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Operational Concepts and Data Elements Required to Improve Air Traffic Management (ATM) - Aeronautical Operational Control (AOC) Ground-Ground Information Exchange to Facilitate Collaborative Decision Making

October 6, 1997
RTCA/DO-241

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FOREWORD

This document was prepared by RTCA Special Committee 169 (SC-169) and approved by the RTCA Technical Management Committee (TMC) on October 6, 1997.

RTCA, Incorporated is a not-for-profit corporation formed to advance the art and science of aviation and aviation electronic systems for the benefit of the public. The organization functions as a Federal Advisory Committee and develops consensus based recommendations on contemporary aviation issues. RTCA's objectives include but are not limited to:

- coalescing aviation system user and provider technical requirements in a manner that helps government and industry meet their mutual objectives and responsibilities;

- analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity and efficiency;

- developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and

- assisting in developing the appropriate technical material upon which positions for the International Civil Aviation Organization and the International Telecommunications Union and other appropriate international organizations can be based

The organization's recommendations are often used as the basis for government and private sector decisions as well as the foundation for many Federal Aviation Administration Technical Standard Orders.

Since RTCA is not an official agency of the United States Government, its recommendations may not be regarded as statements of official government policy unless so enunciated by the U. S. government organization or agency having statutory jurisdiction over any matters to which the recommendations relate.

EXECUTIVE SUMMARY

ES-1. INTRODUCTION

RTCA Special Committee (SC) 169 was chartered by the RTCA Technical Management Committee to develop information requirements for Air Traffic Management (ATM)–Aeronautical Operational Control (AOC) ground-ground information exchange applications.

This paper presents the results of one key responsibility of SC-169, namely, developing operational concepts and data elements required for ground-ground ATM-AOC information exchange—in particular, between dispatchers/flight planners for an Aeronautical Operational Control[1] (AOC) and traffic flow managers in the Air Traffic Management (ATM) system. SC-169 considered the documented accounts of user needs, future operating concepts, and implementation recommendations found in such volumes as the *Air Traffic Service Plan, 1995—2000* (FAA, 1995a), the *Final Report of RTCA Task Force 3: Free Flight Implementation* (RTCA, Inc., 1995), and *Airline Operational Control Overview* (FAA, 1995).

Both National Airspace System (NAS) users and NAS service providers are eager to improve the efficiency of the NAS, as seen from their separate perspectives, while maintaining the current level of safety. Information exchange and collaboration between ATM and AOCs using ground-ground communications are a crucial element in achieving this goal. The ATM-AOC information requirements identified by SC-169 represent an early step in developing a structure that enables collaborative decision-making, a key feature of the future NAS.

ATM-AOC information sharing is a feasible step in the progression of capabilities envisioned for a Free Flight system of the future. A near-term capability for ATM-AOC exchange can be implemented relatively quickly, using current technology and the operational information that is currently produced.

[1] In this document, the term AOC is defined in accordance with the International Civil Aviation Organization (ICAO) as any organization providing flight planning and flight following services to airspace users.

ES-2. OPERATIONAL GOALS OF INFORMATION EXCHANGE

The goals of ATM-AOC information exchange are to:

- Promote safety
- Improve the flow of traffic
- Support operational objectives such as fuel savings, operational efficiency, and reduced operational cost

The achievement of these goals requires not just an extensive information exchange, but also could require the development of new decision support tools and procedures to make use of the available information.

ES-3. SC-169 METHODOLOGY AND RESULTS

Working with a series of scenarios representing typical operational situations experienced today, SC-169 has identified information elements that should be exchanged between the AOCs and the ATM system in order to enhance safety and efficiency in the NAS, and to provide greater flexibility to all NAS users in their planning and operations. These information elements are described in Appendix A.

The operational scenarios illustrate how the information is used in an operational context, and are as follows:

1. Mission planning
2. Ground delay program (GDP) or ground stop program
3. Departure management
4. En route weather/reroutes
5. Arrival management
6. Post-analysis/long range planning
7. Oceanic operations
8. General aviation (GA)
9. Military operations

In addition to the scenarios and identification of information elements for ATM-AOC exchange, SC-169 has identified an example target architecture, based on the following guiding principles, to implement future automated information exchange:

1. A single, transparent, and functional information interface
2. Security measures to protect proprietary information
3. Timely and consistent information exchanges
4. An architecture that is expandable, extensible, and scaleable
5. Multiple levels of service to accommodate NAS users' different automation capabilities

ES-4. RECOMMENDATIONS

The focus of this Operational Concept is the identification of information elements involved in the ground-ground information exchange between ATM and AOCs. Additional work must be performed to realize a NAS that fully supports this information exchange. The following activities are recommended as a follow-up to SC-169's efforts:

1. A short-term committee—composed of representatives from ATM, NAS users, and other interested organizations—for the purposes of identifying sources of the information elements identified in this Operational Concept
2. Near-term actions to obtain immediate benefit from information exchange, including expediting the following exchange efforts:
    a. Current and near-term demand and capacity information (with sensitive information filtered, as necessary), obtainable from the ATM's Enhanced Traffic Management System (ETMS); inclusion of the Remarks field as part of the ETMS data from the ATM system to NAS users; and timely updates of the ETMS interface between the ATM system and the NAS users
    b. Collaborative Decision Making Ground Delay Program (CDM GDP) enhancements
    c. Inclusion of data about GA and other unscheduled flights in the ATM-NAS user ETMS interface
    d. Experimental AOC participation in TFM's Eastern Region Hotline
    e. NAS status information, including airport status, Special Use Airspace (SUA) status, and airport field conditions
    f. Pilot Reports (PIREPs) and Notices to Airmen (NOTAMs) for nation-wide distribution (rather than some classes that are available only by contacting a specific local ATC facility)
    g. Wide area network (WAN) based electronic mail capability between TFM facilities and NAS user facilities, where the WAN is segregated from extraneous and Internet traffic either by a firewall or by isolation
3. An FAA-industry developed strategy for evolution to a future architecture that supports ATM-AOC information exchange
4. Development of operational concepts for an ATM system that operates under the principle of collaborative ATM-AOC decision making, including the following:
    a. Examination of how NAS users and the ATM system can participate more collaboratively in the decision making process with regard to development of strategy options, selection of flights to meet an ATM-specified capacity allocation, and departure options when a GDP or a planned ground stop has been activated
    b. Information exchange requirements associated with the military and GA users
    c. ATM/AOC collaborative decision making in an integrated oceanic/domestic flow management environment

5. Development of an expanded flight plan to provide better information for management of NAS resources and for more accurate predictions of demand for those resources, and identification of steps toward implementing such a flight plan

6. Development, in an evolutionary manner, of an ATM system that supports the operational concepts (see Recommendation 5)

7. Development of an effective program for providing assessments of NAS performance to ATM and AOCs

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1.0 INTRODUCTION

1.1 Purpose

This document identifies information to be exchanged by the ATM system and AOCs using automation and ground-to-ground communications. It is the intention of SC-169 that this document be used by the aviation industry in designing, developing, and implementing a system to support such information exchange.

1.1.1 A Mandate for Information Requirements

Government and industry have recognized the need for enhancing the information exchange capability between Air Traffic Management (ATM) and Aeronautical Operational Control[1] (AOC), and the potential benefits from this exchange. ATM-AOC information sharing is featured in the catalog of customer needs that opens the *Air Traffic Service Plan, 1995–2000* (FAA, 1995a), and it appears throughout the operational concept and recommendations in the *Final Report of RTCA Task Force 3: Free Flight Implementation* (RTCA, Inc., 1995) and in the *Airline Operational Control Overview* (FAA, 1995).

These documented accounts of user needs, future operating concepts, and implementation recommendations were considered in the work of RTCA Special Committee (SC) 169, which was chartered by the RTCA Technical Management Committee to develop requirements for ATM-AOC ground-ground information exchange applications. This paper presents the results of one key responsibility of SC-169, namely, developing operational concepts and required data elements for ATM-AOC ground-to-ground information exchange.

1.1.2 What Is ATM-AOC Information Exchange?

ATM-AOC applications consist of functions that permit two-way information exchange between ATM and AOCs on resource constraints, aeronautical operating plans, and NAS user preferences. More specifically, NAS users interact with the ATM system primarily in two ways: as pilots communicating with controllers at towers, approach control facilities, and en route centers, and as dispatchers/flight planners communicating with traffic flow managers at these Air Traffic Control (ATC) facilities and at the Air Traffic Control System Command Center (ATCSCC).

Pilot-controller interaction is concerned with the gate-to-gate operation of a single flight. The interaction of dispatchers/flight planners with traffic flow managers in the ATM system involves a larger set of concerns arising from the pre-departure planning of routes, fuel loads, alternate airports, and other flight parameters, as well as the scheduling of multiple operations by a single air carrier or other NAS user. It is this second type of interaction, the ground-to-ground communication between dispatchers/flight planners at an AOC and traffic flow managers in the ATM system, that is the topic of these operational concepts.

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[1] In this document, the term AOC is defined in accordance with the International Civil Aviation Organization (ICAO) as any organization providing flight planning and flight following services to airspace users.