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ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

(DRAFT) REPORT OF COMMITTEE B ON AGENDA ITEM 7

The attached constitutes part of the draft report on Agenda Item 7 and is presented for approval by Committee B for submission to the Plenary.

(7 pages)

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

7.1 INTRODUCTION

7.1.1 Under this agenda item, the meeting reviewed the developments on aeronautical mobile communications since the Tenth Air Navigation Conference and in particular considered the planned evolution of existing communication systems and the potential development of future ones in the framework of the global air traffic management operational concept.

7.2 BACKGROUND

7.2.1 The meeting recalled that in September 1991, the Tenth Air Navigation Conference had met to consider and endorse the concept of a future air navigation system, as developed by the Special Committee on Future Air Navigation System (FANS) to meet aviation needs well into the next century.

7.2.2 The meeting noted with appreciation that since the Tenth Air Navigation Conference, ICAO technical bodies had conducted significant development work addressing the communications issues identified by the FANS Committee and by the Tenth Air Navigation Conference. As a result, several amendments to Annex 10 had been introduced, including:

a) Amendment 70 (applicability date: 9 November 1995), including new Standards and Recommended Practices (SARPs) for the aeronautical mobile-satellite service (AMSS);

b) Amendment 71 (applicability date: 7 November 1996), including specifications for the Mode S data link, material relating to the introduction of 8.33 kHz channel spacing, changes to material related to the protection of air-ground communications in the VHF band and technical specifications relating to the RF characteristics for the VHF digital link (VDL);

c) Amendment 72 (applicability date: 6 November 1997), including SARPs and guidance material for VHF digital link (VDL-Mode 2);

d) Amendment 73 (applicability date: 5 November 1998), including material relating to the ATN and changes to specifications of the Mode S data link and subnetwork;

e) Amendment 74 (applicability date: 4 November 1999), including SARPs for HF data link;

f) Amendment 75 (applicability date: 2 November 2000), including changes to the AMSS SARPs introducing a new antenna type, a new voice channel type and enhanced provisions for interoperability among AMSS systems; changes to the VDL SARPs to reduce potential interference to current VHF voice communication systems caused by

VDL transmitters; and changes to the VHF voice communication SARPs to enhance immunity to interference from VDL transmitters on board the same aircraft;

g) Amendment 76 (applicability date: 1 November 2001), including ATN system management, security and directory services; integrated voice and data link system (VDL Mode 3); and data link satisfying surveillance applications (VDL Mode 4);

h) Amendment 77 (applicability date: 28 November 2002), including changes to SARPs addressing issues encountered during tests and operational trials of the Mode S data link subnetwork; and

i) Amendment 78 (expected to become applicable in November 2003), including consequential amendments to ATN SARPs relating to the inclusion of VDL Modes 3 and 4 in the table of priorities.

7.2.3 Work had also been conducted on the optimal use of aeronautical radio spectrum, the maintenance of communications systems standards to ensure continued viability and the examination of future requirements and systems to meet the increasing demands of ATM.

7.2.4 The meeting recognized that, notwithstanding the developments over the last decade, elements of the shortcomings that had been identified by the FANS Committee were still present, including, inter alia:

a) disparate services and procedures resulting from differing systems and limited system and decision support tools;

b) a reliance on increasingly congested voice radio communications for air-ground exchanges;

c) limited facilities for real-time information exchange between ATM, aerodromes and aircraft operators, resulting in less than optimal responses to real-time events and changes in the users' operational requirements;

d) the limited ability to maximize benefits for aircraft with advanced avionics; and

e) the long lead-times involved in developing and deploying improved systems in aircraft fleets or in the ground infrastructure.

7.2.5 It was noted that a number of activities were being conducted to address those limitations:

a) in its participation to International Telecommunication Union (ITU) activities, ICAO was actively supporting the introduction of additional radiofrequency spectrum allocations to meet requirements for increased communication capacity and new applications. In parallel, ICAO was also promoting the development of new techniques to increase the efficiency of use of the existing aeronautical spectrum allocation;

b) with regard to the provisions for voice and data communications systems contained in Annex 10, ICAO activities focused on ensuring that SARPs were up to date and applicable and interoperable on a global basis; and

c) with respect to future digital voice and data communications systems, research and development work on air-ground communications was being monitored, including the use of new modulation schemes, protocols, and frequency bands.

7.2.6 The meeting noted that these activities would be continued to enable international civil aviation to meet future communication requirements in a spectrum-efficient manner and enable gradual implementation of the ATM operational concept.

7.3 IMPLEMENTATION STATUS AND PROGRAMMES

7.3.1 The conference was provided with information on status of the activities undertaken by several States and international organizations towards the operational implementation of various air-ground data links in support of air traffic services (ATS) applications.

7.3.2 A summary of the information is shown in the following paragraphs.

7.3.3 Implementation of air-ground data links in Japan

Transition to VDL

7.3.3.1 The meeting was informed that the Japan Civil Aviation Bureau (JCAB) was in the process of studying the future implementation of VDL Mode 3, recognizing that ATS providers needed a reliable and high-speed VHF voice and data communication system and that the rapid growth in air traffic required a dramatic increase of VHF channel capacity. The Electronic Navigation Research Institute (ENRI) had been working on research and development (R&D) of the VDL Mode 3 system since 1998 and would be conducting actual flight tests for evaluation of data link performance and voice quality in 2003.

Transition to AMSS

7.3.3.2 The meeting noted that, in order to cope with the rapid increase of international traffic in North Pacific (NOPAC), JCAB had decided to develop a new aeronautical satellite system called multifunctional transport satellite (MTSAT) in 1994. In addition to its SBAS functions (Section 6.1.3 refers), the MTSAT system also supported aeronautical mobile-satellite service (AMSS) functions. The AMSS function of MTSAT system was fully compliant with the AMSS SARPs and fully supported all types of aeronautical communications defined by ICAO. The ATS messages through MTSAT system in Japanese FIR would be handled by JCAB in the same manner as very high frequency (VHF) and high frequency (HF) voice communications in the current ATS environment, whereas the aeronautical operational control (AOC), aeronautical administrative communication (AAC) and aeronautical public communications (APC) messages would be handled separately by a service provider (SITA). JCAB had signed an operational agreement with Inmarsat, which was providing AMSS services worldwide, in order to assure full interoperability between

MTSAT and the Inmarsat system. Therefore, the aircraft earth station (AES) currently operating in the Inmarsat system would be able to use the MTSAT system without any modification to aircraft systems by simply adding MTSAT data to their satellite data unit (SDU).

7.3.4 Data link flight information services (DFIS) applications in China

7.3.4.1 The meeting was informed that China had conducted trials at Hong Kong International Airport on the dissemination of the ATIS and VOLMET via data link (D-ATIS and D-VOLMET) and on pre-departure clearance (PDC) delivery to aircraft. Aircraft equipped with the appropriate aircraft communications addressing and reporting system (ACARS) and the required software (compliant to AEEC Specifications 618, 620, 622 and 623) could access and/or receive the full script of the D-ATIS, D-VOLMET and PDC messages. China was considering to extend the D-ATIS and PDC delivery services via data link to other major airports in China. At the same time, use of other data link technologies, including ACARS over aviation VHF link control (AOA) and VHF digital link (VDL) was being explored.

7.3.4.2 The meeting noted that the known intrinsic limitation of the ACARS system did not have a significant impact on information of broadcast nature, such as DFIS, as information could be accessed at the will of the pilots in advance. The implementation of DFIS through the ACARS system could also promote more efficient utilization of avionics that were already available. The identified operational and/or safety benefits gained as a result of these applications of data link flight information services were noted with appreciation.

7.3.5 Implementation of ICAO air-ground data link by ARINC

HFDL

7.3.5.1 The meeting was informed that ARINC had initiated service of its SARPs-compliant HFDL system in January 1998. During 2003, fourteen geographically diverse HFDL ground stations, transmitting on 30 active frequencies, would provide near global (with the exception of Antarctica) air-ground data link coverage. An adaptive frequency management programme changed 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. ARINC would expand site configurations as required by equipage and usage growth. There were nearly 300 aircraft equipped with HFDL (mostly transmitting for AOC and AAC). Operational availability exceeded 99 per cent with an uplink message success rate greater than 97 per cent. An operational trial of HFDL in support of waypoint position reporting was under way in the North Atlantic.

VDL

7.3.5.2 In 2002, ARINC had installed and deployed thirteen VDL Mode 2 ground stations to provide coverage for the US FAA's CPDLC Build 1 programme in the Miami Air Route Traffic Control Center (ARTCC). The associated infrastructure included redundant ATN air-ground and ground-ground routers. Further deployment of VDL Mode 2 (in an ATN environment) by ARINC was planned in Europe and Japan.

7.3.6 SITA AIRCOM data link service

7.3.6.1 The meeting was informed that SITA VHF AIRCOM service (mainly based on ACARS) provided near global coverage with around 700 VHF stations deployed in over 170 countries around the world. The service was used by over 5 000 aircraft mostly for AOC and AAC.

7.3.6.2 The SITA Satellite AIRCOM Data Link service was being used by over 1 500 aircraft that generated an average of 50 000 kilobits of traffic on a daily basis and provided global coverage (except polar regions) via Inmarsat geo-stationary satellites. The service was currently used in ACARS mode but was capable of providing AMSS SARPs-compliant services since its launch.

7.3.6.3 Both VHF and Satellite AIRCOM services supported FANS-1/A operations. The SITA deployment of VDL Mode 2 services had started in 2001. At present there were 25 sites with operational VDL Mode 2 service and this number would increase to over 40 sites by the end of the first quarter of 2004.

7.3.7 FAA's next generation air/ground communications (NEXCOM) and Capstone programmes

NEXCOM

7.3.7.1 The meeting noted that VDL Mode 3 had been selected by the United States FAA for its NEXCOM programme to fulfil requirements for added spectrum capacity, replacement of ageing air-ground communication infrastructure, high-integrity secure and interference-free data path. To facilitate transition, development of a ground-based multi-mode digital radio (MDR) capable of VDL Mode 3, and analog 25 kHz/8.33 kHz operation had been undertaken. Final operational approval of the radio was in progress.

7.3.7.2 Three manufacturers were developing multi-mode avionics that would incorporate VDL Mode 3 for the commercial air transport and general aviation markets. Furthermore, an agreement was in process to develop the same for business jet and commuter market. The Certification Branch of the FAA was currently developing technical standard orders (TSO) to support the installation approval process of the users. A system demonstration involving pre-production avionics and the ground test bed was scheduled at the William J. Hughes Technical Centre for November 2003.

7.3.7.3 Full-scale development of the ground system was scheduled to begin in early 2005 and continue through 2007 allowing for first implementation of a fully digital air-ground infrastructure in selected sectors by 2009.

Capstone

7.3.7.4 As part of the United States FAA's Capstone programme, there were over 180 aircraft in Alaska equipped with universal access transceiver (UAT)[1]. Additionally, ten ground stations had been

[1] UAT is a broadcast data link designed for ADS-B applications. SARPs development for the UAT is under way within the Aeronautical Communications Panel (ACP).

installed. In January 2001, the FAA had approved the use of UAT/ADS-B to support "radar-like services" for equipped aircraft in areas of Western Alaska without radar coverage. This represented the first operational use of ADS-B to support air traffic services. The Capstone programme was planning to upgrade the installed avionics and ground stations to comply with UAT RTCA MOPS. Additionally, the programme planned to award new contracts for 200 additional avionics suites to equip aircraft in Southeast Alaska and for 30 new ground stations.

7.3.8 **Modernization of aeronautical communications in India**

7.3.8.1 The meeting noted that, considering the increase in air traffic growth over Indian terrestrial airspace, the oceanic airspace of the Bay of Bengal and the Arabian Sea and advent of new technology and infrastructure in the data communication, the Airports Authority of India (AAI) had drawn plans to improve air-ground communication infrastructure in accordance with the regional communications, navigation, and surveillance/air traffic management (CNS/ATM) plan. Implementation of the plan was being carried out in phases.

7.3.9 **Modernization of the Brazilian VHF data link communications services**

7.3.9.1 The meeting was informed that the Brazilian DATACOM system was an air-ground digital communication system operating in the VHF band and aimed at reducing the amount of voice communications through automatic data transmission. The system allowed exchange of ATS, AOC and AAC messages between ground users (ATC facilities and airlines) and aircraft. The system was based on ACARS technology. A modernization programme was under way, aimed at introducing VDL Mode 2 technology to optimize data link traffic in those sites already approaching saturation levels. Departure clearance and digital ATIS air traffic services would be supported.

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