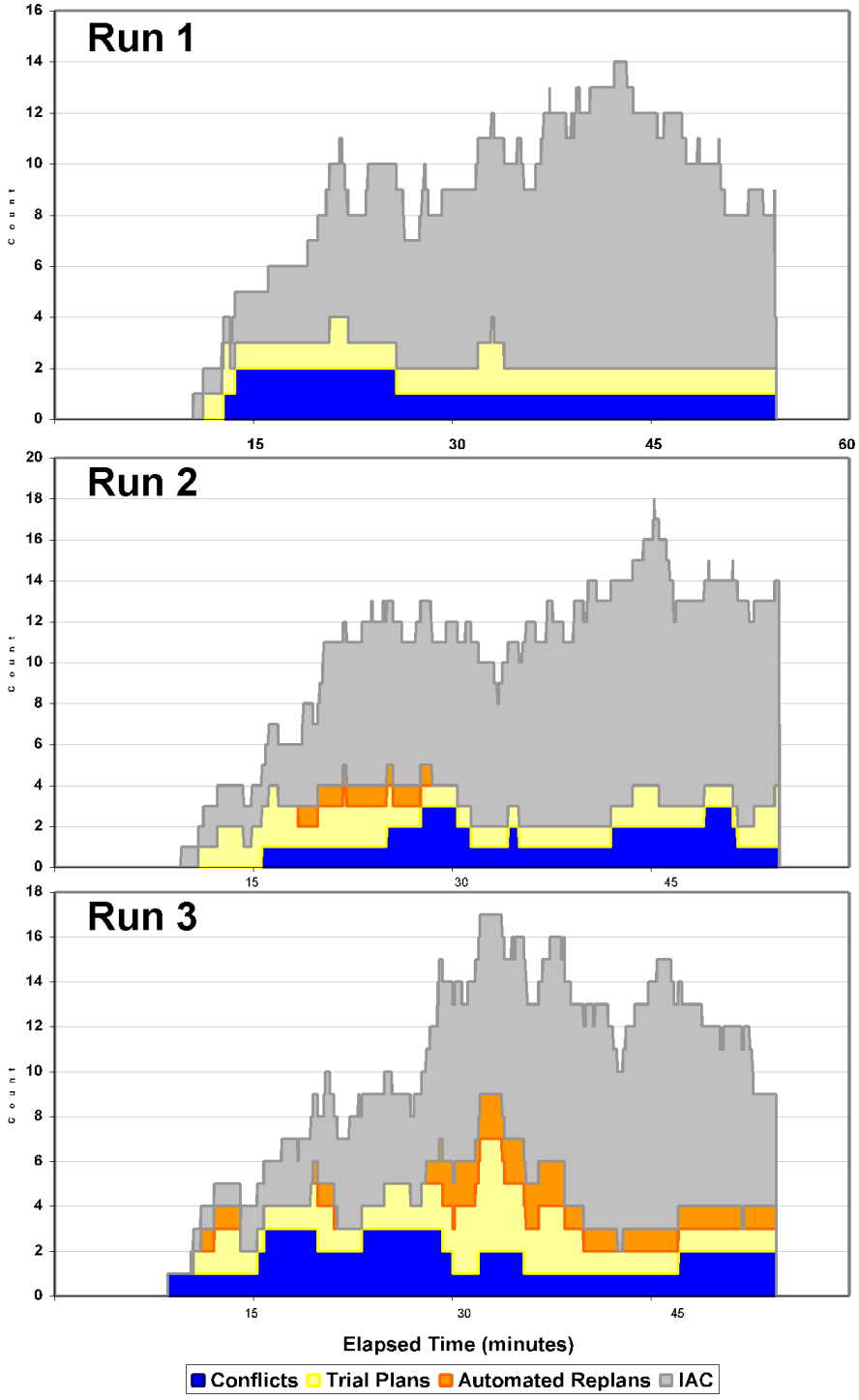

Figure 4-2. Evaluation Scenario 1: Sector 73

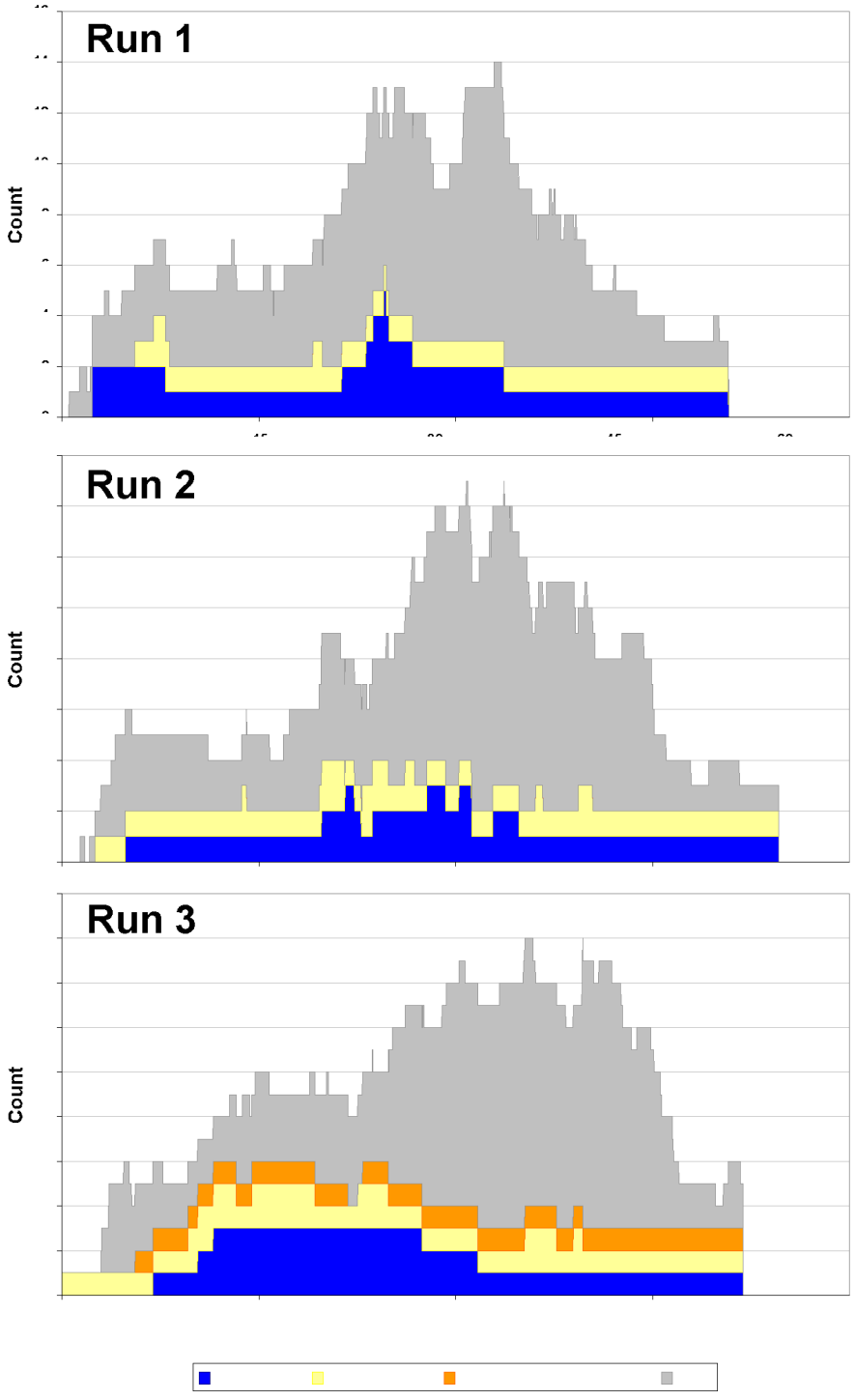

Figure 4-3. Evaluation Scenario 1: Sector 74

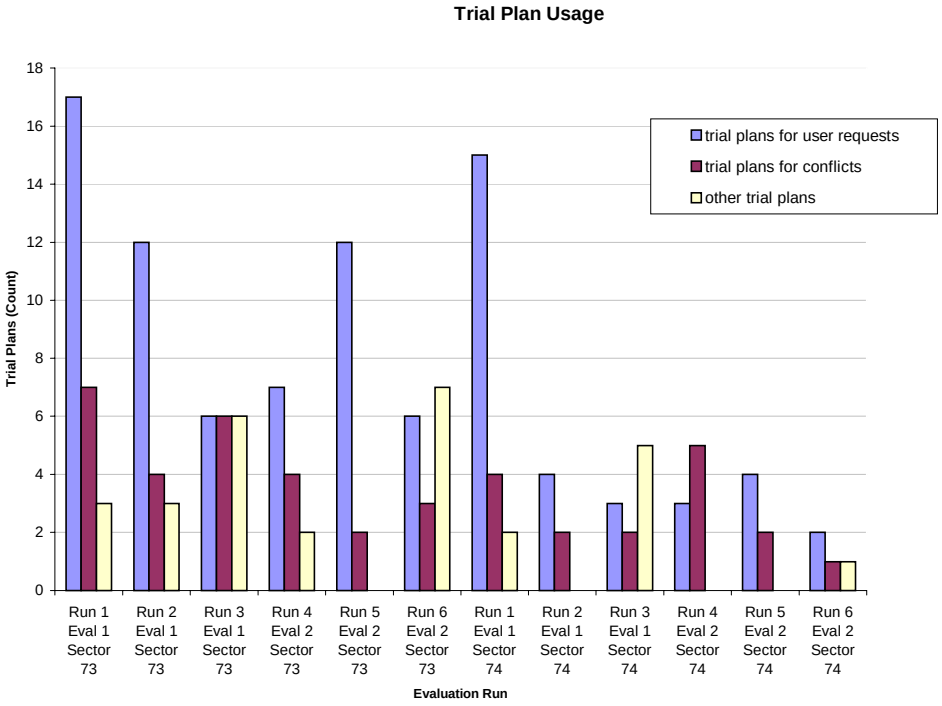

Figure 4-4. Observed Use of Trial Planning

4.3 Subjective Evaluation of New R-Side Capabilities

Each of the four evaluation subjects was interviewed individually at the completion of the evaluation runs. This section summarizes a portion of the results of these interviews.

4.3.1 Overall Assessment

This section contains an overall assessment of the capabilities by the evaluation subjects.

4.3.1.1 Flight Data

All of the evaluation subjects considered the information provided in the Flight Data List to be adequate. All subjects recommended including the Flight Data List as an R-side capability, particularly when flight progress strips are absent.

4.3.1.2 Analysis of Problem Information

All evaluation subjects considered conflict probe to be potentially very useful and thought that the information in the Conflict Probe List was adequate; a suggestion was made

regarding integration of conflict information and flight data information. The evaluation subjects were consistent in indicating that they were aware of problems earlier, and took action earlier to resolve the problems because of conflict probe information. There was agreement that conflict probe should be recommended for inclusion as an R-side capability.

4.3.1.3 Trial Planning

All evaluation subjects considered trial planning to be very useful in helping to evaluate user requests, and most subjects considered trial planning to be very useful in helping to resolve conflicts. All were in agreement that trial planning should be recommended as an R-side capability.

4.3.1.4 Automated Replan

Most subjects considered the automated replan information in the Plans List to be adequate, and half of the subjects, felt that automated replan was very useful in helping to handle user requests. There was agreement among all subjects that automated replan should be recommended as an R-side capability.

4.3.2 Issues

A few changes to the operating guidelines were consistently recommended; these changes were made to the version of the operating guidelines in Section 3 and Appendix D. Comments, recommendations and areas for further research are summarized below, organized by capability, with an additional workload category.

4.3.2.1 Workload

There were repeated comments about implications for workload in a tactical environment, such as the following:

1. A possible increase in verbal communication with the D-side controller because of the lack of strip marking
2. A possible workload increase for the R-side controller because of trial planning by the R-side controller (creating one or more trial plans) for user requests
3. A possible decreased communication workload with other sectors because of automated replan

Perhaps no one of these aspects may, by itself, be a big issue, but in the aggregate they may have some significant impact (negative or positive) on workload.

4.3.2.2 Flight Data

Comments about flight data included the following:

1. There should be an option to sort the Flight Data List by proposed versus active flights, where "proposed" is defined as five to ten minutes before arrival in the sector.
2. Flight Data List entries that are posted earlier (i.e., ten to fifteen minutes before the aircraft enters the sector) could be used for planning, similar to the inbound list.
3. Automatically removing the Flight Data List entry from the list a parameter time (such as 20 seconds) after outbound handoff might be a problem.
4. There is a possible need to provide a capability equivalent to marking on flight progress strips.
5. A Flight Data List entry, when not already visible, should be forced to the list when a conflict involving the flight is indicated in the Conflict Probe List.
6. Conflict information could be integrated/consolidated into the Flight Data List.

4.3.2.3 Analysis of Problem Information

Comments about the analysis of problem information included the following:

1. A countdown clock in the Conflict Probe List might convey a sense of urgency.
2. An indication of, or a way to communicate, which position is handling a problem identified in the Conflict Probe List (i.e., the R-side controller with R-side capabilities or the D-side controller with CCLD) might be needed.
3. The graphic display of conflicts needs to be easier to access.

4.3.2.4 Trial Planning

Comments about trial planning included the following:

1. Coding (e.g., color emphasis) might be needed for trial plans with conflicts.
2. The graphic display of trial plans (especially trial plans with conflicts) might make trial planning more useful, and better inform/facilitate the use of automated replan.
3. A resolution capability might be needed, that is, a version of trial planning that solves detected conflicts.

4.3.2.5 Automated Replan

Comments about automated replan included the following:

1. Using automated replan to check (only) exactly what a pilot requested is of questionable advantage to the pilot when an alternative clearance close to the request is available [and seems to meet the intent of the request, e.g., climbing to FL290 which is currently available versus waiting until FL310 is available].

2. Other/more uses of automated replan should be investigated. For example, the controller might use automated replan when the controller's intent is to issue a clearance - for any reason – and is currently unable to, possibly because the controller is busy with other tasks, etc.)

Section 5

Evolution Strategy

This section proposes a strategy for the evolution from FFP1 to FFP1 plus R-side capabilities. This strategy will continue to evolve as additional evaluations are conducted of the proposed R-side concepts. The proposed evolution strategy considers tradeoffs between CHI guidelines and architectural reality:

- CHI interoperability: The execution of functions and the presentation of data that are common across applications, and the conventions for display format and appearance, exception processing, and input device use, should be consistent across different applications that are being used by a single user community.
- Architectural reality: The basic architecture of 2005 is constrained to be those architectural elements already available now (in 1999) plus those elements currently being installed or already in the procurement pipeline. With respect to R-side capabilities, those elements are the Display System Replacement (DSR) with existing Host software and URET operating on an outboard processor.

The strategy also takes into account the fact that any evolutionary step should help the NAS progress toward the 2005 operational goals. *Addendum 1 of the ATS Concept of Operations for 2005* makes several assertions with special applicability to R-side operations:

> In all control environments, FIPs[9] and situation displays enable controllers to remain aware of all flight-specific activities (e.g., datalink messaging, time-constrained tasking, conflict warnings & resolutions, etc.) without diverting their attention to single-use secondary displays. In addition, they accommodate most of the controller's message input needs by providing single-stroke, multiple action input selections, which reduces reliance on a keyboard-driven command language.
>
> ...
>
> Simple inputs and succinct system outputs make [on-request] trial planning feasible at a single-controller sector under high traffic volume and complexity.

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9 A flight information posting (FIP) is an information output that makes all relevant flight data available to the controller.

Based on the above guidelines and constraints, the proposed strategy incorporates the following features into a first evolutionary step:

- Conflict probe and its related capabilities are directly available to the R-side controller with user input via the R-side keyboard and user displays via the R-side situation display and R-CRD. The R-side controller does not need to divert attention to an alternate (D-side) display.
- Host interface and display conventions are used, even though they are different from URET CHI conventions. Training requirements are minimized, and the R-side controller continues to operate in a familiar environment.
- The expected architecture is used with minimal changes consisting of additional functions and displays within the Host/DSR paradigm and an extension of the two-way Host interface between the Host and URET.

The following sections provide functional and architectural strategies for evolving from FFP1 to FFP1 plus R-side capabilities.

5.1 Functional Evolution

This section proposes a possible strategy for the functional evolution from FFP1 to FFP1 plus R-side capabilities. Tables 4-1 through 4-4 summarize the proposed functional enhancements over FFP1. The first column of each table lists the tasks identified by *Addendum 1 of the ATS Concept of Operations for 2005* as being performed in the 2005 environment. The second column lists recommended enhancements over FFP1 that lead the NAS in the direction of being able to support the 2005 tasks. The last column describes the enhancements to FFP1 that are needed before the 2005 concept can be fully realized: some of these prerequisites are architectural enhancements and some are functional.

Note that a few enhancements in the second column in Table 4-1 for en route tasks 1.1.1, 1.1.2, 1.1.3, and 1.1.4 are enhancements for the D-side position to provide an interactive local information system. The purpose of the R-side enhancement for the same task is to reduce the need to post General Information (GI) messages in the flight strip bay. The R-side enhancement can be accomplished more easily than the D-side enhancement, but can be phased out once the D-side enhancement is available.

Table 5-1. Functional Evolution Steps to Support 2005 En Route Task 1.0 (Situation Awareness)

En Route Task (2005)	R-Side Enhancements over FFP1	Enhancements to FFP1 Prerequisite for 2005
1.1 Maintain awareness of environmental conditions		
1.1.1 Maintain awareness of overall airspace structure	*First enhancement*: Reroute GI messages [Notices to Airmen (NOTAMs)] to list *Second enhancement*: Distribute GI messages (NOTAMS) via interactive GI-based local information system (LIS) on D-side display; phase out R-side list	NAS communications and applications to update and distribute sector map displays
1.1.2 Assess current and predicted wind and weather	*First enhancement*: Reroute GI messages (weather) to list *Second enhancement*: Distribute GI messages (weather) via interactive GI-based LIS on D-side display; phase out R-side list	NAS communications and applications to update and distribute national airspace map display
1.1.3 Assimilate relevant NAS infrastructure information	(same as for 1.1.1)	NAS communications and applications to provide infrastructure schedule and updates to sector
1.1.4 Assimilate sector-relevant aeronautical information	(same as for 1.1.1)	NAS communications and applications to update and distribute aeronautical information to sector

Table 5-1. Functional Evolution Steps to Support 2005 En Route Task 1.0 (Situation Awareness) (continued)

En Route Task (2005)	R-Side Enhancements over FFP1	Enhancements to FFP1 Prerequisite for 2005
1.2 Maintain awareness of pending traffic		
1.2.1 Monitor flight-specific information	Flight Data List	Design and implementation of FIP capability
1.2.2 Monitor non-flight-specific information	No change	NAS communications and applications to update and distribute non-flight-specific data
1.3 Maintain awareness of active traffic		
1.3.1 Monitor the sector's primary traffic information	Flight Data List	Design and implementation of FIP capability
1.3.2 Receive verbal information from other service providers	No change	None
1.3.3 Receive information from aircraft (a) Receive datalink messages (b) Receive voice messages	No change (receive voice messages); Datalink not considered in this report	(a) Datalink

Table 5-1. Functional Evolution Steps to Support 2005 En Route Task 1.0 (Situation Awareness) (continued)

En Route Task (2005)	R-Side Enhancements over FFP1	Enhancements to FFP1 Prerequisite for 2005
1.4 Make control decisions and identify required tasking		
1.4.1 Detect conflicts and assess alternative resolutions (a) Detect aircraft conflicts (b) Detect SUA, terrain, and weather conflicts (c) Evaluate alternative trajectories (d) Assess conflict resolution options	*First enhancement*: Conflict Probe List; Trial Plans List; FDB indicators; trial planning function; automated replan function; enhanced trial planning function *Second enhancement*: Conflict resolution function; weather conflict detection function	Space-based surveillance; (a, c) Aircraft cockpit display of traffic information (CDTI) equipage; as-yet unidentified procedures and separation minima for self-separation; (b) NAS communications and applications to update and distribute SUA schedules
1.4.2 Identify the tasks required to meet procedural requirements	No change	Design and implementation of task prompt capability
1.4.3 Identify the tasks required to implement traffic management (TM) initiatives	No change	NAS communications and applications to update and distribute TM initiatives to sector; Design and implementation of TM initiative implementation capability
1.4.4 Identify the tasks required to accommodate Free Flight	Trial planning function; automated replan function	Design and implementation of application to continually check user-preferred trajectory (desired route and altitude profile)

Table 5-1. Functional Evolution Steps to Support 2005 En Route Task 1.0 (Situation Awareness) (concluded)

En Route Task (2005)	R-Side Enhancements over FFP1	Enhancements to FFP1 Prerequisite for 2005
1.4.5 Identify appropriate flights for implementing problem resolution	No change	Design and implementation of application for equitable allocation of airborne delay
1.4.6 Identify appropriate situations for the use of self-separation	No change	Aircraft CDTI equipage; as-yet unidentified procedures and separation minima

Table 5-2. Functional Evolution Steps to Support 2005 En Route Task 2.0 (Sector Entry)

En Route Task (2005)	R-Side Enhancements over FFP1	Enhancements to FFP1 Prerequisite for 2005
2.1 Assess the impact of the approaching flight		
2.1.1 Receive and review the FIP of the approaching flight	Flight Data List; Conflict Probe List; Trial Plans List; FDB indicators	Design and implementation of FIP capability
2.1.2 Perform inter-sector coordination either to resolve conflicts or to expedite traffic	*First enhancement*: Conflict Probe List; automated coordination function (D to R, R to R) *Second enhancement*: Conflict resolution function	No additional enhancements
2.2 Receive the approaching flight		
2.2.1 Initiate ATC services for pop-ups	No change	Advances in aircraft surveillance equipment and NAS processes to allow discrete signaling by individual aircraft
2.2.2 Receive a flight from another sector (a) Select automatic handoff acceptance "enabled/disabled" (b) Observe handoff notification (c) Plan for timely handoff acceptance or alternative action (d) Request control, if required, and accept or reject the handoff (e) Receive initial datalink contact (f) Receive initial voice call	No change; Datalink not considered in this report	(a) Automatic handoff acceptance function (d) Automatic control negotiation function (e, f) Datalink (f) Automatic frequency issuing function

Table 5-3. Functional Evolution Steps to Support 2005 En Route Task 3.0 (Sector Transit)

En Route Task (2005)	R-Side Enhancements over FFP1	Enhancements to FFP1 Prerequisite for 2005
3.1 Implement control decisions		
3.1.1 Perform inter-sector coordination	Automated coordination function	Design and implementation of FIP capability
3.1.2 Issue clearance	*First enhancement*: Make current function (trial plan) *Second enhancement*: Input selection options on FDB or Flight Data List	Datalink; Design and implementation of FIP capability
3.1.3 Provide IFR* and VFR advisories and on-request information updates	No change	Datalink; Design and deployment of NAS-Wide Information System (NAS-WIS)
3.2 Transfer the flight to the next sector		
3.2.1 Ensure timely handoff initiation	No change	None
3.2.2 Release control to downstream sector if requested	No change	None
3.2.3 Ensure timely handoff acceptance or rejection	No change	Design and implementation of uncompleted handoff function
3.2.4 Issue communications change to a datalink-equipped flight	No change (Datalink not considered in this report)	Datalink

Table 5-3. Functional Evolution Steps to Support 2005 En Route Task 3.0 (Sector Transit) (concluded)

En Route Task (2005)	R-Side Enhancements over FFP1	Enhancements to FFP1 Prerequisite for 2005
3.2.5 Suppress the flight's FIP and indicate non-communicating status on the situation display	Flight Data List (posting rules)	Design and implementation of FIP capability
3.2.6 Suppress the flight's data block	No change	None

* IFR = Instrument Flight Rules

5.2 Architectural Evolution

This section provides strategies for the architectural evolution from FFP1 to FFP1 plus R-side capabilities. The R-side capabilities described in Section 3 of this document can be provided initially by simple Host modifications and additional two-way messaging between the Host and the outboard processor providing conflict probe capabilities.

5.2.1 Functional Requirements

Appendix E contains functional and CHI specifications for proposed new R-side capabilities. The format of the proposed specifications is consistent with that of the following NAS documents:

- NAS-MD-311, *National Airspace System En Route Configuration Management Document Computer Program Functional Specifications [for] Message Entry and Checking* [7]
- NAS-MD-314, *National Airspace System En Route Configuration Management Document Computer Program Functional Specifications [for] Local Outputs* [8]

5.2.2 Interface Requirements

Appendix F provides specifications for interfaces between the Host and external processors to support proposed new R-side capabilities. The format of the proposed specifications is consistent with that of the following NAS document:

- NAS-MD-315, *National Airspace System En Route Configuration Management Document Computer Program Functional Specifications [for] Remote Outputs* [9]

Section 6

Summary

This report describes an initial investigation into the evolution of en route sector team capabilities beyond FFP1, with emphasis on the R-side (radar) position.

FFP1 provides a new decision support tool (URET) to help the en route sector team in managing user requests for flight plan changes and in handling potential aircraft conflicts with other aircraft and with SUAs. However, the functions, displays, and interface associated with this tool are logically and physically dedicated to the D-side (radar associate) position. The R-side controller can access the tool and its capabilities only through the D-side: by requesting the D-side controller to perform a particular task, by physically turning attention to the D-side displays to scan for information, or by physically handling the D-side interface devices when the D-side position is not staffed.

The question arises whether the R-side controller should have a more direct access to this tool and its capabilities via the R-side displays and interface. The capabilities that might benefit the R-side controller include the following:

- Improved access to flight data
- Improved access to conflict probe information
- Trial planning
- Automated replan
- Automated coordination between and within sector teams

This set of R-side capabilities, representing an R-side version of the D-side tool, was implemented in a laboratory setting and a companion set of operating guidelines was developed for use in evaluations. A limited evaluation was carried out in July and August of 1999, using former controllers as evaluation subjects, and considering all the capabilities listed above except automated coordination. Each sector in the evaluation was staffed only by an R-side controller, provided with the new R-side capabilities.

The specific questions motivating the evaluations were as follows:

- Is a strategic conflict probe needed by the R-side controller? If so, how should conflict probe support the R-side controller? Can direct access to conflict probe (and associated capabilities) via R-side displays and interactions benefit air traffic control? Under what types of conditions would such access be beneficial?

Ancillary questions included the following:

- Procedures: How should the R-side controller interact with the new capabilities?
- Information requirements: What information should be available to the R-side controller to facilitate use of the new capabilities?

The subjective results of the limited evaluation are summarized as follows:

- All of the evaluation subjects considered the information provided in the proposed R-side controller's Flight Data List to be adequate. All subjects recommended including the Flight Data List as an R-side capability, particularly when flight progress strips are absent.
- All evaluation subjects considered conflict probe to be potentially very useful and thought that the information in the proposed R-side controller's Conflict Probe List was adequate; a suggestion was made regarding integration of conflict information and flight data information. The evaluation subjects were consistent in indicating that they were aware of problems earlier, and took action earlier to resolve the problems because of conflict probe information. There was agreement that conflict probe should be recommended for inclusion as an R-side capability.
- All evaluation subjects considered trial planning to be very useful in helping to evaluate user requests, and most subjects considered trial planning to be very useful in helping to resolve conflicts. All were in agreement that trial planning should be recommended as an R-side capability.
- Most subjects considered the automated replan information in the Plans List to be adequate, and half of the subjects felt that automated replan was very useful in helping to handle user requests. There was agreement among all subjects that automated replan should be recommended as an R-side capability.
- Several sector team interactions and workload issues were suggested by the evaluation subjects:
  - Possible increase in verbal communication with the D-side controller because of the lack of strip marking
  - Possible workload increase for the R-side controller because of trial planning by the R-side controller (creating one or more trial plans) for user requests
  - Possible decreased communication workload with other sectors because of automated replan

Recorded data from the limited evaluation show that controllers reacted differently to the same traffic and beginning conditions, making different tradeoffs between solving conflicts and satisfying user requests, and adjusting their workload by accelerating or delaying the

initiation and acceptance of handoffs. Although observation of the subjects clearly captured that each subject conscientiously handled conflicts and user requests, even trying many approaches when necessary, the use of the new tools was reduced in favor of familiar capabilities as traffic and associated workload increased. How much of this response was a result of limitations in experience and training is not known, but the subjects' willingness to use the capabilities was certainly strong.

As suggested by evaluation results, CAASD refined the candidate capabilities and operating guidelines and developed candidate requirements and strategies for evolving from FFP1 to an environment including these R-side capabilities. CAASD also developed proposed functional and interface requirements and specifications and a proposed evolution strategy. CAASD recommends that extensive evaluations be conducted to validate the following:

- Proposed operating guidelines for the R-side position, both working independently and interacting with a D-side position, in using FFP1 plus R-side capabilities
- Proposed functional requirements and specifications for R-side functions and for internal interfaces between the Host and external processors, and proposed CHI requirements and specifications for the R-side user interface, to support new R-side capabilities
- Proposed strategies for the functional and architectural evolution from FFP1 to FFP1 plus R-side capabilities (e.g., Host modifications, two-way interface)

The proposals and evaluation results represented in this report provide a starting point from which to conduct further analysis to investigate questions posed by new en route operational concepts, particularly with respect to R-side capabilities. FFP1 will provide capabilities that are expected to provide operational benefits for the sector team. Of particular importance will be controller feedback from the use of the D-side URET CCLD, which includes a flat panel display capability that could improve R-side controller access to D-side information. In addition, if the enhancement of DSR to provide a more Operational Display and Input Development (ODID)-like CHI is accelerated, then the results of this year's R-side capabilities evaluation will need to be reassessed. Further studies involving more operational personnel and a comparison against the FFP1 baseline are needed to fully explore the proposed evolution strategies.

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9. Federal Aviation Administration, NAS-MD-315, *National Airspace System En Route Configuration Management Document Computer Program Functional Specifications [for] Remote Outputs.*

Glossary

ACL	Aircraft List
AID	Aircraft Identification
CAASD	Center for Advanced Aviation System Development
CCLD	Core Capability Limited Deployment
CDTI	Cockpit Display of Traffic Information
CHI	Computer-Human Interface
CID	Computer Identification
CL	Automated Coordination List
CPL	Conflict Probe List
CRD	Computer Readout Device
DEC	Data Entry Controls
DSR	Display System Replacement
DYSIM	Dynamic Simulation
FAA	Federal Aviation Administration
FDB	Full Data Block
FDL	Flight Data List
FLID	Flight Identification
FFP1	Free Flight Phase 1
FIP	Flight Information Posting
GI	General Information
GPD	Graphic Plan Display

HCS	Host Computer System
HOCSR	Host/Oceanic Computer System Replacement
IFR	Instrument Flight Rules
KPR	Keyboard Printer
KVDT	Keyboard Video Display Terminal
LIS	Local Information System
NAS	National Airspace System
NAS-WIS	NAS-Wide Information System
NEXRAD	Next Generation Weather
NOTAM	Notice to Airmen
ODID	Operational Display and Input Development
PD	Plans Display
QAK	Quick Action Key
RD	Response Display
RGL	Raytheon Graphic Language
SAR	System Analysis Recording
SUA	Special Use Airspace
TACAN	Tactical Air Navigation

TCAS	Traffic Alert and Collision Avoidance System
TM	Traffic Management
TMA(SC)	Traffic Management Advisor (Single Center)
TPL	Trial Plans List
URET	User Request Evaluation Tool
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF Omnidirectional Range
VORTAC	Collocated VOR and TACAN
WARP	Weather and Radar Processor
ZAU	Chicago Center
ZDC	Washington Center
ZID	Indianapolis Center
ZKC	Kansas City
ZME	Memphis Center
ZOB	Cleveland Center
ZTL	Atlanta Center

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Appendix A

Evaluation Plan

This Appendix describes an overall plan for evaluating the evolution of R-side capabilities. The limited evaluation in July and August of 1999 followed this plan and produced a subset of the measures described here.

This Appendix describes the questions addressed, the laboratory capabilities developed, and the evaluation process.

A.1 Questions

The specific questions motivating the evaluation are as follows:

- Is a strategic conflict probe needed by the R-side controller? If so, how should conflict probe support the R-side controller beyond the level of support provided by FFP1? Can direct access to conflict probe (and associated capabilities) via R-side displays and interactions benefit air traffic control?[10] Under what types of conditions would such access be beneficial?

Ancillary questions include the following:

- Procedures: How should the R-side controller interact with the new capabilities?
- Information requirements: What information should be available to the R-side controller to facilitate the performance of his/her duties?

A.2 Decision Criteria (Measures)

The measures of interest are summarized in Section A.2.1. Measure data are associated with events and with threads. An event occurs at a moment in time; a thread is a sequence of related events. Events are discussed in Section A.2.2; threads are discussed in Section A.2.3.

A.2.1 Measures

The measures used are categorized by safety, workload, operational acceptability, and benefits. Criterion measures test the validity of any benefits observed. Outcome measures provide direct quantifiable estimates of benefits, such as (for users) flexibility, access, delay, and predictability. Specific measures for each area of measurement are discussed later in this Appendix.

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[10] Anticipated benefits are listed with the discussion of measures in Section A.2.

Safety measure areas include the following:

- Conflict alerts[11]
- Separation violations predicted by the conflict probe capability

Workload measure areas include the following:

- Completed control actions for separation
- Time spent building trial plans
- Communications
- Coordination between R-side and D-side positions
- Handoff accept latency (the elapsed time between initiation and acceptance of handoff)
- Control actions that cannot be completed in a timely manner
- Perceived workload

Operational acceptability measure areas include the following:

- Frequency of tool use
- Acceptance of tool results
- Quality of predictions and flight data
- Controller subjective evaluation

Hypotheses about benefits include the following for the user and for the sector team:

- User
  - Less time and distance flown (delay**)**
  - Fewer unnecessary maneuvers (predictability**)**
  - Pilot requests granted more quickly (flexibility, access**)**
  - More trial plans implemented/less vectoring (predictability)

---

11 A conflict alert is an HCS (not URET) alert of an actual or potential violation of a minimum miss distance criteria derived from separation standards.

- Sector team
  - More workload smoothing between R- and D-side positions (workload**)**
  - Conflict resolution that is more strategic and less tactical, with earlier prediction of and more time available to resolve conflicts (safety**)**
  - Less time needed in granting user requests (workload**)**
  - Less verbal coordination (workload)

Some data are collected and measures calculated in order to characterize the workload demands placed on the controller by the scenario. All other measure values must be interpreted with respect to scenario measure values. Scenario measures include the following:

- Instantaneous aircraft count
- Time in sector
- Aircraft in altitude transition at inbound handoff

A.2.2 Events

Events and the criteria for determining that an event has happened are listed in Table A-1. The measures associated with events are given in Table A-2. Event measures are calculated for each staffed (evaluation) sector and position.

A.2.3 Threads

A thread is a sequence of events, and can be either simple or composite. Simple threads are discussed in Section A.2.3.1; composite threads in Section A.2.3.2.

A.2.3.1 Simple Threads

Simple threads and the beginning and ending events that define each simple thread are listed in Table A-3. The measures associated with simple threads are given in Table A-4. Thread measures are calculated for each staffed sector and position. A simple thread is associated with the same sector and position that are associated with the beginning event of the thread.

Table A-1. Events

Event	Definition	Criteria
E1 Sector handoff	Interactions with a controller when an aircraft is entering a sector	E1.1 Inbound handoff acceptance
E2 Pilot request	Pilot-initiated request of a controller	E2.1/2/3 Change in route, altitude, or speed E2.4 Information request
E3 Controller query	Controller-initiated request of information from a pilot	E3.1/2/3/4 Request for aircraft speed, altitude, route or other (e.g., verify "heavy") information
E4 Controller instruction	Controller-initiated communications with a pilot	E4.1/2/3 Change in route, altitude, or speed E4.4 Deny request E4.5 Dispense information
E5 Verbal controller communications	Verbal controller-initiated communications with another controller (including by telephone)	E5.1/2 Request to view display OR offer to show display E5.3/4 Request evaluation of pilot request OR offer evaluation of pilot request E5.5/6 Request problem resolution (reallocation of problem to other sector position) OR offer problem resolution E5.7/8 Initiate OR receive follow-up on automated coordination request E5.9/10 Respond to verbal request OR offer E5.11 Request plan "make current" E5.12 Other
E6 Automated coordination	Electronic controller-initiated coordination with another controller	E6.1/2/3 Submit, receive, OR cancel request E6.4/5 Respond to OR receive a response to a request E6.6 Request "times out" without a response

Table A-1. Events (concluded)

Event	Definition	Criteria
E7 New information	New information is displayed or information is updated at a sector position	E7.1/2 Conflict Alert (Host) appears OR is removed E7.3/4 Problem notification (for a flight plan) appears OR is removed E7.5 Automated replan is active for an inbound flight E7.6 Status of automated replan (automated replan trial plan becomes conflict-free)
E8 List management	Controller manages display of information in lists	E8.1/2 List forced to display OR automatically removed from display (when empty) E8.3 Change display rules (e.g., sort criteria) E8.4/5 Hide OR recall list E8.6 Move list E8.7 Entry forced to list E8.8/9 Hide OR recall entry
E9 Trial plan creation	Controller constructs a trial plan representing a flight plan amendment	E9.1 Trial plan is displayed E9.2 Trial plan expires E9.3 Trial plan removed (submitted to automated replan or automated coordination)
E10 Automated replan	Controller uses automated replan for periodic evaluation of a trial plan	E10.1 Request automated replan E10.2 Cancel automated replan
E11 Plan management	Controller manages plan information	E11.1/2/3/4 Amend plan (controller entry of data directly into the host: flight plan reroute, track reroute, assigned altitude, interim altitude) E11.5 Make plan current (controller submits plan to Host as amendment) E11.6 Delete plan (controller deletes existing plan before it expires) E11.7/8/9/10 Display plan (controller assesses plan information: textual plan, textual route, graphical route, graphical problem)

Table A-2. Event Measures

Event	Measure
E1 Sector handoff	E1a Count of aircraft in altitude transition at accept inbound handoff
E2 Pilot request	E2a/b/c/d Count of E2.1/2/3/4
E3 Controller query	E3a/b/c/d Count of E3.1/2/3/4
E4 Controller instruction	E4a/b/c/d/e Count of E4.1/2/3/4/5
E5 Verbal controller communications	E5a/b/c/d/e/f/g/h/i/j/k/l Count of E5.1/2/3/4/5/6/7/8/9/10/11/12
E6 Automated coordination	E6a/b/c/d/e/f Count of E6.1/2/3/4/5/6
E7 New information	E7a/b/c/d/e/f Count of E7.1/2/3/4/5/6
E8 List management	E8a/b/c/d/e/f/g/h/i Count of E7.1/2/3/4/5/6/7/8/9 by list
E9 Trial plan creation	E9a/b Count of E9.1/2 E9c Delta time = the time of arrival based on the trial plan minus the time of arrival based on the flight plan
E10 Automated replan	E10a/b Count of E10.1/2
E11 Plan management	E11a/b/c/d/e/f/g/h/i/j Count of E11.1/2/3/4/5/6/7/8/9/10

Table A-3. Simple Threads

Thread	Beginning Event	Ending Event
T1 Aircraft in sector	E1.1 Sector HO < inbound handoff acceptance> this sector	E1.1 Sector HO <inbound handoff acceptance> next sector
T2 Pilot request	E2.1.2.3.4 Pilot request <any>	E4.1/2/3/4/5 Controller instruction <any (matching request)>
T3 Verbal controller communications	E5.1/2/3/4/5/6/7/11 Verbal controller communications <any request OR offer>	E5.8/9/10 Verbal controller communications <any response to same request OR offer>
T4.1 Automated coordination (submit)	E6.1 Automated coordination <submit request>	E6.3/5/6/8 Automated coordination <cancel request OR receive response to request OR request times out without response> OR Verbal controller communications <receive follow-up on automated coordination request>
T4.2 Automated coordination (receive)	E6.2 Automated coordination <receive request>	E6.3/4/6, E5.7 Automated coordination <cancel request OR respond to request OR request times out without response> OR Verbal controller communications <initiate follow-up on auto coordination request>
T5.1 Problem (Conflict Alert)	E7.1 New information <Conflict Alert appears>	E7.2 New information <Conflict Alert is removed>
T5.2 Problem (conflict probe)	E7.3 New information <problem notification appears>	E7.4 New information <problem notification is removed>
T6 Trial planning	E9.1 Trial plan creation <trial plan displayed>	E9.2/3, E11.5 Trial plan creation <trial plan expires OR is removed> OR Plan management <make plan current>
T7 Automated replanning	E10.1 Automated replan <request automated replan>	E10.2, E11.5/6 Automated replan <cancel automated replan> OR Plan management <make plan current OR delete plan>
T8.1 List management (list)	E8.1/5 Manage lists <list forced to display OR recall list>	E8.2/4 List management <list automatically removed from display OR hide list>
T8.2 List management (entry)	E8.7/9 Manage lists <entry forced to list OR recall entry>	E8.4/8 List management <hide list OR hide entry>

Table A-4. Simple Thread Measures

Thread	Measure
T1 Aircraft in sector	T1a Instantaneous aircraft count (IAC) = instantaneous count of aircraft after accept inbound handoff and before accept outbound handoff T1b Handoff acceptance latency = elapsed time from initiate to accept inbound handoff T1c Time in sector = elapsed time from accept inbound handoff to accept outbound handoff
T2 Pilot request	T2a Elapsed time between pilot request and matching controller instruction
T3 Verbal controller communications	T3a Count of intrasector conversations T3b Elapsed time (from request to response) of intrasector conversations T3c Count of intersector conversations T3d Elapsed time (from request to response) of intersector conversations
T4 Automated coordination	T4a Count by results (approve, unable, time out) of downstream automated coordination for information (initiating position is current controller) T4b Count by results (make current, unable, time out) of upstream automated coordination for clearance delivery (upstream controller is current controller) T4c Count by results (make current, unable, time out) of within-sector automated coordination for clearance delivery T4d Initiating position response time = elapsed time between submitting a request and receiving a response T4e Receiving position response time = elapsed time between receiving a request and responding to the request
T5 Problem solving	T5a Problem life = elapsed time from first display of problem to removal from display T5b Count of problems solved by "make current"
T6 Trial planning	T6a Trial plan life = elapsed time from first display of trial plan to removal from display
T7 Automated replanning	T7a Automated replan life = elapsed time from auto replan plan displayed as available to time auto replan plan removed from display
T8 List management	T8a List display life = elapsed time from display of list to removal or hiding of list T8b Entry display life = elapsed time from display of entry to removal or hiding of entry

A.2.3.2 Composite Threads

A composite thread is composed of two or more simple threads joined either end-to-end sequentially or in a tree structure. Two threads joined so that the ending event of one is the beginning event of the other composes a sequential composite thread. An example of a tree structure is a simple thread having an ending event that becomes the beginning event of two or more simple threads.

A.2.4 Transitions

While Section A.2.3 describes a thread as a sequence of events, it is not suggested that a controller is involved with only one event at a time, devoting all of his or her time to that sequence of events, until the ending event of the thread. Instead, controllers can be involved with many threads at the same time, and shift their attention between threads to use their time more efficiently. Of interest is why and how frequently controller shift among threads.

A.3 Laboratory Capabilities

The laboratory used for evaluations is built upon an emulation of the HCS dynamic simulation (DYSIM) capability. This section describes the laboratory, including its operational and supporting components.

A.3.1 Operational Capabilities

The laboratory provides two en route sectors, each with two staffed positions (the radar position and the radar associate position).

The radar position includes a keyboard, trackball, and DSR-like display. The HCS interface allows access to all the normal HCS functions [plus access to new functions and displays representing the capabilities to be evaluated]. However, the interface remains "Host-like," using quick action keys (QAKs), functions displayed in the R-CRD (controller readout device), tabular lists, indicators in the full data block, and the route readout display.

The radar associate position includes a URET keyboard, mouse, and Sony 2k x 2k display,[12] but does not include a functional DSR keyboard. Thus the radar associate controller can interface with the HCS only through URET, and cannot amend flight plans, request flight strips, or accept handoff using the usual HCS interface. The radar associate controller can amend flight plans only by using the "make current" feature of URET.

The limited evaluation described in this report used only the radar position at each sector.

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[12] The display is a monitor; a flat panel is required by the Display System Replacement (DSR).

A.3.2 Supporting Capabilities

This section describes laboratory capabilities that support the operational positions.

The typical DYSIM scenario control capabilities include a user interface to start and stop an exercise, including the mounting of a DYSIM scenario cartridge. A "sim-pilot" position is staffed to represent all the pilots and all the controllers of other (usually adjacent) sectors in communications with the staffed radar position (called the training position). The DYSIM sim-pilot position can be very difficult to staff and can require up to three persons simultaneously in very heavy and complex traffic.

The new supporting laboratory capabilities enhance the normal DYSIM capabilities by simplifying the scenario control interface, eliminating the need for a physical DYSIM scenario tape, and replacing the DYSIM sim-pilot position with separate sim-pilot and sim-controller positions. New data collection capabilities augment the existing System Analysis Recording (SAR) capabilities.

A.3.2.1 Scenario Control

The execution of an exercise is managed from a separate workstation. The scenario control interface allows an analyst to start, pause, and stop the scenario, and provides real-time output for monitoring the progress of the exercise. This interface replaces the basic DYSIM control interface.

A.3.2.2 Sim-Pilot

The old DYSIM sim-pilot display uses a NAS-like graphic plan view display, adding sim datablocks to targets that already have NAS datablocks displayed. The display driver is written in Ratheon Graphics Language (RGL), a proprietary language that requires special display devices.

The sim and NAS datablocks are superimposed on each other when they first appear for an aircraft; the DYSIM sim-pilot must quickly offset one of the datablocks in order to read either one and identify the aircraft. In heavy traffic, the duty of offsetting datablocks can occupy one person completely. In addition, since each aircraft has two datablocks, much more of the screen is occupied by datablocks, making the task of locating any one aircraft much harder.

The new sim-pilot retains the pilot duties of the old DYSIM sim-pilot but uses a new interface. This interface is list-oriented with one line of information (the same information as in the sim datablock) for each aircraft. The new sim-pilot display can use common

display devices and drivers. The new sim-pilot interface allows the same aircraft control interactions, but does not display or require manipulation of datablocks.[13]

A.3.2.3 Sim-Controller

The controller and pilot aspects of the old DYSIM sim-pilot display share the same NAS-like display and interface, with the same problem of datablock conflict. With the removal of sim-pilot duties, the artificial datablock problem can be removed also.

The new sim-controller retains the controller duties of the old DYSIM sim-pilot and uses the same interface. However, there is a new display that looks very much like the old display, but was developed to use common display devices and drivers.[14] The new sim-controller display also provides NAS datablocks and sim datablocks; the display of either type can be selected or suppressed.

A.3.2.4 Automated Data Collection

An automated data collection application captures information about predefined events and stores the data for off-line post-processing and analysis.

A.4 Evaluation Process

The evaluation process consists of three distinct but related phases:

- Planning and preparation
  - Scenario generation
  - Generation of training materials for evaluation subjects and support staff
  - Recruiting of evaluation subjects and support staff
  - Training of support staff
  - Basic training of evaluation subjects

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[13] The new sim-pilot interface does not provide the same situational awareness as before, but it is not clear that this type of awareness of all other aircraft movement is realistic or needed from a pilot.

[14] The display, which was developed using ODS Toolbox, does not yet have all the features of the DSR display. The sim-controller position, which does not require the same fidelity as the staffed controller position, is the first test of the new display. The new sim-controller display will be used in FY00 to permit the staffing of additional sectors without the added expense of DSR display devices.

- Evaluation activities
  - Subjects' introduction to capabilities and operational guidelines to be evaluated
  - Hands-on subjects' training in capabilities and operational guidelines
  - Subjects' use of capabilities with evaluation scenarios
  - Observation of subject activities during running of evaluation scenarios
  - Automated data collection
  - Post-scenario subject interviews
- Post-processing
  - Data analysis
  - Results reporting

The materials described above were created for the purpose of extensive evaluations in FY00 and beyond. The evaluations carried out in July and August of 1999 were considered a dry run of the evaluation process for these later, more formal exercises.

Section A.4.1 below describes the scenarios used in the 1999 evaluations. Appendix B contains the briefing, titled *Evaluation of R-Side Capabilities Evolution and Procedures*, that was used to introduce the evaluation subjects to the capabilities and operational guidelines to be evaluated. Appendix C contains the post-scenario subject interview forms. The results of the evaluation are described in Section 4 of this report.

A.4.1 Scenarios

The scenarios consisted of (1) traffic flowing through and around two adjacent sectors of Memphis Center and (2) user requests created to represent earlier climbs to cruise altitude and shorter routing (e.g., "direct to destination" routing). Sim-pilots were trained to make the user request for a flight as the flight called in "on frequency" to the appropriate sector.

A.4.1.1 Airspace

Sector 26, Memphis High, was selected as DYSIM sector 73. Its predominant flow of traffic is northeast and southwest, and its major jet routes are J6, J35, and J42:

- J42 is designed for northeast-bound traffic.
- J6 is designed for southwest-bound traffic.
- J35 is a major jet route connecting Chicago, New Orleans, and three intermediate terminals in between.

- Large volume of overflights converge at the Memphis VORTAC.

The primary function of Memphis High is to control overflights along the jet routes; the secondary function is arrival/departure transition service to Memphis, Nashville, and Little Rock terminal areas.

The potential trouble spots for traffic in the Memphis High sector are the Memphis VORTAC[15] and the intersection of jet routes J151 and J42.

Sector 31, Muscle Shoals, was selected as DYSIM sector 74. Its predominant flow of traffic is on jet routes, as well as to and from Memphis and Nashville terminal areas. J151 is the major jet route to and from St. Louis from the southeast United States. Muscle Shoals sequences Memphis and Atlanta arrivals simultaneously with Nashville southwest-bound departures.

The primary functions of Muscle Shoals are to provide sequencing to Memphis, Nashville, and Atlanta terminal areas, and to provide services to overflights.

The potential trouble spots for traffic in the Muscle Shoals sector are the intersection of jet routes J151 and J118, the HAB VORTAC, and the HLI VORTAC.

Both sectors have vertical limits of FL240 to FL330.

DYSIM sector 75 represented all other sectors below, beside, and above DYSIM sectors 73 and 74. All traffic not under the control of either sector 73 or 74 was under the control of sector 75.

A.4.1.2 Traffic

For the limited evaluations in July and August of 1999, three scenarios were used: a training scenario and two operational scenarios. The traffic in these scenarios was selected from actual flights flown on 28 April 1999.

The training scenario traffic consists of approximately 45 minutes of traffic taken from actual flights beginning at 1400Z, with user requests added. Traffic was light to allow time to practice the use of new capabilities.

The two evaluation scenarios consist of approximately 55 minutes of traffic each, taken from actual flights beginning at 1700Z, with user requests added. In addition, since the original traffic for sector 74 was light, traffic was added to sector 74 from actual flights beginning at 1200Z.

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15 A VORTAC is a very-high frequency (VHF) omnidirectional range (VOR) device collocated with a tactical air navigation (TACAN) device,

The two resulting evaluation scenarios, called “eval 1” and “eval 2” are categorized as heavy and medium, respectively, for sector 73, and categorized as medium and light, respectively, for sector 74.

A.4.2 Training

Training materials were created for all evaluation subjects and support staff, including the following:

- DYSIM training, including reference materials for posting at the sector positions
- Airspace training, including maps and standard operating procedures for posting at the sector positions
- Sim-pilot training, including reference materials for posting at the sim-pilot positions
- All-other R position training, including reference materials for posting at the all-other R position
- Training in the new capabilities for the evaluation subjects

Four evaluation subjects were recruited from CAASD staff and trained in DYSIM operations and the Memphis airspace. Two subjects were retired en route controllers. The other two subjects had previous experience as military air traffic controllers. Future evaluations should recruit full performance level en route controllers with experience in the North and Central areas of specialization in Memphis Center.

CAASD staff were recruited and trained to staff the other (support) positions during evaluation runs, including five sim-pilots and two all-other R position staff. Four of the sim-pilots were licensed pilots. One of the all-other R position staff was a former terminal controller, and the other staff was a trained air traffic controller awaiting placement in an en route control facility.

Appendix B

Pre-Evaluation Briefing

This Appendix contains the briefing administered to the evaluation subjects (controllers) to introduce them the new R-side capabilities and operating guidelines for evaluation.

Appendix C

Post-Evaluation Questionnaire

This Appendix contains the questionnaire administered to each subject controller and the operating guidelines provided to them as a reference.

Enhanced R-Side Capabilities and Procedures Evaluation

Post-Run Questions

Your anonymous responses to the following questions will be helpful in evaluating capabilities, defining information requirements, refining procedures, and guiding future evaluations. Responses will be tabulated and represented in summary only: ***no individual identities will be associated with any data****. Your thoughtful input is appreciated.*

Date _____ Session #___ Run # ___

Participant Initials (optional) _____ Current Position _____ Years as FPL _____

Experience (En Route/Radar/Memphis Center) _____

* *

1. Rate the potential usefulness of the Flight Data List to help you evaluate the impact of new aircraft on sector operations (i.e., planning).

Very Useful				Not Useful
☐	☐	☐	☐	☐

2. Was the information provided in the Flight Data List adequate?

Yes ☐ No ☐

If No, What information would make this capability more useful?

_____

3. Was the information provided in the Flight Data List displayed and removed at the correct time (e.g., displayed at handoff)?

Yes ☐ No ☐

If No, What timing would be more useful?

_____

4. Did the lack of opportunity to view, mark and handle flight progress strips reduce your ability to handle traffic?

Yes ☐ No ☐

If Yes, Explain _____

5. In what conditions or circumstances would the Flight Data List be most useful as an R-Side capability?

_____

6. Were the procedures you used regarding flight data information appropriate?

Yes	No
☐	☐

If No, Explain_____

7. Would the use of the Flight Data List change the way the R-controller might interact with the D-controller?

Yes	No
☐	☐

Explain_____

8. Rate the likely workload impact of including the Flight Data List on R-Side.

Greatly Increase		No Change		Greatly Decrease
☐	☐	☐	☐	☐

9. Would you recommend including the Flight Data List as an R-side capability?

Yes	No
☐	☐

Other comments about the Flight Data List: _____

* *

10. Rate the potential usefulness of Conflict Probe to help identify potential conflicts.

Very Useful				Not Useful
☐	☐	☐	☐	☐

11. Were you aware of problems earlier than you would be with current capabilities as a result of the information provided by Conflict Probe?

Yes	No
☐	☐

Explain_____

12. Did you take action to resolve problems earlier as a result of the information provided by the Conflict Probe List?

Yes	No
☐	☐

Explain_____

13. Was the information provided in the Probe List adequate?

Yes	No
☐	☐

If No, What information would make this capability more useful?

_____

14. Was the separation distance (i.e., 7 miles) used to predict conflicts optimal?

Yes ☐ No ☐

If No, What distance would be more useful?

_____

Yes ☐ No ☐

If Yes, Explain _____

15. In what conditions or circumstances would the Conflict Probe List be most useful as an R-Side capability?

_____

16. Were the procedures you used regarding conflict probe information appropriate?

Yes ☐ No ☐

If No, Explain_____

17. Would the use of Conflict Probe on the R-Side change the way the R-controller might interact with the D-controller?

Yes ☐ No ☐

Explain_____

18. Would you recommend including Conflict Probe/Conflict Probe List as an R-side capability?

Yes ☐ No ☐

Other comments about Conflict Probe on the R-Side: _____

* *

19. Rate the potential usefulness of the Trial Planning to help you evaluate and resolve conflicts.

Very Useful ☐ ☐ ☐ ☐ Not Useful ☐

20. Rate the potential usefulness of the Trial Planning to help you evaluate user requests.

Very Useful				Not Useful
☐	☐	☐	☐	☐

21. Rate the likely workload impact of including the Trial Planning on R-Side.

Greatly Increase		No Change		Greatly Decrease
☐	☐	☐	☐	☐

22. Did you handle user requests differently (i.e., earlier) as a result of the Trial Planning capability on the R-Side?

Yes	No
☐	☐

If Yes, How? _____

23. Was the information provided in the Trial Plan List adequate?

Yes	No
☐	☐

If No, What information would make this capability more useful?

_____

24. In what conditions or circumstances would Trial Planning be most useful as an R-Side capability?

_____

25. Would the use of Trial Planning on the R-Side change the way the R-controller might interact with the D-controller?

Yes ☐ No ☐

Explain_____

26. Were the procedures you used regarding trial planning appropriate?

Yes ☐ No ☐

If No, Explain_____

27. Would you recommend including Trial Planning as an R-side capability?

Yes ☐ No ☐

Other comments about Trial Planning on the R-Side: _____

* *

28. Rate the potential usefulness of Auto Replan to help you handle user requests.

Very Useful				Not Useful
☐	☐	☐	☐	☐

29. Rate the likely workload impact of including the Auto Replan on R-Side.

Greatly Increase		No Change		Greatly Decrease
☐	☐	☐	☐	☐

30. Did you handle user requests differently as a result of the Auto Replan capability on the R-Side?

Yes	No
☐	☐

If Yes, How? _____

31. Did you handle requests from other controller differently as a result of the Auto Replan capability on the R-Side?

Yes	No
☐	☐

If Yes, How? _____

32. Was the Auto Replan information provided in the Trial Plan List adequate?

Yes ☐ No ☐

If No, What information would make this capability more useful?

_____

33. Was the Auto Replan indicator provided in the data block useful?

Yes ☐ No ☐

34. In what conditions or circumstances would Auto Replan be most useful as an R-Side capability?

_____

35. Were the procedures you used regarding auto replan appropriate?

Yes ☐ No ☐

If No, Explain_____

36. Would the use of the Auto Replan on the R-Side change the way the R-controller might interact with the D-controller?

Yes ☐ No ☐

Explain_____

37. Would you recommend including Auto Replan as an R-side capability?

Yes ☐ No ☐

Other comments about Auto Replan on the R-Side: _____

* *

38. How adequate was the scenario realism (i.e., traffic, events, etc.) for the purpose of the evaluation?

Very Useful ☐ ☐ ☐ ☐ Not Useful ☐

39. How adequate was the level of fidelity (e.g., display, command entry, response time, etc.) for the purpose of the evaluation?

Very Useful ☐ ☐ ☐ ☐ Not Useful ☐

40. How adequate was the training you received to allow you to participate in the evaluation?

Very Useful				Not Useful
☐	☐	☐	☐	☐

R-Side Capabilities Evolution

Evaluation Guidelines

Data Collection

1. Evaluation Guidelines for Flight Data

a. Use Flight Data Entries like flight progress strips.

_____

_____

b. Scan the flight data list to maintain situation awareness and to monitor changes, including additions, to flight information.

_____

_____

c. Correlate flight information from the flight data list with data presented on the radar display.

_____

_____

d. When there is an indication that remarks are included in the flight data, use the flight plan readout on the R-CRD.

_____

_____

e. Entries on the flight data list may be sorted.

_____

_____

2. Evaluation Guidelines for Conflict Probe

a. Include the conflict probe list and full data block indicator in normal scanning.

b. When time permits, graphically display a conflict on the situation display.

c. When/if an airspace conflict is indicated on the conflict probe list or data block, check activation times for the restricted airspace.

d. When appropriate, take early action to resolve conflicts.

e. Remove entries from the conflict probe list only when they are no longer needed.

3. Evaluation Guidelines for Trial Planning

If time permits, construct Trial Plans in response to

a. Conflicts displayed on the Conflict Probe List

b. Pilot requests

c. Requests from other controller

d. Other appropriate situations (e.g., weather)

e. If appropriate, use Graphic Display of Conflicts to analyze Trial Plans

e. Do not implement Trial Plans with conflicts

4. Evaluation Guidelines for Automated Replan

a. When appropriate, use Automated Replan when a Trial Plan created in response to a predicted conflict cannot immediately be granted.

_____

_____

b. When appropriate, use Automated Replan when a Trial Plan created in response to a pilot request cannot immediately be granted.

_____

_____

c. Do not use Automated Replan for a Trial Plan created in response to a request from another controller.

_____

_____

d. Monitor the Trial Plan List and data block for indicators of automated replan status changes.

_____

_____

e. Especially for aircraft with conflict indicator in FDB

_____

_____

Appendix D

Operating Guidelines Quick Reference

This Appendix contains tables summarizing the operating guidelines proposed in Section 3 for the following R-side capabilities:

- Improved access to flight data
- Improved access to conflict probe
- Trial planning
- Automated replan
- Automated coordination

The format of each table is shown in Table D-1.

Table D-1. Key to Quick Reference Tables

Guideline	**R-side does not have capability**		**R-side has capability**	
	R & D	**R only**	**R & D**	**R only**
The R-side	[blank]			
shall/should/may (not)	[guideline]	[guideline]	[guideline]	[guideline]
shall/should/may (not) request the D-side to	[guideline]	N.A.	[guideline]	N.A.
[task description]	[blank]			

The first column in the table defines tasks performed by the R-side controller and by the D-side controller at the request of the R-side controller. There is a differentiation between when a controller is required to take a specific action, and when such action is simply recommended, in accordance with the following definitions:

- Controller shall ... the controller is obligated to do as instructed under all circumstances
- Controller should … the action is highly recommended, but the final decision on whether or not to take the action rests with the controller

- Controller may … the ATC system has the capacity to allow the action, but the unbiased choice to take, or not to take, the action remains with the controller

The next two columns contain guidelines for those situations when the R-side controller does not have access to the enhanced capability named in the column header. The last two columns contain guidelines for those situations when the R-side controller does have access to the enhanced capability.

The line beginning **shall/should/may (not)** contains guidelines for the R-side controller to follow when working independently (even when the D-side position is staffed). The line beginning **shall/should/may (not) request the D-side to** contains guidelines for requesting assistance from the D-side controller. Note that two cells are already filled in with "N.A." indicating that the R-side controller cannot request assistance from the D-side controller when the D-side position is not staffed. Each of the other six cells will contain at least one of the words listed in the first column.

Some cells will contain qualifiers in parentheses indicating the capabilities to be used by a position. If there is no qualifier in the cell, then the guideline refers to the capabilities directly available at that position. For example, if the R-side controller should use the Flight Data List available at the R-side position, then the cell will contain "should." If the R-side controller may use the Aircraft List available at the D-side position, then the cell will contain "may (Aircraft List)."

Table D-2. Flight Data Operating Guidelines

Guideline	R-side does not have FDL		R-side has FDL	
	R & D*	**R only***	**R & D**	**R only**
1. The R-side				
shall/should/may (not)	should (ACL)	should (ACL)	should	should (FDL); may (ACL)
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
scan the R-side Flight Data List (FDL) and/or D-side Aircraft List (ACL) to maintain awareness of aircraft flight data for aircraft currently in the sector as well as for those aircraft predicted to enter the sector.				
2. The R-side				
shall/should/may (not)	should (ACL)	should (ACL)	should	should (FDL); may (ACL)
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
monitor the R-side FDL and/or D-side ACL for changes in flight data.				
3. The R-side				
shall/should/may (not)	should (ACL)	should (ACL)	should	should (FDL); may (ACL)
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
monitor the R-side FDL and/or D-side ACL for new aircraft added to the list.				

Table D-2. Flight Data Operating Guidelines (continued)

Guideline	R-side does not have FDL		R-side has FDL	
	R & D*	R only*	R & D	R only
4. The R-side				
shall/should/may (not)	should (ACL)	should (ACL)	shall	shall (FDL); may (ACL)
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
correlate R-side FDL and/or D-side ACL with radar display.				
5. The R-side				
shall/should/may (not)	should	should	should	should
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
use the R-side R-CRD response area and/or D-side Response Display to view the fight plan readout, including flight plan remarks, when remarks are indicated by the FDL or ACL.				
6. The R-side				
shall/should/may (not)	should not** (ACL)	may (ACL)	may (FDL); should not (ACL)	may (FDL); may (ACL)
shall/should/may (not) request the D-side to	may (ACL)	N.A.	may (ACL)	N.A.
sort entries on the FDL and/or ACL in a way that is most appropriate for sector operations.				

Table D-2. Flight Data Operating Guidelines (concluded)

Guideline	R-side does not have FDL		R-side has FDL	
	R & D*	**R only***	**R & D**	**R only**
7. The R-side				
shall/should/may (not)	should not (ACL)***	may (ACL)	should not (ACL)***	may (ACL)
shall/should/may (not) request the D-side to	may	N.A.	may	N.A.
use the checkbox beside each aircraft entry in the ACL as a reminder of required action or as an indicator that problem information has been addressed.				
8. The R-side				
shall/should/may (not)	may (ACL)	should (ACL)	may (ACL)	should (ACL)
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
monitor the checkbox beside each aircraft entry in the ACL for reminders and indicators.				

* If the Aircraft List is not visible to the R-side, then the R-side **may not** scan, monitor, sort, or otherwise alter the Aircraft List.

** The R-side should not change the sort order of the Aircraft List without D-side concurrence.

*** The R-side should not make entries in the Aircraft List without D-side concurrence.

Table D-3. Analysis of Problem Information Operating Guidelines

Guideline	R-side does not have CPL and FDB Indicator		R-side has CPL and FDB Indicator	
	R & D*	**R only***	**R & D**	**R only**
1. The R-side				
shall/should/may (not)	may (ACL)	should (ACL)	should	should
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
scan the R-side Conflict Probe List (CPL) and Full Data Block (FDB) and/or D-side Aircraft List (ACL) and Graphic Plan Display (GPD) for notification of conflicts in flight plans.				
2. The R-side				
shall/should/may (not)	may (D-side capability)	may (D-side capability)	should	should
shall/should/may (not) request the D-side to	should	N.A.	may	N.A.
use the CPL and graphic display of conflicts and/or D-side Plans Display and GPD to analyze and understand conflict notifications.				
3. The R-side				
shall/should/may (not)	should	should	should	should
shall/should/may (not) request the D-side to	may	N.A.	may	N.A.
determine, for airspace alerts, whether the subject airspace will be active at the time when the aircraft is predicted to lose separation with the airspace.				

Table D-3. Analysis of Problem Information Operating Guidelines (concluded)

Guideline	R-side does not have CPL and FDB Indicator		R-side has CPL and FDB Indicator	
	R & D*	**R only***	**R & D**	**R only**
4. The R-side				
shall/should/may (not)	should	should	should	should
shall/should/may (not) request the D-side to	may	N.A.	may	N.A.
be proactive in taking action to resolve alerts.				

* If the Aircraft List and GPD are not visible to the R-side, then the R-side **may not** scan, monitor, sort, or otherwise alter them.

Table D-4. Trial Planning Operating Guidelines

Guideline	R-side does not have trial planning		R-side does have trial planning	
	R & D*	**R only***	**R & D**	**R only**
1. The R-side				
shall/should/may (not)	may (D-side capability)	may (D-side capability)	may	should
shall/should/may (not) request the D-side to	should	N.A.	may	N.A.
use trial planning to investigate the potential impact of flight plan changes in the following cases: • in response to a non-automation detected conflict as appropriate • in response to an automation-predicted conflict • in response to a pilot request • in response to a request from another sector team member • in response to a request from another operating position				
2. The R-side				
shall/should/may (not)	may (GPD)	may (GPD)	may	may
shall/should/may (not) request the D-side to	may	N.A.	may	N.A.
uses the R-side graphic display of conflicts and/or D-side GPD to analyze trial plan results.				

* If the Plans Display and GPD are not visible to the R-side, then the R-side **may not** scan, monitor, sort, or otherwise alter them.

Table D-5. Automated Replan Operating Guidelines

Guideline	R-side does not have automated replan and FDB Indicator		R-side does have automated replan and FDB Indicator	
	R & D*	**R only***	**R & D**	**R only**
1. The R-side				
shall/should/may (not)	should not (D-side capability)**	may (D-side capability)	should	should
shall/should/may (not) request the D-side to	should	N.A.	may	N.A.
use automated replan to continuously check and maintain trial plans that were created in response to a pilot request and that cannot be granted immediately.				
2. The R-side				
shall/should/may (not)	should not (D-side capability)**	should (D-side capability)	should	should
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
use automated replan to continuously check and maintain trial plans that were created in response to an automation-predicted conflict but that are not conflict-free.				

Table D-5. Automated Replan Operating Guidelines (continued)

Guideline	R-side does not have automated replan and FDB Indicator		R-side does have automated replan and FDB Indicator	
	R & D*	**R only***	**R & D**	**R only**
3. The R-side				
shall/should/may (not)	may (D-side capability)	may (D-side capability)	may	may
shall/should/may (not) request the D-side to	may	N.A.	may	N.A.
use automated replan to continuously check and maintain trial plans that were created in response to a request from another sector team member or another operating position but that cannot be granted immediately.				
4. The R-side				
shall/should/may (not)	may (D-side capability)	may (D-side capability)	may	may
shall/should/may (not) request the D-side to	may	N.A.	may	N.A.
use automated replan to continuously check and maintain trial plans that were created by the controller with the intent to issue a clearance, but the controller is currently unable to do so.				

Table D-5. Automated Replan Operating Guidelines (concluded)

Guideline	R-side does not have automated replan and FDB Indicator		R-side does have automated replan and FDB Indicator	
	R & D*	**R only***	**R & D**	**R only**
5. The R-side				
shall/should/may (not)	may (D-side capability)	should (D-side capability)	should	should
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
monitor the R-side Trial Plans List and FDB automated replan indicator and/or D-side Plans Display for change in status of automated replan trial plans.				
6. The R-side				
shall/should/may (not)	may (D-side capability)	should (D-side capability)	should	should
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
monitor the R-side Trial Plans List and/or D-side Plans Display for the receipt of automated replan trial plans at handoff.				

* If the Plans Display and GPD are not visible to the R-side, then the R-side **may not** scan, monitor, sort, or otherwise alter them.

** When the D-side is staffed and the R-side has no automated replan capabilities, then the R-side should rely on the D-side to use automated replan.

Table D-6. Automated Coordination Operating Guidelines

Guideline	R-side does not have automated coordination and FDB Indicator		R-side does have automated coordination and FDB Indicator	
	R & D*	**R only***	**R & D**	**R only**
1. The R-side				
shall/should/may (not)	may (D-side capability)	may (D-side capability)	should	should (R-side capability)
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
use automated coordination in preference to verbal coordination to communicate non-time-critical plan requests.				
2. The R-side				
shall/should/may (not)	may (D-side capability)	may (D-side capability)	should	should
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
use automated coordination to send requests for clearance delivery and clearance approval.				

Table D-6. Automated Coordination Operating Guidelines (continued)

Guideline	R-side does not have automated coordination and FDB Indicator		R-side does have automated coordination and FDB Indicator	
	R & D*	**R only***	**R & D**	**R only**
3. The R-side				
shall/should/may (not)	should (D-side capability)	should (D-side capability)	should	should
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
avoid coordinating trial plans with (unmuted) red color coded alerts unless there is an operational reason to do so.				
4. The R-side				
shall/should/may (not)	may (D-side capability)	should (D-side capability)	should	should
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
monitor the R-side Automated Coordination List (CL) and FDB automated coordination indicator and/or D-side Aircraft List (ACL) and Plans Display (PD) for disposition of requests sent.				

Table D-6. Automated Coordination Operating Guidelines (continued)

Guideline	R-side does not have automated coordination and FDB Indicator		R-side does have automated coordination and FDB Indicator	
	R & D*	**R only***	**R & D**	**R only**
5. The R-side				
shall/should/may (not)	may	should	should	should
shall/should/may (not) request the D-side to	should	N.A.	may	N.A.
call the sector to whom the request was sent when a "no response" response is received to follow up.				
6. The R-side				
shall/should/may (not)	may (D-side capability)	should (D-side capability)	should	should
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
monitor the R-side CL and FDB automated coordination indicator and/or the D-side ACL and PD for receipt of automated coordination requests.				
7. The R-side				
shall/should/may (not)	should	should	should	should
shall/should/may (not) request the D-side to	should	N.A.	should	N.A.
give requests for clearance delivery priority similar to that for notification of alerts.				

Table D-6. Automated Coordination Operating Guidelines (continued)

Guideline	R-side does not have automated coordination and FDB Indicator		R-side does have automated coordination and FDB Indicator	
	R & D*	**R only***	**R & D**	**R only**
8. The R-side				
shall/should/may (not)	may (D-side capability)	may (D-side capability)	may	may
shall/should/may (not) request the D-side to	may	N.A.	may	N.A.
use the R-side CL and graphic display of conflicts and/or the D-side GPD and PD to investigate coordination requests.				
9. The R-side				
shall/should/may (not)	should (approve and issue clearance)	should	should (approve and issue clearance)	should
shall/should/may (not) request the D-side to	should (approve)	N.A.	should (approve)	N.A.
approve or issue clearance for conflict-free request unless there is an operational reason not to do so.**				

Table D-6. Automated Coordination Operating Guidelines (concluded)

Guideline	R-side does not have automated coordination and FDB Indicator		R-side does have automated coordination and FDB Indicator	
	R & D*	**R only***	**R & D**	**R only**
10. The R-side				
shall/should/may (not)	may	should	should	should
shall/should/may (not) request the D-side to	should	N.A.	may	N.A.
call the sending sector when responding with a "deny" or "unable" response.				

* If the Aircraft List and Plans Display are not visible to the R-side, then the R-side **may not** scan, monitor, sort, or otherwise alter them.

**** It is assumed that only the R-side controller can issue a clearance.**

Appendix E

R-Side Functional Specifications

This Appendix provides a definition of requirements for proposed new R-side capabilities. Unless otherwise noted, only those capabilities that were included in the limited evaluation in 1999 are included here. Table E-1 summarizes modifications to Host logic.

Table E-1. Summary of Modifications

Display	Modification
Full Data Block (FDB)	Add a special aircraft indicator to line 1
	Add planning indicators to line 1
	Add destination to line 3[16]
R Keyboard	Add a planning category key
R-CRD	Add planning category and functions to Category Selection Area
	Accommodate the planning category and functions in the Message Composition Area (Preview and Feedback Areas)
Lists	Add a Flight Data List
	Add an FSP List[17]
	Add a Conflict Probe Alert List
	Add a Plans List
Data Fields	Add new values for the Action Indicator (Field Reference # 36) for the Flight Data, FSP, Conflict Probe Alert, and Plans Lists
	Add a new general field: Trial Plan Identification Suffix (Field Reference # 203)
Plan View Display (PVD)	Add graphic display of conflicts in flight plans
	Add graphic display of conflicts in trial plans

16 Destination in the full data block can be provided by a patch from the national local patch library.

17 The FSP List was not evaluated in July-August 1999.

E.1 Message Entry and Checking

E.1.1 General Fields

New general fields described in Table E-2 are required.

Table E-2. General Field Descriptions

Field Reference Number		Content	Meaning
36	Action Indicator		
	g. Flight Data List Action	(LL)(L)(L)	ON = Display of Flight Data List OFF = Hide Flight Data List SUB = Toggle Flight Data List by sublist SORT = Toggle Flight Data List sequence
36	Action Indicator		
	a. FSP List Action	LL(L) or d(d)	ON = Display of FSP List OFF = Hide FSP List d(d) = Maximum number of entries posted to the list
36	Action Indicator		
	a. Conflict Probe Alert List Action	LL(L) or d(d)	ON = Display Conflict Probe Alert List OFF = Hide Conflict Probe Alert List d(d) = Maximum notification time (in minutes) for any conflict displayed
203	TRIAL PLAN IDENTIFICA-TION SUFFIX		
	a. Trial Plan Identification Suffix	L(L)(d)(d)	1. Used to indicate which trial plan for an aircraft is to be made current by the PM action. 2. Used to indicate which trial plan for an aircraft is to be deleted by the PX action.

Current values for General Field 61 (List Display Identifiers) include the following:

H Hold List

I Inbound List

D Departure List

C Conflict Alert List

G Group Suppression List

V VFR Inhibit List

M Metering List

The General Field 61 (List Display Identifiers) must be modified to recognize the Flight Data List, the FSP List, the Conflict Probe List, and the Plans Lists, as follows:

F Flight Data List

N FSP List

B Conflict Probe List

P Plans List

The Reposition List action must be modified to recognize the new lists, i.e., to accept F, N, B, and P for field 61.

E.1.2 Acceptance, Error, Rejection and Confirmation Messages

Each input message is subjected to various program checks that ensure individual message completeness and coherency. Each unacceptable message is diagnosed and an indication of the problem area is output to assist personnel in correcting an area. Some D and A Controller messages allow a message input-error response-message correction cycle which provides an effective two-way communication medium between operating personnel and the HCS during input of longer or more complex messages. Error messages (E) are generated to respond to errors in such messages. However, Radar Controller input messages are discarded if they are unacceptable, to allow the data source (i.e., the R-Controller Data Entry Controls (DEC)) to be unlocked (i.e., freed for entry of another message) rapidly.

E.1.2.1 Acceptance Message

The Acceptance Message (A) designates that an input message is entered correctly. The Acceptance Message appears as a response in the Computer Originated Area of the CRD. The Acceptance Message has the format given in Table E-3. Examples are given in Table E-4.

Table E-3. Acceptance Message Format

Field	Number of Characters
a. ACCEPT - the acceptance indicator	6
b. Message Type Descriptor	up to 16
c. AID/CID	up to 11

Table E-4. Acceptance Message Examples

Input Message	Acceptance Message
PM T1 TW14	ACCEPT FLIGHT PLAN AMDT TW14

An Accept Response will be displayed on the R-CRD associated with the entering DEC any time any action listed below does not result in the updating of the Track Data Block, List Display, or R-CRD display (e.g., Rejection Response) at the entering sector.

a. flight plan amendment resulting from the Make Current (PM) message

E.1.2.2 Rejection and Error Messages

A message will be acceptance checked in its entirety. If one or more errors are detected, the Error Indicator for the first action (function) in error will be displayed and all auxiliary data in error will be output in a Rejection Message. In the case of multiple action entry, only those actions in error will be rejected. Table B-5 contains the format for Rejection Messages.

Table E-5. Rejection Message Format

Line	CRD Output Field	No. of Character Positions
1	1. Error Indicator	Up to 25
2	2. Message Type Descriptor	Up to 16
2	3. Space	2
2	4. AID	Up to 7
3,4	5. Auxiliary Data	Up to 48* or 49
	6. EOM (Δ or ∇Δ)	1 or 2
	Maximum Number of Character Positions	100

* Note: If TB is used as EOM, EOM will consist of two characters and auxiliary data can consist of no more than 48 characters.

If a Category or Quick Action Key which is not assigned in adaptation is entered, the error indicator will be "INVALID MESSAGE TYPE" and the Message Type Descriptor will be "UNKN ACTION/FUNC."

The computer program will use the Message Type Descriptor for each action (function). The Message Type Descriptor assigned to each action (function) is shown in Table E-6. The Message Type Descriptor for an unidentified function may be used in a rejection response if the computer program determines an error against the aircraft defined in Field 02.

The auxiliary data will contain the alphabetic, numeric, and special symbols as contained in the message. The special symbols may require a code translation. Trackball entries will be represented by the "Δ" symbol.

The information specified in the rejection message must be re-entered correctly before it will be accepted.

Table E-6. Type Descriptors for Response Message to Planning Actions and Lists

Quick Action Key or Category Key	Action or Function	Message Type Designator	Message Type Descriptor
Category Key "PLAN"	Continuous Conflict Probe	PB	CONF PROBE
	Trial Plan	PT	TRIAL PLAN
	Automated Replan	PA	AUTO REPLAN
	Make Current	PM	MAKE CURRENT
	Cancel Trial Plan	PX	CANCEL TRIAL PLN
	Automated Coordination	PD	AUTO COORD
Quick Action Key "PVD"	Reposition List	QP	REPOSITION LIST

When the Flight Identification (FLID) is present in the input message, the FLID will be contained in the error message as part of the auxiliary data when it pertains to the error message being generated. It will be the FLID that has resulted from:

a) The entry of the Aircraft Identification.

b) The entry of a discrete beacon code to identify the aircraft.

c) The entry of the Computer Identification Number.

d) The entry of a trackball.

If the auxiliary data exceeds 25 characters, the data will be broken between the 25th and 26th character. No spaces will be inserted to assist readability.

E.1.2.3 Confirmation Message

When an input message is entered and the computer program determines that it is a valid message and it requires a confirmation, a Confirmation Message will be routed to the Computer Originated Area of the CRD associated with the DEC that entered the input message. The message indicates the flight in the input message. The Confirmation Message has the format shown in Table E-7.

Table E-7. Confirmation Message Format

Line	Field	Number of Characters
1	a. Confirmation Message	21
2	b. Message Type Descriptor	Up to 12
3	c. Aircraft Identification	Up to 7
3	d. Slash Character (/)	1
3	e. Computer Identification	3

Example: For a Remove Strip of a flight plan, the entered message is:

QX FPAA128

The confirmation message is:

CONFIRM BY ENTERING Y
REMOVE STRIP
AA128/300

If the single character "Y" is entered, the message requiring confirmation is accepted. If any input is entered other than the single character "Y", then the message requiring confirmation is cancelled and the following rejection message is output:

REJECT - NOT CONFIRMED

E.1.2.4 Error, Rejection and Confirmation Messages for Planning Functions and Lists

Table B-8 lists the error, rejection, and confirmation messages used for DEC Planning messages. Following each is an indication of its major use: (E) for an error message, (R) for a rejection DEC message, and (C) for a confirmation message. As indicated above, when used in response to errors, both (E) and (R) messages signify rejection of the input message from the Radar Controller. With each message is a brief description of its cause.

Table E-9 associates each error, rejection, and confirmation message with a planning function or list. The acronym "cofie" means "contents of field in error."

E.2 Flight Data Messages

The Host logic shall be modified to add the flight data messages summarized in Table E-10.

Table E-8. Error, Rejection, and Confirmation Messages

Message	Type	Description
MESSAGE TOO SHORT	(R)	A message was entered that does not contain sufficient fields to provide the required data - one or more data fields having been omitted. The action indicator is the only field.
MESSAGE TOO LONG	(R)	A message was entered that contains too many fields - one or more auxiliary data or other fields having been added. There were more than __ fields in a __ message.
cofie ILLEGAL ACTION INDICATOR	(R)	The contents of the Action Indicator Field (36) were other than ___ or ___.
05 SPD cofie FORMAT	(E)	The entered speed does not comply with the format requirements for Field 05.
05 SPD cofie ILLEGAL	(E)	For example, the entered speed of zero is not allowed.
08 ALT cofie FORMAT	(E)	The entered assigned altitude does not comply with the format requirements for Field 08.
NO AMENDMENT DATA ENTERED	(R)	The amendment data field (17) was incorrectly omitted in the entered message.
02 AID cofie VERIFY ELIGIBILITY	(E)	The sector does not have track control and /OK is not input with the message.
02 AID cofie FLID NOT STORED	(E)	The entered flight identification does not match the flight identification of any of the flight plans stored, e.g., associated with a trial plan.
NO TB FLIGHT ID CAPTURE	(R)	The trackball was entered to identify an aircraft by indicating the position of the Position Symbol of the data block of the aircraft or by indicating an aircraft entry in a sublist. However, there is no data block nor sublist aircraft entry in the system with which the trackball entry can be paired.
02 AID cofie FLID FORMAT	(E)	The entered flight identification does not comply with the format requirements for Field 02.
cofie FLID DUPLICATION	(E)	The entered flight identification (e.g., discrete beacon code) matches more than one flight plan.
cofie FLIGHT NOT ACTIVE	(R)	The referent flight plan is not active.
cofie TRIAL PLAN ID NOT STORED	(E)	The entered trial plan suffix does not match any trial plan suffix for the entered flight identification.

Table E-8. Error, Rejection, and Confirmation Messages (concluded)

Message	Type	Description
AUTO REPLAN NOT ACTIVE FOR THIS FLIGHT	(R)	There is no Automated Replan Trial Plan for the identified flight.
AUTO REPLAN ALREADY ACTIVE FOR THIS FLIGHT	(R)	There is already an Automated Replan Trial Plan for the identified flight.
AUTO COORD NOT ACTIVE FOR THIS FLIGHT	(R)	There is no Automated Coordination Plan for the identified flight.
NO LIST ENTRY CAPTURE	(R)	The trackball was entered to identify an entry in a list, but there is no entry in the system with which the trackball entry can be paired.
CONFIRM BY ENTERING Y	(C)	The entered message requires confirmation by the controller.
REJECT - NOT CONFIRMED	(R)	A previously-entered message required confirmation but received an input other than the single character “Y”.
ON ALREADY IN EFFECT	(E)	The entered value(s) for the message have the same effect as the existing condition.
OFF ALREADY IN EFFECT	(E)	The entered value(s) for the message is to suppress a condition that is not in effect or pending.

Table E-9. Error, Rejection, and Confirmation Messages by Message Type for Planning Functions and Lists

		Planning Functions						QP (Lists)				
Message	**Type**	**PB**	**PT**	**PA**	**PM**	**PX**	**PD**	**F**	**N**	**B**	**P**	**D**
MESSAGE TOO SHORT	(R)		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
MESSAGE TOO LONG	(R)	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
cofie ILLEGAL ACTION INDICATOR	(R)						✔	✔	✔	✔		✔
05 SPD cofie FORMAT	(E)		✔									
05 SPD cofie ILLEGAL	(E)		✔									
08 ALT cofie FORMAT	(E)		✔									
NO AMENDMENT DATA ENTERED	(E)		✔									
02 AID cofie VERIFY ELIGIBILITY	(R)				✔							
02 AID cofie FLID NOT STORED	(E)		✔	✔	✔	✔	✔	✔		✔	✔	✔
NO TB FLIGHT ID CAPTURE	(R)		✔	✔	✔	✔	✔	✔		✔	✔	✔
02 AID cofie FLID FORMAT	(E)		✔	✔	✔	✔	✔	✔		✔	✔	✔
cofie FLID DUPLICATION	(E)		✔	✔	✔	✔	✔	✔		✔	✔	✔
cofie FLIGHT NOT ACTIVE	(R)		✔							✔		
cofie TRIAL PLAN ID NOT STORED	(E)			✔	✔	✔	✔				✔	
AUTO REPLAN NOT ACTIVE FOR THIS FLIGHT	(R)				✔							
AUTO REPLAN ALREADY ACTIVE FOR THIS FLIGHT	(R)			✔								

Table E-9. Error, Rejection, and Confirmation Messages by Message Type for Planning Functions and Lists (concluded)

		Planning Functions						QP (Lists)				
Message	**Type**	**PB**	**PT**	**PA**	**PM**	**PX**	**PD**	**F**	**N**	**B**	**P**	**D**
AUTO COORD NOT ACTIVE FOR THIS FLIGHT	(R)				✔							
NO LIST ENTRY CAPTURE*	(R)							✔	✔	✔	✔	✔
CONFIRM BY ENTERING Y	(C)				✔							
REJECT - NOT CONFIRMED	(R)				✔							
ON ALREADY IN EFFECT	(E)							✔	✔	✔		
OFF ALREADY IN EFFECT	(E)							✔	✔	✔		

Table E-10. Planning Category: Functions and Message Types

Function	Message Type	Message Type Patterned After[18]		Response
		R-Position	D-Position	
PB[19]	Continuous Conflict Probe	(new)	(new)	Continuous conflict probe ON/OFF
PT	Trial Plan	Assigned Altitude (QZ) Track Reroute (QU)	Amendment (AM)	TPID, TP clearance & probe results (Plans List)
PA	Automated Replan	(new)	(new)	1. When TP "clean" a. TPID, TP clearance & probe results (Plans List) b. AR indicator (FDB) 2. AR status (TPID, TP clearance & probe results) (Plans List)
PM	Make Current	QZ, QU	AM	Flight plan amended
PD[20]	Automated Coordination	(new)	(new)	TBD
PX	Cancel Trial Plan	Cancel (QX)	Remove Strip (RS)	Trial plan deleted & removed from Plans List

18 Note that the current logic of the Host does not allow the R-side position to amend the speed field of the flight plan or to use the amendment (AM) message.

19 The PB function was not evaluated in 1999.

20 The PD function was not evaluated in 1999.

E.2.1 Continuous Conflict Probe (PB)

Purpose: This action is used to toggle continuous conflict probe notifications ON and OFF for the requesting position. The continuous conflict probe toggle action applies only to the requesting R-position's displays (e.g., some sectors might have continuous conflict probe toggled ON while other sectors have continuous conflict probe toggled OFF). For this implementation, the following is displayed:

- Only red alerts for aircraft conflicts. A red alert for an aircraft conflict is declared when the trajectories of two aircraft come within the separation standard within the lookahead time parameter.
- All airspace conflicts

Format Requirements

01

message type

where field 01 is PB.

Formatted messages are routed to the Preview Area of the CRD of the requesting position.

Example:

PB

Logic Requirements

Detailed Logic Requirements to support this function will be developed in the future.

General Logic Checks

Detailed General Logic Checks to support this function will be developed in the future.

Additional Logic Checks

Detailed Additional Logic Checks to support this function will be developed in the future.

Error Indicators: Error messages are routed to the Feedback Area of the CRD of the requesting position.

Processing After Acceptance: PB messages are routed to the outboard planning processor, which begins to send (or ceases to send) conflict data to the requesting sector. The planning processor automatically detects aircraft conflicts and airspace conflicts in flight plans. When continuous conflict probe is ON, the planning processor automatically returns all currently-detected conflicts that would normally be displayed to that sector. Thereafter, the planning processor continues to send data about newly-detected conflicts. When continuous conflict probe is OFF, the R-controller is not automatically notified of conflicts.

Resultant Outputs: Outputs are routed to the planning indicator of the FDB and to the Conflict Probe Alert List. When continuous conflict probe is OFF, there is no conflict data eligible for display in the planning indicator of the FDB or in the Conflict Probe Alert List.

E.2.2 Trial Plan (PT)

Purpose: This action is used to create and probe a trial plan representing a proposed amendment for the specified flight. A trial plan resulting from this action is identified as being owned by the creating R-position. (A trial plan created by the D-position, using D-side planning tools, is identified as being owned by the D-position.)

Format Requirements

01	(12	17)	02
message type	field reference or abbreviation	amendment	flight identification

where field 12 can represent 05 (SPD), 08 (ALT), or 10 (RTE). The R-position can represent fields 10 and 02 by use trackball entry (i.e., fields 65 - trackball coordinates - and 68 - fix - repeating). [Note that the current logic of the Host does not allow the R-position to amend the speed field of the flight plan or to use the amendment message (AM).]

Formatted messages are routed to the Preview Area of the CRD of the requesting position.

Example:

PT	05	310	08	190	LY20
PT	10	ABC	DEF	GHI	2473

Logic Requirements

Detailed Logic Requirements to support this function will be developed in the future.

General Logic Checks

Detailed General Logic Checks to support this function will be developed in the future.

Additional Logic Checks

Detailed Additional Logic Checks to support this function will be developed in the future.

Error Indicators: Error messages are routed to the Feedback Area of the CRD of the requesting position. See Table E-11 for example messages. (These are the same messages returned by the URET trial planning function.)

Processing After Acceptance: PT messages are routed to the outboard planning processor, which creates a trial plan based on the message contents, probes the trial plan for conflicts, and returns the results. When field 10 is provided via trackball entry of coordinates, the coordinates are translated into latitude/longitude format before transmission to the planning processor.

Resultant Outputs: Outputs are routed to the Plans List (rather than the Response Area of the CRD) of the requesting position.

Table E-11. Sample Error Messages for the Trial Plan Action

Trial Plan Result Error Messages

1. [AID]: Could not create Trial Plan; [FIX NAME] not on route.
2. [AID]: Could not create Trial Plan; Aircraft not found in database.
3. [AID]: Could not create Trial Plan; Trajectory not available.
4. [AID]: Could not create Trial Plan; System error occurred.

Trial Plan Result Warning Messages

1. [AID]: Trial Plan Warning: Target altitude < current altitude.
2. [AID]: Trial Plan Warning: Already at target altitude.
3. [AID]: Trial Plan Warning: Target altitude > current altitude.
4. [AID]: Trial Plan Warning: Target altitude > maximum altitude.
5. [AID]: Trial Plan Warning: Maximum climb gradient used.
6. [AID]: Trial Plan Warning: Maximum descent gradient used.
7. [AID]: Trial Plan Warning: Already at target speed.
8. [AID]: Trial Plan Warning: Target speed outside allowable range.
9. [AID]: Trial Plan Warning: Filed speed > maximum speed.
10. [AID]: Trial Plan Warning: Route item not found in database. Ignored: J146.

E.2.3 Automated Replan (PA)

Purpose: This action is used to submit an existing trial plan, representing a proposed amendment for the specified flight, for periodical reevaluation.

Format Requirements

01	(203)	(02)
message type	trial plan identification suffix	flight identification

where field 01 is PA and field 203 specifies the trial plan identification suffix for the aircraft identified in field 02. Possible values for the trial plan identification suffix are in the form Td(d). When there is only one trial plan displayed in the Plans List, fields 203 and 02 are not required.

Formatted messages are routed to the Preview Area of the CRD of the requesting position.

Example:

PA T72 AAL123

PA TR USA456

Logic Requirements

Detailed Logic Requirements to support this function will be developed in the future.

General Logic Checks

Detailed General Logic Checks to support this function will be developed in the future.

Additional Logic Checks

Detailed Additional Logic Checks to support this function will be developed in the future.

Error Indicators: Error messages are routed to the Feedback Area of the CRD of the requesting position.

Processing After Acceptance: PA messages are routed to the outboard planning processor. When the form of the suffix is Td(d), the planning processor creates an automated replan trial plan, periodically rebuilds and checks it for conflicts, and returns the results to the Plans List with suffix TR.

Resultant Outputs: Outputs are routed to the Plans List (rather than the Response Area of the CRD) of the requesting position.

E.2.4 Make Current (PM)

Purpose: This action is used to amend a flight plan by replacing field values to match the values in an existing trial plan.

Format Requirements

01	(60)	(203)	(02)
message type	logic check override	trial plan identification suffix	flight identification

where field 01 is PM and field 203 specifies the trial plan identification suffix for the aircraft identified in field 02. Possible values for the trial plan identification suffix are in either the form Td(d) or TR. Field 60 is used when the trial plan being made current is not an automated replan trial plan and was not created by the controller entering this message. When an R-controller selects a trial plan for "make current"by centering the trackball on its list entry, the trial plan identification suffix and flight identification are both automatically selected as values for the Make Current action. When the flight identification field is filled through data block selection or keyboard entry, the trial plan identification suffix must be entered via the keyboard. When there is only one trial plan displayed in the Plans List, fields 203 and 02 are not required.

Formatted messages are routed to the Preview Area of the CRD of the requesting position.

Example:

```
PM    T3     AAL123
PM    /ok    T78    USA456
PM    TR     TWA789
```

Logic Requirements

Detailed Logic Requirements to support this function will be developed in the future.

General Logic Checks

Detailed General Logic Checks to support this function will be developed in the future.

Additional Logic Checks: A trial plan that has expired cannot be made current. In this case, an error message is returned:

[AID] [Trial Plan suffix]: Could not make Trial Plan current; Trial Plan has expired.

Only a controller for the sector currently controlling an aircraft can amend the flight plan for that aircraft via the PM action. The controller can use the PM action only for trial plans created at that position, with the exception that only the current controller of an aircraft can "make current" an automated replan trial plan for that aircraft.

Error Indicators: Error messages are routed to the Feedback Area of the CRD of the requesting position.

Processing After Acceptance: PM messages are routed to the outboard planning processor, which returns the flight plan data in the form of a Host amendment message. The amendment is submitted for Host amendment processing. [Note that the current logic of the Host does not allow the R-position to amend the speed field of the flight plan or to use the amendment message (AM).]

Resultant Outputs: Once the amendment is accepted syntactically, the trial plan is removed from the Plans List where it was displayed.

E.2.5 Cancel Trial Plan (PX)

Purpose: This action is used to delete a trial plan and remove it from the Plans List.

Format Requirements

01	(203)	(02)
message type	trial plan identification suffix	flight identification

where field 01 is PX and field 203 specifies the trial plan identification suffix for the aircraft identified in field 02. Possible values for the trial plan identification suffix are in either the form T(d)(d) or TR. When there is only one trial plan in the Plans List, fields 203 and 02 are not required.

Formatted messages are routed to the Preview Area of the CRD of the requesting position.

Example:

PX T20 AAL234
PX TR SWA567

Logic Requirements

Detailed Logic Requirements to support this function will be developed in the future.

General Logic Checks

Detailed General Logic Checks to support this function will be developed in the future.

Additional Logic Checks: A Trial Plan that has expired cannot be deleted. In this case, an error message is returned:

[AID] [Trial Plan suffix]: Could not delete Trial Plan; Trial Plan has expired.

Only the controller (position) that created a trial plan can delete that trial plan via the PX action, with one exception: only a controller for the sector currently controlling an aircraft can delete the automated replan trial plan for that aircraft via the PX action.

Error Indicators: Error messages are routed to the Feedback Area of the CRD of the requesting position.

Processing After Acceptance: PX messages are routed to the outboard planning processor, which deletes the trial plan from its database and returns an acknowledgement message to the Host.

Resultant Outputs: Once the acknowledgement is received, the trial plan is removed from the Plans List where it was displayed.

E.3 Display Control Actions

The Host logic shall be modified to add the display control actions summarized in Table E-12.

Table E-12. Display Control Actions

Action	Quick Action Key (QAK)	Message Type Designator	Message Type Descriptor	Response
Request/Suppress Flight Data List	**PVD**	**QP**	**FLIGHT DATA LIST**	**1. Flight Data List ON/OFF** **2. Sublists ON/OFF** **3. Display sequence** **a. AID** **b. Time over previous posted fix** **4. Add/remove aircraft to/from display**
Request/Suppress FSP List	**PVD**	**QP**	**FSP LIST**	**1. FSP List ON/OFF** **2. Set maximum number of entries**
Request/Suppress Conflict Probe Alert List	**PVD**	**QP**	**CONFLICT PROBE ALERT LIST**	**1. Conflict Probe Alert List ON/OFF** **2. Set maximum alert notification time**
Request/Suppress Plans List	**PVD**	**QP**	**PLANS LIST**	**Plans List ON/OFF**
Request Conflict Probe Display	**PVD**	**QP**	**CONFLICT PROBE GRAPHIC DISPLAY**	**Graphic display of conflicts in flight plan route, with violation areas highlighted**
Request Trial Plan Display	**PVD**	**QP**	**TRIAL PLAN GRAPHIC DISPLAY**	**Graphic display of conflicts in trial plan route, with violation areas highlighted**

E.3.1 Request/Suppress Flight Data List

Purpose: This action is used to control the behavior of the Flight Data List. The Flight Data List can be turned ON or OFF, and its entries can be grouped by sublists (i.e., posted fix). Entries can be displayed sorted by either AID or time over previous posted fix; the sort criteria applies within each sublist. The sort order is ascending alphanumeric for the AID sort and ascending for the time sort (i.e., earliest time at the top of the list or sublist). The default setting is OFF. When the Flight Data List is ON, the default settings are sublists and time-sorted. The controller can add an aircraft to or remove it from the list, regardless of whether it meets the default posting criteria (see description of Flight Data List).

Format Requirements

01	61	(36)	(02)
message type	list display identifier	Action Indicator	flight identification

where message type is QP, list display identifier is F, and field 36 specifies the format of the Flight Data List. Possible values for Flight Data List Indicator are ON, OFF, SUB, and SORT. Their application is summarized in Table E-13.

When field 02 is provided, the identified aircraft is added to the list if it is not already posted, and removed from the list if it is posted. [Note that when the value of field 02 is entered by positioning the trackball on the Flight Data List entry for the aircraft, the result is the removal of the aircraft from the list.]

Formatted messages are routed to the Preview Area of the CRD of the requesting position.

Examples:

QP F

QP F OFF

QP F AAL123

Table E-13. Flight Data List Indicators

Current State	Flight Data List Indicator Value	Resulting State
OFF	none or ON	ON, previous setting (initially, default = sublists, time-sorted OR experiment setup values)
OFF	OFF	OFF
OFF	SUB	ON, one list, time-sorted
OFF	SORT	ON, sublists, AID-sorted
ON	none or ON	ON, return to default grouping and sorting
ON	OFF	OFF
ON	SUB	ON, SORT setting is unchanged, toggle SUB setting: 1 list, if current = sublists sublists, if current = 1 list
ON	SORT	ON, SUB setting is unchanged, toggle SORT setting: time, if current = AID AID, if current = time

Logic Requirements

Detailed Logic Requirements to support this function will be developed in the future.

General Logic Checks

Detailed General Logic Checks to support this function will be developed in the future.

Additional Logic Checks

Detailed Additional Logic Checks to support this function will be developed in the future.

Error Indicators: Error messages are routed to the Feedback Area of the CRD of the requesting position.

Processing After Acceptance: When the status of the Flight Data List is changed to ON, the Flight Data List entries are built from information that would have been printed on paper flight progress strips, i.e., the entries that would still be present had the Flight Data List never been OFF. When the status of the Flight Data List is changed to OFF, all entries are removed from the list and no future entries are displayed.

Resultant Outputs: Outputs are routed to the Flight Data List, organized as determined by the Flight Data List Indicator Value.

E.3.2 Request/Suppress FSP List[21]

Purpose: This action is used to control the behavior of the FSP List. The FSP List can be turned ON or OFF, and the maximum number of entries can be specified. Entries are ordered by time of posting, with the earliest entry listed first. If the posting of a new entry causes the maximum number of entries to exceed the maximum number specified, the oldest entry is removed from the list. The default setting is ON with a maximum of three entries.[22]

Format Requirements

01	61	(36)
message type	list display identifier	Action Indicator

where message type is QP, list display identifier is N, and field 36 specifies the format of the FSP List. Possible values for FSP List Indicator are ON, OFF, and a digit n. Their application is summarized in Table E-14.

Formatted messages are routed to the Preview Area of the CRD of the requesting position.

Examples:

QP N

QP N ON

QP N 5

QP N OFF

---

21 The FSP List was not evaluated in 1999.

22 It might be necessary to limit the number of lines available to the FSP List, independent of the number of entries.

Table E-14. FSP List Indicators

Current State	FSP List Indicator Value	Resulting State
OFF	none or ON	ON, previous settings (initial default = maximum 3 entries)
OFF	OFF	OFF
OFF	digit n	ON, maximum n entries
ON	none or ON	ON, previous settings (initial default = maximum 3 entries)
ON	OFF	OFF
ON	digit n	ON, maximum n entries

Logic Requirements

Detailed Logic Requirements to support this function will be developed in the future.

General Logic Checks

Detailed General Logic Checks to support this function will be developed in the future.

Additional Logic Checks

Detailed Additional Logic Checks to support this function will be developed in the future.

Error Indicators: Error messages are routed to the Feedback Area of the CRD of the requesting position.

Processing After Acceptance: When the status of the FSP List is ON, the FSP List entries are built from information that would have been printed by the flight strip printer. (These entries have been rerouted according to message type.)

Resultant Outputs: Outputs are routed to the FSP List.

E.3.3 Request/Suppress Conflict Probe Alert List

Purpose: This action is used to control the behavior of the Conflict Probe Alert List. The Conflict Probe Alert List can be toggled ON or OFF, and the maximum alert time specified for all entries. The default settings are ON and 6 minutes, respectively. Entries are displayed sorted by the AID of the subject aircraft. The controller can remove any entry from the list.

Format Requirements

01	61	(36)	(02)
message type	list display identifier	Action Indicator	flight identification

where message type is QP, field 61 is B, and field 36 specifies the format of the Conflict Probe Alert List. Possible values for Conflict Probe Alert Indicator are ON, OFF, and a digit n representing the maximum alert notification time in minutes. When n is specified, alerts greater than n minutes away (i.e., the predicted initial time of separation violation is greater than n minutes in the future) will not be displayed. Field 02 identifies an entry to be removed from the list. Table E-15 summarizes the results of different message entries.

Formatted messages are routed to the Preview Area of the CRD of the requesting position.

Example:

```
QP    B
QP    B     OFF
QP    B     4
QP    B     AAL123
QP    B     10    AAL123
```

Table E-15. Conflict Probe Alert List Actions

Field Entry				Current State	Resulting State
01	**61**	**02**	**202**		
QP	B		none or ON	OFF	ON, previous setting (initial default = 6 minutes)
QP	B	✔	none or ON	OFF	ON, previous setting (initial default = 6 minutes), do not show any existing eligible entry for the identified flight in the Conflict Probe Alert List
QP	B		OFF	OFF	OFF
QP	B	✔	OFF	OFF	OFF
QP	B		digit n	OFF	ON, maximum alert time of n minutes
QP	B	✔	digit n	OFF	ON, maximum alert time of n minutes, do not show any existing eligible entry for the identified flight in the Conflict Probe Alert List
QP	B		none or ON	ON	ON, previous setting (initial default = 6 minutes)
QP	B	✔	none or ON	ON	ON, previous setting (initial default = 6 minutes), do not show any existing eligible entry for the identified flight in the Conflict Probe Alert List
QP	B		OFF	ON	OFF
QP	B	✔	OFF	ON	OFF
QP	B		digit n	ON	ON, maximum alert time of n minutes
QP	B	✔	digit n	ON	ON, maximum alert time of n minutes, do not show any existing eligible entry for the identified flight in the Conflict Probe Alert List

Logic Requirements

Detailed Logic Requirements to support this function will be developed in the future.

General Logic Checks

Detailed General Logic Checks to support this function will be developed in the future.

Additional Logic Checks

Detailed Additional Logic Checks to support this function will be developed in the future.

Error Indicators: Error messages are routed to the Feedback Area of the CRD of the requesting position. Error messages include syntax errors and misidentification of aircraft ID for entry removal.

Processing After Acceptance: QP messages with field 61 = B are routed to the outboard planning processor, which begins to send (or ceases to send) conflict data to the requesting sector.[23]

Resultant Outputs: Outputs are routed to the Conflict Probe Alerts List (rather than the Response Area of the CRD) of the requesting position.

---

[23] When the Conflict Probe Alert List is not displayed but continuous conflict probe is ON, conflicts are (still) shown via a Planning Indicator in the full data block (FDB).

E.3.4 Request/Suppress Plans List

Purpose: This action is used to control the behavior of the Plans List. The Plans List can be toggled ON or OFF. The default setting is ON. Entries are displayed sorted by the AID of the subject aircraft in ascending alphanumeric order. The controller can remove any entry from the list.

Format Requirements

01	61	((203)	02)
message type	list display identifier	trial plan identification suffix	flight identification

where field 01 is QP and field 61 is P. Fields 02 and 203 can be used to remove entries from the list. Table E-16 summarizes the results of different message entries.

Example:

QP P

QP P UAL456

QP P T7 AAL890

Formatted messages are routed to the Preview Area of the CRD of the requesting position.

Table E-16. Plans List Actions

Field Entry				Results
01	**61**	**02**	**203**	
QP	P			Reverse the state of the Plans List from displayed to suppressed, or from suppressed to displayed.
QP	P	✔		Remove all entries for the identified flight from the Plans List.* ERROR if there is no entry for the flight in the Plans List.
QP	P	✔	✔	Remove the entry for the identified trial plan from the Plans List.* ERROR if there is no such entry for the flight in the Plans List.
QP	P		✔	ERROR

* Note that entries in the Plans List are automatically removed when they expire.

Logic Requirements

Detailed Logic Requirements to support this function will be developed in the future.

General Logic Checks

Detailed General Logic Checks to support this function will be developed in the future.

Additional Logic Checks

Detailed Additional Logic Checks to support this function will be developed in the future.

Error Indicators: Error messages are routed to the Feedback Area of the CRD of the requesting position.

Processing After Acceptance: QP messages with field 61 = P are routed to the outboard planning processor, which sends trial planning data to the requesting sector. When the Plans List is displayed, the outboard planning processor automatically returns trial plans and the results of trial plan checking for trial plans created by the R-position and all results of status checks for automated replan trial plans,[24] for display in the Plans List.

Resultant Outputs: Error messages are routed to the Response Area of the CRD. All other outputs are routed to the Plans List.

[24] When the Plans List is not displayed, the availability of an automated replan trial plan is (still) shown via a Planning Indicator in the FDB.

E.3.5 Request Conflict Probe Display

Purpose: This action is used to request the display of any conflicts[25] listed in the Conflict Probe Alert List. The flight plan routes of the two flights are displayed on the PVD, along with the areas of separation violation highlighted in red.

Format Requirements

01	(61)	65
message type	list display identifier	trackball coordinates

where message type is QP, list display identifier is B, and field 65 is the trackball coordinates of the entry in the Conflict Probe Alert List (i.e., the period at the beginning of the entry).

Formatted messages are routed to the Preview Area of the CRD of the requesting position.

Examples:

QP B (trackball entry)

QP (trackball entry)

Logic Requirements

Detailed Logic Requirements to support this function will be developed in the future.

General Logic Checks

Detailed General Logic Checks to support this function will be developed in the future.

---

[25] Only red alerts were considered in the 1999 evaluation.

Additional Logic Checks

Detailed Additional Logic Checks to support this function will be developed in the future.

Error Indicators: Error messages are routed to the Feedback Area of the CRD of the requesting position.

Processing After Acceptance: When the message is entered, the automation determines which conflict is to be displayed by matching the trackball entry with list entries. The route of each aircraft is displayed, and highlighting is added to the areas of each route where the aircraft are predicted to violate separation minima.

Resultant Outputs: Outputs are routed to PVD of the requesting controller.

E.3.6 Request Trial Plan Display

Purpose: This action is used to request the display of any trial plan listed in the Plans List. The flight plan route of the trial plan is displayed on the PVD, along with any areas of separation violation[26] highlighted in red.

Format Requirements

01	(61)	65
message type	list display identifier	trackball coordinates

where message type is QP, list display identifier is P, and field 65 is the trackball coordinates of the entry in the Plans List (i.e., the period at the beginning of the entry).

Formatted messages are routed to the Preview Area of the CRD of the requesting position.

Examples:

QP P (trackball entry)

QP (trackball entry)

Logic Requirements

Detailed Logic Requirements to support this function will be developed in the future.

General Logic Checks

Detailed General Logic Checks to support this function will be developed in the future.

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[26] Only red alerts were considered in the 1999 evaluation.

Additional Logic Checks

Detailed Additional Logic Checks to support this function will be developed in the future.

Error Indicators: Error messages are routed to the Feedback Area of the CRD of the requesting position.

Processing After Acceptance: When the message is entered, the automation determines which plan is to be displayed by matching the trackball entry with list entries. The route of the aircraft is displayed, along with the route of any aircraft in conflict with the trial plan route, and highlighting is added to the areas of each route where the aircraft are predicted to violate separation minima.

Resultant Outputs: Outputs are routed to PVD of the requesting controller.

E.4 Local Outputs

E.4.1 Computer Readout Device Outputs (Radar Controller Position)

R-CRD operating procedures are unchanged.

E.4.1.1 R-CRD Display Area

E.4.1.1.1 Operational Display

The Preview Area shall display those additional controller-entered messages defined by this specification.

E.4.1.1.2 Category/Function Display

The Functions Area shall display the Function Labels defined for the new planning functions, summarized in Table E-17. Figure E-1 shows the functions displayed in the radar controller's CRD.

Table E-17. Category and Function Tables

Category Key	Function Label
4. Planning	1. Trial Plan
	2.
	3. Make Current
	4. Continuous Conflict Probe
	5. Cancel Trial Plan
	6.
	7. Automated Replan
	8.
	9.
	10. Automated Coordination

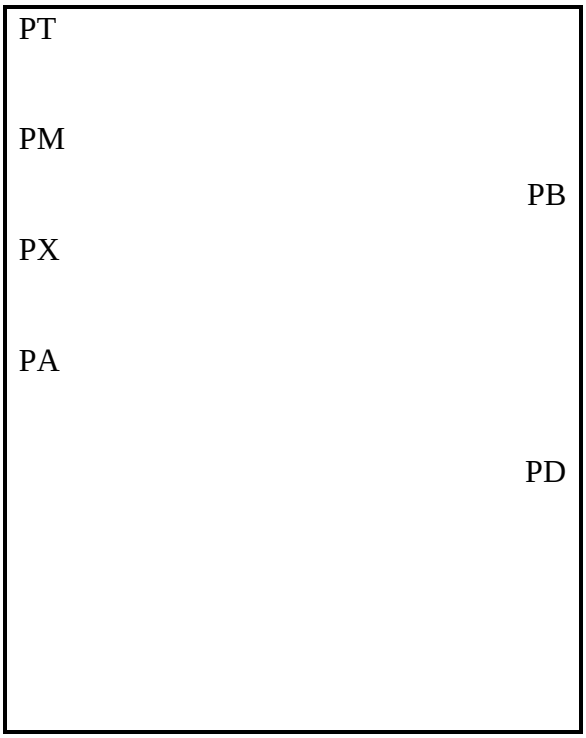

Figure E-1. Planning Functions Displayed in Radar Controller's CRD

E.4.2 Computer Response Messages

E.4.2.1 Acceptance Messages

An Acceptance response is required for the actions resulting from the Make Current (PM) message entered from the R-position.

E.4.2.2 Rejection Messages

When any portion of a Radar Controller-entered message does not pass the general acceptance requirements of NAS-MD-311 and the specific requirements of this specification, a rejection message shall be generated as specified herein.

E.5 Plan View Display Outputs (Radar Controller Position)

E.5.1 Full Data Blocks

The basic position of the track data block display is shown in Figure B-2. Except for positions A8, A9, and E, the track data block is as described in NAS-MD-314.

A1 A2 A3 A4 A5 A6 A7 A8 A9

B1 B2 B3 B4 C1 C2 C3

D1 D2 D3 E1 E2 E3 E4

Figure E-2. Track Data Block

The indicator fields, Field A8 and Field A9, are new fields. The display of fields A8 and A9 is determined as follows:

1. Field A8 is reserved as a data link indicator field.
2. If a planning indicator is eligible for display, it will be displayed as Field A9, except that only one planning indicator will be displayed at a time. The order of display precedence among the planning indicators is C, A, R, and D.
3. If a special aircraft indicator is the only statement eligible for display as Field A9, it will be displayed.

The arrival airport identifier (destination) is time-shared with ground speed in Field E. The display of Field E is determined as follows:

1. If only arrival airport identifier and ground speed are eligible for display, the two statements will be displayed on an equal time-sharing basis.
2. If any single statement, other than arrival airport identifier and ground speed, is eligible for display, the other statement and ground speed will be displayed on an equal time-sharing
3. If more than one item, other than arrival airport identifier and ground speed, are eligible for display, arrival airport identifier and ground speed will not be displayed.

E.5.1.1 Data Link Symbology

Reserved for data link symbology.

E.5.1.2 Planning Indicator Symbology

The planning indicator shall occupy position 9 of line 1 of the full data block (i.e., is Field A9). The meaning associated with the planning indicator is given in Table E-18.

Table E-18. Planning Indicators

Symbol	Meaning
red C	An aircraft conflict is detected in the plan.
blue A	An airspace conflict is detected in the plan.
green R	An automated replan is available (i.e., conflict-free and flow constraint-free) for this aircraft.
D	An automated coordination request has been received concerning this aircraft.

E.5.1.3 Special Aircraft Indicator Symbology

The special aircraft indicator shall occupy position 9 of line 1 of the full data block (i.e., is Field A9). The meaning associated with the special aircraft indicator is given in Table B-19.

Table E-19. Special Aircraft Indicators

Symbol	Meaning
H	Heavy-jet
T	TCAS
B	Heavy-jet and TCAS
F	B757
L	B757 with TCAS

E.5.1.4 Other Data Block Changes

TBD

E.5.2 List Displays

The initial position of each list on the PVD is adaptable on a per-console basis. The controller can reposition each list.

When the Flight Data List is divided into sublists, the sublists are ordered alphabetically by the sublist's fix name. FSP, Conflict Probe Alert, and Plans Lists do not contain sublists.

Whenever an entry is added (deleted) to (from) a list, the list is expanded (contracted).

A period (.) is the first displayed character in each list entry. The controller uses this character to center the trackball when identifying an entry in the list.

List entries contain data fields, described in Sections B.5.2.1 through B.5.2.4 pertaining to each list. When applicable, the following rules apply within each data field:

- Leading zeros are displayed in time and beacon code fields, but not in altitude fields.
- The aircraft identification field is left justified.
- Altitude fields are right justified.

The storage for tabular list displays may become full. Before this occurs, a warning message will be output to an adapted keyboard video display terminal/keyboard printer (KVDT/KPR) (or its backup device) stating

WARNING: TABULAR LIST STORAGE 95% FULL.

In the event that list storage does become full, information for lists (other than metering lists) which cannot obtain list storage will be routed to an adapted KVDT/KPR (or its backup device) with a message stating

TABULAR LIST STORAGE FULL, TABULAR LIST PROCESSING DEGRADED

Once a list has been routed to a printer, it will not automatically be rerouted to the PVD when storage becomes available.

Normal list processing will be resumed when the storage capacity is less than 95% full. A message will be routed to the KVDT/KPR (or its backup device) stating

NORMAL TABULAR LIST PROCESSING RESUMED

E.5.2.1 Flight Data List

E.5.2.1.1 Format

The Flight Data List, when not divided into sublists, will be headed by the two characters FD. When the Flight Data List is subdivided into sublists, each sublist will be headed by two to twelve alphanumeric characters defining the posted fix and the letters FD.

Each Flight Data List entry will contain the following data in two lines, the second line beginning with the tailored route of flight:

1. Aircraft identification (AID)
2. Computer identification (CID)
3. Aircraft data (number; special aircraft indicator; aircraft type; airborne equipment qualifier)
4. Estimated ground speed (for an airborne aircraft) or true airspeed (for a proposed departure)
5. Posted fix
6. Estimated time over posted fix (for an airborne aircraft) or proposed departure time (for a proposed departure)
7. Assigned altitude (for an airborne aircraft) or requested altitude (for a proposed departure)
8. Route of flight (tailored)
9. UTM coordination indicator
10. Remarks indicator

E.5.2.1.2 Display Eligibility

An aircraft is eligible for a Flight Data List entry if:

1. It is scheduled to enter, or is within, a nonradar area while under control of the position accepting handoff.
2. Radar service is lost or terminated.
3. The aircraft is not yet under the control of the sector but a flight strip would have been posted.
4. The aircraft is under control of the sector and the Remarks field of the flight plan is non-empty.
5. Transmission of flight plan data to an adjacent facility for any sector-controlled aircraft was unsuccessful.
6. The sector controller designates the aircraft as eligible for display.

Criteria 1 through 5 are considered the default criteria for display.

There is at most one Flight Data List entry per aircraft per sector.

Information pertaining to an aircraft can appear in both the Flight Data List and track data block at the same time.

Posting and Removal Criteria

Flight Data List entries for eligible aircraft are posted in accordance with flight progress strip posting rules, except that

1. The Flight Data List entry for an aircraft is posted upon inbound handoff initiation or when the Full Data Block for the aircraft is forced for a Conflict Probe Alert, whichever is earlier[27]
2. The Flight Data List entry for an aircraft that does not otherwise meet default display criteria is posted upon designation by the sector controller.
3. The Flight Data List entry for an aircraft is removed upon:
   - Outbound handoff acceptance of the aircraft.
   - Designation by the sector controller.

---

[27] Evaluation results suggest that the lead time for posting could be parameterized to be as early as ten minutes before sector entry to as late as initiation of inbound handoff.

Display Control

1. The sector controller can request (display) or suppress (remove) the Flight Data List.
2. The initial position of the list on the PVD is adaptable on a per console basis. The controller can reposition the Flight Data List.
3. The sector controller can display entries either by sublist (i.e., posted fix = flight strip field 16) or as one consolidated list. The sublist header is the name of the posted fix, followed by FD
4. The sector controller can select the display sequence, either AID or time over previous posted fix.
5. The sector controller can designate any aircraft for addition to or removal from the display.
6. The period (.) is the first displayed character in each list entry. The controller uses this character to center the trackball when identifying aircraft in the Flight Data List (e.g., for removal of the entry from the list).
7. Whenever an aircraft is added (deleted) to (from) the Flight Data List, the list is expanded (contracted). When a sublist is empty, its header is removed.

E.5.2.1.3 Routing

A Flight Data List is addressed to the PVD associated with each sector.

E.5.2.2 FSP List

E.5.2.2.1 Format

The FSP List will be headed by the three characters FSP.

Each Flight Data List entry will contain one General Information (GI) message as free-form text.

E.5.2.2.2 Display Eligibility

A message is eligible for entry in the FSP list if:

1. A corresponding GI message has been routed to the sector.
2. The limit on the number of messages to be displayed in the FSP list has not been exceeded.

Posting and Removal Criteria

1. An entry is posted to the top of the FSP List as soon as a corresponding GI messages arrives at the sector, unless the entry limit has been selected to be zero.
2. When an entry is eligible to be posted to the top of the FSP List, but the addition of that entry would cause the number of list entries to exceed the limit for the number of entries, then an entry (the oldest posted entry) is removed from the bottom of the FSP List and the new entry is posted to the top of the list.

Display Control

1. The sector controller can request (display) or suppress (remove) the FSP List.
2. The initial position of the list on the PVD is adaptable on a per console basis. The controller can reposition the FSP List.
3. The sector controller can control the maximum numbers of entries posted to the FSP List simultaneously.
4. The sector controller can designate any entry for addition to or removal from the display.
5. The period (.) is the first displayed character in each list entry. The controller uses this character to center the trackball when identifying an entry in the FSP List (e.g., for removal of the entry from the list).
6. Whenever an entry is added to (deleted from) the FSP List, the list is expanded (contracted). When the list is empty, its header is removed.

E.5.2.2.3 Routing

A FSP List is addressed to the PVD associated with each sector.

E.5.2.3 Conflict Probe Alert List

E.5.2.3.1 Format

The Conflict Probe Alert List will be headed by the two characters CP.

Each Conflict Probe Alert List entry will contain the following data:

1. Identification of both aircraft (or aircraft and airspace) in conflict
2. Initial time of loss of separation

E.5.2.3.2 Display Eligibility

An aircraft is eligible for entry in the Conflict Probe Alert List for a sector if

1. Continuous conflict probe is ON
2. Continuous conflict probe has detected an aircraft conflict or airspace conflict for this aircraft AND
3. The planning processor has selected this sector as the notification sector.

There is at most one Conflict Probe Alert List entry per sector for each pairwise conflict involving this aircraft.

Posting and Removal Criteria

1. One or more unique alerts are posted in the Conflict Probe Alert List for each eligible aircraft.
2. Entries in the Conflict Probe Alert List are ordered by the AID of the subject aircraft. Multiple entries for the same aircraft are ordered in the same order as they were received.
3. An alert is removed from the Conflict Probe Alert List
    a. When the alert is no longer predicted
    b. Upon outbound handoff acceptance of the aircraft
    c. Upon designation by the sector controller

The Conflict Probe Alert List, if displayed, is removed from display when continuous conflict probe is OFF.

Display Control

1. The sector controller can request (display) or suppress (remove) the Conflict Probe Alert List.
2. A request for the Conflict Probe Alert List will be rejected when continuous conflict probe is OFF for the sector.
3. The controller can specify the maximum alert notification time for entries in the Conflict Probe Alert List.
4. Only entries with initial time of loss of separation closer than the maximum alert notification time will be posted.
5. The sector controller can designate any entry for removal from the Conflict Probe Alert List.

6. The period (.) is the first displayed character in each entry. The controller uses this character to center the trackball when identifying an entry (e.g., for removal from the list).
7. Only red alerts are posted.[28]

E.5.2.3.3 Routing

A Conflict Probe Alert List is addressed to the PVD associated with each sector.

E.5.2.4 Plans List

E.5.2.4.1 Format

The Plans List will be headed by the five characters PLANS.

Each Plans List entry will contain the following data:

1. Trial Plan identifier (AID.Td(d))
2. Amendment in clearance language
3. Expiration time (2 minutes from creation)
4. Conflict information, if appropriate
    a. AID of other aircraft or airspace identifier in conflict
    b. Time of initial loss of separation
    c. Count of additional conflicts in trial plan (+d)

The trial plan identifier for an automated replan trial plan entry in the Plans List will use the identifier TR rather than Td(d). The entry for an automated replan trial plan will also contain the following data:

5. Status information
    a. Conflict-free indicator (-->) or

---

[28] An alert is coded red if the predicted loss of separation is less than or equal to procedural separation and within the problem detection threshold defined by a parameter. An alert is coded yellow if the predicted loss of separation is greater than procedural separation and within the problem detection threshold defined by a parameter. A red alert or yellow alert is muted red or muted yellow, respectively, if loss of separation is predicted to occur on a portion of the route where an altitude transition is planned but not yet cleared. An alert is coded blue when separation is predicted to be lost with a special use airspace (SUA).

b. Conflict information, with the conflict time replacing the expiration time

E.5.2.4.2 Display Eligibility

An aircraft is eligible for entry in the Plans List for a sector if there is a trial plan for this aircraft, created by the R-position. There can be more than one entry for an aircraft in the Plans List.

Posting and Removal Criteria

1. A trial plan is posted in the Plans List when the trial plan is created. The results of checking by conflict probe are displayed with the trial plan.
2. Entries in the Plans List are ordered by the trial plan ID (AID plus trial plan identification suffix).
3. A trial plan is removed from the Plans List
   a. When the trial plan expires.
   b. When the trial plan is designated as a flight plan amendment ("made current").
   c. Upon outbound handoff acceptance of the aircraft.
   d. Upon designation by the sector controller.

Display Control

1. The sector controller can request (display) or suppress (remove) the Plans List.
2. The sector controller can designate any entry for removal from the Plans List.
3. The period (.) is the first displayed character in each entry. The controller uses this character to center the trackball when identifying an entry
   a. For removal from the list.
   b. To designate the trial plan as a flight plan amendment ("make current").

E.5.2.4.3 Routing

A Plans List is addressed to the PVD associated with each sector.

Appendix F

Interface Requirements

This appendix specifies remote messages that are used for data transfer between the center Host and the planning processor for proposed new R-side capabilities. Except where otherwise noted, only those capabilities that were included in the limited evaluation in 1999 are included here.

This appendix does not cover message transmission, message retransmission, or unsuccessful transmission procedures, or those data items needed to identify the sending or receiving position for a message.

F.1 Conflict Probe Related Messages

There are two types of messages sent from the planning processor to the Host with respect to conflict probe.

F.1.1 Conflict Message

F.1.1.1 Purpose

The Conflict Message is sent from the planning processor to the Host to provide new or revised information about the predicted loss of separation between two aircraft or between an aircraft and a special use airspace.

F.1.1.2 Conditions for Generation

The Conflict Message is automatically sent at the conflict notification time determined by the planning processor, up to a parameter time (nominally 20 minutes) before the predicted violation of separation minima.

F.1.1.3 Format and Content

The Conflict Message contains the identification of both aircraft (or aircraft and airspace), the current location (sector identification) of both entities, the time of the predicted loss of separation, and graphical information, including coordinates of those portions of the route predicted to be in conflict, for display of the conflict.

F.1.2 Conflict Delete Message

F.1.2.1 Purpose

The Conflict Delete Message is automatically sent when a conflict previously notified to a sector is no longer predicted to happen, such as in the case when the plan of an aircraft has been amended to solve a conflict. The Host is expected to remove notifications of the conflict from display.

F.1.2.2 Conditions for Generation

The Conflict Delete Message is automatically sent when a conflict previously notified to a sector is no longer predicted to happen.

F.1.2.3 Format and Content

The Conflict Delete Message contains the identification of both aircraft (or aircraft and airspace) and the time of the predicted loss of separation.

F.2 Trial Planning Related Messages

Several messages are sent between the planning processor and the Host to support the trial planning capability.

F.2.1 Trial Plan Request Message

F.2.1.1 Purpose

The Trial Plan Request Message is sent from the Host to the Planning Processor to request that a trial plan be checked for separation violations between the aircraft and another aircraft or special use airspace.

F.2.1.2 Conditions for Generation

The Trial Plan Request Message is sent when the R-Side controller constructs a trial plan using the PT function.

F.2.1.3 Format and Content

The Trial Plan Request Message contains the aircraft identification, the type of change (route, altitude, or speed), and the value associated with the change.

F.2.2 Trial Plan Message

F.2.2.1 Purpose

The Trial Plan Message is sent from the Planning Processor to the Host to transmit the results of checking a trial plan.

F.2.2.2 Conditions for Generation

The Trial Plan Message is sent when the Planning Processor completes checking a submitted trial plan for aircraft and airspace conflicts.

F.2.2.3 Format and Content

The Trial Plan Message contains the results of checking a trial plan for aircraft and airspace conflicts, including the trial plan identification, the expiration time of the trial plan, and any conflict information: the identification of both aircraft (or aircraft and airspace) in the earliest-predicted violation of separation mimima, the current location (sector identification) of both entities, the time of the predicted loss of separation, graphical information (including coordinates of those portions of the route(s) predicted to be in conflict) for display of the conflict, and a count of any other conflicts found in the trial plan.

F.2.3 Trial Plan Delete Message

F.2.3.1 Purpose

The Trial Plan Delete Message is automatically sent from the Planning Processor to the Host when the display of a trial plan is to be removed from display by the Host.

F.2.3.2 Conditions for Generation

The Trial Plan Delete Message is automatically sent when the expiration time of the trial plan has been reached or the flight plan has been amended in such a way that the trial plan is no longer operationally suitable.

F.2.3.3 Format and Content

The Trial Plan Delete Message contains the identification of the trial plan.

F.2.4 Trial Plan Error Message

F.2.4.1 Purpose

The Trial Plan Error Message is sent from the Planning Processor to the Host to inform the R-Side controller who requested the trial plan that the Planning Processor cannot construct a trial plan from the information provided.

F.2.4.2 Conditions for Generation

The Trial Plan Error Message is sent when the Planning Processor encounters a modeling error or invalid flight identification, route, altitude, or speed value when attempting to construct a trial plan from the information given.

F.2.4.3 Format and Content

The Trial Plan Error Message contains the trial plan identification, the fields in error, and a description of the error.

F.2.5 Automated Replan Request Message

F.2.5.1 Purpose

The Automated Replan Request Message is sent from the Host to the Planning Processor to request that a trial plan be rebuilt and checked periodically for separation violations between the aircraft and another aircraft or special use airspace.

F.2.5.2 Conditions for Generation

The Automated Replan Request Message is sent when the R-Side controller submits a trial plan for periodic rechecking using the PA function.

F.2.5.3 Format and Content

The Automated Replan Request Message contains the identification of the trial plan to be rechecked periodically.

F.2.6 Automated Replan Message

F.2.6.1 Purpose

The Automated Replan Message is sent from the Planning Processor to the Host to transmit the results of a periodic checking of a trial plan.

F.2.6.2 Conditions for Generation

The Automated Replan Message is sent when the Planning Processor completes rebuilding and rechecking a trial plan that has been previously submitted to automated replan.

F.2.6.3 Format and Content

The Automated Replan Message contains the results of rechecking an automated replan trial plan for aircraft and airspace conflicts, including the trial plan identification and any conflict information: the identification of both aircraft (or aircraft and airspace) in the earliest-predicted violation of separation mimima, the current location (sector identification) of both entities, the time of the predicted loss of separation, graphical information (including coordinates of those portions of the route(s) predicted to be in conflict) for display of the conflict, and a count of any other conflicts found in the trial plan.

F.2.7 Automated Replan Delete Message

F.2.7.1 Purpose

The Automated Replan Delete Message is sent from the Host to the Planning Processor to terminate the periodic rebuilding and rechecking of a trial plan previously submitted to automated replan.

F.2.7.2 Conditions for Generation

The Automated Replan Delete Message is sent when the R-Side controller submits a request to the Host to terminate the automated replan trial plan for an aircraft using the PX function.

F.2.7.3 Format and Content

The Automated Replan Delete Message contains the identification of the trial plan.

F.2.8 Automated Replan Error Message

F.2.8.1 Purpose

The Automated Replan Error Message is sent from the Planning Processor to the Host to inform the R-Side controller that the Planning Processor cannot construct a trial plan from the information provided.

F.2.8.2 Conditions for Generation

The Automated Replan Error Message is sent when the Planning Processor encounters a modeling error or invalid flight identification, route, altitude, or speed value when attempting to construct a trial plan from the information given.

F.2.8.3 Format and Content

The Automated Replan Error Message contains the trial plan identification, the fields in error, and a description of the error.

F.2.9 Make Current Request Message

F.2.9.1 Purpose

The Make Current Request Message is sent from the Host to the Planning Processor to request that a trial plan be submitted to the Host as an amendment.

F.2.9.2 Conditions for Generation

The Make Current Request Message is sent when the R-Side controller submits a trial plan to amend the flight plan using the PM function.

F.2.9.3 Format and Content

The Make Current Request Message contains the identification of the trial plan to be submitted as a flight plan amendment.

F.2.10 Make Current Error Message

F.2.10.1 Purpose

The Make Current Error Message is sent from the Planning Processor to the Host to inform the R-Side controller that the Host has refused to accept the trial plan as a valid flight plan amendment.

F.2.10.2 Conditions for Generation

The Make Current Error Message is sent when the Host refuses a flight plan amendment submitted by the Planning Processor.

F.2.10.3 Format and Content

The Make Current Error Message contains the trial plan identification, the fields in error, and a description of the error.