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CONCEPTS FOR SERVICES INTEGRATING FLIGHT OPERATIONS AND AIR TRAFFIC MANAGEMENT USING ADDRESSED DATA LINK

RTCA DO-269
June 12, 2001

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FOREWORD

This report was prepared by Special Committee 194 (SC-194) and approved by the RTCA Program Management Committee (PMC) on June 12, 2001.

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 Telecommunication 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.

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EXECUTIVE SUMMARY

This document presents concepts and considerations for future Air Traffic Management (ATM) services that will enhance the overall safety and efficiency of the National Airspace System (NAS). A set of nine integrated service concepts is described that integrates flight operations and air traffic management using Aeronautical Data Link (ADL). The services are: Basic Information Exchange: (1) FMS-ATM-AOC Calibration, (2) NAS Status Information; (3) UPT Flight Planning/Replanning; (4) Flexible Arrival and Departure Routing; (5) Surface Movement; Reduced Separation: (6) Non-Radar Environment; (7) Radar Environment; Communications Management: (8) Automatic Voice Frequency Change; and (9) Emergency Notification. These services introduce operational advantages that go beyond the Air Traffic Services (ATS) defined in the first stage of the Federal Aviation Administration (FAA) implementation of the Aeronautical Telecommunications Network (ATN) known as Controller/Pilot Data Link Communications (CPDLC) Build I/IA. They also introduce benefits beyond those that are enabled with ARINC Aircraft Communication Addressing and Reporting System (ACARS) and Future Air Navigation System- (FANS-) 1/A.

These integrated services were identified from a wide list of potential services as ones that may yield attractive benefits to all stakeholders through the integration of Aeronautical Data Link System (ADLS) with airborne systems and/or ground automation. More than just introducing an ADLS, these Integrated Services are formulated to achieve a net benefit that is greater than the sum of the contributions of the enabling technologies (e.g., flight deck automation, ATM Decision Support Tools, communications). Each service is organized and presented in a spiral evolution to facilitate early operational benefits that leverage value-added combinations of key capabilities.

A primary contribution of this document is the identification of those capabilities that are required in order to enable the Integrated Services including the required datalink messages that should be considered for the ADLS Build II implementation program. Because there are other enabling capabilities to consider, each of these services was evaluated for viability of implementation given the availability of resources. In all cases, spiral development stages were defined that make use of ADLS capabilities and other capabilities in an incremental implementation to provide incremental value to the user. For each spiral stage, all supporting messages were categorized by inclusion in the International Civil Aviation Organization (ICAO) Baseline 1, Baseline 2, or beyond the current definition of messages contained in the SARPs. Those that are beyond SARPs are identified clearly so that future work can include these messages. Some benefits can be obtained by implementing Integrated Services that require only CPDLC Build I/IA avionics.

A second contribution is the identification of key issues (technical feasibility and operational viability) that must be addressed by the R&D community to develop the knowledge necessary to support implementation decisions on the more advanced/farther-term service concepts. As these concepts feed into research and validation activities for the FAA, NASA and other stakeholders, they may provide a path from consensus on future implementations. These concepts, once matured through the research process, should be considered for integration into future development of ADLS.

The following specific recommendations are made:

1. Consideration should be given to this set of Integrated Services in the definition of ADLS Build-II Plans and Principles to select aspects and stages that are appropriate for inclusion.
2. Start SARPs approval process for the new messages identified.
3. Continue benefits/risk analysis to prioritize services.
4. Prepare an implementation roadmap with timelines, interdependencies, organizational roles, and validation programs.
5. Focus the validation, analysis, and implementation efforts through a combined industry/Government steering group.

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PART I: OVERVIEW OF ADL INTEGRATED SERVICES

1.0 INTRODUCTION

1.1 Purpose and Scope

The purpose of this document is to define, describe, and recommend future Air Traffic Management (ATM) service concepts, enabled by the Aeronautical Data Link System (ADLS), that may enhance overall aviation operational efficiency through the integration of ATM, Aeronautical Operational Control (AOC), and flight deck (FD) automation. These "Integrated Services" are limited, in scope, to those services that leverage air-ground addressed datalink capabilities from preflight planning through gate-to-gate flight operations. Several of these "Integrated Services" contain concepts, such as airborne self-separation, delegated separation responsibility, and reduced separation standards, which have yet to be determined to be feasible to implement within the National Airspace System (NAS). The goal is to achieve synergistic benefits through the integration of ATM, FD, and AOC capabilities. Each service is presented in spiral stages of evolution with an emphasis on the mechanisms for achieving qualitative benefits.

One objective of this document is to define the elements needed to enable these Integrated Services. This includes possible datalink requirements for the U.S. Federal Aviation Administration's (FAA's) implementation of the Aeronautical Telecommunications Network (ATN) known as Aeronautical Data Link System (ADLS) Build II. The emphasis in this document is on recommended messages to be included within ADLS Build II that are needed to support the Integrated Services. Other enabling capabilities include flight deck, ATM, and AOC decision support systems as well as supporting Communications, Navigation, and Surveillance (CNS) technologies. While this document focuses on the services that use addressed ADL, other communication means that are considered as enabling capabilities are also contained in the detailed information flow sections for each service.

Another objective is to identify the critical path issues (programmatic, technical feasibility and operational viability) that must be addressed to by the R&D community to validate these service concepts. As these concepts feed into research and validation activities for the FAA, NASA and other stakeholders, they may provide a path from consensus on future implementations. These concepts, once matured through the research process, should be considered for integration into future development of ADLS. This is intended to help organizations identify their priorities, define their work programs, and prepare their business cases and mission needs statements in order to facilitate the development and implementation of ADLS and enabling capabilities to achieve these Integrated Services.

1.2 Intended Audience

This document is intended for National Airspace System (NAS) stakeholders. This encompasses all NAS users (air carrier, general aviation [GA], military, etc.), service providers (air traffic, controllers, specialists, etc.), manufacturers (avionics, airframe,), the supporting research and development community and standards organizations.

1.3 Approach

The approach taken in the definition of Integrated Services is to first define the operational problems that need to be addressed and then formulate operational concepts that can solve the problems. This approach formulates "Integrated Service" solutions for