

ELEVENTH AIR NAVIGATION CONFERENCE**Montreal, 22 September to 3 October 2003****Agenda Item 7 Aeronautical air-ground and air-to-air
: communications****FUTURE COMMUNICATIONS — AN EVOLUTIONARY APPROACH
TOWARDS GLOBAL INTEROPERABILITY**

(Presented by the United States)

SUMMARY

The global air traffic management operational concept requires a VHF communications capability that provides for continued expansion of voice communications in the near to mid term, while concurrently supporting a set of maturing datalink applications.

A Special Communications, Operations Divisional Meeting was convened in 1995 that identified several systems for application in meeting this need. This paper reviews the original issues and the resulting recommendations from that meeting. It further notes issues to be addressed by future communications as described in AN-Conf/11-WP/11, Future Aeronautical Mobile Communications Scenarios that were developed by the Aeronautical Communications Panel (ACP).

This paper emphasizes the need for an interoperable air/ground communications solution from an airspace user's perspective. Multi-mode avionics that comply with the ICAO channelization plan and implement ICAO approved waveforms endorsed by the 1995 COM/OPS/DIV, provide an economical pathway that satisfies the diverse regional communications system needs.

Implementation of systems with previously approved standards should adequately address the issues identified by the ACP for future systems. Finally, the paper projects that the aviation community should receive a minimum of 20 years of useful life for the VHF spectrum dependent on specifics of the regional implementations of each system.

Action by the conference is in paragraph 5.

REFERENCES

International Civil Aviation Organization (ICAO) Special Communications/Operations Divisional Meeting (1995) Report
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1. INTRODUCTION

1.1 Achieving the global air traffic management operational concept requires continued growth of voice communications and the maturation of the still evolving aeronautical telecommunication network (ATN) data link applications. A major obstacle to this growth has been the continued shortage of assignable very high frequency (VHF) communication channels to address the growth in both air traffic services (ATS) and aeronautical operational control (AOC) communication services. Additionally, airspace users have registered significant concern with diverging regional solutions to providing VHF air/ground communications service.

1.2 During the International Civil Aviation Organization (ICAO) Special Communications/Operations Divisional Meeting in 1995 (1995 COM/OPS/DIV), the Contracting States considered both the near-term issue of the European region experiencing severe frequency shortages to meet continuing voice demand, as well as the longer term world-wide aviation needs for evolutionary growth in data link services. That meeting developed six recommendations, five of which are still relevant to today's environment. The meeting also recognized the need for a strategy to achieve a global, interoperable voice and data link system at VHF.

1.3 Subsequent to that meeting, the ICAO Aeronautical Mobile Communication Panel (AMCP) developed and recommended approval of Standards and Recommended Practices (SARPs) for 8.33 kHz DSB-AM voice, and VHF Digital Link Modes 2 and 3. This work has led to the desirable outcome of immediate spectrum congestion relief in the core of Europe, and has provided a jump-start for the development of aeronautical data link.

1.4 However, airspace users still require a method that will allow regional efforts to proceed without generating undue burden for equipment.

2. DISCUSSION

2.1 The following is an overview of the recommendation framework from the 1995 COM/OPS/DIV along with subsequent action by states and the AMCP:

2.1.1 **Recommendation 6/1 — Amendment to Annex 10 - 8.33 kHz channel spacing.** The discussion around this agenda item concerned resolving problems in the core of the European region which was experiencing severe frequency congestion. **Subsequently, the European States implemented this recommendation.**

2.1.2 **Recommendation 6/2 — Development of the future VHF air-ground voice and data link system.** The discussion centered on the expedited development of a 25 kHz time division multiple access (TDMA) integrated voice and data link system to meet a defined set of future system requirements. **Subsequently, the AMCP developed these SARPs and the United States has initiated a program**

to implement this recommendation. (See United States information paper AN-Conf/11-WP/X, *Status of the FAA's Next Generation Air/Ground Communications Program*).

2.2 **Recommendation 6/3 — Development of data links to support navigation and surveillance applications.** The discussion considered the anticipated need for a variety of future data communications exchanges. A major point here was the recognition that in the near term, data link would not relieve frequency congestion, however in the middle term it was expected that data link communications would have a substantial impact on reducing the demand for voice frequencies. This premise has been reviewed and continues to show promise through significant validation and verification efforts in both Europe and the United States.

2.3 **Recommendation 6/4 — Coordinated VHF congestion relief strategy for the European region.** The discussion and conclusions here were based on a separate paper and meeting of the European States to address this issue. Central to the strategy was the development of new ATS data link applications. It was noted in Appendix D of the meeting report that *"It is absolutely necessary to implement those initial applications like pre-departure clearances, automatic terminal information services (ATIS) or meteorological data exchange, in order to gain experience on this new communications means and to be able to specify the next generation of VHF digital link (VDL) to satisfy the communications, navigation, and surveillance/air traffic management (CNS/ATM) systems. The rapid implementation of the VDL carrier sense multiple access (CSMA) data mode as a high speed data link system would help to gain such experience."*

2.3.1 The meeting continued to note that, *"For the airborne side, the system can be implemented economically through the multi-mode voice and data radio."* and that *"For the longer term, the requirements will be different due to the fact that data communications will play the major role, according to the CNS/ATM systems. In order to satisfy the new user requirements, a new system will be required. It is recognized that the solution proposed in this strategy to be implemented in the short term will not satisfy all the future requirements. Future work is required to define and develop a VHF communication system that will use digital technology and TDMA technique, as recommended by Aeronautical Mobile Communications Panel (AMCP)."* **This strategy continues to be the fundamental datalink introduction strategy in both Europe and the United States.**

2.4 **Recommendation 6/5 — Harmonization of the regional plans for implementing a new VHF communication system.** The discussion centered on *"...concerns...that the implementation plans of civil aviation administrations and aircraft operators should be harmonized to ensure that there is no costly waste of investment."* **This harmonization remains an essential element of any future communications scenarios discussion.**

2.5 In AN-Conf/11-WP/11, a number of issues are identified that must be addressed by any proposed future scenario as follows:

- a) availability of spectrum;
- b) definition of an on-board architecture supporting integration of multiple communications systems;

- c) suitability of present and future communications systems to support emerging ATM requirements and RCP levels;
- d) human factors considerations with introduction of new systems; and
- e) costs.

3. **PROPOSED STRATEGY**

3.1 A strategy is needed for the introduction of VHF digital link for global air/ground communications interoperability. The strategy must address the issues identified above while accounting for States' previous equipment and infrastructure investments, and provide cost effective means for investments by airspace users.

3.2 The proposed strategy is to continue development and implementation work on introduction of those ICAO-approved waveforms endorsed by the 1995 COM/OPS/DIV. Specifically to:

- a) continue the expansion of 8.33 kHz AM within the European region, while also continuing the introduction of datalink services via VDL-2;
- b) continue the development, test and certification of the VDL-3 system in the United States as an integrated voice and datalink system; and
- c) complete the development and certification of multi-mode avionics radios capable of utilizing 25 kHz AM, 8.33 kHz AM, VDL-2 and VDL-3 waveforms, and capable of implementing the ICAO global channelization plan.

3.3 To support this strategy the United States Federal Aviation Administration (FAA) has met with its user community to map out a programme that meets the stated objectives and provides time for a smooth transition to the next generation system. As part of this programme the FAA is aggressively managing the 25 kHz AM spectrum to maintain its integrity while developing a new generation of multimode avionics as part of its continuing validation and verification program of the VDL-3 technology. These avionics will comply with all previously approved ICAO waveforms endorsed at the 1995 COM/OPS/DIV (25 kHz AM, 8.33 kHz AM, VDL-2, VDL-3). They will also comply with the ICAO approved international channelization plan.

3.4 Once fully certified and demonstrated in 2004 as part of the FAA programme, these multi-mode avionics will be commercially available for all airspace operators at a cost that is economically attractive.

4. CONCLUSIONS

4.1 A global interoperable VHF communications solution can be achieved by strategic implementation of 1995 COM/OPS/DIV-endorsed waveforms. Multi-mode avionics can provide seamless VHF communications operation for international airspace users.

4.2 This strategy allows regions to mitigate spectrum congestion at a pace appropriate to their anticipated usage. By maximizing service life of the VHF spectrum, it minimizes future investment costs and increases availability of voice and datalink communications options for service providers. In the United States, it is projected based on past spectrum management experience and future data link demand, that a VDL-3 implementation should exceed 30 years of life expectancy. It is anticipated that in other regions implementing various combinations of approved systems, when coupled with reasonable spectrum management techniques, a minimum 20-year useful life extension for the VHF band can be achieved. Thus, the use of multi-mode avionics should provide a cost-effective solution for the aviation community.

4.3 Finally, the combined use of these systems will allow significant time for the aviation community to explore next generation communications options without the pressure of jumping to technology solutions that today may seem promising, (e.g. commercial cellular and SATCOM), but will likely require many years and significant aviation investments to evolve from their commercial roots to meet the safety critical standards of aviation.

5. ACTION BY THE CONFERENCE

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

Recommendation 7/xx — Future communications — An evolutionary approach towards global interoperability

That ICAO:

Recognize the emergence of multi-mode avionics in implementing communication systems as a cost-effective method of achieving interoperability among diverse regional solutions to air/ground communications.

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