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Collaborative Routing Concept Exploration Transition Report

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MITRE
Center for Advanced Aviation System Development
McLean, Virginia

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Abstract

A common occurrence in today's National Airspace System (NAS) is the rerouting of aircraft to avoid either bad weather or congested airspace. The FAA is working to obtain a better understanding of the scope of the rerouting problem, and of what improvements can be gained through increased collaboration, between Air Traffic Management (ATM) and airspace users, in the application of reroutes.

This report documents the results of Concept Exploration (CE) research on Collaborative Routing performed by the Center for Advanced Aviation System Development (CAASD), of the MITRE Corporation It presents operational needs, a summary of a candidate operational concept, potential benefits, significant technical and operational issues identified, and research and development needs which should be addressed as part of the Concept Development phase for the Collaborative Routing capability.

KEYWORDS: Collaborative routing, collaborative decision making, concept exploration, traffic flow management, information exchange

Foreword

This report documents the results of research on Collaborative Routing performed by the Center for Advanced Aviation System Development (CAASD), of the MITRE Corporation, as part of its Concept Exploration (CE) support to the Traffic Flow Management (TFM) Research and Development Branch of the Federal Aviation Administration (FAA).

Acknowledgments

The concepts, issues and plans for Collaborative Routing presented in this report are the result of significant discussion and collaboration with individuals from many organizations within the FAA and from amongst the air carrier community. Their contributions are appreciated by the author. Special thanks are extended to the members of the Collaborative Decision Making (CDM) Working Group. Inputs from members of the CDM Working Group, and in particular the members of the Collaborative Routing Subgroup, provided the basis for the bulk of the author's understanding of the issues and needs associated with collaborative routing.

For consistency and completeness, the candidate operational concept and potential benefits material presented in this report were derived from other products prepared by CAASD. These products were prepared as supporting CE efforts. Thanks are extended to Tom Becher, Debra Berry, Laurel Carlson, Jim DeArmon, Don Olvey, John Reeves, Dusty Rhodes and Mary Yee for the use of the results of their efforts.

Thanks are also extended to Ellen Friedman for taking on the task of getting this work published.

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Section 1

Introduction

The Center for Advanced Aviation System Development (CAASD) of the MTIRE Corporation has been providing Concept Exploration (CE) support to the Traffic Flow Management (TFM) Research and Development Branch of the Federal Aviation Administration (FAA). Collaborative Routing is one of the capabilities being addressed by CAASD as part of this support.

The primary purpose of CE research is to establish the technical and operational viability of a concept and its potential benefits. Results from CE research will provide the FAA with a basis for decision-making on the commitment of funding for further development of the subject capability. Transition criteria have been defined by the FAA for use in evaluating whether or not a capability should be transitioned from the CE phase to the Concept Development (CD) phase (i.e., allocated funds for further research and development). Transition criteria addressed by CAASD as part of its CE of Collaborative Routing are presented in Table 1-1.

1.1 Purpose

The bulk of the Collaborative Routing research performed by CAASD has been directed towards a Collaborative Routing capability for the 2002-2005 time frame. This report summarizes the results of research performed during this and the past fiscal year. It discusses operational needs, presents a summary of a candidate operational concept, summarizes potential benefits, presents significant technical and operational issues identified, and identifies research and development needs which should be addressed as part of the CD phase for the Collaborative Routing capability.

1.2 Scope of CE for Collaborative Routing

The scope of CAASD's CE for Collaborative Routing has been limited to establishing the needs and basic requirements for a Collaborative Routing capability for the 2002-2005 time frame. However, opportunities for the early achievement of potential benefits were explored and are discussed in this report.

Research and development for some of the decision support capabilities discussed in the strawman operational concept has taken place as part of the CE/CD activities performed by CAASD for the Initial Severe Weather and Automated Problem Recognition capabilities. The results of this research and development work are not addressed in this report.

1.3 Audience

The intended audience for this report includes TFM service providers, system developers, the user community and FAA sponsors of TFM research and development.

Table 1-1. Concept Exploration (CE) Transition Criteria Addressed by CAASD

Concept Exploration (CE) Transition Criteria	CAASD Concept Exploration Results
Requirements/Operational Concepts	
Problem definition/clarification	Sufficient understanding of the problem to determine a need for a solution and the feasibility of implementing a solution in the 2002 time frame
Initial operational needs document	Consensus on operational need subject capability will address
Operational concept-strawman	Capability for demonstrating and evaluating alternative concepts Preliminary participant roles and responsibilities, information exchange requirements and desired behaviors/interactions Preliminary operational, functional, data and system interface requirements
Cost/Benefits Analysis (CBA)	
Initial description of benefits	Narrative on anticipated FAA and user community benefits from implementing subject capability
Benefits Estimate-preliminary	Benefits presented in primarily qualitative terms, from both the FAA and user community perspectives (limited quantitative results anticipated in time available)
Wrap-up	
List of Open Issues	Technical and operational issues which need to be addressed by a more robust evaluation capability, or when a specific technical implementation approach is selected
CD Phase Plan	Recommendations for evaluations and additional development during Concept Development Phase

1.4 Background

A common occurrence in today's National Airspace System (NAS) is the rerouting of aircraft to avoid either bad weather or congested airspace. In some instances, the decision to restrict routes is a strategic one, with NAS users given an opportunity to participate in the FAA's decision making process. Because of the strategic nature of the identification of the problem and development of a resolution strategy, the majority of the flights being affected would not have departed. In other instances, aircraft would have departed at the time the decision is made. For both cases, rarely do the FAA service providers and the NAS users share the same information and understanding of the scope and potential impact of the problem, or the impact of the selected reroute strategy.

At issue here is the service provider's ability to address, to the NAS user's general satisfaction, a bad weather or congestion problem without an understanding of that user's operational constraints and preferences as they pertain to taking the user off its preferred route.

The CE work reported here is part of an initial effort to help the FAA obtain a better understanding of the scope of the rerouting problem, and an understanding of what improvements can be brought about through procedural changes and the introduction of new or enhanced decision support capabilities.

Section 2

Collaborative Routing Problem Definition and Clarification

In today's system, users of the NAS prepare and file flight plans which support their needs and priorities. For the case of the air carriers, flight plans developed by their flight planners address a range of sometimes competing business needs which are not apparent from their choice of filed route or altitude. For the most part, the FAA accepts these flight plans, and allows the user to fly as filed. However, in situations caused by bad weather, excess demand or navaid failure, Air Traffic Management (ATM) has to restrict the user's ability to fly as filed in order to bring demand in selected airspace in line with the available capacity. One technique used to achieve this balance is the issuing of blanket reroutes (i.e., changing some or all of the planned routes for a set of aircraft). Under today's process for defining and implementing reroutes, NAS users are confronted with route changes which may not be necessary for a specific flight, or not in their best interest because of economic or safety reasons.

It is ATM's responsibility to bring demand in line with available capacity. ATM decides how best to allocate anticipated demand based on its understanding of the expected capacity of the NAS. "Expected capacity" being defined solely by ATM. ATM's decisions are made with only a limited knowledge of the trade-offs being considered at that time by air carriers and other NAS users. While a selected demand/capacity balancing strategy may resolve the problem from a "system" perspective, the execution of that strategy may adversely effect individual flights, or an air carriers operations for that day, in ways which could have been avoided.

The air carriers are confronted with two problems. One is the lack of a shared understanding with ATM of the future status of the NAS. The other is limited opportunities to have their preferences and constraints taken into account in the development of resolution strategies.

An air carrier's Aeronautical Operational Center (AOC) and its flight dispatchers, who are legally responsible for the safe operation of their flights, have to make flight planning decisions without the same NAS demand and constraint information available to ATM service providers. In performing flight planning and monitoring, they are not able to take into account status information being taken into account by ATM in its planning, problem identification, and resolution strategy development. One result is that the AOCs are reactive participants in the resolution of airspace problems associated with bad weather or congestion. With a better understanding of anticipated demand and system constraints, AOCs could become proactive participants in these airspace management problems. With knowledge of what the FAA anticipates to be areas of bad weather or congestion, AOCs could develop flight plans which respond to that anticipated bad weather or congestion. Another result is that AOC dispatchers are limited in their ability to carryout their regulatory responsibilities as they pertain to

informing the pilot in command of any "known irregularities of NAS facilities **and** services that may affect the safety of flight."[1] For example, without access to knowledge of anticipated airspace congestion or planned reroutes, a flight may have to be diverted for additional fuel. Knowledge of a potential reroute would have given the flight planner the opportunity to take the reroute into account when doing fuel planning, providing the pilot in command with some options, and a safety cushion, if the reroute is applied

AOCs are generally not provided with the opportunity to influence the development of the reroute strategy selected by the FAA. While included in severe weather planning sessions, there is currently little emphasis on addressing air carrier preferences, or providing them with opportunities to introduce additional options during the planning phase. One result of this is a missed opportunity for ATM to change the demand side of the picture. AOC initiated actions such as planning and filing for different routes, different cruise altitudes or different departure times, or canceling one or more flights could change the quantity and distribution of the original demand to the point of eliminating or significantly reducing the need for reroutes. Instead, AOCs are confronted with route changes which may not be necessary, or not in the best interest of the carrier. The resulting reroute could cause unacceptable delays to a high priority flight, or place flights in situations where they have inadequate fuel to fly the new route. The former could result in adverse economic impacts because of missed connections, or having flight crew members flying beyond their legal flying time limit. The latter could adversely effect the safe operation of the flight, and at a minimum require an unscheduled landing for additional fuel to safely reach the planned destination.

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[1] 14 CFR 121.601 Aircraft Dispatcher Information To Pilot In Command: Domestic And Flag Air Carriers. U.S., *14 CFR: Aeronautics and Space*, Chapter I: "Federal Aviation Administration," Parts 1-199 (revised as of January 1, 1996).

Section 3

Initial Operational Needs

The consensus goal articulated, by the FAA and user community, for Collaborative Routing, is the creation of an operational environment which will provide:

- ATM with the information and decision support systems to accurately forecast demand on the NAS resources (i.e., airspace, fixes, airports) and share those forecasts with the user community.
- Airspace users with sufficient information on the status of the NAS to allow them to proactively respond to changes in weather and system congestion without adversely affecting the NAS.

Two fundamental operational needs must be satisfied to achieve the goals expressed for Collaborative Routing: common situational awareness and a collaborative approach for defining reroute strategies.

A means for achieving common situational awareness between ATM service providers and airspace users must be established. At the heart of this is greater sharing of situation and planning information between ATM and NAS users. Collaborative and independent decision making must be made on the basis of a mutual understanding of the problem. This includes both the contributing factors and the possible consequences to the system. Improved information exchange should provide a foundation for common situational awareness, and for reductions in the time required by ATM and NAS users to reach agreement on strategic reroutes.

Common situational awareness by itself will not eliminate the selection of route changes that may not be in the best interest of NAS users. Changes in the current approaches and decision support tools used for defining and executing reroute strategies are also needed to facilitate more active user participation in the decision making process.

Section 4

Candidate Operational Concept

As we move towards 2005, NAS users and traffic flow managers will continue to seek a more efficient NAS, as seen from their separate perspectives, while maintaining or improving upon current levels of safety. The key mechanisms for achieving this goal will be greater information exchange, collaborative decision making, and improved decision support systems and/or tools. Thes tools will support the identification and evaluation of flow management problems, and the collaborative selection of flow management options prior to their implementation. This section presents key components of a candidate operational concept for Collaborative Routing. It was derived from a more detailed Collaborative Routing operational concept which is documented in the MITRE report *Midterm FAA-Airspace User Collaborative Routing Operational Concept*.

4.1 Fundamental Changes In Procedures and Capabilities

Traffic flow managers will continue to use changing the filed, planned, or active route for an aircraft as one of the techniques for alleviating flow problems However, the current process for developing and implementing a reroute strategy will undergo several changes. These changes include the following enhancements to today's procedures and capabilities:

- **Greater sharing of situation and planning information among traffic flow managers and NAS users:** Traffic flow managers and NAS users will have common, well-integrated traffic and weather data, as well as more accurate traffic and weather prediction information. (AOCs could have internally developed or vendor-supplied tools.) If there is disagreement between traffic flow managers and NAS users regarding weather predictions, they will need to be resolved. NAS users and traffic flow managers will be able to share their respective views of a situation using visual collaboration technology such as electronic chalkboards. Improved information exchange and the introduction of visual collaboration capabilities will permit the dynamic exchange of planning information between ATM and NAS users. Phased deployment of these capabilities will result in visual collaboration tools and limited sharing of weather and NAS constraint information being available during the 1998-1999 time frame.
- **Better information exchange and collaboration among traffic flow managers at different facilities:** Since situation and demand data will be shared electronically amongst FAA facilities, traffic flow managers at various facilities can see the same situation and better recognize the impact of reduced capacity at adjacent facilities. This shared vision will make it easier for traffic flow managers from different facilities to work together in developing resolution strategies. They will be able to better observe the impact of the strategies on their airspace and other facilities.

- **Active user participation in the FAA flow management decision process, time permitting:** Collaborative decision making will be a common mode of operation during planning of strategic reroutes, and users will assume a more active role than in today's reroute planning process. For example, where the available planning horizon permits, AOCs will be able to define preferred routing for their own aircraft which require rerouting.
- **Tools to help identify problems and evaluate potential strategies:** Flow managers will have decision support tools available to assist them in problem recognition, strategy development and strategy evaluation. The availability of these tools will improve the decision making process by reducing the time required for the development and evaluation of potential resolution strategies, while simultaneously allowing for the definition and evaluation of more flight specific, as opposed to generic, reroutes.
  - Automated flow problem recognition capabilities**:** TFM automation will include predictive tools that will predict traffic flows more strategically, allowing time for earlier detection of problems and the collaborative development of solutions. These tools will also support the identification of the specific flights predicted to fly through the problem airspace during the problem time period. Flight information on affected flights and information on airspace predicted to have demand/capacity imbalances will be available to both ATM and NAS users.
  - What-if tools to evaluate the potential effects of routes changes before they are implemented**:** With anticipated improvements in the FAA-user communications interface, users will be able to easily communicate preferred route changes to the FAA for inclusion in potential problem resolution strategies. Traffic flow managers will be able to take these inputs into account when they develop potential routes and evaluate the possible effects of candidate route changes on the future traffic. During collaborative planning sessions, AOCs will be able to request and see the results of the what-if analyses performed by TFM personnel .

Although collaborative strategy development will be more common in the mid-term, it will not be the sole means by which traffic flow solutions will be developed. The extent to which techniques such as Collaborative Routing will be applied will be heavily dependent upon how far in advance flow problems amenable to resolution via route changes can be predicted. When these problems are identified sufficiently far in advance, the designated ATM point of contact in charge of the resolution will solicit NAS user participation in flow strategy development. If sufficient time is not available to include users in the decision making process, TFM personnel will develop appropriate strategies with possibly only limited user participation. As a minimum, NAS users will be notified of pending flow initiatives so that they can adjust their operations to meet the flow restrictions

4.2 Anticipated Roles and Responsibilities

Anticipated roles and responsibilities for FAA traffic flow managers and AOCs are presented below. They are based on the candidate operational concept prepared by CAASD (Olvey, et al, 1998).

4.2.1 FAA

4.2.1.1 National traffic flow managers (i.e., ATC System Command Center (ATCSCC) Specialists)

- Monitor the NAS for conditions that could result in demand/capacity imbalances
- Identify causes of potential demand/capacity imbalances (e.g., forecasted severe weather), including those aircraft affected by and/or contributing to that imbalance, and facilitate the sharing of that information with other FAA facilities and NAS users
- Share, with other facilities and NAS users, information about current and anticipated flow constraints and options being considered for managing them
- Collaborate with local traffic flow managers and NAS users to develop strategies to mitigate potential imbalances.
- Analyze potential impacts of user preferences prior to implementing national-level resolution strategies
- Perform post-hoc analysis of the impact of implemented strategies on NAS performance

4.2.1.2 Local traffic flow managers

- Monitor local and adjacent airspace for conditions that could result in demand/capacity imbalances
- Identify causes of potential demand/capacity imbalances, including those aircraft affected by and/or contributing to that imbalance
- Monitor airspace and other resource status, and traffic conditions at other facilities that may cause capacity problems in their own airspace
- Share observed conditions with ATCSCC specialists and NAS users
- Collaborate with NAS users and traffic flow managers at other facilities and, if necessary, the ATCSCC to develop strategies to mitigate local demand/capacity imbalance
- Lead flow strategy development activity when flow problem resides in own airspace and have minimal impact to other/outside facilities
- Perform post-hoc analysis of the impact of implemented strategies on local system performance, and support the ATCSCC in evaluating the NAS performance impacts

4.2.2 AOCs/Flight planners

- Safe and efficient management of own resources and operations planning
- Inform traffic flow managers of current and planned operations
- Assist TFM personnel in dealing with those aircraft affected by and/or contributing to potential capacity/demand imbalances
- Communicate problem resolution preferences (strategies, priorities) to traffic flow managers
- Plan fleet operations to prevent flow problems (with capacity and aggregate demand provided by traffic flow managers)
- Cooperate and collaborate with traffic flow managers to define, analyze and resolve flow problems

Section 5

Preliminary Estimate of Operational and Economic Benefits

As expected for the CE phase (see Table 1-1), an exhaustive, quantitative estimate of the potential impacts and benefits to be derived from Collaborative Routing has not been performed. Instead, inputs from ATM and, primarily, air carrier personnel were used to obtain a qualitative estimate of potential operational benefits. A high-level benefits analysis was also performed, as a first step in quantifying the potential economic benefits Collaborative Routing may provide.

5.1 Potential Operational Benefits

It is anticipated that collaboration on a general level between ATM personnel and the various segments of the NAS user community will improve the overall efficiency of NAS operations. With respect to Collaborative Routing, it is anticipated that the following benefits would be realized through the expansion of collaboration in the reroute process:

- Improved information exchange should provide ATM and NAS users with a better understanding of the current and predicted status of the NAS, and, therefore, a better foundation for planning.
- NAS users will feel better about ATM decisions as a result of a better understanding of the rational behind those decisions.
- The effectiveness of NAS user and ATM decisions will benefit from a better understanding of each others needs, preferences and constraints.
- AOC users will have new opportunities to implement solutions beneficial to their respective operations.
- AOC users will be able to proactively assist in mitigating predicted demand/ capacity imbalances during the flight planning process
- Miscommunications and misunderstandings between AOC users and ATM should be reduced through the increased use of non-voice communication media which can give a more complete and accurate understanding of reroute strategies and their implementation.

5.2 Potential Economic Benefits

A preliminary estimate of the potential benefits from Collaborative Routing was performed as part of CAASD's CE work (DeArmon, 1998). This work was performed to determine if the potential benefits of Collaborative Routing are of sufficient magnitude to warrant the FAA and

user community expending funds on the decision support tool development, upgrading of current systems, and internal process and procedure changes required to fully implement the capability. A secondary purpose was to identify the elements which contribute to the total expected benefits.

The approach taken was based on evaluating the total dollar benefit delivered by an idealized Collaborative Routing tool. This tool would be capable of supporting all of the needed information sharing, negotiation among ATM and airspace users, and perfect weather prediction. Actual data for August 16, 1997 was than analyzed to detect cases where rerouting attributable to severe weather occurred. Some "collaborative reroutes" were hand crafted to establish the magnitude of savings in flight times and distances possible. Results obtained were adjusted to reflect a less-than-perfect delivery of the idealized functions, and applied against the flights for the study day. A summary of the potential savings calculated for the subject day is presented in Table 5-2.

Table 5-2. Potential Savings from Collaborative Routing

Summary of Savings	
Airborne, shorter flight	$385,200
Cancellation	$11,718,000
Diversions	$14,250,000
Ground Delay	$823,500
Total (for subject day)	$27,176,700
Annualized Savings (based on 10 days per year like subject day)	$270M

The potential savings presented in Table 6-1 are based on what may be achievable using an idealized decision support tool and perfect weather prediction capabilities. There is general agreement that our ability to predict weather will improve significantly during the next five years. However, it is doubtful that we will achieve either a perfect weather prediction capability or the idealized decision support tool on which the analysis was based.

The analysis report concluded that even if only half of the $270M/year estimated benefit is obtainable after the full implementation of Collaborative Routing, further investment in Collaborative Routing is worthwhile.

Section 6

Next Steps

Research performed to date indicates that the Collaborative Routing capability is both desirable and feasible from both an operational and technical perspective. The introduction of collaboration into the handling of reroutes should lead to improvements in operational efficiencies for both the FAA and air carriers. As noted in Section 5.2, it should also provide significant economic benefit to NAS users. Considerable work remains to be done before Collaborative Routing can become a standard way of doing business within the NAS. Issues which need to be addressed, and a preliminary plan for addressing those issues in the CD phase are presented below.

6.1 Open Issues Requiring Further Investigation

Based on results obtained from this and other Collaborative Routing related research activities, it is recommended that the following operational and technical issues be investigated during the CD phase.

6.1.1 Open Operational Issues

- Identification of flow problems
  - What degree of information exchange and interaction is needed in order to have "common situational awareness" between ATM and the various NAS user segments?
  - What is the most effective role for airspace users in the definition of the problem space (i.e., establishing lateral boundaries, minimum and maximum altitude)?
  - What level of access to other user's planned routes during the problem period is acceptable to the user community?
  - What should be the ATCSCC, TMU, and AOC responsibilities with regards to identifying affected flights and sharing information?
- Resolution strategy development
  - How much problem lead time is required for users to participate in problem solving?
  - What should be the process/procedures for generating problem resolution strategies?
  - What should be the process for controlling collaborative session iterations and reaching closure?
  - How will collaboration sessions affect staffing and workload?

  - To what extent can users mitigate predicted congestion, as part of their independent flight planning, without unknowingly creating congestion in new areas?
- Strategy implementation and compliance monitoring
  - What are the responsibilities and processes for filing amended flight plans for collaborative routing planning session participants and non-participants?
  - What are the responsibilities and processes for handling "gaming" by collaboration participants and non-participants?
  - How do you avoid penalizing users who voluntarily reroute aircraft based on information made available by ATM prior to a collaboration session?

6.1.2 Open Technical Issues

- Identification of flow problems
  - What security measures are needed to satisfactorily protect proprietary information provided by users to the FAA?
  - How far out in time can operationally acceptable traffic predictions be made?
  - How far in advance must the users (air carriers, military, business/general aviation) communicate their "intended" routes to support operationally acceptable traffic predictions in the three to six hour time frames?
  - What information exchange and decision support system changes are needed to make users aware of predicted congested airspace?
- Resolution strategy development
  - How do the FAA and users share the results from their respective decision support systems?
- Strategy implementation and compliance monitoring
  - Is there a more effective and less time consuming way than voice communications for informing controllers of planned reroutes (as well as other TFM strategies)?
  - How do agreements from collaboration sessions get introduced into NAS automation and decision support systems, such as the Host computer, Enhance Traffic Management System (ETMS), Collaborative Routing Coordination Tool (CRCT), and the Center/Terminal Automation System (CTAS)?

6.2 Preliminary Concept Development Phase Plan

Fully implementing Collaborative Routing, as described in this report, involves the deployment of a number of loosely coupled capabilities. This loose coupling makes the Collaborative Routing capability an excellent candidate for piecemeal implementation. For example, visual collaboration tools, such as electronic chalkboards, can be implemented before

an automated strategy assessment capability is fully developed, or information exchange elements fully defined.

It is recommended that CD for Collaborative Routing be accomplished through a piecemeal process involving evolutionary changes in roles and responsibilities, FAA and AOC procedures, and FAA and AOC decision support systems.

The availability of enabling technologies should be used as the driver for the planning and implementation of Collaborative Routing oriented procedures and processes. Roles and responsibilities for ATM and AOC personnel would be changed to support those new procedures and processes.

Technology enablers for the Collaborative Routing capability include information exchange capabilities, visual collaboration tools, an automated problem recognition capability, and a reroute impact assessment capability. There are technology enablers being developed under separate, loosely coupled schedules. Enablers such as the information exchange capabilities and visual collaboration tools should be available within the next one-to-two years. The automated problem recognition and reroute impact assessment capabilities will not be available for at least another three-to-five years. Collaborative Routing CD activities should be structured into two groupings: one addressing the development and application of capabilities which should be available within the next one-to-two years, the other addressing the further out capabilities.

The following enabling technologies are recommended for inclusion in the near term group:

- Initial information exchange (current and future system demand information, airport conditions and capacity information, planned and implemented flow constraint advisories, schedule changes, current and forecasted weather information, and special use airspace status)
- Visual collaboration tools (internal FAA and FAA/users)

The following enabling technologies are recommended for inclusion in the longer term group:

- Enhanced information exchange (detailed user preferences and priorities, preliminary flight routes, aircraft contributing to subject demand/capacity imbalance, airspace specific demand information)
- Automated problem identification tools
- Reroute impact assessment tools (including What-If analysis tools)
- Flight plan feedback for users

For each group, a clear set of operational objectives, development requirements, supporting implementation schedules, and evaluation plans need to be defined.

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Glossary

ACRONYMS

AOC	Aeronautical Operational Center
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCSCC	ATC System Command Center
ATM	Air Traffic Management
CAASD	Center for Advanced Aviation System Development
CE	Concept Exploration
CD	Concept Development
CRCT	Collaborative Routing Coordination Tool
CTAS	Center/Terminal Automation System
DoD	Department of Defense
ETMS	Enhance Traffic Management System
FAA	Federal Aviation Administration
NAS	National Airspace System
NAVAID	Navigational Aide
NOTAM	Notice to Airmen
SUA	Special Use Airspace
TFM	Traffic Flow Management
TMU	Traffic Management Unit

Definition of Terms

Aeronautical Operational Control (AOC): Any organization that provides flight planning and flight following services to NAS users (ICAO definition). Examples include: Airline operational control facilities, military dispatch facilities, and private dispatch centers. All of these organizations are normally responsible for safe and efficient operation of user resources.

Air Traffic Management (ATM): Term denoting a combination of air traffic control separation services and traffic flow management services.

Collaboration: Process of joint decision making based on a mutual understanding of goals (both shared and independent) and situation. Collaboration requires timely and accurate information exchange between NAS users and ATM service providers, and sharing responsibility in NAS system management.

Dispatcher: "A certified airman who shares joint responsibility with the pilot-in-command for the safety of flight over which he/she exercises operational control." (FAA, FAR 121-533)

Enhanced Flight Plan: The future flight plan to be filed by most NAS users. It will include information on preferences and priorities. The idea was developed by the RTCA SC 169 WG5 (AOC-ATM Information Exchange)

Flight Planner: Any party responsible for flight scheduling, flight planning and flight following. Examples include AOC staff, military flight operations staff, and general aviation (GA) pilots.

NAS Users: Aircraft operators, such as air carriers, commuter and air taxi airlines, cargo carriers, military aircraft, and general aviation.

Traffic Flow Managers: Traffic management coordinators (TMCs) at local facilities (centers, terminal areas, and air traffic control towers), and traffic management specialists at the Air Traffic Control System Command Center (ATCSCC).