AN-Conf/11-WP/194
25/9/03

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.

(8 pages)

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

7.4 ADS-B data links

7.4.1 The meeting recalled that automatic dependent surveillance-broadcast (ADS-B) was defined in Annex 10 as a surveillance technique in which aircraft automatically provided, via a broadcast mode data link, data derived from on-board navigation and position-fixing systems, including aircraft identification, four-dimensional position, and additional data as appropriate.

7.4.2 Progress in the development of an ADS-B concept of use had been discussed under Agenda Item 1, which focused on the role of ADS-B as an enabling concept in support of a global ATM operational concept. In that context, it had been noted that one of the constraints to be taken into account as a part of the activities leading to the implementation of ADS-B was the availability of standardized technology. Thus, the meeting proceeded to address some of the associated issues from a technical standpoint.

7.4.3 Comparative analyses/data link evaluations

7.4.3.1 The meeting was informed that, at the request of the Air Navigation Commission (ANC), the Aeronautical Mobile Communications Panel (AMCP) had considered a comparative analysis of the following three ADS-B data links:

a) secondary surveillance radar (SSR) Mode S extended squitter;

b) VHF digital link (VDL) Mode 4; and

c) universal access transceiver (UAT).

7.4.3.2 In the course of the analysis, the data links had been assessed and compared against a number of criteria. The criteria used included those considered in earlier assessments of data links for surveillance applications carried out by AMCP, criteria derived from RTCA minimum aviation system performance standards (MASPS) for ADS-B, and additional criteria supplied by the European Organisation for the Safety of Air Navigation (EUROCONTROL) to the joint FAA/EUROCONTROL Technical Link Assessment Team (TLAT). In order to evaluate system performance in several different air traffic situations, two air traffic scenarios (a high-density one and a low-density one) had been used as representative of future environments. The meeting noted with appreciation the substantive amount of effort invested and the wealth of technical information provided in the analysis developed by the AMCP. It was noted that each of the three data links could be seen to have relative advantages over the others with regard to some criteria.

7.4.3.3 The meeting was also informed that over the past several years a number of States and organizations had participated in activities to develop and evaluate ADS-B technologies and the operational applications enabled by those technologies. One of these efforts was a cooperative activity between the United States FAA and EUROCONTROL. This activity had included the evaluation of three candidate ADS-B link technologies (i.e. Mode S extended squitter, VDL Mode 4, and UAT) and had been conducted

by the TLAT. In addition, studies by a consortium of European companies had been funded by the Directorate General Air Transport of the European Commission.

7.4.3.4 The FAA had also conducted additional technical and economic studies that were focused on the use of ADS-B within the United States. Likewise, EUROCONTROL had sponsored additional studies focused on the European applications for ADS-B. In addition, the United States FAA and EUROCONTROL had jointly sponsored a number of flight evaluations that had utilized single and multiple ADS-B link technologies. Other States, such as Australia and Sweden had conducted ADS-B evaluations using a single ADS-B link technology.

7.4.3.5 An APANPIRG ADS-B Study and Implementation Task Force had identified near-term applications and benefits of ADS-B in the ASIAPAC region and reviewed the available ADS-B data link, based on a comparison with ADS-B plans for other regions and avionics availability considerations.

7.4.4 Implementation decisions and recommendations at the regional and national level

7.4.4.1 Following its review of comparative analysis/data link evaluation activities, the meeting was informed of a number of national and regional implementation decisions and recommendations originating from several regions on the basis of the results of such activities.

United States link decision

7.4.4.2 The meeting was informed that in 2002 the United States FAA had announced a decision on the ADS-B links for use within the United States for the initial introduction of ADS-B services. Under this decision the SSR Mode S extended squitter was to be used for air transport and other high-performance aircraft while UAT was to be used on the typical general aviation aircraft. No actions had been taken to require ADS-B equipage. The UAT had been selected to provide ADS-B and associated services for the general aviation users because of its lower cost and greater uplink capacity, especially for flight information services — broadcast (FIS-B) services.

European data link recommendation

7.4.4.3 The meeting was informed that within EUROCONTROL, an ADS-B data link recommendation for the short and medium term had been elaborated, concerning primarily a data link option that could support ADS-B applications planned to be implemented in Europe in the time frame 2008 - 2012. It called for, inter alia, the SSR Mode S extended squitter to be accepted as the logical choice to support the early implementation of ADS-B applications (both air-to-ground and air-to-air) and to provide interoperability with the United States, with deployment to begin as soon as practicable.

Australian ADS-B network

7.4.4.4 The meeting was informed that, following operational trials conducted using ADS-B based on the SSR Mode S extended squitter for ATC ground surveillance, Airservices Australia planned to install a network of approximately twenty ADS-B ground stations across the non-radar areas of Australia to provide

nationwide coverage at and above flight level 300, complementing coverage from a radar network down the east coast. The meeting noted that this plan was in line with the Asia/Pacific regional strategy described in below.

Asia/Pacific regional strategies for ADS-B implementation

7.4.4.5 Following its review of available ADS-B data links (Sect. 7.4.3.5 refers), the ASIA/PAC Air Navigation Planning and Implementation Regional Group (APANPIRG) ADS-B Study and Implementation Task Force had unanimously recommended that the SSR Mode S extended squitter be used as the data link for ADS-B radar like services in the ASIA/PAC Regions in the near future. Subsequently, the fourteenth meeting of APANPIRG, held in August 2003, had endorsed the task force's recommendation with the target date of January 2006.

Phased implementation of ADS-B in the Russian Federation

7.4.4.6 The meeting noted that the State Civil Aviation Authority of Russia had adopted the concept and programme of the phased implementation of ADS-B in Russia based on VDL Mode 4. It was planned to create a network of ADS-B ground stations. The equipment developed in the Russian Federation was presently being certificated. Implementation of ADS-B would start in 2004 in the Tyumen region.

ADS in Mongolia

7.4.4.7 The meeting noted that, based on findings from real-time simulations of a possible ADS infrastructure, a recommendation had been made in Mongolia to implement VDL Mode 4 ground stations supporting ADS-B to provide surveillance coverage for domestic traffic in the lower airspace.

Global and inter-regional considerations

7.4.4.8 The meeting reviewed the future aeronautical mobile communication scenarios for data link surveillance services developed by AMCP (section 7.5.1 refers). According to these scenarios, for high density terrestrial areas ADS-B services would be supported by the SSR Mode S extended squitter in the initial phase. Where the ATM service requirements or the RCP levels could not be met, a complementary data link could be introduced using the UAT, or the VDL Mode 4, on the basis of regional agreements. For oceanic and low/medium density areas, ADS-B services would be supported by the SSR Mode S extended squitter, the UAT, or the VDL Mode 4 on the basis of regional agreements.

7.4.4.9 The meeting was apprised of the position of the International Air Transport Association (IATA) on the implementation of ADS-B and noted that IATA supported the identification of the SSR Mode S extended squitter as the single, interoperable link in present regional transition plans, as the system satisfied the requirements posed by the initial applications and was available and mature, enabling early implementation. The meeting was also informed that IFALPA supported the establishment of the SSR Mode S extended squitter as the single interoperable link for initial implementation.

7.4.4.10 In addressing inter-regional harmonization considerations, the meeting noted that the FAA and EUROCONTROL had undertaken to coordinate strategies for the introduction of the initial ADS-B

services within the United States and European airspace respectively. Common to both the United States and the European strategies for the introduction of the initial ADS-B services was the use of the SSR Mode S extended squitter as a common link technology for achieving interoperability in support of near-term ADS-B applications. It was also recalled that, in the course of the development of the Asia Pacific strategy for the implementation of ADS-B in the regions, a comparison with ADS-B plans had been performed.

7.4.4.11 Finally, with regard to avionics availability, it was noted that both Airbus and Boeing had announced plans to equip new commercial air transport class aircraft with SSR Mode S transponders supporting the transmission of SSR Mode S extended squitter for ADS-B. The most recent generation of airborne collision avoidance system (ACAS) and Mode S equipment had incorporated support for the extended squitter and, given the global use of ACAS in air transport class aircraft, the widespread availability of extended squitter based ADS-B services was becoming possible. The retrofit of commercial air transport aircraft with extended squitter capability for ADS-B had already begun by some commercial operators.

7.4.5 **Strategy for the near-term introduction of ADS-B**

7.4.5.1 In reviewing the available information on implementation decisions, the meeting noted that one of the key factors in the decision making process at the national and regional level appeared to have been the overriding requirement to ensure global interoperability while enabling the near term introduction of ADS-B services. Such requirement was dictated by safety and efficiency reasons; was responsive to the needs of the user community; and had been extensively embraced and supported throughout the industry.

7.4.5.2 The meeting also noted that the majority of the States and international organizations that had provided information on their implementation decisions or recommendations had selected the SSR Mode S Extended squitter as an initial ADS-B link, based on a wide range of considerations, including but not limited to technical ones. This convergence could form a sound basis for achieving the desired global interoperability and the associated benefits. In this respect, the meeting noted with appreciation the efforts of States and regions that had fostered the convergence by endeavoring to coordinate their implementation choices to the extent possible.

7.4.5.3 At the same time, the meeting recognized that a significant number of States from several regions might not be in a position to fully support such convergence on a global near-term solution at the present time without further study and consideration. In particular, it was recognized that certain States might not have identified a near term need for introducing ADS-B in their airspace; or might be still in the process of selecting an appropriate ADS-B link technology; or might be conducting regional coordination in the interest of regional harmonization before committing to a technology choice; or might have already identified as their preferred technical solution one that was partly or wholly inconsistent with the implementation of the SSR Mode S extended squitter. In this regard, the meeting recognized that for the near term, other link technologies supporting the initial introduction of ADS-B applications may optionally be used on a local or regional basis either in addition to Mode S extended squitter or in lieu of Mode S extended squitter in support of local or regional operations.

7.4.5.4 The meeting agreed that the awareness of the substantive convergence achieved so far could provide a useful supporting element in the decision process of such States, in addition to the results of

technical studies such as those conducted by AMCP, and to the information made available by States and organizations that had already completed the decision process.

7.4.5.5 On the basis of the above considerations with regard to potential near term ADS-B solutions, the meeting formulated the following Recommendation:

Recommendation 7/1 — Strategy for the near-term introduction of ADS-B

That States:

a) note that a common element in most of the approaches currently adopted for early implementation of ADS-B is the selection of the SSR Mode S extended squitter as initial supporting data link; and

b) take into account this common element to the extent possible in their national and regional implementation choices in order to facilitate global interoperability for the initial introduction of ADS-B.

7.4.6 Support of longer-term ADS-B requirements

7.4.6.1 The meeting recognized that, in the longer term, the current SSR Mode S extended squitter technology may not be able to fully satisfy all of the requirements for ADS-B services in all airspaces. It was therefore important to more fully define the evolution of the operational requirements for ADS-B; the evolution of the air traffic environments in which ADS-B must operate; and the evolution of the use of the 1 090 MHz channel in order to determine whether a link with greater performance would be required. Any long-term ADS-B solution would need to be integral with an overall long-term surveillance architecture that supported the required surveillance performance (RSP) associated with a set of internationally standardized ATS applications.

7.4.6.2 The long-term operational requirements would become the basis for ICAO to develop SARPs for an internationally standardized set of ADS-B applications, supporting both air-air and air-ground services. The meeting confirmed that the continued development within ICAO of alternative ADS-B link technologies was appropriate. However, it was felt that it was premature to select any specific long-term ADS-B link architecture for the support of global aviation needs. In the development of such architectures, care should be taken to ensure backward compatibility with the near term architecture and to make optimum use of the available data links already standardized by ICAO (such as VDL Mode 4) or currently undergoing standardization (such as the UAT). Other link technologies, or enhancements to existing ADS-B link technologies, that might emerge in the future would also need to be taken into account. In considering any candidate link technology, special attention should be paid to ADS operational requirements, frequency spectrum availability and aircraft integration considerations.

7.4.6.3 On the basis of the above considerations with regard to potential near term ADS-B solutions, the meeting formulated the following recommendation:

Recommendation 7/2 — Support of longer term ADS-B requirements

That

a) States recognize that in the longer term the current SSR Mode S extended squitter technology may not be able to fully satisfy all of the requirements for ADS-B services in all airspaces;

b) ICAO continue development of technical standards for ADS-B link technologies, including SSR Mode S extended squitter, VDL Mode 4 and UAT, with special attention being paid to ADS operational requirements, frequency spectrum availability and aircraft integration issues.

7.4.7 VDL Mode 4 considerations

7.4.7.1 The meeting was presented with an overview of the aircraft aspects of multiple VHF transmitter-receiver installations, with particular reference to co-site interference issues related to installation of VDL Mode 4 equipment on large air transport class aircraft. The conclusions of the overview was that, in order to accommodate on such aircraft VDL Mode 4 equipment for ADS-B applications, more onerous precautions needed to be taken at the frequency planning level than those generally required to accommodate other equipment operating in the VHF band.

7.4.7.2 The meeting was informed by the Secretary that the issue was currently under the consideration of the ACP, which had undertaken an assessment of the extent of the problem (including its relevance to other VDL modes in addition to Mode 4) and of potential solutions or mitigations. The Secretary also informed the meeting that the recommendations offered in the paper with regard to frequency planning would be submitted to the ACP for consideration.

— — — — — — — —