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**VHF Air-Ground Communications System Improvements  
Alternatives Study and Selection of Proposals for Future Action**

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Prepared by:  
SC-172

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## FOREWORD

This report was prepared by Special Committee 172 (SC-172) and approved by the RTCA Technical Management Committee (TMC) on November 17, 1994.

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## EXECUTIVE SUMMARY

This report represents the results of a broad study of very high frequency (VHF) air-ground communications system improvements. The study was initiated on recommendations made at the 1990 International Civil Aviation Organization (ICAO) Communications, Meteorology, and Operations Divisional Meeting. This study was primarily concerned with North American system users, service providers, and industry, but took into account the perspectives of other regions of the world. The report reflects developments up to the end of the study, which was essentially completed by the end of February 1994.

During the early stage of this study, it became apparent that while present system improvements should be sought and implemented to allow the present system to last as long as possible, a new system would need to be pursued to satisfy future capacity and functional requirements. The future VHF system should not be compromised by basing a design on predictions of the availability and use of specific functions or other air-ground communications systems.

The study included: (1) gaining an understanding of the present VHF air-ground communications system, (2) developing future Air Traffic Service (ATS) and Aeronautical Operational Control (AOC) communications functional requirements and desirable features, (3) studying present system improvements, (4) developing and analyzing alternative future system candidates, (5) selecting a future system candidate to pursue towards implementation, and (6) developing recommendations resulting from this study.

A total of 12 present system improvements were identified and analyzed during the study. The future system candidates were required to provide voice and data link in a practical manner to all users, and to provide these functions without interference (functionally simultaneous access to voice and data link). Seven candidate future system alternatives were evaluated against the future system requirements and desirable features.

The comparative analysis highlighted a number of high-level factors pointing toward the selection of a class of system design. A fully digital system, preferably with multiple circuits provided on the same RF channel, emerged as the optimum choice to meet future VHF air-ground voice and data link communications system requirements. Based on the comparative analysis, the Time Division Multiple Access (TDMA) architecture was recommended as the best candidate that would satisfy the identified future system requirements and desirable features. The above conclusions are consistent with the study of ICAO Aeronautical Mobile Communications Panel (AMCP) WG-B, and its report to AMCP/3, which evaluated the same seven future system candidates. The 8.33 kHz candidate was also highlighted in ICAO AMCP WG-B's report to AMCP/3 as a mature system design that could be available for implementation with minimum schedule risk.

European experts in AMCP WG-B concluded that no combination of present system improvements would allow a more relaxed implementation timescale of a system to gain additional voice capacity in Western Europe. Several European civil aviation authorities have concluded that 8.33 kHz DSB-AM is the only choice given the need to implement by 1998. This RTCA study did not surface any significant issues that would prevent 8.33 kHz from being implemented.

As a result of this study, six recommendations to pursue present and future system improvements were adopted.

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## TABLE OF CONTENTS

|          |                                                                                                        |    |
|----------|--------------------------------------------------------------------------------------------------------|----|
| 1.0      | INTRODUCTION AND BACKGROUND .....                                                                      | 1  |
| 1.1      | Introduction .....                                                                                     | 1  |
| 1.2      | Background .....                                                                                       | 2  |
| 2.0      | CURRENT VHF AIR-GROUND COMMUNICATIONS SYSTEM .....                                                     | 5  |
| 2.1      | Characteristics .....                                                                                  | 5  |
| 2.2      | Spectrum Congestion .....                                                                              | 5  |
| 2.3      | Principles of Operation for the VHF Air-Ground Voice Communications System Element .....               | 5  |
| 2.4      | General VHF Air-Ground Communications System Description .....                                         | 5  |
| 2.5      | Technical Description .....                                                                            | 6  |
| 2.6      | Limitations of the Current System .....                                                                | 7  |
| 2.7      | VHF Air-Ground Communications System Users .....                                                       | 8  |
| 3.0      | AM(R)S ATS AND AOC REQUIREMENTS AND DESIRABLE FEATURES .....                                           | 9  |
| 3.1      | Regulatory Requirements .....                                                                          | 9  |
| 3.1.1    | Aeronautical VHF Air-Ground Communications Frequencies .....                                           | 9  |
| 3.1.2    | 117.975–137 MHz Spectrum Allocation and Frequency Band Allotment .....                                 | 9  |
| 3.1.3    | U.S. ATS and AOC Service Rules and Regulations .....                                                   | 9  |
| 3.1.4    | U.S. Federal Aviation Regulations .....                                                                | 10 |
| 3.1.5    | Requirements for Message Priority Capability .....                                                     | 11 |
| 3.1.6    | Dedicated ATS and Dedicated AOC Voice and Data Link RF Channels .....                                  | 11 |
| 3.2      | Future VHF Air-Ground Communications Requirements and Desirable Features .....                         | 11 |
| 3.2.1    | Overall Future VHF Air-Ground Communications System Requirements (Voice and Data Link) .....           | 12 |
| 3.2.1.1  | Safety Not Degraded .....                                                                              | 12 |
| 3.2.1.2  | The Capability to Provide Functionally Simultaneous Access to Voice and Data Link Communications ..... | 12 |
| 3.2.1.3  | Airborne Equipment Costs .....                                                                         | 12 |
| 3.2.1.4  | Ground Infrastructure .....                                                                            | 13 |
| 3.2.1.5  | Human-Machine Interface .....                                                                          | 13 |
| 3.2.1.6  | Aircraft Speed .....                                                                                   | 13 |
| 3.2.1.7  | Radio Station Range .....                                                                              | 14 |
| 3.2.1.8  | Area Coverage .....                                                                                    | 14 |
| 3.2.1.9  | Control of Multiple Sectors .....                                                                      | 15 |
| 3.2.1.10 | Circuit Blockage .....                                                                                 | 16 |
| 3.2.1.11 | Direction Finding .....                                                                                | 16 |
| 3.2.1.12 | Security .....                                                                                         | 16 |
| 3.2.1.13 | RFI Protection .....                                                                                   | 16 |
| 3.2.1.14 | Workload .....                                                                                         | 17 |
| 3.2.1.15 | Ease of Transition .....                                                                               | 17 |
| 3.2.1.16 | Co-existence Between Present and Future VHF Air-Ground Communications Systems .....                    | 17 |

|       |          |                                                                                                                                          |    |
|-------|----------|------------------------------------------------------------------------------------------------------------------------------------------|----|
|       | 3.2.1.17 | Circuit Contention .....                                                                                                                 | 18 |
|       | 3.2.1.18 | Automatic Circuit Management .....                                                                                                       | 18 |
|       | 3.2.1.19 | Selective Addressing .....                                                                                                               | 19 |
|       | 3.2.1.20 | Service Availability .....                                                                                                               | 19 |
|       | 3.2.1.21 | Broadcast Capability .....                                                                                                               | 19 |
|       | 3.2.1.22 | Failure Detection and Recovery .....                                                                                                     | 20 |
| 3.2.2 |          | Future VHF Air-Ground Communications System Voice Requirements .....                                                                     | 20 |
|       | 3.2.2.1  | Communications Capacity .....                                                                                                            | 21 |
|       | 3.2.2.2  | Party Line Functional Capability .....                                                                                                   | 21 |
|       | 3.2.2.3  | Air-to-Air Communications .....                                                                                                          | 22 |
|       | 3.2.2.4  | Quality .....                                                                                                                            | 22 |
|       | 3.2.2.5  | Dedicated Air-Ground Voice Circuit for Each ATS Controller/AOC<br>Dispatcher/Group of Aircraft .....                                     | 23 |
|       | 3.2.2.6  | Circuit Throughput Delay .....                                                                                                           | 23 |
|       | 3.2.2.7  | Transmit Audio Clipping .....                                                                                                            | 25 |
|       | 3.2.2.8  | User Capacity .....                                                                                                                      | 25 |
|       | 3.2.2.9  | Easy Entry into the VHF Air-Ground Communications System .....                                                                           | 26 |
|       | 3.2.2.10 | Emergency Communications .....                                                                                                           | 26 |
|       | 3.2.2.11 | Prioritization .....                                                                                                                     | 26 |
|       | 3.2.2.12 | Wide-Area Coverage .....                                                                                                                 | 27 |
| 3.2.3 |          | VHF Air-Ground Communications Data Link Requirements .....                                                                               | 27 |
|       | 3.2.3.1  | Data Link Communications Capability .....                                                                                                | 27 |
|       | 3.2.3.2  | Data Link Communications Capacity Requirement .....                                                                                      | 28 |
|       | 3.2.3.3  | Prioritization .....                                                                                                                     | 28 |
|       | 3.2.3.4  | Undetected Message Error Rate/Message Integrity .....                                                                                    | 28 |
|       | 3.2.3.5  | Message Delivery Time by VHF Air-Ground Communications<br>Subnetwork .....                                                               | 29 |
|       | 3.2.3.6  | ATN Compatibility .....                                                                                                                  | 29 |
|       | 3.2.3.7  | Frequency Usage .....                                                                                                                    | 29 |
| 3.2.4 |          | Future VHF Air-Ground Communications System Desirable Features .....                                                                     | 30 |
|       | 3.2.4.1  | An All-Digital VHF Air-Ground Communications System ..                                                                                   | 30 |
|       | 3.2.4.2  | The Capability to Provide Functionally Simultaneous Access to<br>Voice and Data Link Communications from the Same Avionics<br>Unit ..... | 30 |
|       | 3.2.4.3  | An All-Digital VHF Air-Ground Communications System with<br>Voice and Data Link on the Same RF Channel .....                             | 30 |
|       | 3.2.4.4  | Call-Queuing Capability .....                                                                                                            | 30 |
|       | 3.2.4.5  | Urgency Messages Override .....                                                                                                          | 31 |
| 4.0   |          | VHF AIR-GROUND COMMUNICATIONS SYSTEM IMPROVEMENTS:<br>INTRODUCTION AND PERSPECTIVE .....                                                 | 33 |
|       | 4.1      | Spectrum Utilization Efficiency .....                                                                                                    | 33 |
|       | 4.2      | Implementation and Transition .....                                                                                                      | 33 |

|         |                                                                                                                |    |
|---------|----------------------------------------------------------------------------------------------------------------|----|
|         | IDENTIFICATION/DEVELOPMENT/ANALYSIS OF IMPROVEMENTS TO THE EXISTING VHF AIR-GROUND COMMUNICATIONS SYSTEM ..... | 35 |
| 5.1     | Frequency Assignment Criteria .....                                                                            | 35 |
| 5.1.1   | Reduction of Co-channel Protection Criterion to 14 dB .....                                                    | 35 |
| 5.1.1.1 | Introduction .....                                                                                             | 35 |
| 5.1.1.2 | Background and Supporting Documentation .....                                                                  | 35 |
| 5.1.1.3 | Conclusions and Recommendations .....                                                                          | 36 |
| 5.1.2   | TSVs for En route and Terminal Assignments .....                                                               | 36 |
| 5.1.2.1 | Introduction .....                                                                                             | 36 |
| 5.1.2.2 | Background and Supporting Documentation .....                                                                  | 37 |
| 5.1.2.3 | Conclusions and Recommendations .....                                                                          | 37 |
| 5.1.3   | Adjacent Channel Criterion Change .....                                                                        | 37 |
| 5.1.3.1 | Introduction .....                                                                                             | 37 |
| 5.1.3.2 | Background and Supporting Documentation .....                                                                  | 37 |
| 5.1.3.3 | Conclusions and Recommendations .....                                                                          | 38 |
| 5.2     | Alternative Outlets for Broadcast Functions .....                                                              | 38 |
| 5.2.1   | Introduction .....                                                                                             | 38 |
| 5.2.2   | Background and Supporting Documentation .....                                                                  | 38 |
| 5.2.2.1 | Use of Existing NAVAID Facilities .....                                                                        | 39 |
| 5.2.2.2 | Potential Use of Dedicated Non-Navigation Transmitters in the 111.975–117.975 MHz Frequency Band .....         | 40 |
| 5.2.3   | Conclusions and Recommendations .....                                                                          | 40 |
| 5.3     | Reduction of Guard Band Around Emergency Frequency 121.5 MHz .....                                             | 40 |
| 5.3.1   | Introduction .....                                                                                             | 40 |
| 5.3.2   | Background and Supporting Documentation .....                                                                  | 41 |
| 5.3.3   | Conclusions and Recommendations .....                                                                          | 42 |
| 5.4     | Spectrum Optimization .....                                                                                    | 42 |
| 5.4.1   | Introduction .....                                                                                             | 42 |
| 5.4.2   | Background and Supporting Documentation .....                                                                  | 42 |
| 5.4.3   | Conclusions and Recommendations .....                                                                          | 44 |
| 5.5     | 136–137 MHz Utilization .....                                                                                  | 44 |
| 5.5.1   | Introduction .....                                                                                             | 44 |
| 5.5.2   | Background and Supporting Documentation .....                                                                  | 45 |
| 5.5.3   | Conclusions and Recommendations .....                                                                          | 46 |
| 5.6     | Full 25 kHz Utilization .....                                                                                  | 46 |
| 5.6.1   | Introduction .....                                                                                             | 46 |
| 5.6.2   | Background and Supporting Documentation .....                                                                  | 47 |
| 5.6.3   | Conclusions and Recommendations .....                                                                          | 47 |
| 5.7     | Specific Frequencies Reserved for ATIS/AWOS/ASOS .....                                                         | 48 |
| 5.7.1   | Introduction .....                                                                                             | 48 |
| 5.7.2   | Background and Supporting Documentation .....                                                                  | 48 |
| 5.7.3   | Conclusions and Recommendations .....                                                                          | 48 |
| 5.8     | Minimizing of Ground Transmitter Power .....                                                                   | 48 |
| 5.8.1   | Introduction .....                                                                                             | 48 |
| 5.8.2   | Background and Supporting Documentation .....                                                                  | 49 |
| 5.8.3   | Conclusions and Recommendations .....                                                                          | 49 |
| 5.9     | Increased Use of Air-Ground Data Link .....                                                                    | 49 |
| 5.9.1   | Introduction .....                                                                                             | 49 |

|         |                                                                                                                            |           |
|---------|----------------------------------------------------------------------------------------------------------------------------|-----------|
| 5.9.2   | Background and Supporting Documentation . . . . .                                                                          | 49        |
| 5.9.3   | Conclusions and Recommendations . . . . .                                                                                  | 50        |
| 5.10    | Reduction of Co-site Constraints . . . . .                                                                                 | 50        |
| 5.10.1  | Introduction . . . . .                                                                                                     | 50        |
| 5.10.2  | Background and Supporting Documentation . . . . .                                                                          | 50        |
| 5.10.3  | Conclusions and Recommendations . . . . .                                                                                  | 51        |
| 6.0     | <b>IDENTIFICATION/DEVELOPMENT/ANALYSIS OF LONGER-TERM VHF AIR-<br/>GROUND COMMUNICATIONS SYSTEM IMPROVEMENTS . . . . .</b> | <b>53</b> |
| 6.1     | Introduction . . . . .                                                                                                     | 53        |
| 6.1.1   | Overview . . . . .                                                                                                         | 53        |
| 6.1.2   | A Fundamental Ground Rule . . . . .                                                                                        | 54        |
| 6.1.3   | The Differing Perspectives of North America and Western Europe . . .                                                       | 54        |
| 6.1.4   | Pursuing the Objective of Functionally Simultaneous Access to Voice and<br>Data Link . . . . .                             | 55        |
| 6.2     | VHF System Candidates and Comparisons . . . . .                                                                            | 56        |
| 6.2.1   | System 1: 12.5 kHz DSB-AM Voice/25 kHz CSMA Data . . . . .                                                                 | 57        |
| 6.2.1.1 | Airborne Architecture . . . . .                                                                                            | 57        |
| 6.2.1.2 | Ground Configuration . . . . .                                                                                             | 57        |
| 6.2.1.3 | Operating Concept . . . . .                                                                                                | 58        |
| 6.2.1.4 | Voice/Data System Pros . . . . .                                                                                           | 58        |
| 6.2.1.5 | Voice/Data System Cons . . . . .                                                                                           | 58        |
| 6.2.2   | System 2: 8.33 kHz DSB-AM Voice/25 kHz CSMA Data . . . . .                                                                 | 59        |
| 6.2.2.1 | Airborne Architecture . . . . .                                                                                            | 59        |
| 6.2.2.2 | Ground Configuration . . . . .                                                                                             | 59        |
| 6.2.2.3 | Operating Concept . . . . .                                                                                                | 60        |
| 6.2.2.4 | Voice/Data System Pros . . . . .                                                                                           | 60        |
| 6.2.2.5 | Voice/Data System Cons . . . . .                                                                                           | 60        |
| 6.2.3   | System 3: 5 kHz AME Voice/25 kHz CSMA Data . . . . .                                                                       | 61        |
| 6.2.3.1 | Airborne Architecture . . . . .                                                                                            | 61        |
| 6.2.3.2 | Ground Configuration . . . . .                                                                                             | 61        |
| 6.2.3.3 | Operating Concept . . . . .                                                                                                | 61        |
| 6.2.3.4 | Voice/Data System Pros . . . . .                                                                                           | 62        |
| 6.2.3.5 | Voice/Data System Cons . . . . .                                                                                           | 62        |
| 6.2.4   | System 4: 5 kHz Digital Voice/25 kHz CSMA Data . . . . .                                                                   | 63        |
| 6.2.4.1 | Airborne Architecture . . . . .                                                                                            | 63        |
| 6.2.4.2 | Ground Configuration . . . . .                                                                                             | 63        |
| 6.2.4.3 | Operating Concept . . . . .                                                                                                | 63        |
| 6.2.4.4 | Voice/Data System Pros . . . . .                                                                                           | 64        |
| 6.2.4.5 | Voice/Data System Cons . . . . .                                                                                           | 64        |
| 6.2.5   | System 5: 5 kHz Digital Voice/5 kHz CSMA Data . . . . .                                                                    | 65        |
| 6.2.5.1 | Airborne Architecture . . . . .                                                                                            | 65        |
| 6.2.5.2 | Ground Configuration . . . . .                                                                                             | 65        |
| 6.2.5.3 | Operating Concept . . . . .                                                                                                | 65        |
| 6.2.5.4 | Voice/Data System Pros . . . . .                                                                                           | 66        |
| 6.2.5.5 | Voice/Data System Cons . . . . .                                                                                           | 66        |
| 6.2.6   | System 6: 25 kHz TDMA (Voice/Data on Common RF Channel) . . .                                                              | 67        |
| 6.2.6.1 | Airborne Architecture . . . . .                                                                                            | 67        |

|     |         |                                                                                              |    |
|-----|---------|----------------------------------------------------------------------------------------------|----|
|     | 6.2.6.2 | Ground Configuration .....                                                                   | 67 |
|     | 6.2.6.3 | Operating Concept .....                                                                      | 67 |
|     | 6.2.6.4 | Voice/Data System Pros .....                                                                 | 68 |
|     | 6.2.6.5 | Voice/Data System Cons .....                                                                 | 68 |
|     | 6.2.7   | System 7: 25 kHz DRMA (Voice/Data on Common RF Channel) ...                                  | 69 |
|     | 6.2.7.1 | Airborne Architecture .....                                                                  | 69 |
|     | 6.2.7.2 | Ground Configuration .....                                                                   | 69 |
|     | 6.2.7.3 | Operating Concept .....                                                                      | 69 |
|     | 6.2.7.4 | Voice/Data System Pros .....                                                                 | 69 |
|     | 6.2.7.5 | Voice/Data System Cons .....                                                                 | 70 |
|     | 6.2.8   | Comparison of the Candidate Systems .....                                                    | 70 |
| 6.3 |         | Other Potential System Improvement Possibilities: Reallocation of 108–117.975 MHz Band ..... | 77 |
| 6.4 |         | System Improvement Possibilities Identified and Eliminated from Further Consideration .....  | 77 |
|     | 6.4.1   | Introduction .....                                                                           | 77 |
|     | 6.4.2   | Narrow Band Frequency Modulation .....                                                       | 77 |
|     | 6.4.3   | CDMA .....                                                                                   | 77 |
|     | 6.4.4   | Trunking .....                                                                               | 77 |
|     | 6.4.5   | Frequency-Band Partitioning .....                                                            | 78 |
|     | 6.4.6   | Dual-Frequency Channel Structure .....                                                       | 79 |
| 6.5 |         | Issues Considered in the Comparative Analysis of the Selected System Candidates .....        | 79 |
|     | 6.5.1   | Issues Related to the Satisfaction of Functional Requirements and Desirable Features .....   | 79 |
|     | 6.5.1.1 | System-Level Issues .....                                                                    | 80 |
|     | 6.5.1.2 | Voice Issues .....                                                                           | 84 |
|     | 6.5.1.3 | Data Link Issues .....                                                                       | 87 |
|     | 6.5.1.4 | Issues Related to Desirable Features .....                                                   | 88 |
|     | 6.5.2   | Other Significant System Issues .....                                                        | 89 |
|     | 6.5.2.1 | Maturity/Standardization of Voice Codecs .....                                               | 89 |
|     | 6.5.2.2 | Area Coverage .....                                                                          | 90 |
|     | 6.5.2.3 | Multiple-Circuit System Alternatives .....                                                   | 90 |
|     | 6.5.2.4 | Link Margin Considerations for Digital Modulation Techniques .....                           | 90 |
| 6.6 |         | Selection of a Future System Candidate .....                                                 | 91 |
|     | 6.6.1   | Selected Future System Candidate .....                                                       | 91 |
|     | 6.6.1.1 | Early Implementation Potential of System 6 .....                                             | 92 |
|     | 6.6.2   | AOC Implementation .....                                                                     | 92 |
|     | 6.6.3   | Comments on Other System Candidates .....                                                    | 93 |
|     | 6.6.3.1 | System 1 (12.5 kHz Voice and 25 kHz CSMA Data Link) ...                                      | 93 |
|     | 6.6.3.2 | System 2 (8.33 kHz DSB-AM Voice and 25 kHz CSMA Data Link) .....                             | 93 |
|     | 6.6.3.3 | ACI Considerations .....                                                                     | 93 |
| 7.0 |         | SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS .....                                              | 95 |
| 7.1 |         | Overview of the Study .....                                                                  | 95 |
| 7.2 |         | Future System Requirements and Desirable Features .....                                      | 96 |

|          |                                                                                                                 |     |
|----------|-----------------------------------------------------------------------------------------------------------------|-----|
| 7.3      | Near-Term Improvements to the Present VHF Air-Ground Communications System and Associated Recommendations ..... | 96  |
| 7.4      | Alternative Future System Candidates .....                                                                      | 97  |
| 7.4.1    | Perspective on Development of Future System Candidates .....                                                    | 97  |
| 7.4.2    | Identification of Future System Candidates .....                                                                | 98  |
| 7.4.3    | Comparative Evaluation of Alternative Future System Candidates ...                                              | 99  |
| 7.4.3.1  | 12.5 kHz Candidate .....                                                                                        | 99  |
| 7.4.3.2  | RFI Protection .....                                                                                            | 99  |
| 7.4.3.3  | Security .....                                                                                                  | 99  |
| 7.4.3.4  | Message Priority .....                                                                                          | 99  |
| 7.4.3.5  | Independent Voice Assignment Using DRMA .....                                                                   | 100 |
| 7.4.3.6  | Functionally Simultaneous Access to Voice And Data Link .....                                                   | 100 |
| 7.4.3.7  | Area Coverage .....                                                                                             | 100 |
| 7.4.3.8  | CSMA and DRMA Infrastructure .....                                                                              | 100 |
| 7.4.3.9  | Frequency Assignments .....                                                                                     | 100 |
| 7.4.3.10 | Additional RF Carrier Required .....                                                                            | 101 |
| 7.4.3.11 | Dedicated Voice Circuit .....                                                                                   | 101 |
| 7.4.3.12 | Improved ACI Required .....                                                                                     | 101 |
| 7.4.4    | Selection of the Best Candidate .....                                                                           | 101 |
| 7.4.5    | Other Potential System Improvements: Reallocation of the 108–117.975 MHz to AM(R)S .....                        | 103 |
| 7.4.6    | Remaining Work Regarding TDMA .....                                                                             | 103 |
| 7.5      | Recommendations .....                                                                                           | 104 |

## APPENDICES

|   |                                                                                                                                             |     |
|---|---------------------------------------------------------------------------------------------------------------------------------------------|-----|
| A | Applicable Recommendations from the ICAO COM/MET/OPS Divisional Meeting 1990 .....                                                          | 107 |
| B | Definitions .....                                                                                                                           | 111 |
| C | Acronyms .....                                                                                                                              | 121 |
| D | Participating Members .....                                                                                                                 | 129 |
| E | AM(R)S ATS and AOC Requirement Sources .....                                                                                                | 133 |
| F | Proposed Amendment to ICAO Annex 10, Aeronautical Telecommunications, Regarding Co-Channel Frequency Protection .....                       | 137 |
| G | 12.5 kHz Channel Spacing DSB-AM With and Without In-Band Signalling .....                                                                   | 143 |
| H | Adjacent Channel Interference with 8.33 kHz Channel Spacing in a Mixed 8.33 kHz/25 kHz Environment .....                                    | 147 |
| I | TDMA System Description .....                                                                                                               | 157 |
| J | Analysis of Radio Trunking for the Washington Center Area .....                                                                             | 203 |
| K | Use of a Frequency Assignment Model to Assess the Spectrum Efficiency of VHF S System Architecture and Band Partitioning Alternatives ..... | 209 |
| L | VDL-Adjacent Channel Considerations .....                                                                                                   | 213 |
| M | The Transition to TDMA: A Case Study .....                                                                                                  | 221 |
| N | Tone-Coded Squelch Analysis .....                                                                                                           | 229 |
| O | Adjacent Channel Interference with 12.5 kHz Channel Spacing in a Mixed 12.5 kHz/25 kHz Environment .....                                    | 233 |
| P | Data Link Simulation Study .....                                                                                                            | 243 |

## TABLES

|    |                                             |    |
|----|---------------------------------------------|----|
| 1. | U.S. 136-137 MHz Allotment .....            | 45 |
| 2. | European 136-137 MHz Allotment .....        | 46 |
| 3. | VHF System Comparisons and Trade-offs ..... | 71 |

### Tables in Appendices

|      |                                                                                                                                                   |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| H-1. | Transmitter and Receiver Frequency Stabilities for Existing 25 kHz and Proposed 8.33 kHz VHF Communication Systems                                |
| H-2. | Receiver Filter Skirts, Form Factor = 1.8                                                                                                         |
| H-3. | Minimum Frequency Separation Between the Nose Bandwidth and the Adjacent Carrier for 8.33 kHz Channel Plan                                        |
| H-4. | Minimum Separation Between the Nose Bandwidth and the Adjacent Offset Carrier in an 8.33 kHz Channel Plan                                         |
| H-5. | Adjacent Channel Spectrum Level at Nose Bandwidth (-6dB) for an 8.33 kHz Channel Spacing, Non-Offset Carrier                                      |
| H-6. | Relative Spectral Level at -6 dB Adjacent Channel Receiver Selectivity Point for the GRT-21 Ground Transmitter in an 8.33 kHz Channel Plan        |
| H-7. | Distance Separation Required for 20 dB D/U for Adjacent Channel Spectral Levels from Measured Transmitter Spectra at -6dB Receiver Nose Bandwidth |
| J-1. | Trunking Efficiency for Various Number of Groups Participating at a Radio Trunking Site                                                           |
| O-1. | Transmitter and Receiver Frequency Stabilities for Existing 25 kHz and Proposed 12.5 kHz VHF Communications Systems                               |
| O-2. | Receiver Filter Skirts, Form Factor = 1.8                                                                                                         |
| O-3. | Minimum Frequency Separation Between the Nose Bandwidth and the Adjacent Carrier for a 12.5 kHz Channel Plan                                      |
| O-4. | Minimum Separation Between the Nose Bandwidth and the Adjacent Offset Carrier in a 12.5 kHz Channel Plan                                          |
| O-5. | Adjacent Channel Spectrum Level at Nose Bandwidth (-6dB) for a 12.5 kHz Channel Spacing, Non-Offset Carrier                                       |
| O-6. | Adjacent Channel Spectral Level at Nose Bandwidth (-6dB) for a 12.5 kHz Channel Spacing, for Various Offset Carriers                              |
| O-7. | Distance Separation Required for 20 dB D/U for Adjacent Channel Spectral Levels from Measured Transmitter Spectra at -6dB Receiver Nose Bandwidth |

## FIGURES

|    |                                              |    |
|----|----------------------------------------------|----|
| 1. | Air-Ground End-to-End Delay Components ..... | 24 |
|----|----------------------------------------------|----|

### Figures in Appendices

|      |                                                                                      |
|------|--------------------------------------------------------------------------------------|
| F-1. | Co-channel Configuration for Undesired/Desired Distance Ratio                        |
| I-1. | TDMA System Timing Hierarchy                                                         |
| I-2. | TDMA Timing Budget                                                                   |
| I-3. | TDMA System Configurations (Standard Range)                                          |
| I-4. | Vocoder Operation in TDMA Radio Environment                                          |
| I-5. | Subchannel Burst Fields (Voice-Only System Configurations)                           |
| I-6. | Burst Type, Local User ID and Voice Signal Fields (Voice-Only System Configurations) |
| I-7. | Initialization Message (Voice-Only System Configurations)                            |

- I-8. M Subchannel Uplink Usage for Single User Group (Voice-Only System Configurations)
- I-9. Burst Timing for Configuration 4V
- I-10. Modified Frame Structure for System Configuration 2V2S
- I-11. Burst Timing of Users Associated with Each Site for Configuration 2V2S
- I-12. Example Sector and Site Geometry for Two Adjacent Sectors for System Configuration 2V2S
- I-13. Critical Geometry in Determining FPSV Sizes for System Configuration 2V2S
- I-14. Ground Site Transmissions and Airborne Receiver Site Switching for Configuration 2V2S
- I-15. Subchannel Burst Fields (Discrete Addressed V/D System Configurations)
- I-16. Burst Type, Local User ID, and Voice Signal Fields (Discrete Addressed V/D System Configurations)
- I-17. Initialization Message and Reservation Request Fields (Discrete Addressed V/D System Configurations)
- I-18. M Subchannel Uplink Usage for Single User Group (Discrete Addressed V/D System Configurations)
- I-19. TDMA Media Access Protocol Cycle for Discrete Addressing and Data Link (For Single User Group 2V2D)
- I-20. Airborne Radio Transmit-Receive and Receiver-Transmit Switching Time Requirements: 2.7 ms
- J-1. VHF A/G Database Sample Statistics - ZDC Area
- M-1. The U.S. High-Traffic-Density Region
- M-2. High-Altitude Overland New Jersey Circuits
- M-3. Outline of a Four-Circuit TDMA "Bundle"
- P-1. Frame Structure of Discrete-Addressed System Configuration Alternatives
- P-2. Prioritized Uplink Message Flow
- P-3. Prioritized Downlink Message Flow
- P-4. Downlink Data Performance, 20 Aircraft, High Volume, 2V2D
- P-5. Uplink Data Performance, 20 Aircraft, High Volume, 2V2D
- P-6. Downlink Data Performance, 40 Aircraft, High Volume, 2V2D
- P-7. Uplink Data Performance, 40 Aircraft, High Volume, 2V2D
- P-8. Downlink Data Performance, 40 Aircraft, High Volume, 3T
- P-9. Uplink Data Performance, 40 Aircraft, High Volume, 3T
- P-10. Downlink Data Performance, 60 Aircraft, High Volume, 3T
- P-11. Uplink Data Performance, 60 Aircraft, High Volume, 3T
- P-12. TDMA vs. CSMA Delay (95 Percentile) at High Density with Peak Traffic Volume
- P-13. TDMA vs. CSMA Delay (95 Percentile) at Medium Density with Peak Traffic Volume
- P-14. TDMA vs. CSMA Delay (95 Percentile) at Low Density with Peak Traffic Volume

## 1.0 INTRODUCTION AND BACKGROUND

RTCA Special Committee 172 (SC-172) began its work in mid-1991. The work was initiated in response to requests from the U.S. Federal Aviation Administration (FAA) and Aeronautical Radio, Incorporated (ARINC). They requested the establishment of a government and industry forum in the United States that would investigate and make recommendations on improvements to meet both near-term and longer-term requirements for the very high frequency (VHF) Aeronautical Mobile (Route) Service (AM(R)S) allocated in the 117.975–137 megahertz (MHz) band. This service includes Air Traffic Service (ATS) and Aeronautical Operational Control (AOC) communications.

### 1.1 Introduction

This document is a report of the study efforts undertaken and recommendations made by RTCA SC-172 WG-1. This study was primarily concerned with North American system users, service providers, and industry, but took into account the perspectives of other regions of the world. The report reflects developments up to the end of the study, which was essentially completed by the end of February 1994. It covers the various aspects of the WG-1 work, including the following:

1. The development of a statement of VHF air-ground communications system characteristics and principles of operation for both VHF air-ground voice and data link communications system elements (Section 2)
2. The analysis and development of civil aviation user and provider requirements and desirable features for ATS and AOC voice and data link communications (Sections 3 and 4)
3. A study of present system near-term improvements that could be implemented without requiring changes to user avionics (Section 5)
4. The development and comparative analysis of future system improvement alternatives aimed at satisfying the defined ATS and AOC communications candidate requirements in a cost-effective and spectrum-efficient manner (Section 6)
5. The selection of a future system candidate, taking into account the satisfaction of requirements and desirable features, including spectrum efficiency and cost-effectiveness, as well as various implementation considerations, particularly transitional capabilities (Section 6)
6. The development of a statement of system improvement recommendations resulting from the above efforts (Section 7)

The WG-1 study in the above areas took into account the results of U.S. and U.K. studies on VHF air-ground voice communications system improvements, a Canadian study on carrier sense multiple access (CSMA) versus time division multiple access (TDMA), the VHF data link system development by the AEEC, the work of RTCA SC-172 WG-2, and reflections on the activities of ICAO AMCP WG-B and WG-C.