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ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

Agenda Item 7 : Aeronautical air-ground and air-to-air communications

AIR-GROUND DATA LINK IMPLEMENTATION: VDL/ATN AND HFDL

(Presented by ARINC Incorporated)

SUMMARY

ARINC has developed and deployed two ICAO SARPs compliant air-ground data link communications systems since the Tenth Air Navigation Conference. This paper briefly describes recent activities and current status of the VDL Mode 2/ATN and HFDL GLOBALink services.

Action by the conference is in paragraph 4.

1. INTRODUCTION

1.1 Air-ground communications are fundamental to providing safe, regular, efficient, and economic air transportation. The provision of air-ground aviation safety communications services is a core activity for Aeronautical Radio, Inc. (ARINC). At the forefront of air-ground data link communications, ARINC supports over 8 000 aircraft worldwide, and transports 24 million messages each month. ARINC has deployed the world's most extensive very high frequency (VHF) digital link (VDL) Mode 2 infrastructure and is the sole provider of global high frequency data link (HFDL) services. The aeronautical telecommunication network (ATN) compliant VDL Mode 2 and HFDL communications services provided by ARINC comply with the appropriate ICAO Standards and Recommended Practices (SARPs).

1.2 ARINC has provided strong support to a wide range of air traffic control (ATC) data link initiatives since introducing data link to civil aviation in 1978. The established plans of ARINC to stimulate airline implementation of data link, through benefit of additional applications and data link capacity, complement ICAO initiatives. To support the widespread implementation of these air-ground data link

communications services, integration and test stations have been provided to the factory sites of Boeing, Airbus, Rockwell Collins, Honeywell and Teledyne.

1.3 The following sections briefly describe recent activities, current status, and future plans for two SARPs compliant air-ground data link communications systems activated within the past six years — VDL Mode 2 and HFDL.

2. VDL MODE 2

2.1 PETAL trials

2.1.1 In 2001, a controller-pilot data link communications (CPDLC) application using an ATN compliant VDL Mode 2 air-ground communications subnetwork was demonstrated in successful trials in Europe in the PETAL IIe (preliminary EUROCONTROL test of air-ground data link II (extended)) program. These trials included ARINC VDL Mode 2 ground stations and related infrastructure, American Airlines Boeing 767-300ER aircraft equipped with Rockwell-Collins avionics, BAC 111 aircraft, and ATC controllers from Maastricht Center.

2.1.2 As planned, PETAL IIe demonstrated operational suitability for CPDLC over ATN/VDL Mode 2. In addition, a thorough technical and operational evaluation of CPDLC, VDL Mode 2, and Rockwell-Collins avionics was achieved including interoperability in an operational environment. Establishing an end-to-end operational capability identified and resolved many issues. As a result, these trials significantly reduced risk for the United States based CPDLC Build 1 deployment in Miami and the Link 2000+ program in Europe.

2.2 CPDLC operational service

2.2.1 Building upon the PETAL effort, the Federal Aviation Administration (FAA), American Airlines, and ARINC established the first operational CPDLC service complying with the ICAO ATN SARPs in the Miami Air Route Traffic Control Center (ARTCC) in 2002. FAA deployed a new ATN compliant CPDLC end system compatible with current HOST and controller displays, and trained all facility controllers. American Airlines, with Rockwell Collins and Boeing, installed new ATN/VDL Mode 2 avionics, on its 757/767 aeroplanes. ARINC deployed thirteen VDL Mode 2 ground stations to provide coverage throughout the facility airspace. Affiliated infrastructure includes redundant ATN air-ground and ground-ground routers. Figure 1 illustrates the ATN/VDL Mode 2 network for the Miami ARTCC.

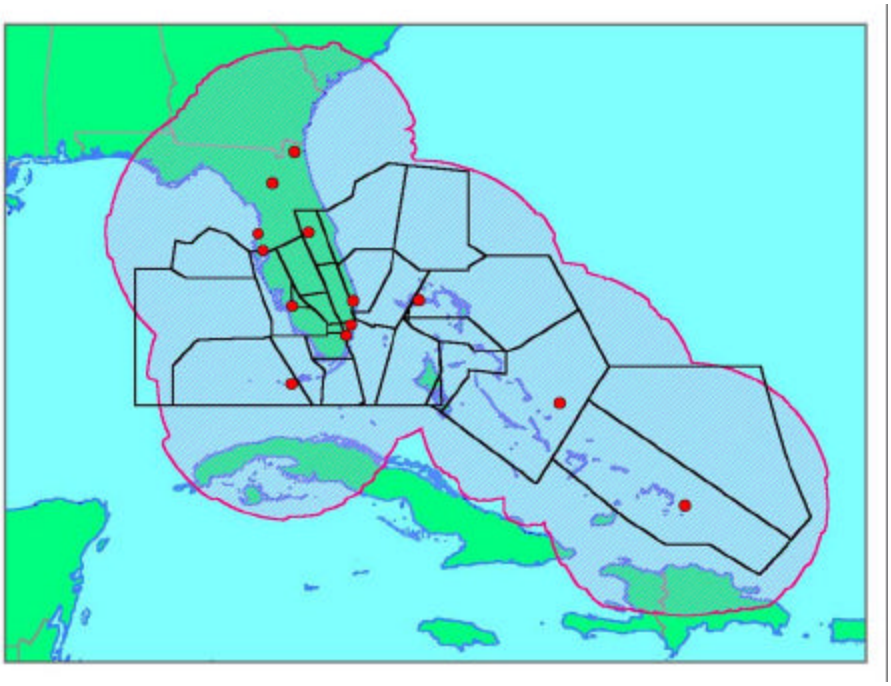

Figure 1. VDL/ATN ground station network

2.2.2 During the first eight months of 2002, a comprehensive ground and flight test programme was conducted to validate the technical functionality, interoperability, and operational suitability of the new installations and procedures for their use. This effort concluded with several certification test flights and award of a supplemental type certificate to American and operational approval for ATN/CPDLC over the ARINC VDL Mode 2 network in the Miami ARTCC.

2.2.3 Initial daily use commenced in October 2002 with a limited set of messages consisting of Initial Contact, Transfer of Communications, Altimeter Setting, and Menu Text. By mid-2003 twenty-two aircraft were participating; over 5 000 pilot to controller data link transactions had been conducted, consisting of 26 000 uplinks and downlinks; and required performance levels were being achieved. Domestic operational availability exceeded 99.999 per cent with transit delay times significantly less than half that allocated to the communications link.

2.3 Future VDL Mode 2 plans

2.3.1 ARINC will continue deploying ATN compatible VDL Mode 2 ground stations in the United States, with 160 sites anticipated by the end of 2003. Current plans also include the deployment of ATN/VDL Mode 2 ground stations in Europe to support the European air navigation service providers (ANSPs) and airline customers. AVICOM, is also deploying an ARINC developed VDL Mode 2 network in Japan during 2003. Future expansion of VDL Mode 2 will be determined by the needs of airline customers and worldwide ANSPs and the United States FAA.

3. HFDL

3.1 HFDL system overview

3.1.1 ARINC initiated service of its SARPs compliant HFDL system in January 1998. During 2003, fourteen geographically diverse HFDL ground stations, transmitting on 30 active frequencies, will provide near global, air-ground data link coverage. The exception is Antarctica. HFDL provides the world's only data link communications capability in the North Polar Region.

3.1.2 HFDL ground stations are operational in New York, California, Alaska and Hawaii, USA; Guam; South Africa; Bolivia; New Zealand; Thailand; Russia; Ireland; Iceland and Bahrain. Installation activities have also been initiated in the Canary Islands. Figure 2 illustrates the HFDL ground station sites and coverage.

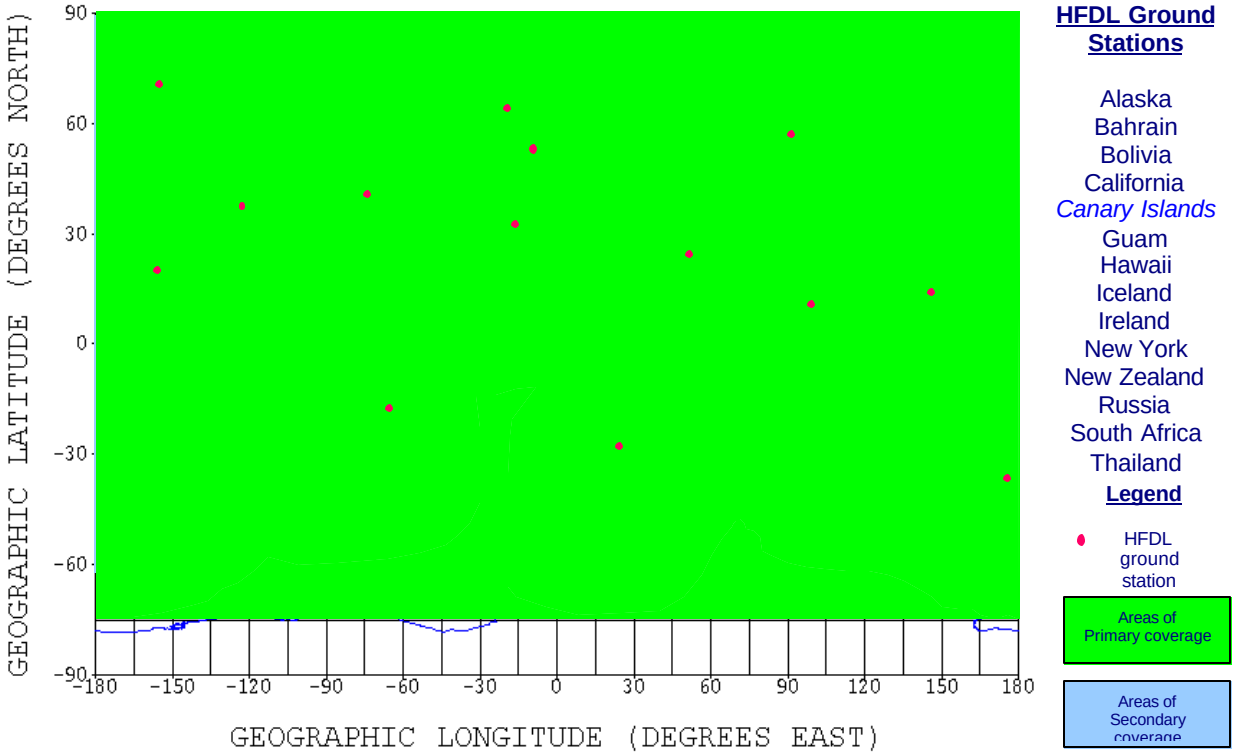

Figure 2. HF data link ground station sites and global coverage

3.1.3 An adaptive frequency management programme changes the active frequencies at each site in response to atmospheric conditions, such as day-night temperature changes and ionospheric anomalies, to achieve optimum propagation and to avoid interference with nearby HFDL ground stations or HF voice stations.

3.1.4 There are nearly 300 HFDL-equipped aircraft transmitting more than 400 000 messages per month. Operational availability exceeds 99 per cent with an uplink message success rate greater than 97 per cent.

3.2 Using HFDL for air traffic service

3.2.1 In the United States the FAA has indicated its acceptance of HFDL for air traffic services (ATS) messages as a back-up to VHF and satellite data link communication.

3.2.2 In the North Atlantic, NAV CANADA, NAV-Portugal and UK NATS have been conducting pre-operational trials of flight management computer (FMC)-generated Waypoint Position Reports for ATS use. These reports are downlinked by a number of airlines including Continental and Finnair B757s, which use HFDL as their sole oceanic data link medium. This data collection/analysis activity has been on-going since November of 2002. Based on the data analysis to date, the ANSPs estimate advancing to operational trials (no voice reports required) by the fall of 2003.

3.3 Future HFDL plans

3.3.1 Current HFDL sites average two transmitting frequencies. The ground stations are capable of managing six frequencies each. As equipage and usage grow, ARINC will expand site configurations as required.

4. ACTION BY THE CONFERENCE

4.1 The conference is invited to review the information contained in this paper and:

a) note the progress being made in advancing the use of data link communications for controller-pilot data link communications; and

b) recommend the continued implementation and expanded use of ICAO standardized data links for harmonized air traffic communications worldwide.

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