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Minimum Human Factors Standards for Air Traffic Services Provided Via Data Communications Utilizing the ATN, Builds I and IA

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Foreword

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- 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.

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1.0 Purpose and Scope

1.1. Introduction

This document defines minimum human factors requirements and guidelines for air traffic services (ATS) data link communications between an air traffic specialist and a pilot utilizing the Aeronautical Telecommunications Network (ATN). The scope is the initial Controller-Pilot Data Link Communications (CPDLC) capabilities which comprise the Build I and Build IA phases of the United States (US) implementation path.

In the US, initial CPDLC capabilities will be implemented in Air Route Traffic Control Centers (ARTCCs) and available to support ATS in the contiguous domestic en route airspace radar environment. CPDLC communications will generally encompass the transition and cruise phases of flight. The initial CPDLC capabilities, discussed in this document, will not be available in US en route oceanic airspace. An early (non-ATN compatible) CPDLC service has been available in US oceanic airspace since 1995. A later phase of the US CPDLC implementation path will field an interoperable CPDLC service in domestic and oceanic en route airspace.

The operational ATS CPDLC system includes an Aeronautical Telecommunications Network (ATN) interface, the Context Management Application (CMA), and CPDLC service requirements. CPDLC message assurance and addressing requirements are supported by the ATN protocols and the CMA, respectively. Key assumptions regarding the operational environment, the role of the ATN, the CMA application, and the CPDLC services in supporting the human factors requirements are presented in the following section.

Human factors considerations are an important element of ATS CPDLC system performance. As illustrated in Figure 1-1, human factors requirements address many aspects of aircraft and ground system equipment, training, and procedures. From a human factors perspective, it is critical that CPDLC ATS messages be checked for reasonableness and implications to flight safety. Moreover, because the system is expected to be used often during controller and pilot operations, the process of interacting with the ATS CPDLC system must be as simple and as easy as possible to reduce the total number of keystrokes that must be made and the amount of attention that must be paid to CPDLC operations. This document therefore contains minimum human factors requirements and guidelines needed to address CPDLC safety, error protection, ease of use, and user acceptance. These requirements will be used by designers, manufacturers, installers, and operators of the CPDLC flight deck and ground system equipment. To facilitate understanding and use of this document by these categories of readers, the requirements and guidelines are grouped into two sections: flight deck and ground system.

Compliance with these requirements is recommended as one means of assuring that the human-computer interface component of the equipment performs its intended functions satisfactorily under all conditions normally encountered in routine aeronautical operations. Any regulatory application of these standards is the sole responsibility of the appropriate governmental agencies.

Section 1.0 provides information on purpose and scope needed to understand the rationale for equipment characteristics and standards stated in the remaining sections. It describes typical

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equipment applications and operational goals as well as establishes the basis for the standards stated in Sections 2 and 3.

Section 2.0 contains standards for the flight deck equipment, equipment installation, and operations. This section also describes the equipment operational performance characteristics and defines conditions that will assure that flight crew operations can be conducted safely and reliably in the expected operational environment.

Section 3.0 contains standards for the air traffic service ground system equipment, equipment installation, and operations. This section also describes the equipment operational performance characteristics and defines conditions that will assure that air traffic service specialist (ATSS or controller) and airway facilities technician (AFT or technician) operations can be conducted safely and reliably in the expected operational environment.

The document contains eight appendices. Appendix A defines the acronyms and abbreviations used in this document. Appendix B defines the acronyms and abbreviations to be used in composing pre-defined free text messages. Appendix C defines the CPDLC Build I/IA Message Set. Appendix D provides guidance on flight crew procedures and training. Appendix E provides guidance on ATS Specialist procedures and training. Appendix F provides guidance on the use of color. Appendix G provides guidance for controls. Appendix H defines CPDLC Build I/IA error conditions and associated message text.

Standards for the design and implementation of optional features, beyond those required for a minimum CPDLC capability, only apply if those features are implemented. This document also includes minimum requirements for the operational environment for which these requirements are appropriate.

1.2 System Overview

1.2.1 Current En Route CPDLC Implementation Path

The currently accepted CPDLC path provides for a phased-implementation of ATN-compatible CPDLC services, beginning with a key site implementation of a limited set of services and maturing to a national deployment of a full set of services. To mitigate implementation risks, the FAA will develop CPDLC in incremental phases, with additional messages and capabilities supported for each build. " It should be noted that these risks are largely related to operational use of CPDLC. It is assumed that transition to phases beyond Builds 1 and IA will be contingent upon the success and "lessons learned" from these builds. That is, the evolutionary CPDLC acquisition process assumes that issues and improvements identified from initial operational use are fed into the ongoing development activities to facilitate deployment of increasingly mature baseline capabilities with each increment of new CPDLC capability.

Note: Principles and guidance for operations in transition phases are provided in DO-250.

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