

ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

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

ICAO ACTIVITIES ON AERONAUTICAL MOBILE COMMUNICATION SYSTEMS DEVELOPMENT

(Presented by the Secretariat)

SUMMARY

This paper is based on material developed by the Aeronautical Mobile Communications Panel (AMCP). It reviews the ICAO activities that have been conducted since the Tenth Air Navigation Conference (September 1991) on development of new aeronautical mobile communications technologies, and recommends continuation of work in a number of areas.

Action by the conference is in paragraph 4.

1. BACKGROUND

1.1 The present state of aeronautical mobile communications systems standards and technologies has been essentially shaped by the vision developed over a decade ago by the Special Committee on Future Air Navigation System (FANS). In the course of its activities, the committee determined that it would be necessary to develop new systems that would overcome limitations of conventional systems and allow air traffic management (ATM) to develop on a global scale. It also concluded that satellite technology offered a viable solution to overcome the shortcomings of conventional ground-based systems and to meet the future needs of the international civil aviation community.

1.2 The shortcomings that the FANS Committee identified amounted to essentially three factors:

- a) the propagation limitations of current line-of-sight systems;
- b) the difficulty, caused by a variety of reasons, to implement current communications, navigation, and surveillance (CNS) systems and operate them in a consistent manner in large parts of the world; and

- c) the limitations of voice communications and the lack of digital air-ground data interchange systems to support automated systems in the air and on the ground.

1.3 In September 1991, the Tenth Air Navigation Conference met to consider and endorse the concept of a future air navigation system, as developed by the FANS Committee to meet aviation needs well into the next century. The FANS concept, which became known as the communications, navigation, surveillance/air traffic management (CNS/ATM) system, involves a complex and interrelated set of technologies, dependent largely on satellites. The conference produced a set of recommendations covering the full spectrum of CNS/ATM activities. These recommendations were the main foundation for the subsequent work on development of Standards and Recommended Practices (SARPs) (see section 2), operational trials, air navigation planning and implementation.

2. AERONAUTICAL COMMUNICATIONS SYSTEMS DEVELOPMENT ACTIVITIES SINCE THE TENTH AIR NAVIGATION CONFERENCE

2.1 Over the last decade, ICAO technical bodies have 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 have been introduced, including:

- a) Amendment 70 (applicability date: 9 November 1995), including new 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.

2.2 Work has also been conducted on the effective and efficient 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.

3. CURRENT AND FUTURE WORK

3.1 Notwithstanding the development of new aeronautical communication systems and the improvements to existing ones over the last decade, elements of the shortcomings that were identified by the FANS Committee a decade ago are still present today. The ATM Operational Concept (AN-Conf/11-WP/4 refers) lists several limitations to the provision of air traffic services, 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.

3.2 A number of activities are being conducted to deal with those limitations.

3.2.1 A serious limiting factor both to present operations and future growth is the scarcity of the available radiofrequency spectrum, especially in the VHF band. In several areas, VHF congestion has increased in the past decade, and shows no signs of abating for the foreseeable future. The implementation of digital communications and the transition of certain voice communications to data link have not yet reached a level where they can alleviate the congestion; at the same time, the planned introduction of new applications may further increase spectrum requirements. In its participation to International Telecommunication Union (ITU) activities, ICAO therefore supports the introduction of additional spectrum allocations to meet requirements for increased communication capacity and new applications. In parallel, ICAO is also promoting the development of new techniques to increase the efficiency of use of the existing aeronautical spectrum allocation.

3.2.2 With regard to the provisions for voice and data communications systems that are currently contained in Annex 10, ICAO activities focus on ensuring that SARPs are kept up to date, and that they are applicable and interoperable on a global basis. In particular, the activities include the introduction of improvements dictated by the growing experience on the operational use of digital systems and by the evolution of the existing technologies. Throughout these activities, care is taken to ensure that SARPs be formulated in

a way consistent with Assembly Resolution A33-14, according to which “. . ., SARPs shall consist mainly of broad, mature and stable provisions specifying system-level, functional and performance requirements.”

3.2.3 With respect to future digital voice and data communications systems, research and development work on air-ground communications is being monitored, including the use of new modulation schemes, protocols, and frequency bands. Further work within ICAO aims to support the evolution of voice and data link applications by way of such new technical solutions. A description of future evolution scenarios for aeronautical mobile communication systems is provided in AN-Conf/11-WP/11.

3.3 The activities outlined in section 3.2 should 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.

4. ACTION BY THE CONFERENCE

4.1 The conference is invited to agree on the following recommendation:

Recommendation 7/yy — ICAO activities on aeronautical mobile communication systems development

That ICAO:

- a) assess the needs for additional aeronautical spectrum to meet requirements for increased communications capacity and new applications, and assist States in securing the introduction by the ITU of appropriate additional allocations;
- b) continue efforts in maximizing efficient use of existing aeronautical spectrum allocations;
- c) maintain and enhance existing ICAO aeronautical mobile communications Standards, consistently with Assembly Resolution A33-14; and
- d) investigate new terrestrial and satellite-based technologies on the basis of their potential for ICAO standardization for aeronautical mobile communications use.

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