
AFC
Aeronautical Frequency Committee

AFC MANUAL


ASRI
Aviation
Spectrum
Resources, Inc.


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FORWARD

The Aeronautical Frequency Committee (AFC) is an Aviation Spectrum Resources, Inc. (ASRI) sponsored industry committee. This Manual contains general descriptive information of both national and international organizations and agencies which are associated with aeronautical frequency management, radio regulatory and AFC activities. This Manual also contains information which is relative only to the AFC, is specifically provided as a convenient source of information for the AFC, and is intended solely for use by AFC Members and others to directly associate with its activities.

The AFC Executive Secretary will maintain this Manual in current status by issuing amendments. The amendments will be numbered and all pages of the Manual will be dated. An Amendment Record Page is included inside the cover of the Manual and should be used to reflect the status of current amendments.

Recommendations for revision of this Manual should be submitted to the Executive Secretary. This document shall be reviewed annually by the AFC during the first Committee meeting of the calendar year.

HISTORY OF AVIATION SPECTRUM RESOURCES, INC. (ASRI)

Aeronautical Radio, Inc. (ARINC) was incorporated in 1929 as a result of public hearings on aviation held by the Federal Radio Commission (now the Federal Communications Commission). The first Commission hearing on aviation was held May 11, 1929. This was the formal beginning of aeronautical radio service. In August, 1929, a series of conferences were held by the Commission with the military and airline industry to formulate an acceptable plan for radio licensing and frequency utilization. Finally on September 9, 1929, the Commission adopted a general order which required the airline industry and all other civil aviation operators to coordinate and consolidate frequency requirements and licensing under one central affiliated group. The purpose of this consolidation was to eliminate confusion created by each airline independently securing licenses and operating their own private radio facilities. By this time, it had already become obvious to all that a high degree of cooperation would be necessary between the airline operators if maximum efficiency in utilization of radio systems was to be achieved. As a result, on December 2, 1929, ARINC was organized and incorporated within the State of Delaware. In consonance with the company's role as the single licensee and coordinator of aeronautical radio communications for the aviation community, ARINC was formed as a normal business enterprise, but one which would be operated on a not-for-profit basis. All of the associated stock was subscribed to by the air transport operators.

On May 12, 1930, the Commission transferred to ARINC the licenses for approximately 75 high frequency (HF) ground stations which previously had been issued to the air carriers. Initially, ARINC members continued to own and staff the ground station facilities. ARINC, as the licensee, supervised the operating procedures to insure proper operation and compliance with the Commission's regulations.

Gradually, as ARINC's capabilities grew, the company was asked by most of the airlines to assume full operational responsibility for their air/ground communication requirements. ARINC's capabilities continued to expand at a level commensurate with advancements in the state of the art. Hence, the aviation community came to regard ARINC as the center of communication planning for the entire transport industry.

During the period 1930-1939, ARINC stations, staffed by airline personnel, performed airport, approach, and enroute communications functions, and were the only air/ground communications stations on the airways. This was the first time a pilot could fly along a route with complete assurance that current weather and alternate airport information was available.

It made flight following by ground controllers possible so that airline companies could make advance planning on disposition of aircraft and crews. In July, 1936, the Civil Aeronautics Authority (now the Federal Aviation Administration), with ARINC's technical assistance, established the first government air traffic control centers at Chicago, Cleveland and Newark. ARINC stations, however, continued to perform air traffic control functions.

During the same period, ARINC, in cooperation with the Civil Aeronautics Authority, played a leading role in the research and development of radio navigational aids to aircraft and instrument landing systems, and development of associated techniques and equipment operating procedures. This effort resulted in establishment of the Radio Technical Commission for Aeronautics (RTCA). The RTCA (no longer known by the former name) has subsequently become the foremost technical consulting group in the aviation community; ARINC is still an active member. ARINC also contributed to the development of numerous equipment characteristics

standards and specifications, including standards for flight checking of ground facilities. ARINC developed the specifications and design for crystal controlled airborne transceivers capable of operating on a number of predetermined frequencies selected by the pilot through a switch. The equipment eliminated the requirements for pilots to make frequency adjustments. This was an important first for ARINC and was equally important to the airline industry.

Following World War II and the release of large, long range aircraft, new methods and techniques were required to satisfy aeronautical requirements for air/ground and point-to-point communications. These demands in the decade immediately following the war caused the airline industry to turn to ARINC to solve these problems. In 1948 and 1949, the volume of air/ground traffic indicated that even greater sharing of frequencies and radio operators was essential. Thus, the first of ARINC's Communication Centers was activated at Houston, Texas. Soon thereafter, similar centers were established at Anchorage, Honolulu, Los Angeles, New Orleans, Okinawa, San Francisco, San Juan, Seattle and Tokyo. In addition, wire lines simultaneously replaced the continuous wave (CW) point-to-point service, and Very High Frequency (VHF) systems began to replace HF as a medium for communicating with flight crews. By 1967, 15 operational extended-range VHF stations substantially reduced reliance upon HF systems on over water routes. The New York/Eastern Canada VHF network, which served aircraft on the North Atlantic routes, was further extended by activating a station at St. Anthony, Newfoundland.

Inauguration of the ARINC Private Line Intercity Network (PLIN) on December 1, 1969, established, in a single system, essentially all intercity circuitry utilized by the air transport industry. In 1969, the Federal Communications Commission also designated ARINC as the Advisory Frequency Coordinator for assignment of Aviation Terminal Use frequencies at all airports, a function that was transferred to the National Association for Business and Educational Radio (NABER) who ceased operations in 1995. During the same period, new equipment was installed at all ARINC gateway stations for transmission and reception of both single sideband and amplitude modulation (AM) signals. Additional HF capability was added to ARINC's stations in Hawaii and New York to augment the Major World Air Route Area (MWARA) frequency assignments in these areas. The new frequencies increased the communication capacity of all MWARA areas served by ARINC. During 1971, operational capability of the system was expanded from the initial over-ocean service at San Francisco with aircraft operating on transcontinental routes. Specially designed ARINC VHF remote radio facilities were added to six domestic locations and connected to the computerized control center at San Francisco.

Due to a reduction in air/ground contacts in 1973 and 1974, ARINC reconfigured control of its domestic VHF network system by decreasing the number of communication centers. Accordingly, air/ground operations in Los Angeles, Seattle and Denver were transferred to San Francisco, Chicago and Forth Worth in mid-year and the former were subsequently decommissioned. The Washington Communication Center was closed in October, and the associated air/ground operation was transferred to New York. The San Juan Communications Center was closed in 1989 and Honolulu in 1994. With these closures, control of the air/ground service is now exercised through ARINC Communications Centers at New York and San Francisco. Early in 1974, the last remaining manual message switching operation was eliminated when this function was mechanized at the Honolulu Communication Center.

In 1978, the Aircraft Communications Addressing and Reporting System (ACARS), was added to the services provided by ARINC to the airline community. ACARS is the

air/ground/air communications service that provides for the exchange of digital information between the ground and ACARS-equipped aircraft. Today, this service is available throughout the continental United States, Hawaii, Alaska, Puerto Rico, Mexico, Canada, South America, Europe, and Asia.

The foregoing is a very brief historical account of ARINC's growth and facilities. This growth was correlated to expansion of the U.S. airline industry. Similarly, airline requirements for communications grew at a commensurate pace, and technology and communication-electronic systems became more complex. Consequently, the Aeronautical Frequency Committee (AFC) was established in 1949 to develop and maintain a single airline voice in frequency management activities. In 1955, the Air Lines Communications Advisory Council (ALCAC) was established, and the AFC became a standing committee of the Council. The AFC remained a standing committee of ALCAC until December, 1974. At that time the ARINC Board of Directors made it directly responsible to the Board and recommended expansion of its membership, insofar as practicable, in order to be representative of all users of ARINC's radio services.

In order for ARINC to proceed with obtaining outside financial support, ARINC petitioned the Federal Communications Commission (FCC) in September 2004 with a request for Declaratory Ruling that would alter the manner in which VHF and HF spectrum used in aeronautical enroute service was managed. This request would not only allow the change in spectrum management but would also enable the restructuring of ARINC. In March 2005, the FCC granted ARINC's request to move to a new entity under aviation industry governance and control the management of VHF and HF frequency spectrum used to provide the aeronautical enroute service in accordance with Part 87 of the FCC rules that was currently licensed to ARINC. The ARINC Board of Directors asked Management to proceed with creating a new entity. As a result, on January 1, 2006, Aviation Spectrum Resources, Inc (ASRI) was organized and incorporated within the State of Delaware. A separate ASRI Board of Directors consisting of airline management staff was formed to provide guidance and oversight to the new company.

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1 Organization and Administration

1.1 RESOLUTION

Action by Written Consent of
Board of Directors of
Aviation Spectrum Resources, Incorporated

December 31, 2005

“The undersigned, being the sole member of the Board of Directors (the “Board”) of Aviation Spectrum Resources, Incorporated, a Delaware corporation (the “Corporation”), in lieu of holding a special meeting of the Board, hereby takes the following actions and adopts the following resolutions by unanimous written consent, pursuant to Section 141(f) of the Delaware General Corporation Law (the “DGCL”): Appointment of Directors, Appointment of Officers, and General Resolutions.

This Action by Written Consent of the Board of Directors of Aviation Spectrum Resources, Incorporated is effective as of the date first set forth above,” Signed John M. Belcher

Adopted by the ARINC Board of Directors

October 20, 1999

"WHEREAS, it is the desire of the Board of Directors of Aeronautical Radio, Inc. to call upon the expertise and assistance of the users of ARINC services in the development of plans and policies with regard to the use and regulation of the radio frequency spectrum, and believes that it would be beneficial to the Board and to the users of ARINC services were the membership of the Aeronautical Frequency Committee expanded to be as representative as practicable of all aircraft operators using ARINC's air-ground radio services;

BE IT THEREFORE RESOLVED, that the Aeronautical Frequency Committee shall be directly responsible to the Board of Directors; that the Terms of Reference attached are adopted for the Aeronautical Frequency Committee; and that the Aeronautical Frequency Committee is requested to make such recommendations and suggestions as it may deem appropriate for consideration by the Board of Directors."

1.2 TERMS OF REFERENCE

1.2.1 Purpose

The Aeronautical Frequency Committee (AFC) shall be an ASRI sponsored industry committee providing assistance in the formulation of industry recommendations and policies relating to the allocation, assignment and use of the radio frequency spectrum and regulatory matters pertaining thereto, both domestic and international.

In fulfilling its purpose, the Aeronautical Frequency Committee (AFC) shall study aeronautical and land mobile systems concepts and recommend to the ASRI Board of Directors the assignment, use and control of radio frequencies related thereto. The AFC shall also maintain a constant awareness of the status of regulatory matters pertaining to the use of the radio frequency spectrum, and recommend, where necessary, appropriate action to the ASRI Board of Directors.

1.2.2 Membership

Membership shall be comprised of major and regional commercial aircraft operators, air/ground service providers and organizations representing aircraft operators in business and private general aviation. The constituency of organizational memberships, and affiliations among airlines should be considered so as to minimize duplication of representation.

It is recommended that individuals nominated for membership in the Aeronautical Frequency Committee be experienced in aeronautical communications, radio frequency planning, and communications regulatory matters.

The membership of AFC shall be composed of voting members, alternates for voting members, and non-voting members as approved by the ASRI Board of Directors. ASRI shall designate one voting member from the ASRI staff. Service providers will designate one voting member and a Technical Director to act in a non-voting capacity to the AFC. The AFC will review its membership periodically, and make recommendations for any additions or deletions to the voting membership to the ASRI Board of Directors.

1.2.3 Officers

1.2.3.1 A CHAIRMAN, whose term shall be one calendar year, shall be elevated from the office of Vice Chairman from the preceding year, or elected each year by the committee from among its members should that office have been vacant. The Chairman may not immediately succeed himself in office except that, if the elected Chairman should vacate his post prior to the expiration of his term, the Vice Chairman shall automatically assume the office of Chairman, but shall remain eligible to fulfill the office of Chairman during the following term. The Chairman's duties shall be to call and preside at all meetings of the committee and to direct the administrative affairs of the committee.

1.2.3.2 A VICE CHAIRMAN, whose term shall be one calendar year, shall be elected each year by the committee from among its members. In the event of the absence of the Chairman, The Vice Chairman will carry out the Chairman's duties. After serving one year, the Vice Chairman shall serve as Chairman for the following calendar year commencing January 1.

1.2.3.3 AN EXECUTIVE SECRETARY, not a voting member of the committee, shall be appointed by ASRI and shall receive, maintain and distribute correspondence, bulletins, documents, minutes of meetings and other written material of the committee, shall maintain technical liaison with other organizations (e.g., ATA, IATA, etc.) and keep the Chairman advised of all matters requiring committee attention.

1.2.4 Meetings

Scheduled meetings shall be held three times a year. Non-scheduled meetings may be called by the Chairman, as circumstances require. Meeting locations will be selected based upon geographical region, taking into account prior meeting sites and member based locations. Meeting schedules will be subject to review and approval by ASRI Management.

1.2.5 General

Reports of AFC meetings will be issued to its members and to other interested parties. Industry recommendations and positions developed by the AFC will be referred to the ASRI Board of Directors. Upon approval by the Board, ASRI shall be responsible for the prosecution of such recommendations and positions before the applicable government agencies and in such other forums as deemed appropriate.

The AFC Executive Secretary shall keep the ASRI Board of Directors and applicable users informed on schedules of meetings, projects instituted and terminated and other important significant actions or changes.

Administrative, budgetary and regulatory aspects of AFC activities will be subject to review and supervision by ASRI.

1.2.6 Modification of Committee Terms of Reference

Any proposed amendment to the Committee Terms of Reference shall require a favorable two-thirds vote, and a previous notice that a proposed amendment is to be considered during a specific meeting. The notice shall be distributed to all Committee Members at least three weeks prior to the date the proposal is to be voted upon. All changes to the Terms of Reference are subject to approval by the ASRI Board of Directors.

1.3 MEMBERSHIP

1.3.1 Membership (voting)

Prospective AFC members shall be nominated by a manager or higher level employee of the airline or aviation organization to be represented, and who is responsible for that agency's interest in air-ground communications. Upon AFC recommendation, the nomination will be referred to the ASRI Board of Directors for confirmation of appointment. Any voting member who fails to attend, or be represented by an alternate, for three consecutive regularly scheduled AFC meetings will be considered as inactive.[1] An inactive member is reinstated to active membership upon attendance or bonafide representation at a regularly scheduled AFC meeting.

The AFC strongly recommends that members be actual airline employees, although airline contractors can attend the AFC meetings. An airline contractor must be recommended by their airline in accordance with paragraphs 1.2.2 and 1.3.1 of the AFC Manual. A letter or email of recommendation for membership representation from an airline manager or above should be sent to the AFC Executive Secretary. The airline contractor will be on probation for two attended meetings before the AFC votes to recommend them to the ASRI Board of Directors for actual membership. They will become non-voting members of the AFC when approved by the ASRI Board of Directors. The airline contractor will only represent the nominating airline and be limited to AFC subject matter when supporting AFC meetings.

1.3.2 Alternate Membership (voting)

A Standing Alternate member may be designated, in accordance with the procedure in section 1.3.1, and for the purpose of continuity will be encouraged. An alternate for a specific meeting may be designated by the Member concerned, or by his Company's Management, provided the Chairman and Executive Secretary are advised in advance of the meeting. Such alternates shall then be entitled to vote at that meeting.

1.3.3 Lifetime Honorary Membership (Non-Voting)

THE COMMITTEE may, in recognition of the contributions of former members, confer a "Lifetime Honorary Membership" upon those members who have contributed to the achievement of more effective utilization of the radio frequency spectrum while serving as a member of the

[1] Attendance of SWG, other Special meetings, or by proxy, will not be considered in determination of inactive status.

Committee. An appropriate certificate will be presented to former Members accorded the "Lifetime Honorary Membership."

1.3.4 Associate Membership (Non-Voting)

Representatives of the Federal Aviation Administration, aviation trade associations, and other aviation industry representatives may be nominated by the AFC as Associate Members. Such nomination shall be forwarded to the ASRI Board of Directors for confirmation of appointment. Associate Members shall not be entitled to vote at meetings. The AFC may hold closed meetings or sessions to which Associate Members need not be invited, or from which Associate Members may be excluded.

1.3.5 Cooperative Activities (Non-Voting)

It has long been recognized that a continued cooperative effort with aviation organizations in communications matters can provide a high level of expertise to AFC Members. Their participation at AFC meetings may be solicited when appropriate. The AFC Chairman has the authority to invite such representatives to be present at portions of the AFC Meetings where the expertise of these organizations is required to address specific agenda items.

1.3.6 Guests (non-voting)

Guests may be invited by a Member to participate in discussion of specific issues before the AFC, subject to prior approval of the Chairman. Members may also invite guests to participate for the purpose of introduction and familiarization of a co-worker, prospective member, or alternate.

1.3.7 Ex-Officio Member (non-voting)

The ASRI Member may invite any service provider personnel to attend whose expertise he feels is required to fully develop and support AFC recommendations and their implementation.

1.3.8 Past Chairmen are listed in Appendix A

1.3.9 The ASRI Board of Directors are listed in Appendix B

1.3.10 Current membership is as shown in Appendix C

Most current membership information can be found on the ASRI website at http://www.asri.aero.

1.4 ADMINISTRATIVE GUIDANCE

1.4.1 Conduct of Meetings

1.4.1.1 Temporary Chairman

In the event the Chairman and Vice Chairman are unavoidably absent, the Committee shall elect a temporary Chairman for the occasion from among its members. The Executive Secretary shall preside until a Chairman pro tem has been elected.

1.4.1.2 Quorum

A quorum shall consist of one half of the active voting membership of the committee, including proxies. Inactive members will not be counted in determining whether or not a quorum exists.

1.4.1.3 Voting Eligibility

Each Voting Member of the Committee shall be entitled to one vote on all questions. All votes may be cast in person, by an alternate, or by proxy. An authorization for a proxy shall be provided to the Executive Secretary at least two weeks prior to the meeting at which it is to be exercised. The Executive Secretary shall inform the Committee Members of the proxy authorization immediately after the Chairman calls the meeting to order. A proxy shall not be valid for more than one month from the date of issuance.

1.4.1.4 Voting Methods

All motions are divided into two classes; i.e., debatable and undebatable. Undebatable motions are put to a vote immediately after the chairman states the motion. Some motions require only a majority vote, or a number greater than half the votes cast, while others require a two-third vote. A two-thirds vote is required for motions that suppress a main question without free debate. The plurality voting method (e.g. the most votes cast for a candidate) shall be used only in election of Officers and selection of meeting sites and on motions which have been debated. Except for those situations which require a roll call or general consent vote, the vote shall be taken by raising the right hand. The general consent voting method is used to avoid the formality of taking the vote when there seems to be no objection to the question. It is used when routine business is conducted and for minor matters. The approval of minutes and asking for corrections does not require a motion. The chairman states, "If there is no objection, the minutes stand approved as presented (or corrected)."

When necessary the Executive Secretary may disseminate urgent issues for vote by email and/or teleconference. In this event, a two-thirds favorable vote by the voting membership, as defined in 1.2.2, shall be required to adopt an issue or position. The Executive Secretary shall inform the Committee of the results of the vote.

1.4.1.5 Recording Committee Votes

The minutes of meetings shall indicate whether a decision was unanimous or by majority. When applicable, abstentions shall be reflected in the minutes.

1.4.1.6 Special Working Groups

Special Working Groups (SWG) may be established to address specific projects and issues which require development of an Industry position, policy, or recommendation. Membership in a SWG shall be open to all members of the Committee. Conveners of a SWG shall present an oral interim report at all regular Committee meetings. All Industry positions, policies, and recommendations developed by a SWG are subject to approval by the full Committee prior to implementation or acceptance as an Industry position. SWGs will be disestablished after the assigned tasks have been completed and the Committee accepts the work of the Group. The Committee may reactivate a SWG if deemed necessary.

1.4.1.7 Minutes

The minutes of Committee meetings shall be the official record of all business transacted, activities undertaken, plans projected, etc. The minutes shall be signed by the Executive Secretary and sent to Committee Members or posted on the AFC Website prior to the next regularly scheduled meeting. The minutes may be corrected whenever an error is noticed regardless of the time that has elapsed. However, after their adoption, when it is too late to reconsider the vote, a two-thirds vote for amendment shall be required unless previous notice of a proposed amendment has been given; then only a majority vote is required. The minutes of meetings shall include the following:

a. Whether it was a regular or special meeting.

b. The name of the presiding Chairman.

c. Whether the minutes of the previous meeting were approved.

d. The names of all Members (or proxy) present and absent.

e. All main motions, whether adopted or lost. Motions that are withdrawn shall not be recorded. The complete text of all adopted Recommendations and Resolutions shall be recorded in the minutes.

f. The names of persons making and seconding motions.

g. Points of order and appeals, and whether sustained or lost.

h. Summarized reports of Special Working Groups, unless written reports are appended to the minutes.

i. All appointments to Special Working Groups, elected officers, etc.

j. The number of pro and con votes when a count has been ordered, or when the vote is by ballot or roll call.

1.4.1.8 Order of Business

The order of business for a regularly scheduled Committee Meeting shall be as follows:

a. Consideration of Minutes of the previous meeting

b. Reports from Special Committees

c. Unfinished Business (as previously announced in a formal agenda)

d. New Business

1.4.2 Election and Duties of Officers

1.4.2.1 Election of Officers

Officers for a succeeding year shall be elected during the last Committee meeting of the current calendar year; i.e. usually the Fall Meeting. During the regular meeting preceding the Fall Meeting, the Chairman shall appoint a Nominating Committee consisting of three Members to select Nominees for the position of Vice Chairman. The Nominees' names shall then be presented to the Committee during the last Committee Meeting of the year for a vote.

1.4.2.2 Vacancies

In the event the Chairman's position becomes vacant, the Vice Chairman shall automatically assume Chairmanship of the Committee for the remainder of the calendar year, and shall continue to serve as Chairman the following year. If a situation dictates the Vice Chairman assume the chairmanship, or if the Vice Chairman's position becomes vacant, a new Vice Chairman shall be elected to serve out that term, and that of the following year.

1.4.2.3 Duties of the Chairman

It is the duty of the chairman to call the meeting to order at the appointed time; to preside at all the meetings; to announce the business before the Committee in its proper order; to state and put all questions properly brought before the Committee; to preserve order and decorum; and to decide all questions of order (subject to an appeal).

2 Aeronautical Industry Operational VHF Policy

2.1 INTRODUCTION

In the United States, the Federal Communications Commission (FCC) has designated a portion of the VHF Aeronautical Mobile (R) band as the Aeronautical Enroute Service (AES), for use by aircraft operators to fulfill their requirements for Aeronautical Operational Control (AOC) communications. The AES sub-bands, 128.825 to 132.0 MHz, and 136.500 to 136.975 MHz, have been designated in the U.S. for AES purposes, using either 8.33 kHz[2] or 25 kHz channel spacing. The last four 25 kHz channels of the sub-band 136.500 to 136.975, are designated for use in internationally compatible data systems. The Aeronautical Industry VHF Policy addresses the industry criteria for assignment, sharing, and use of these channels. Under this Policy, all channel assignments will be made by ASRI pursuant to the guidelines set forth herein.

The Policy addresses general conditions in channel assignments, permissible communications, specific assignment criteria for voice and data systems, specialized terms and categories of service, and the U.S. - Canadian Agreement on the VHF Aeronautical Mobile spectrum.

2.2 DEFINITIONS AND EXPLANATORY REMARKS

2.2.1 General Information

In the Aeronautical Mobile (R) sub-bands 128.825-132.0 and 136.5-136.975 MHz, certain voice and data operations are authorized. Voice operations are restricted solely to AOC communications. Data communications may consist of either Safety (AOC and Air Traffic Services [ATS]) communications or aeronautical administrative communications (AAC). AAC is allowed on a secondary, non-interference basis and is authorized for the data mode only.

2.2.2 Terms (also see Chapter 9, Glossary, Two-Letter State and Territory Abbreviations, Terms and Definitions)

2.2.2.1 ACARS

The character oriented Aircraft Communications Addressing and Reporting System for data communications.

[2] The FCC Third Report and Order in WT Docket No. 01-289 dated June 1, 2010, amended Part 87 of the Commission's Rules to permit the use of 8.33 kHz channel spacing in the aeronautical enroute service and by flight test stations.

2.2.2.2 Adjacent Channel

A channel whose center frequency is spaced from another by one channel increment, within the same service volume. The current channels spacing is either 8.33 kHz or 25 kHz.

2.2.2.3 Adjacent Signal

The frequency of the channel next nearest in frequency to another co-located channel, without regard to the number of unassigned frequencies in between.

2.2.2.4 Aeronautical Operational Control (AOC) Communications

Communication in the Aeronautical Enroute Service (AES) between an aircraft and the aircraft's operating agency. It includes communications to and from an aircraft when the aircraft is in flight status. The aircraft operating agency refers to the dispatch, maintenance, scheduling, operating agency headquarters or others involved in the operation of a flight. Communication may be one-way or two-way between personnel, computers or other storage or readout devices. The communication may be conducted directly between the pilot and company offices or through a third-party radio operator. These communications can be classified as enroute Super High Level (SHL), High Level (HL) or Mid-Level (ML), terminal or in-range Low Level (LL), Helicopter (HO), and ground Ramp (RT) communications (see Tables and Figures 2-1 and 2-2).

2.2.2.5 Air Traffic Services (ATS) Communications

Encompasses Air Traffic Control (ATC), Automatic Weather Observation Systems (AWOS), Ramp Control (RC), and numerous other functions. While ATS functions are normally provided by the FAA on frequencies set aside for air traffic services, ATC and RC functions may be conducted on AES frequencies due to their relationship to safety of flight.

2.2.2.6 Co-located

Any two or more ground stations whose antennas are located within 80 feet of each other are considered to be co-located.[3]

2.2.2.7 Common-user system

A radio communications network whose operator provides service to any aircraft operator who enters a cooperative agreement with a Service Provider for provision of those services, and which is, in fact, regularly serving more than two independent aircraft operators.

[3]This distance is that at which the FAA recommends at least 500 kHz separation of adjacent signals, and is approximately that required to prevent adjacent channel interference as in the cosite case, but with a receiver adjacent channel rejection of 100 dB.

2.2.2.8 Cosite

Any two or more ground stations whose antennas are located within 1 nautical mile of each other are considered to be cosite.[4]

2.2.2.9 Control Point

A Control Point is the location at which the radio operator responsible for assuring proper operation of a transmitter is located. Radio Stations in the Aviation Services must be provided with a control point at the location of the transmitting equipment, unless otherwise specifically authorized. Additional control points at locations other than the transmitter location may be authorized. All such additional control points shall be shown on the station authorization (license). A control point must meet the following conditions:

a. The location must be under the control and supervision of the licensee;

b. It must be provided with monitoring facilities and a means to render the transmitter inoperative;

c. It must be equipped to provide the operator the ability to aurally monitor transmissions originating at dispatch points under his supervision and equipment must be arranged to provide the operator with the ability to disconnect any or all dispatch point circuits from the transmitter.

d. It must be equipped to provide the operator with a visual indication that the transmitter is operating.

2.2.2.10 Dispatch Point

A dispatch point is a location from which radio communications may be conducted, which is under the direct supervision of a Control Point. Dispatch Points need not be shown on the FCC license.

2.2.2.11 Enroute Communications

Communication, other than "Terminal (In-Range)", between an aircraft and its operating agency when the aircraft is at, or above 10,000 feet.

[4]This distance is approximately the separation required to prevent adjacent channel interference in a receiver having 60 dB adjacent channel rejection, and 2uV squelch threshold, when subject to a 10 watt transmitter on an adjacent channel.

2.2.2.12 Co-channel Exclusion Zone

For a given frequency, the area around a data link ground station within which no voice stations or other independently operated co-channel data link stations will be authorized or the area around a voice station within which no data link stations will be authorized. The radius of the exclusion zone is determined from Table 2-1.

2.2.2.13 Flight Status

Flight status is normally defined as beginning when the flight crew enters the flight deck of the aircraft for a particular flight and ending when the flight crew leaves the flight deck at the completion of that flight. In addition, when an aircraft is taxied by authorized ground personnel it is also considered to be in flight status.

2.2.2.14 Frequency vs. Channel

The term "channel" applies to a communications path which supports one contact at a time within a given geographical area, sharing a common radio frequency. Thus, in a given coverage area, several users may share a "channel". The term "frequency" is used when referring to a spectral band, which can be used to support one or more "channels" in different geographical areas.

2.2.2.15 Ground Communications

Communication between ground personnel and an aircraft on the ground when in flight status. These communications are typically carried on without a third party radio operator. This includes, for example, maintenance, ramp control[5], etc.

Essential communications to or from an aircraft required for servicing the aircraft when not in flight status are permitted for authorized ground personnel when other means of communication are not readily available. This will permit the ground crew servicing the parked aircraft to communicate with other support personnel relative to the needs of the aircraft and to perform checks of the communications equipment.

2.2.2.16 Network

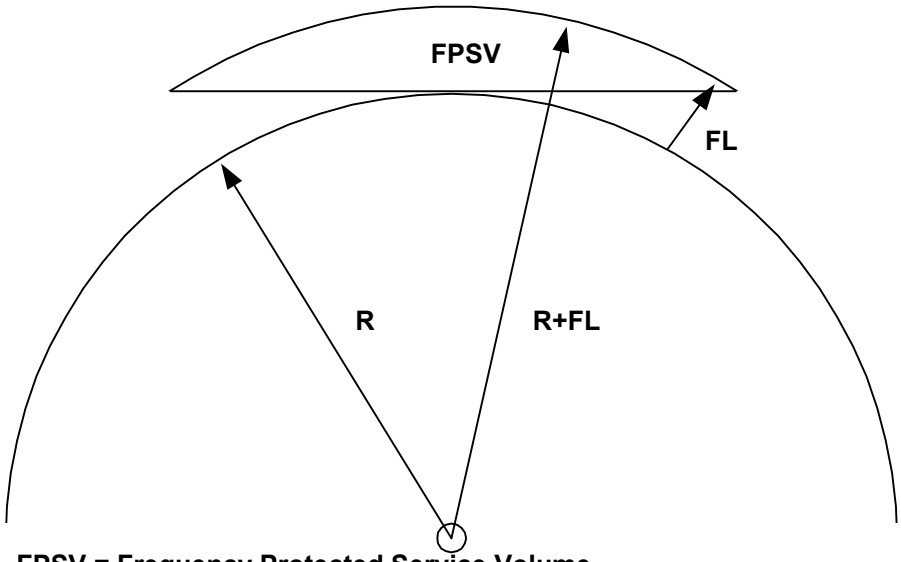
A system of two or more stations connected by a common communications circuit and operated from one or more control points.

[5]Note that the ATS Ramp Control function is permitted on AOC channels due to its relationship to "Safety-of-Flight".

2.2.2.17 Service Volume

The protected region within which communications service is offered via a ground station. For all line-of-sight AES services, it is a segment of a sphere, concentric with the earth, defined by the intersection of a plane tangent to the earth at the point where the ground station is located, and a sphere of radius equal to 4/3 of the earth's radius plus the maximum altitude of aircraft to be served by the ground station. For RT stations, a maximum transmitter height of 50 feet is assumed.

FIGURE 2-1



FPSV = Frequency Protected Service Volume
R = 4/3 Earth Radius
FL = Maximum Coordinated Altitude

2.2.2.18 Terminal (In-Range) Communications

Communication between an aircraft and the arrival or departure ground personnel[6]. This communication is typically carried on without a third-party radio operator.

2.2.2.19 VHF Digital Link (VDL) Mode

The internationally standardized VHF digital link system, as defined by ICAO Annex 10 SARPs Chapter 6, Section 6.4.3.

2.3 CHANNEL ASSIGNMENTS AND CONDITIONS

2.3.1 Application

Applications for assignment to Aeronautical Enroute channels will be reviewed by ASRI Frequency Management for completeness and for conformance with this Policy. Applicants will then be assigned to channels subject to availability and shared use. The method of meeting the identified communication requirement will vary, depending upon the channel congestion in the requested service area. The procedures detailed below will be used to determine how requirements will be satisfied.

2.3.2 Justification of Requirements

Applicants will be required to determine and justify their request for an assignment in accordance with the criteria contained in Sections 2.6 or 2.7 of this policy. Ground handling companies that are requesting frequencies in support of other air carriers, will justify their requests for one or more frequencies with letters of justification from the air carriers they support. Requests which are not accompanied by such justification will be returned to the applicant as incomplete.

2.3.3 Conditions of Assignment

Due to regulatory requirements and constantly changing demands placed on shared spectrum resources, any assignment may be revoked or modified. To the greatest extent practicable, however, assignment of an operating entity to one or more channels will remain without alteration so long as the following conditions are satisfied:

2.3.3.1 Communications services are in fact provided under the assignment,

2.3.3.2 Operations are conducted in accordance with the provisions of the ASRI Rules and Regulations for Ground Radio Stations operating in the Aviation Services, and the FCC Rules, and the assignment continues to meet the criteria of Section 2.6 or 2.7 of this policy.

[6]Ground personnel refers to the Operations, Maintenance, Ramp Parking, Ground Handling and other personnel charged with servicing the aircraft.

2.3.3.3 The assignment criteria in Sections 2.6 and 2.7 will be reviewed and updated periodically to reflect operating experience, technological advancements, and revisions to industry standards.

2.3.4 Guidelines for Assignments to Channels

2.3.4.1 FCC Rules do not permit Private Aeronautical Enroute Service ground stations. "Service must be provided to any aircraft station licensee who makes cooperative arrangements for the operation, maintenance and liability of the stations which are to furnish enroute service."[7]

2.3.4.2 Assignments to channels will be made on a case-by-case basis in the service area under consideration. ASRI will select the appropriate channel, sharing channels wherever possible, after due consultation with the aircraft operating agencies concerned, considering the channel loading and nature of the operations involved. Where sharing is deemed appropriate and necessary, ASRI will insure that all concerned users are informed.

2.3.4.3 To reduce the potential for interference and permit the implementation of the maximum possible number of channels at terminal areas, it is recommended that transmitters located within the confines of airports use the minimum Effective Radiated Power (ERP) needed for adequate communications (i.e., normally 10 watts ERP or less). However, such systems should be limited to no more than 25 watts ERP. The system needs will be reviewed by ASRI at the time of application.

2.3.4.4 In the assignment to channels, due consideration will be given to the protection of established operations from interference to and from other operations. Determination of whether interference protection between operators employing the same frequency is to be provided shall be based on consideration of channel loading. In the event harmful interference is caused by a new service to an established facility, reduction of interference to a non-harmful level by engineering techniques or facility relocation is the responsibility of the new user.

2.3.4.5 If the applicant has a preference as to a frequency using either 8.33 kHz or 25 kHz channel spacing, the applicant will include this preference on the ASRI coordination form. ASRI will endeavor to accommodate the applicant's preference. Where the applicant has no preference, ASRI will select the best frequency to be used.

2.3.4.6 Voice and data communications will be accommodated on separate frequencies unless, as a rare exception, coordinated for air-to-air line-of-sight separation.

2.3.4.7 Table 2-1 and Figure 2-2 show the separation required between co-channel ground stations in order that aircraft radios operated at the extremes of their respective service volumes will not be within line-of-sight of each other. Ground stations are separated by twice the sum of the radii of the two service volumes. These distances represent the ICAO recommended separation required between co-channel ground stations in order that aircraft operating at their nominal altitudes and at the limits of the functional service range of their respective ground stations will not cause harmful interference to one another.

[7] 47 CFR Part 87.261(b)

2.3.4.8 Table 2-2 and Figure 2-3 show the separation required between co-channel voice ground stations for assignment of channels where none are available that would meet the criteria of Table 2-1. These separations provide only air-ground-air protection, and do not consider air-to-air protection. Thus, a ground station would not hear aircraft attempting to communicate with the adjacent service volume, but that aircraft's communications would be heard by approximately 50% of the aircraft operating in the adjacent service volume. This will greatly reduce channel capacity, since 50% of the air/ground communications in one service volume constitutes traffic, during which the channel is not available, in as many as six adjacent ones.

2.3.4.9 Data ground stations must be separated from co-channel analog voice ground stations by the full ICAO recommended distances in order to prevent air-to-air interference, and to comply with FCC Rules regarding prohibition of data on channels also used for voice communications, except where the two are multiplexed.

2.3.4.10 While separation of voice ground stations in accordance with ICAO/FAA standards is desirable, the shortage of AES frequencies has necessitated greatly reduced geographic separation. Protection from air-to-air interference must be reduced to approximately 50% in order to accommodate current spectrum demand. Therefore, the ground station geographical separation indicated in Table 2-2 is presently used on a case-by-case basis, as determined by ASRI Frequency Management, for AES co-channel assignments.

2.3.4.11 Both tables were derived using the formula for the distances to the radio horizon from a station in an aircraft. This formula is given below.

$$D = K\sqrt{h}$$

Where D = distance to horizon in nautical miles
h = height of aircraft station in feet [8]
K = 1.23 for an effective earth's radius of 4/3 of the actual radius

[8] All coordination altitudes are relative to mean sea level, except for ramp/terminal (RT) and helicopter (HO), which are referenced to ground level.

TABLE 2-1

ICAO RECOMMENDED
GROUND STATION SEPARATION
FOR LINE-OF-SIGHT SERVICE VOLUMES
(NEAREST 5 NAUTICAL MILES)

		RT GND	HO 2000	LL 15000	ML 24000	HL 45000	SHL 70000
SHL	70000	670	760	950	1030	1175	1300
HL	45000	540	630	825	905	1045	1175
ML	24000	400	490	580	760	905	1030
LL	15000	320	410	605	580	825	950
HO	2000	125	220	410	490	630	760
RT	GND	35	125	320	400	540	670

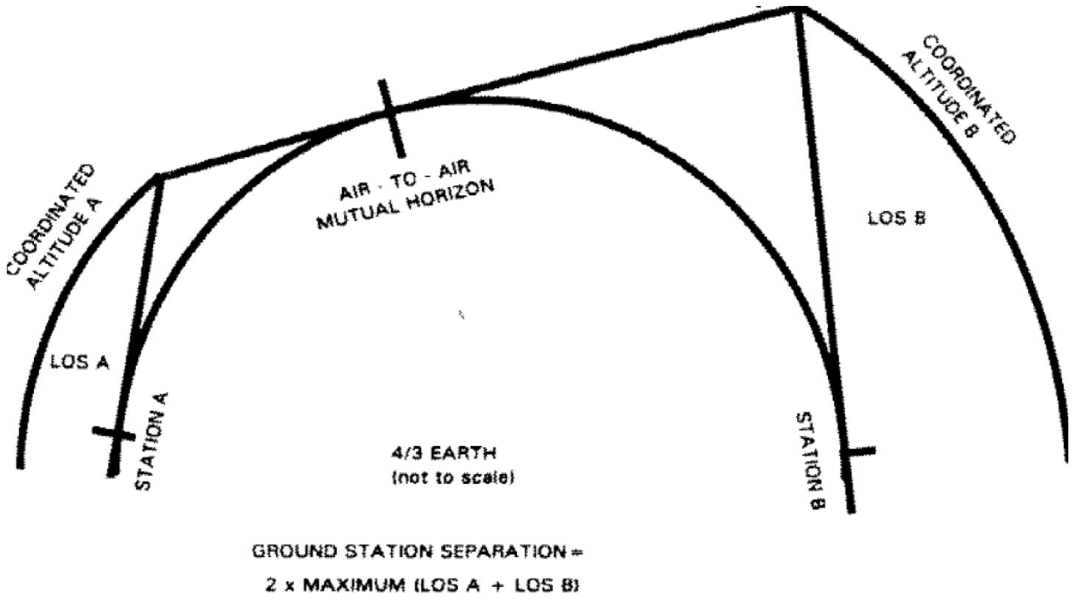
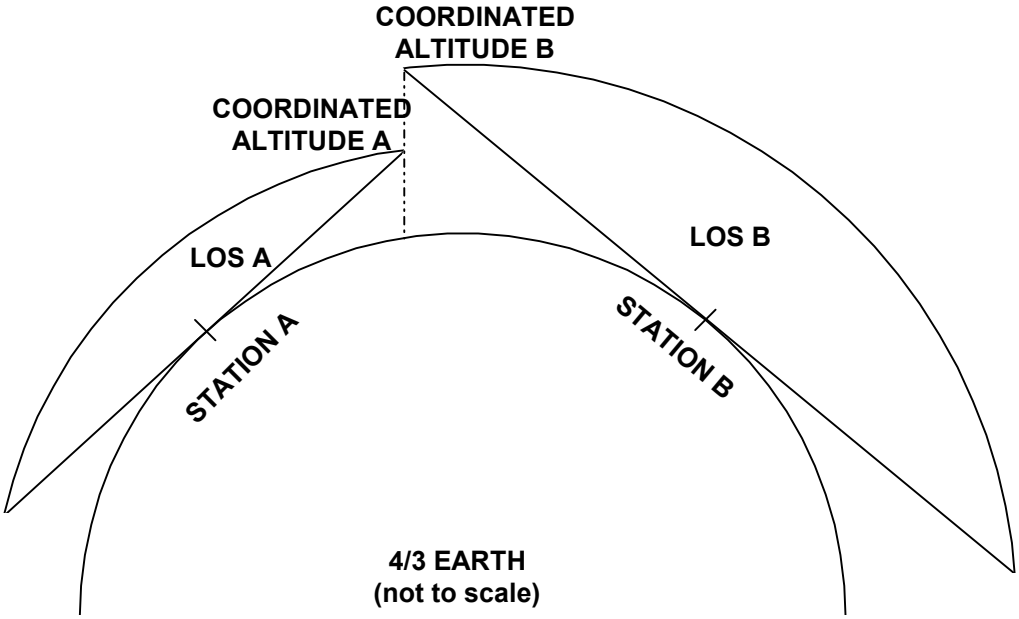


FIGURE 2-2

TABLE 2-2 and FIGURE 2-3

GROUND STATION SEPARATION FOR
AIR-GROUND-AIR PROTECTION ONLY
(50% or Less Air-Air Protection)
FOR LINE-OF-SIGHT SERVICE VOLUMES
(NEAREST 5 NAUTICAL MILES)

		RT GND	HO 2000	LL 15000	ML 24000	HL 45000	SHL 70000
SHL	70000	335	380	475	515	585	650
HL	45000	270	315	410	450	1045	1175
ML	24000	400	490	580	760	905	1030
LL	15000	320	410	605	580	825	950
HO	2000	125	220	410	490	630	760
RT	GND	35	125	320	400	540	670



**GROUND STATION SEPARATION =
MAXIMUM (LOS A + LOS B)**

2.4 PERMISSIBLE COMMUNICATIONS ON VHF AOC CHANNELS

2.4.1 Regulatory References

2.4.1.1 FCC Regulations are, to the extent required for international coordination and compatibility, based upon general allocations and rules generated by the International Telecommunication Union (ITU). FAA Rules are, in a like manner, guided by recommendations developed by the International Civil Aviation Organization (ICAO). Both the ITU and ICAO are international bodies to which the United States is a signatory of their respective Conventions.

2.4.1.2 Use of communications channels in the AES is governed by FCC and FAA Rules, which are generally in accordance with regulations contained in the ITU Radio Regulations, and Annex 10 to the Convention on International Civil Aviation.

2.4.1.3 ICAO defines Operational Control Communications as those "required for the exercise of authority over the initiation, continuation, diversion, or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of a flight."[9]

2.4.1.4 The FCC defines the Aeronautical Enroute Service in similar terms:

> "Aeronautical enroute stations provide operational control communications to aircraft along domestic or international air routes.[10] Operational control communications include the safe, efficient and economical operation of aircraft, such as fuel, weather, position reports, aircraft performance, and essential services and supplies. Public correspondence is prohibited."[11]

2.4.1.5 Some ATS communications are permitted on AOC channels by virtue of their relationship to safety of flight.

[9] Annex 10 to the ICAO Convention, Volume 1 Part II, Ch. 1

[10] As required by the Federal Air Regulations for U.S. operations certificated under 14 CFR Part 121.

[11] 47 CFR Part 87.261(a)

2.4.1.6 In addition, the FCC permits, on a secondary basis using data transmission only, Aircraft Administrative Communications, which are defined as follows:

> "Such secondary administrative communications must directly relate to the business of a participating aircraft operator in providing travel and transportation services to the flying public or to the travel, transportation or scheduling activities of the aircraft operator itself. Stations transmitting administrative communications must provide absolute priority for operational control and other safety communications by means of an automatic priority control system."[12]

2.4.2 Permissible Communications (Voice and Data)

The following are examples of typical permissible AES communications:

2.4.2.1 AOC

The following is a non-exhaustive list of permissible AOC communications:

Pilot/Dispatch Communications

- Weather Information
- Flight Planning Data
- Weight/Balance
- Flight Release
- Flight Progress Information
- Position Information
- Gate Assignments
- OOOI (Out-Off-On-In) Reports

Maintenance

- Maintenance Alerting
- Flight Diagnostics
- Airframe/Avionics Monitoring
- Engine Monitoring

Other

- Check Lists

[12] 47 CFR Part 87.265

De-Icing
Essential Supplies and Services

Emergencies

Medical
Equipment
Non-Equipment
Security
Weather

Aircraft Ramp Movements[13]

Base to Aircraft
Mobile to Aircraft

2.4.2.2 AAC

AAC is permissible in U.S. air space on data channels and on a secondary basis to all other permissible communications only. The following is a non-exhaustive list of permissible AAC communications:

Travel and Transportation Services
Non-essential Supplies and Services

2.4.2.3 ATS

Subject to FAA and Industry agreement, ATS communications may be accomplished on AOC channels. For example, PDC (Pre-Departure Clearance) and ATIS (Air Terminal Information System) communications are ATS functions that are being performed on AOC frequencies for the purpose of early implementation via an existing data link system for mutual FAA/Industry benefit.

[13] Although some air carriers have agreed to perform certain ramp control communications in "non-movement areas," (as defined by the FAA) there is no agreement as to whether this is an ATS or AOC function.

2.4.3 Typical Non-permissible Communications (Voice and Data)

The following is a non-exhaustive list of non-permissible communications:

a) Public correspondence
b) Personal messages to or from crew or passenger

2.5 CONTROL/DISPATCH POINTS

2.5.1 There must be a control point for each transmitter. The control point is usually at the transmitter and must provide:

a) A security system to prevent unauthorized access to and operation of the radio.

b) A visual indication that the transmitter is keyed by either a dispatch point or the control point.

c) Aural monitoring of transmissions from subordinate dispatch points.

d) A way to disconnect subordinate dispatch points from the transmitter.

e) A means to turn off the transmitter.

f) A way to restrict calls from aircraft to the Public Switched Telephone Network (PSTN) to authorized operational control destinations.

2.5.2 All control points must be listed on the license. Control points cannot be located outside the U.S. Multiple control points are permitted.

2.5.3 Enroute radios can be operated from dispatch points subordinate to a control point. Dispatch points can be located anywhere the license holder desires. They need not be listed on the license.

2.5.4 Dispatch points should not be capable of operating when the associated control point is not manned. Manned means authorized persons are within audible range of the control point.

2.5.5 Acceptable means of deterring unauthorized persons from using dial-up systems include:

a) User programmable passwords of 4 or more characters.
b) Call back schemes.
c) Digital data streams.

2.5.6 In dial-up systems, wherein public switched circuits are used to control a ground station, the control point should not connect the telephone line to the radio until an authorized password, data stream or security tone is received. If an authorized password, data stream or security tone is not received, the control point should automatically disconnect from the telephone line in a user programmable period of time.

2.5.7 Control/Dispatch points should not be accessible to unauthorized persons when not manned.

2.5.8 Mobile Operations

2.5.8.1 All handheld and vehicle mounted radios are considered mobile operations.

NOTE: Handheld radios used while in a desk charger are considered base stations.

2.5.8.2 Mobile radios used on AOC channels are licensed under their associated base station license and will only be used to communicate with their associated base station and/or with aircraft that are on the ground. They are not authorized to communicate with aircraft that are airborne.

2.6 VHF VOICE FREQUENCY ASSIGNMENT CRITERIA

2.6.1 Non-Congested Areas

An operating entity may receive assignment to a single voice channel at each location at which they operate. Assignment to more than one frequency will be made in accordance with flight activity data. Each applicant should provide flight activity data for its own use regardless of its affiliation with other carriers. The following guidelines will apply:

The applicant will submit flight activity data to ASRI using the following formula to justify the need of additional assignment(s):

$N = A/14$

Where:

N = The number of channels required in the service area under consideration.

14 = The number of flights that can be accommodated within a channel assignment sector within a peak hour for voice.

$$A = \sum_{i=1}^{i=4} (T_i + L_i + 0.25P_i/S)$$

Where:

T_i = the number of scheduled departures at the airport served during the four peak 15-minute activity periods.

L_i = the number of scheduled arrivals at the airport served during the four peak 15 minute activity periods.

P_i = the peak instantaneous count of aircraft served by the station(s) (excluding those aircraft included in T_i or L_i in the station's service volume during the four peak 15 minute activity periods.

0.25 = Factor to recognize that four separate counts are to be added together.

S = The number of airports at which the user has assignments within the service volume of the station(s).

Note: The operating entity shall select the four 15 minute periods, which need not be consecutive, but the same four 15 minute periods shall be used for all the factors, T_i, L_i and P_i.

Where application of the formula results in a fractional number greater than 0.3, the next larger whole number will apply.

2.6.2 Congested Areas

2.6.2.1 Certain areas of the U.S. (and U.S. possessions) are designated as "congested", when approximately 80% of the available frequencies are in use by ground stations located within low level air-to-air interference range of the designated center of the congested area (605 nmi radius), or when it becomes necessary to assign cosite adjacent channels. Within 600 nautical miles of the Canadian border, 96 AOC frequencies (25 kHz spaced) are available for unrestricted use (32 are Canadian primary). Once users are assigned to 76 frequencies in an area, that area is considered "congested". In a like manner, locations more than 600 nautical miles from the Canadian border have 128 channels available and the 80% level, or congested point, is 102 channels in use. (Note: Using these criteria, it has been determined that all locations in the contiguous 48 states are now classified as "congested".)

2.6.2.2 Requests for additional assignments in congested areas must be justified by actual loading in addition to initial justification by the non-congested area formula above, and will be subject to

validation by physical measurement of channel occupancy on all channels used by the applicant, recognizing that this measurement is made during normal weather and operating conditions.

2.6.2.3 The intent of the physical measurement is to gather data on utilization of existing assignments on which to base decisions on sharing of frequencies. The aim of Frequency Management will be to insure that loading is relatively uniform across the available frequencies. The goal will be to load channels until they reach a predetermined level of "carrier on", or utilization. If that level is exceeded, a user will be provided additional access to reduce the utilization rate to the desired level.

2.6.2.4 In determination of the maximum workable channel load, the radio channel will be treated as a simple queuing system. This assumes that a contact is a two way communication between the aircraft and the ground. A contact consists of several transmissions and the average contact length is between 10 and 15 seconds in duration. It is assumed that good channel discipline exists, i.e. no one attempts to start a contact until the previous one finishes. This also assumes that delays due to ground personnel response will be kept to a minimum by properly manning the ground station during peak loading periods, providing a mean ground response delay of less than 4 seconds in responding to the initial call.

2.6.3 Loading Standards

2.6.3.1 Voice Channel With Single User

Physical measurement should indicate 35-45% "carrier on" during peak five minute periods under normal operating conditions. When the mean "carrier on" measurement exceeds 45%, access to another channel will be considered if requested, and if channels are available. When the mean level drops to below 30%, the channel will be considered available and additional users may be assigned to that channel.

2.6.3.2 Voice Channel With Multiple Users

Physical measurement should indicate 30 to 40% "carrier on" during peak five minute periods under normal operating conditions. When the mean rate exceeds 40%, one or more users will be assigned to another channel, if available, to reduce the utilization rate downward toward the desired area of 30 to 40%.

2.6.4 New Users

Assignments of new operators to channels will be made in accordance with the anticipated flight traffic volume of the operation concerned. New users will be assigned to share an existing, in-use channel unless their initial requirement is reasonably expected to meet the desired loading for a channel with a single user. Individual users will be assigned to a non-shared channel, when available, only if that user can demonstrate a firm requirement of loading in excess of the desired loading criterion.

2.6.5 Replacement

Replacement of an existing assignment that is no longer acceptable for technical or operational reasons will be handled on a case-by-case basis, only after all reasonable alternative technical solutions have been considered.

2.6.6 Route Adjustments

Assignments to channels due solely to route adjustments will be handled as follows:

An existing assignment provided for the users involved will be extended, insofar as possible, commensurate with maintaining interference protection in accordance with Table 2-2. Extension of existing assignments, where required and justified, which create contention with the established operation of another user, shall be resolved by consultation and agreement among the users and ASRI. ASRI will then initiate the required reassignment(s).

In the event an existing assignment cannot be extended without creating contention with an established operation:

a) A different frequency, if available, will be selected to fulfill the new requirement or

b) The applicant involved may elect to obtain service from an established facility, or

c) The air-to-air interference protection provided by the spacing shown in Table 2-2 with due consideration, may be further derogated to permit extension.

2.6.7 Extraordinary Requirements

Additional assignments to channels may be considered for extraordinary or special requirements, unusual operational and/or technical problems. Decisions regarding special circumstance will be made by ASRI management and/or the AFC.

2.6.8 Network Stations

No simulcast voice network stations will be assigned to frequencies in the 136 to 137 MHz band.

The validation process for assigning voice network stations to channels will take into account the utilization rate for the entire network at the network control point. Only

"Common-user" networks will be authorized. Assignments to network channels will be made on the same basis as "In-Range" stations, i.e. shared use. Existing networks will be "Grandfathered" subject to continuing compliance with the loading requirements of paragraph 2.6.3.

Network stations that also provide low altitude enroute, in-range, or ground communications service must be included in justification for additional frequencies at that location in accordance with the formula given in Section 2.6. Those network stations which are used exclusively for high level and mid-level enroute coverage will not be included in determining eligibility for additional channels.

2.6.9 ATS Related Functions

Whenever functions typically provided on ATS channels are proposed for AOC channels, additional channels from outside the AOC band should be requested due to the paucity of spectrum and the resulting reduced protection criteria used in AOC applications.

2.6.9.1 Ramp Control

Ramp Control assignments will be made to any certificated air carrier which has been designated by the FAA, in writing, to be responsible for the ATS ramp control function in “non-movement” areas. Frequencies required for Ramp Control in “movement” areas shall be provided by the FAA when available. Due to their shared nature, AOC frequency assignments used for Ramp Control will be restricted to communications only in non-movement” areas. AOC frequencies used for this purpose shall not be afforded any priority over other users’ authorized AOC communications on the same frequency. Therefore, the Ramp Control user is cautioned to assure that other means are available to communicate between the ground handlers and the flight crew in the event that the frequency is in use by others. FAA mandated ramp control assignments will not be counted in determining the number of in-range assignments of the respective user. Companies choosing to conduct “non-movement” Ramp Control functions on channels also used for other AES functions must justify the channel in accordance with the policy for AOC channels.

2.6.9.2 De-Icing

Temporary assignments for de-icing shall not be used for any other purposes, and shall be valid only for the current de-icing season. The deicing season normally runs from the beginning of September until the end of April, but can be extended by ASRI due to unique location and/or weather situations on a case by case basis. Where de-icing requirements cannot be accommodated on currently authorized AOC frequencies, a single shared channel, 129.525 MHz, will be authorized for shared use by all users at an airport, without regard to justification by flight activity. Additional de-icing frequencies may be granted, subject to availability, up to the number of frequencies that are justified or have previously been justified at the same location in accordance with Section 2.6.1. These additional frequencies will not be reserved beyond the de-icing season, and will become available for general AOC assignments. Therefore, additional de-icing frequencies are subject to change, or lack of availability, from year to year.

2.7 VHF DATA LINK FREQUENCY ASSIGNMENT CRITERIA

Common-user data link systems based on industry derived standards, have demonstrated increased spectral and economic efficiencies in providing integrated data link communications networks and are supported by the aviation community as a spectrally efficient means of providing air-ground data communications. This policy addresses common-user ACARS and VDL Mode 2 systems, which allow networked multiple ground stations to use the same frequency within overlapping service volumes. Therefore, only common-user data link systems will be authorized. All applications for new data link systems must be approved by the AFC.

2.7.1 General

Due to the extreme shortage of AOC frequencies, it may not be possible to grant authorization for data link frequencies justified in accordance with this section. When a suitable data link frequency is not otherwise available, it may be possible to relocate incumbent users from a frequency identified by ASRI Frequency Management. It shall be the responsibility of the applicant to negotiate the relocation of the incumbents

2.7.1.1 An additional frequency is justified only when the peak RF channel activity regularly exceeds a given occupancy on all currently assigned channels simultaneously, as defined and/or measured in accordance with Section 2.7.2. (This percentage reflects today's technology and should not be construed to be an impediment to future optimization.) The ground station operator will determine channel loading by physical measurement of RF channel occupancy, or by analysis of traffic records, in accordance with Section 2.7.2 .

2.7.1.2 An additional frequency may be assigned if a trend can be shown that would cause all currently authorized system frequencies to be loaded in excess of the metrics defined in Section 2.7.2 within one year. Frequencies authorized under this provision will be re-evaluated after one year, and will be decommissioned if not justifiable at that time.

2.7.1.3 All under-utilized frequencies[14] at a particular station are subject to return to the common pool of assignable frequencies. A single under-utilized frequency will not be subject to recall. However, additional under-utilized frequencies will be returned to the pool after one year.

2.7.1.4 A Frequency that is under-utilized at a particular station will not be subject to return to the common pool if the exclusion zones of remaining justified co-channel stations preclude its use for other purposes.

2.7.1.5 Data operations shall conform to the protocols and other signal-in-space standards set forth in ARINC Characteristics 597A, 724, 724A, 724B, 750, 758, ARINC Specifications 618, 619, 620,

[14] A frequency is considered to be underutilized when its loading does not exceed 10% as measured in accordance with Section 2.7.2.

622, 623, and 631, and their successors, to assure proper discipline and efficiency in the use of the spectrum.

2.7.1.6 All data ground stations shall have the ability to deliver third party data traffic if requested and prior arrangements have been concluded.

2.7.1.7 Systems transmitting administrative communications shall employ an automatic priority system to ensure absolute priority of Safety (AOC and ATC) communications on the channel whether these communications originate in the aircraft system or in the ground system.

2.7.2 Methods of Data Link Frequency Justification

Channel loading shall be determined as "seen" by an aircraft flying at the maximum coordinated altitude above the location at which an additional frequency is proposed[15] ("test point"). The VDL Mode 2 system has a more efficient channel access algorithm than the ACARS system resulting in a much improved channel performance (loading) per channel.

2.7.2.1 ACARS

2.7.2.1.1 RF Monitoring Method

An additional frequency will be considered as justified when RF monitoring at or below the test point shows that all currently authorized frequencies are simultaneously loaded at, or above, 40% over the averaging period. The averaging period is defined as one hour. Alternatively, if more than one frequency is assigned; three five-minute periods in one month may be used.

2.7.2.1.2 Traffic Analysis Method

An additional frequency will be considered as justified when an analysis of the traffic records shows that all currently authorized frequencies at that location are simultaneously loaded at, or above, 40% over an averaging period of one hour. This analysis will be based upon the following parameters:

It may be assumed that 2000 ACARS block attempts per hour is equivalent to an RF channel load of 40%. System control blocks with labels listed in ARINC Specification 620 Section 4.2 (Uplinks) and Section 5.2 (Downlinks) may not be counted for this purpose.

All uplinks from ground stations within line-of-sight of the test point may be considered.

All unique downlinks received from stations within 1.66 times line-of-sight of the test point may be considered.

[15] The system operator is encouraged to monitor all system frequencies within line-of-sight of the test point to support determination of the most appropriate frequency.

The total uplinks and downlinks recorded for each system frequency currently authorized, and for the same time period, will be tabulated.

For additional information on the derivation of these requirements, see AFC FP 99-07.

2.7.2.2 VDL Mode 2

2.7.2.2.1 RF Monitoring Method

An additional frequency will be considered as justified when RF monitoring at or below the test point shows that all currently authorized frequencies are simultaneously loaded at, or above, 40%[16] [17] during the busy hour over the averaging period. The averaging period is defined as over a 30 day period, the number of days which the 40% threshold is exceeded is greater than 15 days.

2.7.2.2.2 Traffic Analysis Method

An additional frequency will be considered as justified when an analysis of the traffic records shows that all currently authorized frequencies at that location are simultaneously experiencing RF utilizations at or above, 40% over an averaging period of one hour. This analysis will be based upon the following parameters:

It may be assumed that a presented load of 50% during the hour is equivalent to an RF utilization of 40%. Presented load may be calculated as follows.

All uplinks from ground stations within line-of-sight of the test point may be considered. This includes uplinks from all service providers on the frequency.

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[16] ARINC comment: Due to hidden terminals, enroute performance degrades from CSMA performance to near aloha performance. Peak throughput on aloha channels is 18% of presented load and occurs when the normalized presented load is 50%. The RF utilization at this peak is 39.4%. It is conceivable that the technical justification of the original voice channel requirement of 40% came from this value of 39.4%. It should be noted that as channel loading approaches this peak, delays become long, which may be acceptable for AOC traffic. On the other hand, ATC traffic usually has delay requirements which would preclude using an enroute channel operating anywhere near this peak load. The Aloha model may be overly pessimistic for VDL due to factors such as the capture performance of the avionics, but this has never been validated in the field.

[17] SITA comment: The performance of a VDL Mode 2 data link channel has already been analyzed in great detail through simulation by various organizations. The simulation scenerios for VDL Mode 2 channel operations at different traffic levels supported both a small terminal area as well as a wider en-route area. The most demanding case was for an en-route VDL Mode 2 channel providing service to 150-200 aircraft. The results indicated that as long as the channel utilization was below 50%, the performance requirements were met consistently.

[17] SITA comment: It should be noted that the simulation results also indicated that when a VDL Mode 2 channel is restricted to providing data link services in a terminal area only (aircraft at the airport) the performance requirements are met even when the channel is utilized as much as 75%. However, this criteria cannot be applied to the one VDL Mode 2 channel in use today, that is the Common Signaling Channel (CSC), because the CSC is used for services in terminal areas as well as enroute. Since the enroute usage is more sensitive to channel loading, due to CSMA inefficiencies such as hidden transmitter for example, the more stringent enroute metrics must be used.

All unique downlinks received from stations within 1.66 times line-of-sight of the test point may be considered. This includes downlinks from all aircraft on the frequency, regardless of service provider.

The presented load is calculated by summing the durations of these transmissions and dividing the sum by 3600 seconds. The presented load for each system frequency currently authorized, and for the same time period, will be tabulated.

2.8 U.S.A./CANADA INTERIM CHANNELLING ARRANGEMENT FOR THE AERONAUTICAL MOBILE (R)/(ENROUTE) SERVICE UTILIZING 25 KHZ CHANNELS FOR THE BAND 128.8125-132.0125 MHZ[18]

This Arrangement, which is subject to periodic review at the request of either Administration, is of an interim nature pending its incorporation into an Allotment Plan for certain bands allotted to the aviation services to meet the United States and Canadian aeronautical frequency requirements along the U.S./Canada border, to the mutual satisfaction of both countries.

Implementation of 25 kHz channel assignments by either Administration shall become effective on the date of signing of Letters of Understanding by both the United States and Canada. The use of 50 and 100 kHz equipments shall not be protected from properly operating 25 kHz equipments beyond February 1, 1981.

The provisions of this Arrangement apply to Canada and the United States in the utilization of the 25 kHz channels for the band 128.8125-132.0125 MHz which are shown in Table 2-3.

Note: The future implementation of 8.33 kHz channel spacing into the band 128.8125 to 132.0125 MHz will require re-evaluation of the U.S.A./Canada Interim Channeling for the Aeronautical Mobile (R)/(Enroute) Service Agreement.

[18] Attachment 1, to Letter of Agreement, Andre Lapointe, Acting Deputy Minister of Communications, Canada to Charles D. Ferris, Chairman, Federal Communications Commission, dated December 20, 1977.

Table 2-3

Freq. MHz	U.S.A.	Canada	Freq. MHz	U.S.A	Canada
128.825	X		129.625	X	
128.875		X	129.675		X
128.925	X		129.725	X	
128.975		X	129.775		X
129.025	X		129.825	X	
129.075		X	129.875		X
129.125	X		129.925	X	
129.175		X	129.975		X
129.225	X		130.025	X	
129.275		X	130.075		X
129.325	X		130.125	X	
129.375		X	130.175		X
129.425	X		130.225	X	
129.475		X	130.275		X
129.525	X		130.325	X	
129.575		X	130.375		X
130.425	X		131.225	X	
130.475		X	131.275		X
130.525	X		131.325	X	
130.575		X	131.375		X

Table 2-3 (cont'd)

Freq. MHz	U.S.A.	Canada	Freq. MHz	U.S.A	Canada
130.625	X		131.425	X	
130.675		X	131.475		X
130.725	X		131.525	X	
130.775		X	131.575		X
130.825	X		131.625	X	
130.875		X	131.675		X
130.925	X		131.725	X	
130.975		X	131.775		X
131.025	X		131.825	X	
131.075		X	131.875		X
131.125	X		131.925	X	
131.175		X	131.975		X

Table 2-3 (cont.d)

Freq. MHz	U.S.A.	Canada
136.525	X	
136.575		X
136.625	X	
136.675		X
136.725	X	
136.775		X
136.825	X	
136.875		X
136.925	X	X
136.975	X	X

Note 1) Frequencies primarily allotted for United States use may also be assigned to Canadian stations within the frequency coordination zones shown in Figure 2-6, following successful coordination with the United States.

Note 2) Frequencies primarily allotted for Canadian use may also be assigned to United States stations within the frequency coordination zones shown in Figure 2-4 and Figure 2-5, following successful coordination with Canada.

Note 3) All frequencies listed in Table 2-3 may be assigned without prior coordination outside the indicated coordination.

Channels proposed for assignment in accordance with Table 2-3, which will be located within 25 NM of the U.S./Canada border, shall be coordinated with the other Administration prior to implementation. Requests for channel assignments removed 25 kHz from existing assignments listed in Table 2-4 will be coordinated when such an assignment will be within 130 NM of the existing station. With these exceptions, channels may be assigned and stations established by either country in accordance with Table 2-3 without coordination with the other country.

In adopting the above arrangement, it is understood that each administration has complete flexibility in making use of its channels within the frequency coordination zone; that the option provided by Notes (1) and (2) should not be exercised unless the proposed assignment cannot be accommodated on a channel allotted under the plan; that an assignment made under the provisions of Notes (1) and (2) should not be a bar to future utilization of the channel by the Administration to which it is allotted under this arrangement. However, in the event that return of a frequency is deemed necessary by the Administration to which it is allotted, consideration shall be given to the overall frequency utilization in the area of the proposed station. Before an Administration requests the return of one of its allotted frequencies, it shall be established that it cannot otherwise meet its operational requirements. Where a determination indicates congestion of equal magnitude, consideration should be given to the sharing of a frequency on an equal basis by the two countries. In cases where such determination indicates greater congestion in the area of the proposed station, the frequency shall be returned to the Administration to which the channel is allotted.

In order to ensure protection of the Air Traffic Control frequencies 128.8 and 132.025 MHz, the assignment of the frequencies 128.825 and 131.975 MHz within 600 NM of the U.S./Canada border are subject to prior coordination with the other Administration.

Table 2-4

U.S. 25 KHZ ASSIGNMENTS WILL BE
COORDINATED WITH CANADA WHEN
ADJACENT TO AND WITHIN 130 NAUTICAL MILES OF
THE EXISTING 50 KHZ CANADIAN
ASSIGNMENTS LISTED HEREUNDER

LOCATION	FREQUENCY(MHz)
Abbotsford, British Columbia	129.25
	130.80
Burnaby, British Columbia	130.00
Delta, British Columbia	128.85
	130.80
Saltspring Island, British Columbia	130.50
Vancouver, British Columbia	129.25
	129.35
	129.90
	130.80
	130.90
	131.20
Victoria, British Columbia	129.20
	130.60
Fort Frances, Ontario	130.15
Sarnia, Ontario	130.35
Sault Ste. Marie, Ontario	130.15
	130.90
St. Catherines, Ontario	131.10
Windsor, Ontario	131.10

Table 2-5
FREQUENCY COORDINATION ZONES
FOR CO-CHANNEL ASSIGNMENTS
PER U. S./ CANADIAN AGREEMENT[21]

Type Of Station	Altitude Level[22] (Feet)	Coordination Zone (Nautical Miles)
Ramp (RT)	Ground Level	50
Helicopter (HO)	0 to 2,000	150
Low Level (LL)	0 to 10,000	250
Mid-Level (ML)	0 to 20,000	400
High Level (HL)	Over 20,000	600

Note that due to the "sterile cockpit rule" coordination altitudes for AES stations in the U.S. are different from those in the Canadian agreement. See Tables 2-1 and 2-2 for AES coordination levels. Thus, a U.S. Low-Level assignment should be coordinated with Canada as a Mid-Level assignment.

[21] "Treaties and Other International Acts" Series 5205; An agreement between the U.S. and Canada dated October 24, 1962, revised by letter adopted by the FCC on September 14, 1977.

[22] All coordination altitudes are relative to mean sea level, except for ramp/terminal (RT), which is the local ground level.

2.9 UTILIZATION OF THE AES FREQUENCY BAND 136.500 - 137.000 MHz

2.9.1 Voice Mode Spectral Plan using 8.33 kHz Channel Spacing

To support initial 8.33 kHz implementation it was recommended to utilize a sub-band of 100 kHz starting at frequency 136.500 MHz and ending at frequency 136.600 MHz. This sub-band will be used for systems employing voice communications modes only when all lower frequencies have been fully assigned or for digitally modulated data communications systems only when all higher frequencies have been fully assigned. (Use of frequencies in this sub-band in the U.S. or in Canada must be coordinated with Canada or the U.S. in accordance with the U.S. Department of State "Treaties and Other International Acts Series 5205").

2.9.2 VDL Mode 2 Spectral Plan

2.9.2.1 Frequency Separation and Installation Requirements

VDL Mode 2 communications use a D8PSK modulation operating at a data rate of 31.5 Kbps. It is considerably less tolerant of interference as compared to classic ACARS operation, which uses Amplitude Modulation (AM) and a sub modulation of minimum shift key (MSK) at a data rate of 2400 bps. As a result, special operational and field considerations are required in order to ensure successful operation of the VDL Mode 2 service. The following material was developed based on extensive analysis and testing and provides the fundamentals of a successful VDL spectral plan.

2.9.2.1.1 Co-Site Operation of Active VDL Channels

For co-site installations where the VDL antenna to VDL antenna separation must be a minimum of 60 feet horizontal and at least 150 kHz of separation or five 25 kHz guard-band channels are required for a standard VDL transmitter power of 25 watts.

In addition, to prevent interference, tuned-cavity notch filters are required for each VDL frequency that is operated in this co-site environment. It is expected that the VDL service will require three active VDL channels in an airport, co-site environment (e.g., the Common Signaling Channel (CSC), Alternate #1, and Alternate #2). Therefore, it is expected that each VDL transceiver will require two cavity filters with the notch tuned to the other two frequencies that are being rejected.

A VDL transceiver operating on the CSC will require two serially connected filters between the transceivers and antenna, one notch tuned to Alt #1 and one notch tuned to Alt #2 is shown in Figure 2-7.

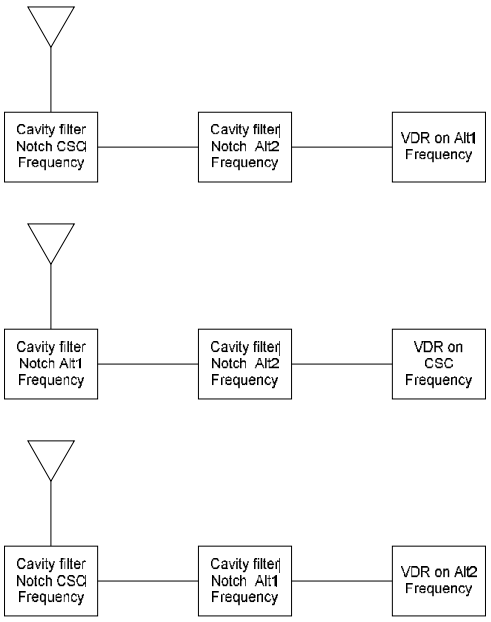


Figure 2-7

2.9.2.1.2 Required Performance of TX/RX Cavity Filters

Performance of cavity filters can vary considerably by both manufacturer and model. While use of cavity filters can reject off-tune signals, cavity filters have the adverse effect of adding insertion loss to the signal path.

Suitable cavity filters for this application should yield a minimum rejection of 20 dB at a 125 KHz offset and a pass frequency insertion loss of ideally 1.0 dB or less.

Data below is provided for two suitable filters: a 6 inch Vari-Notch filter and a 10 inch Vari-Notch filter. The 10 inch filter is physically larger and more costly. However, with increased notch rejection and reduced insertion loss, a 10 inch Vari-Notch filter is recommended. Cavity filter insertion loss and rejection levels are illustrated in Table 2-6.

Table 2-6

Frequency separation	TX/RX 6” Vari-Notch		TX/RX 10” Vari-Notch	
	Insertion loss (dB)	Rejection (dB)	Insertion loss (dB)	Rejection (dB)
75 kHz	1.1	14.5	1.7	20
100 kHz	1.5	20	1.0	21
125 kHz	1	20	0.8	24
150 kHz	1	23	0.9	27
175 kHz	0.7	24	0.5	27

One family of cavity filters is the Vari-Notch Cavity filters made by Bird Technologies Group. These filters must be ordered as a pass low reject high filter or a pass high reject low filter depending on the deployment configuration. The tuning of these filters may need to be adjusted on-site because of mechanical vibration and shock during shipment.

2.9.2.1.3 Mixed Mode Operations

VDL Mode 2 operations can co-exist with other ACARS (AM with MSK modulation), VDL Mode 2 data, and voice services if the proper frequency separation is observed. Based on a transmitter power of 25 watts and omni-directional antennas:

- A VDL Mode 2 station can be successfully operated within 50 kHz of another VDL Mode 2, AM Voice, or ACARS station if the antennas are separated by a minimum of 1.0 mile.
- Some interference (~10-12% channel degradation) can be expected if the stations are operated with separation of less than 1.0 mile.
- Unacceptable interference and degradation can be expected if the stations are operated closer than 0.5 mile unless proper filtering is applied.

2.9.2.2 VDLM2 Implementations

The implementation considerations include frequency assignments based on philosophy of deployment. Variables include shared vs. dedicated channels, potential AOC and ATC frequency sharing, transmitter power output, transmitter intermodulation products, and the

relationship between frequency and physical separation. These topics are discussed in this section.

2.9.2.2.1 Shared Common Signaling Channel and Dedicated Channels

Industry standards and agencies have identified 136.975 MHz as the international common signaling channel (CSC) for VDL Mode 2 operations. All data link service providers announce their service availability on this channel.

Per VDL Mode 2 industry standards, to avoid congestion and off load traffic, each data link service provider may operate one or more VDL Mode 2 alternate channels. Unlike the CSC, these channels are not shared but are dedicated and licensed to each DSP. Dedicated channels avoid the issues associated with shared channels (CSMA collisions, hidden terminal effects, and interference) and maximize the efficient use of the VHF spectrum.

2.9.2.2.2 Coordination of ASRI AFC and FAA VDL Spectrum for AOC and ATS Applications

From the upper portion of the Aeronautical Enroute Service (AES) 136-137 band, the FAA has been allocated the 136.000 to 136.475 MHz portion for ATC applications whereas ASRI has been allocated the 136.500 to 136.975 MHz portion of the band for AOC applications.

The current direction as indicated by FAA documentation is that the FAA data link based Data Communications program will use VDL channels that share both AOC and ATS applications.

Although a formal plan is unavailable it is expected that, when required for the Data Communications program, the FAA will allocate frequencies than can be used for ATC and AOC applications. This plan will be defined in the future.

2.9.2.2.3 Airport Installations with Multiple VDL Transceivers

Due to the complex nature of larger airports and based on airlines requirements for redundancy and comprehensive VDL coverage at all gates, data link service providers frequently operate several ground stations that share the same frequencies at the same airport.

In airports where multiple VDL Mode 2 Transceivers are used, the service provider may designate a station as the primary “enroute” station operated at full transmitter power, typically 25 Watts. In order to minimize unnecessary spectral emissions, the other VDL transceivers within the airport shall operate with the minimum power needed to provide successful communications at the gate areas.

2.9.2.2.4 Transmitter Intermodulation Considerations

When two collocated transmitters are activated, third order intermodulation products are produced. Even with the cavity filters installed, these products are about 10dB stronger than the typical adjacent frequency emissions of the transmitters.

The transmitter intermodulation products will be generated at frequencies 2F1 – F2 and 2F2 – F1. If there is no channel assigned at these offset frequencies, then the intermodulation products are transmitted without detriment to any of the VDL channels. As an example, if we have 136.975 MHz and 136.825 MHz (150 kHz offset), the third frequency cannot be 136.675 MHz (another 150 kHz offset) because the 2F1-F2 product is on the CSC 136.975 MHz. Because of this, the first DSP is assigned to 136.800 MHz or 175 kHz from the CSC and the second DSP is assigned a frequency that is 150 kHz away or at 136.650 MHz

2.9.2.2.5 Frequency Separation vs. Geographical Separation

Transmitter to receiver isolation may be achieved by a combination of frequency and geographical separation. The tables below are based on the adjacent channel emissions as specified in section 6.2.4 of the ICAO SARPS. Note the inverse relationship between antenna separation and frequency separation.

The SARPS specifies that the adjacent channel emission for the fourth adjacent channel is at a maximum of -38 dBm and that it shall monotonically decrease at a rate of 5 dB per octave thereon. The free space loss will increase by 6 dB each time the geographical isolation doubles. These two points are the basis for the VDLM2 Frequency Separation versus Antenna Separation table below. VDLM2 frequency separation versus antenna separation with cavity filters is shown in Table 2-7.

Table 2-7

Frequency Separation kHz	Emissions at this Separation dBm	Notch Filter Isolation 10 Inch Cavity Filter dB	Minimum Antenna Separation feet	Minimum Antenna Separation Miles
25	2	0	169103	32.027
50	-28	0	5348	1.013
75*	-33	20	301	0.057
100*	-38	21	151	0.029
125*	-39	24	95	0.018
150	-40	27	60	0.011
200	-43	27	42	0.008
400	-48	27	24	0.005
800	-53	27	13*	0.003

*Note *1: This table does not consider the undesirable insertion losses associated with the operation of a notch filter that is tuned to reject interference separated by 75 to 125 KHz from the desired (Pass) frequency.*

Note 2: Placing radios closer than 18 feet together without cavity filters may have destructive effects on the front end of the receiving radio.

Table 2-8

Frequency separation kHz	Emissions at this separation dBm	Minimum Antenna Separation feet	Minimum Antenna Separation Miles
25	2	169103	32.027
50	-28	5348	1.013
75	-33	3007	0.570
100	-38	1691	0.320
125	-39	1507	0.285
150	-41	1197	0.227
200	-43	951	0.180
400	-48	535	0.101
800	-53	301	0.057

Table 2-8 illustrates frequency separation versus geographical separation with no cavity filters. It is expected that the emissions of the radio will continue to decrease as the frequency separation increases and that the minimum antenna separation will continue to decrease. The table does not go beyond the SARPS requirement that the emissions continue to decrease to a maximum of -53dBm (second column).

2.9.3 Proposed Voice and VDL Frequency Assignments

The proposed frequency plan for the upper portion of the Aeronautical Enroute Service sub-band from 136.500 to 136.975 MHz is provided in Table 2-9.

To support initial 8.33 kHz implementation it was recommended to utilize a sub-band of 100 kHz starting at frequency 136.500 MHz and ending at frequency 136.600 MHz.

This plan identifies two VDL Mode 2 On-Airport alternate frequencies which may be operated in a co-site environment (60 feet of horizontal separation). It is expected that 3 frequencies, the CSC, DSP Alternate #1 (136.650 MHz), and DSP Alternate #2 (136.800 MHz) will provide sufficient AOC capacity for the next decade. Thereafter enroute frequencies can be assigned as needed based on the description below. Enroute assignments require a minimum of 1 mile of separation between the transmitter antennas providing for the CSC and two VDL On-Airport alternates. The VDL enroute frequencies could alternately be assigned for Voice or ACARS operations given the separation requirements of >1.0 mile are met.

This plan only considers the ASRI upper part of the VDL spectrum and does not consider the 128 discrete 25 kHz channels in the lower Aeronautical Enroute Service sub-band of 128.825 to 132.000 MHz. The FAA is expected to contribute some VDL Mode 2 channel for the expansion of ATS applications.

Table 2-9

VHF Frequency (MHz)	VDL or Voice (8.33 kHz) Allocation	Notes
136.975	Common Signaling Channel	VDLM2
136.950	Guard Band Channel	Unused
136.925	VDL Enroute Alternate (>1mi)	Voice/VDLM2/ACARS
136.900	Guard Band Channel	Unused
136.875	VDL Enroute Alternate (>1mi)	Voice/VDLM2/ACARS
136.850	Guard Band Channel	Current SITA USA ACARS Base
136.825	Guard Band Channel	Unused
136.800	VDL Alternate #1 On Airport	Co-Site (60 feet)
136.775	Guard Band Channel	Unused
136.750	VDL Enroute Alternate (>1mi)	Voice/VDLM2/ACARS
136.725	Guard Band Channel	Unused
136.700	VDL Enroute Alternate (>1mi)	Voice/VDLM2/ACARS
136.675	Guard Band Channel	Unused
136.650	VDL Alternate #2 On Airport	Co-Site (60 feet)
136.625	Guard Band Channel	Unused
136.600	VDL Enroute Alternate (>1mi)	Voice/VDLM2/ACARS
136.575/136.5833/136.5917	Voice (8.33 or 25 kHz) or VDL Guard Band Channel	Voice/Unused
136.550/136.5583/136.5667	Voice (8.33 or 25 kHz) or VDL Enroute Alternate (>1mi)	Voice/VDLM2/ACARS
136.525/136.5283/136.5417	Voice (8.33 or 25 kHz) or VDL Guard Band Channel	Voice/Unused
136.500/136.5083/136.5167	Voice (8.33 or 25 kHz) or VDL Enroute Alternate (>1mi)	Voice/VDLM2/ACARS

FIGURE 2-4

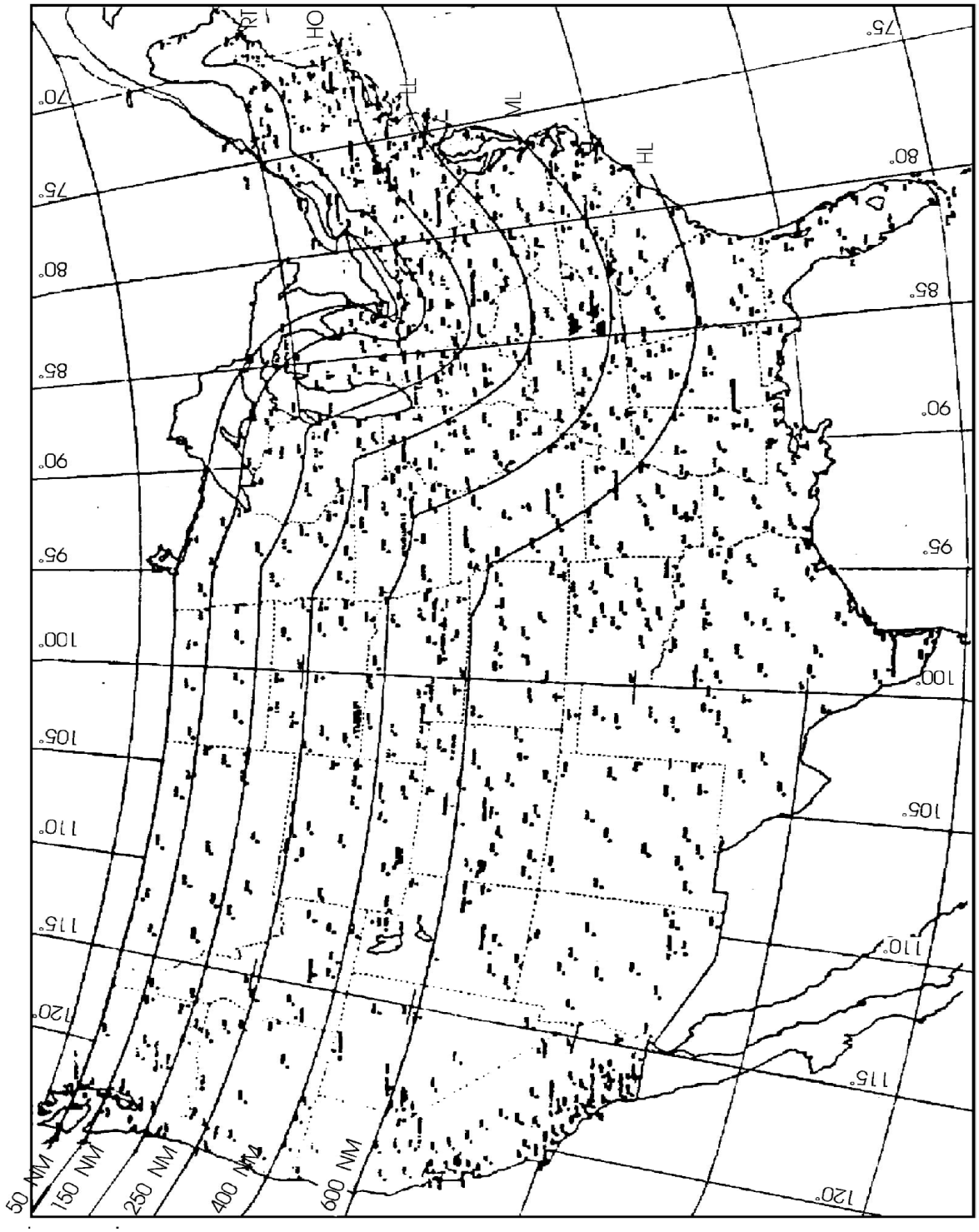

ORT
HO
TL
ML
TH
75°
80°
85°
90°
95°
100°
105°
110°
115°
120°
50 NM
150 NM
250 NM
400 NM
600 NM

FIGURE 2-5

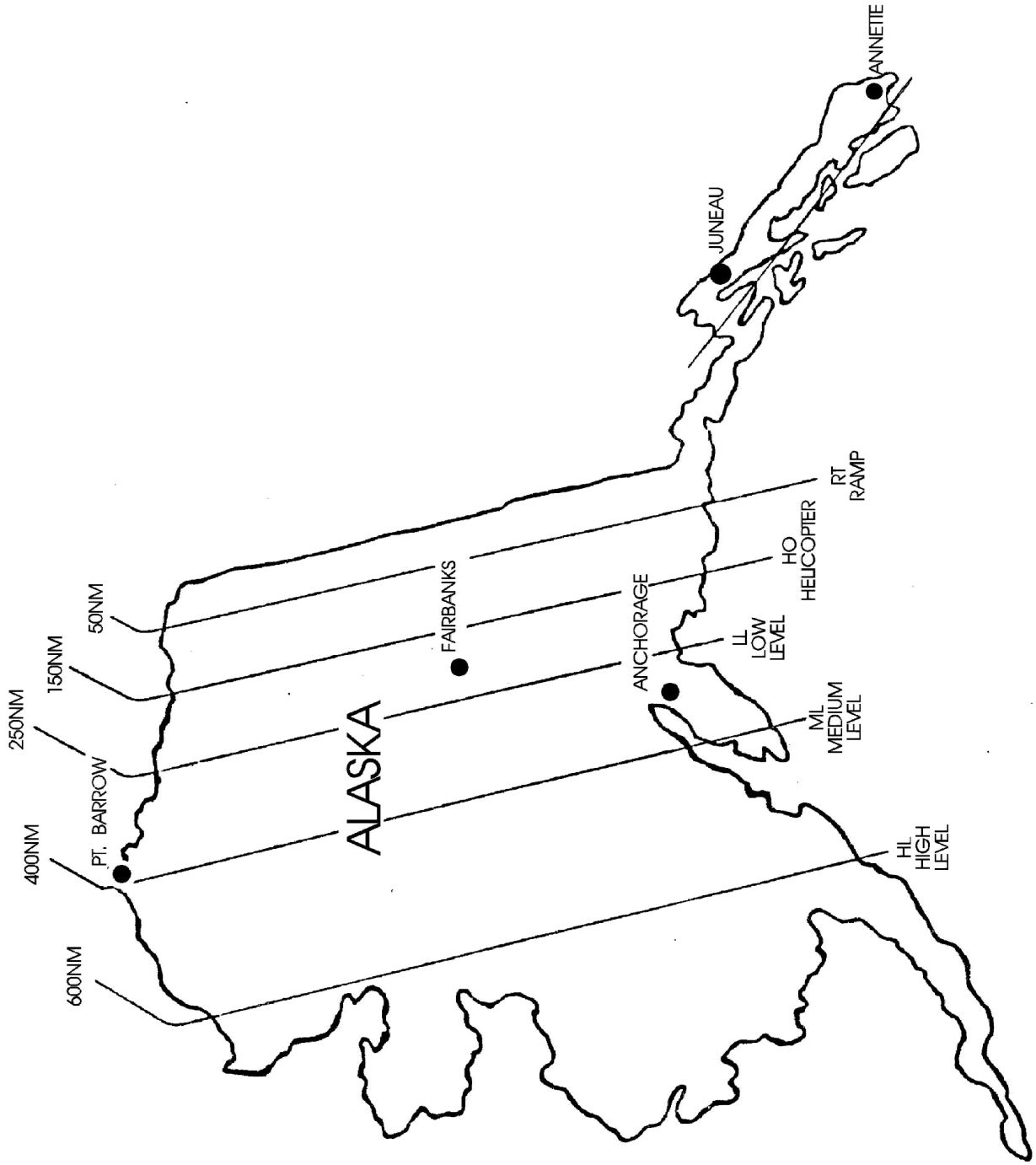
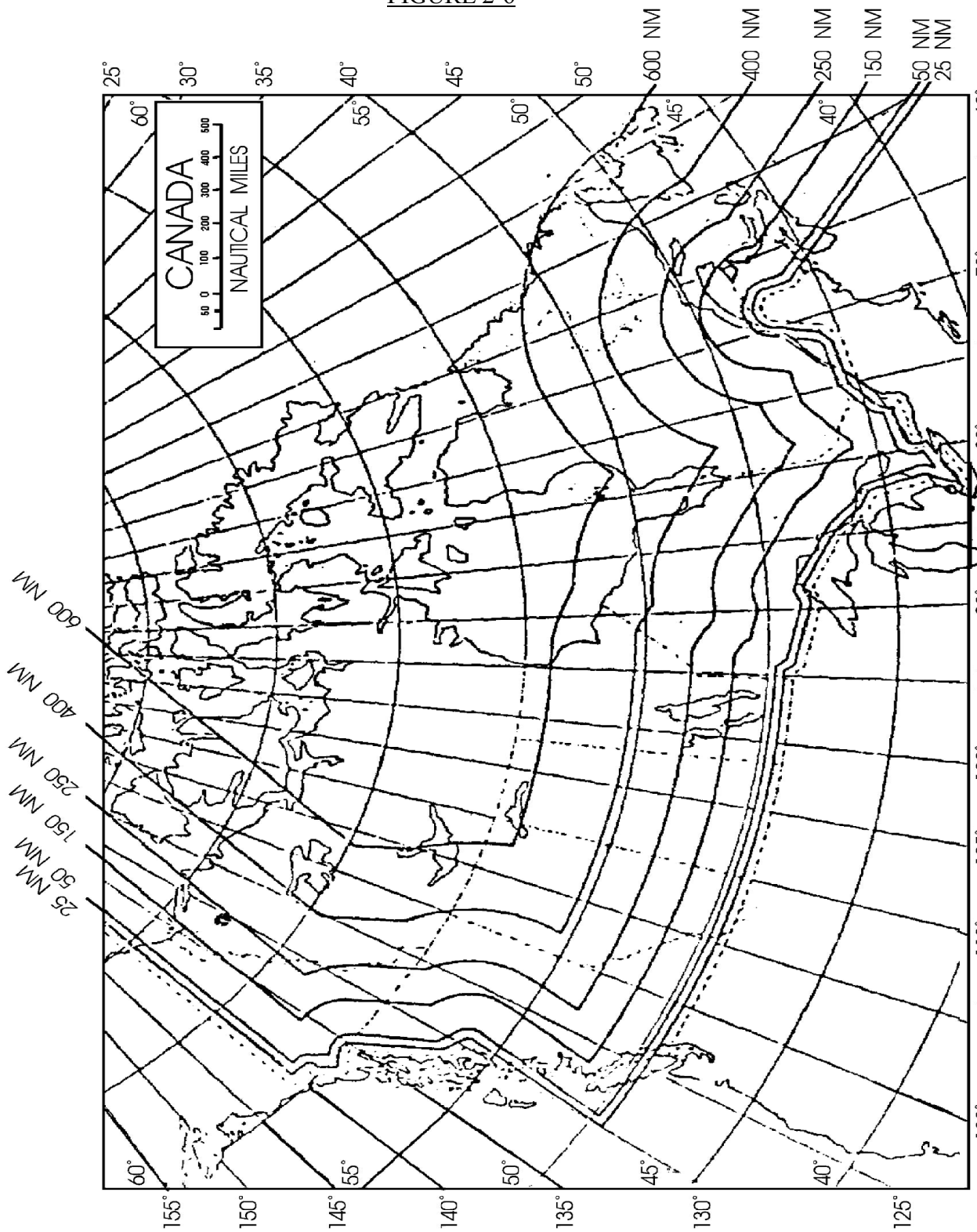

ANNETTE
JUNEAU
RT
RAMP
HO
HELICOPTER
LL
LOW
LEVEL
ML
MEDIUM
LEVEL
HL
HIGH
LEVEL
50NM
150NM
250NM
400NM
600NM
FAIRBANKS
ANCHORAGE
ALASKA
PT. BARROW

FIGURE 2-6



3 VHF Installation Standards

3.1 Introduction

These guidelines provide direction and recommendations for the installation of aviation VHF Ground Stations that are licensed by ASRI in the Aeronautical Enroute bands.

Generally, the most recent licensee deployed at a location is responsible for mitigating any and all interference caused by the addition of their system. This includes but is not limited to the purchase and installation of cavity filters on other tenant's systems. Stated differently, it is understood that any new installation that causes harmful RF interference to an existing user Base Station will be resolved at the expense of the new licensee. The standards herein have been developed in an attempt to minimize such situations.

3.2 Frequency Management (pre-installation/site survey)

1. Identify all existing co-located base stations. A co-located base station is defined as any base station that operates on an antenna within 200' of the proposed antenna location.
2. Determine/measure the distance between all co-located antennas and the location of the proposed antenna and record the results. It is highly recommended that maximum antenna separation be achieved between base stations. This provides for greater transmitter isolation with co-located base stations, minimizing the risk of transmitter intermodulation.
3. Identify the operating frequency of these co-located stations and correlate them to the antenna distances above.
4. Recommend an Inter Modulation study be done on all frequencies located within 200 feet of the station being installed. The study should identify all 3rd and 5th order products that fall within the Aeronautical Frequency band. Consult with ASRI to determine if these frequencies are in use at this location. If they are, coordination with the using agencies should be done.

3.3 Antennas

1. The antenna should be installed using a vendor approved mount only.
2. The antenna mount and ancillary hardware should be either stainless steel or hot-dipped galvanized steel only.

3. The connection between the antenna and the transmission line (and all other RF connections external to the building) must be weather proofed.
4. All decommissioned and unused antennas should be removed from the site.
5. Typically base station antennas are assumed to be omni-directional with unity gain (2.15 dBi)

3.4 Transmission lines

1. All outdoor transmission lines shall be of the solid outer conductor type. Good quality cable should be used. Examples include the Heliax or LMR series type.
2. Transmission lines that are in excess of 60' in length external to the building or shelter must be grounded within 2' of the antenna connection using a vendor approved grounding kit and connected to the building grounding system. The grounding kit must be weather proofed after installation using butyl rubber or vulcanizing tape; either of which should then be encapsulated with electrical tape.
3. All transmission lines must be grounded within the building or shelter using a vendor approved grounding kit bonded to earth ground.
4. All transmission lines must be terminated with a vendor approved connector. It is highly recommended that connectors using ferrous metals (nickel) not be used due to corrosion and them being a possible source of Passive Intermodulation.
5. The indoor connector should terminate at an approved surge suppression device (Polyphaser).
6. All transmission lines should be labeled at the following locations: at the antenna, at the building penetration and at the radio (or cavity). The labels shall indicate the owner and the transmission frequency. All labels shall be installed on the transmission line in a manner/location that are visible from common areas (one should not be required to open cabinets or racks to find the labels).
7. All "spare" transmission lines that are installed for future use/maintenance (or decommissioned) should be properly terminated with a 50 ohm load on at least one end and properly weatherproofed and marked.
8. All transmission lines used between indoor equipment (commonly referred to as jumpers) should be of the double shielded coax type (RG-223, RG-393, RG-142, etc.).

3.5 Rack/Equipment

1. All equipment must be FCC type approved.
2. All radios should be installed in secure cabinets or be in secure areas.
3. Radios should be in areas protected from excessive heat and moisture.

4. All equipment racks are to be properly grounded to the building earth ground system.
5. All equipment that has provisions for an external earth ground should be connected to the building system ground.
6. All equipment should be secured in the rack using the vendor recommended mounts and fasteners.
7. All transmitters must be labeled with their operating frequency on their face.

3.6 TELCO

1. For installations in remote locations not serviced directly by an airport telecommunications room, it is recommended that surge protection be installed on all telco lines.

3.7 RF Isolation (transmitter IM prevention)

In general, to minimize the possible occurrence of IM interference, each system should obtain a nominal RF isolation of 45 dB from all other transmitters. This is equal to 60' horizontal separation between antennas in the aviation VHF band. This is achieved with 25’ of vertical separation between antennas in the aviation VHF band. If vertical separation is not an option, then 60’ of horizontal separation will provide approximately 30 dB of isolation.

The following tactics should be used for installations in a moderate to high RF location, when additional isolation is required.

1. Maximize antenna separation between co-located base stations and determine the free-space loss between each existing antenna and the proposed antenna location.
2. Using the TnRd curves for the specified radios, determine what the required isolation values are for both the transmitter noise and transmitter carrier.
3. Some guidelines are provided below based on the Motorola VHF Quantar 100 Watt VHF station transmitter sideband noise specifications and adjacent channel rejection ratio for the receiver curves
    - A transmitter to receiver separation of 0.2MHz to 1 MHz requires 73dB + 6dB margin = 79dB transmitter noise filtering to not have transmitter noise above the –123dBm Noise floor of the receiver. At 2MHz, 76dB is required, at 3MHz, 75dB is required and at 5 MHz, 71dB is required.
    - A transmitter to receiver separation of 0.2MHz to 2 MHz requires 66dB + 6dB margin = 72dB transmitter carrier filtering to prevent a single 100 Watt transmitter from degrading the receiver sensitivity. At 5MHz separation, 69dB is required.

4. If the transmitters have a single stage isolator built into them, the use of an external isolator on the transmitter multicoupler is not required when there is at least 45dB filter isolation between transmitters on the same antenna.
5. Choose appropriate equipment to meet the required isolation values. For example, the use of C2037 as transmitter combiners at 3.2dB insertion loss will provide 15dB isolation at 150 KHz and 45dB at 300 KHz. At 1.7 dB insertion loss, these values are achieved at 250 and 650 KHz respectively. When set to 3.2dB insertion loss, the receiver frequencies can be as close a 1.3 MHz away on the same antenna or 0.4 MHz on separated antennas to achieve 79dB isolation.
6. Increase the transmitter conversion efficiency (IM attenuation). The only effective way to achieve this is to consider replacing the transmitter with a transmitter that has better performance characteristics. Therefore, this should be considered a last resort.

3.8 Interference Identification, and Elimination

As the proliferation of VHF air to ground base radios continues, the incidence of radio interference (RFI) is increasing. Identifying the source of the interference often can be very difficult. Sometimes the source of the interference is the sufferer's own equipment.

3.9 Technical Terms and Their Meanings Related to Interference

3.9.1 Intermodulation

Intermodulation (IM) or intermodulation distortion (IMD) is a frequency conversion process that occurs when two or more signals pass through a non-linear system or device(s)/component(s) within a system. The essential result of the process is that energy contained in the input signal of a non-linear system is transformed at its output into a set of frequency components at the original frequencies plus additional components at new frequencies that were not contained in the input. The IM phenomenon is often referred to as mixing.

For example, consider a signal composed of two fundamental tones f_1 and f_2 that could represent two transmitter signals co-located at a communications site. If this composite signal is passed through a non-linear device (of third-order), the most general form of the output signal will contain frequency components at dc, f_1, f_2, second-order products and harmonics as well as the third-order products at $2f_1 - f_2$, $2f_2 - f_1$. These last products are often troublesome because they fall closest to the original tones at f_1 and f_2. It is possible that the newly generated third-order products could fall close to or within the receive band of a communication system located at the same site, which could degrade the performance of the receiver.

As another example, consider the same two tones at f_1 and f_2 passing through a stronger non-linear device of fifth-order. The set of most potentially troublesome IM products that can be produced by a fifth-order non-linear system would fall at the frequencies

$2f_1 - f_2$, $2f_2 - f_1$, third-order products,
$3f_1 - 2f_2$, $3f_2 - 2f_1$, fifth-order products.

Note that the order of the non-linearity is determined by the sum of the coefficients. If the non-linearity were stronger still (such as a seventh-order), it would have an output containing the following most potential interfering carriers

$2f_1 - f_2$, $2f_2 - f_1$, third-order products,
$3f_1 - 2f_2$, $3f_2 - 2f_1$, fifth-order products,
$4f_1 - 3f_2$, $4f_2 - 3f_1$, seventh-order products.

With respect to the original tones at f_1 and f_2, the third-order components are closest, the fifth-order are the next closest and the seventh-order are furthest removed but still 'close' to f_1 and f_2. This pattern continues for devices of increasing non-linear severity.

When more than two tones of sufficient strength are present at a site, the generated IM products will consist of the set of tones occurring at all linear combinations of the original tones (up to the order of the non-linearity). Some of these IM tones will be potentially threatening to system performance, with the exact threat being dependent upon the particular frequencies and bandwidths of the receivers present at the site.

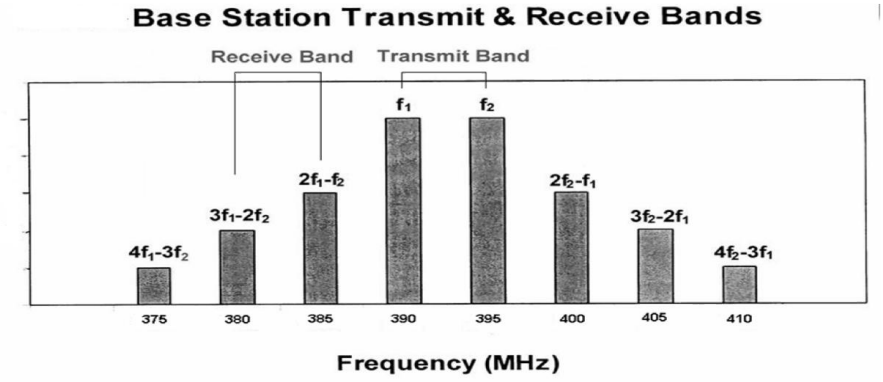


Figure 3-1: Intermodulation Products

The third order-difference intermodulation products generated by two sources are usually the most serious due to the fact that they fall within the same aeronautical band: 2F1-F2 and 2F2-F1. Fifth order products 3F1-2F2 and 3F2-2F1 also fall within the same band but are normally much less amplitude. For example if F1 equaled 130.4 MHz and F2 equaled 130.6 MHz the following products could be generated:

130.2 MHz, 130.8 MHz (3^{rd} order)
130.0 MHz, 131.0 MHz (5^{th} order)

Note: For transmitters, the European Telecommunications Standards Institute (ETSI) EN 300 676 Standard, section 7.8, defines a test method and specifies limits for intermodulation attenuation caused by the presence of the carrier and an interference signal entering the transmitter via the antenna. This test method is a good way to determine any deficiencies in transmitter design. Any modern equipment should be able to exceed the specified limit. See Section 2.3 "Calculating Transmitter Intermodulation Susceptibility".

3.9.2 Blocking or Desensitization

Blocking or desensitization results when a strong unwanted signal at the receiver input causes a change in the desired signal level. This unwanted signal can effectively "block" the desired signal, thus the term. ETSI EN 300 676 section 8.9 defines a test method and specifies limits for the blocking ratio. The limit specified for a base station, shall not be less than 80 dB. Modern VHF base station receivers should be 10 to 20 dB's above the ETSI limit.

3.9.3 Spurious Emissions

Spurious emissions are any emissions from a transmitter which are not part of the theoretical output. Any radiation from a receiver (normally local oscillator leakage) is spurious. Section 87.139 of the FCC rules specifies the limits associated with this measurement for type acceptance (TA). ETSI EN 300 676 section 7.5, 7.6 and 7.7 defines a test method and specifies limits for these emissions but also includes near in noise and adjacent channel power limits. ETSI EN 300 676 section 8.10 defines spurious radiation related to the receiver.

3.9.4 Cross Modulation

Cross modulation in regard to receiver operation is related to the transfer of modulation to the desired signal from a strong adjacent transmitter. Unlike "blocking or desensitization" where the undesired signal attenuates the desired signal cross modulation appears along with the desired signal. Common cases of this are due to receiver front end design and "local oscillator" noise allowing the mix to take place. This mix can be from the synthesizer noise floor of either the transmitter or receiver.

3.10 Reducing Interference Related to Airport Installations

Interference is normally related to intermodulation, blocking or desensitization, spurious emissions and/or cross modulation due to transmitters too closely coupled to receivers. To resolve this we need to add attenuation between those transmitters or receivers by increasing separation distance or by additional filtering. Additionally, the design of the equipment plays a major role as to how well the equipment will play together.

A quick way to determine if the intermodulation is being generated within the receiver front end is to add a small attenuator in the path. If the interference drops by other than the amount of the attenuator, the interference is caused by the receiver. Example a 3 dB attenuator caused a 9 dB reduction of the interference level. This also applies when using a Spectrum Analyzer to determine if the test is valid. If the interference drops by the amount of the attenuator then the problem is external (most likely coupling between two other transmitters).

3.10.1 Space or Path Attenuation

The approximate straight line path attenuation space to radio waves is given by the formula:

$$L = 36.58 + 20 \text{ Log } F + 20 \text{ Log } D$$

Where
L = path loss in decibels,
F = Frequency in MHz, and
D = distance between points in statute miles.

Using the above formula at aeronautical VHF:

60 feet is equal to 40 dB path loss
(This relationship is important to remember)

200 miles is equal to 125 dB path loss
(For a 20 watt ground transmitter an aircraft receiver 200 miles away would have a signal level -82 dBm)

If we double the distance we increase the path loss by 6 dB. If we halve the distance we decrease the path loss by 6 dB. The following table might make this clear:

15 feet is equal to 28 dB path loss
30 feet is equal to 34 dB path loss
60 feet is equal to 40 dB path loss
120 feet is equal to 46 dB path loss
240 feet is equal to 52 dB path loss
480 feet is equal to 58 dB path loss – and so on

An example of how this applies with some older equipment is using two Wulfsberg WCS-100 transceivers that both transmit at 43 dBm (20 watts), would present +3 dBm to the other receiver if we had 60 feet between the individual antennas. Knowing the receiver characteristics, it would require almost 1.0 MHz difference in frequency for co-existence with no degradation. The Wulfsberg's performance has been the benchmark for many years.

Most experts agree that the use of as much space as possible between base station antennas provides the most effective insurance against interference. A properly designed vertically stacked antenna can provide almost 40 dB of isolation (the patterns are within their nulls). This can provide an alternative when horizontal spacing doesn't permit.

Additionally the selection of the individual frequencies to co-locate plays an important role (keep close-in frequencies as far apart as possible).

3.10.2 Cavity Filters

The use of bandpass cavity and notch cavity filters can provide the additional electrical space to allow transmitters and receivers to co-exist when physical space cannot be achieved. The disadvantage of cavity filters is their size, cost and insertion loss. And at times more than one filter is needed in each antenna path to achieve the necessary isolation to avoid harmful interference.

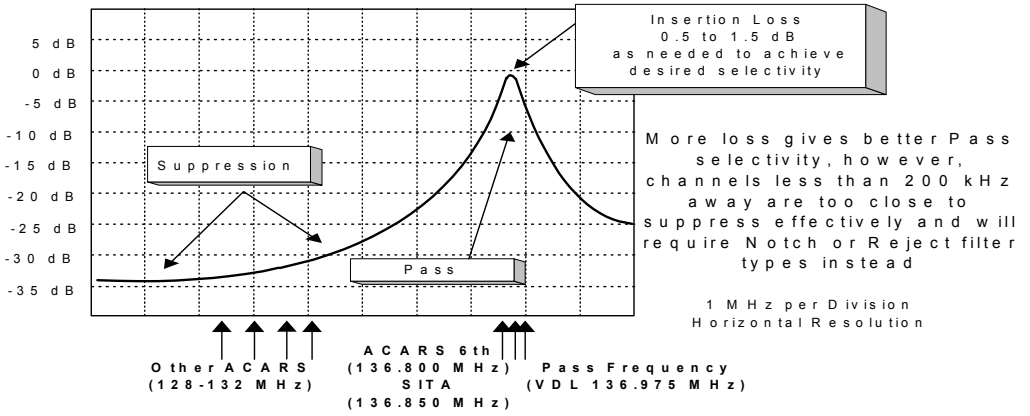


Figure 3-2, TxRx Cavity with BandPass Elements
Forward Power through the Cavity as measured on a calibrated Network Analyzer
(Pass 136.975 MHz and Surpress 128-132 MHz)

As can be seen in Figure 3-2 a single bandpass cavity can provide almost 35 dB additional isolation when the frequencies you want to protect are a number of MHz away. Cascading filters can be used to improve filter action. The summation effect is greater than just adding the results of the two cavities together.

The use of notch filters can greatly improve two close-in frequencies. At times cascading a notch with a bandpass is necessary. The major disadvantage other than size and cost is that a notch needs to be inserted in the antenna line for every close-in frequency (station) you need to protect. Using a notch on the closest frequency and bandpass to protect far away frequencies is used when physical space cannot be achieved.

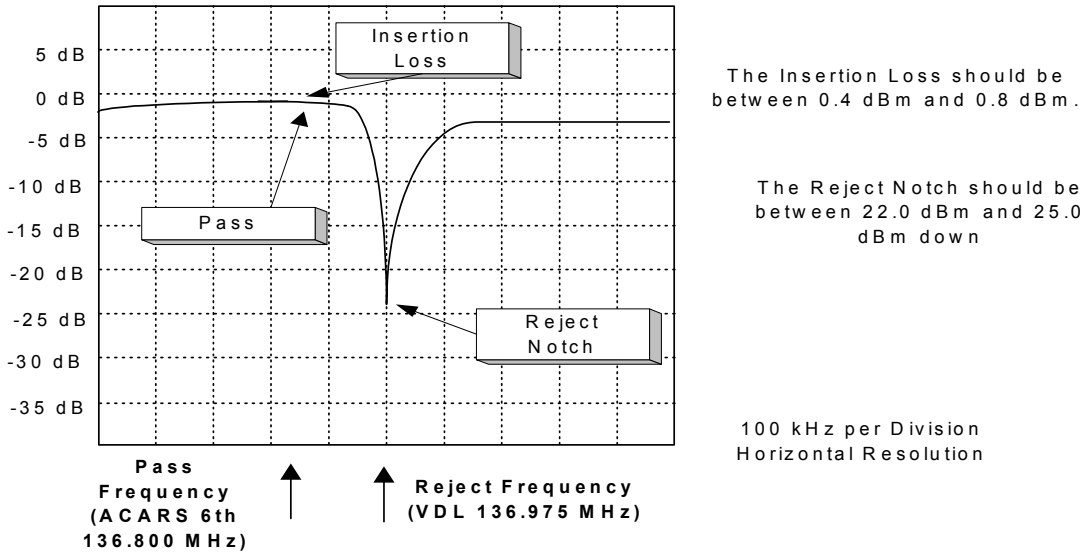


Figure 3-3, TxRx Cavity with 'Pass Low' Element

Forward Power through the Cavity as measured

on a calibrated Network Analyzer

(EXAMPLE: Pass 136.800 MHz and Reject 136.975 MHZ)

As can be seen in Figure 3-3 a single notch cavity filter can provide 25 dB of additional isolation when two stations are only 200 kHz apart. It also shows that the protection is limited to the one frequency of interest.

3.10.3 Ferrite Isolators

Ferrite isolators are commonly used in transmitter combiners in conjunction with cavity filters. They operate by allowing RF energy to pass effectively in one direction and attenuate the return path to the transmitter. When applied to a single station transceiver the complexity of switching the device in the transmitter path and out of the receive path becomes a problem. Additionally, the failure mode of this device is such that it is the cause of interference when the transmitter would operate fine without. These devices are costly to provide and are only used when there is no other solution.

3.10.4 Crystal Filters

Crystal filters are an effective way to improve the performance of receivers where the intermodulation is generated within the receiver. This also helps reduce blocking, desensitization, and cross modulation effects to the protected receiver. The disadvantages are very high cost, approximately 5 dB additional path loss, need to be inserted in the receive path only (difficult with some transceivers), physically fragile, and easily damaged from nearby lightning strikes.

3.10.5 Antenna Gain

At 400 miles the signal from a VHF ground station would be only have a path loss in free space of 131 dB. This would equate to a signal level at the aircraft of -88 dBm if a line of sight condition existed from a 20 watt transmitter. This clearly shows that we are limited by the line of sight and not path loss. Using gain antennas when not necessary can contribute to the interference to nearby stations. The exception to this statement relates to extended range stations that operate far away from other ground stations.

3.10.6 Frequency Change

Frequency change as a solution to an interference problem should only be done when all other possible solutions have been tried and found to be inadequate. Since there are so many "networked frequencies" this option can be extremely costly since it would also affect stations not located near the interference and the change itself could cause additional interference problems.

3.11 Calculating Transmitter Intermodulation Susceptibility

Intermodulation (IM) attenuation is the capability of a transmitter to avoid the generation of signals in the non-linear elements caused by the presence of the carrier and an interfering signal entering the transmitter via the antenna.

It is specified as the ratio, in dB, of the power level of the third order intermodulation product to the carrier power level. The test is performed with 30 dB of isolation between the test transmitters.

ETSI EN 300 676 section 7.8 defines a test method and sets a limit of 40 dB below the carrier power level. Most modern transmitters meet or exceed the specified level. Some of the older transmitters fall short of the specified level.

Below are two examples that identify when additional space isolation is necessary between two transmitters with their antennas are in close proximity. Normally this space isolation can be obtained by the addition of cavity filters on the offending transmitter. It can also be determined when it's not necessary to add a cavity filter even though there is a receiver nearby and a mathematical third order product has been identified.

Example 1:

Transmitter ‘A’ - 130.4 MHz, 20 watts (+43 dBm), 60 dB IM attenuation
Transmitter ‘B’ - 131.0 MHz, 7 watts (+38.5 dBm), 40 dB IM attenuation
Physical space between transmitter antennas equals 60 feet (40 dB isolation)

40 dB space minus 30 dB test isolation equals 10 dB additional IM attenuation. Now transmitter ‘A’ has 70 dB and transmitter ‘B’ has 50 dB IM attenuation under this installation.

Third order products –
2F1 - F2 = 129.8 MHz (mostly from transmitter ‘A’)
2F2 - F1 = 131.6 MHz (mostly from transmitter ‘B”)

Checking the airport database identifies stations nearby on both of these frequencies.
129.8 MHz is 1000 feet away (64 dB of path attenuation) identified as ‘C’
131.6 MHz is 2000 feet away (70 dB of path attenuation) identified as ‘D”

Transmitter ‘A’ to station ‘C’
+43 dBm – 70 dB = -27 dBm on 129.8 MHz from antenna ‘A’
-27 dBm – 64 dB (path loss) = -91 dBm signal level at station ‘C’

Transmitter ‘B’ to station ‘D’
+38.5 dBm – 50 dB = -11.5 dBm on 131.6 MHz from antenna ‘B’
-11.5 dBm – 70 dB (path loss) = -81.5 dBm signal level at station ‘D’

This clearly identifies that approximately 10 dB additional isolation is necessary from Transmitter ‘A’ and 20 dB additional isolation is necessary from transmitter ‘B’.

3.12 Conclusion

Understanding the transmitter, receiver and transceiver performance related to the interference susceptibility is necessary for co-locating equipment. Test methods like ETSI EN 300 676 are a good start to insure interference free installations and understanding the limitations involved with co-locating equipment. Using the lowest power necessary to achieve communications is a good way to work together. Airports should allow the different airlines their own antenna space, thereby limiting the interference potential to other users, by designing distance between users. Coordination between the users is also necessary to identify and fix interference issues.

Airports should refrain from designing/building antenna farms which condense or co-locate users to small physical areas, greatly increasing the potential for harmful interference.

4 HF Policy

ARINC LDOC (LONG DISTANCE OPERATIONAL CONTROL)

HIGH FREQUENCY ASSIGNMENTS

COM CENTER	FREQUENCIES (kHz)
New York, NY	3494, 6640, 8933, 10075, 11342, 13348, 17925
Santa Cruz, Bolivia	3494, 6640, 8933, 10075, 11342, 13348, 17925
San Francisco, CA	3494, 6640, 11342, 13348, 17925, 21964
Barrow, AK	3494, 6640, 11342, 13348, 17925, 21964

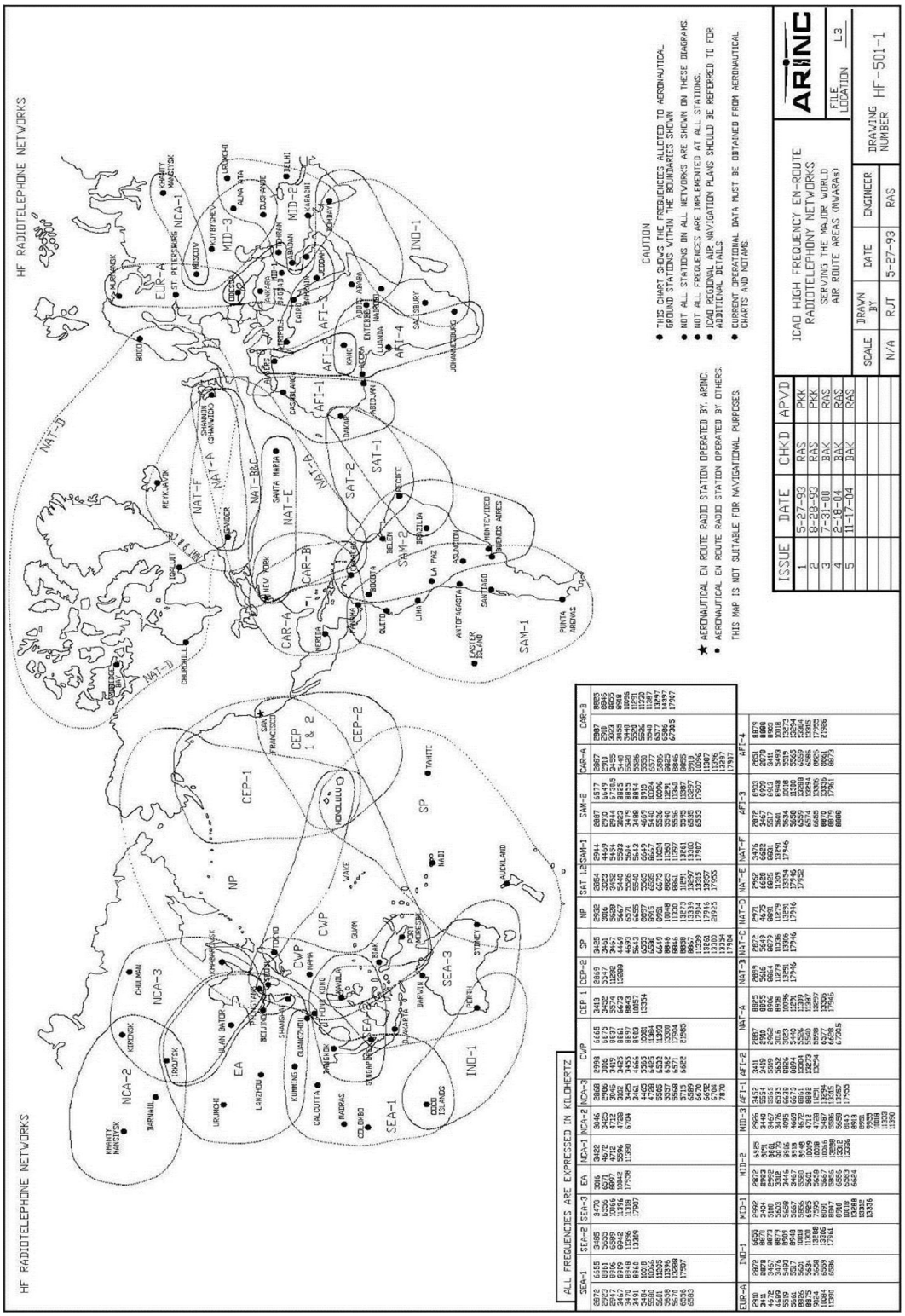

HF RADIOTELEPHONE NETWORKS
HF RADIOTELEPHONE NETWORKS
ALL FREQUENCIES ARE EXPRESSED IN KILOHERTZ
CAUTION
• THIS CHART SHOWS THE FREQUENCIES ALLOTED TO AERONAUTICAL GROUND STATIONS WITHIN THE BOUNDARIES SHOWN
• NOT ALL STATIONS ON ALL NETWORKS ARE SHOWN ON THESE DIAGRAMS
• NOT ALL FREQUENCIES ARE IMPLEMENTED AT ALL STATIONS.
• ICAO REGIONAL AIR NAVIGATION PLANS SHOULD BE REFERRED TO FOR ADDITIONAL DETAILS.
• CURRENT OPERATIONAL DATA MUST BE OBTAINED FROM AERONAUTICAL CHARTS AND NOTAMS.
★ AERONAUTICAL EN ROUTE RADIO STATION OPERATED BY ARINC.
• AERONAUTICAL EN ROUTE RADIO STATION OPERATED BY OTHERS.
THIS MAP IS NOT SUITABLE FOR NAVIGATIONAL PURPOSES.
ISSUE DATE CHKD APVD
1 5-27-93 RAS PKK
2 8-28-93 RAS PKK
3 7-31-00 BAK RAS
4 2-16-04 BAK RAS
5 11-17-04 BAK RAS
ICAO HIGH FREQUENCY EN-ROUTE RADIOTELEPHONY NETWORKS
SERVING THE MAJOR WORLD AIR ROUTE AREAS (MWARAs)
ARINC
FILE LOCATION L3
SCALE N/A
DRAWN BY RJT
DATE 5-27-93
ENGINEER RAS
DRAWING NUMBER HF-501-1

FIGURE 4-1

5 Member Associations

5.1. AVIATION SPECTRUM RESOURCES, INC.

The Aviation Spectrum Resources, Inc. (ASRI) is responsible for managing the Aeronautical Enroute VHF Spectrum 128.825 – 132.000 MHz and 136.500 – 136.975 MHz and the Long Distance Operational Control (LDOC) HF Spectrum in the United States. This Aeronautical Enroute spectrum is used by aircraft operators to fulfill their requirements for Aeronautical Operational Control communications.

ASRI's Frequency Management selects frequencies and holds licenses for use by airlines and other aircraft operators for use in operational control of aircraft. Frequency Management has developed computer programs which analyze current frequency assignments recorded in a master database to obtain a list of candidate frequencies available for assignment to meet a new requirement. The list is analyzed by displaying each candidate frequency on a map showing the target location, all other co-channel assignments and their coordinated altitudes, the approximate radio range for the requested coordination altitude, and the international coordination zone contours.

Management of these spectrum resources includes coordinating and licensing of over 5000 ground stations; 200 new assignments; 200 modifications and 1000 license renewals per year.

ASRI participates in the International Telecommunications Union (ITU) and International Civil Aviation Organization (ICAO) panels and working groups in matters related to radio spectrum. ASRI also works closely with the Federal Communications Commission (FCC) and Federal Aviation Administration (FAA) in formulation of U.S. positions for the World Radio Conference (WRC).

ASRI functions as the International SELCAL Registrar on behalf of ICAO. This includes responsibility for the worldwide assignment of SELCAL codes and management of the SELCAL database containing approximately 27,300 SELCAL assignments for 4300 registrants.

5.1.1 ASRI Ground Station Administration (AGSA) Service

The AGSA service provides customers with a VHF frequency that can be used for aviation business purposes. This service is for customers that have their own FCC approved radio equipment and only need a licensed frequency to operate on or lease radio equipment and/or maintenance from an authorized provider.

5.1.2 Aeronautical Frequency Committee (AFC)

The AFC is an ASRI-sponsored industry committee comprising representatives of airlines and organizations representing business aviation and general aviation interests. The AFC provides assistance to ASRI and users of its service in the formulation of industry recommendations and policies relating to the allocation, assignment, and the use of the radio frequency spectrum and related regulatory matters, both domestic and international.

ASRI provides staff support for the AFC. The AFC develops and recommends radio spectrum policy and Industry positions regarding regulatory actions to the ASRI Board of Directors. The AFC is composed of major USA passenger and cargo air carriers, the National Business Aviation Association (NBAA), Helicopter Association International (HAI), and the Aircraft Owners and Pilots Association (AOPA) with observers from the FAA, the Air Transport Association (ATA), and the International Air Transport Association (IATA).

5.1.3 ASRI Information

Additional information on ASRI can be found on the ASRI website at http://www.asri.aero .

5.2. AIRCRAFT OWNERS AND PILOTS ASSOCIATIONS

The U.S. Aircraft Owners and Pilots Association (AOPA) was incorporated in New Jersey on May 12, 1939. The AOPA was originally formed to: (1) Promote, protect and represent the interests of the members'; (2) further the art, science and industry of aeronautics, and (3) promote the economy, safety, use and popularity of flight in aircraft. The U.S. AOPA has defined no basic objectives to fulfill the purposes of the Association. These broad objectives are: (1) Maximum airspace freedom for all users; (2) maximum aviation safety; (3) adequate airport systems; (4) improved navigation systems; (5) improved air traffic system; (6) production of improved aircraft; (7) promote economy and utility of aircraft; (8) facilitate international travel by private aircraft, and, (9) gain wider public support of general aviation.

5.2.1 International Role

After exploring alternatives to obtain a voice for general aviation in the International Civil Aviation Organization (ICAO), it was decided to establish an international general aviation organization. After consulting with ICAO officials, it was decided to model the new organization after the International Federation of Air Line Pilot Associations. The U.S. AOPA initiated action to form the International Council of Aircraft Owners and Pilots Associations (IAOPA). An interim organization was formed on February 2, 1962. Four other groups joined the U.S. AOPA to form the nucleus which culminated in the permanent IAOPA. The founding groups were the U.S. AOPA, the Australian AOPA, the South African AOPA, the Canadian Owners and Pilots Association and the Philippine Airmen's Organization. The foregoing organizations and ICAO officials agreed that a minimum of 13 countries would be represented in an international association before the organization would apply to ICAO for official status. The permanent

International Aircraft Owners and Pilots Association (IAOPA) organization became official on October 22, 1964.

5.2.2 IAOPA Objectives

The IAOPA has established eight objectives to satisfy the members' requirements. These objectives are to: Facilitate the movement of general aviation aircraft internationally, for peaceful purposes, in order to develop friendship and understanding among the people of the world and to increase the utility of general aviation airplanes as a means of personal transportation; integrate the views and requirements of member organizations with regard to international standards, recommended practices, procedures, facilities and services for international general aviation, providing forums as appropriate for meetings of representatives of the member groups; advance the interests of general aviation internationally and to represent the membership on matters of interest to general aviation at pertinent meetings of ICAO; develop and promote desirable and practical standardization for the regulation and guidance of general aviation; encourage representatives of national authorities in the interest of promoting better understanding, enlightened regulation and adequate facilities for general aviation; encourage the implementation of planned systems, facilities, services and procedures in order to promote flight safety, efficiency and utility in the use of general aviation aircraft; coordinate with other international and national organizations to promote better understanding of general aviation's requirements and further the interests of the membership; and, encourage the collection from ICAO Contracting States and dissemination by ICAO of information, data and statistics related to general aviation to provide a meaningful base for development of technical programs.

5.2.3 IAOPA Organization and Activities

The governing authority of IAPOA is the Executive Board which consists of the chief executives of all accredited member organizations. The President and other members of the Board are elected for four-year terms. Regional Vice Presidents are elected from the Board. Regular meetings of the Board are convened bi-annually. During the Board meetings, representatives of the constituent organizations hold a simultaneous meeting. In addition, meetings of the European Region member groups normally are held quarterly to discuss and coordinate problems related to general aviation operations in that region. IAOPA provides representation at all major ICAO meetings of interest to general aviation and to many of the regional meetings. Participants are selected on a voluntary basis from IAOPA constituent groups to provide representation at ICAO meetings and at many other international conferences. The representatives for each meeting are selected, insofar as practicable, from IAOPA member groups in the area of the meeting. These groups are supplemented by staff members of the IAOPA secretariat, and as necessary by additional experts from groups that have the required expertise. IAOPA positions on contemporary matters have consideration by ICAO and other groups are formed through dissemination of agenda items and working papers by the headquarters secretariat in Washington, D.C. and the European Regional secretariat in Amsterdam, Netherlands. In addition, specialized committees evaluate and make recommendations on selected subjects. IAOPA maintains two standing committees: The Technical Advisory Committee and the Medical Committee. IAOPA also provides representation on selected occasions for general aviation at meetings of the International Federation of Air Traffic Control Associations, the International Air Transport Association, the International Federation of

Air Line Pilot Associations, the European Organization for Civil Aviation Electronics, the World Meteorological Organization, the International Civil Airport Association, EUROCONTROL and the European Civil Aviation Conference. Consequently, the IAOPA is well established as the international representative for general aviation on a worldwide basis.

5.2.4 IAOPA Member Organizations

A list of IAOPA Member Organizations can be found on the IAOPA website at http://www.iaopa.org/affil/index.html.

5.2.5 AOPA Information

Additional information on AOPA can be found on the AOPA website at http://www.aopa.org .

5.3. NATIONAL BUSINESS AVIATION ASSOCIATION, INC.

The National Business Aviation Association, Inc. (NBAA), is an association of organizations which own or operate aircraft in the conduct of their business. The Association was formed in 1947 for the purpose of furthering the cause of safety, security and economy of business aircraft operations.

5.3.1 Membership

A full membership in NBAA may be accorded to any commercial or industrial enterprise (corporation, company, partnership, financial institution, proprietorship, or individual) which is engaged in business, commerce, trade or industry and owns and/or operates aircraft (primarily not for hire) of United States registry. These aircraft are utilized as aids to the conduct of the enterprise's business and are flown by pilots having current professional qualifications of at least a valid commercial license and instrument rating. Association membership is available to other interested parties that do not qualify for full membership but does not provide voting rights. Affiliate membership is available to enterprises which own and/or operate aircraft registered in any nation other than the United States under the same conditions as a full member but does not provide voting rights.

5.3.2 Activities

The NBAA represents its members at all levels of government, and provides technical information, advice and support for improved equipment and facilities. The Association also seeks to enhance aviation safety, security and operational economy, and sponsors activities to promote improved understanding of business aviation among all segments of the community. In addition, the NBAA staff coordinates and implements the work of standing Board Committees concerning industry affairs. The Staff also works with specialized membership committees on Airports/Heliports, Airspace/Air Traffic, Associate Member Advisory Council, Corporate Aviation Management, FAR Part 135, Flight Attendants, Government Affairs, International Operators, Maintenance, Operations, Safety, Schedulers & Dispatchers, Tax and Technical issues as well a Security Council and augmentation by Regional and Local Business Aviation Organizations. At the national level, the NBAA Staff also interprets business aviation's accomplishments and requirements to federal regulators and policy makers; analyzes governmental proposals and actions to

determine their effects on the industry; generates public information from members and publishes it for the guidance and use of others; and, arranges and conducts annual meetings, seminars, both domestically and in conjunction with other organizations, internationally.

5.3.3 International Role

NBAA is a founder member of the International Business Aviation Council, LTD (IBAC).

5.3.3.1 Purpose of IBAC

Administered from offices in the ICAO Building in Montreal, the International Business Aviation Council, Ltd., (IBAC) provides, through the cooperation of global national and regional business aviation organizations, a pool of knowledge, experience and general information in all aspects of international business aircraft operations on which member organizations can draw for the benefit of their own members. IBAC undertakes all activities appropriate to ensure that the needs and interests of business aviation on an international scale are clearly presented to, and understood by, those national and international authorities and organizations whose responsibilities include any administration which may influence the safety, security, efficiency or economic use of business aircraft operating internationally.

5.3.3.2 IBAC Membership

The following organizations are national members of IBAC:

a. ABAA - Australian Business Aircraft Association, Ltd.
Website: www.abaa.com.au

b. ABAG - Associaçao Brasileira de Aviáçáo Geral
Website: www.abag.org.br

c. BBGA - British Business & General Aviation Association
Website: www.bbga.aero

d. BAAI – Business Aviation Association of India

e. CBAA - Canadian Business Aircraft Association, Inc.
Website: www.cbaa.ca

f. EBAA-France - European Business Aviation Association – France

g. GBAA - German Business Aviation Association
Website: www.gbaa.de

h. IBAA - Italian Business Aviation Association

i. JBAA – Japan Business Aviation Association
Website: www.jbaa.org

j. MEBAA – Middle East Business Aviation Association
Website: www.mebaa.com

k. NBAA - National Business Aircraft Association, Inc.
Website: www.nbaa.org

The following organizations are Regional Members of IBAC:

a. AsBAA – Asian Business Aircraft Association

b. BAASA - Business Aviation Association of Southern Africa
Website: www.caasa.co.za

c. EBAA - European Business Aviation Association
Website: www.ebaa.org

5.3.4 NBAA Information

Additional information on NBAA can be found on the NBAA website at http://www.nbaa.org .

5.4. HELICOPTER ASSOCIATION INTERNATIONAL

The Helicopter Association International (HAI) is an international, independent, non-profit organization. This Association had its beginning on December 13, 1948 when a group of helicopter operators met in the Los Angeles area and formed an organization known as the California Helicopter Association. In 1951, due to the growing list of members from other states and Canada, as well as interest from other foreign based operators, the name of the Association was changed to the Helicopter Association of America (HAA). The Association was incorporated in the State of California in 1954 and became HAI in 1981.

5.4.1 Operations

The Operations Department' primary function is to assist owners and operators in enhancing their operations and utilizing their aircraft. One of the primary reasons individuals and companies join a trade association is for the collective advocacy support offered to people and businesses with common interests. Helicopter Association International (HAI) works on behalf of its members on legislative issues that affect operations. HAI coordinates with international, national, and local government authorities, including the Federal Aviation Administration (FAA) and the Transportation Security Administration (TSA), in various matters that impact the businesses of members. If you are a member and operate in the United States, we are your voice in Washington. The department is responsible for**:** security issues, safety and flight programs, heliports and maintenance/technical programs, legislative affairs programs, and acoustics and environmental issues.

5.4.2 Membership

Membership information can be found at HAI's website at http://www.rotor.com .

5.4.3 Liaison Activities

Liaison Activities can be found at HAI's website at http://www.rotor.com .

5.5 HELICOPTER SAFETY ADVISORY CONFERENCE

The Helicopter Safety Advisory Conference (HSAC) was formed in January 1978 after an accident in which 19 people lost their lives when a helicopter came in contact with a platform crane.

Realizing there was a lack of communication between oil companies, service organizations, helicopter operations, and the helicopter industry, representatives of these companies agreed to work toward improved safety offshore. The HSAC continues to identify critical issues that affect safety in the Gulf of Mexico. Through interaction of the HSAC subcommittees and associated responsible organizations, HSAC has been, and continues to be, proactive in resolving issues of interest to the industry.

The HSAC, through its pledge of "Safety through Cooperation", has made significant contributions to improved communication and safe practices within the offshore community. Its efforts have been recognized both nationally and internationally.

5.5.1 Participants

The HSAC has grown to more than 115 members representing major petroleum companies, drilling companies, helicopter operators, oil industry services companies, and helicopter manufacturers. Numerous federal agencies and every branch of the Armed Forces participate in the HSAC. Included in these are the U. S. Army, Air Force, Navy, Coast Guard, Department of Interior, Customs, and the Federal Aviation Administration.

The HSAC is a conference and is not incorporated or organized to be a spokesman for the industry. Members are volunteers sharing a common goal.

5.5.2 HSAC Information

Additional information on HSAC can be found on the HSAC website at http://www.hsac.org

5.6 NATIONAL AVIATION TRAINING ASSOCIATION

On Dec. 28, 1940, shortly after the organizational meeting in Kansas City, Mo., the National Aviation Training Association (NATA) was officially formed with 83 charter member companies with a goal to push back the heavy hand of Big Government. NATA was instrumental in lobbying congress and reversing the government's approach to civilian aviation. So much so that NATA not only saved the Civilian Pilot Training Program, it was largely responsible for saving the entire general aviation industry. If NATA had not been formed, civilian aviation would have been banned from our skies and it would have likely been the end of general aviation as we know it. Today's general aviation industry owes much to the foresight and resiliency of the founders of NATA, William A. Ong and Leslie H. Bowman – the association's first two presidents – as well as George E. Haddaway, John L. Gaylord and others who played a strong role in the organization's formation.

Today, NATA is widely known for its ability to lobby and track key legislative and regulatory issues, which have specific impact on the business operations of FBOs and air charter companies. The association maintains a constant vigil on common issues that threaten the livelihood of its members.

The industry research performed by NATA's government and industry affairs department has provided members and others throughout the industry with vital information and highly acclaimed publications, such as The Aviation Industry Guide to the Taxpayer Relief Act of 1997 and the Aviation UST Management Manual.

NATA continually taps into one of the greatest sources of industry expertise – that of its own members. The association maintains standing committees made up of experienced and knowledgeable members – regular and associate members alike – who meet a minimum of three times each year to address important organizational and operational issues. The involvement of members in this way has contributed immensely to the growth of NATA, both in terms of members and the association's standing in the aviation community.

5.6.1 Committees

Member-based committees play an important role in achieving an effective and progressive NATA and are a vital part of the association's operations.

There are some basic purposes to utilizing a committee and advantages to be gained. Bringing together a cross section of member knowledge and experience, an effective committee can generate qualified group judgment and continuity of thinking. To the NATA staff liaison, it provides constructive guidance and direction. The committee's ability to provide direct member involvement ensures that NATA truly represents its members. And the committee is both a classroom and a proving ground for developing better informed and more knowledgeable members who could in the future serve on the association's board of directors.

5.6.2 NATA Information

Additional information on NATA can be found on the NATA website at http://www.nata.aero.

6 Related Industry Organizations

6.1. AERONAUTICAL RADIO, INC.

6.1.1 Formation and Organization

Aeronautical Radio, Inc. (ARINC) is a communications company which specializes in providing information handling and processing systems and other communication facilities and services designed specifically to satisfy requirements of the civil aviation community. ARINC was organized as a corporation in 1929 with the airline companies being the principal owners and users of its services. However, its services are extended to all aircraft operators, large and small, U.S. or foreign, scheduled and supplemental, business, private or government.

Headquarters in Annapolis, Maryland, ARINC employs more than 3200 employees in more than 100 offices around the world providing over 150 value-added solutions and services to customers in 104 countries. To better serve their worldwide customers ARINC has two regional headquarters: Singapore, established in 2003 for the Asia Pacific region, and London, established in 1999 to serve the Europe, Middle East, and Africa region.

ARINC is a portfolio company of The Carlyle Group.

6.1.2 Industry Conferences and Coordination

The air transport industry and ARINC jointly coordinate communications and electronics requirements and related matters. The Airlines Electronic Engineering Committee (AEEC), Avionics Maintenance Conference (AMC), and the Flight Simulator and Engineering Maintenance Conference (FSEMC) are all active participants in this endeavor. In sponsoring these activities, ARINC provides the secretarial and the necessary supporting technical staff.

6.1.3 ARINC Sponsored Systems and Services

ARINC is recognized as the leading provider of transportation, communications, and systems engineering solutions to five major industries: aviation, airports, defense, government, and transportation.

More information of various ARINC systems and services can be found on the ARINC website at http://www.arinc.com.

6.2. AIR TRANSPORT ASSOCIATION OF AMERICA

6.2.1 Formulation and Membership

The Air Transport Association of America (ATA) was founded in 1936 and is the trade and service organization of the scheduled airlines of the United States. Through ATA, the member airlines combine their technical and operational knowledge to form a single, integrated airline system. The air transportation system ATA service was initially formed by Congress with passage of the Civil Aeronautics Act of 1938. The Act was subsequently updated by the Federal Aviation Act of 1958, and amended by the Deregulation Act of 1978.

6.2.2 Organization

The ATA is divided into departments which parallel functions of the airlines. The interests of the airlines as an industry are channeled through a system of councils and related committees made up of airline and ATA representatives working together. Departments and Committees of interest to the AFC are as follows:

6.2.2.1 International Affairs

The International Affairs Department is concerned with issues associated with landing rights abroad, overseas travel procedures and tourist promotion. The Department also assesses the potential impact of international air transport agreements and bilateral negotiations which may involve requests for new or improved air rights by either the United States or foreign nations. After assessing the impact, the Department provides liaison between the airlines and the Department of State and the Civil Aeronautics Board which are responsible for conducting the negotiations. In addition, the Department administers six multilateral facilitation agreements between airlines, steamship operators, freight forwarders and governments which affect the expeditious movement of passengers and cargo throughout the United States. These agreements include responsibilities for immigration and customs regulations. Flag carriers of Canada, the United States and most foreign carriers which serve the United States, also participate in these facilitation agreements.

6.2.2.2 Federal Affairs

The Federal Affairs Department monitors legislation of interest to the aviation industry and coordinates industry action on associated legislation. The Department represents the industry before Congress and Executive Departments through correspondence, as well as appearance of ATA representatives at Congressional hearings.

6.2.2.3 Communications Committee

The Communications Committee is responsible for development of airline industry internal and external data communications, and other forms of electronic information exchange requirements, standards and policies that serve the interest of improved and more timely, reliable and cost effective exchange of information. The Committee also provides expertise in development of industry programs and projects in support of other ATA Councils, Committees and Task Forces. The Committee reviews government and industry communications policies to determine their necessity and adequacy, and, when appropriate, recommends appropriate modifications. The Committee also develops recommended ATA airline policies on point-to-point and air/ground communications for consideration by the industry, and, develops, coordinates with the users and promulgates communications operational requirements for information that have been identified by user application development groups or committees. In addition, the Committee develops and coordinates airline positions on communications standards and policies.

6.2.3 ATA Information

Additional information on ATA can be found on the ATA website at http://www.airlines.org.

6.3. THE INTERNATIONAL AIR TRANSPORT ASSOCIATION

6.3.1 General Structure

The International Air Transport Association (IATA) is a free association of airlines which operate international commercial air services. Membership in IATA is open to both scheduled and non-scheduled operators, subject only to the condition that the state in which they are registered is a Member of the International Civil Aviation Organization (ICAO). Airlines designated to operate international services may become active members, while airlines with only domestic services may become associate members. The Association is incorporated by a special act of the Canadian Parliament. The Articles of Association which are governed by the Act, and which define the general rules under which the Association functions, cannot be changed without the express approval of the Canadian Government. Other governments also reserve the right to approve changes in Articles of the Association. Control of the Association is maintained by the Annual General Meeting of all members. The Annual General Meeting has two official responsibilities. The first responsibility relates to the internal affairs of the Association, and, in particular, such domestic business as approving the budget, electing presidents who hold office for one year and deciding the place and date of the next Annual General Meeting. Action on these matters is usually based on recommendations submitted by the Executive Committee. The Annual General Meeting is also responsible for electing members to the Executive Committee and other Standing Committees.

The Executive Committee consists of twenty-one members, all of whom are senior executives of active airline members of the Association. The Executive Committee deals with both the domestic arrangements of the Association and also plays a role in solving problems facing the airline

industry as a whole. In both of these functions, the Committee acts in close concert with the Director General. The Executive Committee, in conjunction with the Director General, decides on the most effective structure within the Secretariat. The IATA administration is headed by a Director General and six Assistant Director Generals. The Association has main offices in Montreal and Geneva. Regional Technical Directors are located in Bangkok, Geneva, London, Nairobi and Rio de Janeiro. In addition, Regional Directors are based in Buenos Aires and Singapore. To promote the interests of the world's airlines and their customers, IATA maintains contact with approximately one hundred national, regional and international organizations. The principal interface at the international level is with ICAO.

6.3.2 Purpose

The purpose of IATA is to organize cooperation between airlines to enable them to consolidate their experience and requirements. The Association acts as a spokesman for the air transport industry's relations with governments and governmental organizations. All members of IATA must hold a certificate for scheduled air carriage from a government eligible for membership in the ICAO.

6.3.3 Technical Activities

IATA involvement in technical matters has two main thrusts. One is primarily concerned with enabling close cooperation between airline experts in order to improve the efficiency of the airline industry as a whole, and the other is to present to ICAO and other organizations, airline requirements for facilities which governments, rather than airlines, are responsible. The technical activities of the Association are directed by the Technical Committee which is composed of experts drawn from the Member Companies. Technical activities in the broad sense take place at two levels: Those conducted at the headquarters and those which are handled by the Regional Technical Panels in the field. Policies are established by the airlines at the headquarters level, however, the regional machinery is needed to insure it is effectively implemented. The range of subjects addressed by IATA technical activities include communication, navigational and landing aids, airports and airport terminal facilities and all other matters related to operation of aircraft, including air traffic control systems, separation of aircraft, etc. All of these matters dictate close collaboration with ICAO and the other authorities responsible for making rules which impact the air transport industry.

6.3.4 Communications and Avionics

IATA works closely with both ICAO and other authorities who are responsible for providing ground radio aids to insure compatibility and standardization. The airline industry works collectively through the Communications Advisory Committee of IATA to examine all the possibilities and make practical recommendations regarding equipment and methods. The Communications Advisory Committee also deals with matters relative to company communications; i.e., reservations and similar matters of a commercial nature. In this context, IATA works closely with Aeronautical Radio, Inc. (ARINC) and the Societe International de Telecommunications Aeronautiques (SITA).

6.3.5 IATA Information

Additional information on IATA can be found on the IATA website at http://www.iata.org.

6.4. RTCA

6.4.1 General

RTCA, Inc. is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management (CNS/ATM) system issues. RTCA functions as a Federal Advisory Committee. Its recommendations are used by the Federal Aviation Administration (FAA) as the basis for policy, program, and regulatory decisions and by the private sector as the basis for development, investment and other business decisions.

Organized in 1935 as the Radio Technical Commission for Aeronautics, RTCA today includes roughly 335 government, industry and academic organizations from the United States and around the world. Member organizations represent all facets of the aviation community, including government organizations, airlines, airspace users and airport associations, labor unions, plus aviation service and equipment suppliers. A sampling of our domestic membership includes the Federal Aviation Administration, Air Line Pilots Association, Air Transport Association of America, Aircraft Owners and Pilots Association, ARINC Incorporated, Avwrite, The Boeing Company, Department of Defense, GARMIN International, Rockwell International, Stanford University, Lockheed Martin, MIT Lincoln Laboratory, MITRE/CAASD, Harris Corporation, NASA, National Business Aviation Association, and Raytheon.

Because RTCA interests are international in scope, many non-U.S. government and business organizations also belong to RTCA. We currently are supported by over 100 International Associates such as Airservices Australia, Airways Corporation of New Zealand, Airbus, the Chinese Aeronautical Radio Electronics Research Institute (CARERI), EUROCONTROL, NAV Canada, Bombardier Aerospace, Society of Japanese Aerospace Companies, Thales Avionics Limited, Centre for Airborne Systems-Bangalore, the United Kingdom Civil Aviation Authority and many more.

RTCA has proven to be an excellent means for developing government / industry consensus on contemporary CNS/ATM issues.

6.4.2 Task Forces

Occasionally, RTCA is asked by the Administrator of the Federal Aviation Administration to develop industry consensus on a broad gauged strategic issue. Examples of completed Task Force issues include Global Navigation Satellite System (GNSS) Transition and Implementation Strategy, Transition to Digital Communications, Free Flight Implementation and Certification.

6.4.3 Air Traffic Management Advisory Committee

The Air Traffic Management Advisory Committee's (ATMAC) purpose is to provide the Federal Aviation Administration with consensus-based, recommended investment priorities that will improve the safety, capacity and/or efficiency of the United States air transportation system.

Public and private sector operational requirements, coupled with the current and expected availability of public and private sector funding, are the fundamental criteria upon which ATMAC deliberations and recommendations are based. International interoperability is also a major consideration. System life cycle costs development, acquisition, facility and equipment modification, training, operation and maintenance and removal from service serve as the basis for the economic aspects of the committee's deliberations.

The timing and inter-relationship of government and industry actions are considered while developing recommendations.

6.4.4 Program Management Committee

Our most frequent requests are for RTCA to establish a new, special committee to recommend Minimum Operational Performance Standards (MOPS) or appropriate technical guidance documents. MOPS are developed by RTCA and become the basis for certification. When these requests are received, RTCA's Program Management Committee (PMC) discusses the topic and, based on consensus, initiates Special Committee action.

6.4.5 Special Committees

Essentially all RTCA products are developed by issue-oriented Special Committees staffed by volunteers. As with all Federal Advisory Committee activities, Special Committee meetings are publicly announced and open to participation by anyone with an interest in the topic under consideration. During Special Committee meetings, volunteers from government and industry explore the operational and technical ramifications of the selected topic and develop consensus-based recommendations. These recommendations are then presented to the RTCA Program Management Committee, which either approves the Special Committee report or directs additional Special Committee work. Approved recommendations are published and made available for sale to members and to the public.

Easy access to updates on committee activities and related subjects is available on the RTCA web site and in the Digest, which is published every two months.

Through the years, RTCA has received several awards for its service to the aviation community. The organization was awarded the 1949 Collier Trophy for "A guide plan for the development of a system of air navigation and traffic control for safe and unlimited aircraft operations under all weather conditions." Additionally, in 1994, the FAA named RTCA, Inc. as the U.S. recipient of the ICAO 50th anniversary Medal of Honour. This unique recognition identified RTCA as the single most important U.S. contributor organization to the advancement and support of civil aviation since the creation of ICAO by the Chicago Convention in 1944.

6.4.6 RTCA Information

Additional information on RTCA can be found on the RTCA website at http://www.rtca.org .

6.5. AEROSPACE AND FLIGHT TEST RADIO COORDINATING COUNCIL

6.5.1 Organization and Objectives

The Aerospace and Flight Test Radio Coordinating Council (AFTRCC) was organized in 1954 and is composed of major aerospace manufacturers who represent the aerospace manufacturing industry for flight test voice and telemetry frequencies. The AFTRCC coordinates on usage of flight test spectrum by both government agencies (military and non-military) and non-government aerospace manufacturing entities. Special objectives of the AFTRCC are:

- To advance the arts and sciences of radio communications and control, and the orderly and efficient allocation and utilization of the electromagnetic spectrum, as connected with or employed in aeronautical and space flight evaluation of vehicles, spacecraft, related services or major components thereof, or as may otherwise affect the interests of the aerospace manufacturing industry.

- To concern itself with radio frequency management, planning, coordination and control in the aerospace manufacturing industry, and any proposed or needed changes, amendments or modifications of rules, policy or other governmental requirements relating to the usage of the electromagnetic spectrum which may affect the interests of the aerospace manufacturing industry.

6.5.2 Policies

AFTRCC furnishes mutual aid to the general membership in matters concerning licensing, equipment, installation, operations and miscellaneous items of interest in aeronautical and space flight test radio operations and technical groups. It strives for the efficient and profitable use of radio facilities, instruments, measuring devices and control equipment associated with aeronautical and space flight testing, and functions on a not-for-profit basis as a service to the general membership.

6.5.3 General

In order to identify and provide for future aerospace flight test voice and telemetry requirements, AFTRCC has for many years participated actively in rulemaking and other proceedings before the Federal Communications Commission (FCC) and other government agency activities. Since 1959, AFTRCC has also been active on a continuing basis in international radio regulatory matters. The Council is also an active participant in RTCA Special Committees and the U.S. CCIR Study Group 8 (Mobile Services) activities.

6.5.4 Flight Test Communications

Flight test communications are those nonpublic voice and telemetry communications required to support and coordinate the flight testing of aerospace vehicles and their major components. These tests are essential in the development of aircraft and space vehicles to obtain comprehensive information on the actual performance characteristics of the vehicle. The four basic types of flight testing are: (1) Experimental and certification flight testing of new aircraft design; (2) Production flight testing of newly manufactured or modified aircraft; (3) Flight testing of major components; and, (4) customer crew training flight test. The primary purpose of flight test communications is to assure the safety of flight test activities. Safety considerations require reliable voice and telemetry communications links between the crew of the test vehicle, engineering personnel and test observers in supporting aircraft. In addition, flight test communications are required to collect test data. The most practicable means of gathering the test data is to telemeter it from test vehicles to ground tracking stations. Another important role of flight test communications support, especially telemetry, is to increase the efficiency of flight testing. With adequate communications support, tests can be modified while in progress as necessary to gather additional or different test data. Flight test telemetry and voice communications requirements are technically and operationally distinct.

6.5.5 AFTRCC Information

Additional information on AFTRCC can be found on the AFTRCC website at http://www.aftrcc.org .

6.6. SOCIETE INTERNATIONALE de TELECOMMUNICATIONA AERONAUTIQUES

6.6.1 History

As a partner with airlines, airports and many related air transport organizations, Societe International de Telecommunications Aeronautiques (SITA) has worked closely with the community as it has evolved over the last 58 years. SITA has evolved in that time to be a very different organization today than when it was founded in 1949.

SITA is unique in being owned by the community, with the SITA Board of Directors comprising shareholders and customers from across the air transport industry. The organization is unique in aiming to provide innovative and community-focused solutions that offer the industry greater cost-effectiveness anywhere in the world.

Working with and for the air transport community, SITA is helping to drive and shape industry standards. In these endeavors, all of the initiatives and solutions aim to ensure interoperability and cost-effective use of technologies for the industry.

SITA continues to be the only organization dedicated to providing the air transport industry with the information and communications technology needed to operate seamlessly in every corner of the world. The global reach is based on local presence, with services for over 600 members and around 1800 customers in over 220 countries and territories. Today, SITA employs people of more than 140 nationalities, speaking over 70 different languages.

6.6.2 Corporate Profile

SITA is the world's leading provider of IT business solutions and communications services to the air transport industry. With over 55 years of experience:

- SITA manages complex communication solutions for its air transport, government and Global Distribution Services customers over the world's most extensive communication network, complemented by consultancy in the design, deployment, and integration of communication services.
- SITA provides market-leading common-use services to airports and air-to-ground communications to airlines.
- SITA delivers a comprehensive portfolio of e-commerce solutions for airlines and is pioneering new technologies in areas such as in-flight passenger communications and transportation security.
- Motivated by industry concern for lower costs, asset optimization and an improved passenger experience, SITA aims to simplify travel and transportation removing complexity and improving our customers' operational performance.
- SITA has two main subsidiaries: OnAir, which is leading the race to bring in-flight mobile telephony to the market, and CHAMP Cargosystems, the world's only IT company solely dedicated to air cargo. SITA also operates two joint ventures providing services to the air transport community: Aviareto for aircraft asset management and CertiPath for secure electronic identity management.

6.6.3 SITA Information

Additional information on SITA can be found on the SITA website at http://www.sita.aero.

6.7. REGIONAL AIRLINE ASSOCIATION

The Regional Airline Association (RAA) represents U.S. regional and commuter air carriers in various National activities. The RAA monitors legislative activity at various governmental levels which may have a potential impact on regional and/or commuter airlines. The RAA advises its members of these activities, and participates in the consideration of associated legislation at the Federal, State and local levels.

6.7.1 Membership

Regular members of the RAA consist of regional and commuter air carriers, as defined by Civil Aeronautics Board (CAB), which are engaged in the air carriage of passengers, cargo and/or mail on a scheduled basis, and certificated air carriers who are engaged in operations normally performed by commuter airlines. Regular membership also includes "non-operating air carriers." Associate Members consist of persons, companies, and organizations engaged in activities related either directly or indirectly to commercial aviation. Associate Members are eligible to participate in affairs of the Association except they are not eligible to vote. Affiliate members are restricted to colleges and universities (or members of their faculties), state and local governments and state aviation associations. Affiliate members are not eligible to vote in RAA proceedings.

6.7.2 Operations

The Operations Department addresses matters relating to the FAA, FCC and other federal regulations; e.g., Parts 91, 121, and 135 of the Federal Aviation Regulations. The RAA's Operations Committee is composed of representatives of the commuter and regional airline industry, and, in coordination with the RAA Staff, deals with proposed regulatory changes and interpretations of current regulations. Comments are filed by the RAA on behalf of its carriers on all Notices of Proposed Rulemaking issued by the FAA and other government agencies which effect its member carriers. The Association schedules four Operations Conferences each year for member carrier operations personnel. These conferences address safety, air traffic control, training programs and other similar subjects and are used to discuss operational problems with representatives of the FAA, the National Transportation Safety Board, and certificated air carriers.

6.7.3 RAA Information

Additional information on RAA can be found on the RAA website at http://www.raa.org.

7 Federal and International Agencies

7.1. THE FEDERAL COMMUNICATIONS COMMISSION

The Federal Communications Commission (FCC) is an independent United States government agency, directly responsible to Congress. The FCC was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. The FCC's jurisdiction covers the 50 states, the District of Columbia, and U.S. possessions.

7.1.1 Organization

The FCC is directed by five Commissioners appointed by the President and confirmed by the Senate for 5-year terms, except when filling an unexpired term. The President designates one of the Commissioners to serve as Chairperson. Only three Commissioners may be members of the same political party. None of them can have a financial interest in any Commission-related business.

As the chief executive officer of the Commission, the Chairman delegates management and administrative responsibility to the Managing Director. The Commissioners supervise all FCC activities, delegating responsibilities to staff units and Bureaus.

7.1.2 Bureaus and Offices

The Commission staff is organized by function. There are seven operating Bureaus and ten Staff Offices. The Bureaus' responsibilities include: processing applications for licenses and other filings; analyzing complaints; conducting investigations; developing and implementing regulatory programs; and taking part in hearings. Our Offices provide support services. Even though the Bureaus and Offices have their individual functions, they regularly join forces and share expertise in addressing Commission issues.

7.1.2.1 Consumer and Governmental Affairs Bureau - educates and informs consumers about telecommunications goods and services and engages their input to help guide the work of the Commission. CGB coordinates telecommunications policy efforts with industry and with other governmental agencies — federal, tribal, state and local — in serving the public interest.

7.1.2.2 Enforcement Bureau - enforces the Communications Act, as well as the Commission's rules, orders and authorizations.

7.1.2.3 International Bureau - represents the Commission in satellite and international matters.

7.1.2.4 Media Bureau - regulates AM, FM radio and television broadcast stations, as well as cable television and satellite services.

7.1.2.5 Wireless Telecommunications - oversees cellular and PCS phones, pagers and two-way radios. This Bureau also regulates the use of radio spectrum to fulfill the communications needs of businesses, aircraft and ship operators, and individuals.

7. 1.2.6 Public Safety and Homeland Security Bureau - addresses public safety, homeland security, national security, emergency management and preparedness, disaster management, and other related issues.

7.1.2.7 Wireline Competition Bureau - responsible for rules and policies concerning telephone companies that provide interstate, and under certain circumstances intrastate, telecommunications services to the public through the use of wire-based transmission facilities (i.e., corded/cordless telephones).

7.1.2.8 Office of Administrative Law Judges - presides over hearings, and issues Initial Decisions.

7.1.2.9 Office of Communications Business Opportunities - provides advice to the Commission on issues and policies concerning opportunities for ownership by small, minority and women-owned communications businesses.

7.1.2.10 Office of Engineering and Technology - allocates spectrum for non-Government use and provides expert advice on technical issues before the Commission.

7.1.2.11 Office of The General Counsel - serves as chief legal advisor to the Commission's various Bureaus and Offices.

7.1.2.12 Office of Inspector General - conducts and supervises audits and investigations relating to the operations of the Commission.

7.1.2.13 Office of Legislative Affairs - is the Commission’s main point of contact with Congress.

7.1.2.14 Office of The Managing Director - functions as a chief operating official, serving under the direction and supervision of the Chairman.

7.1.2.15 Office of Media Relations - informs the news media of FCC decisions and serves as the Commission‘s main point of contact with the media.

7.1.2.16 Office of Strategic Planning and Policy Analysis - works with the Chairman, Commissioners, Bureaus and Offices to develop strategic plans identifying policy objectives for the agency.

7.1.2.17 **Office of Work Place Diversity** - advises the Commission on all issues related to workforce diversity, affirmative recruitment and equal employment opportunity.

7.1.3 FCC Information

Additional information on the FCC can be found on the FCC website at http://www.fcc.gov .

7.2 THE FEDERAL AVIATION ADMINISTRATION

The Federal Aviation Administration (FAA) is responsible for the safety of civil aviation. The Federal Aviation Act of 1958 created the agency under the name Federal Aviation Agency. The FAA adopted its present name in 1967 when it became a part of the Department of Transportation. FAA major roles include:

- Regulating civil aviation to promote safety
- Encouraging and developing civil aeronautics, including new aviation technology
- Developing and operating a system of air traffic control and navigation for both civil and military aircraft
- Researching and developing the National Airspace System and civil aeronautics
- Developing and carrying out programs to control aircraft noise and other environmental effects of civil aviation
- Regulating U.S. commercial space transportation

7.2.1 Organization

An Administrator manages FAA, assisted by a Deputy Administrator. Five Associate Administrators report to the Administrator and direct the line-of-business organizations that carry out the agency's principle functions. The Chief Counsel and nine Assistant Administrators also report to the Administrator. The Assistant Administrators oversee other key programs such as Human Resources, Budget, and System Safety. We also have nine geographical regions and two major centers, the Mike Monroney Aeronautical Center and the William J. Hughes Technical Center.

7.2.2 Activities

7.2.2.1 Safety Regulation

The FAA issues and enforces regulations and minimum standards covering manufacturing, operating, and maintaining aircraft. FAA certify airmen and airports that serve air carriers.

7.2.2.2 Airspace and Air Traffic Management

The safe and efficient use of navigable airspace is one of the FAA primary objectives. We operate a network of airport towers, air route traffic control centers, and flight service stations. The FAA develops air traffic rules, assign the use of airspace, and control air traffic.

7.2.2.3 Air Navigation Facilities

The FAA builds or installs visual and electronic aids to air navigation. The FAA maintains, operates, and assures the quality of these facilities. The FAA also sustains other systems to support air navigation and air traffic control, including voice and data communications equipment, radar facilities, computer systems, and visual display equipment at flight service stations.

7.2.2.4 Civil Aviation Abroad

The FAA promotes aviation safety and encourages civil aviation abroad. The FAA exchanges aeronautical information with foreign authorities; certifies foreign repair shops, airmen, and mechanics; provides technical aid and training; negotiates bilateral airworthiness agreements with other countries; and takes part in international conferences.

7.2.2.5 Commercial Space Transportation

The FAA regulates and encourages the U.S. commercial space transportation industry. The FAA licenses commercial space launch facilities and private launches of space payloads on expendable launch vehicles.

7.2.2.6 Research, Engineering, and Development

The FAA does research on and develops the systems and procedures needed for a safe and efficient system of air navigation and air traffic control. The FAA helps develop better aircraft, engines, and equipment and tests or evaluates aviation systems, devices, materials, and procedures. The FAA also does aeromedical research.

7.2.2.7 Other Programs

The FAA registers aircraft and records documents reflecting title or interest in aircraft and their parts. The FAA administers an aviation insurance program, develops specifications for aeronautical charts, and publishes information on airways, airport services, and other technical subjects in aeronautics.

7.2.3 Interagency Group on International Aviation

The Interagency Group on International Aviation (IGIA) was established by interagency agreement in 1960 at the direction of the President to provide coordinated recommendations on International aviation matters to the Department of State.

7.2.3.1 Terms of Reference

The Department of Transportation shall utilize the IGIA to obtain the views of participating departments and agencies on international aviation matters requiring Government decision or policy direction which affect two or more agencies other than the Department of State.

The Department of Transportation shall assure that the Secretary of State is provided with recommendations on policy directives, and technical or other instructions for the guidance of United States representatives on the International Civil Aviation Organization and other international bodies concerned with aviation, and United States delegations to international conferences in this field, after obtaining the recommendations of the agencies represented on IGIA. The Secretary of State shall be furnished the agreed recommendations and dissenting views of any substantially affected agency.

7.2.3.2 Membership

The Group is composed of one representative from the Departments of State, Defense, Commerce, and Transportation; the Federal Communications Commission; and the National Transportation Safety Board. When matters of substantial concern are considered, representatives from other Federal agencies are invited to participate on an ad hoc basis.

All representatives, whether continuing or ad hoc, are policy officials designated by heads of participating agencies, and have authority to represent their agency positions. Alternate members may be designated as required.

7.2.3.3 Organization

The Department of Transportation member chairs the Group. The alternate representative of the Department of Transportation (FAA) serves as Vice Chairman.

Administrative support is furnished by the Department of Transportation (FAA) through the IGIA Secretariat, located in the FAA Office of International Aviation.

7.2.4 FAA Information

Additional information on the FAA can be found on the FAA website at http://www.faa.gov .

7.3. NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION

The National Telecommunications and Information Administration (NTIA) is the President's principal adviser on telecommunications and information policy issues, and in this role frequently works with other Executive Branch agencies to develop and present the

Administration's position on these issues.

Since its creation in 1978, NTIA has been at the cutting edge of critical issues.

In addition to representing the Executive Branch in both domestic and international telecommunications and information policy activities, NTIA also manages the Federal use of spectrum; performs cutting-edge telecommunications research and engineering, including resolving technical telecommunications issues for the Federal government and private sector; and administers infrastructure and public telecommunications facilities grants.

The telecommunications and information revolution is bringing dramatic growth and change to the nation's economic, social, and political life. As a result, our fundamental mission is to promote market-based policies which lower prices to consumers and encourage innovation, while harnessing the resources of the Federal government to support spectrum-based technologies which enhance efficiency and productivity.

7.3.1 NTIA Line Offices

7.3.1.1 Office of Spectrum Management

The Office of Spectrum management (OSM) formulates and establishes plans and policies that ensure the effective, efficient, and equitable use of the spectrum both nationally and internationally. Through the development of long range spectrum plans, the OSM is prepared to address future Federal government spectrum requirements, including public safety operations and the coordination and registration of Federal government satellite networks. The OSM also satisfies the frequency assignment needs of the Federal agencies and provides spectrum certification for new Federal agency radio communication systems.

7.3.1.2 Office of Policy Analysis and Development

The Office of Policy Analysis and Development (OPAD) is the domestic policy division of the NTIA. OPAD supports NTIA's role as principal adviser to the Executive Branch and the Secretary of Commerce on telecommunications and information policies by conducting research and analysis and preparing policy recommendations. The domestic policy office generates policies that promote innovation, competition, and economic growth for the benefit of American businesses and consumers.

7.3.1.3 Office of International Affairs

The Office of International Affairs (OIA) develops and implements policies to enhance U.S. companies' ability to compete globally in the information technology and communications (ICT) sectors. In consultation with other U.S. agencies and the U.S. private sector, OIA participates in international and regional fora to promote policies that open ICT markets and encourage competition.

7.3.1.4 Institute for Telecommunication Sciences

The Institute for Telecommunication Sciences (ITS) is the research and engineering laboratory of the NTIA. ITS provides technical support to NTIA in advancing telecommunications and information infrastructure development, enhancing domestic competition, improving U.S. telecommunications trade opportunities, and promoting more efficient and effective use of the radio spectrum. ITS also serves as a principal Federal resource for investigating the telecommunications challenges of other Federal agencies, state and local governments, private corporations and associations, and international organizations.

7.3.1.5 Office of Telecommunications and Information Applications

The Office of Telecommunications and Information Applications (OTIA) administers two programs: the Technology Opportunities Program (TOP) and the Public Telecommunications Facilities Program (PTFP). From 1994 to 2004, TOP provided matching grants to non-profit organizations and state and local governments across the United States to demonstrate innovative applications of advanced telecommunications and information technology. PTFP awards grants to public broadcasting and other noncommercial entities for the purchase of telecommunications equipment.

7.3.2 NTIA Information

Additional information on the NTIA can be found on the NTIA website at http://www.ntia.doc.gov .

7.4. INTERNATIONAL CIVIL AVIATION ORGANIZATION

7.4.1 Formulation

The foundation of the International Civil Aviation Organization (ICAO) was laid at the International Civil Aviation Conference held in Chicago in November 1944. At that time, an International Civil Aviation and International Air Transport Agreement, an International Air Services Transit Agreement and a Convention on International Civil Aviation were all adopted. The latter culminated in formation of the ICAO on April 4, 1947. Since that time, ICAO has been responsible for obtaining international agreement and implementing numerous standards, practices and procedures.

7.4.2 Organization

The ICAO bodies of greatest interest to technical aspects of the airline industry are the Council, Air Navigation Commission and the Technical Divisions.

7.4.2.1 Council

The Council is composed of representatives of thirty states. Its President, not a representative of any state, is a permanent officer of the organization. The Council has authority to make administrative decisions, other than budget approval, and approve ICAO regulations.

7.4.2.2 Air Navigation Commission

The Air Navigation Commission is composed of members appointed by the Council from among nominees submitted by contracting states. The Commission submits recommendations for adoption of air navigation standards and recommended practices to the Council. After adoption by the Council, the standards are annexed to the Convention on International Civil Aviation.

7.4.2.3 Technical Divisions

The eleven divisions meet every 2 or 3 years to weigh the technical aspects of subjects assigned to them.

7.4.2.4 ICAO Regions

ICAO has subdivided the world into 8 regions. Meetings are held in each region every 2 to 3 years to analyze facilities and special procedures required for operations in the region. These meetings are used as forums to decide upon implementation of air navigation facilities and utilization of routine, day-to-day operating procedures.

7.4.3 Annexes

The Standards and Recommended Practices by ICAO are published in the form of Annexes to the Convention on International Civil Aviation.

7.4.3.1 Standards

A Standard is any specification for physical characteristics, configuration, material, performance, personnel or procedure. The uniform application of Standards is recognized as necessary for the safety or regularity of international air navigation and which contracting states will conform in accordance with the Convention.

7.4.3.2 Recommended Practices

A recommended practice is any specification of physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interest of safety, regularity or efficiency of international air navigation, and to which members will attempt to conform in accordance with the Convention. States not implementing the Standards promulgated in the Annexes are bound to notify ICAO of deviations from the Recommended Practices contained in the Annexes. ICAO, however, does not have the power to enforce the Standards or Recommended Practices, but rather must rely upon the States to cooperate and voluntarily include them in their national regulations. Annex 1, "Personnel Licensing" and Annex 8, "Airworthiness" are unique in that it is agreed in the Convention that it is compulsory for States to recognize the licenses and airworthiness certificates of other States if those licenses and certificates comply with these two Annexes.

7.4.4 Reports of ICAO Divisional and Regional Air Navigation Meetings

These reports do not have official status in ICAO other than as indicated by their titles. They are merely reports containing recommendations to the Council for Standards and Recommended Practices or for any other action which the Divisions see fit. These reports must be acted upon by the Air Navigation Commission and Council before any ICAO action can be taken.

7.4.5 Frequency Management Study Group

The Frequency Management Study Group (FMSG) was established by the Air Navigation Commission to assist the ICAO Secretariat in developing proposals for the 1979 General World Administrative Radio Conference (GWARC). The Study Group remained active after the Conference for implementation of the 1979 agreements and other future changes which affect civil aviation.

7.4.6 ICAO Information

Additional information on the ICAO can be found on the ICAO website at http://www.icao.int .

7.5. THE INTERNATIONAL TELECOMMUNICATION UNION

The purposes of the International Telecommunication Union (ITU) are maintaining and extending international cooperation for the improvement and rational use of telecommunications, prompting the development of technical facilities and their most efficient operation with a view of improving the efficiency of telecommunication services, increasing their usefulness, making them generally available to the public and harmonizing the actions of nations in the attainment of common goals.

7.5.1 Organization

The organization of the ITU consists of the Plenipotentiary Conference, ITU Council, General Secretariat, and Bureaus of Development, Radiocommunications, and Telecommunications Standardization.

ITU is based in Geneva, Switzerland, and its membership includes 191 Member States and more than 700 Sector Members and Associates.

7.5.1.1 Plenipotentiary Conference

The Plenipotentiary Conference is the top policy-making body of the International Telecommunication Union (ITU). Held every four years, the Conference sets the Union's general policies, adopts four-year strategic and financial plans and elects the senior management team of the organization, the members of Council and the members of the Radio Regulations Board. In other words, it is the key event at which ITU Member States decide on the future role of the organization, thereby determining the organization's ability to influence and affect the development of Information and communication technologies (ICT) worldwide. Sector members (recognized operating agencies, scientific or industrial organizations and financial or development institutions and organizations of an international character representing them) can also attend the Conference as observers.

7.5.1.2 ITU Council

The ITU Council was established in 1947 under the name Administrative Council, following a decision taken by the 1947 Plenipotentiary Conference in Atlantic City, New Jersey, United States.

It comprises a maximum of 25% of the total number of Member States, which are elected by the Conference with due regard to the need for equitable distribution of Council seats among the five world regions (Americas, Western Europe, Eastern Europe, Africa, Asia, and Australasia). The current Council is comprised of 46 members.

The role of Council is to consider, in the interval between Plenipotentiary Conferences, broad telecommunication policy issues to ensure that the Union's activities, policies and strategies fully respond to today's dynamic, rapidly changing telecommunications environment. It also prepares a report on the policy and strategic planning of the ITU.

In addition, Council is responsible for ensuring the smooth day-to-day running of the Union, coordinating work programmes, approving budgets and controlling finances and expenditure.

Finally, Council also takes all steps to facilitate the implementation of the provisions of the ITU Constitution, the ITU Convention, the Administrative Regulations (International Telecommunications Regulations and Radio Regulations), the decisions of Plenipotentiary Conferences and, where appropriate, the decisions of other conferences and meetings of the Union.

7.5.1.3 General Secretariat

The General Secretariat assists the Secretary-General providing high-quality and efficient services to the membership of the Union, notably in the Plenipotentiary Conference, the Council, TELECOM exhibitions and other conferences and meetings.

The General Secretariat manages the administrative and financial aspects of the Union's activities, information services, long-range strategic planning, and corporate functions (communications, legal advice, finance, personnel and common services).

7.5.1.4 ITU Bureaus

7.5.1.4.1 Telecommunication Development Bureau

The Telecommunication Development Bureau (BDT) is the executive arm of the Telecommunication Development Sector, and is headed by an elected Director. Its duties and responsibilities cover a variety of functions ranging from programme supervision and technical advice to the collection, processing and publication of information relevant to telecommunication development.

The mission of the Telecommunication Development Sector (ITU-D) aims at achieving the Sector's objectives based on the right to communicate of all inhabitants of the planet through access to infrastructure and information and communication services.

7.5.1.4.2 Radio Communication Bureau

The Radiocommunication Bureau (ITU-R) plays a vital role in the management of the radio-frequency spectrum and satellite orbits, finite natural resources which are increasingly in demand from a large number of services such as fixed, mobile, broadcasting, amateur, space research, meteorology, global positioning systems, environmental monitoring and, last but not least, those communication services that ensure safety of life on land, at sea and in the skies.

7.5.1.4.3 Telecommunication Standardization Bureau

The Telecommunication Standardization Bureau (ITU-T) acts as a platform for governments and the private sector to coordinate the development of international standards for global telecom networks and services. The Telecommunication Standardization Bureau (TSB) acts as the secretariat of ITU-T, organizing and coordinating the work of the sector.

7.5.2 ITU Information

Additional information on the ITU can be found on the ITU website at http://www.itu.int .

8 Frequency Allocations, Coordination and Assignments

8.1. The Usable Spectrum

Since the discovery of electromagnetic waves, man has continually expanded the usable area of spectrum, and, almost simultaneously, developed the necessary technology and demand to saturate it. From the starting point near 1 kHz, frequency utilization below 10 kHz and up to 300 GHz and beyond has been achieved. This area, of course, is only a small fraction of the entire spectrum. There are two major reasons why frequency usage is concentrated in such a small area. One is man's inability to produce, manipulate, transmit and receive frequencies across the spectrum with equal ease and reliability. Consequently, frequency usage is usually confined to those frequency bands that allow easy, economical and stable operations. The second reason for this concentration is the demand for the varying, unique propagation characteristics inherent to certain frequency bands. The latter limitation is more restrictive because it is imposed by nature. Increased technology will gradually negate the former. The highest level of utilization is in portions commonly referred to as the radio frequency spectrum which encompasses frequencies from 3 kHz to 300 GHz.

The spectrum is divided by wavelength into bands between each power of 10. For example, wave lengths 10 {4} and 10 {5} meters constitute the very low frequency (VLF) band and include the frequencies from 3-30 kHz (See Figure 8-1). Due to unique propagation characteristics, some frequency bands are in greater demand. The high frequency (HF) area, for example, is the only portion of the spectrum capable of providing relatively reliable, long-range propagation which is capable of accommodating voice or teletype data. Hence, the HF spectrum is the only method of communicating over long distances from one point on earth to another without utilizing a relay or connecting cable. Accordingly, the band is congested with heavy overcrowding, other frequency bands present similar problems.

Changes in technological, political and socioeconomic factors have been responsible for the increased demand for spectrum. These changing factors are frequently interrelated and often have a subtle, but very significant, long-term impact on frequency usage. Socioeconomic and political factors also effect the demand for frequencies; e.g., the rapidly expanding world population. The population growth is continually increasing the requirements for additional communications capability, and, consequently, causing additional facilities and systems to be created. The world's changing economy also contributes to the increased demands for communications systems. As the standard of living increases, the demand for state-of-technology products increases at a commensurate pace. For example, the number of available channels in the VHF aeronautical frequency band has been doubled by reducing the channel bandwidth from 50 kHz to 25 kHz. (The current U.S./Canada Interim Channeling Arrangement for 25 kHz channels in the frequency band 128.8125 - 132.0125 MHz is provided in Chapter 2). In addition, new, developing nations are emerging, and as these governments become stronger and more sophisticated, they logically demand a fair share of the spectrum to serve their national interests.

Rapidly increasing technology has also contributed to the frequency demand/availability problem. The achievements in space technology, for example, have had a profound effect on frequency usage and planning. Bands of frequencies formerly used for short-range communications are now being used for an earth satellite relay system, thereby requiring a costly conversion to accommodate the former users. The same relay system, however, is relieving the over taxed earth relay, cable and HF systems of long distance communications circuits. Intensive, large scale research is on the verge of making possible an entirely new concept of communications. The use of fiber-optics transmission systems as an alternative to free-space may make available a spectral area several thousand times larger than all the frequency bands presently in use under 300 GHz. While a system of such enormous potential will serve to alleviate many frequency problems, the additional demands it will trigger will undoubtedly create new and perhaps more complex problems for the frequency management community.

8.1.1 Problems Resulting From Increased Frequency Usage

Presently, nearly all portions of the usable spectrum are assigned for use. Most countries, especially the emerging nations, have become increasingly aware of the advantages, and, to a lesser degree, the problems associated with exploiting the frequency spectrum. However, these problems are not limited to the developing nations. On the contrary, all of the highly industrialized countries, enjoying their high standards of living, are experiencing similar difficulties. It is especially in these countries of high and growing frequency usage that proper attention to frequency management is paramount. In the United States, the rapidly escalating frequency usage has focused high-level attention on several resultant problems. For example, electromagnetic phenomena, either directly or indirectly, can degrade the performance of an electronic receiver or system. The degradation may be caused by a variety of conditions, which may be difficult to correct without restricting the operations of those involved. A great deal of effort is currently being expended to resolve these interference problems.

Band Number	Symbols	Frequency Range (lower limit exclusive, upper limit inclusive)	Corresponding Metric Subdivision	Metric Abbreviations for the Bands
4	VLF	3 to 30 kHz	Myriametric waves	B.Mam
5	LF	30 to 300 kHz	Kilometric waves	B.km
6	MF	300 to 3000 kHz	Hectometric waves	B.hm
7	HF	3 to 30 MHz	Decametric waves	B.dam
8	VHF	30 to 300 MHz	Metric waves	B.m
9	UHF	300 to 3000 MHz	Decimetric waves	B.dm
10	SHF	3 to 30 GHz	Centimetric waves	B.cm
11	EHF	30 to 300 GHz	Millimetric waves	B.mm
12		300 to 3000 GHz	Decimillimetric waves	

NOMENCLATURE OF FREQUENCY BANDS

FIGURE 8-1

8.2. ELECTROMAGNETIC PROBLEMS

Electromagnetic problems may be categorized into two distinct areas: (1) Electromagnetic Interference (EMI); and, (2) Electromagnetic Compatibility (EMC). EMI is an electromagnetic phenomena which either directly or indirectly can contribute to degradation in the performance of an electronic receiver or system. EMI can be caused by a large variety of conditions, many of which are difficult to correct without restricting the operations of those involved. A great deal of effort is currently being expended in the resolution of these interference problems. EMC is the capability of electronic equipment and systems to operate in the intended environment at designated levels of efficiency without degradation due to unintentional interference. The continually increasing utilization of frequency-employing devices, and the consequent increase in EMI problems, have clearly established the necessity for careful planning prior to activating electronic systems.

8.3. THE NEED FOR MANAGEMENT, CONTROL AND COOPERATION

With an increasing demand for frequencies and a fixed supply, the necessity for an efficient regulatory system is obvious. Without such a system, the resulting EMI would effectively deny the use of the spectrum to many and encourage the employment of more powerful transmitters, which, in turn, would produce more EMI. To be effective, the system requires the following elements:

8.3.1 Central Management

To preclude a chaotic condition and to obtain maximum utility from the spectrum, an orderly system of distributing frequencies among competing users is imperative. Ideally, this system would equitably divide the usable spectrum, set priorities, establish rules, plan for future changes, and, in general, promote the most efficient use of the spectrum possible. In addition, the system must allow for periodic review and adjustment to changing conditions.

8.3.2 Means of Control

Agencies administering the frequency spectrum must have the authority to approve or disapprove requests for frequency usage, as well as to enforce the rules governing frequency deviation, power limits, bandwidth and interference criteria. A method must exist to resolve EMI problems. In addition, agencies and user-community must be able to represent their respective sectors, both nationally and internationally.

8.3.3 User Cooperation

Because electromagnetic radiation does not respect national boundaries, successful worldwide frequency management requires the unanimous cooperation of all nations. Consequently, national frequency management must also have cooperation from all users, as a single entity or agency cannot police the entire spectrum on a national scale.

8.4. DISTRIBUTION OF FREQUENCIES

Frequency management includes the administration and control of electromagnetic radiation to permit the orderly, efficient, and effective use of the spectrum. The distribution of frequencies or bands of frequencies consists of three distinct processes: (1) Allocation; (2) Allotment; and, (3) Assignment. Frequency allocation is the designation of frequency bands for performing specific functions or services. Allocations are made to communication services such as fixed, mobile, aeronautical, etc. The various telecommunication propagation modes are depicted in Figure 8-10. Frequency allotment is the designation of specific frequency bands or discrete frequencies (within a prescribed allocation) for use by specific countries or within certain areas. Within the United States, allotments are made to specific agencies or activities. Frequency assignment is the process of designating a specific frequency for use at a particular station under specified operating conditions, subject to limitations and/or restrictions of both national and international frequency allocations for

a specific service. The following major types of services are considered to be of interest to the AFC membership:

8.4.1 Fixed Service

Fixed service is defined as radio communications between specified fixed locations. The word "specified" is used to establish the difference between fixed service and certain broadcast services. Fixed service includes all communications points and through relays along established communications routes.

8.4.2 Mobile Service

Mobile service relates to radio communication between mobile stations or between mobile stations and land stations. Aeronautical mobile service includes radio communication between aircraft, or between aircraft and aeronautical stations; e.g., air traffic control facilities and the ARINC LDOCF. Aeronautical mobile services are normally identified in frequency allocation charts and tables by the letter "R" or letters "OR". The HF frequency bands allocated to the aeronautical mobile (R) service are identified in Figure 8-2.

8.4.3 Radio Navigation Service

Frequencies have been allocated in various parts of the spectrum for aeronautical navigation aids. Specific frequency bands have been allocated for VHF Omnidirectional Radio Range (VOR), Tactical Air Navigation (TACAN), and Instrument Landing System (ILS) facilities.

8.4.4 Space Service

The space service includes such functions as Space Research Satellite, Intersatellite and Communications Satellite services. A typical space system include the fixed terrestrial stations associated with a particular service. In addition, satellite services can augment almost any other radio service; e.g., the NAVSTAR Global Positioning System Radionavigation Satellite System augments the TACAN system.

8.4.5 Distress and Emergency Service

Frequencies have been designated in many frequency bands throughout the spectrum for distress, emergency and survival purposes. The international aeronautical emergency and distress frequencies are described in Figure 8-3. In addition to the frequencies identified in Figure 8-3, the carrier frequencies 3023 and 5680 kHz may be used by mobile stations for intercommunication between mobile stations engaged in coordinated search and rescue operations. The frequency 123.1 MHz may be used by mobile stations and by land stations directly associated with such mobile stations, for search and rescue communications at the scene of an incident.

FIGURE 8-2
HF SERVICE RANGES. AERONAUTICAL MOBILE (R) SERVICE

Frequency Bands Allocated to the (R) Service	Service Ranges Day	Night	Interference (15 dB) Ranges Day	Night
kHz	km	km	km	km
2850 - 3025	100	500	700	3,500
3400 - 3500	100	800	700	4,000
4650 - 4700	350	1,400	1,200	5,500
5450 - 5480 *	450	1,800	1,500	6,500
5480 - 5680	450	1,800	1,500	6,500
6525 - 6685	650	2,200	1,900	3,000
8815 - 8965	1,000	3,400	3,800	11,000
10005 - 10100	1,250	-	5,500	-
11275 - 11400	1,500	-	6,000	-
13260 - 13360	1,900	-	7,700	-
17900 - 17970	2,600	-	10,000	-
21924 - 22000	2,600 +	-	10,000 +	-

*In ITU Region 2 Only.

FIGURE 8-3
INTERNATIONAL AERONAUTICAL EMERGENCY
AND DISTRESS FREQUENCIES

FREQUENCY	SERVICE	FUNCTION
500 & 2182 kHz	Aeronautical, Maritime, Survival Craft	Distress
4125 kHz	Aeronautical, Maritime Survival Craft	Supplement to 2182 kHz
121.54 MHz	Aeronautical Emergency	Emergency and Safety
123.1 MHz	Aeronautical Auxiliary	Emergency and Safety
243 MHz	Aeronautical (Military)	Emergency and Survival
406.028 MHz	Aeronautical Emergency	Emergency and Safety

8.5. AIR TRAFFIC CONTROL FREQUENCIES

The purpose of air traffic control (ATC) facilities, of course, is to control the movement of aircraft taxiing, departing and approaching air terminals and enroute in controlled air space. ATC facilities require frequencies that are instantly available, free from interference and not subject to interruptions to insure the safe, orderly and expeditious control of air traffic. This capability is provided by assigning frequencies to ATC facilities which are used exclusively for ATC purposes.

8.6. NAVIGATIONAL AID FREQUENCIES

The frequencies allocated to the functions of aeronautical navigation aids are described in the following:

8.6.1 Instrument Landing System (ILS)

Localizer and glideslope frequency pairs have been standardized by the International Civil Aviation Organization (ICAO) to form 20 ILS channels. The 75 MHz fan marker frequency is used by all agencies, civil and government, for ILS marker beacons.

8.6.2 Tactical Air Navigation (TACAN)

The TACAN system operates on 126 frequency channels spaced 1 MHz apart. The ground station transmitters operate in the frequency ranges of 962 to 1024 MHz and 1151 to 1213 MHz. The airborne transmitters operate in the frequency range of 1025 to 1150 MHz. With few exceptions, only the ground transmit frequency is assigned and recorded in the frequency records; use of the paired airborne transmit frequency is assumed. An exception to the foregoing is developmental or experimental operations when the TACAN is not used in the normal manner. TACAN channels 1 through 16 and 60 through 69 are generally used for military tactical purposes. The remaining 100 channels are used in the common civil and military national airspace system. TACAN channel 98 is normally reserved for equipment testing.

8.6.3 VHF Omnidirectional Range (VOR)

Frequencies ending in even tenth decimals between 108.2 and 112.0 MHz are reserved for the VOR. In addition, all frequency channels, 100 kHz spaced from 112.0 through 117.9 MHz, are reserved for VOR to make a total of 79 VOR channels. The 108.0 MHz frequency is reserved for VOR testing.

8.6.4 TACAN and VOR/ILS Paired Frequencies

When a TACAN operates with a VHF navigational facility (VOR or ILS), the transponder is collocated and the frequency paired with that of the VHF facility. If the system is used for terminal services such as airport approach or landing, the facilities are considered to be collocated when the transponder and VHF antennas are not more than 260 feet apart. For enroute procedures, collocation exists if the antenna separation does not exceed 2,000 feet. Where the separation

exceeds these figures, a VOR/ILS frequency from one pair and the TACAN frequency from another pair are assigned. This alerts users to the fact that they are not receiving azimuth and range information from the same point.

8.6.5 ATCRBS/IFF/SIF

The Air Traffic Control Radar Beacon System (ATCRBS) Identification, Friend or Foe (IFF)/Selective Identification Features (SIF) operates on standard transmit frequencies of 1030 MHz for the ground interrogators and 1090 MHz for airborne transponders. Only the ground station frequency 1030 MHz is normally recorded in frequency assignment records. The FAA has statutory responsibility for the ATCRBS.

8.7. STANDARD FREQUENCY AND TIME BROADCASTS

Frequencies have been nationally and internationally allocated and assigned to designated radio stations to provide an accurate source of calibrating frequency sensitive equipment. During the transmission of time signals, stations are prohibited from any transmissions that might interfere with the reception of these signals by other stations. Key points concerning the national and international standard broadcasts are contained in the following paragraphs.

8.7.1 U.S. Standard Broadcasts

The National Bureau of Standards (NBS) operates two HF radio stations - WWV near Fort Collins, Colorado and WWVH at Kihei, Maui, Hawaii. Each station broadcasts standard frequency and time signals of high accuracy. The coordinates of WWV are 40^{o} 40' 49" north latitude and 105^{o} 02' 27" west longitude. The coordinates of WWVH are 20^{o} 46' 02" north latitude and 156^{o} 27' 42" west longitude. Both stations transmits simultaneously on the same frequencies. The transmitted frequencies of both stations are accurate to within one part in 10 billion and are broadcast on 2500, 5000, 10000, 15000, 20000 and 25000 kHz. The NBS also operates a low frequency (60 kHz) station, WWVB, near Fort Collins, Colorado. These stations are used to coordinate operation of the global networks of missile and satellite stations, to assist other Government efforts which require accurate time and frequency, to improve the uniformity of frequency measurement on a national and international basis, and to provide a more accurate standard of frequency for electronic research and development.

8.7.2 Foreign Standard Broadcasts

The Canadian Dominion Observatory (Ottawa, Ontario) broadcasts standard frequency and time signals continuously over station CHU on frequencies 3330, 7335 and 14670 kHz. In addition, the Tokyo Astronomical Observatory broadcasts standard time and frequency signals over station JJY on 2500, 5000, 10000 and 15000 kHz.

8.8. INTERNATIONAL DISTRESS AND EMERGENCY FREQUENCIES

The U.S. Government has adopted the international distress and emergency frequencies shown in Figure 8-3 and discussed in paragraph 8.4.5. (Note: Only those frequencies relative to the aeronautical industry are depicted in the chart).

8.9. NAVIGATIONAL AID IDENTIFIERS

Navigational aids are assigned unique codes to identify their location. Various types of navigational aid identifiers are assigned to facilities as follows:

8.9.1 Airports, Heliports and Seaplane Bases

Three-letter identifiers are assigned to those airports, heliports and seaplane bases on which there is a manned FAA air traffic control facility or a terminal air navigational aid within the airport boundaries, or to those which receive Department of Defense airlift service or scheduled tour air carrier services directly into the airport. United States airports, heliports and seaplane bases not meeting the requirements stated above may be assigned a one-letter, two-numeral identifier, provided such landing facilities average at least two general aviation inbound flight plans daily.

8.9.2 Instrument Landing System Localizers and Associated DMEs

The initial Instrument Landing System (ILS) Localizer is assigned the same identifier as the airport which it serves, even though the other compass locator is given a location name different from the city or airport name. If additional ILS facilities are established, separate three-letter identifiers are assigned to each facility. The foregoing applies to facilities when an additional ILS serving the opposite end of an ILS-equipped runway, to a parallel runway even though both systems operate on the same frequencies on a non-simultaneous basis, and two different type localizer equipment serving the same runway. To distinguish the ILS localizer from another VHF facility using the same identifier, the keyed ILS identifier is preceded by the letter "I". When the DME is installed as an integral part of an ILS, the same identifier, preceded by the letter "I", is assigned to both the localizer and DME.

8.9.3 Interim Standard Microwave Landing System

The criteria used to assign an identifier to an ILS also applies to the Interim Standard Microwave Landing System (ISMLA). The identifier assigned, however, is preceded by the letter "M". If an ILS and ISMLS are installed to serve the same runway end, one basic identifier may be assigned, preceded by an "I" for the ILS and an "M" for the ISMLS.

8.9.4 Compass Locators (COMLO)

The COMLO is a nondirectional radio beacon (NDB), usually of low power, strategically located on an ILS approach path to provide L/MF azimuth guidance to an airport, in addition to the more precise guidance of the ILS LOC. COMLO's are normally collocated with ILS Outer Markers (OM) and/or Middle Markers (MM), and referred to as "LOM" and "LMM," respectively. The Morse code identification is derived from the three-letter identifier of the ILS. The LOM will be the first two letters, while the LMM will be the last two letters, with the middle letter overlapping. For example, COMLO's installed with the Los Angeles, CA (LAX) ILS would be "LA" for the LOM and "AX" for the LMM. To the extent possible, the frequencies of the LOM and LMM shall not be separated less than 15 kHz nor more than 25 kHz and shall be in descending frequency order.

8.9.5 Nondirectional Radio Beacons

The NDB is a free-standing nondirectional radio beacon designed to provide navigational service over a specified radial distance from the facility. It can have power from 10 W to 1000 W, typically 25 W, depending on the need. It should be noted that due to very heavy congestion in this band, the FAA Spectrum Management Office shall do everything possible, by coordinating with Air Traffic Control (AT) and Flight Service (FS), to engineer the lowest possible emitted power to cover the requirement. Its identification is by three letters and is chosen by AT.

8.9.6 VOR, TACAN and VORTAC

VORs, TACANs and VORTACs are assigned three-letter identifiers based on chart names. If two or more such facilities are established at a location, they are assigned different names and identifiers.

8.10. BUSINESS RADIO FREQUENCIES ALLOCATED FOR AVIATION TERMINAL USE

The Federal Communications Commission designated NABER as the central coordinating authority for all frequencies designated for Aviation Terminal Use (ATU). The ATU channels are identified in Figure 8-4.

BASE STATIONS AND MOBILES	MOBILE STATIONS
460.650	465.650
460.675	465.675
460.700	465.700
460.725	465.725
460.750	465.750
460.775	465.775
460.800	465.800
460.825	465.825
460.850	465.850
460.875	465.875

FIGURE 8-4. ATU CHANNELS

FIGURE 8-5
FREQUENCY AND WAVELENGTH RELATIONSHIPS

FREQUENCY			WAVELENGTH				
GHz	MHz	kHz	Meter	Centimeter	Millimeter	(Micron)	(Angstrom)
3×10^{-7}	3×10^{-4}	3×10^{-1}	10^{6}	10^{8}	10^{9}	10^{12}	10^{16}
3×10^{-6}	3×10^{-3}	3	10^{5}	10^{7}	10^{8}	10^{11}	10^{15}
3×10^{-5}	3×10^{-2}	3×10^{1}	10^{4}	10^{6}	10^{7}	10^{10}	10^{14}
3×10^{-4}	3×10^{-1}	3×10^{2}	10^{3}	10^{5}	10^{6}	10^{9}	10^{13}
3×10^{-3}	3	3×10^{3}	10^{2}	10^{4}	10^{5}	10^{8}	10^{12}
3×10^{-2}	3×10^{1}	3×10^{4}	10	10^{3}	10^{4}	10^{7}	10^{11}
3×10^{-1}	3×10^{2}	3×10^{5}	1	10^{2}	10^{3}	10^{6}	10^{10}
3	3×10^{3}	3×10^{6}	10^{-1}	10	10^{2}	10^{5}	10^{9}
3×10^{1}	3×10^{4}	3×10^{7}	10^{-2}	1	10^{1}	10^{4}	10^{8}
3×10^{2}	3×10^{5}	3×10^{8}	10^{-3}	10^{-1}	1	10^{3}	10^{7}
3×10^{3}	3×10^{6}	3×10^{9}	10^{-4}	10^{-2}	10^{-1}	10^{2}	10^{6}
3×10^{4}	3×10^{7}	3×10^{10}	10^{-5}	10^{-3}	10^{-2}	10	10^{5}
3×10^{5}	3×10^{8}	3×10^{11}	10^{-6}	10^{-4}	10^{-3}	1	10^{4}

FIGURE 8-6
POWER/VOLTAGE CONVERSATION TABLE

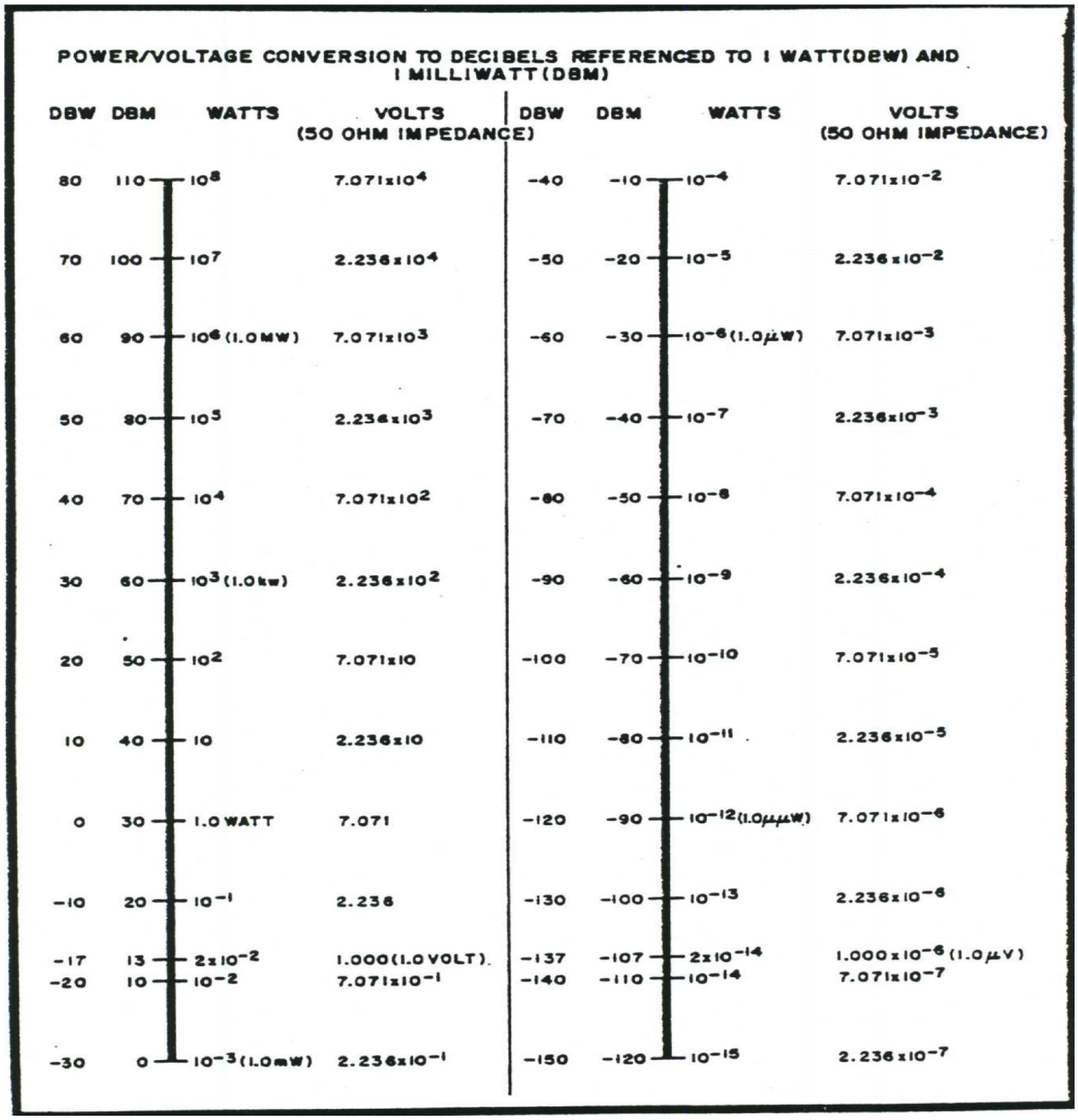


FIGURE 8-7
RADIO AND OPTICAL LINE-OF-SITE DISTANCES

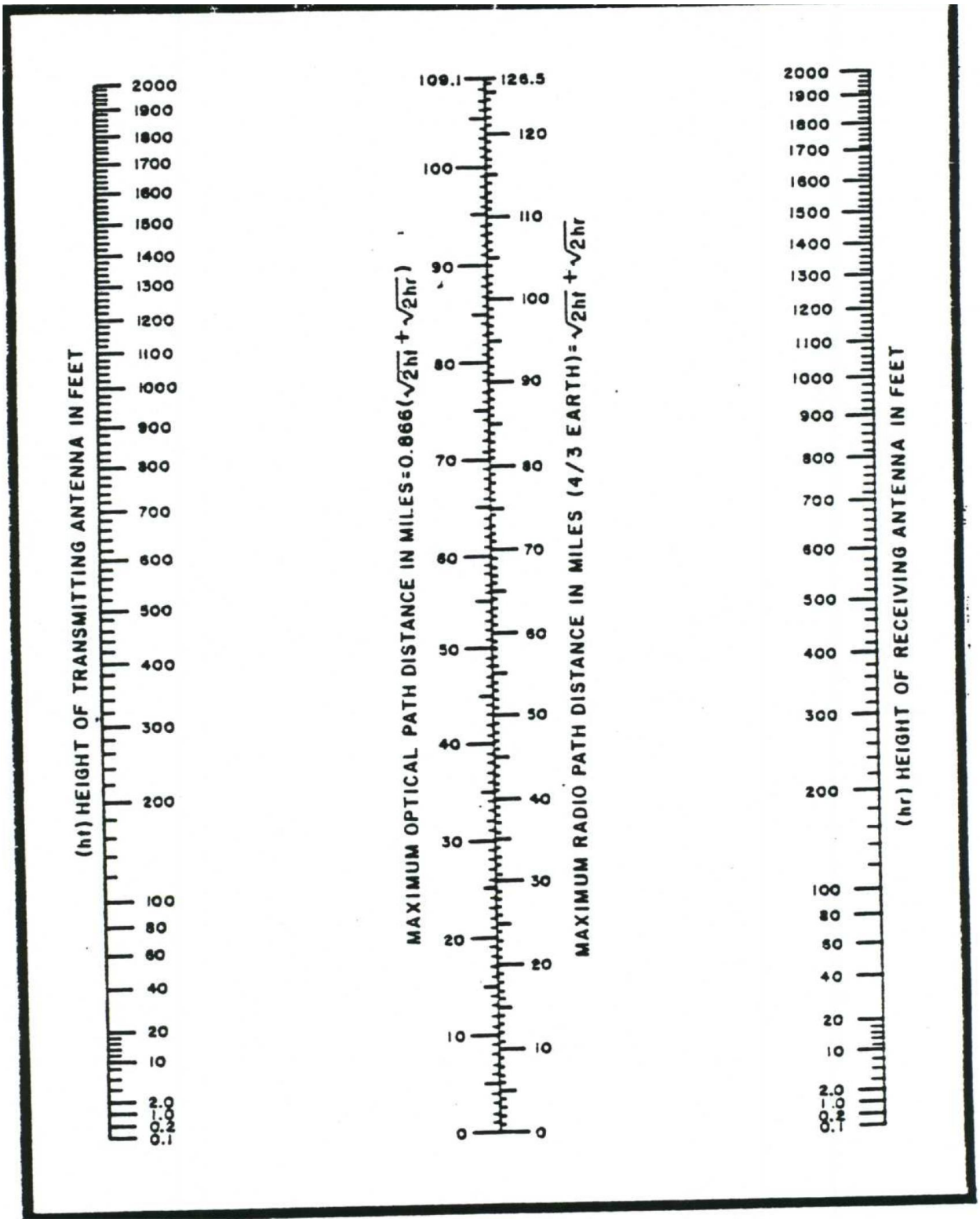


FIGURE 8-8
GEOGRAPHICAL DIVISIONS USED FOR
INTERNATIONAL FREQUENCY ALLOCATIONS

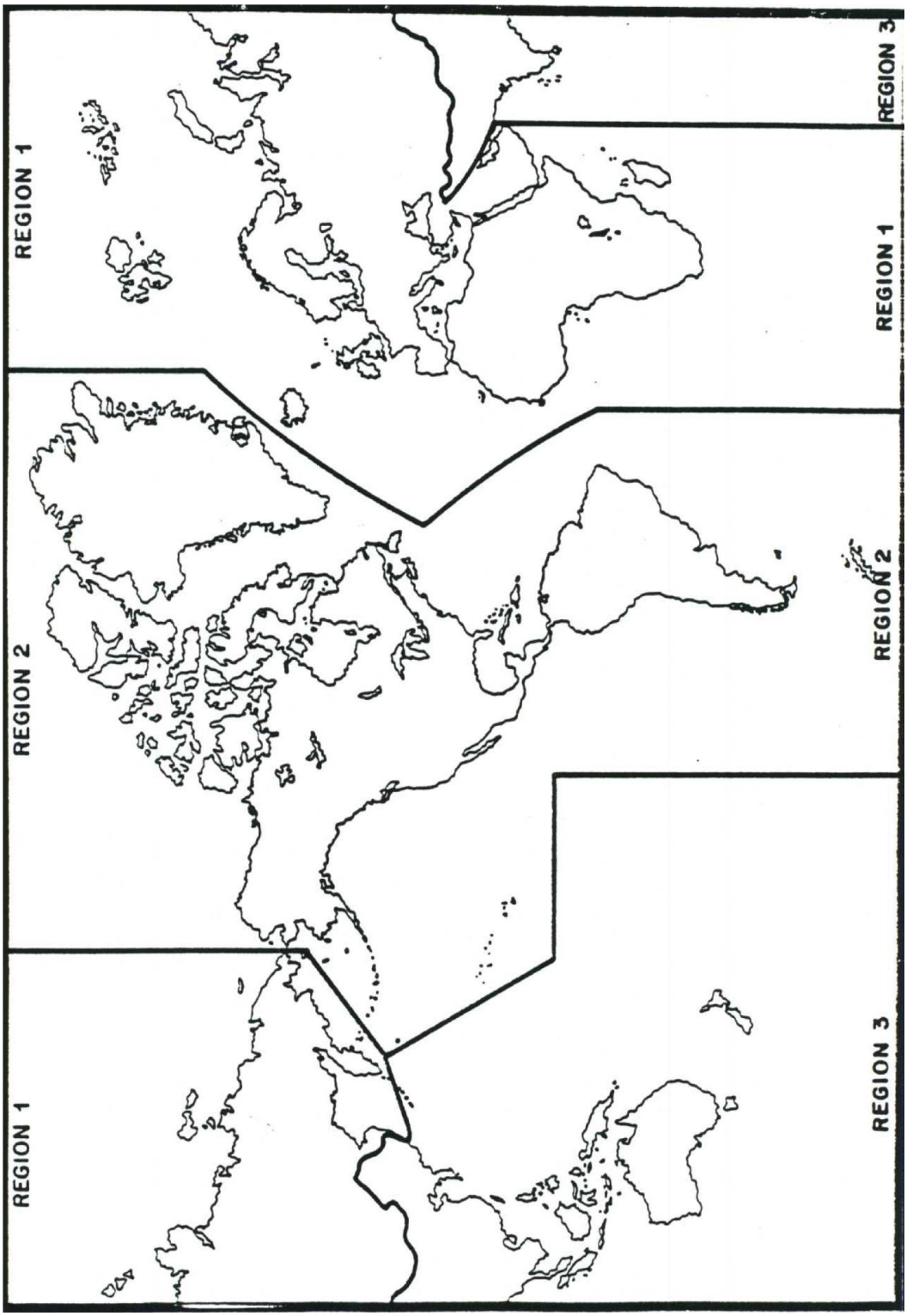


FIGURE 8-9

NATIONAL FREQUENCY COORDINATION AND ASSIGNMENT PROCESS

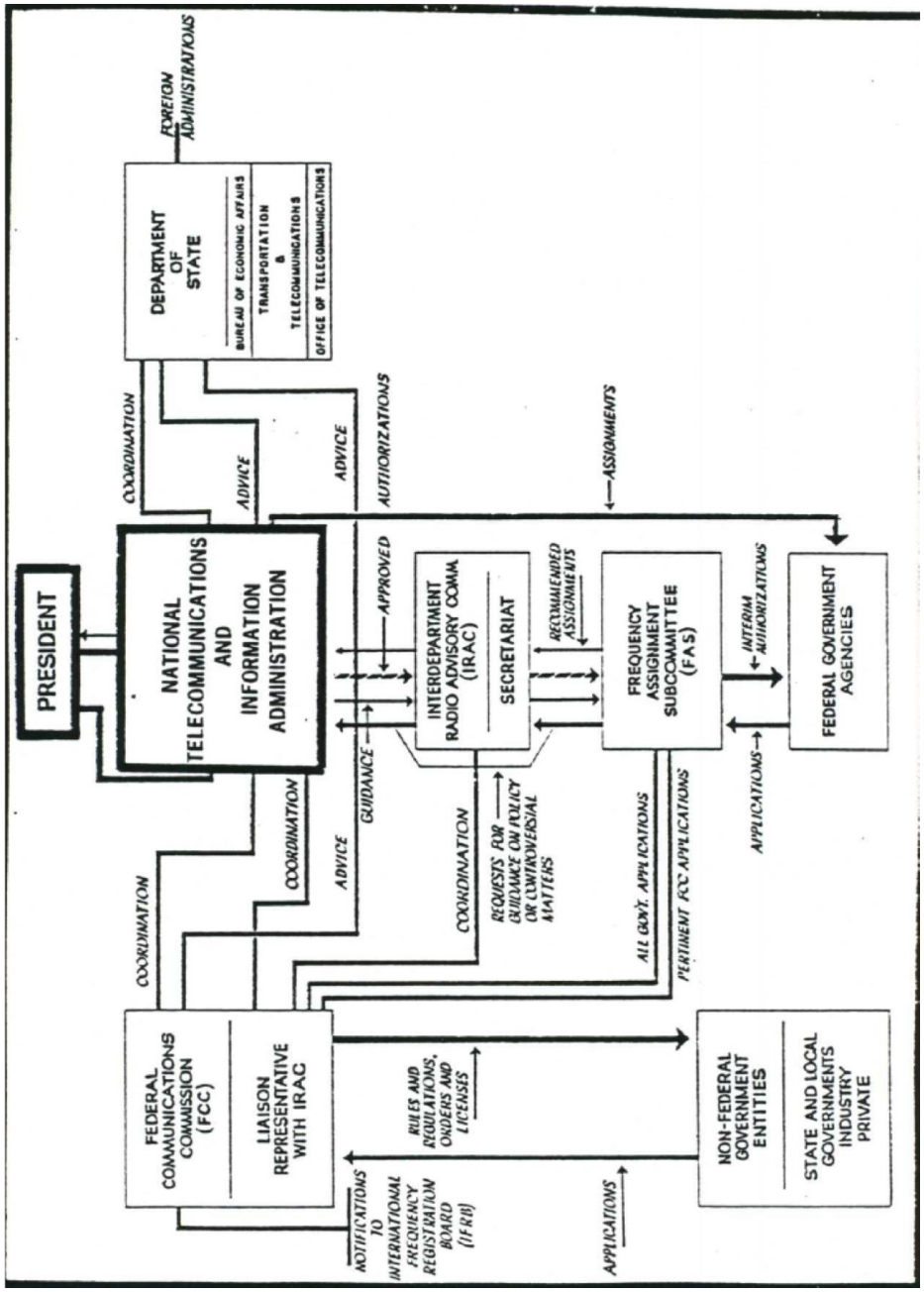
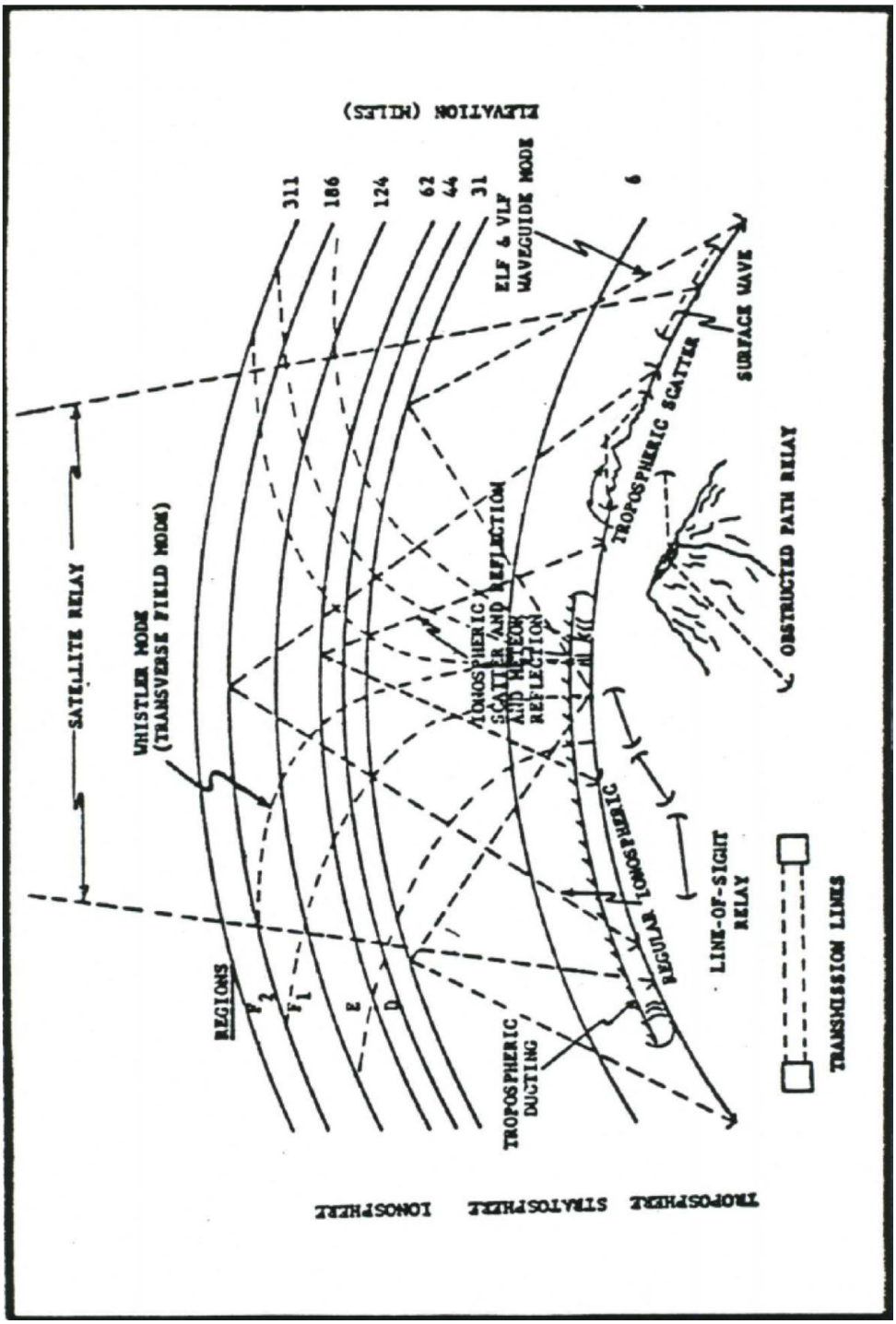


FIGURE 8-10

TELECOMMUNICATIONS PROPAGATION MODES



9 Glossary, Two Letter State and Territory Abbreviations, Terms and Definitions

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

* A *

AAS	-Airport Advisory Service
AASR	-Airport & Airways Surveillance Radar
ACARS	-Aircraft Communications Addressing & Reporting System
ACC	-Area Control Center
ACCTS	-Airlines Coordinating Committee for Telecommunications Service
ADF	-Automatic Direction Finder
ADIS	-Automated Data Interchange System
ADIZ	-Air Defense Identification Zone
ADS	-Automatic Dependent Surveillance
ADS-B	-Automatic Dependent Surveillance - Broadcast
AECS(P)	-Aeronautical Emergency Communications System Plan
AEEC	-Airlines Electronic Engineering Committee
AES	-Aeronautical Enroute Service
AFC	-Aeronautical Frequency Committee
AFI	-Africa-Indian Ocean
AFS	-Aeronautical Fixed Service
AFTN	-Aeronautical Fixed Telecommunication Network
AFTRCC	-Aerospace & Flight Test Radio Coordinating Council
AIM	-Airman's Information Manual
AIREPS	-Inflight Weather Reports
AIS	-Aeronautical Information Service
ALCAC	-Air Lines Communication Advisory Council
ALPA	-Air Line Pilots Association
AMC	-Avionics Maintenance Conference
AME	-Amplitude Modulation Equivalent
AMS	-Aeronautical Mobile Service
ANC	-Air Navigation Commission/Air Navigation Conference
ANP	-Air Navigation Plan
AOC	-Aeronautical Operational Control
AOPA	-Aircraft Owners & Pilots Association
APC	-Area Positive Control
ARINC	-Aeronautical Radio Incorporated
ARSR	-Air Route Surveillance Radar

ARTCC	-Air Route Traffic Control Center
ARTS	-Automated Radar Traffic Control Center
ASRI	-Aviation Spectrum Resources Incorporated
ASTRA	-Application of Space Techniques Relating to Aviation
ATA	-Air Transport Association of America
ATC	-Air Traffic Control
ATCRBS	-Air Traffic Control Radar Beacon System
ATIS	-Automated Terminal Information Service
ATMAC	-Air Traffic Management Advisory Committee
ATS	-Air Traffic Services
ATU	-Aviation Terminal Use
AVINET	-ARINC Data Network Services
AVPAC	-Aviation Packet, bit oriented protocol
AWARC	-Aeronautical World Administrative Radio Conference

* B *

BCN	-Beacon
BDT	-Telecommunication Development Bureau

* C *

CAA	-Civil Aviation Authority
CAB	-Civil Aeronautics Board
CAR	-Caribbean/Civil Air Regulations
CARERI	-Chinese Aeronautical Radio Electronics Research Institute
CAS	-Collision Avoidance System
CCIR	-International Radio Consultative Committee - Now ITU-R
CCITT	-International Telegraph & Telephone Consultative Committee - Now ITU-T
CEP	-Central East Pacific
CNS/ATM	-Communications, Navigation, Surveillance/Air Traffic Management
COM/OPS	-Communications/Operations
COMAC	-Communications Advisory Committee (IATA)
COMLO	-Compass Locations
CRAF	-Civil Reserve Air Fleet
CTA	-Control Area
CWP	-Central West Pacific

* D *

DF	-Direction Finder
DGPS	-Differential GPS
DME	-Distance Measuring Equipment
DSB	-Double Side Band
DVOR	-Doppler VOR

* E *

EAEC	-European Airlines Electronic Committee
EARC	-Extraordinary Administrative Radio Conference
EHF	-Extremely High Frequency
ELT	-Emergency Locator Transmitter
EMC	-Electromagnetic Compatibility
EMI	-Electromagnetic Interference
ERP	-Effective Radiated Power
ESRO	-European Space & Research Organization
ETSI	-European Telecommunications Standards Institute
EUM	-European/Mediterranean
EUR	-Europe
EUROCAE	-European Organization for Civil Aviation Electronics

* F *

FA	-Fixed Aeronautical (Ground/Air Station Class)
FAA	-Federal Aviation Administration
FAR	-Federal Aviation Regulations
FCC	-Federal Communications Commission
FE	-Far East
FIC	-Flight Information Center
FIO	-Flight Information Office
FIR	-Flight Information Region
FMAC	-Frequency Management Advisory Council (NTIA)
FMSG	-Frequency Management Study Group (ICAO)
FSK	-Frequency Shift Keying
FSS	-Flight Service Station
FX	-Fixed Service Station Class

* G *

G/A	-Ground-to-Air
GHZ	-Gigahertz
GMT	-Greenwich Mean Time
GNSS	-Global Navigation Satellite System
GPS	-Global Positioning System
GS	-Glide slope
GSARS	-Ground Station Automated Reporting System
GWARC	-General World Administrative Radio Conference

* H *

HAA	-Helicopter Association of America
HAI	-Helicopter Association International

HF -High Frequency
HSAC -Helicopter Safety Advisory Conference
HZ -Hertz (Cycles per second)

* I *

IAOPA -International Council of Aircraft Owners & Pilots Association
IATA -International Air Transport Association
IBAC -International Business Aviation Council, Ltd.
ICAO -International Civil Aviation Organization
ICT -Information and Communication Technologies
IFALPA -International Federation of Air Line Pilots Association
IFF -Identification, Friend or Foe
IFR -Instrument Flight Rules
IFRB -International Frequency Registration Board
IFSS -International Flight Service Station
IGA -International General Aviation
IGIA -Interagency Group on International Aviation
ILS -Instrument Landing System
IM -Inner Markers
IM -Intermodulation
IMC -Instrument Meteorological Conditions
IMD -Intermodulation Distortion
IMO -International Maritime Organization
INS -Inertial Navigation System
IRAC -Interdepartment Radio Advisory Committee
ISB -Independent Side Band
ISMLS -Interim Standard Microwave Landing System
ITS -Institute for Telecommunications Sciences
ITT -International Telephone & Telegraph Corporation
ITU -International Telecommunication Union
ITU-D -Telecommunication Development Sector
ITU-R -Formerly CCIR - ITU Radiocommunications Sector
ITU-T -Formerly CCITT - ITU Telecommunication Standards Sector

* J *

JTIDS -Joint Tactical Information & Distribution System

* K *

kHz -Kilohertz

* L *

LANT -Atlantic

LAT -Latitude
LF -Low Frequency
LOC -Localizer
LONG -Longitude
LOS -Line-of-sight
LSB -Lower Side Band

* M *

MA -Mobile Aeronautical (Air/Ground Station Class)
ME -Middle East
MEA -Minimum Enroute IFR Altitude
MET -Meteorological
MF -Middle Frequency/Medium Frequency
MHz -Megahertz
MM -Middle Markers
MO&O -Memorandum Opinion & Order
MOPS -Minimum Operational and Performance Standards
MWARA -Major World Air Route Area

* N *

NABER -National Association of Business & Educational Radio, Inc.
NAM -North American (ICAO Air Navigation Region)
NAS -National Airspace System
NAT -North Atlantic (ICAO Air Navigation Region)
NAT-SPG -North Atlantic Systems Planning Group
NAVAID -Aid to Air Navigation
NBAA -National Business Aviation Association
NBS -National Bureau of Standards
NCA -North Central Asia
NCS -National Communications System
NDB -Non-Directional Radio Beacon
NDEA -National Defense Emergency Authorization
NEA -North East Asia
NFPRM -Notice of Further Proposed Rule Making
NIAC -National Industry Advisory Committee
NOTAM -Notice to Airmen
NP -North Pacific
NPRM -Notice of Proposed Rule Making
NTIA -National Telecommunications & Information Administration
NWS -National Weather Service

* O *

OAC -Oceanic Area Control

OCA	-Oceanic Control Area
OFIS	-Operational Flight Information Service
OIA	-Office of International Affairs
OM	-Outside Markers
OPAD	-Office of Policy Analysis and Development
OPC	-Operational Control
OPS	-Operations
OSM	-Office of Spectrum Management
OTIA	-Office of Telecommunications and Information Applications

* P *

PAC	-Pacific
PANS	-Procedures for Air Navigation Services
PAR	-Precision Approach Radar
PLIN	-Private Line Intercity Network
PMC	-Program Management Committee
PN	-Pseudo-Random Noise
P/P	-Point-to-Point
PSTN	-Public Switched Telephone Network
PTFP	-Public Telecommunications Facilities Program

* R *

RAC	-Rules of the Air & Air Traffic Services (ICAO)
RAPCON	-Radar Approach Control
RATCC	-Radar Air Traffic Control Center
RC	-Ramp Control
RCAG	-Remote Center Air/Ground Communications
RCCRCC	-Rescue Coordination Center
RDARA	-Regional & Domestic Air Route Area
RF	-Radio Frequency
RFI	-Radio Interference
RGN	-Region
RM	-Rule Making
RNAV	-Area Navigation System
R & O	-Report & Order
RSSC	-Radio Systems Subcommittee (IATA)
RT	-Ramp/Terminal
RTCA	-RTCA
RTCM	-Radio Technical Commission for Marine
RTR	-Remote Transmitter Receiver
RX	-Receiver

* S *

SA	-South Atlantic
SAM	-South America
SAM-1	-South America - West
SAM-2	-South America - East
SAM/SAT	-South American/South Atlantic
SAR	-Search and Rescue
SARDA	-State & Regional Disaster Airlift
SARPS	-Standards & Recommended Practices (ICAO)
SAT	-Satellite
SATCOM	-Satellite Communications
SCATANA	-Security Control of Air Traffic & Air Navigation Aids
SEA	-Southeast Asia (ICAO Air Navigation Region)
SESAR	- Single European Sky ATM Research (system)
SELCAL	-Selective Calling System
SG	-Study Group
SIAC	-State Industry Advisory Committee
SIF	-Selective Identification Features
SITA	-Societe International de Telecommunications Aeronautiques
SMO	-Spectrum Management Office (FAA)
SMS	-Spectrum Monitoring System
SP	-South Pacific
SPG	-Systems Planning Group
SSB	-Single Side Band
SSR	-Secondary Surveillance Radar
SWG	-Special Working Group
SWR	-Standing Wave Ratio

* T *

TA	-Type Acceptance
TACAN	-Tactical Air Navigation
TAR	-Terminal Area Surveillance Radar
TCA	-Terminal Control Area
TCAS	-Traffic Alert Collision Avoidance System
T/F	-Time/Frequency
TMA	-Terminal Area Aids
TOP	-Technology Opportunities Program
TSA	-Transportation Security Administration
TSB	-Telecommunications Standardization Bureau
TVOR	-Low Power Terminal VOR
TX	-Transmitter

* U *

UACC	-Upper Area Control Center
UAD	-Upper Advisory Route

UAR -Upper Air Route
UHF -Ultra-High Frequency
UFIR -Upper Flight Information Region
USB -Upper Side Band
UTC -Coordinated Universal Time

* V *

VASIS -Visual Approach Slope Indicator System
VDL -VHF Digital Link
VFR -Visual Flight Rules
VHF -Very High Frequency
VHF NAV -VHF Navigation
VLF -Very Low Frequency
VLR -Very Low Range
VOLMET -Meteorological Information for Aircraft in Flight
VOR -VHF Omnidirectional Radio Range
VORTAC -Co-located VOR and TACAN

* W *

WAC -World Aeronautical Chart (ICAO)
WARC -World Administrative Radio Conference
WASP -War Air Service Program
WMO -World Meteorological Organization
WRC -World Radio Conference
WX -Weather

* X *

XRVHF -Extended Range VHF

* Z *

ZI -Zone of Interior

TWO-LETTER STATE AND TERRITORY ABBREVIATIONS

AL	-	Alabama
AK	-	Alaska
AZ	-	Arizona
AR	-	Arkansas
CA	-	California
CO	-	Colorado
CT	-	Connecticut
DE	-	Delaware
DC	-	District of Columbia
FL	-	Florida
GA	-	Georgia
GM	-	Gulf of Mexico
GU	-	Guam
HI	-	Hawaii
ID	-	Idaho
IL	-	Illinois
IN	-	Indiana
IA	-	Iowa
KS	-	Kansas
KY	-	Kentucky
LA	-	Louisiana
ME	-	Maine
MD	-	Maryland
MA	-	Massachusetts
MI	-	Michigan
MN	-	Minnesota
MS	-	Mississippi
MO	-	Missouri
MT	-	Montana
NB	-	Nebraska
NV	-	Nevada
NH	-	New Hampshire
NJ	-	New Jersey
NM	-	New Mexico
NY	-	New York
NC	-	North Carolina
ND	-	North Dakota
OH	-	Ohio
OK	-	Oklahoma
OR	-	Oregon
PA	-	Pennsylvania
PR	-	Puerto Rico
RI	-	Rhode Island
SC	-	South Carolina
SD	-	South Dakota
TN	-	Tennessee
TX	-	Texas
UT	-	Utah
VA	-	Virginia
VI	-	Virgin Islands
VT	-	Vermont
WA	-	Washington
WI	-	Wisconsin
WV	-	West Virginia
WY	-	Wyoming

TERMS AND DEFINITIONS

Introduction

For the purposes of these Regulations, the following terms shall have the meaning defined below. These terms and definitions do not, however, necessarily apply for other purposes. Definitions identical to those contained in the International Telecommunication Convention (Malaga-Torremolinos, 1973) are marked "(CONV.)".

Administration: Any governmental department or service responsible for discharging the obligations undertaken in the Convention of the International Telecommunication Union and the Regulations (CONV.)

Aeronautical Earth Station: An earth station in the fixed-satellite service, or, in some cases, in the aeronautical mobile-satellite service, located at a specified fixed point on land to provide a feeder link for the aeronautical mobile-satellite service.

Aeronautical Station: A land station in the aeronautical mobile service. In certain instances, an aeronautical station may be located, for example, on board ship or on a platform at sea.

Aeronautical Fixed Service: A radiocommunication service between specified fixed points provided primarily for the safety of air navigation and for the regular, efficient and economical operation of air transport.

Aeronautical Mobile-Satellite Service: A mobile-satellite service in which mobile earth stations are located on board aircraft; survival craft stations and emergency position-indicating radio beacon stations may also participate in this service.

Aeronautical Mobile Service: A mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which survival craft stations may participate; emergency position indicating radio beacon stations may also participate in this service on designated distress and emergency frequencies.

Aeronautical Radionavigation-Satellite Service: A radionavigation-satellite service in which earth stations are located on board aircraft.

Aeronautical Radionavigation Service: A radionavigation service intended for the benefit and for the safe operation of aircraft.

Aircraft Operator: An aviation entity that uses ASRI licensed ground radio stations to support their aircraft operations. (Examples: Part 91, 121, and 135 Operators)

Aircraft Station: A mobile station in the aeronautical mobile service, other than a survival craft station, located on board an aircraft.

Allocation (of a frequency band): Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned.

Allotment (of a radio frequency or radio frequency channel): Entry of a designated frequency channel in an agreed plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space radiocommunication service in one or more identified countries or geographical areas and under specified conditions.

Assigned Frequency: The centre of the frequency band assigned to a station.

Assigned Frequency Band: The frequency band within which the emission of a station is authorized; the width of the band equals the necessary bandwidth plus twice the absolute value of the frequency tolerance. Where space stations are concerned, the assigned frequency band includes twice the maximum Doppler shift that may occur in relation to any point of the Earth's surface.

Assignment (of a radio frequency or radio frequency channel): Authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions.

Carrier Power (of a radio transmitter): The average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle taken under the condition of no modulation.

Class of Emission: The set of characteristics of an emission, designated by standard symbols, e.g., type of modulation of the main carrier, modulating signal, type of information to be transmitted, and also, if appropriate, any additional signal characteristics.

Coordinated Universal Time (UTC): Time scale, based on the second (SI), as defined and recommended by the CCIR, and maintained by the International Time Bureau (BIH). For most practical purposes associated with the Radio Regulations, UTC is equivalent to mean solar time at the prime meridian (0^o longitude), formerly expressed in GMT.

Effective Radiated Power (e.r.p.) (in a given direction): The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction.

Emission: Radiation produced, or the production of radiation, by a radio transmitting station. For example, the energy radiated by the local oscillator of a radio receiver would not be an emission but a radiation.

Equivalent Isotopically Radiated Power (e.i.r.p.): The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain).

Frequency Tolerance: The maximum permissible departure by the centre frequency of the frequency band occupied by an emission from the assigned frequency or, by the characteristic frequency of an emission from the reference frequency. The frequency tolerance is expressed in parts in 10^6 or in hertz.

Full Carrier Single-Sideband Emission: A single-sideband emission without reduction of the carrier.

Gain of an Antenna: The ratio, usually expressed in decibels, of the power required at the input of a loss-free reference antenna to the power supplied to the input of the given antenna to produce, in a given direction, the same field strength or the same power flux-density at the same distance. When not specified otherwise, the gain refers to the direction of maximum radiation. The gain may be considered for a specified polarization.

Depending on the choice of the reference antenna a distinction is made between:

a. absolute or isotropic gain (G_i), when the reference antenna is an isotropic antenna isolated in space;
b. gain relative to a half-wave dipole (G_d), when the reference antenna is a half-wave dipole isolated in space whose equatorial plane contains the given direction;
c. gain relative to a short vertical antenna (G_v), when the reference antenna is a linear conductor, must be shorter than one quarter of a wavelength, normal to the surface of a perfectly conducting plane which contains the given direction.

Harmful Interference*: Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with these Regulations.

Industrial, Scientific and Medical (ISM) Applications (of radio frequency energy): Operation of equipment or appliances designed to generate and use locally radio frequency energy for industrial, scientific, medical, domestic or similar purposes, excluding applications in the field of telecommunications.

Interference: The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.

Mean Power (of a radio transmitter): The average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions.

Mobile Service: A radiocommunication service between mobile and land stations, or between mobile stations (CONV.).

Movement Area: The runways, taxiways, and other areas on an airport/heliport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing aircraft, exclusive of loading ramps and parking areas. At those airports/heliports with a tower, specific approval for entry onto the movement area must be obtained from ATC. (See ICAO term for Movement Area.)

Movement Area (ICAO): That part of an aerodrome to be used for the takeoff, landing and taxiing of aircraft, consisting of the maneuvering area and the apron(s).

Necessary Bandwidth: For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.

Non-Aircraft Operator: A business entity that uses ASRI licensed ground radio stations to support their customers' aircraft operations. (Examples: Million Air, AAR Oklahoma, BAX Global, etc.)

Non-Movement Area: Taxiways and apron (ramp) areas not under the control of air traffic.

Occupied Bandwidth: The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage B/2 of the total mean power of a given emission.

Unless otherwise specified by the CCIR for the appropriate class of emission, the value of B/2 should be taken as 0.5%.

Out-of-Band Emission*: Emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

Peak Envelope Power (of a radio transmitter): The average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle at the crest of the modulation envelope taken under normal operating conditions.

Power: Whenever the power of the radio transmitter etc. is referred to it shall be expressed in one of the following forms, according to the class of emission, using the arbitrary symbols indicated:

- peak envelope power (PX or $_{p}$X);
- mean power (PY or $_{p}$Y);
- carrier power (PZ or $_{p}$Z).

For different classes of emission, the relationships between peak envelope power, mean power and carrier power, under the conditions of normal operation and of no modulation, are contained in CCIR Recommendations which may be used as a guide.

For use in formulae, the symbol $_{p}$ denotes power expressed in watts and the symbol P denotes power expressed in decibels relative to a reference level.

Public Correspondence: Any telecommunication which the offices and stations must, by reason of their being at the disposal of the public, accept for transmission (CONV.).

Radiation: The outward flow of energy from any source in the form of radio waves.

Radiocommunication: Telecommunication by means of radio waves (CONV.).

Radiodetermination: The determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves.

Radio Direction-Finding: Radiodetermination using the reception of radio waves for the purpose of determining the direction of a station or object.

Radiolocation: Radiodetermination used for purposes other than those of radionavigation.

Radionavigation: Radiodetermination used for the purposes of navigation, including obstruction warning.

Reduced Carrier Single Sideband Emission: A single-sideband emission in which the degree of carrier suppression enables the carrier to be reconstituted and to be used for demodulation.

Reference Frequency: A frequency having a fixed and specified position with respect to the assigned frequency. The displacement of this frequency with respect to the assigned frequency has the same absolute value and sign that the displacement of the characteristic frequency has with respect to the centre of the frequency band occupied by the emission.

Safety Service: Any radiocommunication service used permanently or temporarily for the safeguarding of human life and property (CONV.).

Service Provider: A business entity that uses ASRI licensed ground radio stations to provide voice and/or data link communications services to their customers. (Examples: SITA, ARINC, etc.)

Singe-Sideband Emission: An amplitude modulated emission with one sideband only.

Spurious Emission*: Emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Station: One or more transmitters or receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location for carrying on a radiocommunication service, or the radio astronomy service.

Each station shall be classified by the service in which it operates permanently or temporarily.

Suppressed Carrier Single-Sideband Emission: A single-sideband emission in which the carrier is virtually suppressed and not intended to be used for demodulation.

Survival Craft Stations: A mobile station in the maritime mobile service or the aeronautical mobile service intended solely for survival purposes and located on any lifeboat, life-raft or other survival equipment.

Telecommunication: Any transmission, emission or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems (CONV.).

Unwanted Emissions*: Consist of spurious emissions and out-of-band emissions.

* NOTE BY THE GENERAL SECRETARIAT: THIS DEFINITION IS NOT IN ALIGNMENT WITH ANNEX 2 TO THE CONVENTION. THE CORRESPONDING DEFINITION IN THAT ANNEX SHALL PREVAIL TO THE EXTENT THAT THERE ARE DIFFERENCES BETWEEN THEM (SEE ALSO RESOLUTION 68).

10 AFC Recommendations and Resolutions

AERONAUTICAL RADIO, INC.
Board of Directors' Meeting
December 1, 1982

ITEM VI TECHNICAL COMMITTEE REPORT

Chairman McLeod reported that the only item on the committee agenda was a memorandum of November 12, 1974, from the President requesting committee consideration of a proposed change in name, status, and Terms of Reference of the Airlines Frequency Committee.

He further reported (after the luncheon recess) that, upon consideration of the matter, the Technical Committee recommended adoption of the proposed Resolution and Terms of Reference essentially as submitted with the November 12 letter reading as follows:

> WHEREAS, it is the desire of the Board of Directors of Aeronautical Radio, Inc., to call upon the expertise and assistance of the users of ARINC services in the development of plans and policies with regard to the use, and regulation of the radio frequency spectrum and believes that it would be beneficial to the Board and to the users of ARINC services were the membership of the Airlines Frequency Committee expanded to be as representative as practicable of all users of ARINC's radio services;
>
> BE IT THEREFORE RESOLVED, that the Airlines Frequency Committee is hereby renamed the Aeronautical Frequency Committee; that such Aeronautical Frequency Committee shall be directly responsible to the Board of Directors; that the Terms of Reference attached are adopted for the Aeronautical Frequency Committee; and that the Aeronautical Frequency Committee is requested to review these Terms of Reference at its next scheduled meeting and make such recommendations and suggestions as it may deem appropriate for consideration by the Board of Directors.

AERONAUTICAL FREQUENCY COMMITTEE (AFC)
TERMS OF REFERENCE

PURPOSE:

The Aeronautical Frequency Committee (AFC) shall be an ARINC-sponsored industry committee providing assistance to ARINC and Users of its services in the formulation of industry recommendations and policies relating to the allocation, assignment, and use of the radio frequency spectrum and regulatory matters pertaining thereto, both domestic and international.

ITEM VI TECHNICAL COMMITTEE REPORT (continued)

MEMBERSHIP:

The membership of AFC shall be composed of voting members and nonvoting members as designated by the ARINC Board of Directors.

OFFICERS:

A CHAIRMAN, whose term shall be one calendar year, shall be elected each year by the Committee from among its members. The Chairman may not immediately succeed himself in office. His duties shall be to call and preside at all meetings of the Committee and to direct the administrative affairs of the Committee.

A VICE-CHAIRMAN, whose term shall be one calendar year, shall be elected each year by the Committee from among its members. In the event of the absence of the Chairman, the Vice-Chairman will carry out his duties. After serving one year as Vice-Chairman, he shall serve as Chairman for the following year, commencing January 1.

AN EXECUTIVE SECRETARY, not a voting member of the Committee, shall be appointed by ARINC. His duties shall be to receive, maintain, and distribute correspondence bulletins, documents, minutes of meetings, and other written material of the Committee, maintain technical liaison with other organizations (e.g., ATA, IATA, etc.) and to keep the Chairman advised of all matters requiring Committee attention.

MEETINGS:

Scheduled meetings shall be held three times a year, usually in March, August, and November. Nonscheduled meetings may be called by the Chairman as circumstances require. Meetings normally should be scheduled in the Washington, DC area; however, the Committee may find it advantageous and economically justified to occasionally schedule meetings in various U. S. locations. Meeting schedules will be subject to review and approval by ARINC.

GENERAL:

I. Reports of AFC meetings shall be issued to its members and to other interested parties. Industry recommendations and positions developed by the AFC will be

ITEM VI TECHNICAL COMMITTEE REPORT (continued)

referred to the ARINC Board of Directors through the Technical Committee of the Board. Upon approval by the Board, ARINC shall be responsible for the prosecution of such recommendations and positions before the applicable government agencies and in such other forums as deemed appropriate.

II. The AFC Chairman shall keep ARINC and applicable Users of its services informed on schedules of meetings, projects instituted and terminated, and other important significant actions or changes.

III. Administrative, budgetary and regulatory aspects of AFC activities will be subject to review and supervision by ARINC.

ACTION
28-74A After considerable discussion, primarily on the relationship of AFC to ALCAC, and ALCAC's future role, it was moved, seconded, and carried by majority vote (Mr. Robertson voting in the negative) to accept the Technical Committee's recommendations, and to adopt the proposed Resolution as stated.

After the above action, question was raised as to the position of Management and/or the Technical Committee on the 25 kHz VHF separation implementation date of January 1, 1976. Some question has arisen as to the validity of this date. The President advised that there was no immediate status report, but the matter will be investigated, and results will be forwarded to the Directors. For the Technical Committee, Chairman McLeod suggested that this matter be checked with respect to both the Domestic and International operations since a problem has arisen in Europe already where 50 kHz separation VOR's are currently being implemented.

Mr. McLeod, Chairman of the Technical Committee, reported there were not sufficient technical issues to justify calling a meeting of the Technical Committee prior to the December 6, 1978, Board Meeting. However, several recommendations from the Aeronautical Frequency Committee were distributed to the technical Committee by mail on November 27, 1978, with a request for approval prior to this meeting. A copy of these recommendations with background information (included herewith as Attachment III) was distributed to the Board at the meeting. There was some misunderstanding of the language with respect to responsibility for interference in the Revised VHF Policy.

AERONAUTICAL RADIO, INC.
Board of Directors' Meeting
December 1, 1982

ITEM VI TECHNICAL COMMITTEE REPORT (continued)

ACTION
39-78A It was moved, seconded, and unanimously carried to accept the report of the Technical Committee and to adopt the following recommendations of the Aeronautical Frequency Committee (AFC).

A. That ARINC become more involved in CCIR activities and that necessary funding for this activity be provided. The attention of the Technical Committee of the ARINC Board of Directors is invited to this matter.

B. That the ARINC Board of Directors be apprised of the importance of U. S. airline members' participation on IATA delegations to international forums and to encourage U. S. IATA member airlines to specifically provide delegates for a three-week period during the upcoming WARC.

C. That the ARINC Board of Directors recognize the need for ARINC to be included on delegations to international conferences in matters concerning aviation and to further recognize the implications contained in the State Department Notice of Proposed Rule Making concerning participation of private sector representatives of U. S. Delegations.

Further, the revised aeronautical industry VHF policy which would insure that implementation of 25 kHz channels is not inhibited by existing 50 kHz channels be referred back to the AFC for further language clarification prior to the next meeting of the Board.

AERONAUTICAL RADIO, INC.
Board of Directors' Meeting
December 1, 1982

ITEM VIII TECHNICAL COMMITTEE REPORT

Mr. McLeod, Chairman, reported his Committee had held a meeting to review the following recommendations of the Aeronautical Frequency Committee (AFC):

RECOMMENDATION I That members of the ARINC Board of Directors who are associated with companies having membership on the Aeronautical Frequency Committee (AFC) are urged to support active participation in AFC activities by their respective airline/company.

RECOMMENDATION II That five of the following organizations be extended an invitation by the Executive Secretary, AFC, for membership in the AFC:

Air Florida
Frontier Airlines, Inc.
Northwest Orient Airlines, Inc.
Ozark Airlines, Inc.
Republic Airlines, Inc.
Texas International Airlines, Inc.
USAir
World Airways, Inc.

The above recommendations for expanded membership were proposed to allow the AFC to adequately discharge its responsibilities to the ARINC Board of Directors.

The Technical Committee recommended the Board approve the recommendations as listed above and further requested ARINC Management to review its staffing requirements and report to the next Board Meeting.

ACTION
7-80A It was moved, seconded, and unanimously carried to accept the report and approve the recommendations of the Technical Committee.

AERONAUTICAL RADIO, INC.
Board of Directors' Meeting
December 1, 1982

ITEM XIII AERONAUTICAL FREQUENCY COMMITTEE - TERMS OF REFERENCE

The Aeronautical Frequency Committee had requested approval of the Board to revise the current Terms of Reference to include the ARINC member of the AFC and conveners of Special Working Groups on the Steering Committee. The rationale for adding the ARINC Member was based on ARINC's responsibility to the Board of Directors for administrative, budgetary, and regulatory aspects of all Committee activities. In addition, the Committee concluded it would be beneficial to the full Committee if the Conveners of Special Working Groups were Members of the Steering Committee. Inclusion of the Conveners will strengthen the Steering Committee and facilitate improved planned future activities of the Working Groups.

A copy of the Terms of Reference is included herewith as Attachment V, with proposed revisions underlined.

AFC also recommended approval of the following changes to its membership:

Mr. H. L. Brown to succeed Mr. T. R. Kelly, American Airlines, Inc.

Mr. C. M. Huntley to succeed Mr. K. A. Moore; Continental Airlines, Inc.

Mr. W. L. Martin to succeed Mr. H. H. Fink; Delta Air Lines, Inc.

ACTION
13-81A It was moved, seconded, and unanimously carried to approve the changes in the AFC Terms of Reference and the changes in AFC Membership, as requested.

AERONAUTICAL RADIO, INC.
Board of Directors' Meeting
December 1, 1982

ITEM IX TECHNICAL COMMITTEE REPORT

Mr. Woodyard, Chairman, reported the Technical Committee met on March 5, 1982, and discussed the following subjects:

1. Aeronautical Distress Communications - Recommendation of Aeronautical Frequency Committee (AFC)

The Technical Committee recommended approval by the Board of Directors of the following Recommendation of the Aeronautical Frequency Committee:

The developments in the SARSAT project be brought to the attention of the Board and it is recommended that the Board request ARINC to:

1. Apprise ATA of the NASA proposals and recommend that ATA consider

   A. Informing the operations divisions of member airlines of these plans and

   B. If practicable, solicit member airlines to participate in the operational tests

2. Apprise AEEC of these proposals in order that they may assess the effect, if any, these proposals will have on avionics and

3. Consider the impact these schemes may have on general aviation and bring these issues to the attention of AOPA, NBAA, RAA and

4. It is further recommended that ARINC, ATA, NBAA, AOPA and other interested organizations assist NASA in pursuing this matter with the appropriate national authorities to insure that it is brought before a cognizant body in ICAO for consideration in the development of appropriate standards and recommended practices.

ACTION
7-82A It was moved, seconded, and unanimously carried to accept the report of the Technical Committee and approve the Recommendation of the Aeronautical Frequency Committee as set forth in Item I.

AERONAUTICAL RADIO, INC.
Board of Directors' Meeting
December 1, 1982

ITEM IX AERONAUTICAL FREQUENCY COMMITTEE (AFC)

1. Amendments to Aeronautical Industry Operational VHF Policy

The Aeronautical Industry Operational VHF Policy, developed by the AFC and approved by the ARINC Board of Directors on March 28, 1979, contains definitions and provisions from the International Civil Aviation Organization (ICAO), Annex 10 and Federal Communications Commission (FCC) Rules and Regulations. In order to accommodate new wording adopted by ICAO and FCC, AFC recommended approval by the Board of the following changes to the Aeronautical Industry Operational VHF Policy:

(a) Delete Paragraph A, Section I,

A. Aeronautical Enroute Service: Aeronautical enroute stations shall provide all necessary non-public service, HF and VHF, of the particular class authorized without discrimination to any aircraft station licensee who makes cooperative arrangements for the operation and maintenance of the aeronautical enroute stations which are to furnish such service and for shared liability in the operation of such stations. In case of distress, aeronautical enroute stations shall provide the above service without prior arrangements.

and Add the following New Paragraph A, Section I, from Part 87, Paragraph 87.291 of the FCC Rules and Regulations:

A. Scope of Service: Aeronautical enroute stations shall provide communications for the operational control of aircraft along domestic or international air routes by the aircraft operating agency. Operational control communications relate to the safe, efficient and economical operation of aircraft, such as fuel, weather, position reports, aircraft performance, essential services and supplies, and the like. Public correspondence is not permitted.

(b) Delete the material contained under PERMISSIBLE COMMUNICATIONS,

PERMISSIBLE COMMUNICATIONS (Pertaining to the above categories)

ITEM IX AERONAUTICAL FREQUENCY COMMITTEE (AFC) (continued)

All stations in the Aviation Services shall transmit only communications for the safe, expeditious and economical operation of aircraft and the protection of life and property while the aircraft is in flight status, including messages related to:

- Communications relating to the initiation, continuation, diversion or termination of a flight
- Performance of the aircraft including its components
- Information of value to the crew in accomplishing that particular flight
- Information of value to ground personnel concerned with the safe and efficient operation of the flight
- Information of value to other flights in the same area
- Supplementary information and corrections pertaining to weight, balance and/or passenger counts
- Medical or other urgent information pertaining to individual passengers
- Connections with other transportation
- Connections with ongoing air transportation
- Essential supplies and services

and Substitute the following, derived from Annex 10, Volume II of the Convention on International Civil Aviation:

PERMISSIBLE COMMUNICATIONS (Pertaining to the above categories)

All stations in the Aviation Services shall transmit only communications for the safe, expeditious and economical operation of aircraft and the

ITEM IX AERONAUTICAL FREQUENCY COMMITTEE (AFC) (continued)

protection of life and property while the aircraft is in flight status, including messages related to:

-The exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of a flight

-Performance of the aircraft, including its components

-Information of value to the crew in accomplishing that particular flight

-Information of value to ground personnel concerned with the safe and efficient operation of the flight

-Information of value to other flights in the same area

-Supplementary information and corrections pertaining to weight, balance, and/or passenger counts

-Urgent medical information

-Connections with other transportation and ongoing air transportation

-Essential supplies and services

ACTION
24-82A It was moved, seconded, and unanimously carried to approve the recommendations of the AFC with the exception of the footnote under "Permissible Communications," which reads:

"*Messages related to individual requirements of passengers and/or crew are not permitted."

2. Amendments to the Terms of Reference

The AFC requested that the Terms of Reference be amended to more adequately reflect the Committee's purpose and membership.

AERONAUTICAL RADIO, INC.
Board of Directors' Meeting
December 1, 1982

ITEM IX AERONAUTICAL FREQUENCY COMMITTEE (AFC) (continued)

ACTION
25-82A It was moved, seconded, and unanimously carried to approve amendments to the AFC Terms of Reference. The Terms of Reference now read as follows (new material underlined):

AERONAUTICAL FREQUENCY COMMITTEE (AFC)
TERMS OF REFERENCE

PURPOSE:

The Aeronautical Frequency Committee (AFC) shall be an ARINC sponsored industry committee providing assistance to ARINC and Users of its services in the formulation of industry recommendations and policies relating to the allocation, assignment and use of the radio frequency spectrum and regulatory matters pertaining thereto, both domestic and international.

In fulfilling its purpose, the Aeronautical Frequency Committee (AFC) shall study aeronautical systems concepts and recommend to the ARINC Board of Directors the assignment, use and control of radio frequencies related thereto. The AFC shall also maintain a constant awareness of the status of regulatory matters pertaining to the use of the radio frequency spectrum, and recommend, where necessary, appropriate action to the ARINC Board of Directors.

MEMBERSHIP:

The membership of AFC shall be composed of voting members and non-voting members as designated by the ARINC Board of Directors.

ARINC shall designate one voting member. In addition, ARINC shall name one individual from the ARINC Operations Department to act in a non-voting advisory capacity to the AFC.

OFFICERS:

A CHAIRMAN, whose term shall be one calendar year, shall be elected each year by the committee from among its members. The Chairman may not immediately succeed

ITEM IX AERONAUTICAL FREQUENCY COMMITTEE (AFC) (continued)

himself in office. The Chairman's duties shall be to call and preside at all meetings of the committee and to direct the administrative affairs of the committee.

A VICE CHAIRMAN, whose term shall be one calendar year, shall be elected each year by the committee from among its members. In the event of the absence of the Chairman, the Vice Chairman will carry out the Chairman's duties. After serving one year, the Vice Chairman shall serve as Chairman for the following year, commencing January 1.

AN EXECUTIVE SECRETARY, not a voting member of the committee, shall be appointed by ARINC and shall receive, maintain and distribute correspondence, bulletins, documents, minutes of meetings and other written material of the committee, shall maintain technical liaison with other organizations (e.g., ATA, IATA, etc.) and keep the Chairman advised of all matters requiring committee attention.

STEERING COMMITTEE:

A Steering Committee, consisting of the Chairman, the Past Chairman, the Vice Chairman, the ARINC Member, current Special Working Group (SWG) Conveners, and the Executive Secretary shall administer the affairs of the Committee, including approval of the agenda and background material for meetings.

MEETINGS:

Scheduled meetings shall be held three times a year, usually in March, August and November. Nonscheduled meetings may be called by the Chairman as circumstances require. Meetings normally should be scheduled in the Washington, DC area; however, the committee may find it advantageous and economically justified to occasionally schedule meetings in various U. S. locations. Meeting schedules will be subject to review and approval by ARINC.

GENERAL:

1. Reports of AFC meetings will be issued to its members and to other interested parties. Industry recommendations and positions developed by the AFC will be referred to the ARINC Board of Directors through the Technical Committee of the Board. Upon approval by the Board, ARINC shall be responsible for the

ITEM IX AERONAUTICAL FREQUENCY COMMITTEE (AFC) (continued)

prosecution of such recommendations and positions before the applicable government agencies and in such other forums as deemed appropriate.

2. The AFC Chairman shall keep ARINC and applicable users of its services informed on schedules of meetings, projects instituted and terminated and other important significant actions or changes.

3. Administrative, budgetary and regulatory aspects of AFC activities will be subject to review and supervision by ARINC.

AERONAUTICAL RADIO, INC.
Board of Directors' Meeting
December 1, 1982

ITEM XIII TECHNICAL COMMITTEE REPORT

Mr. Woodyard, Chairman, reviewed the report of the Technical Committee as submitted with the Agenda.

The Technical Committee recommended the Board indicate its concurrence with ARINC's views, as follows:

1. ARINC concurs with the results of the Oasis study in that substantial savings may be achieved in the North Atlantic with improvements to the North Atlantic Track System.

2. Improved communications are essential to support improvements in the ATC system, and related ATC automation will require data link capabilities; cost efficiencies may be obtained through use of a single system for operational control and ATC purposes as practiced by the United States today.

3. Satellite communications can provide better and more reliable communications that HF; accordingly, an evolutionary approach leading to use of satellite communications in the 1990s should be undertaken with HF data link as an interim system for the 1980s.

4. The United States commercial aviation community supports system evolution under institutional arrangements with control by the aviation private sector.

5. Shared use of the frequency spectrum by the maritime and aviation community is inconsistent with the needs of aviation.

The Technical Committee specifically recommended Board approval of a recommendation to continue development and implementation of HF ACARS as the interim system for the 1980s and pursue the use of satellite communications for the 1990s.

Management will present recommendations on the HF ACARS operational implementation plan at the March 1983 Board Meeting.

Also, at its Fall 1982 Meeting, the Aeronautical Frequency Committee (AFC) considered the issues of the frequency band to be used for experimental evaluation of satellite systems used to meet aeronautical requirements.

ITEM XIII TECHNICAL COMMITTEE REPORT

Accordingly, AFC recommended, and the Technical Committee concurred, that the Board adopt the following Recommendation:

> That any planned participation in satellite experiments must provide for operations to be conducted in frequency bands allocated to the Aeronautical Mobile-Satellite (R) service (1545-1559 MHz, space-to-earth and 1646.5-1660.5 MHz, earth-to-space).

AERONAUTICAL RADIO, INC.
Board of Directors' Meeting
March 23, 1983

ITEM TECHNICAL COMMITTEE REPORT

RECOMMENDATIONS:

1. That the band 136-137 MHz is best suited for the accommodation of both operational control and aeronautical administrative communications via ACARS and should be used for both types of communications in the digital mode as this band is not exclusively allocated to the aeronautical mobile (R) services and there is no regulatory or implied prohibition of these types of communications;

2. That, initially, both operational control and administrative communications be conducted on the designated frequencies in the current operational control band (128.825-132.000 MHz) with subsequent transfer of all ACARS communications, regardless of type, to the band 136-137 MHz as aviation equipment capable of tuning this band becomes operationally available, with total transfer of all ACARS operations to this band by 1 January 1990.

3. That within the aeronautical industry, the concept of creating the Aeronautical Administrative Service be adopted with subsequent recognition of such a service in national regulations as of 1 January 1990 when the band 136-137 MHz becomes available to the aeronautical mobile (R) service.

ITEM VIII TECHNICAL COMMITTEE REPORT

That the Aeronautical Mobile-Satellite (R) service allocation (1545-1559 MHz, space-to-earth and 1646.5-1660.5 MHz, earth-to-space) is a highly critical and valuable asset of the aviation community; that it represents the minimum spectrum required to operate a viable system; that concerted, determined and coordinated actions will be taken to protect against any efforts to shift this allocation or any portion thereof, to any use other than aeronautical mobile-satellite (R) service.

3. The Technical Committee also reviewed and recommended Board approval of the recommendations of the Aeronautical Frequency Committee with regard to the expanded use of ACARS to accommodate administrative traffic, as follows:

    1. All administrative traffic must be on a secondary, non-interference basis to Operational Control traffic.

    2. The concept of "controlled growth" must be followed to preclude administrative traffic from hampering the flow of Operational Control traffic.

    3. The expanded service should be labeled Aeronautical Administrative Service to identify it as a separate function and service from Operational Control, with different Permissible Communications.

    4. As expeditiously as possible, all data operations should be shifted to the 136-137 MHz band.

ARINC requested the Federal Communications Commission to grant a Waiver of Section 87.291 to the extent necessary to authorize the digital transmission of airline administrative messages on a secondary basis by Aeronautical Enroute Stations licensed to ARINC. This Waiver was granted on July 15, 1983. As a result of this Waiver being granted, AFC identified the following actions that must be accomplished to cover this new Policy:

1. Add provisions to the current Aeronautical Industry Operational Policy to cover the new service (Attachment V).

2. Approval of the AFC Resolution regarding the shift of data operation to the 136-137 MHz Band. (Attachment VI).

ITEM VIII TECHNICAL COMMITTEE REPORT (continued)

ACTION
21-83S It was moved, seconded, and unanimously carried to accept the report and approve the recommendations of the ARINC Technical Committee.

The report of the Technical Committee Meeting held March 5, 1985, was included with the Agenda. The following items were reviewed.

1. AFC Proposed Amendments to Aeronautical Industry Operational VHF Policy

The Committee had reviewed the AFC Proposed Amendments to Aeronautical Industry Operational VHF Policy, and recommended approval by the Board.

ACTION

7-85S It was moved, seconded, and unanimously carried to accept the report and approve the recommendations of the Technical Committee.

AERONAUTICAL RADIO, INC.
Board of Directors' Meeting
October 1988

Approved changes to the VHF Policy reducing co-channel spacing, and modifying Terms of Reference to include standing alternate membership.

Statement

Adopted by the ARINC Board of Directors
30 November 1989

In response to an initiative of the Industry Committees (ACCTS, AEEC, AFC, and AMC), the Board of Directors of Aeronautical Radio, Inc., requested that its Technical Committee meet regularly with representatives (non-ARINC) of the Industry Committees to share views as to programs, priorities, budgets, and potential problems. Two such meetings have been held, and the Board has gained a better insight into the needs and concerns of the Industry Committees. The Board believes that this ongoing dialogue will lessen the likelihood of future misunderstandings.

The ARINC Board hereby reaffirms that:

1. Sponsorship and support of the four Industry Committees is an important service of ARINC and is recognized as vital to the industry;

2. ARINC must exercise strict neutrality in the provision of secretariat (and in the case of AEEC, Chairmanship and Vice-Chairmanship) functions; and

3. The procedures employed by the Industry Committees and ARINC Industry Activities must be open, even-handed, and fair to all interested parties.

Statement

ACTION BY WRITTEN CONSENT OF
BOARD OF DIRECTORS OF
AVIATION SPECTRUM RESOURCES, INCORPORATED
December 31, 2005

Pursuant to Section 141(f) of the
Delaware General Corporation Law

The undersigned, being the sole member of the Board of Directors (the "Board") of Aviation Spectrum Resources, Incorporated, a Delaware corporation (the "Corporation"), in lieu of holding a special meeting of the Board, hereby takes the following actions and adopts the following resolutions by unanimous written consent, pursuant to Section 141(f) of the Delaware General Corporation Law (the "DGCL"):

APPOINTMENT OF DIRECTORS

WHEREAS, the Corporation's Certificate of Incorporation and Bylaws allow for a maximum of nine members of the Board of Directors;

WHEREAS, there are currently eight vacancies on the Corporation's Board of Directors;

NOW, THEREFORE, BE IT

RESOLVED, that the following persons be, and hereby are, appointed as members of the Board of Directors:

Robert C Cordes
Stephen Dickson
Dave Davis
Stephan G. Regulinsky
Zane Rowe

APPOINTMENT OF OFFICERS

FURTHER RESOLVED, that the following individuals be, and hereby are, elected to the offices set forth below opposite their respective names, each to hold office until his or her successor shall have been duly elected and qualified, unless earlier removed:

Chairman	Kris E. Hutchison
Chief Executive Officer	Kris E. Hutchison

President	Kris E. Hutchison
Vice President	Richard A. Stutz
Secretary	Richard A. Stutz
Treasurer	Richard A. Stutz

As of the effective date of these resolutions, Kris E. Hutchison shall cease to be the Corporation's Vice President-Frequency Management.

GENERAL RESOLUTIONS

FURTHER RESOLVED, that all actions heretofore taken by any officer or director of the Corporation in connection with the foregoing resolutions be, and they hereby are, ratified and approved in all respects;

FURTHER RESOLVED, that a copy of this Unanimous Written Consent be filed in the Minute Book of the Corporation; and

FURTHER RESOLVED, that each officer of the Corporation is authorized and empowered to take any actions necessary to carry out the intent and accomplish the purposes of the foregoing resolutions.

This Action by Written Consent of the Board of Directors of Aviation Spectrum Resources, Incorporated is effective as of the date first set forth above.

Signed John M. Belcher

A. Past Chairman

PAST CHAIRMAN OF THE AERONAUTICAL FREQUENCY COMMITTEE

C. A. Petry	1958	XA
H. L. Garrison	1959	UA
D. R. Buckler	1960	EA
J. M. Reilly	1961	AA
H. O. Harrison	1962	BN
E. G. Jones	1963	DL
V. N. Williams	1964	PA
D. R. Buckler	1965	EA
R. J. Glischinski	1966	NW
L. S. Gallemore	1967	TWA
K. J. Rhead	1968	UA
T. J. Sanders	1969	AA
J. S. Glenn	1970	RW
R. M. Bennett	1971	FT
S. A. Moore	1972	BN
A. R. Clark	1973	CO
K. M. Ross	1974	EA
G. R. Carter	1975	AA
H. H. Fink	1976	DL
L. S. Gallemore	1977	TW
M. O. Everhart	1978	PI
G. A. Carlson	1979	UA
L. S. Donahue	1980	AC
R. M. Bennett	1981	FT
W. H. Stine, II	1982	NBAA
C. Dennis Wright	1983	AOPA
W. Martin	1984	DL
H. Brown	1985	AA
H. Smith	1986	TW

G. E. Allen	1987	EAL
G. E. Allen	1988	EAL
W. H. Stine, II	1989	NBAA
P. Anderson	1990	NWA
D. Tangney	1991	UAL
B. Funk	1992	AOPA
H. R. May	1993	AAL
D. Riddle	1994	USA
Timothy B. Totten	1995	UPS
Chris Bogg	1996	AWE
H. Robert May	1997	AAL
P. Anderson	1998	NWA
T. King	1999	DAL
M. Swaringen	2000	USA
W.H. Stine, II	2001	NBAA
Tim Totten	2002	UPS
Nathan Lemon	2003	FDX
Bill Winfrey	2004	DAL
Chris Kelly	2005	COA
Robert Lee	2006	UAL
Rich Farr	2007	AAL
Bill Stine	2008	NBAA
Pete Talbot	2009	HSAC
Paul Anderson	2010	NWA/DAL
John Gana	2011	COA/UAL
Neal Young	2012	SWA

B. The ASRI Board of Directors

The following companies make up the Board of Directors of Aviation Spectrum Resources, Inc. as of April 15, 2009 :

1. **American Airlines, Inc.**
2. **Aviation Spectrum Resources, Inc.**
3. **US Airways**
4. **Delta Airlines, Inc.**
5. **United Airlines, Inc.**
6. **Independent Member (Chairman)**

NOTE: For additional information concerning the ASRI board members, contact ASRI management personnel at 410-266-4800 or info@asri.aero

C. Members, Associates, and Staff

1 AFC Membership Listing

Due to the continuous change in the AFC membership, this information is only available on the ASRI web site (www.asri.aero) under the "AFC Members Only" section. If you cannot access or view this list on the ASRI web site, then contact ASRI at 410-266-4800 or info@asri.aero for assistance.

2 Honorary Members

The following are AFC members that the committee has designated as permanent lifetime honorary members in recognition of their outstanding service to the committee and the entire aviation industry.

E. G. Jones (DAL) - June 28, 1979 (Deceased)

Harold H. Fink (DAL) - April 15, 1980

K. A. Moore (COA) - August 27, 1980

Lee S. Donahue (AC) - September 1, 1981

Lorrence S. Gallemore (TWA) - December 16, 1982

H. S. Smith (XA) - February 27, 1985

Mitch Everhart (PAI) - December 31, 1986

Harvey L. Brown (AAL) - December 31, 1986

Larry Berryhill (UAL) - December 31, 1986

Wayland L. Martin (DAL) - March 31, 1989

Donald Trombley (ATA) - May 19, 1993

Dick Covell (ARINC) - August 26, 1993

Edward Adelson (ARINC) - February 22, 2001

H. Robert May (AAL) - June 27, 2001

U. W. King (DAL) - October 31, 2003

Chris Bogg (USA) – October 11, 2011