**Documents of the Extraordinary Administrative Radio Conference for the preparation of a revised allotment plan for the aeronautical mobile (R) service (1st session) (EARC-64)**

**(Geneva, 1964)**

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# AERONAUTICAL CONFERENCE

Corrigendum No. 1 to
Document No. I/1-E
7 February 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

United States of America

AMENDMENT OF U.S.A. PROPOSALS IN
DOCUMENT No. I-1-E, PAGES 19 AND 48

Insert the attached amendment (No. 2A) following the Reason under No. 18 appearing towards the top of page 19 of Document No. I-1-E.

Delete page 48 of Document No. I-1-E and replace with the attached amendment (No. 2B).

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Annex : 1

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# A N N E X

PROPOSAL No. 2A :

18A 10.8 Stations serving MWARA's may, where required to provide satisfactory communications with aircraft, employ directional antennas and a transmitter power in accordance with the provisions of paragraph 21 (see No. 57). In such cases, the Administration having jurisdiction over the transmitting station shall assure :

18B 10.8.1 That harmful interference is not caused to stations using frequencies in accordance with the applicable provisions of the allotment plan;

18C 10.8.2 That the power transmitted into other MWARA's or RDARA's allotted the same frequency(s) is not greater than that permitted under the technical criteria on which the plan is based;

18D 10.8.3 That the characteristics of the radiated pattern of the directional antenna employed be known, or that the directional antenna employed be of a type for which a typical radiation pattern is available;

18E 10.8.4 That the directional characteristics of the antenna employed will be such as to minimize radiation in unnecessary directions, particularly into other MWARA's or RDARA's which under the plan have been allotted the same frequencies.

Reason : While the use of directional antennas has a limited applicability in the aeronautical mobile (R) service, their use at terminus stations of long-distance over-water routes, such as MWARA's, permits improvement in communications service to aircraft, not otherwise obtainable, without detriment to the technical criteria on which the plan is based. Under these circumstances the use of an appropriately designed directional antenna makes it practicable to employ a higher transmitter power, also without detriment (degradation) of the agreed interference protection ratio of 15 db.

The determination of compliance by countries with the provisions of paragraphs 10.8.1 through 10.8.4 (Nos. 18B through 18E) is placed with Administrations and, thus, would not be included in the I.T.U. notification and registration procedures for examination by the I.F.R.B. (see U.S.A. Proposal No. 30).

The determination required by 10.8.1 through 10.8.4 (Nos. 18B through 18E) would apply where ever a directional antenna is employed, regardless of the transmitter power employed.

The foregoing provisions, therefore, are intended to define the circumstances under which a directional antenna, with a transmitter power as provided in paragraph 21 (see No. 57) may be employed at terminus stations serving MWARA's.

PROPOSAL No. 2B :

57 ~~C.--Radiated Powers~~

21. Unless otherwise indicated in Parts II, ~~and IV~~, the peak envelope power supplied to the antenna transmission line is assumed to be ~~the following:~~ in accordance with the following :

| Class of Emission | Stations | Peak Envelope Power | |
|---|---|---|---|
| | | Stations using nondirectional antennas | Stations using directional antennas |
| A1 | ~~Land~~ Aeronautical Stations | 1 kW | 2.5 kW |
| | Aircraft Stations | 50 W | (See 21.A) |
| A3, A3H (100% modulated) | ~~Land~~ Aeronautical Stations | 4 kW | 10 kW |
| | Aircraft Stations | 200 W | (See 21.A) |

57A 21.A Because of the wide variation in the directional characteristics of aircraft antennas, no maximum aircraft power has been specified. The radiated power shall be such as to avoid harmful interference to other stations using frequencies in accordance with the allotment plan.

Reason : To provide b) for a more accurate description of power and to make the Table consistent with actual practice where directional antennas are used at aeronautical stations; and b) for the continued use of transmitting equipment as currently installed aboard aircraft.

58 21.1 For the purpose of indication mean power for notification of A3H emission used in the aeronautical mobile (R) service, mean power will be considered equal to 0.500 peak envelope power, based on a single periodic sine-wave oscillation modulating an emission at 100%.

Reason : To provide for the conversion of peak envelope power to mean power for notification of power to the International Frequency Registration Board.

AERONAUTICAL
CONFERENCE

Document No. I-1-E
1 November, 1963
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

United States of America

# PROPOSALS FOR THE WORK OF THE CONFERENCE

## PREFACE

The U.S.A. completely supports the concept that the 1964 aeronautical E.A.R.C. should be a planning session only, preparatory for the 1965 Main Session. However, it is the view of the U.S.A. that to obtain the maximum benefit from the planning conference, it is necessary to be aware of the end results to be achieved. It is with this view in mind that the U.S.A. has prepared the attached proposals. Some of these proposals will not require final consideration until the 1965 Main Session of the E.A.R.C. Such proposals will be identified at the 1964 Session and will be reviewed by the U.S.A. prior to their consideration at the 1965 Session in light of the results of the 1964 Session.

Annex : 1

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## DIGEST OF U.S.A. PROPOSALS

The United States is proposing that a new Appendix 27 be prepared for the Aeronautical Mobile (R) Service and that application of Appendix 26 be restricted to the Aeronautical Mobile (OR) Service. This division of the (R) and (OR) Plans into separate Appendices to the Radio Regulations permits a substantially different approach to be taken in the revision of the (R) Service Plan. A system of reference numbers, similar to that found in the Radio Regulations, has been included to facilitate reference to the separate provisions of the new Appendix 27.

In its proposals for the new Appendix 27, the general outline of Appendix 26 has been followed with rearrangements to facilitate its application and use by Administrations. This includes the addition of provisions for :

a) the permissive use of single sideband with appropriate restrictions;

b) replacement data for preparation of interference range contours to a scale other than that included in the current Appendix 26;

c) expansion of the propagation data by inclusion of maps and transparencies for the north and south polar areas;

d) the deletion of provisions no longer required, and

e) the amendment of other provisions.

In accordance with the agreement reached in I.C.A.O., the United States is proposing the revision of Appendix 26 be based on the use of double sideband amplitude modulated emission and that primary attention be directed by the Aeronautical E.A.R.C. to the protection of that system.

The revision of Appendix 26 and the preparation of a new Appendix 27 causes consequential amendments to Appendix 1, Article 7 and Article 9 of the Radio Regulations, Geneva, 1959. With revision of Appendix 26, need exists in the Radio Regulations to provide a distinction between notices filed with the I.F.R.B. under the (R) Plan of 1959 and that of 1965. Further, an interim procedure is necessary to facilitate transition from the 1959 to the 1965 (R) Plan. Proposals for amendment of Article 9 and appropriate Resolution covering the interim procedure are submitted.

To assist the Preparatory Session in resolution of a suitable format for the uniform submission by Administrations of statistics concerning aircraft operations over civil world air routes, proposals are submitted relating to that format and the criteria to be applied in its utilization.

To reduce to a minimum the duration of the Main Session of the Aeronautical E.A.R.C., the proposed format gives full attention to the potentialities of use of the IBM 1401 (or equivalent) computing equipment, available at the seat of the Union, in the processing of aircraft operation statistics submitted by Administrations.

Amplification of the philosophies, proposals for new provisions, or amendment(s) of existing provisions will be found in the following pages. In each case the detailed reason for adoption of new or amended provisions is associated with the specific provision involved.

Most of the proposals submitted by the United States are in accord with the recommendations contained in the Report of the I.C.A.O. Special COM Meeting, Montreal, April-May 1963.

# P A R T I

## U. S. PROPOSALS CONCERNING AMENDMENT

## OF PARTS I & II OF APPENDIX 26

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PROPOSAL No. 1 :

In revision of Appendix 26 there be included a convenient numbering system to facilitate reference to the various individual provisions.

Reason : During the years of use of Annex 8, EARC Geneva, 1951, and Appendix 26, Radio Regulations Geneva, 1959, the need has repeatedly arisen for a convenient system of numbering of the individual sections or subsections of Appendix 26 so that rapid and specific reference may be made to provisions of interest. To meet that need, it is proposed an agreed system be included at the time of final drafting the revisions to Appendix 26.

The reference numbering system should not be in conflict with the system utilized in the Radio Regulations as those Regulations now exist, or as they may be modified during the next few years. Since, however, it may be essential to refer to the Appendix by number, such conflict may be more theoretical than real. On that basis, a single consecutive numbering system may suffice.

In change from the practice employed in Annex 8, EARC Geneva, 1951, and Appendix 26, Radio Regulations Geneva, 1959, the titles of the various sections of Appendix 26 would bear no reference number. This would follow the procedure used in the Radio Regulations, Geneva, 1959.

It will be noted that the proposals of the U.S.A. for revision of Appendix 26 employ such a reference numbering system.

PROPOSAL No. 2 :

APPENDIX ~~26~~ 27

to the Radio Regulations

Geneva, 1959

# Frequency Allotment Plan

# for the Aeronautical Mobile (R) Service

# and Related Information

(See Article 7 of the Radio Regulations,
Geneva, 1959)

General Secretariat of the
International Telecommunication Union

GENEVA

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SECTION I. Description of the MWARA, RDARA, and sub-RDARA Boundaries

Article 1. Description of the Major World Air Route Area (MWARA) Boundaries

Article 2. Description of the Regional and Domestic Air Route Area (RDARA) Boundaries

SECTION II. Allotment of Frequencies to the Aeronautical Mobile (R) Service

Article 1. Frequency Allotment Plan (per MWARAs, RDARAs and sub-RDARAs)

Article 2. Frequency Allotment Plan (per numerical order of frequencies)

# PART I

## GENERAL PROVISIONS

### Section I. Definitions

1 1. Frequency Allotment Plan : A plan which shows the frequencies to be used in particular areas or by particular countries, without specifying the stations to which the frequencies are to be assigned.

2 2. The terms to express the different methods of frequency distribution as used in this Appendix have the following meanings :

| Frequency distribution to : | French | English | Spanish |
|---|---|---|---|
| Services | Attribution (attribuer) | Allocation (to allocate) | Atribución (atribuir) |
| Areas | Allotissement (allotir) | Allotment (to allot) | Adjudicación (adjudicar) |
| Stations | Assignation (assigner) | Assignment (to assign) | Asignación (asignar) |

3 3. A Major World Air Route is considered to be a long-distance route, made up of one or more segments, essentially international in character, extending through more than one country and requiring long-distance communications facilities.

4 4. A Major World Air Route Area (MWARA) is an area embracing a certain number of Major World Air Routes, which generally follow the same traffic pattern and are so related geographically that the same frequency families may logically be applied.

5 5. Regional and Domestic Air Routes are all those using the Aeronautical Mobile (R) Service not covered by the definition of Major World Air Routes in paragraph 4 above.

6 6. A Regional and Domestic Air Route Area (RDARA) is one embracing a certain number of the air routes defined in the foregoing paragraph.

7 ~~7~~. Family of Frequencies in the Aeronautical Mobile Service : A group of frequencies selected from different aeronautical mobile bands in such a way as to permit communication, at any time and over any distance, between aircraft in flight and appropriate aeronautical stations.

## Section II. Technical and Operational Principles used for the Establishment of the Plan of Allotment of Frequencies in the Aeronautical Mobile (R) ~~and (OR) Services~~ Service

Reason : Change necessary in the proposed format of the new Appendix 27 for (R) service.

### A. Determination of Channel Width

8 ~~18~~. Frequency Separation : The frequency separations adopted are adequate to permit high capacity means of communication, as indicated in the following table :

| Band (kc/s) | Separation (kc/s) | Band (kc/s) | Separation (kc/s) |
|---|---|---|---|
| 2 850 - ~~3 155~~ 3 025 | 7 | 8 815 - ~~9 040~~ 8 965 | 8.5 |
| 3 400 - 3 500 | 7 | 10 005 - 10 100 | 9 8.5 |
| ~~3 900 - 3 950~~ | 7 | 11 275 ~~11 175~~ - 11 400 | ~~9.5~~ 8 |
| 4 650 - ~~4 750~~ 4 700 | 7 | 13 260 ~~13 200~~ - 13 360 | ~~10~~ 8 |
| 5 450 - ~~5 480~~ 5 680 | 7.5 | ~~15 010 - 15 100~~ | ~~10~~ |
| ~~5 480 - 5 730~~ | 7.5 | 17 900 - ~~18 030~~ 17 970 | ~~10~~ 8.5 |
| 6 525 - ~~6 765~~ 6 685 | 7.5 | | |

Reason : To delete the (OR) Service bands and show the proposed channel separation in the (R) Service bands at 10, 11, 13 and 17 Mc/s.

~~a) It is assumed, ..... of A3 emissions.~~

~~b) The use of ..... class of emission.~~

~~c) It is recognized ..... frequency separation plan.~~

~~d)~~ ~~The grouping of ..... concerned.~~

~~e)~~ ~~The arrangements ..... Radio Regulations.~~

Reason : Move to paragraph 10 to maintain continuity of format.

9 9. Frequencies to be allotted

9.1 The list of frequencies to be allotted in the exclusive aeronautical mobile (R) bands, on the basis of the frequency separation provided ~~for~~ under paragraph ~~4~~ 8 above, will be found in the table opposite.

Reason : To indicate the table applied to (R) Service bands only.

Particulars relating to assignment

10. 10.1 ~~a)~~ It is assumed that A3 modulation frequencies will be limited to 3 000 cycles per second and that the sideband radiation of other authorized emissions will not exceed that of A3 emissions.

11 10.2 ~~b)~~ The use of channels as derived from the above table, for ~~the~~ various classes of emissions (~~A1, A2, A3, A4 and F1~~ See paragraph 11), will be subject to special arrangements by the administrations concerned in order to avoid the interference which may result from the simultaneous use of the same channel for several classes of emission, no inherent priority being given to any particular class of emission.

Reason : To provide for emissions other than those deleted.

kHz - kc/s

| 2 850 - ~~3-155~~ 3 025 | 3 400 - 3 500 | 5 450 - 5 480 | 6 525 - ~~6-765~~ 6 685 |
|---|---|---|---|
| 2 854<br>2 861<br>2 868<br>2 875<br>2 882<br>2 889<br>2 896<br>2 903<br>2 910<br>2 917<br>2 924<br>2 931<br>2 938<br>2 945<br>2 952<br>2 959<br>2 966<br>2 973<br>2 980<br>2 987<br>2 994<br>3 001<br>3 008<br>3 015<br>(R)<br>24 voies<br>24 channels<br>24 canales | 3 404,5<br>3 411,5<br>3 418,5<br>3 425,5<br>3 432,5<br>3 439,5<br>3 446,5<br>3 453,5<br>3 460,5<br>3 467,5<br>3 474,5<br>3 481,5<br>3 488,5<br>3 495,5<br>(R)<br>14 voies<br>14 channels<br>14 canales | Région 2<br>5 454<br>5 461,5<br>5 469<br>5 476,5<br>(R)<br>4 voies<br>4 channels<br>4 canales | 6 529,5<br>6 537<br>6 544,5<br>6 552<br>6 559,5<br>6 567<br>6 574,5<br>6 582<br>6 589,5<br>6 597<br>6 604,5<br>6 612<br>6 619,5<br>6 627<br>6 634,5<br>6 642<br>6 649,5<br>6 657<br>6 664,5<br>6 672<br>6 679,5<br>(R)<br>21 voies<br>21 channels<br>21 canales |
| 3 023,5 (R) et (OR) | ~~3-900---3-950~~ | 5 480 - ~~5-730~~ 5 680 | |
| ~~3-032~~<br>~~3-039~~<br>~~3-046~~<br>~~3-053~~<br>~~3-060~~<br>~~3-067~~<br>~~3-074~~<br>~~3-081~~<br>~~3-088~~<br>~~3-095~~<br>~~3-102~~<br>~~3-109~~<br>~~3-116~~<br>~~3-123~~<br>~~3-130~~<br>~~3-137~~<br>~~3-144~~<br>~~3-151~~<br>~~(OR)~~<br>~~18-voies~~<br>~~18-channels~~<br>~~18-canales~~ | ~~Région 1~~<br>~~3-904~~<br>~~3-911~~<br>~~3-918~~<br>~~3-925~~<br>~~3-932~~<br>~~3-939~~<br>~~3-946~~<br>~~(OR)~~<br>~~7-voies~~<br>~~7-channels~~<br>~~7-canales~~ | 5 484<br>5 491,5<br>5 499<br>5 506,5<br>5 514<br>5 521,5<br>5 529<br>5 536,5<br>5 544<br>5 551,5<br>5 559<br>5 566,5<br>5 574<br>5 581,5<br>5 589<br>5 596,5<br>5 604<br>5 611,5<br>5 619<br>5 626,5<br>5 634<br>5 641,5<br>5 649<br>5 656,5<br>5 664<br>5 671,5<br>(R)<br>26 voies<br>26 channels<br>26 canales | ~~*)6-685~~<br>~~*)6-687,5~~<br>~~6-693~~<br>~~6-700,5~~<br>~~6-708~~<br>~~6-715,5~~<br>~~6-723~~<br>~~6-730,5~~<br>~~6-738~~<br>~~6-745,5~~<br>~~6-753-~~<br>~~6-760,5~~<br>~~(OR)-~~<br>~~12-voies~~<br>~~12-channels~~<br>~~12-canales~~ |
| | 4 650 - ~~4-750~~ 4 700 | | |
| | 4 654,5<br>4 661,5<br>4 668,5<br>4 675,5<br>4 682,5<br>4 689,5<br>4 696,5<br>(R)<br>7 voies<br>7 channels<br>7 canales | 5 680 (R) et (OR) | |
| | ~~4-703,5~~<br>~~4-710,5~~<br>~~4-717,5~~<br>~~4-724,5~~<br>~~4-731,5~~<br>~~4-738,5~~<br>~~4-745,5~~<br>~~(OR)~~<br>~~7-voies~~<br>~~7-channels~~<br>~~7-canales~~ | ~~5-688~~<br>~~5-695,5~~<br>~~5-703~~<br>~~5-710,5~~<br>~~5-718~~<br>~~5-725,5~~<br>~~(OR)~~<br>~~6-voies~~<br>~~6-channels~~<br>~~6-canales~~ | |

**Motifs:** Supprimer, dans le tableau relatif au service mobile aéronautique (R), les allotissements de fréquences pour le service (OR).

**Reason:** To remove references in the aeronautical mobile (R) service table to (OR) service allotments.

**Motivos:** Suprimir del cuadro del servicio móvil aeronáutico (R) toda referencia a las adjudicaciones al servicio (OR).

kHz - Kc/s

| 8 815 - ~~9-010~~ 8 965 | | ~~11-175~~ - 11 400<br>11 275 | | ~~15-010~~ - ~~51-100~~<br>~~15-100~~ | |
|---|---|---|---|---|---|
| 8 820 | | ~~11-180-5~~ | | ~~15-016~~ | |
| 8 828,5 | | ~~11-190~~ | | ~~15-026~~ | |
| 8 837 | | ~~11-199,5~~ | | ~~15-036~~ | |
| 8 845,5 | | ~~11-209~~ | | ~~15-046~~ | |
| 8 854 | | ~~11-218,5~~ | | ~~15-056~~ | (~~OR~~) |
| 8 862,5 | | ~~11-228~~ | (~~OR~~) | ~~15-066~~ | ~~10-voies~~ |
| 8 871 | | ~~11-237,5~~ | ~~11-voies~~ | ~~15-076~~ | |
| 8 879,5 | (R) | ~~11-247~~ | | ~~15-086~~ | |
| 8 888 | 18 voies | ~~11-256,5~~ | | *)~~15-092,5~~ | |
| 8 896,5 | | ~~11-266~~ | | *)~~15-096,5~~ | |
| 8 905 | chan- | *)~~11-273~~ | | | |
| 8 913,5 | nels | | | | |
| 8 922 | cana- | ~~11-280,5~~ | 11 281 | 17 900 - ~~18-030~~<br>17 970 | |
| 8 930,5 | les | ~~11-290~~ | 11 289 | | |
| 8 939 | | ~~11-299,5~~ | 11 297 | | |
| 8 947,5 | | ~~11-309~~ | 11 305 | ~~17-906,5~~ | 17 904,5 |
| 8 956 | | ~~11-318,5~~ | 11 313 | ~~17-916,5~~ | 17 913 |
| *) **)8 961,5 | | ~~11-328~~ | 11 321 | ~~17-926,5~~ | 17 921,5 |
| | | ~~11-337,5~~ | 15(R) | ~~17-936,5~~ | 8 ~~(R)~~ |
| ~~8-967~~ | | ~~11-347~~ | ~~13~~ voies | ~~17-946,5~~ | ~~7-voies~~ |
| ~~8-975,5~~ | | ~~11-356,5~~ | 11 329 | ~~17-956,5~~ | 17 930 |
| ~~8-984~~ | | ~~11-366~~ | 11 337 | ~~17-966,5~~ | 17 938,5 |
| ~~8-992,5~~ | (~~OR~~) | ~~11-375,5~~ | 11 345 | | 17 947 |
| ~~9-001~~ | ~~9-voies~~ | ~~11-385~~ | 11 353 | *)~~17-975~~ | 17 955,5 |
| ~~9-009,5~~ | | ~~11-394,5~~ | 11 361 | ~~17-983,5~~ | 17 964 |
| ~~9-018~~ | | 11 369 | 11 377 | ~~17-993,5~~ | (~~OR~~) |
| ~~9-026,5~~ | | 11 385 | 11 393 | ~~18-003,6~~ | ~~6-voies~~ |
| ~~9-035~~ | | | | ~~18-013,5~~ | |
| | | ~~13-200~~ - 13 360<br>13 260 | | ~~18-023,5~~ | |
| 10 005 - 10 100 | | ~~13-205,5~~ | | | |
| | | ~~13-215,5~~ | | | |
| | | ~~13-225,5~~ | (~~OR~~) | | |
| ~~10-012~~ | 10 009,5 | ~~13-235,5~~ | ~~6-voies~~ | | |
| ~~10-021~~ | 10 018 | ~~13-245,5~~ | | | |
| ~~10-030~~ | 10 026,5 | ~~13-255,5~~ | | | |
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| ~~10-075~~ | 10 052 | ~~13-294,5~~ | 13 289 | | |
| ~~10-084~~ | 10 060,5 | ~~13-304,5~~ | 12(R) | | |
| ~~10-093~~ | 10 069 | ~~13-314,5~~ | ~~10~~ voies | | |
| | 10 077,5 | ~~13-324,5~~ | 13 297 | | |
| | 10 086 | ~~13-334,5~~ | 13 305 | | |
| | 10 094,5 | ~~13-344,5~~ | 13 313 | | |
| | | ~~13-354,5~~ | 13 321 | | |
| | | 13 329 | 13 337 | | |
| | | 13 345 | 13 353 | | |

(Voir notes page 17 - See notes page 17 - Véanse notas página 17)

Motif : Supprimer, dans le Plan relatif au service (R), les fréquences allotties pour le service (OR). Indiquer les nouvelles fréquences rendues disponibles du fait d'un espacement plus petit entre les fréquences, dans les bandes des 10, 11, 13 et 17 MHz.

Reason: To remove the (OR) service frequencies from the (R) service plan. To indicate the new frequencies made available as a result of reduced channel separation 10, 11, 13, and 17 Mc/s.

Motivos: Suprimir del cuadro del servicio móvil aeronáutico (R) toda referencia a las adjudicaciones al servicio (OR). Indicar las nuevas frecuencias que quedan disponibles como consecuencia de la reducción de la separación entre canales en 10, 11, 13 y 17 Mc/s.

*) Cette fréquence ne doit être utilisée que pour des émissions de classe A1.
Available for A1 emission only.
Solamente para emisiones de clase A1.

**) Cette fréquence ne doit être utilisée que pour des émissions dont la fréquence est très stable.
It is necessary that only equipment having a high degree of stability be used on this channel.
Es necesario que en este canal se empleen solamente equipos de gran estabilidad.

12 ~~c)~~ 10.3 It is recognized that two or more A1 channels can be derived from each of the channels provided under this frequency separation plan.

~~d) The grouping of adjacent channels derived from the above table to permit the satisfaction of particular requirements, will be subject to special arrangements by the administrations concerned.~~

Reason : This provision has never been applied within the (R) service and is not expected to be required in the future.

13 ~~c)~~ 10.4 The arrangements contemplated in ~~b)~~ ~~c)~~ 10.2 and 10.3 ~~d)~~ above should be made under the provisions of Article 43 (Special Agreements) of the International Telecommunication Convention and Article 4 of the Radio Regulations.

14 10.5 The International Civil Aviation Organization (I.C.A.O.) co-ordinates aeronautical (R) communications with international air operations for a large part of the world and this organization should be consulted in appropriate cases, particularly in the operational use of the frequencies in the Plan.

15 10.6 Stations utilizing single sideband full carrier emissions shall be considered to be in accordance with the Table if the necessary bandwidth does not extend beyond the upper limits of the bandwidth provided for double sideband emissions in the Table.

16 10.7 Stations employing single sideband full carrier single channel emissions (A3H) shall operate only in the upper half of the channels designated by the center frequencies in the Table.

17 10.7.1 Such stations shall use only the upper sideband emissions with their carrier frequency at: a) the value listed in the Table if the allotted frequency terminates in an integral number of kilocycles; or b) where necessary due to equipment limitations, a value of 0.5 kilocycle per second lower than that listed in the Table when the allotted frequency terminates in 0.5 kilocycle per second.

Reason : Subparagraphs 10.1 through 10.5 concern frequency assignment and should be so treated. Inclusion of subparagraphs 10.6 and 10.7 is to provide in Appendix 27 for the use of single sideband emissions under circumstances which assure that adequate protection is given to the double sideband system; to ensure that stations employing single sideband emissions do not lose priority registration by virtue of their use of single sideband emission; and to provide for the off-set where necessary, of the carrier

frequency of single sideband systems having frequency generation capability of integral multiples of 1.0 kilocycle per second.

18 10.7.2 In the aeronautical mobile (R) service, the frequeny to be notified shall be the frequency shown in the Frequency Allotment Plan. Where the carrier frequency differs from the frequency shown in the Plan, it shall also be indicated.

Reason : To avoid confusion as to which frequency is to be notified.

11. Classes of emission

19 11.1 The use of any emission listed below is permissible, provided that the use of the emission: a) has been coordinated with the planned users of the frequency; b) complies with the applicable provisions of paragraph 10, above; and c) does not cause harmful interference to other users of the frequency.

11.1.1 Telephony - Amplitude Modulated :

20 11.1.1.1 Double sideband . . . . . (A3)

21 11.1.1.2 Single sideband, full carrier . . . . . (A3H)

22 11.1.1.3 Single sideband, reduced carrier (see No. 25) . . . . . (A3A)

23 11.1.1.4 Single sideband, suppressed carrier (see No. 25) . . . . . (A3J)

24 11.1.1.5 Single sideband, two independent sidebands (see No. 25) . . . . . (A3B)

25 Note : These emissions are not compatible with the double sideband radiotelephony system in current use over world routes by international civil aviation. Compatibility may not be a matter of importance where a frequency is allotted to an Area within the boundaries of a single country.

11.1.2 Telegraphy (Including automatic data systems):

26 11.1.2.1 Without the use of a modulating audio frequency (by on-off keying) . . . . . (A1)

27 11.1.2.2 Automatic (data), DSB, amplitude modulated, on-off keying of amplitude modulating audio frequency(ies), or by on-off keying of the modulated emission . . . . . (A2)

28 11.1.2.3 Automatic (data), DSB, frequency modulated by the on-off keying of a frequency modulating audio frequency or by the on-off keying of a frequency modulated emission . . . . . (F2)

29 11.1.2.4 Automatic (data), SSB, amplitude modulated, reduced carrier, multichannel voice frequency telegraphy . . . . . (A7A)

30 11.1.2.5 Automatic (data), SSB, amplitude modulated full carrier, multichannel voice frequency telegraphy . . . . . (A7H)

31 11.1.2.6 Automatic (data), SSB, amplitude modulated, suppressed carrier, multichannel voice frequency . . . . . (A7J)

Reason : To bring the emission designations into accord with the changes to Article 2 of the 1959 Geneva Radio Regulations, and to expand the classes of emissions to include systems now under consideration, the use of which may receive favorable consideration in the foreseeable future.

32 11.2 In respect of use of single sideband full carrier emissions by international civil aviation in the aeronautical mobile (R) service, first consideration shall be given to the protection of the double sideband system, as follows:

33 11.2.1 Only those single sideband systems are permitted which are operated in accordance with subparagraphs 10.6 through 10.7.1 above;

34 11.2.2 The use of single sideband emission shall be subject to coordination between administrations concerned pursuant to subparagraph 11.1 above, except that such coordination shall not be required with respect to stations authorized to use single sideband prior to the effective date of this Appendix.

Reason : To include in Appendix 27 provision for the permissive use of single sideband full carrier emission under circumstances which assure that adequate protection is given to the existing double sideband system.

~~3.~~ 12. Channels Common to (R) and (OR) Services

35 12.1 The channels common to the (R) and (OR) services, centered at 3 023.5 and 5 680 kc/s, are authorized for use world-wide as shown in Part II of this Appendix.

36 12.2 Notwithstanding those provisions of the Allotment Plan set forth in Part II hereof, the frequency 5 680 kc/s may also be used at aeronautical stations for communication with aircraft stations when other frequencies of the aeronautical stations are either unavailable or unknown. However, this use shall be restricted to such areas and conditions that harmful interference cannot be caused to other authorized aeronautical uses.

Reason : Renumbering necessary as a result of other changes.

~~5.~~ 13. Adaptation of Allotment Procedure

37 13.1 It is recognized that all the sharing possibilities have not been exhausted in the allotment plan contained in this Appendix. Therefore, in order to satisfy particular operational requirements which are not otherwise met by ~~these~~ this allotment plans, Administrations may assign frequencies from the HF aeronautical mobile (R) bands in areas other than those to which they are allotted in ~~the said~~ this plan. However, the use of the frequencies so assigned must not decrease the protection to the same frequencies in the areas where they are allotted by the plans below that determined by application of the procedure defined in Part I, and Section II B ~~and Part III, Section II, paragraph 4 (d)~~ of this Appendix for the (R) ~~and (OR)~~ Services. ~~respectively.~~

Reason : Renumbered as necessary to proposed format. Editorial changes to remove reference to the (OR) Service.

~~6.~~ ~~When necessary to satisfy the needs of international air operations Administrations may adapt the allotment procedure for the assignment of aeronautical mobile (R) frequencies, which assignments shall then be the subject of prior agreement between Administrations affected.~~

Reason : This provision was added at the Administrative Radio Conference, Geneva-1959, to provide for the satisfaction of requirements not included in the Plan. With revision of the Plan, those requirements are expected to be satisfied. Accordingly, this provision will no longer be required.

~~7.~~ 14. 38 Resort to the co-ordination described in paragraph 4 10.5 shall be made where appropriate and desirable for the efficient utilization of the frequencies in question.

Reason : Editorial to meet new numbering.

~~8.~~ ~~In addition to the extensions provided for in this Appendix for certain frequencies of MWARA's EU and ME to cover the requirments of international aircraft flights to and from U.S.S.R. territory, this Administration may use, for the same purpose, the frequencies allotted to RDARA's 2 and 3 and sub-RDARA's thereof. Such uses, however, must not decrease the protection below the standards mentioned in paragraph 5 above for all stations of the aeronautical mobile service.~~

Reason : No longer required.

## B. Interference Range Contours

~~1.~~ 15. Definition of Contours

39 15.1 The transparencies inserted in the pocket at the end of this Appendix show contours which indicate the minimum acceptable distance separating two ground stations of 1.0 kW power (unmodulated) for the frequencies stated and for producing a protection ratio of 15 db of desired signal to interfering signal on the same frequency at an aircraft operating at the limit of the service range of the desired ground transmitter.

40 15.2 Two types of transparencies are provided. Those for use with (a) the Mercator projection world maps and those for use with (b) the Gnomonic projection for the polar areas. The Mercator projection transparencies encompass the area between latitude 60° North and 60° South. The Gnomonic projection transparencies encompass the areas north of Latitude 30° North and south of Latitude 30° South. The Gnomonic projection overlaps the Mercator projection between Latitudes 30° - 60° North and 30°- 60° South. Over-lap is included to provide continuity between transparencies of the two projections.

Reason : To provide for the addition of polar maps and transparencies.

41 15.3 The service range is not included in the contour.

~~2.~~ 16. Type of Maps Used

42 16.1 These transparencies can be used only on a ~~Mercator's projection~~ world or polar map of the projection and scales given on each transparency, and will not be suitable for use on any other scale ~~of Mercator's projection~~ or any other projection. The world and polar maps accompanying this Appendix, depicting RDARA and MWARA boundaries, are to the correct scale and the transparencies carrying the interference range contours can be directly used on these maps.

Reason : To provide for the addition of polar maps and transparencies.

~~3.~~ 17. Change of Scale or Projection

43 17.1 Should any other ~~Mercator~~ scale be desired, then, by using the co-ordinates given in the tables shown below, new interference range contours can be drawn to fit the new scales.

Reason : To provide for the addition of polar maps and transparencies.

44 17.2 It must be remembered that when the new transparencies are constructed, the intersection of the vertical line of symmetry, i.e. the meridian of longitude and the horizontal line of latitude should be at 00° latitude for the 00° contour, 20° N for the 20° contour, 40° N for 40° contour, etc.

45 17.3 The co-ordinates shown in the above-mentioned tables are given with reference to the 180° meridian taken as the axis of symmetry for the construction of the contours.

~~4.~~ 18. Sharing Conditions Between Areas

46 18.1 The transparencies ~~were~~ are constructed on the basis of the following sharing conditions: ~~agreed at the International Administrative Aeronautical Radio Conference (I.A.A.R.C.) of 1948-1949, namely:~~

Reason : To update the paragraph.

| Areas | Bands between: Mc/s | Sharing Conditions |
|---|---|---|
| MWARA to MWARA | 3 - 6.6<br>9 - 11.3<br>13 - 18 | night propagation<br>day propagation<br>time separation<br>Note : 6.6 Mc/s and 5.6 Mc/s sharing conditions considered the same |
| MWARA to RDARA | 3 - 5.6<br>6.6 - 11.3<br>13 - 18 | night propagation<br>day propagation<br>time separation |
| RDARA to RDARA | 3 - 4.7<br>5.6 - 11.3<br>13 - 18 | night propagation<br>day propagation<br>time separation |

47 18.2 The additional contours for day included for 3 Mc/s, 3.5 Mc/s and 4.7 Mc/s are for determining daylight sharing possibilities.

48 NOTE : The material in "Minimum and Maximum Range Charts for Use as a Guide to the Allotment of Frequencies" Annex 1 to Volume 1 of the Report of the First Session of the I.A.A.R.C. (Geneva, 1948) was used in the preparation of the allotment plan. The aeronautical EARC, Geneva-1965, reviewed the conclusions drawn from this material and found them to have continuing validity.

~~5.~~ 19. Method of Use

49 19.1 Take the MWARA or the RDARA maps accompanying this Appendix and select the transparency for the frequency order and sharing conditions under consideration.

50 19.2 The Gnomonic projections are applicable in the polar areas north of 60° N and south of 60° S; and the Mercator projections are applicable between 60° N and 60° S.

Reason : To clarify when each projection should be used.

51 19.3 Place the center of the transparency (i.e. the intersection of the axis of symmetry and the latitude line) over the boundary of the area or at the location of the transmitter. Note the latitude of this point and select the contour corresponding to this latitude.

52 19.4 A transmitter at any point outside the contour will result, as defined in paragraph ~~1~~ 15.1 above, in a protection ratio of better than 15 db.

53 19.5 Any transmitter located at a point inside the contour will result in a protection ratio of less than 15 db.

54 19.6 Mercator projection : For the Northern Hemisphere, the contours should be used in their natural position as published, but for the Southern Hemisphere, the transparency should be inverted. This point should be carefully observed when following the boundaries of the areas which involve the transition of the equator.

55 19.7 Gnomonic projection : In the case of either the north or south polar areas, the transparency should be positioned so that the north-south line (terminated with an arrow) is parallel to the meridian of longitude, with the arrow pointing towards the pole.

~~6.~~ 20. Data for tracing interference contours
56

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3,0 et 3,5 MHz, jour - ELEMENTS POUR LE TRACE DES COURBES DE BROUILLAGE SUR 700 km

3.0 & 3.5 Mc/s, day - DATA FOR PLOTTING 700 km INTERFERENCE CONTOURS

3,0 y 3,5 Mc/s, día - DATOS PARA EL TRAZADO DE CURVAS DE INTERFERENCIA A 700 km

| Latitude | 00° | | 10° | | 20° | | 30° | | 40° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | N-S<br>6,3° | E-W<br>6,3° | | | N-S<br>6,3° | E-W<br>6,7° | | | N-S<br>6,3° | E-W<br>8,5° |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180,0 | 6,3 | 180,0 | 16,3 | 180,0 | 26,3 | 180,0 | 36,3 | 180.0 | 46,3 |
| | 178,9 | 6,2 | 173,9 | 16,2 | 178,8 | 26,2 | 178,6 | 36,2 | 178,4 | 46,2 |
| | 177,8 | 5,9 | 177,8 | 15,9 | 177,6 | 25,9 | 177,3 | 35,9 | 176,9 | 45,9 |
| | 176,8 | 5,5 | 176,7 | 15,4 | 176,5 | 25,4 | 176,1 | 35,4 | 175,5 | 45,4 |
| | 175,9 | 4,8 | 175,8 | 14,8 | 175,5 | 24,8 | 175,1 | 34,7 | 174,3 | 44,7 |
| | 175,2 | 4,0 | 175,0 | 14,0 | 174,7 | 24,0 | 174,2 | 33,9 | 173,3 | 43,9 |
| | 174,5 | 3,1 | 174,4 | 13,1 | 174,1 | 23,0 | 173,5 | 33,0 | 172,5 | 42,9 |
| | 174,1 | 2,2 | 173,9 | 12,1 | 173,6 | 22,0 | 173,0 | 32,0 | 172,0 | 41,9 |
| | 173,8 | 1,1 | 173,7 | 11,0 | 173,4 | 21,0 | 172,8 | 30,9 | 171,8 | 40,8 |
| | 173,7 | 0,0 | 173,6 | 9,9 | 173,3 | 19,9 | 172,7 | 29,8 | 171,8 | 39,7 |
| | 173,8 | -1,1 | 173,7 | 8,8 | 173,4 | 18,8 | 172,9 | 28,7 | 172,0 | 38,6 |
| | 174,1 | -2,2 | 174,0 | 7,8 | 173,8 | 17,7 | 173,3 | 27,7 | 172,5 | 37,6 |
| | 174,5 | -3,1 | 174,5 | 6,8 | 174,3 | 16,8 | 173,9 | 26,7 | 173,2 | 36,6 |
| | 175,2 | -4,0 | 175,2 | 5,9 | 175,0 | 15,9 | 174,6 | 25,8 | 174,1 | 35,8 |
| | 175,9 | -4,8 | 175,9 | 5,2 | 175,8 | 15,1 | 175,5 | 25,1 | 175,1 | 35,1 |
| | 176,8 | -5,5 | 176,8 | 4,5 | 176,8 | 14,5 | 176,5 | 24,5 | 176,2 | 34,5 |
| | 177,8 | -5,9 | 177,8 | 4,1 | 177,8 | 14,1 | 177,6 | 24,1 | 177,4 | 34,0 |
| | 178,9 | -6,2 | 178,9 | 3,8 | 178,9 | 13,8 | 178,8 | 23,8 | 178,7 | 33,8 |
| | 180,0 | -6,3 | 180,0 | 3,7 | 180,0 | 13,7 | 180,0 | 23,7 | 180,0 | 33,7 |

| Latitude | 50° | | 60° | | 70° | | 80° | | 90° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | | | N-S<br>6,3° | E-W<br>12,6° | | | | | | |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180,0 | 56,3 | 180,0 | 66,3 | 180,0 | 76,3 | 180,0 | 86,3 | Toutes longitudes<br>All Longitudes<br>Todas longitudes | 83,7 |
| | 178,0 | 56,2 | 177,3 | 66,2 | 175,4 | 76,2 | 163,9 | 86,1 | | 83,7 |
| | 176,2 | 55,9 | 174,7 | 65,8 | 171,2 | 75,8 | 152,2 | 85,4 | | 83,7 |
| | 174,5 | 55,3 | 172,5 | 65,3 | 167,7 | 75,1 | 145,2 | 84,5 | | 83,7 |
| | 173,0 | 54,6 | 170,6 | 64,5 | 164,9 | 74,3 | 141,9 | 83,4 | | 83,7 |
| | 171,8 | 53,8 | 169,1 | 63,6 | 162,9 | 73,4 | 140,8 | 82,4 | | 83,7 |
| | 171,0 | 52,8 | 168,1 | 62,7 | 161,6 | 72,3 | 141,3 | 81,3 | | 83,7 |
| | 170,4 | 51,8 | 167,5 | 61,6 | 161,3 | 71,2 | 142,8 | 80,2 | | 83,7 |
| | 170,2 | 50,7 | 167,3 | 60,5 | 161,5 | 70,1 | 144,9 | 79,2 | | 83,7 |
| | 170,3 | 49,6 | 167,5 | 59,4 | 162,1 | 69,1 | 147,6 | 78,2 | | 83,7 |
| | 170,6 | 48,5 | 168,1 | 58,3 | 163,2 | 68,0 | 150,5 | 77,3 | | 83,7 |
| | 171,2 | 47,5 | 169,0 | 57,4 | 164,6 | 67,1 | 153,8 | 76,5 | | 83,7 |
| | 172,1 | 46,6 | 170,1 | 56,4 | 166,4 | 65,2 | 157,3 | 75,8 | | 83,7 |
| | 173,1 | 45,7 | 171,4 | 55,6 | 168,3 | 65,5 | 160,8 | 75,2 | | 83,7 |
| | 174,3 | 45,0 | 172,9 | 55,0 | 170,4 | 64,9 | 164,6 | 74,6 | | 83,7 |
| | 175,6 | 44,5 | 174,6 | 54,4 | 172,7 | 64,4 | 168,4 | 74,2 | | 83,7 |
| | 177,0 | 44,0 | 176,3 | 54,0 | 175,1 | 64,0 | 172,2 | 73,9 | | 83,7 |
| | 178,5 | 43,8 | 178,2 | 53,8 | 177,5 | 63,8 | 176,1 | 73,8 | | 83,7 |
| | 180,0 | 43,7 | 180,0 | 53,7 | 180,0 | 63,7 | 180,0 | 73,7 | | 83,7 |

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3,0 MHz, nuit - ELEMENTS POUR LE TRACE DES COURBES DE BROUILLAGE SUR 3500 km

3,0 Mc/s night- DATA FOR PLOTTING 3500 km INTERFERENCE CONTOURS

3,0 Mc/s noche- DATOS PARA EL TRAZADO DE CURVAS DE INTERFERENCIA A 3500 km

| Latitude | 00° | | 10° | | 20° | | 30° | | 40° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N-S~~<br>31,5° | ~~E-W~~<br>31,5° | | | ~~N-S~~<br>31,5° | ~~E-W~~<br>33,6° | | | ~~N-S~~<br>31,5° | ~~E-W~~<br>41° |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180,0 | 31,5 | 180,0 | 41,5 | 180,0 | 51,5 | 180,0 | 61,5 | 180,0 | 71,5 |
| | 173,9 | 31,0 | 173,1 | 40,9 | 171,7 | 50,8 | 169,3 | 60,7 | 164,3 | 70,4 |
| | 168,2 | 29,4 | 166,7 | 39,2 | 164,2 | 48,9 | 160,1 | 58,4 | 152,1 | 67,5 |
| | 163,0 | 26,9 | 161,1 | 36,4 | 158,0 | 45,8 | 153,0 | 54,9 | 144,2 | 63,5 |
| | 158,5 | 23,6 | 156,4 | 32,8 | 153,2 | 41,9 | 148,0 | 50,6 | 139,7 | 58,7 |
| | 154,9 | 19,6 | 152,9 | 28,6 | 149,8 | 37,4 | 144,9 | 45,8 | 137,5 | 53,6 |
| | 152,0 | 15,1 | 150,3 | 23,9 | 147,6 | 32,5 | 143,3 | 40,7 | 137,0 | 48,4 |
| | 150,1 | 10,3 | 148,7 | 18,9 | 146,4 | 27,4 | 142,9 | 35,5 | 137,6 | 43,2 |
| | 148,9 | 5,2 | 148,0 | 13,7 | 146,3 | 22,1 | 143,4 | 30,3 | 139,1 | 38,1 |
| | 148,5 | 0,0 | 148,1 | 8,5 | 146,9 | 17,0 | 144,7 | 25,2 | 141,3 | 33,2 |
| | 148,9 | -5,2 | 149,0 | 3,4 | 148,3 | 11,9 | 146,7 | 20,9 | 144,1 | 28,6 |
| | 150,1 | -10,3 | 150,6 | -1,6 | 150,3 | 7,1 | 149,3 | 15,8 | 147,4 | 24,3 |
| | 152,0 | -15,1 | 152,9 | -6,3 | 153,1 | 2,6 | 152,5 | 11,5 | 151,1 | 20,4 |
| | 154,9 | -19,6 | 156,0 | -10,5 | 156,4 | -1,4 | 156,2 | 7,8 | 155,3 | 16,9 |
| | 158,5 | -23,6 | 159,7 | -14,2 | 160,3 | -4,8 | 160,3 | 4,6 | 159,8 | 14,0 |
| | 163,0 | -26,9 | 164,1 | -17,3 | 164,7 | -7,7 | 164,8 | 2,0 | 164,5 | 11,6 |
| | 168,2 | -29,4 | 169,1 | -19,6 | 169,6 | -9,8 | 169,7 | 0,1 | 169,5 | 9,9 |
| | 173,9 | -31,0 | 174,4 | -21,0 | 174,7 | -11,1 | 174,8 | -1,1 | 174,7 | 8,9 |
| | 180,0 | -31,5 | 180,0 | -21,5 | 180,0 | -11,5 | 180,0 | -1,5 | 180,0 | 8,5 |

| Latitude | 50° | | 60° | | 70° | | 80° | | 90° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N-S~~<br>31,5° | ~~E-W~~<br>49° | ~~N-S~~<br>31,5° | ~~E-W~~<br>64° | | | | | | |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180,0 | 81,5 | 0, | 88,5 | 0, | 78,5 | 0, | 68,5 | Toutes longitudes<br>All Longitudes<br>Todas longitudes | 58,5 |
| | 149,5 | 79,7 | 78,0 | 84,7 | 25,3 | 77,7 | 14,2 | 68,3 | | 58,5 |
| | 133,9 | 75,6 | 90,4 | 79,7 | 46,5 | 75,7 | 28,0 | 67,7 | | 58,5 |
| | 127,6 | 70,7 | 97,5 | 74,7 | 62,9 | 72,9 | 41,3 | 66,7 | | 58,5 |
| | 125,7 | 65,6 | 103,3 | 69,8 | 75,9 | 69,7 | 53,8 | 65,4 | | 58,5 |
| | 126,0 | 60,3 | 108,7 | 65,0 | 86,6 | 66,4 | 65,5 | 63,9 | | 58,5 |
| | 127,6 | 55,2 | 118,9 | 60,3 | 95,8 | 62,9 | 76,4 | 62,3 | | 58,5 |
| | 129,9 | 50,2 | 118,9 | 55,9 | 104,1 | 59,6 | 86,7 | 60,5 | | 58,5 |
| | 132,9 | 45,4 | 124,1 | 51,6 | 111,9 | 56,3 | 96,5 | 58,8 | | 58,5 |
| | 136,4 | 40,8 | 129,2 | 47,6 | 119,2 | 53,2 | 105,8 | 57,1 | | 58,5 |
| | 140,2 | 36,5 | 134,5 | 43,9 | 126,2 | 50,4 | 114,8 | 55,5 | | 58,5 |
| | 144,4 | 32,6 | 139,8 | 40,5 | 133,1 | 47,7 | 123,4 | 54,0 | | 58,5 |
| | 148,8 | 29,0 | 145,3 | 37,4 | 139,9 | 45,4 | 131,9 | 52,6 | | 58,5 |
| | 153,6 | 25,9 | 150,8 | 34,8 | 146,6 | 43,3 | 140,1 | 51,4 | | 58,5 |
| | 158,5 | 23,3 | 156,5 | 32,6 | 153,3 | 41,6 | 148,2 | 50,4 | | 58,5 |
| | 163,7 | 21,2 | 162,3 | 30,8 | 160,0 | 40,3 | 156,2 | 49,6 | | 58,5 |
| | 169,1 | 19,7 | 168,1 | 29,5 | 166,6 | 39,3 | 164,2 | 49,0 | | 58,5 |
| | 174,5 | 18,8 | 174,1 | 28,8 | 173,3 | 38,7 | 172,1 | 48,6 | | 58,5 |
| | 180,0 | 18,5 | 180,0 | 28,5 | 180,0 | 38,5 | 180,0 | 48,5 | | 58,5 |

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3,5 MHz, nuit - ELEMENTS POUR LE TRACE DES COURBES DE BROUILLAGE SUR 4000 km

3,5 Mc/s night - DATA FOR PLOTTING 4000 km INTERFERENCE CONTOURS

3,5 Mc/s noche - DATOS PARA EL TRAZADO DE CURVAS DE INTERFERENCIA A 4000 km

| Latitude | 00° | | 10° | | 20° | | 30° | | 40° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N-S~~<br>36° | ~~E-W~~<br>36° | | | ~~N-S~~<br>36° | ~~E-W~~<br>38° | | | ~~N-S~~<br>36° | ~~E-W~~<br>47° |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180,0 | 36,0 | 180,0 | 46,0 | 180,0 | 56,0 | 180,0 | 66,0 | 180,0 | 76,0 |
| | 172,8 | 35,4 | 171,7 | 45,3 | 169,7 | 55,1 | 166,1 | 64,9 | 157,6 | 74,5 |
| | 166,0 | 33,5 | 164,0 | 43,2 | 160,6 | 52,7 | 154,7 | 62,0 | 142,8 | 70,6 |
| | 160,0 | 30,6 | 157,5 | 39,9 | 153,4 | 49,0 | 146,6 | 57,7 | 134,9 | 65,5 |
| | 155,0 | 26,8 | 152,3 | 35,7 | 148,1 | 44,4 | 141,5 | 52,6 | 131,2 | 59,9 |
| | 150,9 | 22,2 | 148,4 | 30,8 | 144,5 | 39,2 | 138,7 | 47,0 | 129,9 | 54,0 |
| | 147,8 | 17,1 | 145,7 | 25,5 | 142,3 | 33,6 | 137,4 | 41,2 | 130,2 | 48,2 |
| | 145,7 | 11,6 | 144,1 | 19,8 | 141,4 | 27,7 | 137,4 | 35,4 | 131,6 | 42,4 |
| | 144,4 | 5,9 | 143,4 | 13,9 | 141,4 | 21,9 | 138,3 | 29,5 | 133,8 | 36,7 |
| | 144,0 | 0,0 | 143,6 | 8,1 | 142,3 | 16,1 | 140,0 | 23,9 | 136,5 | 31,3 |
| | 144,4 | -5,9 | 144,6 | 2,3 | 143,9 | 10,4 | 142,4 | 18,4 | 139,8 | 26,2 |
| | 145,7 | -11,6 | 146,4 | -3,3 | 146,3 | 5,0 | 145,4 | 13,3 | 143,6 | 21,5 |
| | 147,8 | -17,1 | 149,0 | -8,6 | 149,4 | 0,0 | 149,0 | 8,6 | 147,8 | 17,2 |
| | 150,9 | -22,2 | 152,4 | -13,4 | 153,1 | -4,5 | 153,2 | 4,4 | 152,4 | 13,3 |
| | 155,0 | -26,8 | 156,6 | -17,6 | 157,5 | -8,4 | 157,8 | 0,8 | 157,4 | 10,1 |
| | 160,0 | -30,6 | 161,6 | -21,2 | 162,5 | -11,6 | 162,9 | -2,1 | 162,8 | 7,5 |
| | 166,0 | -33,5 | 167,3 | -23,8 | 168,0 | -14,0 | 168,4 | -4,2 | 168,3 | 5,6 |
| | 172,8 | -35,4 | 173,5 | -25,4 | 173,9 | -15,5 | 174,1 | -5,6 | 174,1 | 4,4 |
| | 180,0 | -36,0 | 180,0 | -26,0 | 180,0 | -16,0 | 180,0 | -6,0 | 180,0 | 4,0 |

| Latitude | 50° | | 60° | | 70° | | 80° | | 90° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N-S~~<br>36° | ~~E-W~~<br>36° | ~~N-S~~<br>36° | ~~E-W~~<br>73° | | | | | | |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180,0 | 86,0 | 0, | 84,0 | 0, | 74,0 | 0, | 64,0 | Toutes longitudes<br>All longitudes<br>Todas longitudes | 54,0 |
| | 126,9 | 82,7 | 46,5 | 81,9 | 20,9 | 73,4 | 13,4 | 63,8 | | 54,0 |
| | 115,7 | 77,1 | 69,8 | 77,6 | 39,7 | 71,6 | 26,5 | 63,2 | | 54,0 |
| | 113,9 | 71,3 | 83,0 | 72,8 | 55,5 | 69,1 | 39,2 | 62,3 | | 54,0 |
| | 114,9 | 65,4 | 92,2 | 67,8 | 68,8 | 66,1 | 51,3 | 61,0 | | 54,0 |
| | 117,1 | 59,6 | 99,7 | 62,8 | 80,1 | 62,8 | 62,8 | 59,6 | | 54,0 |
| | 120,1 | 54,0 | 106,4 | 57,9 | 90,1 | 59,4 | 73,7 | 58,0 | | 54,0 |
| | 123,5 | 48,5 | 112,6 | 53,2 | 99,0 | 56,0 | 84,1 | 56,3 | | 54,0 |
| | 127,4 | 43,3 | 118,6 | 48,7 | 107,3 | 52,7 | 93,9 | 54,5 | | 54,0 |
| | 131,5 | 38,3 | 124,5 | 44,5 | 115,2 | 49,5 | 103,4 | 52,8 | | 54,0 |
| | 135,9 | 33,7 | 130,4 | 40,5 | 122,8 | 46,5 | 112,6 | 51,2 | | 54,0 |
| | 140,7 | 29,4 | 136,3 | 36,9 | 130,1 | 43,7 | 121,5 | 49,6 | | 54,0 |
| | 145,7 | 25,5 | 142,3 | 33,6 | 137,4 | 41,3 | 130,2 | 48,2 | | 54,0 |
| | 150,9 | 22,1 | 148,4 | 30,8 | 144,5 | 39,1 | 138,7 | 47,0 | | 54,0 |
| | 156,4 | 19,3 | 154,6 | 28,4 | 151,6 | 37,3 | 147,1 | 45,9 | | 54,0 |
| | 162,1 | 17,0 | 160,8 | 26,5 | 158,7 | 35,9 | 155,4 | 45,1 | | 54,0 |
| | 168,0 | 15,3 | 167,2 | 25,1 | 165,8 | 34,8 | 163,6 | 44,5 | | 54,0 |
| | 174,0 | 14,3 | 173,6 | 24,3 | 172,9 | 34,2 | 171,8 | 44,1 | | 54,0 |
| | 180,0 | 14,0 | 180,0 | 24,0 | 180,0 | 34,0 | 180,0 | 44,0 | | 54,0 |

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4,7 MHz, jour - ELEMENTS POUR LE TRACE DES COURBES DE BROUILLAGE SUR 1200 km
4,7 Mc/s day - DATA FOR PLOTTING 1200 km INTERFERENCE CONTOURS
4,7 Mc/s dfa - DATOS PARA EL TRAZADO DE CURVAS DE INTERFERENCIA A 1200 km

| Latitude | 00° | | 10° | | 20° | | 30° | | 40° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>Alcance de interferencia | -N.S.-<br>~~10.8°~~ | ~~E.W.~~<br>~~10.8°~~ | | | -N.S.-<br>~~10.8°~~ | -E.W.-<br>~~11.5°~~ | | | -N.S.-<br>~~10.8°~~ | -E.W.-<br>~~14°~~ |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180.0<br>178.1<br>176.3<br>174.6<br>173.0<br>171.7<br>170.6<br>169.8<br>169.4<br>169.2<br>169.4<br>169.8<br>170.6<br>171.7<br>173.0<br>174.6<br>176.3<br>178.1<br>180.0 | 10.8<br>10.6<br>10.1<br>9.3<br>8.3<br>6.9<br>5.4<br>3.7<br>1.9<br>0.0<br>-1.9<br>-3.7<br>-5.4<br>-6.9<br>-8.3<br>-9.3<br>-10.1<br>-10.6<br>-10.8 | 180.0<br>178.0<br>176.1<br>174.3<br>172.7<br>171.4<br>170.3<br>169.6<br>169.1<br>169.0<br>169.3<br>169.8<br>170.6<br>171.7<br>173.1<br>174.6<br>176.3<br>178.1<br>180.0 | 20.8<br>20.6<br>20.1<br>19.3<br>18.2<br>16.8<br>15.2<br>13.5<br>11.7<br>9.8<br>8.0<br>6.2<br>4.5<br>3.0<br>1.7<br>0.6<br>-0.2<br>-0.6<br>-0.8 | 180.0<br>177.8<br>175.8<br>173.8<br>172.2<br>170.3<br>169.7<br>168.9<br>168.6<br>168.5<br>168.8<br>169.4<br>170.4<br>171.5<br>172.9<br>174.5<br>176.3<br>178.1<br>180.0 | 30.8<br>30.6<br>30.1<br>29.2<br>28.1<br>26.7<br>25.1<br>23.3<br>21.5<br>19.6<br>17.8<br>16.0<br>14.4<br>12.9<br>11.6<br>10.6<br>9.8<br>9.4<br>9.2 | 180.0<br>177.5<br>175.2<br>173.1<br>171.2<br>169.7<br>168.6<br>167.9<br>167.5<br>167.6<br>168.0<br>168.7<br>169.8<br>171.0<br>172.6<br>174.3<br>176.1<br>178.0<br>180.0 | 40.8<br>40.6<br>40.1<br>39.2<br>38.0<br>36.5<br>34.9<br>33.1<br>31.3<br>29.4<br>27.6<br>25.8<br>24.2<br>22.8<br>21.5<br>20.5<br>19.8<br>19.3<br>19.2 | 180.0<br>177.1<br>174.3<br>171.8<br>169.7<br>168.0<br>166.8<br>166.1<br>165.8<br>166.0<br>166.6<br>167.5<br>168.7<br>170.2<br>171.9<br>173.8<br>175.8<br>177.9<br>180.0 | 50.8<br>50.6<br>50.0<br>49.1<br>47.8<br>46.4<br>44.7<br>42.9<br>41.0<br>39.2<br>37.3<br>35.6<br>34.0<br>32.6<br>31.4<br>30.5<br>29.8<br>29.3<br>29.2 |

| Latitude | 50° | | 60° | | 70° | | 80° | | 90° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | | | -N.S.-<br>~~10.8°~~ | -E.W.-<br>~~21.6°~~ | | | | | | |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180.0<br>176.2<br>172.6<br>169.5<br>167.0<br>165.1<br>163.8<br>163.2<br>163.1<br>163.5<br>164.3<br>165.5<br>167.0<br>168.3<br>170.3<br>172.9<br>175.8<br>177.6<br>180.0 | 60.8<br>60.6<br>60.0<br>59.0<br>57.6<br>56.1<br>54.4<br>52.5<br>50.7<br>48.8<br>47.0<br>45.3<br>43.3<br>42.5<br>41.3<br>40.4<br>39.7<br>39.3<br>39.2 | 180.0<br>174.4<br>169.3<br>165.0<br>161.8<br>159.6<br>158.4<br>158.0<br>158.3<br>159.1<br>160.4<br>162.1<br>164.2<br>166.4<br>168.9<br>171.6<br>174.3<br>177.1<br>180.0 | 70.8<br>70.6<br>69.8<br>68.7<br>67.3<br>65.6<br>63.8<br>62.0<br>60.1<br>58.3<br>56.6<br>54.9<br>53.5<br>52.2<br>51.2<br>50.3<br>49.7<br>49.3<br>49.2 | 180.0<br>168.7<br>159.4<br>152.9<br>149.1<br>147.2<br>146.8<br>147.4<br>148.9<br>150.8<br>153.3<br>156.0<br>159.1<br>162.3<br>165.7<br>169.1<br>172.7<br>176.3<br>180.0 | 80.8<br>80.5<br>79.5<br>78.1<br>76.4<br>74.6<br>72.8<br>70.9<br>69.1<br>67.4<br>65.8<br>64.3<br>63.0<br>61.9<br>60.9<br>60.2<br>59.6<br>59.3<br>59.2 | 0.<br>71.1<br>87.5<br>96.6<br>103.6<br>109.9<br>115.8<br>121.4<br>126.9<br>132.3<br>137.7<br>143.0<br>148.3<br>153.6<br>158.9<br>164.2<br>169.4<br>174.7<br>180.0 | 89.2<br>88.0<br>86.3<br>84.6<br>82.9<br>81.2<br>79.6<br>78.1<br>76.7<br>75.3<br>74.1<br>73.0<br>72.0<br>71.2<br>70.5<br>69.9<br>69.5<br>69.3<br>69.2 | Toutes longitudes<br>All Longitudes<br>Todas longitudes | 79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2<br>79.2 |

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4,7 MHz, nuit et 10,0 MHz, jour - ELEMENTS POUR LE TRACE DES COURBES DE BROUILLAGE SUR 5500 km

4.7 Mc/s night & 10.0 Mc/s day -- DATA FOR PLOTTING 5500 km INTERFERENCE CONTOURS

4,7 Mc/s noche y 10,0 Mc/s, día - DATOS PARA EL TRAZADO DE CURVAS DE INTERFERENCIA A 5500 km

| Latitude | 00° | | 10° | | 20° | | 30° | | 40° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N.S.~~ 50° | ~~E.W.~~ 50° | | | ~~N.S.~~ 50° | ~~E.W.~~ 53° | | | ~~N.S.~~ 50° | ~~E.W.~~ 65° |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180,0 | 49,5 | 180,0 | 59,5 | 180,0 | 69,5 | 180,0 | 79,5 | 178,7 | 89,5 |
| | 168,5 | 48,5 | 165,5 | 58,2 | 159,6 | 67,8 | 144,9 | 76,7 | 97,0 | 82,4 |
| | 158,2 | 45,6 | 153,2 | 54,7 | 144,6 | 63,3 | 128,3 | 70,7 | 98,4 | 74,8 |
| | 149,7 | 41,2 | 144,1 | 49,6 | 135,4 | 57,2 | 121,5 | 63,5 | 101,0 | 67,2 |
| | 143,0 | 35,6 | 137,8 | 43,3 | 130,1 | 50,3 | 119,0 | 56,0 | 104,1 | 59,7 |
| | 138,1 | 29,3 | 136,6 | 36,5 | 127,3 | 43,0 | 118,6 | 48,4 | 107,5 | 52,4 |
| | 134,6 | 22,3 | 131,1 | 29,2 | 126,1 | 35,4 | 119,5 | 40,8 | 111,0 | 45,1 |
| | 132,3 | 15,1 | 129,8 | 21,6 | 126,1 | 27,8 | 121,2 | 33,4 | 114,8 | 38,1 |
| | 130,9 | 7,6 | 129,5 | 14,1 | 127,0 | 20,3 | 123,5 | 26,0 | 118,9 | 31,2 |
| | 130,5 | 0,0 | 130,1 | 6,5 | 128,7 | 12,8 | 126,5 | 18,9 | 123,2 | 24,7 |
| | 130,9 | -7,6 | 131,5 | -1,0 | 131,2 | 5,6 | 130,0 | 12,1 | 127,9 | 18,4 |
| | 132,3 | -15,1 | 133,8 | -8,2 | 134,4 | -1,3 | 134,1 | 5,7 | 132,9 | 12,6 |
| | 134,6 | -22,3 | 137,0 | -15,2 | 138,3 | -7,8 | 138,8 | -0,3 | 138,4 | 7,3 |
| | 138,1 | -29,3 | 141,2 | -21,6 | 143,2 | -13,7 | 144,2 | -5,7 | 144,3 | 2,5 |
| | 143,0 | -35,6 | 146,6 | -27,4 | 148,9 | -19,0 | 150,2 | -10,4 | 150,7 | -1,6 |
| | 149,7 | -41,2 | 153,2 | -32,4 | 155,5 | -23,4 | 156,9 | -14,2 | 157,6 | -5,0 |
| | 158,2 | -45,6 | 161,2 | -36,2 | 163,1 | -26,7 | 164,2 | -17,1 | 164,8 | -7,5 |
| | 168,5 | -48,5 | 170,3 | -38,7 | 171,3 | -28,8 | 172,0 | -18,9 | 172,3 | -9,0 |
| | 180,0 | -49,5 | 180,0 | -39,5 | 180,0 | -29,5 | 180,0 | -19,5 | 180,0 | -9,5 |

| Latitude | 50° | | 60° | | 70° | | 80° | | 90° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N.S.~~ 50° | ~~E.W.~~ 77° | ~~N.S.~~ 50° | ~~E.W.~~ 100° | | | | | | |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 0, | 80,5 | 0, | 70,5 | 0, | 60,5 | 0, | 50,5 | Toutes longitudes<br>All Longitudes<br>Todas longitudes | 40,5 |
| | 40,2 | 78,2 | 22,2 | 69,5 | 15,3 | 60,0 | 11,9 | 50,3 | | 40,5 |
| | 63,5 | 73,1 | 41,5 | 66,9 | 30,1 | 58,7 | 23,8 | 49,8 | | 40,5 |
| | 77,1 | 67,0 | 57,1 | 63,1 | 43,8 | 56,7 | 35,4 | 48,9 | | 40,5 |
| | 86,6 | 60,7 | 69,8 | 58,6 | 56,4 | 54,0 | 46,7 | 47,8 | | 40,5 |
| | 94,2 | 54,3 | 80,4 | 53,8 | 67,8 | 51,0 | 57,7 | 46,4 | | 40,5 |
| | 100,8 | 47,9 | 89,6 | 48,8 | 78,4 | 47,8 | 68,3 | 44,9 | | 40,5 |
| | 107,0 | 41,7 | 97,9 | 43,8 | 88,2 | 44,4 | 78,7 | 43,2 | | 40,5 |
| | 112,9 | 35,6 | 105,7 | 38,9 | 97,5 | 41,0 | 88,7 | 41,5 | | 40,5 |
| | 118,8 | 29,8 | 113,1 | 34,2 | 106,3 | 37,6 | 98,4 | 39,8 | | 40,5 |
| | 124,7 | 24,4 | 120,4 | 29,8 | 114,8 | 34,4 | 108,0 | 38,1 | | 40,5 |
| | 130,8 | 19,3 | 127,6 | 25,6 | 123,1 | 31,4 | 117,3 | 36,5 | | 40,5 |
| | 137,1 | 14,7 | 134,8 | 21,9 | 131,3 | 28,7 | 126,5 | 35,0 | | 40,5 |
| | 143,7 | 10,6 | 142,1 | 18,5 | 139,5 | 26,3 | 135,6 | 33,7 | | 40,5 |
| | 150,5 | 7,1 | 149,5 | 15,7 | 147,6 | 24,3 | 144,5 | 32,6 | | 40,5 |
| | 157,6 | 4,3 | 157,0 | 13,5 | 155,7 | 22,6 | 153,5 | 31,7 | | 40,5 |
| | 164,9 | 2,2 | 164,6 | 11,8 | 163,8 | 21,5 | 162,3 | 31,0 | | 40,5 |
| | 172,4 | 0,9 | 172,3 | 10,8 | 171,9 | 20,7 | 171,2 | 30,6 | | 40,5 |
| | 180,0 | 0,5 | 180,0 | 10,5 | 180,0 | 20,5 | 180,0 | 30,5 | | 40,5 |

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5,6 MHz, jour - ELEMENTS POUR LE TRACE DES COURBES DE BROUILLAGE SUR 1500 km

5,6 Mc/s day - DATA FOR PLOTTING 1500 km INTERFERENCE CONTOURS

5,6 Mc/s dfa - DATOS PARA EL TRAZADO DE CURVAS DE INTERFERENCIA A 1500 km

| Latitude | 00° | | 10° | | 20° | | 30° | | 40° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N.S. 13.6°~~ | ~~E.W. 13.6°~~ | | | ~~N.S. 13.6°~~ | ~~E.W. 14.5°~~ | | | ~~N.S. 13.6°~~ | ~~E.W. 17.6°~~ |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| | 180,0 | 13,5 | 180,0 | 23,5 | 180,0 | 33,5 | 180,0 | 43,5 | 180,0 | 53,5 |
| | 177,6 | 13,3 | 177,5 | 23,3 | 177,2 | 33,3 | 176,8 | 43,3 | 176,1 | 53,2 |
| | 175,3 | 12,7 | 175,0 | 22,6 | 174,6 | 32,6 | 173,8 | 42,5 | 172,5 | 52,5 |
| | 173,2 | 11,7 | 172,8 | 21,6 | 172,1 | 31,5 | 171,0 | 41,4 | 169,3 | 51,3 |
| | 171,2 | 10,3 | 170,8 | 20,2 | 170,0 | 30,0 | 168,7 | 39,9 | 166,6 | 49,6 |
| | 169,6 | 8,6 | 169,1 | 18,5 | 168,3 | 28,3 | 166,9 | 38,0 | 164,6 | 47,7 |
| | 168,3 | 6,7 | 167,8 | 16,5 | 167,0 | 26,2 | 165,5 | 36,0 | 163,2 | 45,6 |
| | 167,3 | 4,6 | 166,9 | 14,3 | 166,1 | 24,1 | 164,7 | 33,7 | 162,4 | 43,3 |
| | 166,7 | 2,3 | 166,4 | 12,1 | 165,7 | 21,8 | 164,4 | 31,4 | 162,3 | 41,0 |
| | 166,5 | 0,0 | 166,3 | 9,7 | 165,7 | 19,4 | 164,5 | 29,1 | 162,6 | 38,7 |
| | 166,7 | - 2,3 | 166,6 | 7,4 | 166,1 | 17,1 | 165,1 | 26,8 | 163,4 | 36,4 |
| | 167,3 | - 4,6 | 167,3 | 5,2 | 166,9 | 14,9 | 166,0 | 24,6 | 164,6 | 34,3 |
| | 168,3 | - 6,7 | 168,3 | 3,1 | 168,0 | 12,9 | 167,3 | 22,6 | 166,1 | 32,4 |
| | 169,6 | - 8,6 | 169,7 | 1,2 | 169,5 | 11,0 | 169,0 | 20,9 | 168,0 | 30,7 |
| | 171,2 | -10,3 | 171,4 | -0,4 | 171,2 | 9,5 | 170,8 | 19,3 | 170,1 | 29,2 |
| | 173,2 | -11,7 | 173,3 | -1,7 | 173,2 | 8,2 | 172,9 | 18,1 | 172,4 | 28,0 |
| | 175,3 | -12,7 | 175,4 | -2,7 | 175,4 | 7,3 | 175,2 | 17,2 | 174,8 | 27,2 |
| | 177,6 | -13,3 | 177,7 | -3,3 | 177,7 | 6,7 | 177,6 | 16,7 | 177,4 | 26,7 |
| | 180,0 | -13,5 | 180,0 | -3,5 | 180,0 | 6,5 | 180,0 | 16,5 | 180,0 | 26,5 |

| Latitude | 50° | | 60° | | 70° | | 80° | | 90° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | | | ~~N.S. 13,6°~~ | ~~E.W. 27,2°~~ | | | | | | |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| | 180,0 | 63,5 | 180,0 | 73,5 | 180,0 | 83,5 | 0, | 86,5 | Toutes longitudes<br>All Longitudes<br>Todas longitudes | 76,5 |
| | 174,8 | 63,2 | 172,0 | 73,1 | 160,8 | 82,9 | 35,2 | 86,0 | | 76,5 |
| | 170,1 | 62,4 | 164,9 | 72,1 | 147,7 | 81,4 | 59,4 | 84,7 | | 76,5 |
| | 166,1 | 61,0 | 159,4 | 70,6 | 140,7 | 79,4 | 75,5 | 83,1 | | 76,5 |
| | 162,9 | 59,3 | 155,6 | 68,7 | 137,6 | 77,1 | 87,2 | 81,4 | | 76,5 |
| | 160,7 | 57,3 | 153,3 | 66,5 | 137,0 | 74,8 | 96,7 | 79,6 | | 76,5 |
| | 159,3 | 55,1 | 152,3 | 64,2 | 137,8 | 72,5 | 104,9 | 77,9 | | 76,5 |
| | 158,7 | 52,8 | 152,3 | 61,9 | 139,6 | 70,2 | 112,4 | 76,3 | | 76,5 |
| | 158,8 | 50,4 | 153,0 | 59,6 | 142,0 | 68,1 | 119,3 | 74,7 | | 76,5 |
| | 159,5 | 48,1 | 154,4 | 57,4 | 144,9 | 66,0 | 125,9 | 73,3 | | 76,5 |
| | 160,7 | 46,0 | 156,2 | 55,3 | 148,2 | 64,1 | 132,2 | 71,9 | | 76,5 |
| | 162,3 | 43,9 | 158,4 | 53,3 | 151,7 | 62,4 | 138,4 | 70,7 | | 76,5 |
| | 164,2 | 42,1 | 161,0 | 51,6 | 155,4 | 60,9 | 144,5 | 69,6 | | 76,5 |
| | 166,4 | 40,4 | 163,8 | 50,1 | 159,3 | 59,6 | 150,5 | 68,7 | | 76,5 |
| | 168,9 | 39,0 | 166,8 | 48,8 | 163,3 | 58,5 | 156,5 | 67,9 | | 76,5 |
| | 171,5 | 37,9 | 170,0 | 47,8 | 167,4 | 57,6 | 162,4 | 67,3 | | 76,5 |
| | 174,3 | 37,1 | 173,3 | 47,1 | 171,6 | 57,0 | 168,3 | 66,9 | | 76,5 |
| | 177,1 | 36,7 | 176,8 | 46,6 | 175,8 | 56,6 | 174,1 | 66,6 | | 76,5 |
| | 180,0 | 36,5 | 180,0 | 46,5 | 180,0 | 56,5 | 180,0 | 66,5 | | 76,5 |

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5,6 et 6,6 MHz, nuit - ELEMENTS POUR LE TRACE DES COURBES DE BROUILLAGE SUR 6500 km

5.6 & 6.6 Mc/s night - DATA FOR PLOTTING 6500 km INTERFERENCE CONTOURS

5,6 y 6,6 Mc/s día - DATOS PARA EL TRAZADO DE CURVAS DE INTERFERENCIA A 6500 km

| Latitude | 00° | | 10° | | 20° | | 30° | | 40° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N.S. 58Ω~~ | ~~E.W. 56Ω~~ | | | ~~N.S. 58Ω~~ | ~~E.W. 63Ω~~ | | | ~~N.S. 58Ω~~ | ~~E.W. 76Ω~~ |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180,0 | 58,5 | 180,0 | 68,5 | 180,0 | 78,5 | 180,0 | 88,5 | 0 | 81,5 |
| | 164,2 | 57,1 | 158,1 | 66,6 | 144,0 | 75,4 | 102,4 | 81,3 | 46,7 | 78,3 |
| | 150,8 | 53,2 | 142,2 | 61,6 | 126,6 | 68,7 | 100,1 | 72,8 | 68,5 | 71,7 |
| | 140,8 | 47,6 | 132,2 | 54,9 | 119,2 | 60,8 | 101,1 | 64,3 | 80,1 | 64,4 |
| | 133,6 | 40,8 | 126,2 | 47,2 | 116,0 | 52,4 | 102,9 | 55,8 | 88,0 | 56,7 |
| | 128,7 | 33,2 | 122,7 | 39,1 | 114,9 | 43,9 | 105,3 | 47,4 | 94,2 | 49,1 |
| | 125,3 | 25,2 | 120,8 | 30,7 | 115,1 | 35,4 | 108,0 | 39,1 | 99,7 | 41,5 |
| | 123,1 | 17,0 | 120,1 | 22,2 | 116,0 | 26,9 | 110,9 | 30,9 | 104,9 | 34,0 |
| | 121,9 | 8,5 | 120,2 | 13,7 | 117,7 | 18,5 | 114,3 | 22,9 | 110,0 | 26,7 |
| | 121,5 | 0,0 | 121,1 | 5,2 | 119,9 | 10,3 | 118,0 | 15,1 | 115,1 | 19,6 |
| | 121,9 | -8,5 | 122,8 | -3,2 | 122,8 | 2,3 | 122,1 | 7,6 | 120,5 | 12,9 |
| | 123,1 | -17,0 | 125,2 | -11,3 | 126,4 | -5,5 | 126,8 | 0,5 | 126,3 | 6,5 |
| | 125,3 | -25,2 | 128,6 | -19,2 | 130,8 | -12,8 | 132,0 | -6,2 | 132,4 | 0,5 |
| | 128,7 | -33,2 | 133,0 | -26,7 | 136,1 | -19,7 | 138,0 | -12,3 | 139,0 | -4,8 |
| | 133,6 | -40,8 | 138,9 | -33,5 | 142,5 | -25,8 | 144,9 | -17,7 | 146,2 | -9,5 |
| | 140,8 | -47,6 | 146,4 | -39,5 | 150,2 | -31,0 | 152,6 | -22,2 | 154,0 | -13,3 |
| | 150,8 | -53,2 | 156,0 | -44,3 | 159,1 | -35,0 | 161,1 | -25,6 | 162,3 | -16,1 |
| | 164,2 | -57,1 | 167,4 | -47,4 | 169,2 | -37,6 | 170,4 | -27,8 | 171,0 | -17,9 |
| | 180,0 | -58,5 | 180,0 | -48,5 | 180,0 | -38,5 | 180,0 | -28,5 | 180,0 | -18,5 |

| Latitude | 50° | | 60° | | 70° | | 80° | | 90° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N.S. 58Ω~~ | ~~E.W. 92Ω~~ | ~~N.S. 58Ω~~ | ~~E.W. 116Ω~~ | | | | | | |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 0 | 71,5 | 0 | 61,5 | 0 | 51,5 | 0 | 41,5 | Toutes longitudes<br>All Longitudes<br>Todas longitudes | 31,5 |
| | 25,7 | 70,1 | 17,6 | 60,7 | 13,6 | 51,1 | 11,4 | 41,3 | | 31,5 |
| | 46,4 | 66,2 | 34,0 | 58,6 | 26,9 | 49,9 | 22,7 | 40,8 | | 31,5 |
| | 61,7 | 61,0 | 43,4 | 55,3 | 39,6 | 48,0 | 33,8 | 40,0 | | 31,5 |
| | 73,3 | 55,1 | 61,0 | 51,2 | 51,6 | 45,6 | 44,8 | 38,9 | | 31,5 |
| | 82,7 | 48,8 | 71,9 | 46,6 | 62,8 | 42,7 | 55,5 | 37,6 | | 31,5 |
| | 90,7 | 42,4 | 81,7 | 41,7 | 73,9 | 39,6 | 66,0 | 36,1 | | 31,5 |
| | 98,0 | 36,0 | 90,6 | 36,7 | 83,2 | 36,2 | 76,2 | 34,4 | | 31,5 |
| | 104,8 | 29,7 | 99,0 | 31,8 | 92,7 | 32,8 | 86,2 | 32,7 | | 31,5 |
| | 111,6 | 23,6 | 107,0 | 26,9 | 101,8 | 29,4 | 96,1 | 31,0 | | 31,5 |
| | 115,1 | 17,8 | 114,9 | 22,2 | 110,7 | 26,1 | 105,7 | 29,3 | | 31,5 |
| | 124,9 | 12,3 | 122,7 | 17,9 | 119,5 | 23,0 | 115,3 | 27,6 | | 31,5 |
| | 131,8 | 7,3 | 130,5 | 13,8 | 128,1 | 20,2 | 124,7 | 26,1 | | 31,5 |
| | 139,2 | 2,7 | 138,4 | 10,3 | 136,7 | 17,7 | 134,0 | 24,9 | | 31,5 |
| | 146,8 | -1,1 | 146,5 | 7,2 | 145,3 | 15,5 | 143,3 | 23,6 | | 31,5 |
| | 154,7 | -4,3 | 154,7 | 4,8 | 154,0 | 13,8 | 152,5 | 22,7 | | 31,5 |
| | 162,9 | -6,6 | 163,0 | 3,0 | 162,6 | 12,5 | 161,7 | 22,1 | | 31,5 |
| | 171,4 | -8,0 | 171,5 | 1,9 | 171,3 | 11,8 | 170,8 | 21,6 | | 31,5 |
| | 180,0 | -8,5 | 180,0 | 1,5 | 180,0 | 11,5 | 180,0 | 21,5 | | 31,5 |

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6,6 MHz, jour - ELEMENTS POUR LE TRACE DES COURBES DE BROUILLAGE SUR 1900 km

6,6 Mc/s day - DATA FOR PLOTTING 1900 km INTERFERENCE CONTOURS

6,6 Mc/s dia - DATOS PARA EL TRAZADO DE CURVAS DE INTERFERENCIA A 1900 km

| Latitude | 00° | | 10° | | 20° | | 30° | | 40° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N.S.~~<br>~~17,2°~~ | ~~E.W.~~<br>~~17,2°~~ | | | ~~N.S.~~<br>~~17,2°~~ | ~~E.W.~~<br>~~18,3°~~ | | | ~~N.S.~~<br>~~17,2°~~ | ~~E.W.~~<br>~~22,4°~~ |
| | Long. | lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180,0<br>176,9<br>174,0<br>171,3<br>168,8<br>166,7<br>165,1<br>163,9<br>163,1<br>162,9<br>163,1<br>163,9<br>165,1<br>166,7<br>168,8<br>171,3<br>174,0<br>176,9<br>180,0 | 17,1<br>16,8<br>16,0<br>14,8<br>13,0<br>10,9<br>8,5<br>5,8<br>2,9<br>0,0<br>-2,9<br>-5,8<br>-8,5<br>-10,9<br>-13,0<br>-14,8<br>-16,0<br>-16,8<br>-17,1 | 180,0<br>176,7<br>173,6<br>170,7<br>168,2<br>166,1<br>164,5<br>163,3<br>162,7<br>162,7<br>163,1<br>163,9<br>165,2<br>167,0<br>169,1<br>171,5<br>174,2<br>177,1<br>180,0 | 27,1<br>26,8<br>26,0<br>24,6<br>22,8<br>20,6<br>18,1<br>15,4<br>12,5<br>9,6<br>6,6<br>3,8<br>1,2<br>-1,2<br>-3,2<br>-4,9<br>-6,1<br>-6,8<br>-7,1 | 180,0<br>176,3<br>172,9<br>169,7<br>167,0<br>164,9<br>163,3<br>162,3<br>161,8<br>161,9<br>162,4<br>163,5<br>165,0<br>166,8<br>169,0<br>171,5<br>174,2<br>177,1<br>180,0 | 37,1<br>36,8<br>35,9<br>34,5<br>32,6<br>30,3<br>27,7<br>24,9<br>22,0<br>19,1<br>16,2<br>13,4<br>10,9<br>8,6<br>6,6<br>5,0<br>3,9<br>3,1<br>2,9 | 180,0<br>175,7<br>171,7<br>168,1<br>165,2<br>162,9<br>161,3<br>160,4<br>160,2<br>160,4<br>161,3<br>162,5<br>164,2<br>166,3<br>168,6<br>171,2<br>174,1<br>177,0<br>180,0 | 47,1<br>46,8<br>45,8<br>44,3<br>42,3<br>39,9<br>37,2<br>34,4<br>31,5<br>28,5<br>25,7<br>23,0<br>20,5<br>18,3<br>16,4<br>14,9<br>13,8<br>13,1<br>12,9 | 180,0<br>174,7<br>169,7<br>165,5<br>162,2<br>159,8<br>158,2<br>157,5<br>157,5<br>158,1<br>159,3<br>160,9<br>162,9<br>165,2<br>167,8<br>170,7<br>173,7<br>176,8<br>180,0 | 57,1<br>56,7<br>55,7<br>54,0<br>51,9<br>49,4<br>46,6<br>43,7<br>40,8<br>37,9<br>35,1<br>32,5<br>30,1<br>28,0<br>26,2<br>24,8<br>23,7<br>23,1<br>22,9 |

| Latitude | 50° | | 60° | | 70° | | 80° | | 90° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | | | ~~N.S.~~<br>~~17,2°~~ | ~~E.W.~~<br>~~34,4°~~ | | | | | | |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le trace des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180,0<br>172,6<br>166,0<br>160,7<br>156,8<br>154,4<br>153,1<br>152,8<br>153,3<br>154,4<br>156,1<br>158,2<br>160,7<br>163,5<br>166,5<br>169,7<br>173,1<br>176,5<br>180,0 | 67,1<br>66,7<br>65,5<br>63,6<br>61,3<br>58,6<br>55,8<br>52,8<br>49,9<br>47,1<br>44,4<br>41,9<br>39,6<br>37,6<br>36,0<br>34,6<br>33,7<br>33,1<br>32,9 | 180,0<br>167,3<br>157,1<br>150,3<br>146,2<br>144,4<br>144,0<br>144,7<br>146,3<br>148,4<br>151,0<br>153,9<br>157,2<br>160,7<br>164,3<br>168,1<br>172,0<br>176,0<br>180,0 | 77,1<br>76,5<br>75,0<br>72,8<br>70,1<br>67,3<br>64,3<br>61,4<br>58,6<br>55,9<br>53,3<br>51,0<br>49,0<br>47,2<br>45,7<br>44,5<br>43,6<br>43,1<br>42,9 | 180,0<br>137,0<br>123,8<br>120,8<br>121,4<br>123,5<br>126,5<br>130,1<br>133,9<br>138,0<br>142,3<br>146,7<br>151,3<br>155,9<br>160,7<br>165,4<br>170,3<br>175,1<br>180,0 | 87,1<br>85,7<br>83,1<br>80,1<br>77,2<br>74,3<br>71,5<br>68,8<br>66,3<br>63,9<br>61,7<br>59,7<br>58,0<br>56,5<br>55,2<br>54,2<br>53,5<br>53,0<br>52,9 | 0,<br>23,2<br>43,5<br>60,0<br>73,5<br>84,9<br>94,8<br>103,6<br>111,8<br>119,4<br>126,8<br>133,8<br>140,7<br>147,4<br>154,0<br>160,6<br>167,1<br>173,5<br>180,0 | 82,9<br>82,5<br>81,6<br>80,2<br>78,6<br>76,9<br>75,2<br>73,5<br>71,8<br>70,3<br>68,8<br>67,5<br>66,3<br>65,3<br>64,4<br>63,8<br>63,3<br>63,0<br>62,9 | Toutes longitudes<br>All Longitudes<br>Todas Longitudes | 72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9<br>72,9 |

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9,0 MHz, jour - ELEMENTS POUR LE TRACE DES COURBES DE BROUILLAGE SUR 3800 km

9.0 Mc/s day - DATA FOR PLOTTING 3800 km INTERFERENCE CONTOURS

9,0 Mc/s dia - DATOS PARA EL TRAZADO DE CURVAS DE INTERFERENCIA A 3800 km

| Latitude | 00° | | 10° | | 20° | | 30° | | 40° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N-S~~<br>~~34.3°~~ | ~~E-W~~<br>~~34.3°~~ | | | ~~N-S~~<br>~~34.3°~~ | ~~E-W~~<br>~~36.5°~~ | | | ~~N-S~~<br>~~34.3°~~ | ~~E-W~~<br>~~44.8°~~ |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| | 180.0 | 34.2 | 180.0 | 44.2 | 180.0 | 54.2 | 180.0 | 64.2 | 180.0 | 74.2 |
| | 173.3 | 33.6 | 172.3 | 43.5 | 170.6 | 53.4 | 167.5 | 63.2 | 160.6 | 72.9 |
| | 166.9 | 31.9 | 165.1 | 41.6 | 162.1 | 51.2 | 157.0 | 60.6 | 146.8 | 69.4 |
| | 161.2 | 29.1 | 158.9 | 38.5 | 155.3 | 47.8 | 149.3 | 56.6 | 138.8 | 64.8 |
| | 156.4 | 25.5 | 154.0 | 34.6 | 150.2 | 43.4 | 144.2 | 51.9 | 134.6 | 59.5 |
| | 152.5 | 21.2 | 150.2 | 30.0 | 146.6 | 38.5 | 141.2 | 46.6 | 133.0 | 53.9 |
| | 149.5 | 16.3 | 147.6 | 24.9 | 144.4 | 33.2 | 139.8 | 41.1 | 132.9 | 48.3 |
| | 147.4 | 11.1 | 145.9 | 119.4 | 143.4 | 27.6 | 139.6 | 35.5 | 134.0 | 42.8 |
| | 146.2 | 5.6 | 145.2 | 13.9 | 143.3 | 22.0 | 140.3 | 29.9 | 135.9 | 37.3 |
| | 145.8 | 0.0 | 145.4 | 8.3 | 144.1 | 16.4 | 141.9 | 24.4 | 138.4 | 32.1 |
| | 146.2 | -5.6 | 146.3 | 2.7 | 145.7 | 11.0 | 144.1 | 19.2 | 141.5 | 27.2 |
| | 147.4 | -11.1 | 148.1 | --2.6 | 147.9 | 5.9 | 147.0 | 14.3 | 145.1 | 22.6 |
| | 149.5 | -16.3 | 150.6 | -7.7 | 150.9 | 1.1 | 150.4 | 9.8 | 149.1 | 18.4 |
| | 152.5 | -21.2 | 153.9 | -12.3 | 154.5 | -3.2 | 154.4 | 5.8 | 153.6 | 14.8 |
| | 156.4 | -25.5 | 157.9 | -16.3 | 158.7 | -7.0 | 158.8 | 2.3 | 158.4 | 11.6 |
| | 161.2 | -29.1 | 162.6 | -19.6 | 163.4 | -10.1 | 163.7 | -0.5 | 163.5 | 9.1 |
| | 166.9 | -31.9 | 168.0 | -22.1 | 168.7 | -12.3 | 168.9 | -2.5 | 168.8 | 7.3 |
| | 173.3 | -33.6 | 173.9 | -23.7 | 174.2 | -13.7 | 174.4 | -3.8 | 174.4 | 6.2 |
| | 180.0 | -34.2 | 180.0 | -24.2 | 180.0 | -14.2 | 180.0 | -4.2 | 180.0 | 5.8 |

| Latitude | 50° | | 60° | | 70° | | 80° | | 90° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N-S~~<br>34.3° | ~~E-W~~<br>53.5° | ~~N-S~~<br>34.3° | ~~E-W~~<br>69° | | | | | | |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| | 180.0 | 34.2 | 0. | 85.8 | 0. | 75.8 | 0. | 65.8 | All Longitudes | 55.8 |
| | 137.8 | 81.6 | 56.0 | 83.2 | 22.4 | 75.1 | 13.7 | 65.6 | | 55.8 |
| | 123.5 | 76.7 | 77.1 | 73.6 | 42.0 | 73.3 | 27.0 | 65.0 | | 55.8 |
| | 119.5 | 71.2 | 88.4 | 73.7 | 58.2 | 70.7 | 39.9 | 64.0 | | 55.8 |
| | 119.2 | 65.6 | 96.4 | 68.7 | 71.4 | 67.6 | 52.2 | 62.8 | | 55.8 |
| | 120.6 | 60.0 | 103.2 | 63.8 | 82.5 | 64.3 | 63.8 | 61.3 | | 55.8 |
| | 123.0 | 54.5 | 109.3 | 59.0 | 92.2 | 60.8 | 74.7 | 59.7 | | 55.8 |
| | 126.0 | 49.2 | 115.1 | 54.3 | 101.0 | 57.5 | 85.1 | 58.0 | | 55.8 |
| | 129.5 | 44.1 | 120.7 | 49.9 | 109.1 | 54.2 | 94.9 | 56.2 | | 55.8 |
| | 133.4 | 39.3 | 126.3 | 45.7 | 116.7 | 51.0 | 104.3 | 54.5 | | 55.8 |
| | 137.6 | 34.8 | 132.0 | 41.9 | 124.1 | 48.1 | 113.4 | 52.9 | | 55.8 |
| | 142.1 | 30.7 | 137.7 | 38.3 | 131.3 | 45.4 | 122.2 | 51.4 | | 55.8 |
| | 146.9 | 26.9 | 143.5 | 35.2 | 138.3 | 42.9 | 130.8 | 50.0 | | 55.8 |
| | 152.0 | 23.7 | 149.3 | 32.4 | 145.3 | 40.8 | 139.2 | 48.7 | | 55.8 |
| | 157.2 | 20.9 | 155.3 | 30.1 | 152.3 | 39.0 | 147.5 | 47.7 | | 55.8 |
| | 162.7 | 13.7 | 161.4 | 28.2 | 159.2 | 37.6 | 155.7 | 46.9 | | 55.8 |
| | 168.4 | 17.1 | 167.6 | 26.9 | 166.1 | 36.6 | 163.8 | 46.3 | | 55.8 |
| | 174.2 | 16.1 | 173.3 | 26.1 | 173.1 | 36.0 | 171.9 | 45.9 | | 55.8 |
| | 180.0 | 15.8 | 180.0 | 25.8 | 180.0 | 35.8 | 180.0 | 45.8 | | 55.8 |

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11,3 MHz, jour - ELEMENTS POUR LE TRACE DES COURBES DE BROUILLAGE SUR 6000 km

11,3 Mc/s day - DATA FOR PLOTTING 6000 km INTERFERENCE CONTOURS

11,3 Mc/s dfa - DATOS PARA EL TRAZADO DE CURVAS DE INTERFERENCIA A 6000 km

| Latitude | 00° | | 10° | | 20° | | 30° | | 40° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N-S~~<br>~~54°~~ | ~~E-W~~<br>~~54°~~ | | | ~~N-S~~<br>~~54°~~ | ~~E-W~~<br>~~58°~~ | | | ~~N-S~~<br>~~54°~~ | ~~E-W~~<br>~~71°~~ |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 180,0<br>166,6<br>154,8<br>145,5<br>138,5<br>133,5<br>130,0<br>127,7<br>126,4<br>126,0<br>126,4<br>127,7<br>130,0<br>133,5<br>138,5<br>145,5<br>154,8<br>166,6<br>180,0 | 54,0<br>52,3<br>49,5<br>44,5<br>39,3<br>31,3<br>23,9<br>16,1<br>8,1<br>0,0<br>- 8,1<br>-16,1<br>-23,9<br>-31,3<br>-38,3<br>-44,5<br>-49,5<br>-52,8<br>-54,0 | 180,0<br>162,3<br>148,2<br>138,5<br>132,2<br>128,2<br>126,0<br>124,9<br>124,8<br>125,6<br>127,1<br>129,5<br>132,8<br>137,2<br>142,9<br>150,0<br>158,7<br>163,9<br>180,0 | 64,0<br>62,5<br>58,3<br>52,4<br>45,4<br>37,9<br>30,0<br>22,0<br>13,9<br>5,9<br>- 2,1<br>- 9,8<br>-17,2<br>-24,2<br>-30,5<br>-36,0<br>-40,3<br>-43,0<br>-44,0 | 180,0<br>153,3<br>136,6<br>127,7<br>123,2<br>121,1<br>120,6<br>121,1<br>122,3<br>124,3<br>127,0<br>130,4<br>134,6<br>139,7<br>145,8<br>152,9<br>161,2<br>170,3<br>180,0 | 74,0<br>71,9<br>66,3<br>59,3<br>51,6<br>43,6<br>35,5<br>27,5<br>19,5<br>11,6<br>4,0<br>- 3,4<br>-10,3<br>-16,7<br>-22,4<br>-27,2<br>-30,9<br>-33,2<br>-34,0 | 180,0<br>128,2<br>115,0<br>111,4<br>111,0<br>111,9<br>113,6<br>116,0<br>118,8<br>122,2<br>126,0<br>130,4<br>135,4<br>141,1<br>147,6<br>154,8<br>162,7<br>171,2<br>180,0 | 84,0<br>79,7<br>72,2<br>64,2<br>58,2<br>48,1<br>40,1<br>32,2<br>24,6<br>17,1<br>9,9<br>3,1<br>- 3,2<br>- 9,0<br>-14,1<br>-18,2<br>-21,4<br>-23,3<br>-24,0 | 0<br>66,2<br>82,1<br>90,0<br>95,7<br>100,6<br>105,2<br>109,7<br>114,3<br>119,1<br>124,2<br>129,6<br>135,4<br>141,7<br>148,5<br>155,8<br>163,6<br>171,7<br>180,0 | 86,0<br>81,2<br>73,8<br>66,1<br>58,5<br>50,9<br>43,4<br>36,1<br>29,0<br>22,2<br>15,7<br>9,5<br>3,9<br>- 1,2<br>- 5,6<br>- 9,1<br>-11,8<br>-13,4<br>-14,0 |

| Latitude | 50° | | 60° | | 70° | | 80° | | 90° | |
|---|---|---|---|---|---|---|---|---|---|---|
| ~~Portée de brouillage~~<br>~~Interference Range~~<br>~~Alcance de interferencia~~ | ~~N-S~~<br>~~54°~~ | ~~E-W~~<br>~~85°~~ | ~~N-S~~<br>~~54°~~ | ~~E-W~~<br>~~100°~~ | | | | | | |
| | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. | Long. | Lat. |
| Coordonnées pour le tracé des courbes<br>Coordinates for plotting of contours<br>Coordenadas para el trazado de las curvas | 0<br>31,1<br>53,5<br>68,6<br>79,4<br>88,1<br>95,5<br>102,3<br>108,7<br>115,0<br>121,4<br>127,8<br>134,5<br>141,4<br>148,6<br>156,1<br>163,9<br>171,0<br>180,0 | 75,0<br>74,2<br>69,9<br>64,2<br>58,1<br>51,7<br>45,3<br>38,9<br>32,7<br>26,3<br>21,1<br>15,8<br>11,0<br>6,7<br>3,0<br>- 0,0<br>- 2,2<br>- 3,5<br>- 4,0 | 0<br>19,5<br>37,2<br>52,3<br>65,0<br>75,8<br>85,4<br>94,1<br>102,2<br>110,0<br>117,5<br>125,1<br>132,6<br>140,2<br>148,0<br>155,8<br>163,8<br>171,9<br>180,0 | 66,0<br>65,1<br>62,8<br>59,2<br>55,0<br>50,3<br>45,3<br>40,3<br>35,4<br>30,6<br>26,0<br>21,8<br>17,9<br>14,4<br>11,5<br>9,1<br>7,4<br>6,4<br>6,0 | 0<br>14,4<br>28,3<br>41,5<br>53,7<br>65,1<br>75,7<br>85,6<br>95,0<br>104,0<br>112,7<br>121,2<br>129,7<br>138,1<br>146,4<br>154,8<br>163,2<br>171,6<br>180,0 | 56,0<br>55,6<br>54,3<br>52,4<br>49,8<br>46,9<br>43,7<br>40,3<br>36,9<br>33,5<br>30,3<br>27,2<br>24,5<br>22,0<br>19,9<br>18,2<br>17,0<br>16,3<br>16,0 | 0<br>11,6<br>23,2<br>34,5<br>45,7<br>56,5<br>67,1<br>77,4<br>87,4<br>97,2<br>106,8<br>115,2<br>125,5<br>134,7<br>143,9<br>152,9<br>162,0<br>171,0<br>180,0 | 46,0<br>45,8<br>45,3<br>44,5<br>43,4<br>42,0<br>40,5<br>38,3<br>37,1<br>35,4<br>33,7<br>32,1<br>30,6<br>29,2<br>23,1<br>27,2<br>26,5<br>26,1<br>26,0 | Toutes longitudes<br>All longitudes<br>Todas longitudes | 36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0<br>36,0 |

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COMMENT : In the Tables of Data for Tracing Interference Contours appearing on pages 27 through 45 of these U.S.A. proposals it was, of course, necessary to compute, for each of the megacycle orders, new geographic coordinates for latitudes north of 60°N and south of 60°S, - using as the basis the same interference range distances as that contained in Appendix 26 for latitudes between 60°N and 60°S.

In the process of completing those computations, which were done on the computer at the Central Radio Propagation Laboratory, it was noted that new and more detailed data - than that appearing on pages 11 through 14 of Appendix 26 - could easily be provided for each megacycle order and that those new data would substantially simplify the application of that data in preparing new charts (see paragraph 17.1, above) for other scales or projections.

In view of the advantages - and lack of apparent disadvantages - complete new data has been prepared covering 90°N to 90°S, for each of the megacycle orders, which the U.S.A. proposes to replace with the data now appearing on pages 11 through 14 of Appendix 26.

It will be noted the column headings relating to "Interference Range" have been deleted. All of the information contained in these headings has been included in each of the Tables making its repetition unnecessary.

~~C.--Radiated Powers~~

57 21. Unless otherwise indicated in Parts II, ~~and IV~~, the peak envelope power supplied to the antenna transmission line is assumed to be ~~the following~~ : in accordance with the following :

| Class of Emission | Stations | Peak Envelope Power | |
|---|---|---|---|
| | | Stations using nondirectional antennas | Stations using directional antennas |
| A1 | ~~Land~~ Aeronautical Stations | 1 kW | 2.5 kW |
| | Aircraft Stations | 50 W | 150 W |
| A3, A3H (100% modulated) | ~~Land~~ Aeronautical Stations | 4 kW | 10 kW |
| | Aircraft Stations | 200 W | 600 W |

Reason: To provide for a more accurate description of power and to make the Table consistent with actual practice where directional antennas are used.

58 21.1 For the purpose of indicating mean power for notification of A3H emission used in the aeronautical mobile (R) service, mean power will be considered equal to 0.500 peak envelope power, based on a single periodic sine-wave oscillation modulating an emission at 100%.

Reason: To provide for the conversion of peak envelope power to mean power for notification of power to the International Frequency Registration Board.

PROPOSAL No. 3 :

(With reference to : Part II, Section I of Appendix 26, entitled "Plan for the Allotment of Frequencies for the Aeronautical Mobile (R) Service in the Exclusive Bands between 2850 and 17970 kc/s).

That amendment of the provisions describing boundaries of MWARA's and RDARA's appearing in Part II, Section I, pages 16 through 29 of Appendix 26 to the Radio Regulations, Geneva-1959, is appropriate to the main session of the Aeronautical EARC, January-1965, and should not be undertaken by the first session of the Aeronautical EARC, 10 February, 1964.

Reason: The actual boundaries of MWARA's and RDARA's must be determined on the basis of routes actually flown by the world's civil aircraft. One of the tasks to be performed of the I.T.U. Aeronautical EARC, Geneva-10 February, 1964, will be that of preparation of a form for distribution to Members of I.T.U. seeking specific information as to aircraft operations conducted by each administration. Upon receipt and appropriate processing of that information specific information will be available on air routes to be included in each of the MWARA's and RDARA's. Since that information on aircraft operation statistics will be considered by the I.T.U. Aeronautical EARC, January-1965, it would be premature to attempt revision of the present provisions appearing on pages 16 through 29 inclusive, of Appendix 26 to the Radio Regulations, Geneva-1959.

Article 2

Frequency Allotment Plan
(per numerical order of frequencies)

22 General Notes :

1) Class of stations: FA

Types of emission: ~~A1, A2, A3, A4 and F1~~

Permissible types of emission and their conditions of use are specified in No. 11.

Power (unless otherwise indicated) :

~~A1 emissions :~~

~~Ground station~~ ~~1.0 kilowatt radiated (peak),~~

~~Aircraft~~ ~~50 watts radiated (peak)~~

~~A3 emissions :~~

~~Ground station~~ ~~4.0 kilowatts radiated (peak),~~
~~100% modulated,~~
~~200 watts radiated (peak),~~
~~100% modulated~~

Permissible powers for aeronautical and aircraft stations are contained in No. 21.

Reason: To bring the above provisions in conformity with changes made in the relevant provisions concerning emission and power.
Hours: H 24, unless otherwise indicated.

2) A frequency allotted on "day-time basis" may be used on a secondary basis during the period one hour after sunrise to one hour before sunset when the identical channel is allotted on a primary basis to Major World Air Route Areas Regional and Domestic Air Route Areas, or Sub-Regional and Domestic Air Route Areas which receive full protection during the twenty-four hours.

The use of frequencies on a secondary basis is subject to there being no interference with the primary allotment.

3) A "shared channel" is a channel allotted in common to adjacent areas within interference distance of each other and its use is subject to agreement between the administrations concerned.

/ Amend the particulars of use of 3023.5 kc/s, appearing on page 38 of Appendix 26, as follows / :

| Frequency kc/s<br>1 | Authorized area of use<br>2 | Remarks<br>3 |
|---|---|---|
| 3023.5 | World-wide. | Authorized for world-wide use for the (R) and (OR) services as follows:<br>1) aboard aircraft for:<br>a) communications with approach and aerodrome control;<br>b) communication with an aeronautical station when other frequencies of the station are either unavailable or unknown;<br>2) at aeronautical stations for aerodrome and approach control under the following conditions:<br>a) for approach control with power limited to a value that will produce 20 μV/m at 100 km and in any case no more than 20 watts in the antenna circuit,<br>b) for aerodrome control with the power limited to a value that will produce 20 μV/m at 40 km and in any case no more than 20 watts in the antenna circuit,<br>c) special attention must be given in each case to the type of antenna used in order to avoid harmful interference,<br>d) the power of aeronautical stations which use this frequency and which operate under the conditions prescribed above may be increased through I.T.U. and/or I.C.A.O. regional agreements to the extent necessary to meet certain operational requirements;<br>3) for intercommunication between ~~mobile~~ stations in the mobile service engaged in co-ordinated search and rescue operations at the scene of the disaster;<br>4) the specific application of this frequency for the above purposes may be decided at regional aeronautical conferences;<br>5) This channel may be used for A1 or A3 emission in accordance with special arrangements. It shall not be subdivided. |

Reason: To more accurately express the conditions of use of 3023.5 kc/s by stations engaged in coordinated search and rescue operations at the scene of the disaster.

/ Amend the particulars of use of 5680 kc/s, appearing on page 41 of Appendix 26, as follows /:

| Frequency kc/s 1 | Authorized area of use 2 | Remarks 3 |
|---|---|---|
| 5664 | MWARA: 2,3,4A, 7D,9,10D,12C, 13E. | 2 and 3 : common channel |
| 5671.5 | RDARA: FE1,NA. | |
| 5680 | World-wide | Authorized for world-wide use for the (R) and (OR) services as follows:<br>1) aboard aircraft for:<br>a) communications with approach and aerodrome control,<br>b) communication with an aeronautical station when other frequencies of the station are either unavailable or unknown;<br>2) at aeronautical stations for aerodrome and approach control under the following conditions:<br>a) for approach control with power limited to a value that will produce 20 µV/m at 100 km and in any case no more than 20 watts in the antenna circuit,<br>b) for aerodrome control with the power limited to a value that will produce 20 µV/m at 40 km and in any case no more than 20 watts in the antenna circuit,<br>c) special attention must be given in each case to the type of antenna used in order to avoid harmful interference,<br>d) the power of aeronautical stations which use this frequency and which operate under the conditions prescribed above may be increased through I.T.U. and/or I.C.A.O. regional agreements to the extent necessary to meet certain operational requirements;<br>3) for intercommunication between ~~mobile~~ stations <u>in the mobile service engaged</u> in co-ordinated search and rescue operations at the scene of the disaster;<br>4) the specific application of this frequency for the above purposes may be decided at regional aeronautical conferences;<br>5) this channel may be used for A1 or A3 emissions, in accordance with special arrangements. It shall not be subdivided. |

**Reason:** To more accurately express the conditions of use of 5680 kc/s by stations engaged in coordinated search and rescue operations at the scene of the disaster.

# P A R T II

## U. S. PROPOSALS FOR AMENDMENT OF APPENDIX 26

## CONCERNING (R) ALLOTMENTS FOR

## METEOROLOGICAL BROADCASTING

## TO AIRCRAFT

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PROPOSAL No. 4 :

That in the revision of Appendix 26 provision be continued for the allotment of one family of frequencies for meteorological broadcast to aircraft in the area "Atlantic-MET" and, further, that a higher megacycle order frequency in the 13260-13360 Mc/s (R) band be added to the present complement of frequencies.

Reason : To bring the revised (R) allotment plan into accord with current operational requirements under which the routinely broadcast weather information would be available to aircraft at distances beyond the normal propagation range of frequencies of the order of 8 Mc/s.

PROPOSAL No. 5 :

That in the revision of Appendix 26 provision be continued for the allotment of one family of frequencies for meteorological broadcast to aircraft in the area "Pacific-MET" and, further, that a higher megacycle order frequency in either the 11275-11400 or 13260-13360 Mc/s (R) bands, with preference to the latter, be added to the present complement of frequencies.

Reason : To bring the revised (R) allotment plan into accord with current operational requirements under which the routinely broadcast weather information would be available to aircraft at distances beyond the normal propagation range of frequencies of the order of 8 Mc/s.

PROPOSAL No. 6 :

That in the revision of Appendix 26 provision be included for the allotment of one family of frequencies for meteorological broadcast to aircraft in that portion of MWARA's NSA-1 and NSA-2 which, generally defined, corresponds to the continent of Africa; that this family of frequencies be designated "African-MET"; and that this family of frequencies include one frequency each from the following (R) bands : 3400-3500, 5480-5680, and 8815-8965 kc/s.

Reason : To more adequately meet the operational requirements of international civil aviation in that area.

PROPOSAL No. 7 :

That in the revision of Appendix 26 provision be included for the allotment of one family of frequencies for meteorological broadcast to aircraft in the geographical area of south-eastern Asia which, generally defined, corresponds to MWARA FE-1; that this family of frequencies be designated "South-east Asia-MET"; and that this family of frequencies include one frequency each from the following (R) bands : 3400-3500, 5480-5680, and 8815-8965 kc/s.

Reason : To more adequately meet the operational requirements of international civil aviation in that area.

PROPOSAL No. 8 :

That the following Resolution, entitled "Relating to the Use of VHF for Meteorological Broadcasts in the Aeronautical Mobile (R) Service", be adopted.

Reason : To encourage, to the maximum feasible extent, the use by Administrations of VHF frequencies for the satisfaction of meteorological broadcasts to civil aircraft.

RESOLUTION No.

RELATING TO THE USE OF VHF FOR METEOROLOGICAL BROADCASTS IN THE AERONAUTICAL MOBILE (R) SERVICE

The Aeronautical Extraordinary Administrative Radio Conference, (Geneva, 1964),

considering

a) that the number of channels available for the Aeronautical Mobile (R) Service in its frequency bands between 2850 and 17970 kc/s is limited;

b) that the need for frequencies for aeronautical mobile (R) communications and for meteorological broadcasts to civil aircraft is increasing;

c) that the propagation characteristics of high frequencies make them essential for satisfaction of civil aviation requirements for transmission of necessary information over long distance;

d) that Recommendation No. 13 of the International Administrative Aeronautical Radio Conference (Geneva, 1949) and Resolution No. 14 of the Administrative Radio Conference (Geneva, 1959) urge Administrations "to make as great a use as possible of very high frequencies in order to lessen the load on the high frequency (R) bands";

e) that substantial technical progress has been made by civil aviation during the interim since 1949 in extending the useful range of very high frequencies (VHF) to meet the needs for communication by the aeronautical mobile (R) service;

f) that this extension of the useful range of VHF offers the potential of satisfaction of a portion of the increasing needs for meteorological broadcasts to civil aircraft;

resolves

that Administrations, to the maximum extent feasible, employ VHF frequencies for the satisfaction of their requirements for meteorological broadcasts to civil aircraft.

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# PART III

## U. S. PROPOSALS CONCERNING TECHNICAL AND OPERATIONAL PRINCIPLES TO BE EMPLOYED IN THE REVISION OF APPENDIX 26

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Section I : Aircraft Operation Statistics - MWARA

Section II : Aircraft Operation Statistics - RDARA

Section III : Interference Range Contours - Polar Areas

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## Section I. Aircraft Operation Statistics - MWARA

PROPOSAL No. 9

That the preparatory session of the Aeronautical E.A.R.C. adopt the principle that aircraft operations statistics for the world major air routes be provided by Administrations for use at the main session of the Aeronautical E.A.R.C. and that the statistics reported be based on actual flights during a representative period of one week in 1964.

Reason: Statistical material provided by Administrations for aircraft operations under their jurisdictions will provide a reliable common basis upon which an equitable allotment of the available high frequencies may be made.

PROPOSAL No. 10

That the following two alternative procedural processes be considered for adoption by the preparatory session of the Aeronautical E.A.R.C. in 1964 for use by the main session of the Aeronautical E.A.R.C. in 1965 as the basis upon which an equitable allotment of available high frequencies will be made.

Reason: The choice of procedure is dependent upon the quality and completeness of statistical material which can be made available by Administrations for use at the second session.

PROPOSAL No. 11 (First Alternative)

a) It is proposed as the first alternative that the preparatory session of the Aeronautical E.A.R.C. consider adoption of the principle that aeronautical high frequencies to serve the major world air routes be allotted on the basis of requirements for such frequencies as can reasonably be supported by reports of actual aircraft operations, during a representative period of one week in 1964, and that no consideration be given to allotment of high frequencies to serve aircraft operations supported only by estimates of operations.

Reason: It is reasonable to expect that statistics on operations can be collected and compiled by each of the Administrations concerned. Such statistics can be used at the main session of the Aeronautical E.A.R.C. to assist in allotting high frequencies in a manner which will assure, insofar as practicable, that required radio frequencies can be made available to serve the major world air routes.

b) That in conjunction with the first alternative, the preparatory session of the I.T.U. Aeronautical E.A.R.C. consider adoption of the following formula for use by the main session in 1965, to determine the number of aircraft per hour (probable peak loading).

Formula (a):

$$N = K \left(\frac{L \times Fs}{Vsx7x24} + \frac{L \times Fns}{Vnsx7x24}\right)$$

Which can be simplified to read:

$$N = \frac{KL}{168} \left(\frac{Fs}{Vs} + \frac{Fns}{Vns}\right)$$

where:

N = the maximum number of aircraft that would require communication in any one hour;

K = concentration factor;

L = total route length to the nearest 10 nautical miles;

Vs = 500 knots, which is used as a rounded off figure for scheduled aircraft speed;

Vns = 350 knots, which is used as a rounded off figure for non-scheduled aircraft speed;

Fs = flights per week - scheduled aircraft;

Fns = flights per week - non-scheduled aircraft;

7 = days per week;

24 = hours per day.

This can be simplified further to read:

$$N = \frac{KL}{168} \left(\frac{F}{V}\right)$$

where:

F = total reported number of international flights.

V = rounded off figure for aircraft speed.

Reason: Formula (a) is for the purpose of calculating the number of aircraft that may be in the air in any one operation per hour when actual aircraft operation statistics are available for scheduled and non-scheduled aircraft.

c) That in conjunction with the first alternative the Conference consider adoption of a single rounded-off aircraft speed for use in Formula (a).

Reason: 1) To simplify calculations of the numbers of aircraft that require communication in any one hour.

2) To simplify machine processing.

3) It is likely that the speed of the majority of the aircraft operating over international air routes during the period which the plan developed by the Conference will be used will tend toward a fairly uniform higher speed.

d) In utilizing Formula (a), (in the first alternative) it is proposed that the Conference consider adoption of the principle that the concentration factor K, which represents an estimate of the ratio of the peak number of aircraft in an hour to the average number of aircraft in an hour be 2.4 for all major world air routes except where it is agreed by the main session of the Aeronautical E.A.R.C. that another factor is more appropriate on a particular international air route.

Reason: Recent studies related to the North Atlantic area have been performed by several Administrations. It appears from this material that the factor K was not significantly different from the figure 2.4 used by the First I.A.A.R.C.

PROPOSAL No. 12 (Second Alternative)

a) That as a second alternative, the preparatory session of the Aeronautical E.A.R.C. consider adoption of the principle that the main session in 1965 will review the statistical material concerning aircraft operations on the major world air routes as furnished by the contributing Administrations and assign numbers representing an estimate of the unreported aircraft for each of the world air routes where it is agreed by the Conference that a substantial number of such unreported aircraft operations should be taken into consideration in the allocation of aeronautical high frequencies.

Reason: Whereas the statistics available for a number of the world air routes may form sufficient basis for an orderly allocation of frequencies, it is anticipated that some Administrations may not be prepared to furnish complete information concerning all the aircraft operations on all the international air routes within their jurisdiction. In these particular instances, additional allowances for unreported aircraft should be agreed by the Conference which will assure, insofar as practicable, that each of the world air routes is provided with an appropriate frequency complement.

b) As an integral part of the second alternative, it is proposed that the preparatory session of the I.T.U. Aeronautical E.A.R.C. consider adoption of the following formula for use by the Conference at the main session in 1965 to determine the number of aircraft per hour (probable peak loading) by combining in one formula the reported aircraft operations on a major international air route with an estimated figure (to be agreed after consideration of available statistics by the main session) for the number of unreported aircraft operations on the same major world international air route.

Formula (b):

$$\text{Alternate } N = K \left(\frac{L \times R}{V \times 7 \times 24} + \frac{L \times E}{V \times 7 \times 24}\right)$$

Which can be simplified to read:

$$\text{Alternate } N = KL \left(\frac{R + E}{V \times 168}\right)$$

where:

Alternate N = the maximum number of aircraft that would require communications in any one hour;

K = concentration factor;

L = total route length to the nearest 10 nautical miles;

V = a rounded-off figure for aircraft speed;

R = reported flights per week;

E = an estimate of the number of unreported flights per week;

168 = 7 days per week x 24 hours per day.

Reason: Formula (B) is for the purpose of calculating the number of aircraft that may be in the air in one operation during any hour when some actual aircraft operation statistics are available. An allowance is made, however, for unreported aircraft.

c) In utilizing Formula (b), in the second alternative, it is proposed that the Conference consider adoption of a concentration factor K of 2.4, which represents an estimate of the ratio of the peak number of aircraft in an hour to the average number of aircraft in an hour and that this factor be used for all major world air routes except where it is agreed by the main session of the Aeronautical E.A.R.C. that another factor is more appropriate on a particular international air route.

Reason: Recent studies related to the North Atlantic area which have been performed by several Administrations indicate that the factor K was not significantly different from the figure 2.4 used by the First I.A.A.R.C.

PROPOSAL No. 13

With respect to either alternative, the United States proposes that the preparatory session of the I.T.U. Aeronautical E.A.R.C. adopt the following formula for use of the main session in 1965 to reflect the impact of the use of Very High Frequencies (VHF) upon the number of High Frequency (HF) families to be allotted.

Formula (c):

$$I = \frac{(\text{Total route length}) - (\text{Route length covered by VHF})}{\text{Total route length}}$$

where:

I Impact of use of VHF upon the number of HF frequencies to be allotted. Route length is expressed to the nearest 10 nautical miles.

This formula may be expressed as:

$$I = \frac{L - Lvhf}{L}$$

where:

L = total route length,

Lvhf = route length covered by VHF.

Reason: Formula (c) will be used to calculate the extent to which the use of Very High Frequencies (VHF) will relieve the congestion on the High Frequencies (HF). The factor I may be applied either to individual calculations or to bulk calculations of route lengths or numbers of aircraft.

PROPOSAL No. 14

It is proposed that October 1, 1964, be adopted by the Conference as the date by which the reports of aircraft operation statistics collected by Administrations will be made available to the I.T.U.

Reason: The date October 1, 1964 provides a period of approximately three months for the I.T.U. to collate the data received from the contributing Administrations.

PROPOSAL No. 15

It is proposed that the Conference adopt the period 0001 GMT Sunday, 2 August 1964 to 2400 GMT Saturday, 8 August 1964 inclusive, as the reporting period during which Administrations will collect statistical information concerning actual aircraft operations on the major world air routes within their jurisdiction.

Reason: The first full week in August 1964 allows a period of approximately four months for Administrations to make necessary arrangements for collection of statistical data and a period of approximately two months for Administrations to prepare the information for transmission to the I.T.U. This particular week was selected with a view to avoidance of known national holidays such as July 14 (Bastille Day, French) or extreme weather conditions such as may be expected in the winter months in the Northern Hemisphere.

PROPOSAL No. 16

It is proposed that the preparatory session of the Aeronautical E.A.R.C. adopt the attached format for use by Administrations in reporting aircraft operation statistics on the major world air routes and that the statistical material submitted to the I.T.U. for use at the main session be in the agreed format.

Reason: Reports of aircraft operations should be in a common format in order that clerical processing by the I.T.U. may proceed in an expeditious manner. Use of a common format will insure, insofar as practicable, that all contributing Administrations use identical terminology, thereby avoiding confusion and misunderstanding at the main session of the Aeronautical E.A.R.C.

PROPOSAL No. 17

The aircraft operations of the major world air route categories be reported on the basis of agreed, defined geographical areas and that the preparatory session of the Aeronautical E.A.R.C. adopt the attached chart or other appropriate method of designating operations for use by all Administrations in preparing their reports of aircraft operations for use at the main session.

Reason: Relatively small geographical areas, identified by a code suitable for use in the I.T.U. computer will simplify data processing. Areas shown on the chart will be easily identified and may include several airports or cities which simplifies machine processing. Aircraft operation statistics should be reported in a format which takes into account the limitations of the computer available to the I.T.U.

PROPOSAL No. 18

It is proposed that the following information be adopted by the preparatory session of the Aeronautical E.A.R.C. for use as instructions for completing their reports using the Reporting Format "Aircraft Operation Statistics - MWARA."

INSTRUCTIONS FOR COMPLETING THE REPORT FORM

AIRCRAFT OPERATION STATISTICS - MWARA

General: Aircraft flights should be reported by the Administration of Registry; except in the case of leased aircraft where the Administration authorizing the operation or operating the aircraft is different than the Administration under which the aircraft is registered, the Administration operating or authorizing the operation shall be responsible for supplying aircraft operation statistics. International flights or segments of international flights not requiring HF communications shall not be reported.

Part A: Country of registry of aircraft whose flights reported.

Part B: I.T.U. designation of Administration. Use abbreviation appearing in Preface to International Frequency List.

Part C: Enter calendar week in GMT selected for survey. (See proposal No. 15).

Column (1): Reference Number. Sequentially number each flight.

Column (2): Flight Identification. If airline flight indicate airline two-letter designation (as shown in the attached list) and trip number. If the name of the airline operation does not appear in the attached list of two-letter designators, Administrations should indicate an appropriate national flight identification.

Column (3): Type of Flight: 1) Scheduled airline.

2) Non-scheduled airline (including Military).

3) General aviation.

Note 1: Categories 2 and 3 are to be treated in respect to the MWARA formula as non-scheduled aircraft.

Note 2: In category 2, "Military" means transport types which are operated routinely in the civil system on Aeronautical Mobile (R) Frequencies.

Column (4): Enter 1, 2 or 3 corresponding to the aircraft speed category in the following list:

1 - Below 350 knots,

2 - 350 to 500 knots,

3 - Above 500 knots.

Column (5): Area of Departure

Note 3: In Columns (5), (6), (7), and (9), select appropriate area identification by reference to the attached chart of defined geographical areas of the world.

Column (6): Areas of intermediate stops, if different from Area of Departure or Area of Termination. (See Note 3).

Column (7): Area of Termination: (See Note 3)

Column (8): Figures supplied are to correspond with stage lengths in nautical miles from airport to airport, limiting the entries to the lowest number feasible.

Column (9): World Flight Zones. (Numbered 1 - 25). These Zones are depicted in the attached chart and include a number for each Zone. These Zones are intended to represent, in a general way, the major areas of the world in which international flights, having common requirements for high frequencies, are conducted. List the number of the World Flight Zone in which the major portion of the flight occurs. List separately for each entry in Columns (5), (6) and (7).

Note 4: Two zones are shown in dotted rather than solid lines for clarity.

Column (10): Day of Flight Departure. Insert "X" under the Greenwich Mean Time day(s) of the week during which the flight departed and operated under the same flight identification and routing.

Reason: It is essential that Administrations use identical terms in reporting aircraft operations:

The proposal that Column (9) include "Distance (Nautical Miles) covered per stage by VHF" has been changed to reflect reports of World Flight Zone(s). This has been changed for reasons such as the following.

1) To avoid the necessity for one Administration to supply figures showing the limits of coverage of radio facilities furnished by another Administration.

2) VHF coverage will be of use to the main session of the Conference in its determination of the high frequencies required. The extent of VHF coverage should be determined by the Conference at the main session for use on an area basis.

3) VHF coverage need not be reported for each individual flight since it will be applicable to all flights in the area.

4) World Flight Zone(s) will assist the Conference to identify the area of operation of a flight without listing each separate block flown through.

5) To simplify machine processing.

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Annex

Aircraft Operation Statistics - MWARA

A. Administration providing data : Argentina B. I.T.U. Designation : ARG

C. Representative week selected : (GMT Sunday 0001, 2 August 1964 to Saturday 2400, 8 August 1964 inclusive)

| (1) Ref. No. | (2) Flight Identification | (3) Type of flight | (4) Aircraft Speed (knots) | (5) Area of Departure | (6) Area of Intermediate Stop(s) | (7) Area of Termination | (8) Distance (Nautical Miles) per Stage | (9) World Flight Zone(s) | (10) Day (GMT) of Flight Departure S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AR 140 | 1 | 2 | 1434 | | | | 1 | | x | | | x | | |
| | | | | | 1263 | | 1100 | 1 | | x | | | x | | |
| | | | | | 1018 | | 1100 | 1 | | x | | | x | | |
| | | | | | 697 | | 1650 | 1 | | | x | | | x | |
| | | | | | 319 | | 1730 | 7 | | | x | | | x | |
| | | | | | 321 | | 715 | 7 | | | x | | | x | |
| | | | | | | 231 | 525 | 7 | | | x | | | x | |
| 2 | AR 321 | 1 | 2 | 310 | | | | 3 | | | x | | | x | |
| | | | | | 772 | | 1860 | 3 | | | | x | | | |
| | | | | | 1263 | | 2215 | 11 | | | | x | | | |
| | | | | | 1262 | | 190 | 11 | | | | x | | | |
| | | | | | | 1434 | 900 | 11 | | | | x | | | |
| | | | | | | | (see footnote below) | | | | | | | | |

The above examples, Reference Numbers 1 and 2, report the following Flight activity :

1. Aerolineas Argentinas flight number 140: scheduled airline flight; speed 2 (350-500 knots); originated Buenos Aires (limited geographical area 1434); intermediate stops - Rio de Janeiro, Natal, Dakar, Madrid and Rome; terminated Frankfurt; operated Monday, August 3 and Thursday, August 6, 1964.

2. Aerolineas Argentinas flight number 321; scheduled airline flight; speed 2 (350-500 knots); originated New York (limited geographical area 310); intermediate stops - Trinidad, Rio de Janeiro, and Sao Paulo; terminated Buenos Aires; operated Tuesday, August 4, 1964.

Note : The distances given in Column (8) are approximate and are based on incomplete information obtained from I.C.A.O. Air Navigation Regional Plans.

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# ABREVIATIONS DES NOMS DES TRANSPORTEURS AERIENS
# AIRLINE TWO-LETTER DESIGNATOR
# CUADRO DE DISTINTIVOS DE EMPRESAS DE LINEAS AEREAS

| Abréviation<br>Airline Key<br>Distintivo | Signification<br>Signification<br>Significado | Abréviation<br>Airline Key<br>Distintivo | Signification<br>Signification<br>Significado |
|---|---|---|---|
| A | | B | |
| AA | American Airlines Inc. | BA | British Overseas Airways Corporation |
| AB | Manila Aviation Service, Inc. | BB | Balair S. A. |
| AC | Aerovías Nacionales de Colombia, S. A. | BC | British Insulated Callender's Cables Ltd. |
| AD | Aden Airways Ltd. | BD | |
| AE | Air Ceylon Ltd. | BE | British European Airways Corporation |
| AF | Air France | BF | Bees Flight Ltd. |
| AG | Guest Aerovías México, S. A. | BG | British Guiana Airways Ltd. |
| AH | Air Algérie | BH | Bahamas Airways Ltd. |
| AI | Air India | BI | Bharat Commerce and Industries Ltd. |
| AJ | | BJ | |
| AK | Alaska Coastal - Ellis Airlines | BK | B.K.S. Air Transport Ltd. |
| AL | Allegheny Airlines Inc. | BL | Bonanza Air Lines Inc. |
| AM | Aeronaves de México, S. A. | BM | |
| AN | Australian National Airways Pty. Ltd./Ansett Airways Pty. Ltd. | BN | Braniff International Airways Inc. |
| AO | Aviación y Comercio, S. A. | BO | Société Air-Brousse |
| AP | BIAS (Belgian International Air Service) | BP | |
| AQ | | BQ | Blidberg, Metcalfe & Co., A.B. |
| AR | Aerolineas Argentinas | BR | British United Airways Ltd. |
| AS | Alaska Airlines Inc. | BS | Borneo Airways Ltd. |
| AT | Compagnie Nationale de Transports Aériens - Royal Air Maroc | BT | |
| AU | Compañía Argentina de Transporte Aéreo S.A.C. e Y. - Austral | BU | Braathens South-American and Far East Airtransport A/S |
| AV | Compagnie Sénégalaise de Transports Aériens | BV | |
| AW | Avalon Air Transport, Inc. | BW | British West Indian Airways Ltd. |
| AX | AAXICO Airlines, Inc. | BX | |
| AY | Aero O/Y Finnish Airlines (FINNAIR) | BY | |
| AZ | ALITALIA-Aerolinee Italiane Internazionali | BZ | |

| Abréviation Airline Key Distintivo | Signification Signification Significado | Abréviation Airline Key Distintivo | Signification Signification Significado |
|---|---|---|---|
| C | | D | |
| CA | Caledonian Airways Ltd. | DA | Dan-Air Services Ltd. |
| CB | Caribbean-Atlantic Airlines Inc. | DB | Darbhanga Aviation |
| CC | Lloyd Aéreo Colombiano, S. A. | DC | Department of Civil Aviation Australia (Aircraft) |
| CD | Cordova Airlines, Inc. | DE | Continentale Luftreederei GmbH. |
| CE | Central African Airways Corporation | DF | Condor Flugdienst GmbH. |
| CF | Compañía de Aviación,"FAUCETT" S.A. | DG | |
| CG | Compañía Aeronáutica Uruguaya, S.A. | DH | |
| CH | Chicago Helicopter Airways Inc. | DI | |
| CI | | DJ | |
| CJ | | DK | Scanair Ltd. |
| CK | Connellan Airways Ltd. | DL | Delta Air Lines, Inc. |
| CL | | DM | Departamento de Comunicaciones (Argentina) |
| CM | Compañía Panameña de Aviación, S.A. | DN | AIR LLOYD, Deutsche Nahluft-Verkehrs A.G. |
| CN | Central Airlines, Inc. | DO | Compañía Dominicana de Aviación |
| CO | Continental Air Lines Inc. | DP | Dunlop Rubber Company Ltd. (Aviation Division) |
| CP | Canadian Pacific Airlines Ltd. | DQ | |
| CQ | | DR | Derby Aviation Ltd. |
| CR | Rhodesian United Air Carriers | DS | |
| CS | Cambrian Airways, Ltd. | DT | Divisão de Transportes Aéreos (Angola) |
| CT | Civil Air Transport Company Ltd. | DU | Duncan Logan (Contractors) Ltd. |
| CU | Empresa Consolidada Cubana de Aviación, S. A. | DV | Deutsche Taxiflug GmbH. Mannheim |
| CV | Campling Bros. and Vanderwall Ltd. | DW | |
| CW | | DX | |
| CX | Cathay Pacific Airways Ltd. | DY | |
| CY | Cyprus Airways Ltd. | DZ | |
| CZ | Cuba Aeropostal, S. A. | | |

| Abréviation Airline Key Distintivo | Signification Signification Significado | Abréviation Airline Key Distintivo | Signification Signification Significado |
|---|---|---|---|
| E | | F | |
| EA | Eastern Air Lines Inc. | FA | Air America, Inc. |
| EB | Avitour Air Services Ltd. | FB | Ferranti Ltd. |
| EC | East African Airways Corporation | FC | |
| | | FD | |
| ED | Directorate of Civil Aviation East Africa (Aircraft) | FE | Flying Enterprise |
| | | FF | American Flyers Airline Corp. |
| EE | Executair (Nigeria) Ltd. | FG | Ariana Afghan Airlines |
| EF | Channel Airways Ltd. | FH | Foshing Airlines |
| EG | Cunard Eagle Airways Ltd. | FI | Flugfélag Islands h.f. (Icelandair) |
| EH | | | |
| EI | Aer Lingus Teoranta | FJ | Fiji Airways Ltd. |
| EJ | | FK | Austria-Flugdienst GmbH. |
| EK | | FL | Frontier Airlines, Inc. |
| EL | Escadrille Mercure | FM | Flying Syndicate Twente |
| EM | | FN | Flota Aérea Nicaragüense, S.A. |
| EN | Cunard Eagle (Bahamas) Limited | FO | Fred. Olsen Flyselskap A/S |
| EO | Eros Airline (U.K.) Ltd. | FP | |
| EP | Aerolíneas Peruanas, S. A. | FQ | |
| EQ | Aerovías Ecuatorianas C.A. | FR | Flight Refuelling Ltd. |
| ER | Don Everall (Aviation Ltd.) | FS | Field Aircraft Services Ltd. |
| ES | | FT | Flying Tiger Line Inc., The |
| ET | Ethiopian Air Lines Inc. | FU | |
| EU | Compañía Ecuatoriana de Aviación, S.A. | FV | Falck's Flyvetjeneste |
| | | FW | |
| EV | ELIVIE-Società italiana d'esercizio elicotteri | FX | Svensk Flygtjänst AB |
| EW | East West Airlines Ltd. | FY | Fairey Air Surveys Ltd. |
| EX | Expreso Aéreo Inter Americano | FZ | |
| EY | Euravia (London) Ltd. | | |
| EZ | Executive Air Transport Ltd. | | |

| Abréviation Airline Key Distintivo | Signification Signification Significado | Abréviation Airline Key Distintivo | Signification Signification Significado |
|---|---|---|---|
| G | | H | |
| GA | Garuda Indonesian Airways | HA | Hawaiian Airlines Ltd. |
| GB | Société de Transport Aérien du Gabon | HB | |
| | | HC | |
| GC | | HD | |
| GD | Granada TV Network Ltd. | HE | |
| GE | Transportes Aéreos da Guiné Portuguesa | HF | |
| | | HG | |
| GF | Gulf Aviation | HH | |
| GG | Globe-Air S.A. | HI | |
| GH | Ghana Airways Ltd. | HJ | |
| GI | Air Guinée | HK | |
| GJ | | HL | |
| GK | | HM | Iran National Airlines Corporation |
| GL | Grønlandsfly Ltd. | HN | |
| GM | Tyne Tees Air Charter Ltd. | HO | |
| GN | J.C. Brouillet/Transgabon | HP | Aerovias Panama |
| GO | Sierra Leone Airways Ltd. | HQ | |
| GP | Groupement d'études et de consultations aéronautiques Airnautic | HR | |
| GQ | | HS | Aero Sales (Pty.) Ltd. |
| GR | | HT | TransAir Limited (Canada) |
| GS | Società ALIS Aerolinee Siciliane | HU | |
| | | HV | |
| GT | Gibraltar Airways Ltd. | HW | |
| GU | Empresa Guatemalteca de Aviación (AVIATECA) | HX | |
| | | HY | |
| GV | Government of Northern Rhodesia (Aircraft) | HZ | Herts and Essex Aero Club Ltd. |
| GW | | | |
| GX | | | |
| GY | Gyrafrance | | |
| GZ | | | |

| Abréviation Airline Key Distintivo | Signification Signification Significado | Abréviation Airline Key Distintivo | Signification Signification Significado |
|---|---|---|---|
| I | | J | |
| IA | Iraqi Airways | JA | Trans-Asiatic Airlines (Siam) Ltd. |
| IB | Lineas Aéreas de España, S.A. (IBERIA) | JB | Aero-Nord AB |
| IC | Indian Airlines Corporation | JC | Jamair Company Ltd. |
| ID | | JD | |
| IE | Aerolineas INI | JE | |
| IF | | JF | Johnsons Flying Service Inc. |
| IG | | JG | |
| IH | | JH | |
| II | Airways (India) Ltd. | JI | Aerovías Sud Americana Inc. |
| IJ | | JJ | Airlines (Jersey) Ltd. |
| IK | Air Links Ltd. | JK | African Air Cars Ltd. |
| IL | | JL | Japan Air Lines Company, Ltd. |
| IM | | JM | |
| IN | Aerlinte Eireann | JN | JORDANIAN (Jordan Airways) |
| IO | Interocean Airways, S.A. | JO | |
| IP | Transportes Aéreos de India Portuguesa | JP | Adria Aviopromet |
| IQ | | JQ | |
| IR | Iranian Airways Company | JR | |
| IS | Air Survey Company of India Ltd. | JS | Service des Transports et de Travail Aérien |
| IT | | JT | |
| IU | Intercontinental U.S., Inc. | JU | Jugoslovenski Aerotransport (JAT) |
| IV | | JV | Aero Club of East Africa |
| IW | | JW | Trek Airways (Pty.) Ltd. |
| IX | | JX | Aero Exploration |
| IY | | JY | |
| IZ | Arkia Inland Airlines | JZ | |

| Abréviation<br>Airline Key<br>Distintivo | Signification<br>Signification<br>Significado | Abréviation<br>Airline Key<br>Distintivo | Signification<br>Signification<br>Significado |
|---|---|---|---|
| K | | L | |
| KA | Kalinga Airlines | LA | Línea Aérea Nacional (LAN) |
| KB | | LB | Lloyd Aéreo Boliviano, S.A. |
| KC | | LC | Lake Central Airlines, Inc. |
| KD | | LD | Líneas Aéreas del Estado |
| KE | Korean Air Lines, Inc. | LE | Lebanese International Airways (LIA) |
| KF | | | |
| KG | Aero-Transport, Flugbetriebsgesellschaft mbH., Ltd. | LF | Linjeflyg AB |
| | | LG | Luxembourg Airlines (Compagnie Luxembourgeoise de Navigation aérienne) - Luxair |
| KH | | | |
| KI | | LH | Deutsche Lufthansa A.G. |
| KJ | Crescent Air Transport Ltd. | LI | Air Laos |
| KK | | LJ | Sierra Leone Airways Ltd. |
| KL | K.L.M. Royal Dutch Airlines (Koninklijke Luchtvaart Maatschappij N.V.) | LK | |
| | | LL | Loftleidir, Icelandic Airlines Ltd. |
| KM | | LM | |
| KN | Korean National Airlines | LN | Air Liban |
| KO | Kodiak Airways Inc. | LO | Polskie Linie Lotnicze (LOT) |
| KP | | LP | Loide Aéro Nacional, S.A. |
| KQ | | LQ | Transports Aériens Libanais |
| KR | KAR-AIR O/Y (KAR-AIR) | LR | Líneas Aéreas Costarricenses, S.A. |
| KS | | | |
| KT | Trans Arabia Airways | LS | Atlas Air Express |
| KU | Kuwait Airways | LT | Lufttransport Unternehmen, GmbH. |
| KV | Modern Air Transport Inc. | | |
| KW | | LU | Línea Internacional Aéreo "LIA" |
| KX | | | |
| KY | | LV | Línea Aeropostal Venezolana |
| KZ | | LW | Lloyd International Airways Ltd. |
| | | LX | Los Angeles Airways Inc. |
| | | LY | El AL-Israel Airlines Ltd. |
| | | LZ | Transport Aérien Civil Bulgare - TABSO |

| Abréviation Airline Key Distintivo | Signification Signification Significado | Abréviation Airline Key Distintivo | Signification Signification Significado |
|---|---|---|---|
| M | | N | |
| MA | Hungarian Air Transport (MALEV) | NA | National Airlines Inc. |
| MB | | NB | Sterling Airways Ltd. |
| MC | Civil Aviation Flying Unit | NC | Northern Consolidated Airlines Inc. |
| MD | Compagnie Nationale Malgache de Transports Aériens MADAIR | ND | Nordair Ltd. |
| ME | Middle East Airlines | NE | Northeast Airlines Inc. |
| MF | Marshall's Flying Services Ltd. | NF | |
| MG | MacRobertson Miller Airlines Ltd. | NG | |
| MH | Macau Air Transport (H.K.) Ltd. | NH | All Nippon Airways Co., Ltd. |
| MI | Mercury Airlines Ltd. | NI | Líneas Aéreas de Nicaragua, S.A. |
| MJ | Manchester Airport Agencies | NJ | |
| MK | Mackey Airlines, Inc. | NK | Nordic Airways, Nordair Ltd. |
| ML | Malayan Airways Ltd. | NL | Liberian National Airlines |
| MM | Sociedad Aeronáutica de Medellin, S.A. (SAM) | NM | |
| MN | Commercial Air Service (Pty.) Ltd. | NN | |
| MO | Mohawk Airlines Inc. | NO | North Central Airlines Inc. |
| MP | Martin's Air Charter | NP | Nuclear Power Group |
| MQ | Società Aerea Mediterranea | NQ | New Zealand Civil Aviation Administration Operations Fleet |
| MR | Maritime Central Airways | NR | Northern Rhodesia Aviation Services Ltd. |
| MS | United Arab Airlines | NS | North Sea Air Transport Ltd. |
| MT | Morton Air Services Ltd. | NT | |
| MU | Malta Aviation Services | NU | |
| MV | | NV | |
| MW | | NW | Northwest Airlines Inc. |
| MX | Compañia Mexicana de Aviación, S.A. | NX | |
| MY | Air Mali | NY | New York Airways, Inc. |
| MZ | | NZ | New Zealand National Airways Corporation |

| Abréviation Airline Key Distintivo | Signification Signification Significado | Abréviation Airline Key Distintivo | Signification Signification Significado |
|---|---|---|---|
| O | | P | |
| OA | Olympic Airways S.A. | PA | Pan American World Airways Inc. |
| OB | | PB | Panair do Brasil, S.A. |
| OC | Aircraft Operating Co. (Aerial Surveys) Ltd. | PC | Pacific Airlines, Inc. |
| | | PD | |
| OD | "Aerocondor" Aerovías Condor de Colombia Ltda. | PE | N.V. Philips' Gloeilampen-fabrieken Flight Division |
| OE | | PF | |
| OF | | PG | Pan American Grace Airways Inc. |
| OG | | PH | Polynesian Airlines Ltd. |
| OH | San Francisco and Oakland Helicopter Airlines Inc. | PI | Piedmont Aviation, Inc. |
| | | PJ | Polar-Air O/Y |
| OI | | PK | Pakistan International Airlines Corporation |
| OJ | | | |
| OK | Československé Aerolinie | PL | Plymouth Aero Club Ltd. |
| OL | | PM | |
| OM | | PN | Pacific Northern Airlines Inc. |
| ON | | PO | Protea Lugdiens (Edms.) Bpk. |
| OO | | PP | Pilatus S.A. Air Service |
| OP | | PQ | South Pacific Airlines of New Zealand Ltd. |
| OQ | | | |
| OR | | PR | Philippine Air Lines Inc. |
| OS | Austrian Airlines | PS | Pacific Southwest Airlines |
| OT | Servico de Transportes Aéreos de S. Tomé | PT | Provincetown-Boston Airlines Inc. |
| OU | AUTAIR (Luton) Ltd. | PU | Primeras Líneas Uruguayas de Navegación Aérea |
| OV | Overseas National Airways | | |
| OW | Owenair (Pty.) Ltd. | PV | Eastern Provincial Airways Ltd. |
| OX | | PW | Pacific Western Airlines Ltd. |
| OY | | PX | Pressed Steel Co. Ltd., (Aviation Division) Oxford |
| OZ | Ozark Airlines, Inc. | PY | Surinaamse Luchtvaart Maatschappij N.V. |
| | | PZ | Persian Air Services |

| Abréviation Airline Key Distintivo | Signification Signification Significado | Abréviation Airline Key Distintivo | Signification Signification Significado |
|---|---|---|---|
| Q | | R | |
| QA | Aerovías "Q", S.A. | RA | |
| QB | Quebecair, Inc. | RB | Syrian Arab Airlines |
| QC | Société Air Congo | RC | Royal Air Cambodge |
| QD | Sadia Transportes Aéreos S.A. | RD | Riddle Airlines Inc. |
| QE | | RE | |
| QF | Quatas Empire Airways Ltd. | RF | Rhodesian Air Services (Private) Ltd. |
| QG | | RG | Viação Aéreo Rio Grandense S.A. (VARIG) |
| QH | | | |
| QI | | RH | |
| QJ | | RI | Rutas Internacionales Peruanas S.A. (RIPSA) |
| QK | | | |
| QL | | RJ | |
| QM | | RK | Air Afrique |
| QN | Navegaçao Aérea Brasileira S.A. | RL | Real Aerovias Nacional S.A. |
| QO | | RM | Rotterdamse Luchtvaart Expeditie Maatschappij |
| QP | Caspair Ltd. | | |
| QQ | | RN | Rutas Aéreas Nacionales, S.A. |
| QR | Paraense Transportes Aéreos S.A. | RO | Roumanian Air Transport |
| | | RP | M. Robert Petrelluzzi, Antilles Air Services |
| QS | Transportes Aéreos Salvador S.A. | RQ | |
| QT | Transportes Aéreos Catarinense | RR | Aircarries Ltd. |
| QU | Air Couriers Ltd. | RS | Rutas Aéreas de Colombia Limitada |
| QV | Viação Aérea Gaúcha S.A. | | |
| QW | | RT | Transportes Aéreos de Timor |
| QX | Transair S.A. | RU | |
| QY | | RV | Reeve Aleutian Airways Inc. |
| QZ | | RW | |
| | | RX | |
| | | RY | Royal Air Laos |
| | | RZ | |

| Abréviation Airline Key Distintivo | Signification Signification Significado |
|---|---|
| S | |
| SA | South African Airways |
| SB | Seabord World Airlines Inc. |
| SC | Serviçios Aéreos Cruzeiro do Sul S.A. |
| SD | Sudan Airways |
| SE | Sociedad de Transportes Aéreos Ltd. (ALA) |
| SF | South Pacific Airlines Inc. |
| SG | Aerotransportes Litoral Argentino, S.A. |
| SH | Servicio Aéreo de Honduras,S.A. |
| SI | Slick Airways |
| SJ | Southern Air Transport Inc. |
| SK | Scandinavian Airlines System |
| SL | Scottish Airlines |
| SM | Southend Municipal Flying School |
| SN | Société Anonyme Belge d'Exploitation de la Navigation Aérienne (SABENA) |
| SO | Southern Airways, Inc. |
| SP | Sociedade Açoriana de Transportes Aéreos Ltda. |
| SQ | Saskatchewan Government Airways |
| SR | SWISSAIR (Société Anonyme Suisse pour la Navigation Aérienne) |
| SS | Standard Airways Inc. |
| ST | Société Transports Aériens en Extrême-Orient |
| SU | AEROFLOT |
| SV | Saudi Arabian Airlines |
| SW | South West Air Transport (Pty.) Ltd. |
| SX | Samoan Airlines Limited |
| SY | Skyways Ltd. |
| SZ | Süddeutsche Fluggesellschaft GmbH. (Südflug) |

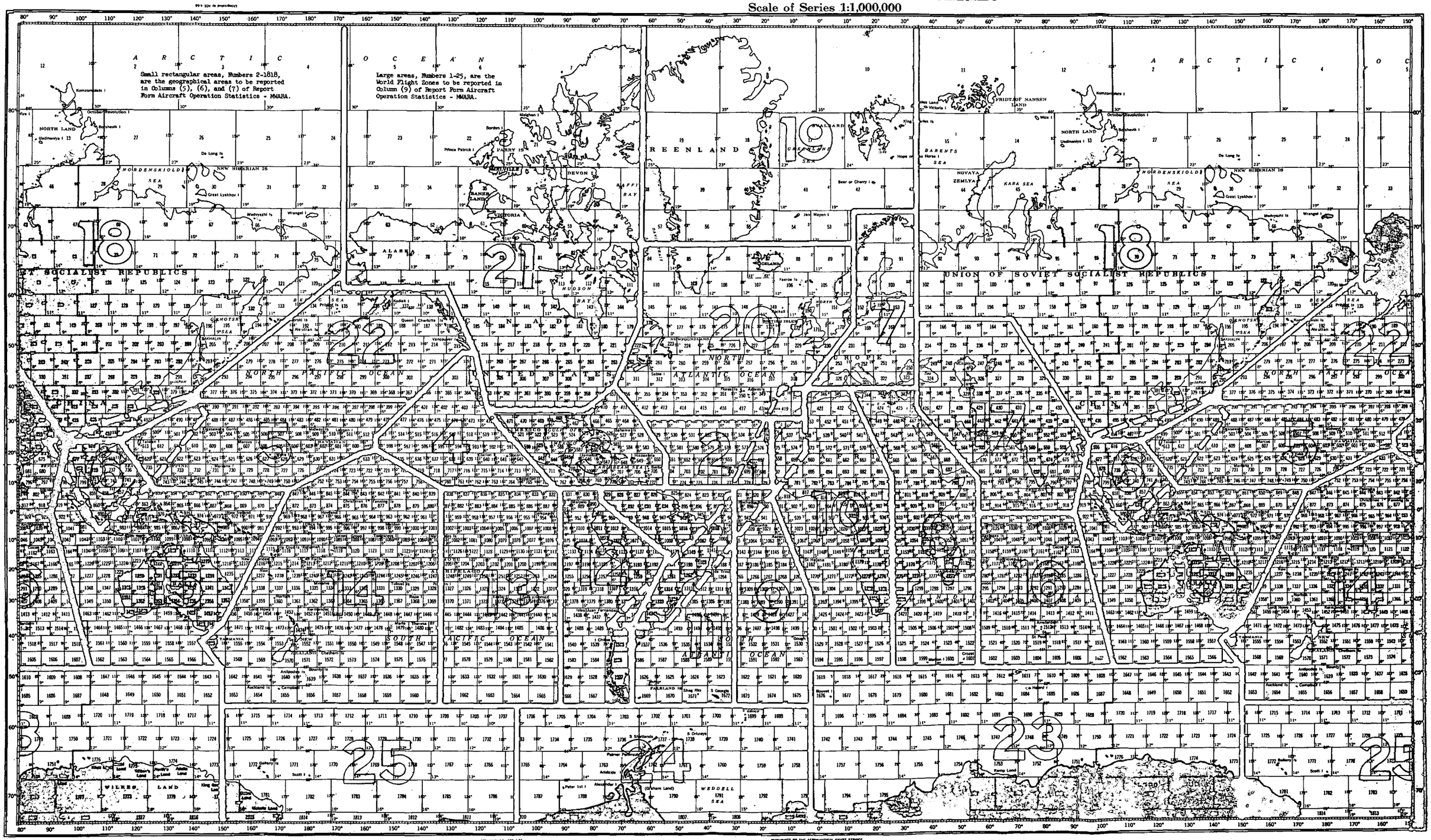
| Abréviation Airline Key Distintivo | Signification Signification Significado |
|---|---|
| T | |
| TA | TACA International Airlines, S.A. |
| TB | Transair Sweden AB |
| TC | Trans-Canada Air Lines (TCA) |
| TD | "Taxader" Líneas Aéreas Taxader S.A. |
| TE | Tasman Empire Airways Ltd. (TEAL) |
| TF | Compagnie Air Transport |
| TG | Thai Airways International, Ltd. |
| TH | Thai Airways Co. Ltd. |
| TI | Compagnie de Transports Aériens Intercontinentaux |
| TJ | Transair Copenhagen |
| TK | Türk Hava Yollari (Turkish Airlines) |
| TL | Trans Mediterranean Airlines (TMA) |
| TM | Divisao de Exploraçao dos Transportes Aéreos (Moçambique) |
| TN | Trans-Australia Airlines |
| TO | |
| TP | Transportes Aéreos Portugueses, S.A.R.L. |
| TQ | Tradair Ltd. |
| TR | Trans Caribbean Airways Inc. |
| TS | Aloha Airlines Inc. |
| TT | Trans-Texas Airways |
| TU | Société Tunisienne de l'Air (TUNIS-AIR) |
| TV | Trans International Airlines Inc. |
| TW | Trans World Airlines Inc. |
| TX | Transportes Aéreos Nacionales, S.A. |
| TY | Société Calédonienne de Transport Aérien-Transpac |
| TZ | Trans European Aviation Ltd. |

| Abréviation Airline Key Distinctive | Signification Signification Significado | Abréviation Airline Key Distinctive | Signification Signification Significado |
|---|---|---|---|
| U | | V | |
| UA | United Air Lines Inc. | VA | Venezolana Internacional de Aviación, S.A. |
| UB | Union of Burma Airways | VB | |
| UC | | VC | |
| UD | | VD | Société Générale d'Affrêtement Aérien. |
| UE | | VE | Aerovias Venezolanas, S.A. |
| UF | Universal Flying Services Ltd. | VF | |
| UG | | VG | |
| UH | | VH | |
| UI | | VI | Panamá Aeronáutica |
| UJ | | VJ | Société Aérotechnique |
| UK | | VK | |
| UL | | VL | Société commerciale aérienne du Littoral |
| UM | | VM | Société aéronautique "Air Caen" |
| UN | | VN | Air Viet-Nam |
| UO | United States Overseas Airlines Inc. | VO | |
| UP | Stuttgarter Flugdienst GmbH. | VP | Viação Aérea São Paulo, S.A. |
| UQ | | VQ | Société Aérienne de Transports Guyane-Antilles |
| UR | Uraba, Medellín and Central Airways | VR | Société de Liaison et Transports Aériens |
| US | | VS | Servicios Aéreos, S.A. |
| UT | Union Aéromaritime de Transport | VT | Réseau Aérien Interinsulaire |
| UU | | VU | Air Ivoire |
| UV | | VV | Société Algérienne de Constructions Aéronautiques "AFRIC AIR" |
| UW | | VW | |
| UX | | VX | Viêt-Nam Air Transport (VIAT) |
| UY | | VY | Société Anonyme des Avions Meyer et Co. |
| UZ | United Steel Companies Ltd Air Transport | VZ | |

| Abréviation<br>Airline Key<br>Distintivo | Signification<br>Signification<br>Significado | Abréviation<br>Airline Key<br>Distintivo | Signification<br>Signification<br>Significado |
|---|---|---|---|
| W | | | |
| WA | Western Airlines Inc. | | |
| WB | | | |
| WC | West Coast Airlines, Inc. | | |
| WD | Wardair Canada Ltd. | | |
| WE | Wien Alaska Airlines | | |
| WF | | | |
| WG | | | |
| WH | | | |
| WI | Wilken Air Services Ltd. | | |
| WJ | | | |
| WK | Western Alaska Airlines, Inc. | | |
| WL | | | |
| WM | | | |
| WN | Western Airways Ltd. | | |
| WO | World Airways Inc. | | |
| WP | | | |
| WQ | Sky Van Airways | | |
| WR | | | |
| WS | Wiltshire School of Flying Ltd. | | |
| WT | W.A.A.C. (Nigeria) Ltd.<br>Nigeria Airways | | |
| WU | | | |
| WV | | | |
| WW | | | |
| WX | | | |
| WY | Starways Ltd. | | |
| WZ | | | |

# WORLD AERONAUTICAL CHART SERIES

## Scale of Series 1:1,000,000




Lithographed by ACIS 4-58

PUBLISHED BY THE AERONAUTICAL CHART SERVICE,
U. S. AIR FORCE, WASHINGTON, D.C.
DECEMBER 1959 (ACIS) BASE NO. 1

Les numéros de 2 à 1818 figurant dans les petits rectangles désignent les zones géographiques et sont à inscrire dans les colonnes (5), (6) et (7) de la formule "Données statistiques sur le trafic aérien - ZLAMP"

Les numéros de 1 à 25 figurant dans les grandes surfaces désignent les zones aériennes mondiales et sont à inscrire dans la colonne (9) de la formule "Données statistiques sur le trafic aérien - ZLAMP"

ZONES AERIENNES MONDIALES
WORLD AERONAUTICAL CHART SERIES
PLANISFERIO PARA LA NAVEGACION AERONAUTICA

Echelle - Scale of Series - Escala : 1/1.000.000

Las pequeñas superficies rectangulares (números 2 a 1818) son las áreas geográficas que deben indicarse en las columnas 5), 6) y 7) del Formulario estadístico de movimiento de aeronaves - ZRMP.

Las grandes superficies (números 1 a 25) representan las Zonas de vuelo que deben inscribirse en la columna 9) del Formulario estadístico de movimiento de aeronaves - ZRMP.

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PROPOSAL No. 18A

Based on operational experience extending over a period of more than a decade, the United States proposes that the Preparatory Session of the I.T.U. Aeronautical E.A.R.C. adopt the following criteria for use by the Main Session in determining the number of aeronautical (R) band high frequencies or high frequency families that are required to serve the Major World Air Route Areas (MWARA's) :

A family of high frequencies may be expected to serve a maximum number of 12 aircraft in one hour.

A single high frequency may be expected to serve a maximum number of 10 aircraft in an hour.

Reason : Once the number of aircraft that would require communications on a major world air route has been determined, and the number of aircraft that can be served by a high frequency or a family of high frequencies has been agreed, the number of frequencies required to serve an international air route may be calculated. The figures 10 and 12 which were the numbers agreed by the I.A.A.R.C., First Session appear valid in the light of operational experience gained through use of the current Aeronautical Mobile (R) Frequency Allotment Plan over a period of more then 10 years.

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## Section II - Aircraft Operation Statistics - RDARA

PROPOSAL No. 19

That the preparatory session of the Aeronautical E.A.R.C. adopt the principle that operation statistics for the regional and domestic air route areas should be provided by Administrations for use at the main session of the Aeronautical E.A.R.C. and that the statistics reported should be based on actual flights during a representative period of one week in 1964.

Reason : Statistical material provided by Administrations for aircraft operations under their jurisdiction should provide a reliable common basis upon which an equitable allotment of the available high frequencies may be made.

PROPOSAL No. 20

That the Conference adopt the period 0001 GMT Sunday, 2 August 1964 to 2400 GMT Saturday, 8 August 1964 inclusive, as the reporting period for which Administrations will submit aircraft operation statistics for actual aircraft operations in the regional and domestic air route areas.

Reason : The first full week in August 1964 allows a period of approximately four months for Administrations to make necessary arrangements for collection of statistical data and a period of approximately two months for Administrations to prepare the information for transmission to the I.T.U. This particular week was selected with a view to avoidance of known national holidays such as July 14 (Bastille Day, French) or extreme weather conditions such as may be expected in the winter months in the Northern Hemisphere.

PROPOSAL No. 21

That the preparatory session of the Aeronautical E.A.R.C. adopt the attached format for use by Administrations in reporting aircraft operations for RDARA's.

Reason : Reports of aircraft operations should be in a common format in order that clerical processing by the I.T.U. may proceed in an expeditious manner. Use of a common format will insure, insofar as practicable, that all contributing Administrations use identical terminology, thereby avoiding confusion and misunderstanding at the main session of the Aeronautical E.A.R.C.

PROPOSAL No. 22

That the following INSTRUCTIONS be adopted by the preparatory session of the Aeronautical E.A.R.C. for use by Administrations in submitting their reports of Aircraft Operation Statistics - RDARA.

Reason : It is essential that Administrations use identical terms in reporting aircraft operation statistics.

## INSTRUCTIONS FOR COMPLETING THE REPORT FORM "AIRCRAFT OPERATION STATISTICS - RDARA"

General : Report only those flights where HF is required. Aircraft flights should be reported by the Administration of Registry; except in the case of leased aircraft where the Administration authorizing the operation or operating the aircraft is different than the Administration under which the aircraft is registered, the Administration operating or authorizing the operation shall be responsible for supplying aircraft operation statistics.

Part A : Reporting Administration.

Part B : I.T.U. designation of Administration. Use abbreviation appearing in Preface to International Frequency List.

Part C : Reports by subdivision of countries such as by State, or Province, or by geographical areas may be employed at the discretion of the Administration; however, such subdivision should not be made where the longest air route in country does not exceed 1000 nautical miles.

Part D : Enter calendar week in GMT selected for survey. (See Proposal No. 20).

Part E : Insert, in the appropriate spaces, the total number of aircraft flights, according to aircraft speeds and distances flown from point of departure to point of next landing, for the representative week selected.

Example : A total of 19 flights are to be reported for aircraft having a cruising speed of 325 knots. Ten flights were of distances (between point of departure and point of first landing) less than 100 nautical miles. The other 9 involved flights between two points separated 720 nautical miles. Enter the figure 10 opposite 0-100 in Column (3). Enter the number 9 opposite 401-800 in Column (3).

Part F : The classification of aircraft to be reported is set forth in detail in "General" in these instructions. Report the number of active aircraft classified according to cruising speed.

Example : Assuming a total of 400 active aircraft, 200 of which have cruising speeds less than 150 knots, 80 between 151-350 knots, 100 between 351-500 knots, and, 20 over 500 knots, enter the figure 200 in Column (1); 80 in Column (2), 100 in Column (3), and, 20 in Column (4).

Annex

Aircraft Operation Statistics - RDARA

A. Administration providing data : _____ B. I.T.U. Designation:
C. Subdivision of country - if used : _____
D. Representative week selected : (G.M.T. Sunday 0001, 2 August 1964 to Saturday 2400, 8 August 1964 inclusive)
E. Aircraft Operation Statistics :

| Distance from Point of Departure to Point of First Landing in Nautical Miles (1) | Total Number of Flights in Week | | | |
|---|---|---|---|---|
| | Aircraft Speed below 150 knots (2) | Aircraft Speed 151-350 knots (3) | Aircraft Speed 351-500 knots (4) | Aircraft Speed Over 500 knots (5) |
| 0 - 100 | | | | |
| 101 - 200 | | | | |
| 201 - 400 | | | | |
| 401 - 800 | | | | |
| 801 - 1600 | | | | |
| Over 1600 | | | | |

F. Summary of aircraft in active service. (See General Instructions).

| Below 150 knots (1) | 151-350 knots (2) | 351-500 knots (3) | Over 500 knots (4) |
|---|---|---|---|
| | | | |

## Section III - Interference Range Contours - Polar Areas

PROPOSAL No. 23 :

That the Interference Range Contours and Mercator's projection world map, applicable between latitudes 60° N and 60° S, described on pages 9 through 14 of Part I and inserted in the pocket at the end of Appendix 26 to the Radio Regulations, Geneva-1959, also shall be made a part of the new Appendix 27.

Reason : To provide an essential tool for use in the course of preparation of Appendix 27 by the Aeronautical E.A.R.C. and, after the coming into force of the E.A.R.C. Agreement, to provide Administrations with a uniform method of complying with the technical criteria relating to geographic separation between (R) frequencies at the various megacycle orders.

PROPOSAL No. 24 :

That the Interference Range Contours and Gnomonic polar area maps, applicable at latitudes north of 60° N and south of 60° S, attached hereto and forming a part of this proposal, be adopted by the Aeronautical E.A.R.C. as a part of Appendix 27. These contours and maps are described as follows:

| Frequency Band | Day or Night | Frequency Band | Day or Night |
|---|---|---|---|
| 3.0 ) | Day | 5.6 | Day |
| 3.5 ) | Day | | |
| | | 5.6 ) | |
| 3.0 | Night | 6.6 ) | Night |
| 3.5 | Night | 6.6 | Day |
| 4.7 | Day | 9.0 | Day |
| 4.7 ) | Night | 11.3 | Day |
| 10.0 ) | Day | | |

Reason: To provide an essential tool to the Aeronautical E.A.R.C., where none now exists, at latitudes north of 60° N and south of 60° S, to assure that requisite geographic separation is maintained between (R) frequencies at the various megacycle orders in those cases where air routes are operated beyond the limits of the area encompassed (between latitudes 60° N and 60° S) by the interference range transparencies included in Appendix 27.

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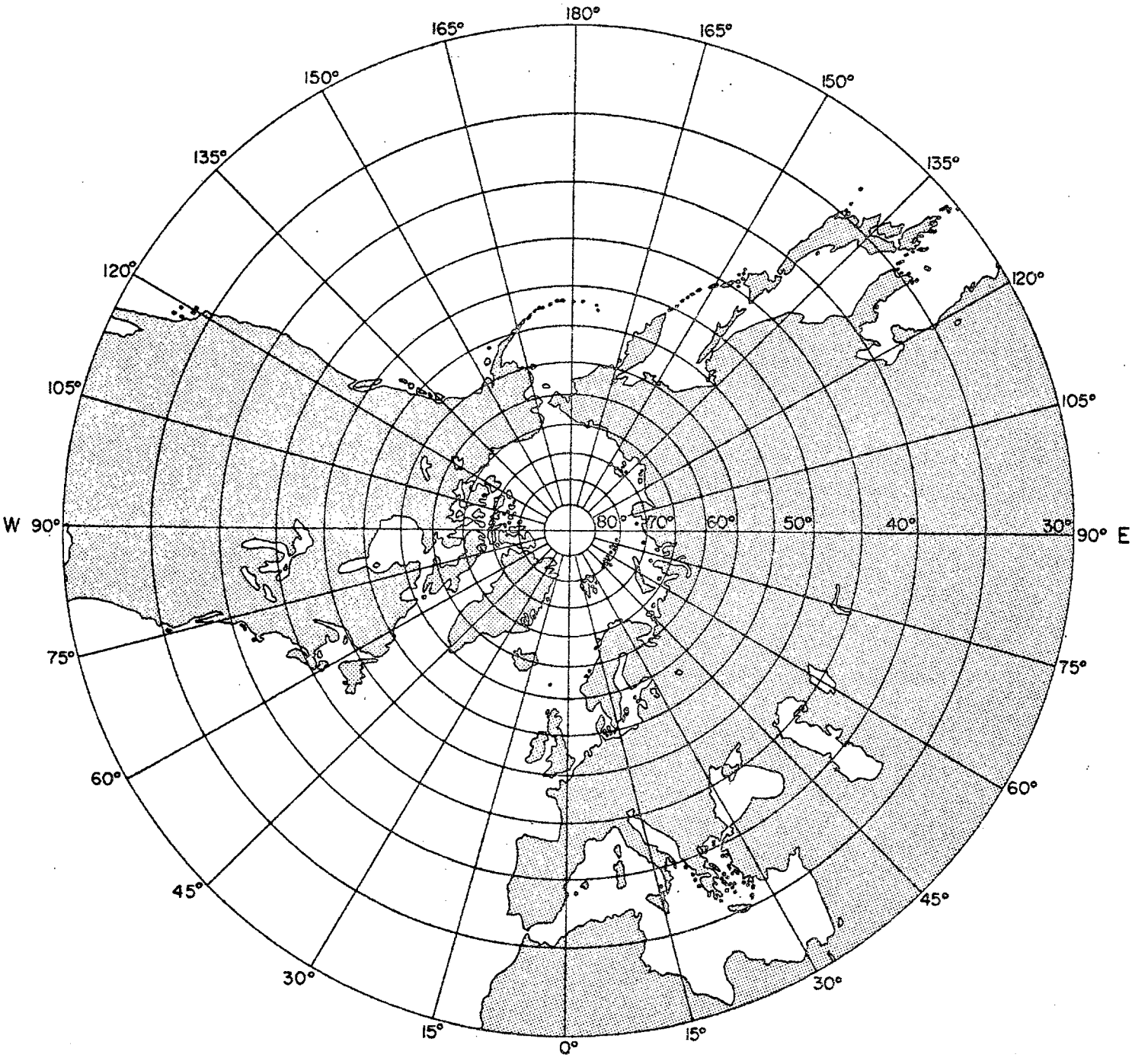
Pôle Nord - North Pole - Polo Norte




NORTH POLE

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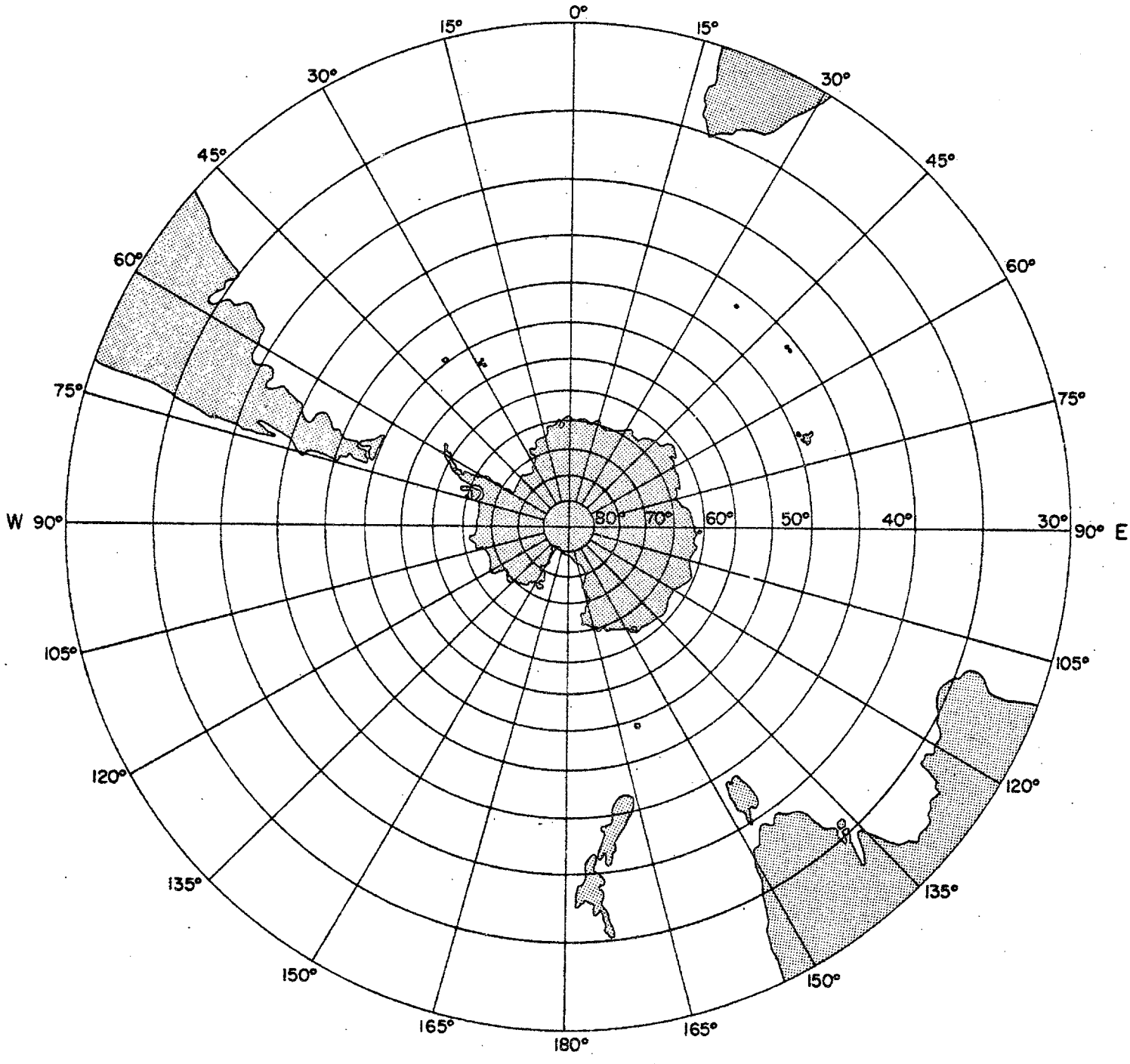
Pôle Sud - South Pole - Polo Sur




SOUTH POLE

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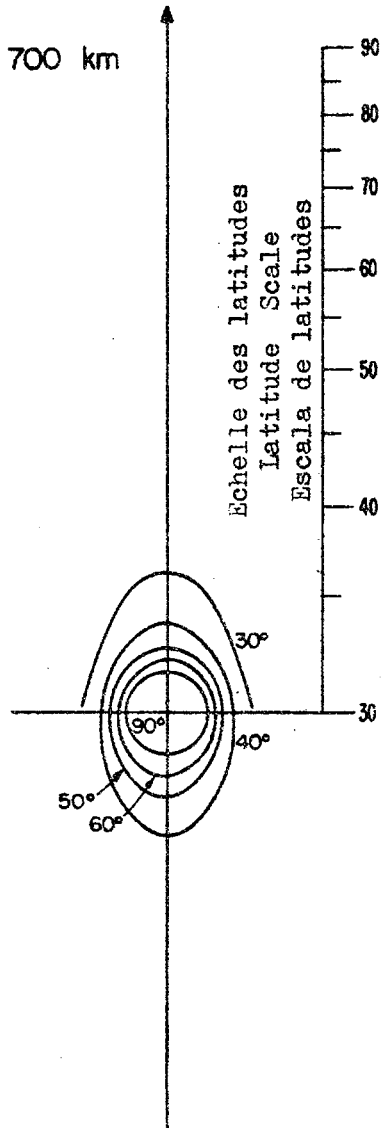


| | | | |
|---|---|---|---|
| 3.0 | 3.5 | MHz | JOUR |
| | | Mc/s | DAY |
| | | Mc/s | DIA |

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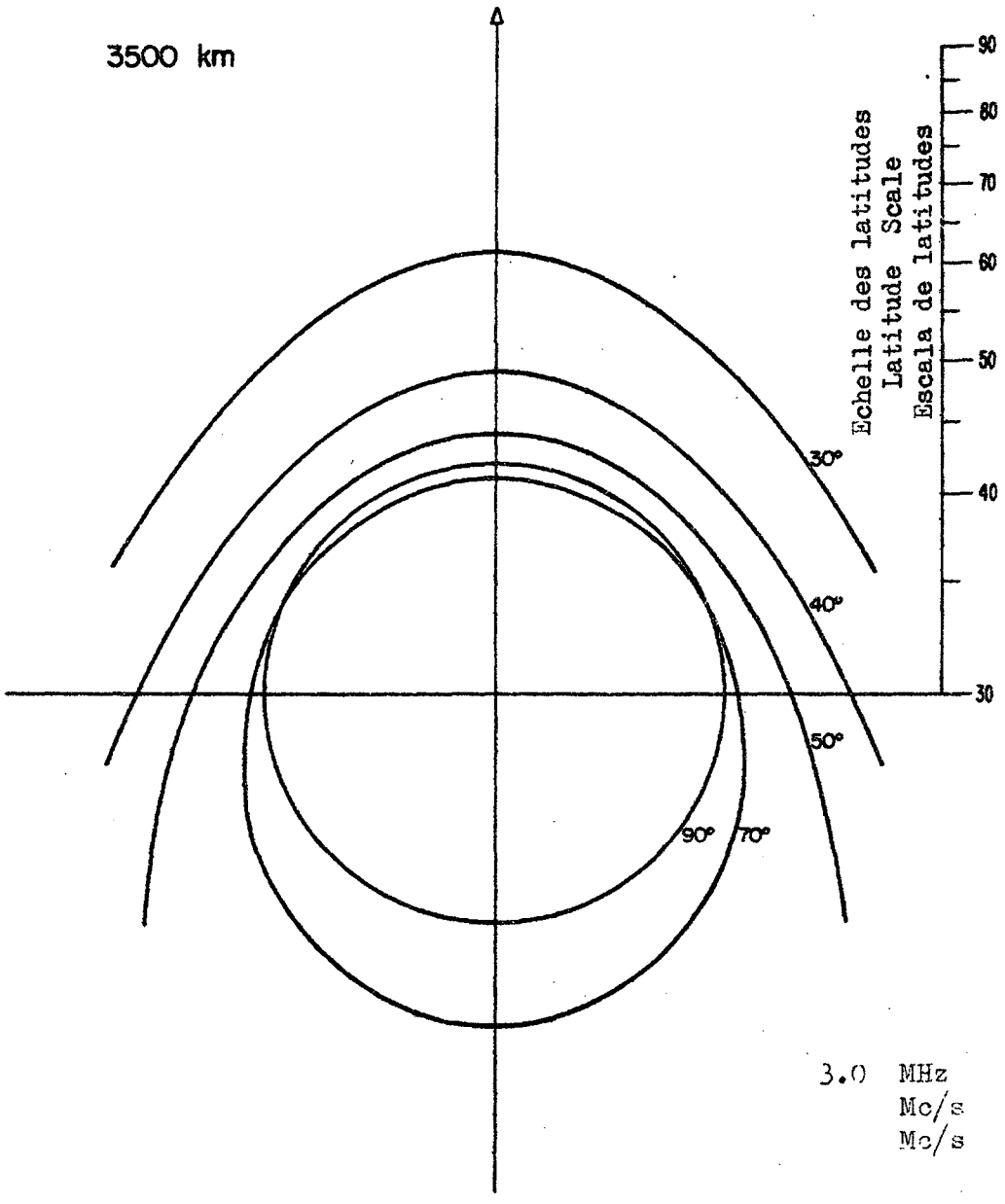


3.0 MHz NUIT
Mc/s NIGHT
Mc/s NOCHE

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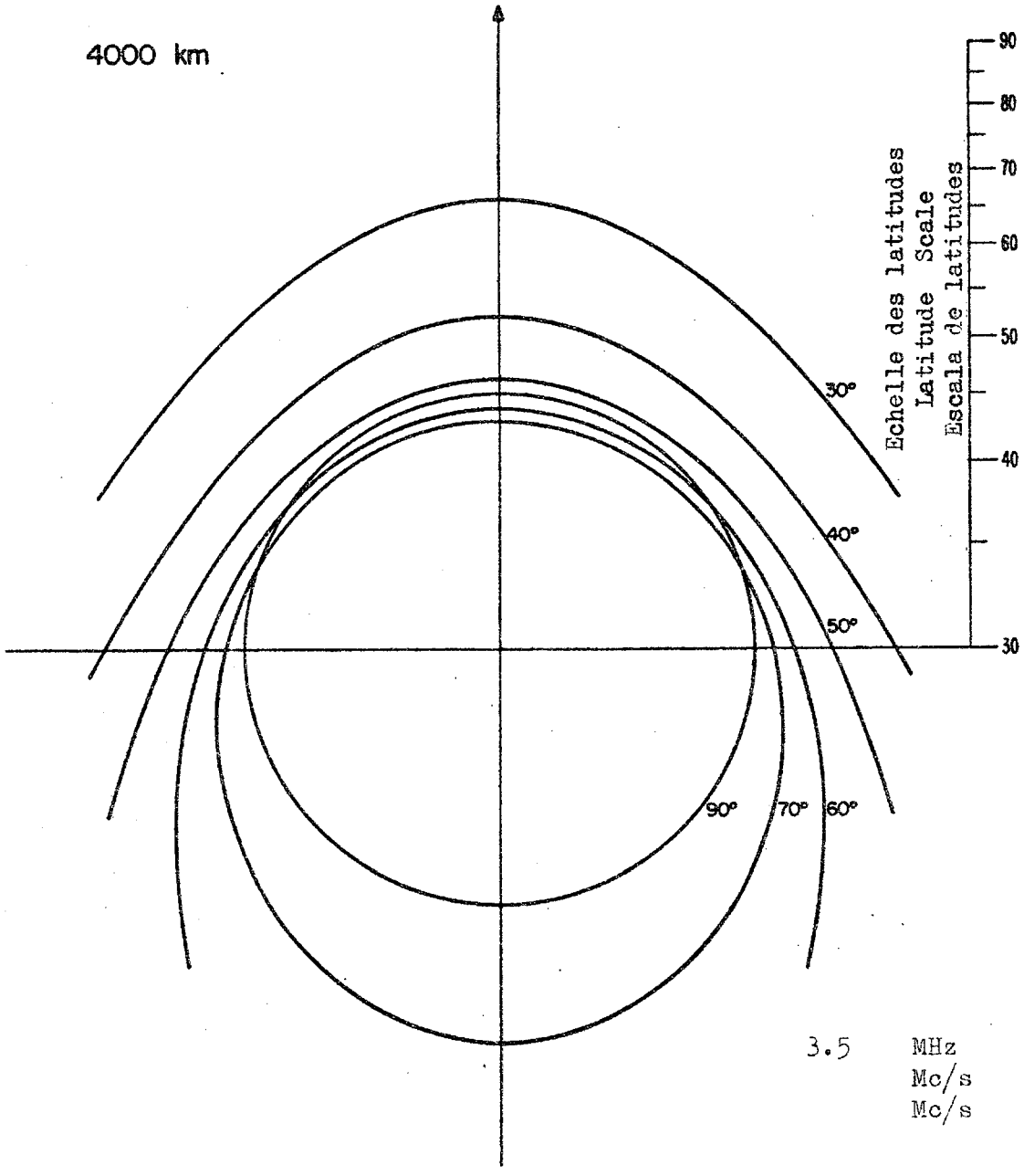


3.5 MHz NUIT
Mc/s NIGHT
Mc/s NOCHE

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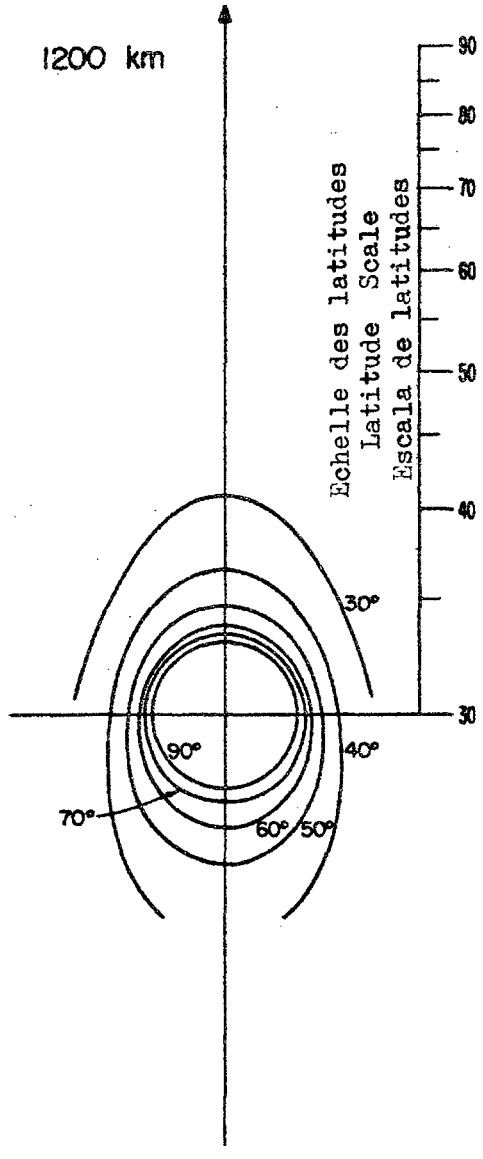


4.7 MHz JOUR
Mc/s DAY
Mc/s DÍA

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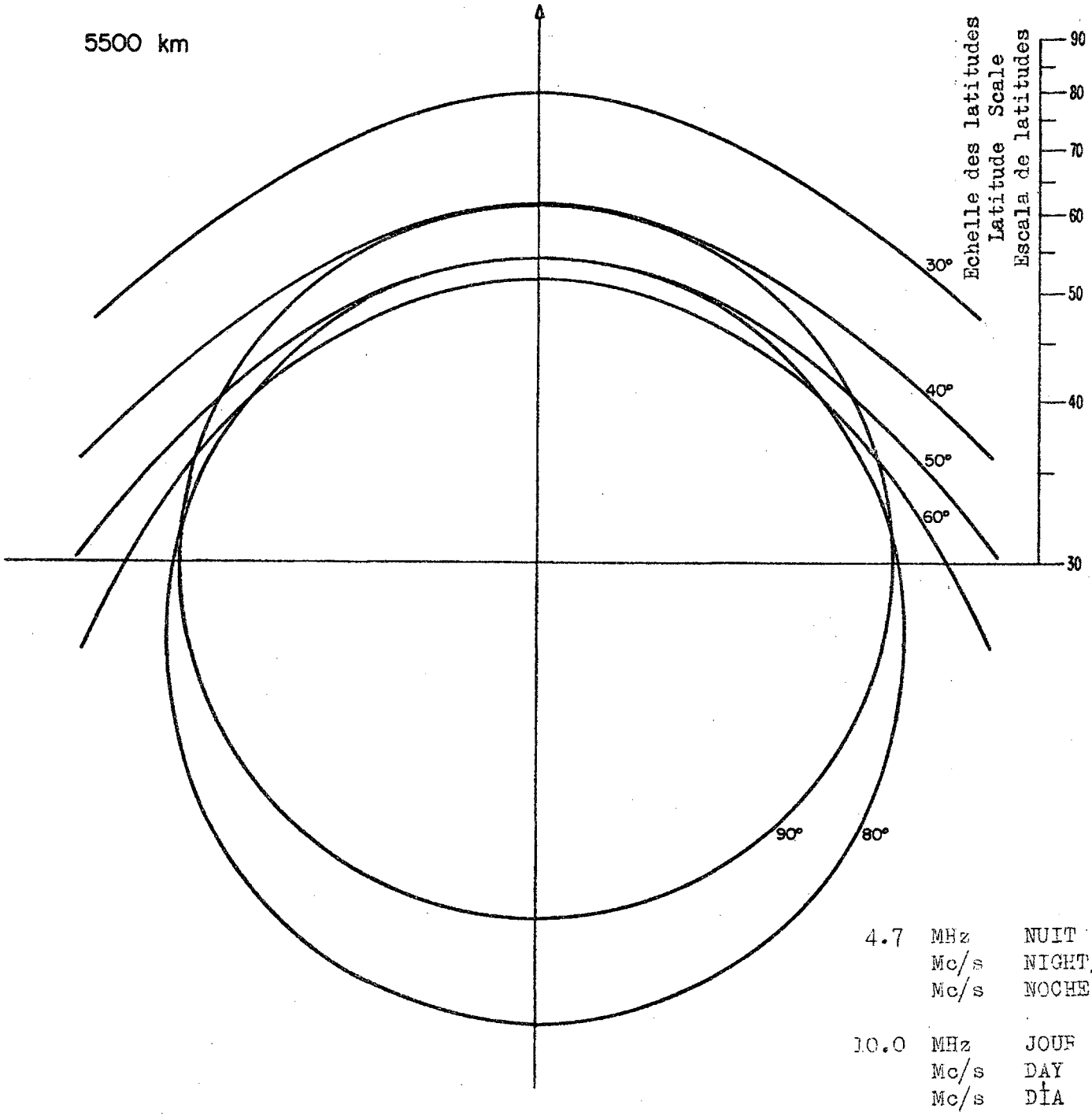
5500 km
Echelle des latitudes
Latitude Scale
Escala de latitudes
90
80
70
60
50
40
30
30°
40°
50°
60°
90°
80°
4.7 MHz NUIT
Mc/s NIGHT
Mc/s NOCHE
10.0 MHz JOUR
Mc/s DAY
Mc/s DÍA

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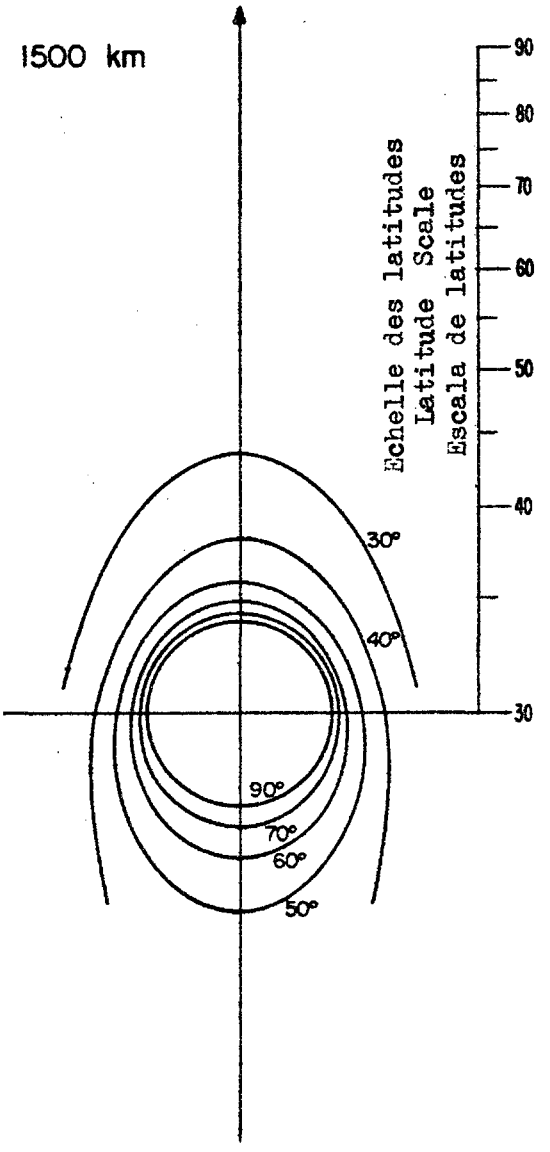


5.6 MHz JOUR
Mc/s DAY
Mc/s DÍA

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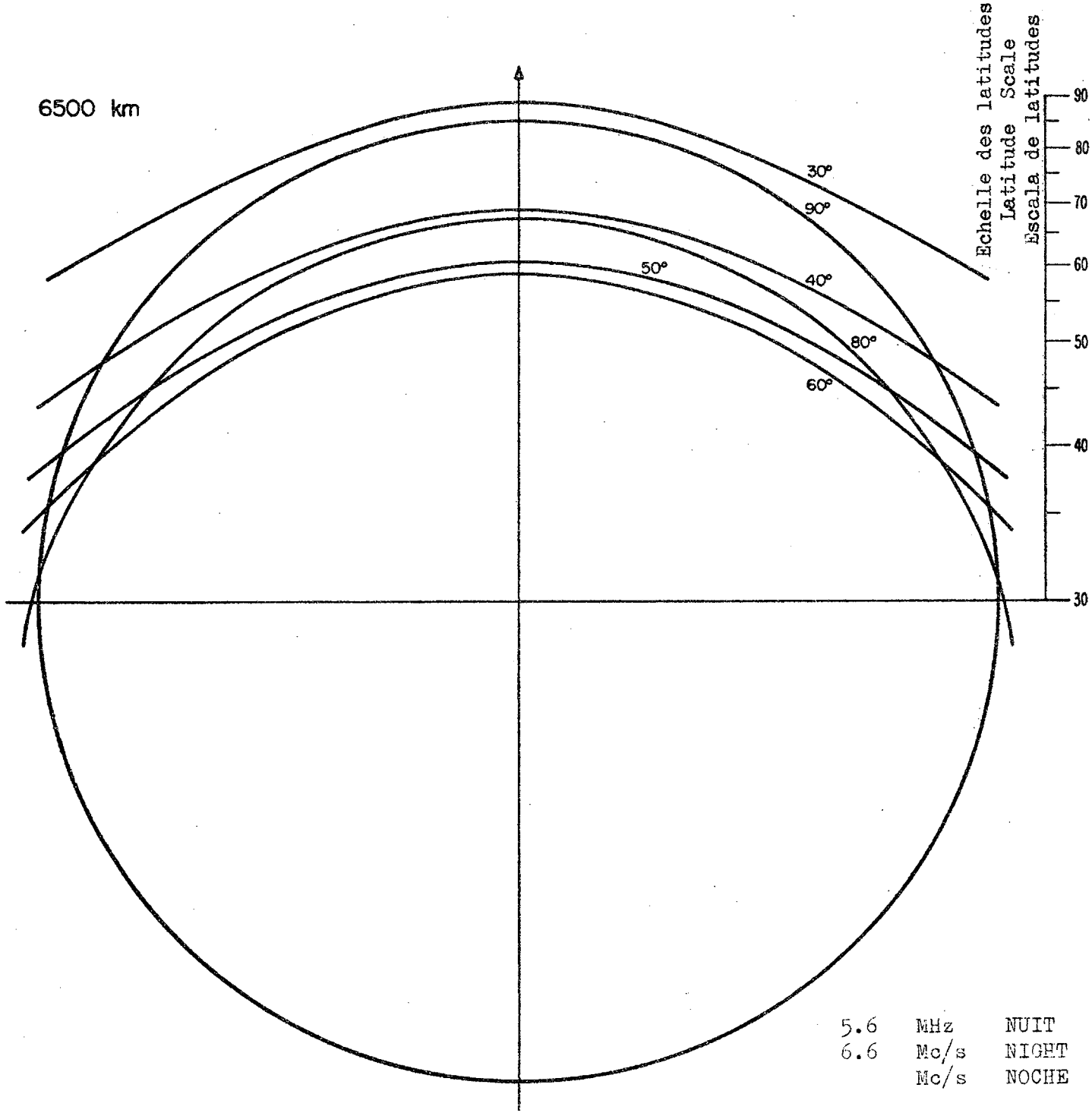
6500 km
30°
90°
50°
40°
80°
60°
Echelle des latitudes
Latitude Scale
Escala de latitudes
90
80
70
60
50
40
30
5.6 MHz NUIT
6.6 Mc/s NIGHT
Mc/s NOCHE

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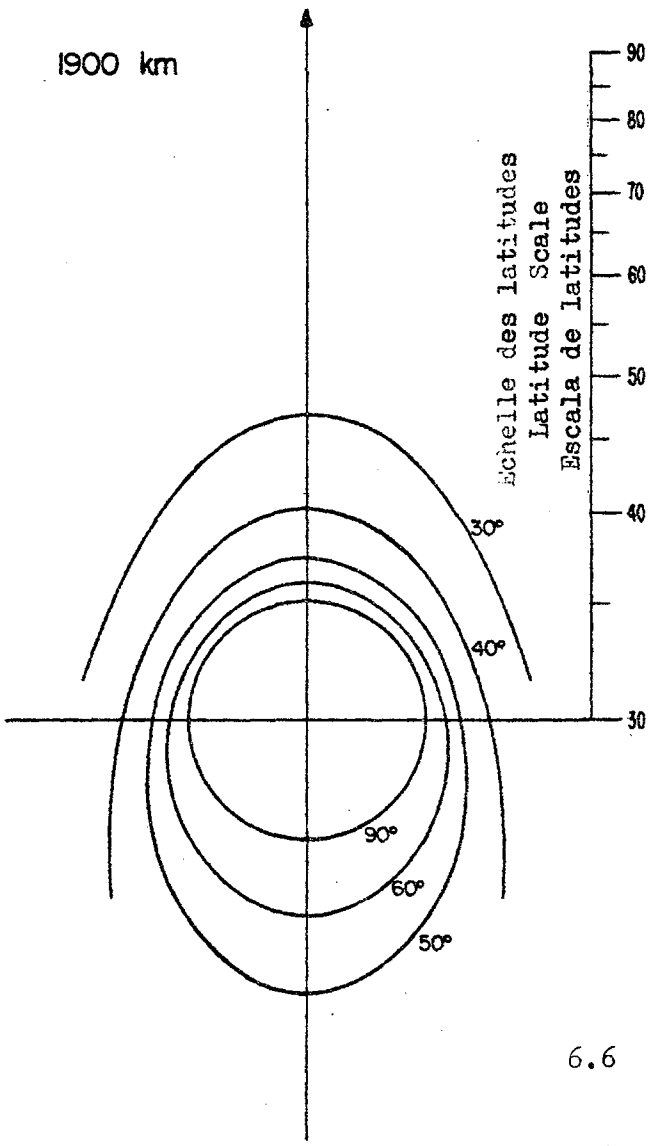


6.6 MHz JOUR
Mc/s DAY
Mc/s DIA

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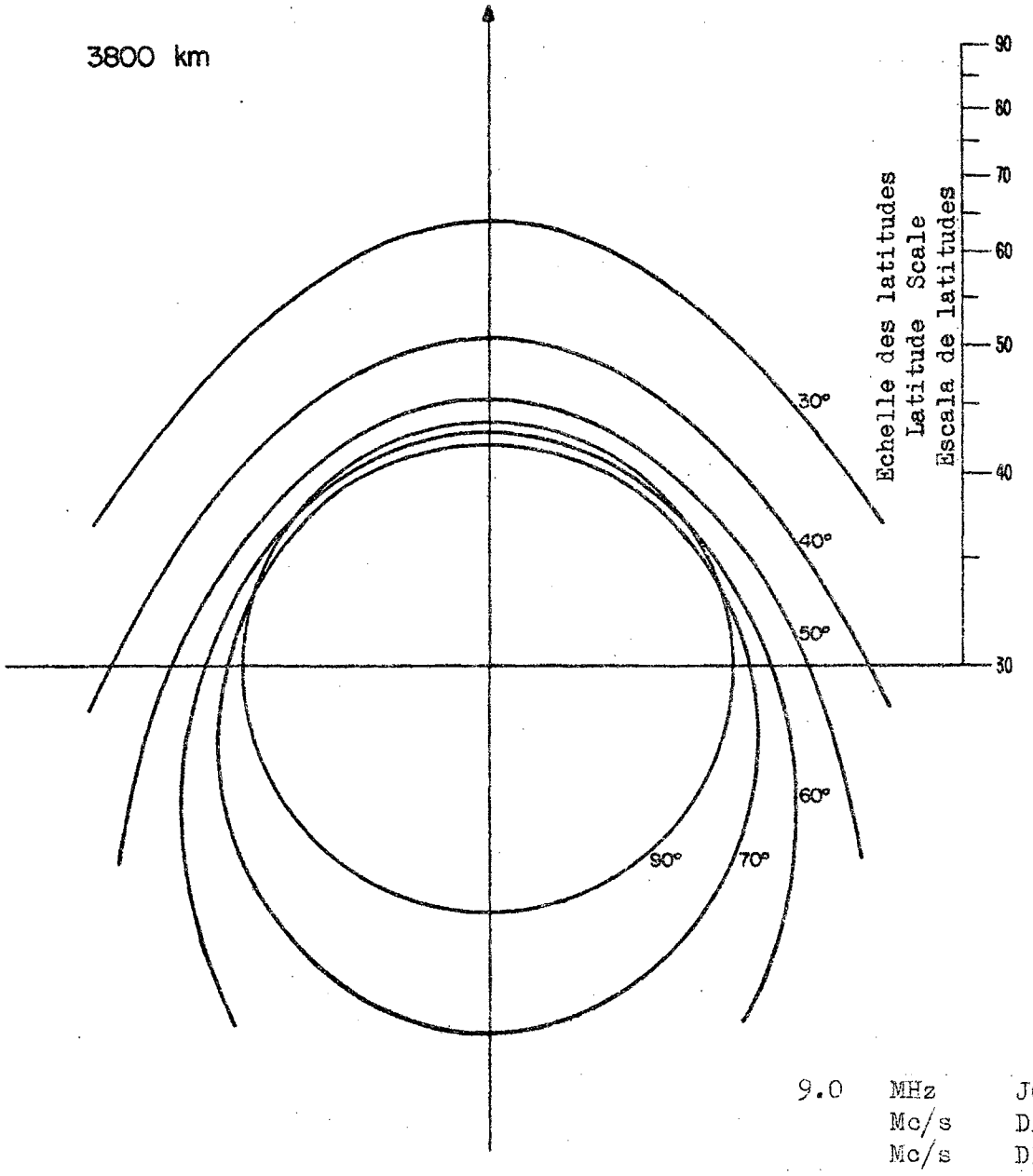


9.0 MHz JOUR
Mc/s DAY
Mc/s DÍA

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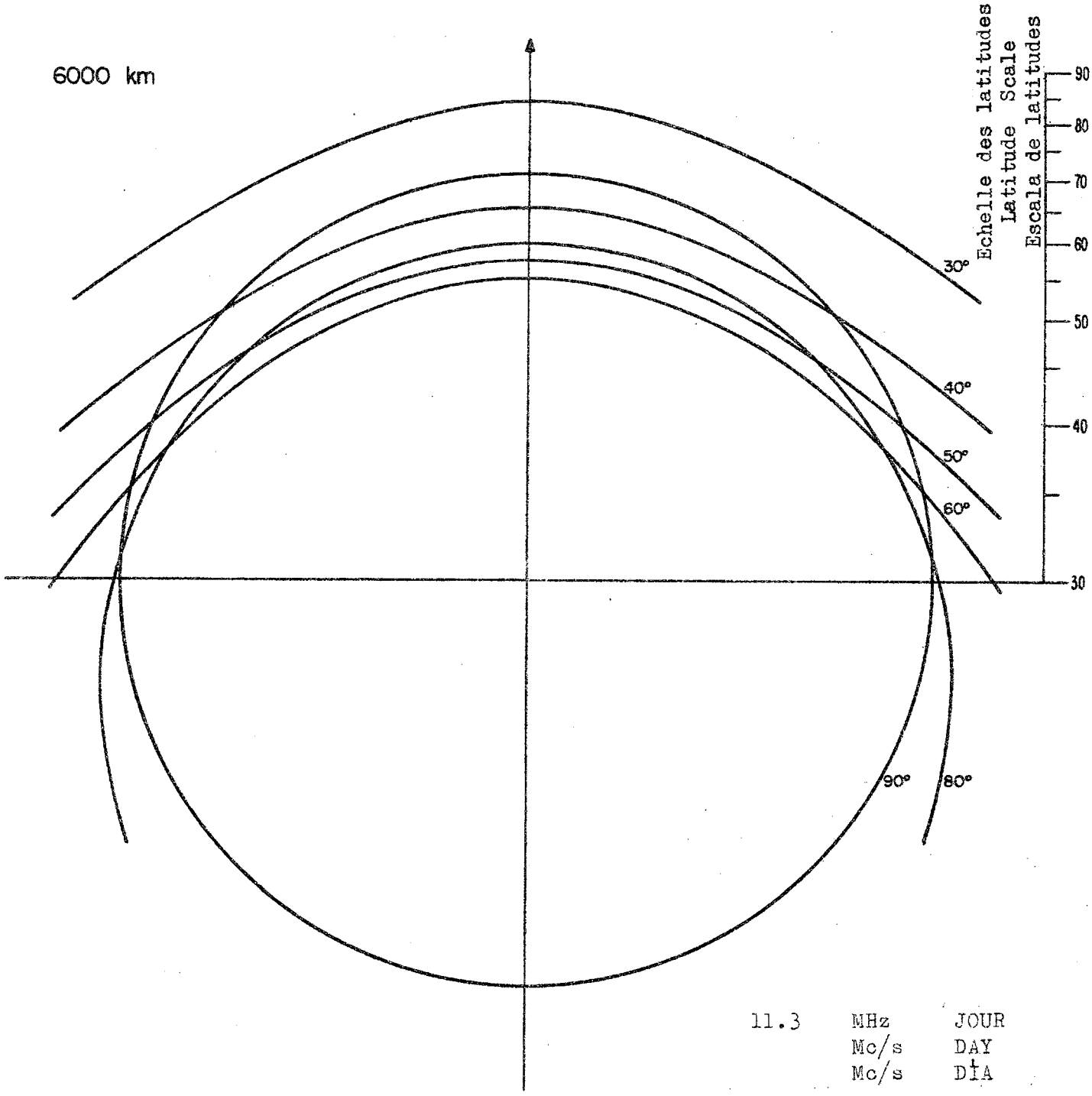


11.3 MHz JOUR
Mc/s DAY
Mc/s DÍA

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PROPOSAL No. 25

That the following Resolution entitled, "Relating to the Use of VHF by the Aeronautical Mobile (R) Services", be adopted by the First Session of the Aeronautical E.A.R.C., Geneva 1964.

Reason: To reduce to the lowest possible number the high frequency requirements that must be satisfied at the main session of the Aeronautical E.A.R.C., Geneva 1965 and to encourage the use of the more reliable VHF system of communication.

RESOLUTION No.

RELATING TO THE USE OF VHF BY THE AERONAUTICAL MOBILE (R) SERVICES

The Aeronautical Extraordinary Administrative Radio Conference (Geneva, 1964),

considering

a) that from an aeronautical viewpoint, VHF provides a more reliable and more noise free communication system than HF;

b) that from a technical, operational and economic viewpoint the use of VHF by aviation has progressed appreciably since conception of the HF plan in Appendix 26 to the Radio Regulations;

c) that the use of VHF in its several modes could appreciably alleviate the requirements for aeronautical mobile high frequencies.

resolves

a) that the main Aeronautical E.A.R.C. 1965 examine each requirement for high frequencies to determine the feasibility from an operational and technical point of view of satisfying the requirement by use of VHF;

b) that only after it is determined that a requirement cannot be satisfied by the use of VHF, consideration be given to satisfying it by high frequencies.

PROPOSAL No. 26

That the following Resolution entitled, "Relating to Plans for the Future which may affect the use of High Frequencies" be adopted by the preparatory session of the Aeronautical E.A.R.C., Geneva 1964.

Reason : To take into consideration any administration plans that will have a bearing on the use of high frequencies within the lifetime of the new aeronautical mobile plan.

RESOLUTION No.

RELATING TO PLANS FOR THE FUTURE WHICH MAY AFFECT THE USE OF HIGH FREQUENCIES

The Aeronautical Extraordinary Administrative Radio Conference (Geneva, 1964),

considering

a) that several administrations are actively engaged in development or other work which is intended to provide for use of other than high frequencies for aeronautical air/ground purposes;

b) that among the techniques under consideration are : increased use of VHF, extended and long range VHF and space radiocommunication techniques;

c) that by the time of the main session of the Aeronautical E.A.R.C. some of the techniques and plans may have progressed to the point where actual operational plans will have been made for implementation of the new techniques within the time frame allotted for the new HF aeronautical mobile plan;

d) that such implementation could have a significant impact on the requirements for high frequencies during the time span of the new plan.

resolves

a) that all administrations be requested to submit plans to the main session of the Aeronautical E.A.R.C. (1965) for use of other than high frequencies to satisfy aeronautical mobile requirements during the life span of the new plan;

b) that such plans be taken into consideration in the writing of the new aeronautical mobile HF Allotment Plan.

# P A R T  F O U R

## U. S. PROPOSALS CONCERNING

## AMENDMENT OF THE RADIO REGULATIONS

## ASSOCIATED WITH

## APPENDIX 26

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PROPOSAL No. 27

That Appendix 1 to the Radio Regulations, Geneva-1959 be amended as follows:

Amend Section E, II, Column 1 of Appendix 1 by the addition of a (new) second footnote, so that "Column 1", as amended, would read:

"Column 1 : Assigned frequency

1. Indicate the assigned frequency as defined in Article 1*) **), in kc/s up to 30 000 kc/s inclusive, and in Mc/s above 30 000 kc/s.

2. This information is a basic characteristic.

---

*) For television broadcasting stations in Region 1, the frequencies to be notified are those of the sound and vision carriers.

**) For stations in the aeronautical mobile (R) service, the frequencies to be notified are those of the (R) allotment plan (see Part II, Section II of Appendix 27)."

Reason: Consequential change necessary to implement the provision set forth in No. 18 of Appendix 27.

PROPOSAL No. 28

That Article 7 of the Radio Regulations, Geneva-1959, be amended as follows:

"431 §5. Frequencies in the bands allocated to the aeronautical mobile (OR) service between ~~2850~~ 3025 and 18030 kc/s (see Article 5) shall be assigned in conformity with the provisions of Appendix 26 and the other relevant provisions of these Regulations."

Reason: Consequential change resulting from separation of the allotment plans for the aeronautical mobile (R) and (OR) services.

"431a §5a. Frequencies in the bands allocated to the aeronautical mobile (R) service between 2850 and 17970 kc/s (see Article 5) shall be assigned in conformity with the provisions of Appendix 27 and the other relevant provisions of these Regulations.

Reason: Consequential change resulting from separation of the allotment plans for the aeronautical mobile (R) and (OR) services.

PROPOSAL No. 29

That the following Resolution, entitled "Relating to the Applicability of Appendix 26 to the Aeronautical Mobile (R) Service" be adopted by the main session of the Aeronautical EARC, Geneva-1965.

Reason: Consequential change resulting from separation of the allotment plans for the aeronautical mobile (R) and (OR) services.

RESOLUTION No. ....

RELATING TO THE APPLICABILITY OF APPENDIX 26 TO THE

AERONAUTICAL MOBILE (R) SERVICE

The Aeronautical Extraordinary Administrative Radio Conference, Geneva-1965

considering

a) that Resolution No. 13 of the Administrative Radio Conference, Geneva-1959, provided for the revision, when deemed appropriate and timely by the Administrative Council, of the high frequency allotment plan for the aeronautical mobile services;

b) that the Administrative Council in Resolution No. 525 of its 18th Session:

1. deemed it appropriate and timely that an Aeronautical EARC be convened for the purpose of revising the high frequency allotment plan for the aeronautical mobile (R) service;

2. made provision for the convening of a preparatory session and a main session, the former in February 1964 and the latter in ..... 1965.

3. proposed to Administrations an agenda for the Aeronautical EARC which was limited to the allotment plan for the (R) service;

4. made no provision for the revision of the high frequency allotment plan for the aeronautical mobile (OR) service;

c) that Members of the Union approved these actions of the Administrative Council;

d) that the preparatory session of the Aeronautical EARC was convened on 10 February, 1964; the main session was convened on ..... 1965; and that appropriate amendments were made to the high frequency allotment plan for the aeronautical mobile (R) service, but not to the aeronautical mobile (OR) service;

e) that the Aeronautical EARC, to clearly distinguish in the Regulations the high frequency allotment plan of the (R) service from the allotment plan of the (OR) service and to avoid any modification whatsoever of the allotment plan of the (OR) service, has prepared a new and complete high frequency allotment plan for the (R) service which has been designated as Appendix 27 to the Regulations;

directs the Secretary-General

to advise all Administrations that Appendix 26 to the Regulations will not apply to the Aeronautical Mobile (R) Service upon the entering into force of Appendix 27.

## ARTICLE 9

## RADIO REGULATIONS - GENEVA-1959

Comment: In its proposals for amendment of Article 9, the U.S.A. sets forth procedures to be applied by the I.F.R.B. in processing of Notices of assignments in the aeronautical mobile (R) service (a) during the interim period between the date of signing of the revised Appendix 26 (Appendix 27) and the entry into force of that Appendix; and (b) after the entry into force of that Appendix. Following the precedent of other Administrative Radio Conferences, those interim procedures would be contained in a Resolution for adoption by the Aeronautical EARC, Geneva-1965. The procedure set forth in the proposed Resolution parallels, in substance, the details of the final procedure, but differs in the matter of dates to be recorded. On the effective date of the revised Appendix 26 (Appendix 27), a procedure is provided for recording of Notices found satisfactory by the Board in the Master International Frequency Register in accordance with dates as specified by the final procedure.

The proposed final procedure is substantially similar to the current provisions of Article 9, the basic differences are directed to fulfilling the following objectives:

1. Protection of the double sideband radiotelephony system in current use over world air routes of international civil aviation;

2. to impose upon the I.F.R.B. responsibility to ascertain :

a) that the emission notified is in current use over the concerned world air route; or

b) that coordination of its use has been effected with concerned users of the pertinent world air route.

3. Specification of a finite procedure to be employed by the I.F.R.B. in examination of Notices. In addition, consequential changes are proposed to the reference numbers of the various provisions of the Appendix.

4. Amplification of the procedure by inclusion of provisions for processing of Notices relative to use of compatible single sideband emission(s).

The proposed amendments include the consolidation of the present Nos. 556 and 559 of the Radio Regulations.

PROPOSAL No. 30

That Article 9 of the Radio Regulations, Geneva-1959, be amended as follows:

"552 §21. (1) Examination of Notices concerning Frequency Assignments to Aeronautical Stations in the Aeronautical Mobile (R) Service in the Bands allocated exclusively to that Service between 2850 and 17970 kc/s (see No. 500).

553 (2) The Board shall examine each notice covered by No. 552 to determine whether:

554 a) the frequency corresponds to one of the frequencies specified in Column 1 of the Allotment Plan for the aeronautical mobile (R) service contained in Part II, Section II, Article 2 of Appendix 27;

~~or the assignment is the result of a permissive change from one class of emission to another and the occupied bandwidth is within the channelling arrangement provided for in Appendix 26 (Part I, Section IIA, paragraph 1);~~

555 b) the limitations of use set forth in Column 3 of the Plan have been appropriately observed;

556 c) ~~the class of station, class of emission, power, and hours of use are in accordance with the General Notes which constitute the heading for the Plan;~~

the notice is in conformity with the Plan technical principles set forth in Appendix 27, with particular reference to the provisions of Nos. 10.2 and 11.2 thereof;

557 d) the area of use is within the boundaries of the Air Route Areas as set forth in Column 2 of the Plan.

558 (3) In the case of a notice in conformity with the provisions of Nos. 554, to 556, but not with those of No. 557, the Board shall examine whether the protection specified in Appendix ~~26~~ 27 (Part 1, Section IIA, paragraph ~~5~~ 13.1) is afforded to the allotments in the Plan. In doing so, the Board shall assume that the frequency will be used in accordance with the "Sharing conditions between areas" specified in Appendix ~~26~~ 27 (Part I, Section IIB, paragraph 4 18).

~~559 (4) The technical criteria to be employed by the Board in its examination of these notices shall be those in Appendix 26 (Part I).~~"

Reason: Unnecessary since the provisions of No. 559 have been included within the amended No. 556, above.

560 (5) /No change/.

589 (1) Frequency Bands allocated exclusively to the Aeronautical Mobile (R) Service between 2850 and 17970 kc/s.

590 (2) /If the finding is favourable with respect to Nos. 554 to 557 the date of ~~3 December, 1951~~ (date of signing of the EARC Agreement, Geneva, 1965) shall be entered in Column 2a/.

Reason: To provide a uniform procedure for the Recording of Dates and Findings by the Board after the effective date of Appendix 27.

591 (3) If the finding is favourable with respect to No. 558, the date of ~~3 December, 1951~~ (date of signing of the EARC Agreement, Geneva, 1965) shall be entered in Column 2b.

Reason: To provide a uniform procedure for the Recording of Dates and Findings by the Board after the effective date of Appendix 27.

592 (4) In all other cases covered by No. 552, the date of receipt of the notice by the Board shall be entered in Column 2b.

Comment: No change.

593 (5) For assignments to stations other than aeronautical stations in the aeronautical mobile (R) service, the relevant date shall be entered in Column 2b (see Nos. 525, 526, 530 and 531).

PROPOSAL No. 31

That the following Resolution, entitled "Relating to the Treatment of Frequency Assignments to Aeronautical Stations in the Aeronautical Mobile (R) Service in the Bands Allocated Exclusively to that Service Between 2 850 and 17 970 kc/s" be adopted by the main session of the Aeronautical EARC, Geneva-1965.

RESOLUTION No. ....

RELATING TO THE TREATMENT OF FREQUENCY ASSIGNMENTS TO AERONAUTICAL STATIONS IN THE AERONAUTICAL MOBILE (R) SERVICE IN THE BANDS ALLOCATED EXCLUSIVELY TO THAT SERVICE BETWEEN 2 850 AND 17 970 kc/s

The Aeronautical Extraordinary Administrative Radio Conference, Geneva, 1965

resolves

1. that in the interim between [the date of signing] and [the date of coming into force of the EARC Agreement, Geneva, 1965]:

1.1 the provisions of Nos. 553 to 559 of the Radio Regulations, Geneva, 1959, shall continue to be applied in the examination of frequency assignments to aeronautical stations in the aeronautical mobile (R) service in the bands allocated exclusively to that service between 2 850 and 17 970 kc/s;

1.2 all such assignments shall be recorded in the Master International Frequency Register according to the findings reached by the I.F.R.B.;

1.3 the date to be entered in Column 2a or 2b of the Master International Frequency Register shall be as follows:

a) if the finding is favourable with respect to Nos. 554 to 557, the date of 3 December 1951 shall be entered in Column 2a;

b) if the finding is favourable with respect to No. 558, the date of 3 December 1951 shall be entered in Column 2b;

c) for all other such assignments (including those which may be in conformity with the Aeronautical Mobile (R) Frequency Allotment Plan, Geneva, 1965, but not in conformity with the Aeronautical Mobile (R) Frequency Allotment Plan, Geneva, 1959) the date of receipt of the Notice by the I.F.R.B. shall be entered in Column 2b;

1.4 any assignment which is in accordance with the Aeronautical Mobile (R) Frequency Allotment Plan, Geneva, 1965, shall be so indicated by the insertion by the I.F.R.B. of an appropriate symbol in the Remarks Column of the Master International Frequency Register;

2. that those frequency assignments to aeronautical stations in the aeronautical mobile (R) service in the bands allocated exclusively to that service between 2 850 and 17 970 kc/s which are contained in the Master International Frequency Register on /the date of coming into force of the EARC Agreement, Geneva, 1965/ shall be examined by the I.F.R.B. for conformity with the Aeronautical Mobile (R) Frequency Allotment Plan, Geneva, 1965, following the relevant parts of the procedure described in Nos. 553 to 559 of the Radio Regulations, Geneva, 1959, as modified by the EARC Agreement, Geneva, 1965, and shall be re-recorded in the Master International Frequency Register with a date in Column 2a or 2b as follows:

2.1 assignments found favourable with respect to Nos. 554 to 557 shall have /the date of signing of the EARC Agreement, Geneva, 1965/ entered in Column 2a;

2.2 assignments found favourable with respect to No. 558 shall have [the date of signing of the EARC Agreement, Geneva, 1965] entered in Column 2b;

2.3 all other assignments shall have [the day after the date of signing of the EARC Agreement, Geneva, 1965] entered in Column 2b.

AERONAUTICAL CONFERENCE

Corrigendum No.1 to
Document No. I-2-E.
9 January, 1964
Original: english

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

1. Kindly replace the second part of page 10 by the following:

U.S.A. Proposals to be Considered at the
Preparatory Session Aeronautical E.A.R.C.

AIRCRAFT OPERATION STATISTICS COMMITTEE

Proposal No. 3, page 49
Proposal No. 9, page 61
Proposal No.10, page 61
Proposal No.11, pages 61 - 63
Proposal No.12, pages 63 - 65
Proposal No.13, page 65
Proposal No.14, page 66
Proposal No.15, page 66
Proposal No.16, page 66
Proposal No.17, pages 66 - 67
Proposal No.18, pages 67 - 85
Proposal No.19, page 89
Proposal No.20, page 89
Proposal No.21, page 89
Proposal No.22, pages 90 - 92

2. Kindly replace the second part of page 12 by the following:

U.S.A. Proposals to be considered at the
Preparatory Session Aeronautical E.A.R.C.

ALLOTMENT OF R FREQUENCIES COMMITTEE

Proposal No. 2, page 10
(No. 18 only)
Proposal No.27, page 123
Proposal No.28, pages 123 - 124
Proposal No.29, pages 124 - 126
Proposal No.30, pages 126 - 128
Proposal No.31, pages 129 - 130

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3. Kindly replace page 7 by the attached one.

U.S.A. Proposals to be considered at the
Preparatory Session Aeronautical E.A.R.C.

TECHNICAL AND OPERATIONAL COMMITTEE

| | |
|---|---|
| Proposal No. 2, | pages 10 - 48 (except No. 18) |
| Proposal No. 3, | pages 49 - 52 |
| Proposal No. 4, | page 55 |
| Proposal No. 5, | page 55 |
| Proposal No. 6, | page 55 |
| Proposal No. 7, | page 56 |
| Proposal No. 8, | pages 56 - 57 |
| Proposal No.18A, | page 87 |
| Proposal No.24, | pages 93 - 117 |
| Proposal No.25, | page 119 |
| Proposal No.26, | page 120 |

# AERONAUTICAL CONFERENCE

Document No.I-2-E
1 November, 1963
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

United States of America

## PROPOSAL RELATING TO THE CONFERENCE STRUCTURE, AND RESPECTIVE TERMS OF REFERENCE OF EACH COMMITTEE, OF THE AERONAUTICAL E.A.R.C. TO ACCOMPLISH THE DIRECTIVES SET FORTH IN THE CONFERENCE AGENDA

1. The Preparatory Session of the Extraordinary Administrative Aeronautical Radio Conference (E.A.A.R.C.) is to be held in Geneva, Switzerland from 10 February to 9 March, 1964. This is a period of four weeks.

2. In order to take the fullest advantage of this time for substantive work, the Administration of the United States is of the view that some of the necessary administrative work might be done, or at least started, in advance of the meeting. This administration is therefore submitting in this paper a suggested organization of this Conference. The three Appendices contain step-by-step analyses of the work to be done by the three proposed substantive Committees and, for purposes of illustration, a suggested distribution of the United States proposals to these Committees.

3. It will be noted that this organization reflects that of the International Administrative Aeronautical Radio Conference (I.A.A.R.C., 1948 and 1949 Sessions), and applies to both sessions. In the view of the United States the organization of the 1948 and 1949 I.A.A.R.C. had over seven months' trial, and proved to be entirely satisfactory. Moreover, on careful consideration of the responsibilities of the 1964 - 1965 E.A.A.R.C. it was concluded that any of the substantive Committees could be called upon to operate at either Session. This paper proposes the following main Committees for this Conference:

1. Credentials Committee
2. Budget Control Committee
3. Steering Committee

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4. Editorial Committee

5. Technical and Operational Committee

6. Aircraft Operation Statistics Committee

7. Allotment of R Frequencies Committee

4. Credentials Committee

Pursuant to the provisions of Chapter 5 (No. 535) of the General Regulations, annexed to the Convention, to verify the credentials of each delegation.

5. Budget Control Committee

Pursuant to the provisions of Rule 5 (No. 572) of the General Regulations, annexed to the Convention, to determine the organization and facilities available to the delegates, and to examine and approve the accounts for expenditure incurred throughout the duration of the conference.

6. Steering Committee

To be composed of the chairman and vice chairmen of the conference and the chairman of committees. This Committee will provide guidance to facilitate the functioning of the Conference.

7. Editorial Committee

Pursuant to the provisions of Rule 21 (No. 657), of the General Regulations, annexed to the Convention, to perfect the final form of the texts of the Conference without altering the sense of the agreements reached.

8. Technical and Operational Committee

The terms of reference and explanatory amplification are set forth in Appendix A.

9. Aircraft Operation Statistics Committee

The terms of reference and explanatory amplification are set forth in Appendix B.

10. Allotment of R Frequencies Committee

The terms of reference and explanatory amplification are set forth in Appendix C.

11. During the first few days of the Conference, it will be necessary that the various proposals of Administrations be assigned for study and consideration by Committee(s), in accordance with the agreed Conference organizational structure. To further assist in a clear understanding of the organizational (committee) structure proposed above, the United States is including, as the second page of each of the Appendices, a tabulation of those of its proposals which would be considered by each of the respective committees.

12. The Administration of the United States makes these advance suggestions in the hope of saving a substantial amount of the time which might otherwise have to be devoted to purely administrative and organizational problems during the Preparatory Session of the 1964 - 1965 E.A.A.R.C.

Appendices : 3

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# A P P E N D I X A

## TECHNICAL AND OPERATIONAL COMMITTEE

Terms of Reference: To examine and recommend technical and operational principles to be used by the Conference as a basis for the preparation of a revised frequency allotment plan for the R service.

A. Technical. To consider:

1. The availability of continued application of the propagation data prepared by First I.A.A.R.C. (Aer-Document No. 231) /Refer to Appendix 26: Part 1, Section IIA, 1 a) through 1 c); Part 1, Section IIB, pages 9 through 15 and pocket at the end of the Appendix/;

2. The need for additional propagation data for areas to the north of 60° N and to the south of 60° S and, if needed, to prepare;

3. Applicable technical factors and to prepare recommendations (see B, 9), below) concerning the separation to be applied between contiguous frequencies in each of the bands allocated to the exclusive aeronautical mobile R service /Refer to Appendix 26: Part 1, Section II, 1, page 6/.

B. Operational. To consider:

1. The number of aircraft that can be accommodated on any single frequency or family of frequencies;

2. Sharing conditions between Areas: (i) MWARA to MWARA, (ii) MWARA to RDARA, and (iii) RDARA to RDARA /Refer to Appendix 26: Part 1, Section IIB, 4), page 10/;

3. Grouping of international air routes into areas of mutual interest (MWARA's);

4. Grouping of national air routes into areas of mutual interest (RDARA's);

5. Areas and frequency requirements for handling of meteorological information over MWARA's;

6. Requirements for channels common to the R and OR services /Refer to Appendix 26, Part 1, Section IIA, 3)/;

7. The requirements for and procedures to be applied relative to permissive use of compatible SSB emissions;

8. Development of special rules, as required, of a technical or operational nature pertaining to allotment or use of R. frequencies /Refer to Appendix 26: Part 1, Section IIA/;

9. Employing the results of the technical considerations developed under A, 3), above, and taking into account applicable operational factors, to prepare a list of frequencies to be allotted in the exclusive aeronautical mobile R bands /Refer to Appendix 26: Part 1, Section IIA, 2, page 7/

C. New Techniques. To consider:

1. New aeronautical communication techniques which have a direct bearing on channel widths and on the number of channels required to meet essential communications needs of national and international aircraft operations, with particular attention to:

i) extensions of the useful communication range and increased application of very high frequencies;

ii) new high frequency techniques to increase the speed and quantity of communications;

iii) new methods for more expeditious dissemination of meteorological information;

iv) improved selective calling systems; and

2. Measures to be taken to adequately reflect the above aeronautical communication techniques in the new frequency allotment plan.

D. Resolutions and Recommendations.

To consider all Resolutions and Recommendations of a technical or operational nature which should be put into suitable form for incorporation into the Final Report.

U.S.A. Proposals to be considered at the
Preparatory Session Aeronautical E.A.R.C.

TECHNICAL AND OPERATIONAL COMMITTEE

Proposal No. 2, pages 3 - 33 (corrected) (except No. 18)

Proposal No. 3, pages 35 - 38

Proposal No. 4, page 40

Proposal No. 5, page 40

Proposal No. 6, page 40

Proposal No. 7, pages 40 & 41

Proposal No. 8, pages 42 & 43

Proposal No. 18A, page 70A

Proposal No. 24, pages 78 - 90

Proposal No. 25, page 91

Proposal No. 26, page 92

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# A P P E N D I X  B

## AIRCRAFT OPERATION STATISTICS COMMITTEE

Terms of Reference:

1) To examine and to develop the requirements for minimum aircraft flight operations statistics to be required from Administrations, essential for preparation of a revised frequency allotment plan for the aeronautical (R) service, relating to the type and nature of information to be requested;

2) To consider and prepare guidance for use by the I.T.U. in the grouping, tabulating, and sorting (prior to the convening of the Main Session) of aircraft operations statistics received from Administrations, relating to,

   i) the use of automatic means for processing statistics

   ii) the preparation of world chart(s) and tabular lists showing the number of flights and air routes flown, based on aircraft flight operations reported by Administrations, and

3) To recommend their acceptance to the Plenary Assembly;

4) To prepare an analysis, data and charts regarding aircraft flight operations reported by Administrations deemed necessary to serve as a basis for the work of the Conference.

To consider, for both MWARA and RDARA:

A) The type and nature of information concerning aircraft flight operations which should be provided by each country;

B) The utilization of automatic means which may be employed in the processing of flight operation statistics received from Administrations;

C) The submission of information by countries in a manner to facilitate grouping, tabulating or sorting of that information into areas of mutual interest;

D) To determine the duration and time of the year when flight operation statistics should be reported;

E) The development of a standard form and associated instructions to be used by Administrations in supplying flight operation statistics;

F) On the basis of flight operation statistics submitted by Administrations, to develop appropriate procedures and instructions to assist the General Secretariat, during the interim between the Preparatory and Main Sessions, in preparing analysis and/or summary reports of the number of flights and routes flown (density and distribution) within each of the various specified geographic areas,

G) On the basis of flight operation statistics submitted by Administrations, to develop guidance material to the General Secretariat for preparation, prior to the convening of the Main Session, of chart(s) and tabulations depicting the number of flights and routes flown (density and distribution of flight operations),

H) To consider all Resolutions and Recommendations concerning the requirements for, the collection of, the listing of tabulation, and the disposition, of aircraft operations statistics, both MWARA and RDARA, which should be put into suitable form for incorporation into the Final Report.

## U.S.A. Proposals to be Considered at the Preparatory Session Aeronautical E.A.R.C.

### AIRCRAFT OPERATION STATISTICS COMMITTEE

Proposal No. 3, page 34
Propoasl No. 9, page 46
Proposal No. 10, page 46
Proposal No. 11, page 46-49
Proposal No. 12, page 49-51
Proposal No. 13, page 51-52
Proposal No. 14, page 52
Proposal No. 15, page 52
Proposal No. 16, page 52-53
Proposal No. 17, page 53
Proposal No. 18, page 53-70
Proposal No. 19, page 72
Proposal No. 20, page 72
Proposal No. 21, page 73
Proposal No. 22, page 73-75

# A P P E N D I X C

## ALLOTMENT OF R FREQUENCIES COMMITTEE

Terms of Reference:

1) To study the results of the Technical and Operational Committee and the Aircraft Operation Statistics Committee and such other data available to the Conference as it may deem necessary, to make a complete world-wide plan of allotment of frequencies in the HF bands allocated for the aeronautical mobile R service;

2) In consequence of the revisions to the allotments in Appendix 26, to examine and to recommend to the Conference necessary amendments to the Radio Regulations, including Appendix 1, Article 7 and Article 9, and, within its terms of reference, to prepare recommendations or resolutions which should be included in the Final Report of the Conference.

To consider:

A) For MWARA, the reports of the Aircraft Operation Statistics Committee and the Technical and Operational Committee and to recommend: (a) the necessary megacycle order of frequencies and (b) the number of necessary frequencies in each megacycle order; required to meet the needs of all MWARA's /Refer to Appendix 26, Part II/;

B) For RDARA - Western Hemisphere, the reports of the Aircraft Operation Statistics Committee and the Technical and Operational Committee and to recommend: (a) the necessary megacycle order of frequencies and (b) the number of necessary frequencies in each megacycle order; required to meet the needs of all of the RDARA's of the Western Hemisphere /Refer to Appendix 26, Part II/;

C) For RDARA - Eastern Hemisphere, the reports of the Aircraft Operation Statistics Committee and the Technical and Operational Committee and to recommend: (a) the necessary megacycle order of frequencies and (b) the number of necessary frequencies in each megacycle order; required to meet the needs of all of the RDARA's of the Eastern Hemisphere /Refer to Appendix 26, Part II/;

D) For Meteorological Requirements, the report of the Technical and Operational Committee and such other data available to the Conference as it may deem necessary and to recommend: (a) the necessary order of frequencies and (b) the number of necessary frequencies in each megacycle order; required to meet the needs for distribution of meteorological information to aircraft flying within MWARA's /Refer to Appendix 26, Part II/; and

E) Frequency Co-ordination, on the basis of: (a) the conclusions reached under A) through D), above; (b) the list of frequencies to be alloted in the exclusive R bands, as prepared by the Technical and Operational Committee; (c) the agreed propagation data, as prepared by the Technical and Operational Committee; and (d) other directives of Committee 6; to develop and recommend an allotment plan for the R service.

F) Resolutions, Recommendations and Amendments to the Radio Regulations, within its Terms of Reference, and to provide recommendations for their incorporation, as appropriate, into the Final Report of the Conference.

U.S.A. Proposals to be Considered at the Preparatory Session Aeronautical E.A.R.C.

ALLOTMENT OF R FREQUENCIES COMMITTEE

Proposal No. 2, page 11 (corrected) (No. 18 only)

Proposal No. 27, page 94

Proposal No. 28 page 95

Proposal No. 29, pages 96-97

Proposal No. 30, pages 99-101

Proposal No. 31, pages 102-103

AERONAUTICAL CONFERENCE

Addendum No. 1 to
Document No. I-3-E
27 January, 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Japan

# ANNEX TO THE JAPANESE PROPOSAL II RELATING TO "COUNTER MEASURES AGAINST HARMFUL INTERFERENCE"

## Condition of interference obtained from radio monitoring

This annex shows the result of the investigation into the distribution characteristics of frequency spectrum and condition of interference to the existing operating frequencies, etc. of the aeronautical mobile (R) service, conducted in November 1963 at seven monitoring stations in this country.

1. Name and locations of monitoring stations

| Name | Location | |
|---|---|---|
| Tokyo | 35° 12' 14" N | 139° 29' 14" E |
| Osaka | 34° 42' 28" N | 134° 57' 15" E |
| Koga | 33° 43' 26" N | 130° 29' 26" E |
| Toyama | 36° 44' 37" N | 137° 11' 13" E |
| Miyakonojo | 31° 44' 00" N | 131° 02' 49" E |
| Sendai | 38° 26' 30" N | 141° 15' 00" E |
| Sapporo | 43° 05' 12" N | 141° 19' 01" E |

2. Instruments used

Automatic radio frequency spectrum monitoring equipment; field strength measuring equipment.

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3. Method of measurement and the result

The frequency spectrum of the following frequency bands was continuously recorded with an automatic radio frequency spectrum monitoring equipment, and the value at 50% per time in db (1 micro volt/m = 0 db) was obtained by measuring the field strength within each frequency band.

| | | |
|---|---|---|
| 2,854 kc | - | 3,015 kc |
| 3,404 kc | - | 3,495 kc |
| 4,654 kc | - | 4,696.5 kc *) |
| 5,484 kc | - | 5,670 kc *) |
| 6,529 kc | - | 6,679.5 kc |
| 8,820 kc | - | 8,961.5 kc |
| 10,012 kc | - | 10,093 kc |
| 11,280.5 kc | - | 11,394.5 kc |
| 13,264.5 kc | - | 13,354.5 kc |
| 17,906.5 kc | - | 17,966.5 kc |
| 21,850 kc | - | 22,000 kc |

Note : The record was made at the sweep recording frequency bandwidth 500 kc/s, but the bandwidth marked with *) was made at 100 kc/s.

a) Figs. 1.A.1 - 1.A.12 were drawn up on the basis of the data obtained from the records of frequency spectrum distribution investigated at the monitoring stations. Frequencies are shown on the abscissa; and the bands used in the aeronautical (R) service are denoted with arrow marks. Time is denoted on the ordinate, the left side being G.M.T. and the right side, J.S.T. The time fixed with mark ◦ on the recorded spectrum line is the time when the frequency was measured, and the figures at its side denote the class of emission, and the field strength value at 50% per time in db (1 micro V/m).

b) As the 5536.5 kc/s of MWARA - CWP and the 5521.5 kc/s of MWARA - NP have been experiencing harmful interference by the HF broadcastings of adjacent countries hitherto, such situation is shown on Figs. 2.B.1 - 2.B.3 based upon the recorded data of spectrum in the past.

c) Figs. 3.1 - 3.15 show the values at 50% per time in db (1 micro V/m = 0 db) of the field strength received within the bands ± 4 kc of the following frequencies of MWARA surrounding Japan. As the operating hours of the stations in the aeronautical mobile (R) service were so short, the measurement of their emissions was impossible; accordingly the investigation was impossible, too.

MWARA - CWP = 2966 kc, 5506.5 kc, 5536.5 kc, 8862.5 kc, 13354.5 kc, 17906.5 kc

MWARA - NP = 2987 kc, 5521.5 kc, 8939 kc, 13274.5 kc, 17906.5 kc

MWARA - FE-2= 2868 kc, 5611.5 kc, 8871 kc, 13284.5 kc, 17966.5 kc

d) From the result of the foregoing investigations, it was clarified that the harmful interferences in 5 Mc/s bands are specially so heavy around Japan.

Method of reading

1) Sweep recording frequency (Mc) — Recorded on abscissa scale for frequency (10 kc uniform scale)

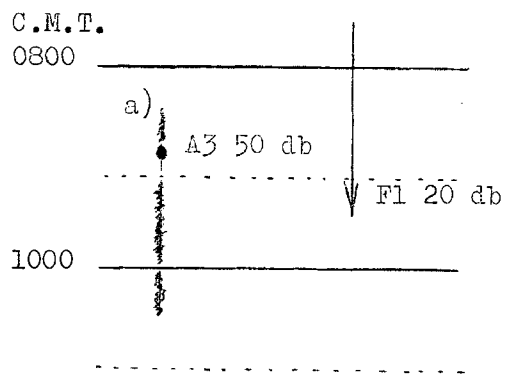
2) Time — Recorded on ordinate scale for G.M.T. and J.S.T. (2 hours uniform scale)

3) Aeronautical Mobile Service (R) band — Shown with symbol →| |←

4) Spectrum distribution of received wave — Vertically recorded

5) Time of measurement of field strength — Shown with symbol ♦

(Example)




a) Received during: 0815 - 1030 h
Class of emission: A3
Field strength at 50% time percentage in db: 50 db
Time of measurement of field strength: 0845 (G.M.T.)

b) Received during: 0735 - 0930 h
Class of emission: F1
Field strength at 50% time percentage in db: 20 db
Time of measurement of field strength: 0915 (G.M.T.)

Note : Spectra due to noises are not recorded in this figure.

Fig. 1.A.1 2854 kc/s kHz - 3015 kc/s kHz 3404 kc/s kHz - 3495 kc/s kHz

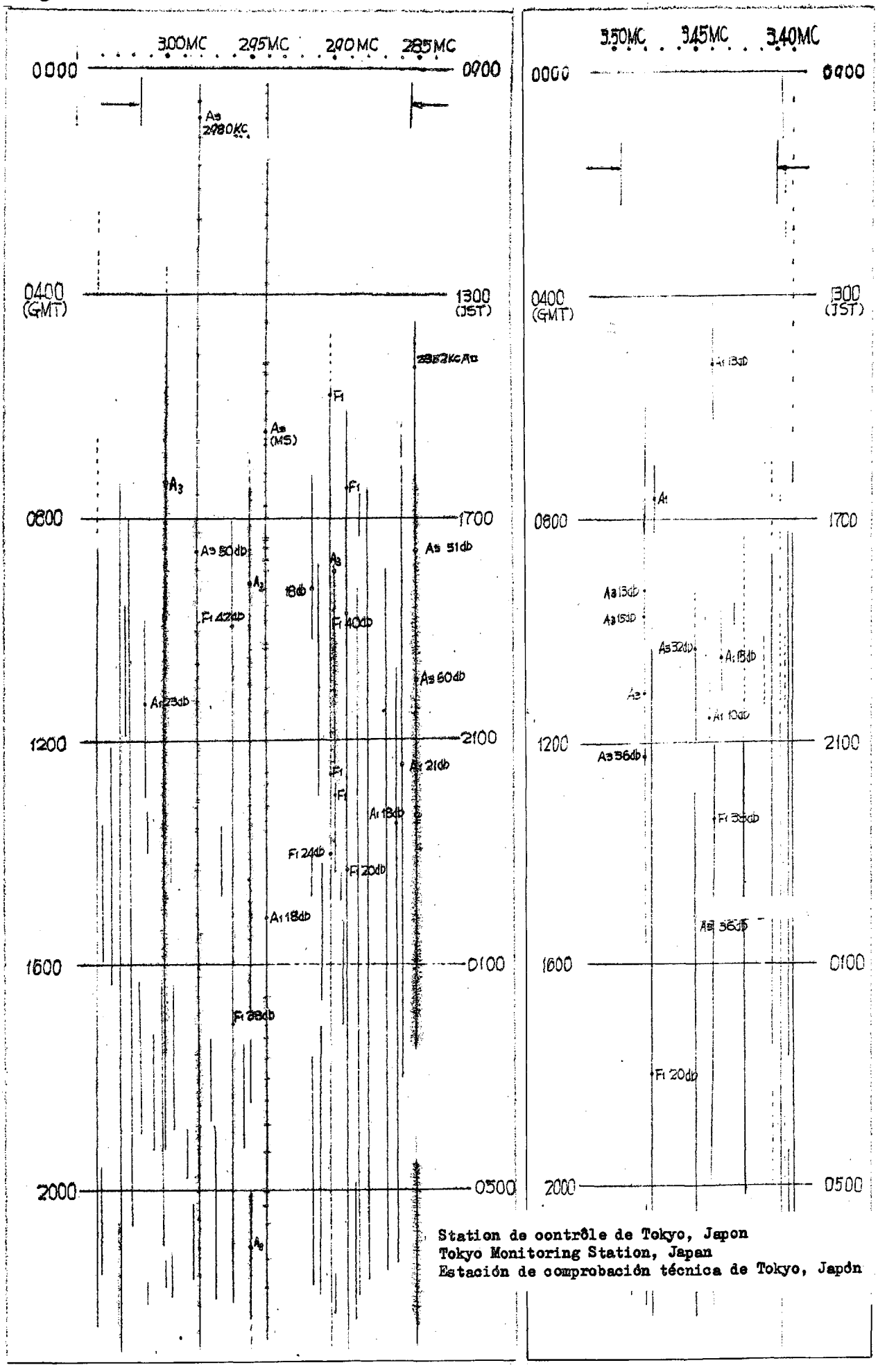



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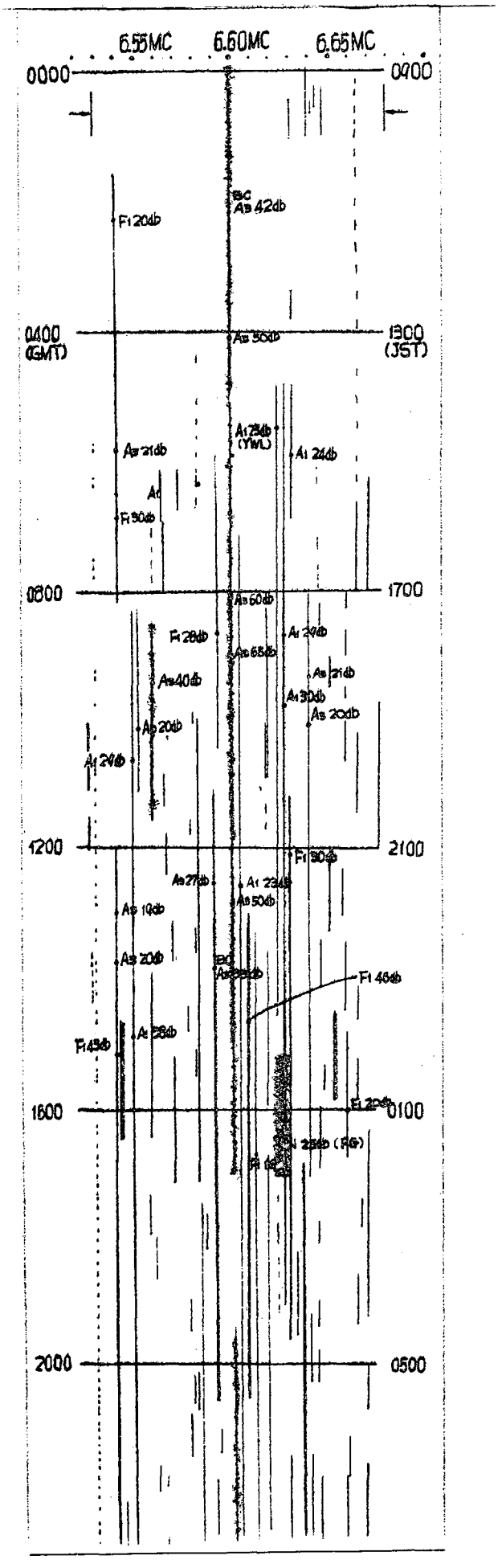
Fig. 1.A.3 6529 $\frac{ko/s}{kHz}$ - 6679,5 $\frac{ko/s}{kHz}$




8820 $\frac{ko/s}{kHz}$ - 8961,5 $\frac{ko/s}{kHz}$

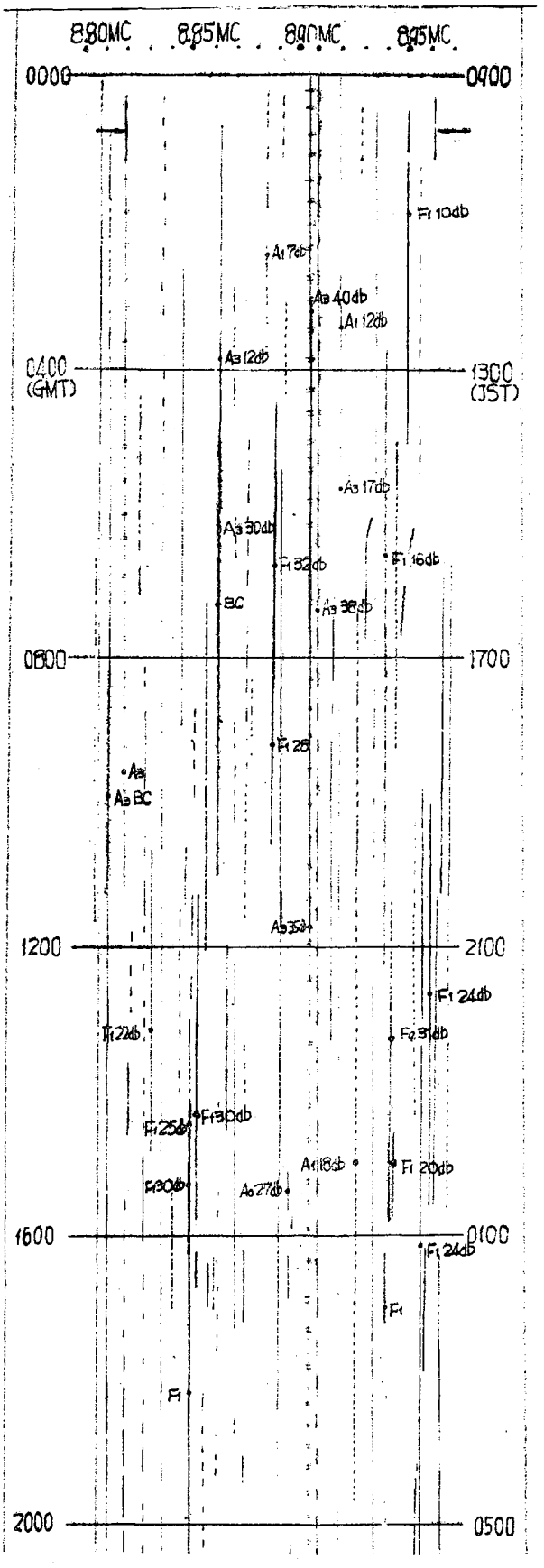



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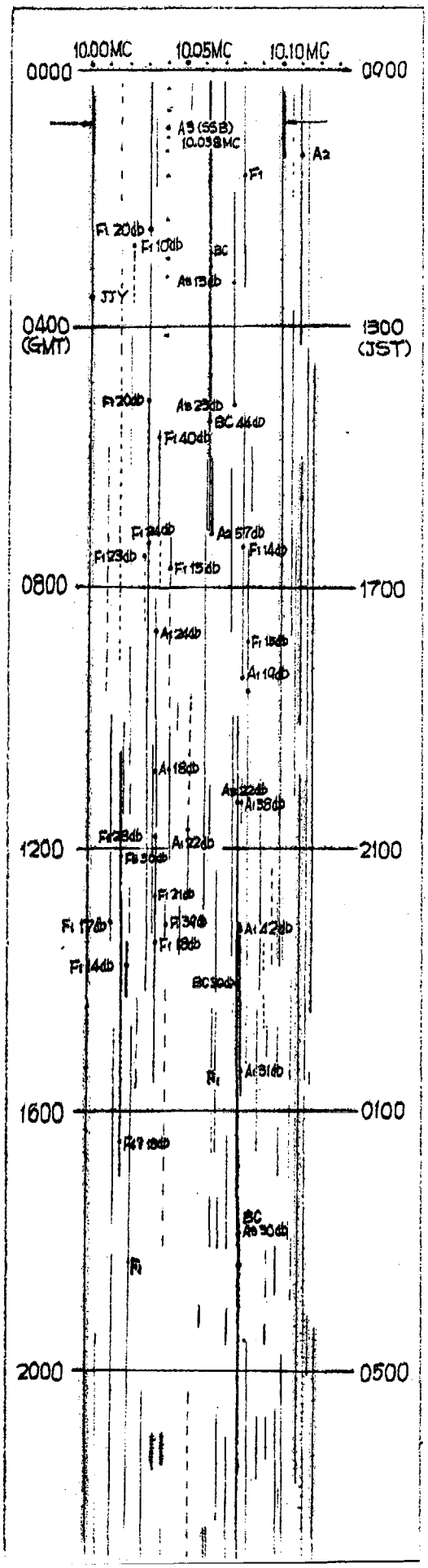
Fig. 1.A.5 10 012 kc/s kHz - 10 093 kc/s kHz




11 280,5 kc/s kHz - 11 394,5 kc/s kHz

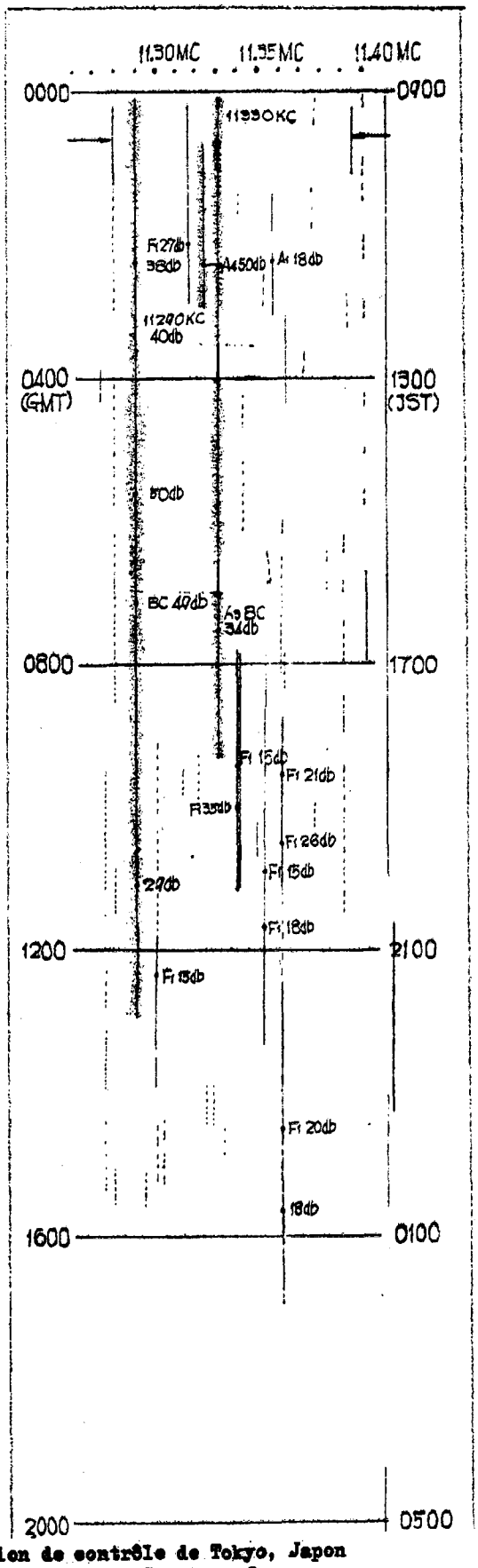



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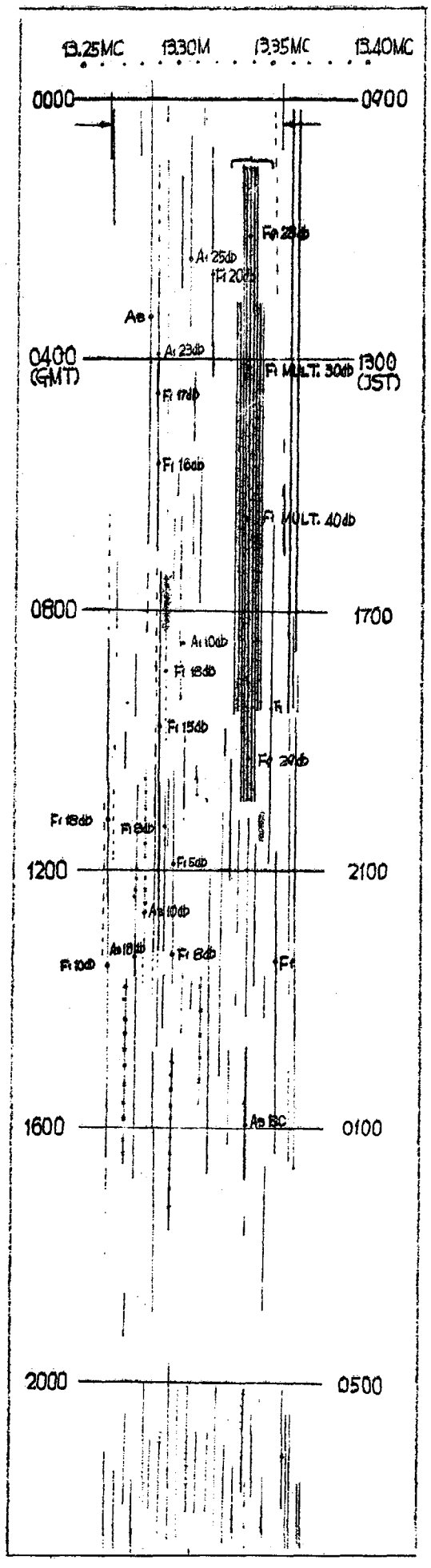
Fig. 1.A.7 13 264,5 $\frac{ko/s}{kHz}$ - 13 354,5 $\frac{ko/s}{kHz}$




17 906,5 $\frac{ko/s}{kHz}$ - 17966,5 $\frac{ko/s}{kHz}$

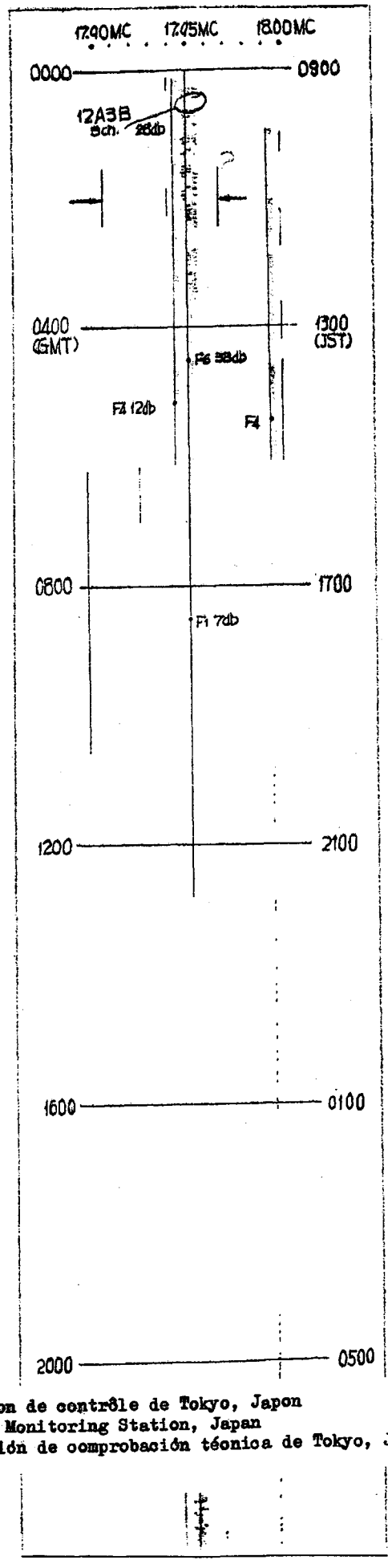



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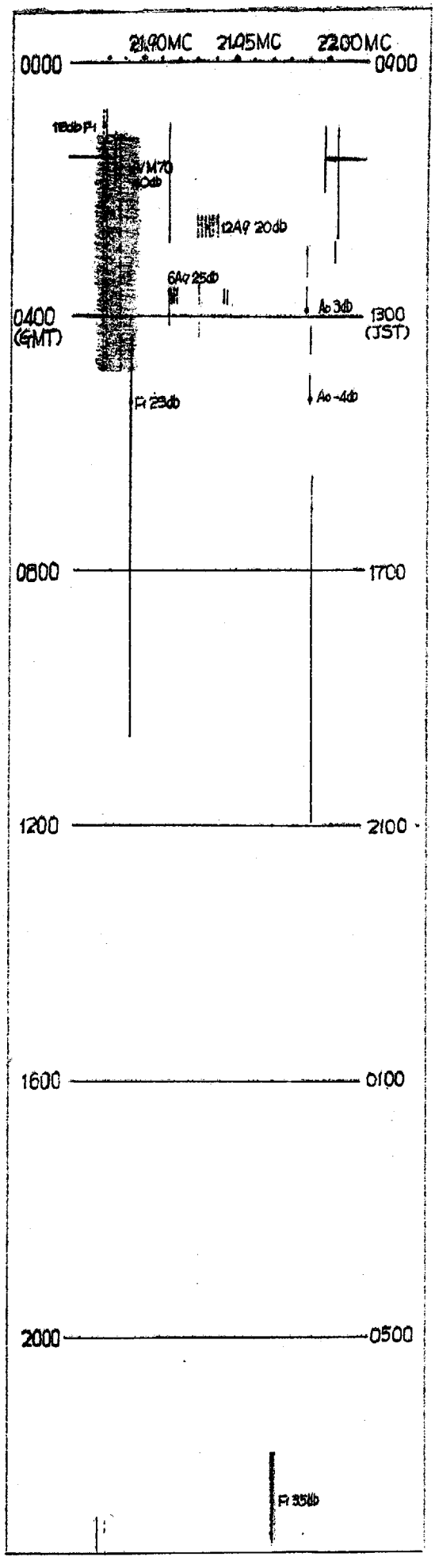
Fig. 1.A.9 21 850 kc/s kHz - 22 000 kc/s kHz




4 654 kc/s kHz - 4 696,5 kc/s kHz

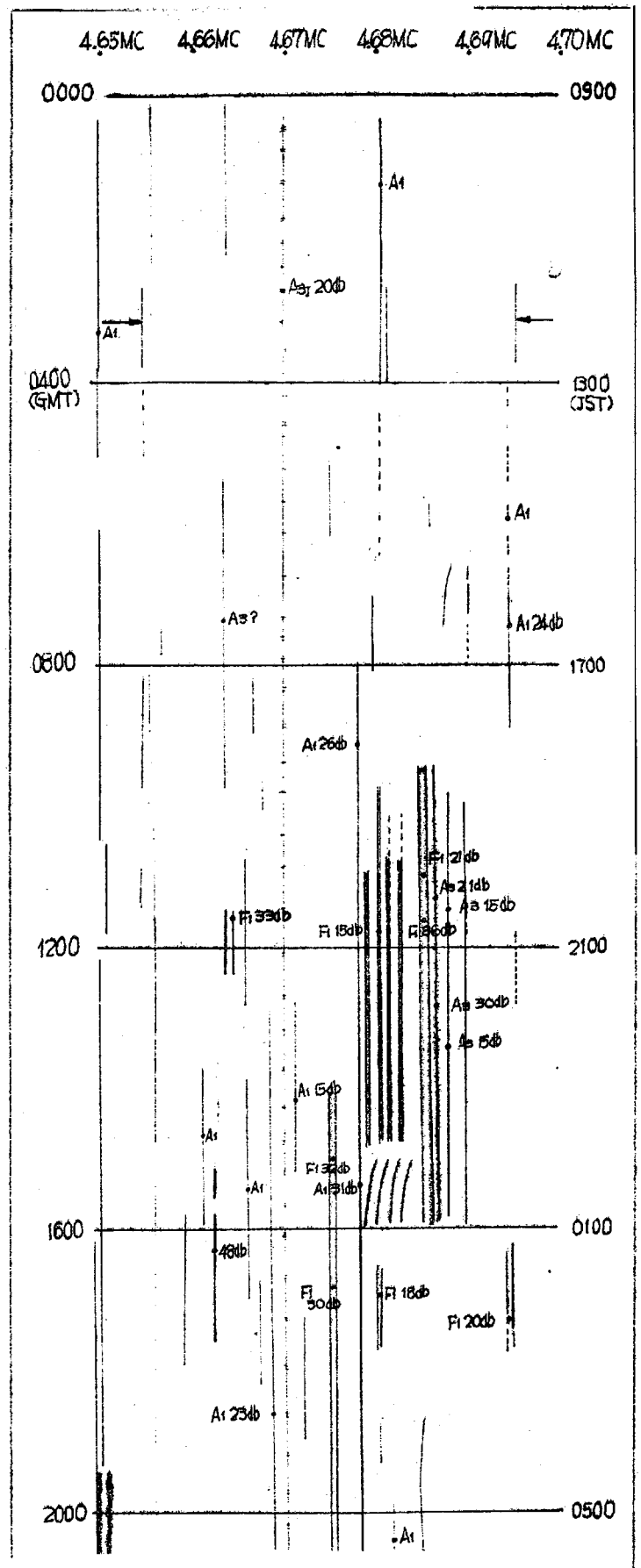



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Fig. 1·A·11 — 9 484 kc/s – 9670 kc/s (5 484 kHz – 5 620 kHz)

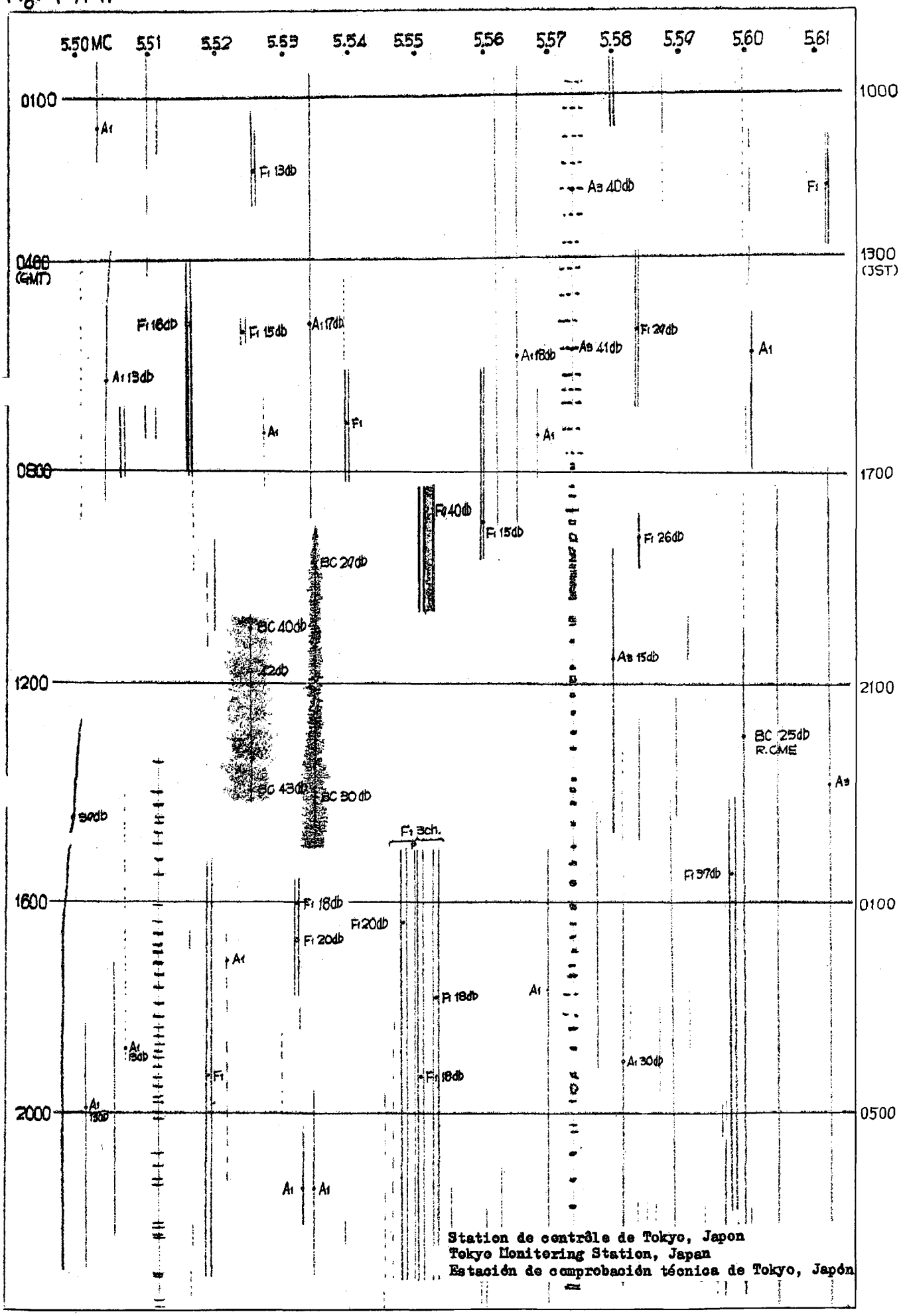


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Fig. 1·A·12 — 5 484 kc/s / kHz - 5 670 kc/s / kHz (5 570 kc/s / kHz - 5 670 kc/s / kHz)

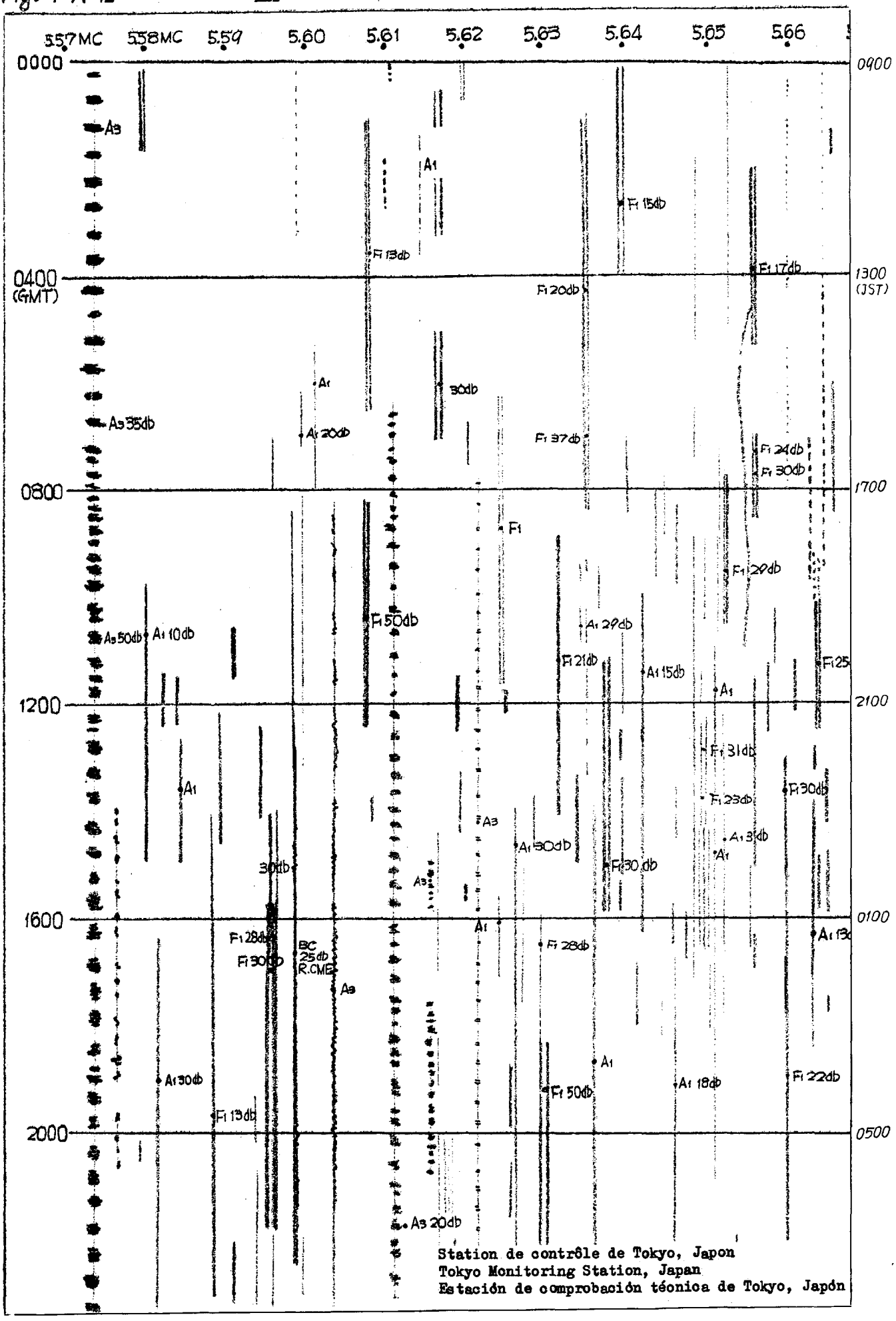


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Fig. 2·B·1

Mars
18 - 19 March 1963
Marzo

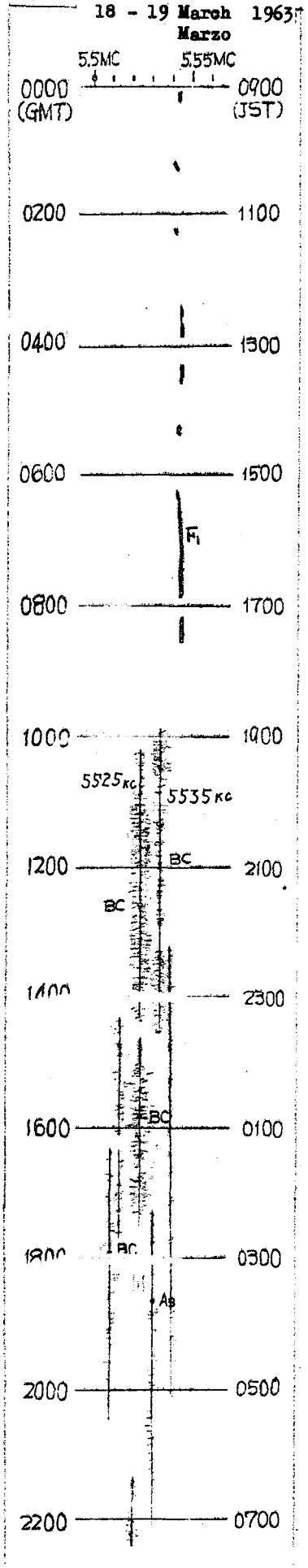



Fig. 2·B·2

Juin
6 - 7 June 1963
Junio

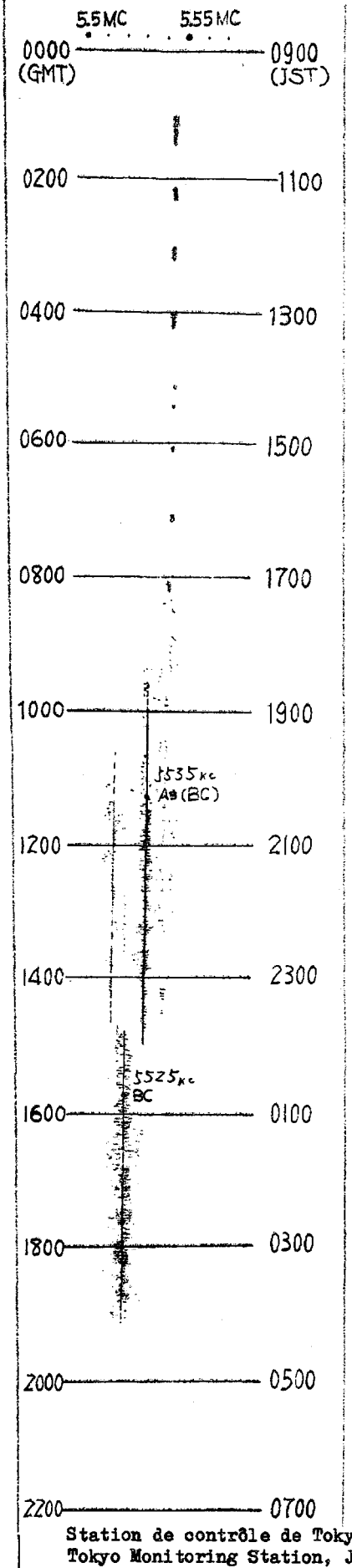
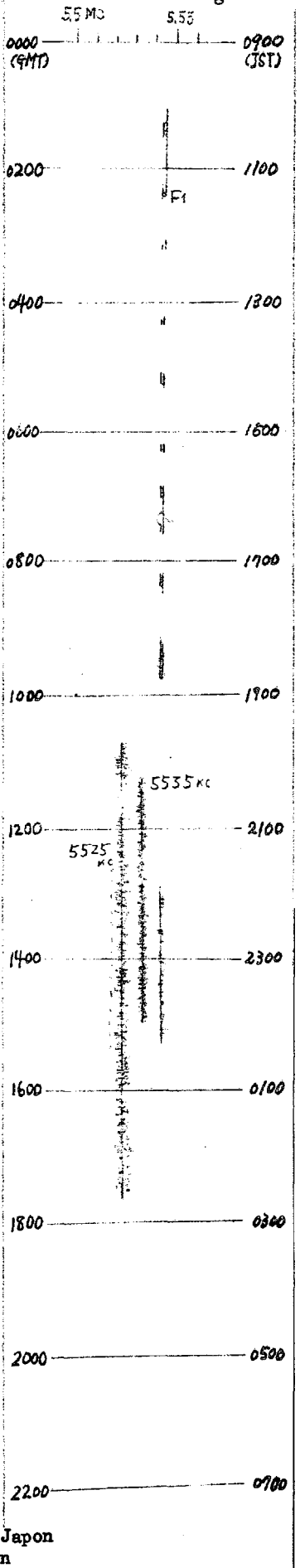



Fig. 2·B·3

Août
29-30 August 1963
Agosto

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ANNEXE - ANNEX - ANEXO

Fig. 3 Fréquence d'apparition des ondes brouilleuses dans les ZLAMP - CWP, NP, FE-2 (novembre 1963)
Frequency of appearance of interfering waves in MWARA - CWP, NP FE-2 areas (November 1963)
Frecuencia de aparición de las ondas interferentes en las zonas ZRMP - CWP, NP, FE-2 (Noviembre de 1963)

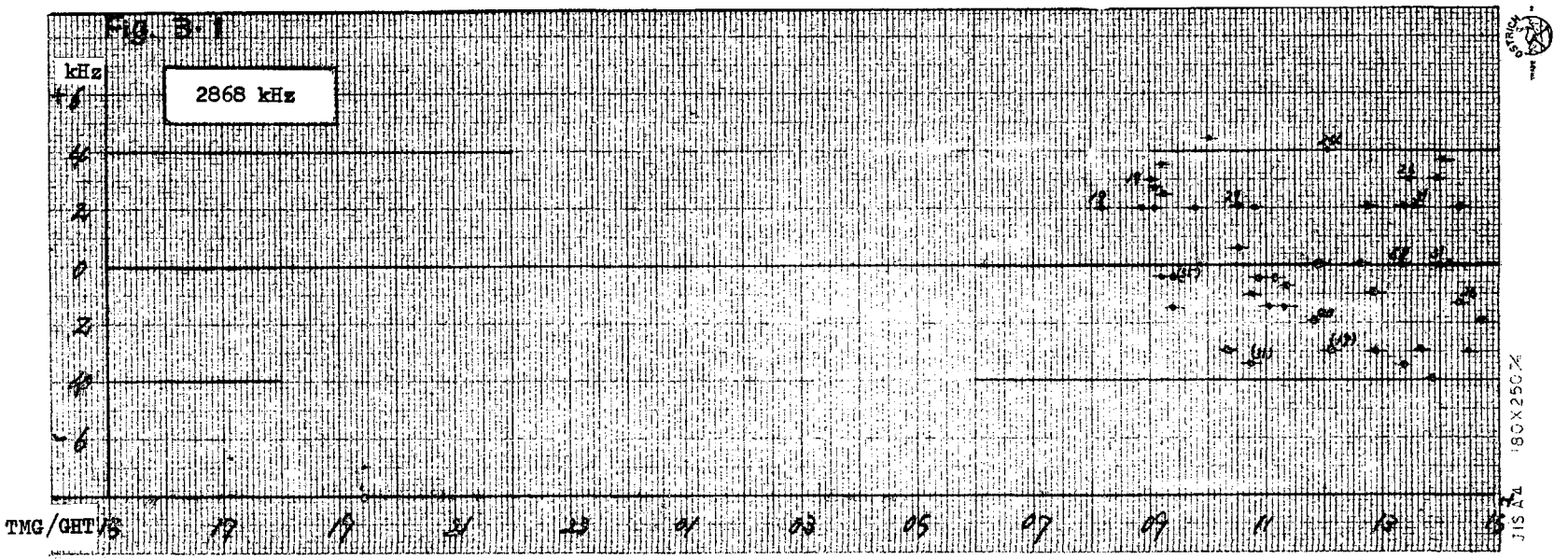
1. ZLAMP/MWARA/ZRMP - CWP = 2966 kc, 5506.5 kc, 8862.5 kc, 13354.5 kc, 17906.5 kc, 5536.5 kc
2. ZLAMP/MWARA/ZRMP - NP = 2987 kc, 5521.5 kc, 8939 kc, 13274.5 kc, 17906.5 kc
3. ZLAMP/MWARA/ZRMP - FE-2= 2868 kc, 5611.5 kc, 8871 kc, 13284.5 kc, 17966.5 kc

Note :
Nota :

o Téléphonie/Telephony/Telefonía
. Télégraphie/Telegraphy/Telegrafía
x Autres émissions/Others/Otro origen

——·—— Service continu/Continuous/Continua
------- Service intermittent/Intermittent/Intermitente

(A l'exclusion des fréquences de travail/Operating frequencies excepted/
Salvo las frecuencias de explotación)



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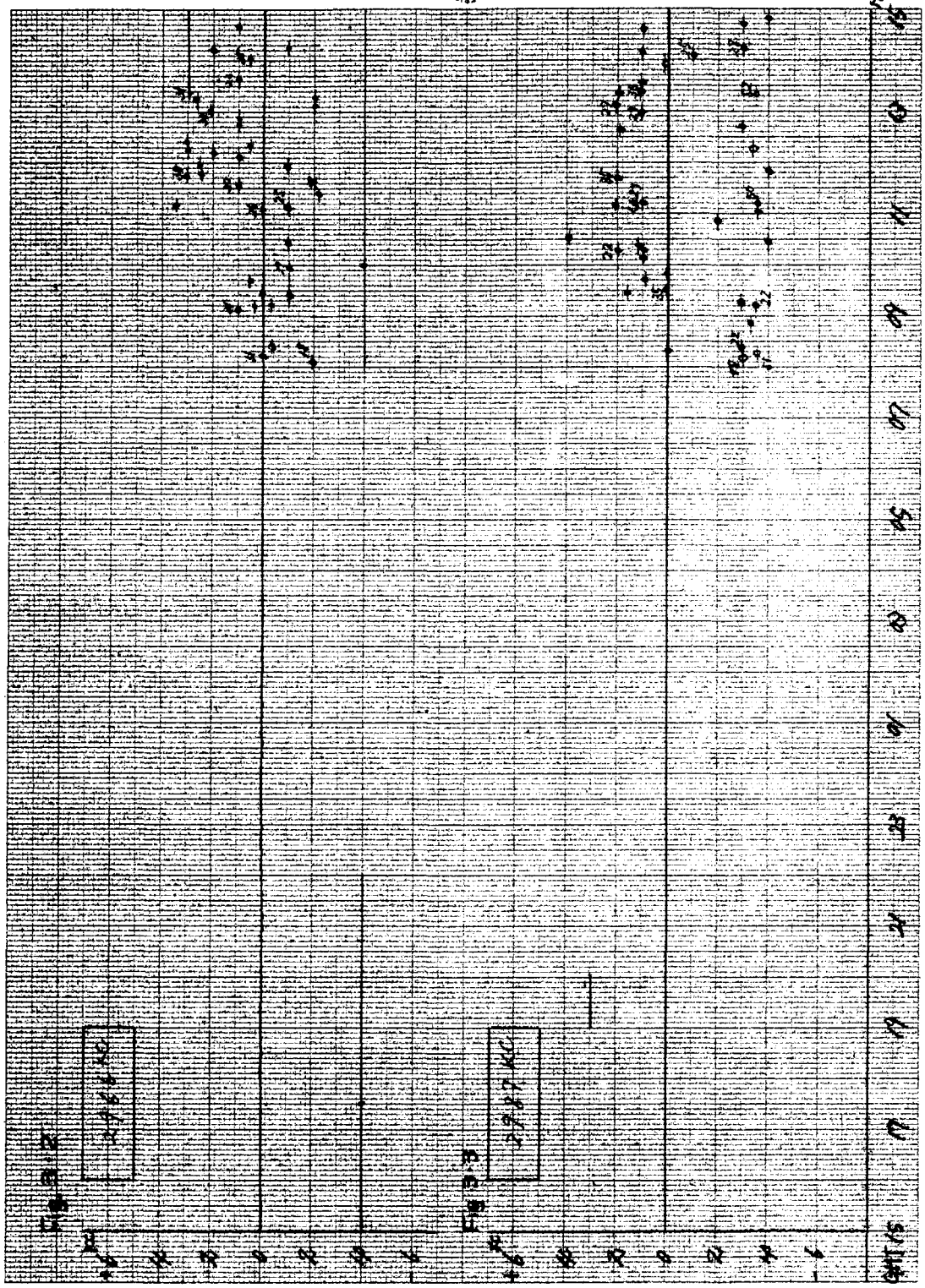

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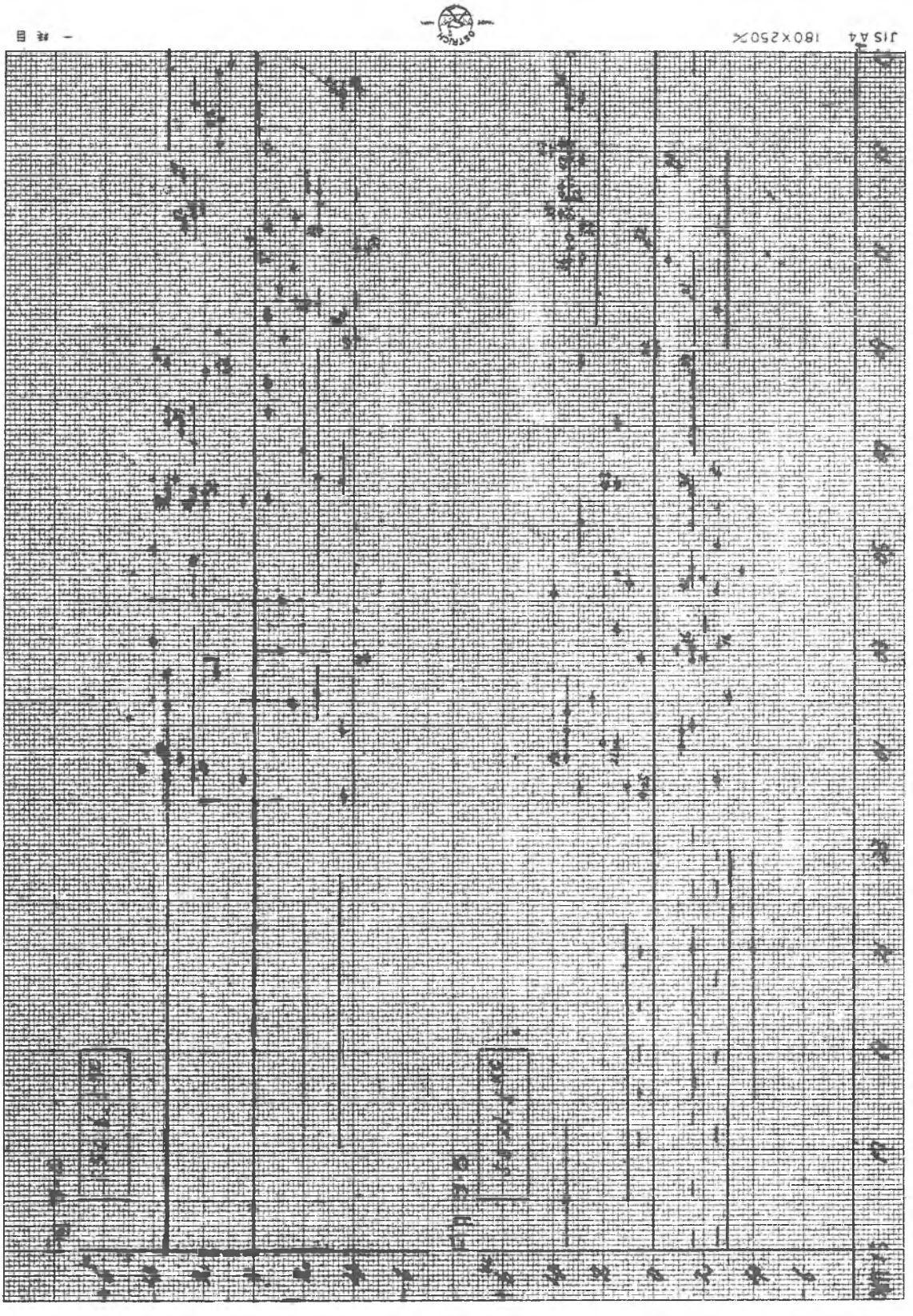

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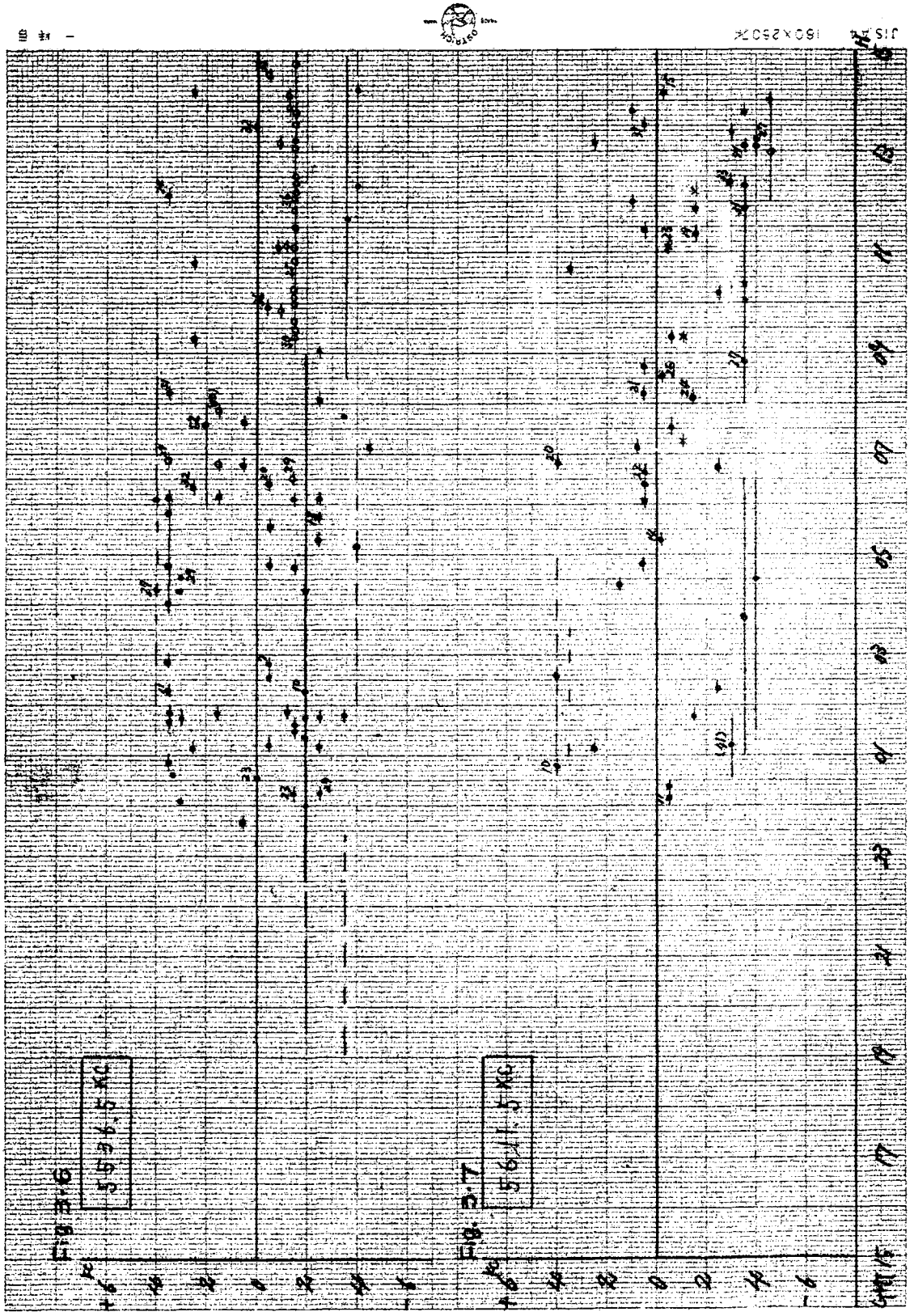
Fig n°6
5b 6 5 xC
Fig n°7
5b 7 5 xC

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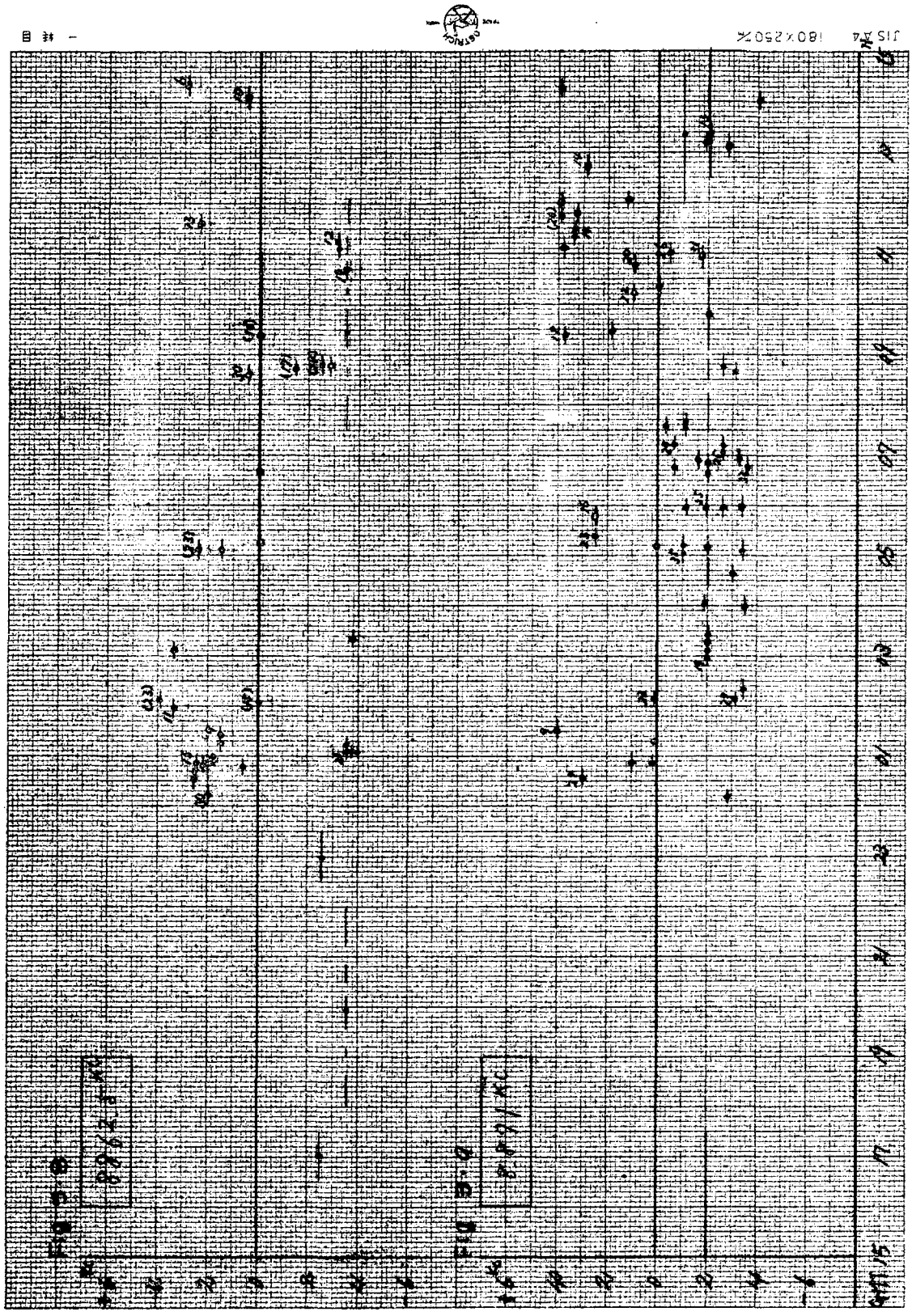

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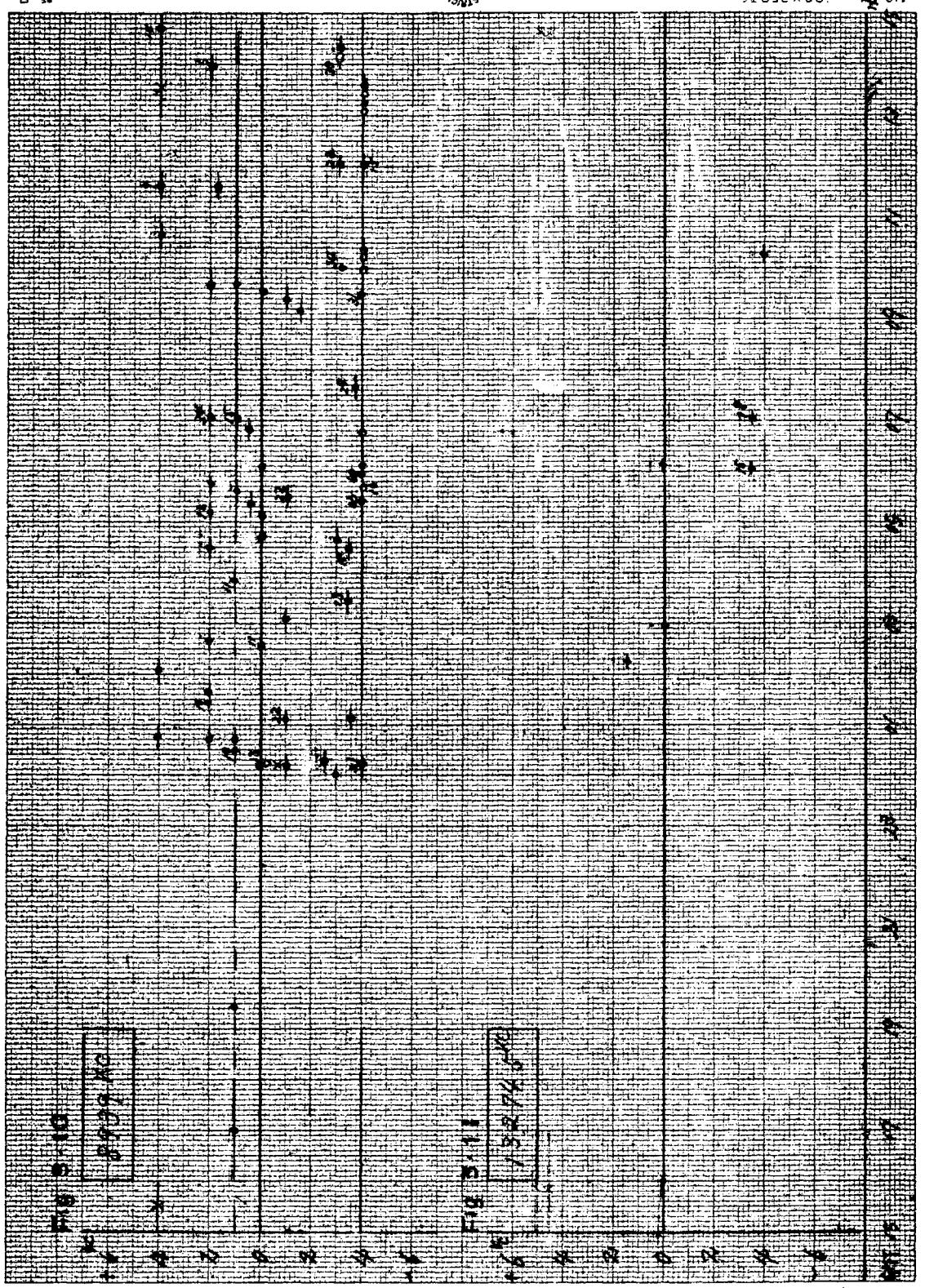

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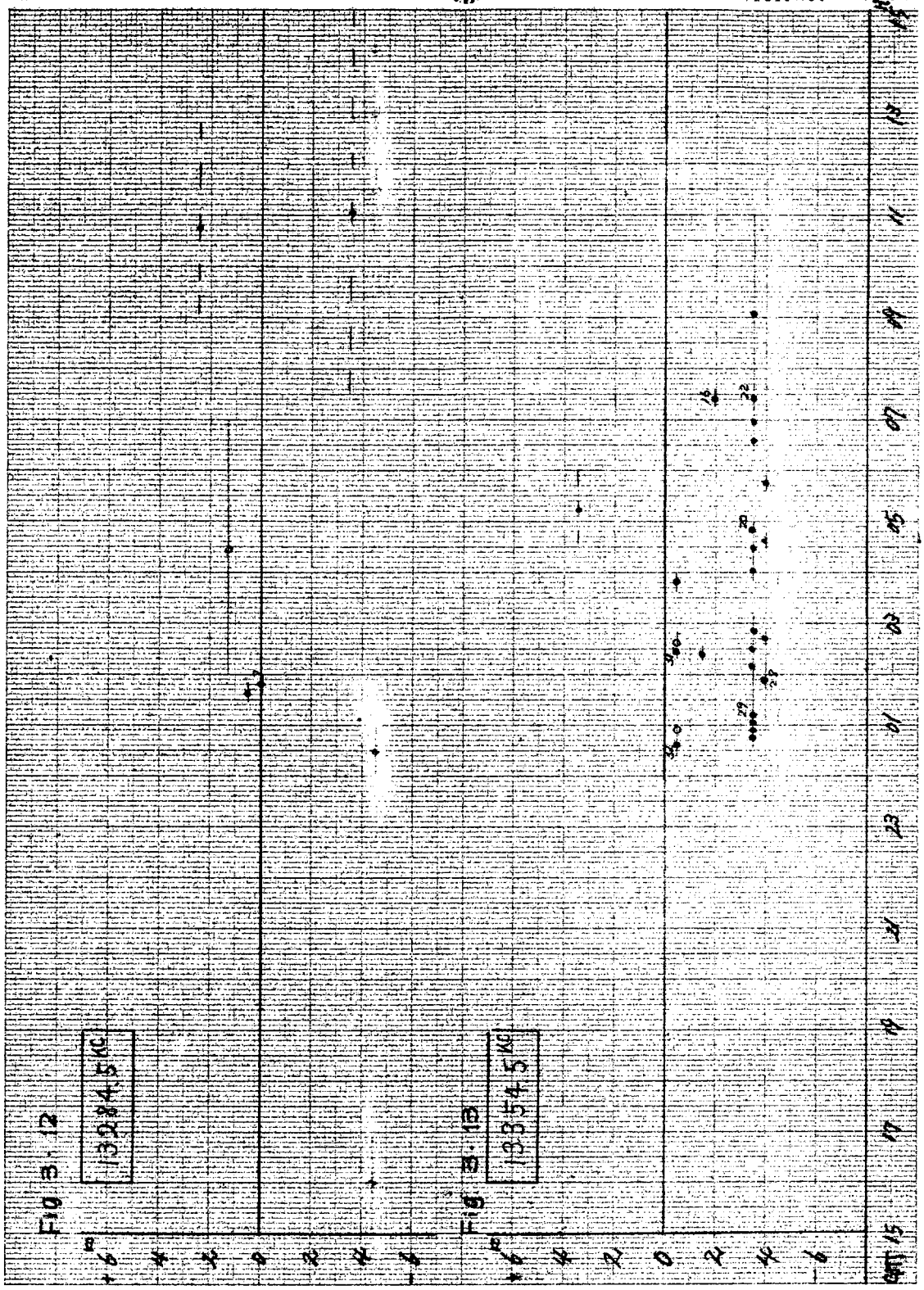
Fig 3.12
13284.5 kc
Fig 3.13
13354.5 kc

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Fig 3-14
17706.5 MHz
Fig 3-15
17766.4 MHz

AERONAUTICAL
CONFERENCE

Document No. I/3-E
13 November 1963
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Japan

# PROPOSALS FOR THE PREPARATORY SESSION OF THE EXTRAORDINARY ADMINISTRATIVE RADIO CONFERENCE FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE

## I. Creation of MWARA-Arctic

Proposal :

1. To newly establish the MWARA for the Arctic Polar Air Route;

2. The boundary of this MWARA will be from the North Pole to the point 60°N 169°W, then to the point 60°N 40°W along the latitude 60°N; and then through the points 52°N 10°E and 60°N 20°E, to the North Pole;

3. The frequencies to be allotted to this MWARA shall be one frequency family consisting of the frequencies in the bands 3 Mc/s, 4 Mc/s, 5 Mc/s, 6 Mc/s, 9 Mc/s, 10 Mc/s and 13 Mc/s.

Reasons :

At present, the Arctic Polar Air Route is covered by the extension of the MWARA-NP and MWARA-NA. However, as this route is one of the important international air routes connecting the Pacific and the European countries, it is desirable that a new MWARA be established.

The propagation of radio wave in the Arctic Area has the characteristics different from those in other areas. It is necessary, according to our study, to allot the proposed frequencies to the Arctic Area taking into account the seasonal variations of ionosphere and sunspot cycle.

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II. Counter Measures against Harmful Interference

Proposal :

In revising the Frequency Allotment Plan in Appendix 26, special consideration shall be made to eliminate the harmful interference which the Aeronautical Mobile (R) Service has encountered hitherto.

Reasons :

5536.5 kc/s used in the MWARA-CWP and 5521.5 kc/s of the MWARA-NP are incurring harmful interferences from 5535 kc/s and 5525 kc/s emitted from the HF broadcastings of certain neighbouring country. In reviewing the Frequency Allotment Plan, these frequencies incurring harmful interference from other services and other frequencies considered to be inappropriate for use in a specific area for some specific reasons should be relieved from the harmful interference and inappropriate condition by taking suitable measures, such as the modification of frequency allotment area for such frequencies.

Note : The frequency 5536.5 kc/s is the frequency transferred from RDARA-6C for the purpose of relieving the congestion of traffic in the MWARA-CWP at the I.C.A.O. Pacific Air Navigation Meeting, 1955.

III. HF VOLMET Frequencies

Proposal :

Allotment of an appropriate frequency family to meteorological broadcasting should be reviewed in every area taking into account the new aviation requirements.

Reasons :

1. Frequency families in the bands below 9 Mc/s are allotted to the Pacific-MET, Atlantic-MET, EU-MET and ME-MET by the Frequency Allotment Plan in Appendix 26.

2. The I.C.A.O. Special Communications Meeting, 1963, adopted a recommendation to newly allot one frequency family respectively to the South East Asian, the African and the South American areas. The recommendation has been based upon the demand of the international civil aviation; accordingly, it is deemed necessary to allot appropriate frequencies to these areas.

3. With rapid increase in aircraft speed, early reception of meteorological information even at a long distance is earnestly desired. Therefore, the high order frequencies having longer communication range than the frequencies in the 8 Mc/s band should be allotted. For example, there is a strong demand for the meteorological information at such a long distance as about 1,100 nautical miles in the Pacific-MET. For this purpose, a frequency in the 13 Mc/s band is indispensable in the Pacific Area.

4. As to the problem of the harmful interference caused by the allotment of the same frequency family to two areas, it is necessary to examine at the time of reviewing the allotment of frequency families to new areas mentioned in 2 above, such measures as to allot such frequencies to the areas where there is no possibility of interference.

## IV. Additional Allotment of Frequency Family to MWARA-CWP

Proposal :

It is necessary to allot one more frequency family to the MWARA-CWP.

Reasons :

1. It was decided at the 1948/1949 I.A.A.R.C. that the number of aircraft per hour that can be accommodated on a frequency family in the MWARA shall be 12 at the maximum. This number was confirmed valid at I.C.A.O. Special Communications Meeting, 1963.

2. At present, in accordance with the Frequency Allotment Plan in Appendix 26, one frequency family consisting of 2966 kc/s, 5506.5 kc/s, 8862.5 kc/s, 13 354.5 kc/s and 17 906.5 kc/s is allotted to and used in the MWARA-CWP. Furthermore, as one of the measures to reduce congestion in communication caused by the increase of traffic, and for the purpose of increasing the frequencies in the 5 Mc/s band which are of high utility, it was decided at the I.C.A.O. Pacific Air Navigation Meeting, 1955, that 5536.5 kc/s of RDARA-6C should be transferred to the MWARA-CWP. This frequency is in use to date since then.

3. The number of aircraft handled with one frequency family in the Tokyo F.I.R. sometimes exceeds 15 per hour, reaching to the utmost operational limits.

4. The future demand for HF in the MWARA-CWP will remain, and the traffic will increase, as the MWARA-CWP is a vast maritime area, even the increased use of the long distance VHF air-ground communication is taken into account. Considering such tendency of increase, additional allotment of one more frequency family to the MWARA-CWP is necessary.

V. Channelling Arrangements

Proposal :

The channelling arrangements of the Frequency Allotment Plan in Appendix 26 shall be as described in the attached Tables A and B based upon the use of DSB until 31 December 1974, and as from 1 January 1975, be as described in the attached Tables C and D prepared for the utilization of SSB.

Reasons :

1. The Panel of Experts convened in June 1963 recommended that the I.T.U. Aeronautical E.A.R.C., 1964/1965, should consider the early and progressive conversion to SSB operation from the present DSB operation as one of the measures to reduce congestion in the HF bands. (See Recommendation No. 4).

The demand for the use of HF bands for the radiotelephone communication in the Aeronautical Mobile (R) Service is generally decreasing due to the adoption of the long distance VHF air-ground communication and other communication systems using newly developed techniques. However, there may exist, even in the future, some areas where the communication therein must depend upon the HF communication (e.g., the Pacific Area etc.). And also, the role of the HF radiocommunication channel as the spare channel may not be neglected even when the communication through the satellite relay systems is realized.

So, it is necessary to reduce congestion in all HF bands by improving the quality of the HF radiocommunication in the Aeronautical Mobile (R) Service and effectively utilizing radio spectrum, in so far as the demand for the HF bands remains in the Aeronautical Mobile (R) Service.

2. For this purpose, it is necessary to convert the DSB system into the SSB system gradually. As the first step of conversion, the channelling arrangements as described in Tables A and B

attached, prepared in accordance with Scheme A of the channelling arrangements recommended at the I.C.A.O. Special Communications Meeting, 1963 should be used, until 31 December 1974, satisfying the present requirements with the least financial burden by making minimum necessary changes.

3. Though the period required for the depreciation of the radio equipment used in the HF Aeronautical Mobile Service differs according to the circumstances, we shall assume it as about ten years, and also, we shall assume that the same period is required for the completion of the development of the SSB equipments, then the period required for the depreciation of the equipments in use at the time of E.A.R.C. (AM), i.e. 1965, should have elapsed by 1974. As the second step to be taken for the equipments to be used in the air routes areas the communication of which depend upon HF even in the future, we should begin to use the SSB equipments compatible with those of the DSB system in place of DSB equipments, the depreciation years of which have elapsed. By taking the above steps, we might smoothly be able to shift to the channelling arrangements mentioned in the Tables C and D as from 1 January 1975.

4. Table C is a table of the 6 kc/s separation taking into account the use of the SSB system. For the SSB system, we may be able to prepare an effective allotment plan using the splitted frequencies of channel frequencies mentioned in Table D. And also we may be able to make a channel frequency arrangement exclusively for the emissions of other classes of emission the sideband emissions of which exceed 3 kc/s.

Tableau A

Table A

Cuadro A

Espacement entre fréquences

Frequency Separation

Separación entre frecuencias

| Bande<br>Band<br>Banda<br>(kHz-kc/s) | Espacement<br>Separation<br>Separación<br>(kHz-kc/s) | Bande<br>Band<br>Banda<br>(kHz-kc/s) | Espacement<br>Separation<br>Separación<br>(kHz-kc/s) |
|---|---|---|---|
| 2850 - 3025 | 7 | 8815 - 8965 | 8,5 |
| 3400 - 3500 | 7 | 10005 - 10100 | 8,5 |
| 4650 - 4700 | 7 | 11275 - 11400 | 8 |
| 5450 - 5680 | 7,5 | 13260 - 13360 | 8 |
| 6525 - 6685 | 7,5 | 17900 - 17970 | 8,5 |

Ce tableau est à utiliser jusqu'au 31 décembre 1974.

This table shall be used until 31 December 1974.

Este cuadro se utilizará hasta el 31 de diciembre de 1974.

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Tableau B - Table B - Cuedro B **)

kc/s - kH/z

| 2850 - 3025 | | 4650 - 4700 | | 6525 - 6685 | |
|---|---|---|---|---|---|
| 2854<br>2861<br>2868<br>2875<br>2882<br>2889<br>2896<br>2903<br>2910<br>2917<br>2924<br>2931<br>2938<br>2945<br>2952<br>2959<br>2966<br>2973<br>2980<br>2987<br>2994<br>3001<br>3008<br>3015 | (R)<br>(voies<br>24 (channels<br>(canales | 4654.5<br>4661.5<br>4668.5<br>4675.5<br>4682.5<br>4689.5<br>4696.5 | (R)<br>(voies<br>7 (channels<br>(canales | 6529.5<br>6537<br>6544.5<br>6552<br>6559.5<br>6567<br>6574.5<br>6582<br>6589.5<br>6597<br>6604.5<br>6612<br>6619.5<br>6627<br>6634.5<br>6642<br>6649.5<br>6657<br>6664.5<br>6672<br>6679.5 | (R)<br>(voies<br>21 (channels<br>(canales |
| 3023.5 | (R) & (OR) | 5450 - 5480 | | | |
| 3400 - 3500 | | Region 2 | | | |
| 3404.5<br>3411.5<br>3418.5<br>3425.5<br>3432.5<br>3439.5<br>3446.5<br>3453.5<br>3460.5<br>3467.5<br>3474.5<br>3481.5<br>3488.5<br>3495.5 | (R)<br>(voies<br>14 (channels<br>(canales | 5454<br>5461.5<br>5469<br>5476.5 | (R)<br>(voies<br>4 (channels<br>(canales | | |
| | | 5480 - 5680 | | 8815 - 8965 | |
| | | 5484<br>5491.5<br>5499<br>5506.5<br>5514<br>5521.5<br>5529<br>5536.5<br>5544<br>5551.5<br>5559<br>5566.5<br>5574<br>5581.5<br>5589<br>5596.5<br>5604<br>5611.5<br>5619<br>5626.5<br>5634<br>5641.5<br>5649<br>5656.5<br>5664<br>5671.5 | (R)<br>(voies<br>26 (channels<br>(canales | 8820<br>8828.5<br>8837<br>8845.5<br>8854<br>8862.5<br>8871<br>8879.5<br>8888<br>8896.5<br>8905<br>8913.5<br>8922<br>8930.5<br>8939<br>8947.5<br>8956<br>* 8961.5 | (R)<br>(voies<br>18 (channels<br>(canales |
| | | 5680 | (R) & (OR) | | |

Tableau B (suite) - Table B (contd.) - Cuadro B (cont.)**)

kc/s - kH/z

| 10005 - 10100 | | 17900 - 17970 | |
|---|---|---|---|
| 10009.5<br>10018<br>10026.5<br>10035<br>10043.5<br>10052<br>10060.5<br>10069<br>10077.5<br>10086<br>10094.5 | (R)<br>11 (voies<br>(channels<br>(canales | 17904.5<br>17913<br>17921.5<br>17930<br>17938.5<br>17947<br>17955.5<br>17964 | (R)<br>8 (voies<br>(channels<br>(canales |

| 11275 - 11400 | |
|---|---|
| 11281<br>11289<br>11297<br>11305<br>11313<br>11321<br>11329<br>11337<br>11345<br>11353<br>11361<br>11369<br>11377<br>11385<br>11393 | (R)<br>15 (voies<br>(channels<br>(canales |

| 13260 - 13360 | |
|---|---|
| 13265<br>13273<br>13281<br>13289<br>13297<br>13305<br>13313<br>13321<br>13329<br>13337<br>13345<br>13353 | (R)<br>12 (voies<br>(channels<br>(canales |

*) Cette fréquence ne doit être utilisée que pour des émissions de classe A1.

Cette fréquence no doit être utilisée que pour des émissions dont la fréquence est très stable.

Available for A1 emission only.

It is necessary that only equipment having a high degree of stability be used on this channel.

Solamente para emisiones de clase A1.

Es necesario que en este canal se empleen solamente equipos de gran estabilidad.

**) Ce tableau est à utiliser jusqu'au 31 décembre 1974.

This table shall be used until 31 December 1974.

Este cuadro se utilizará hasta el 31 de diciembre de 1974.

Tableau C

Table C

Cuadro C

Espacement entre fréquences

Frequency Separation

Separación entre frecuencias

| Bande<br>Band<br>Banda<br>(kHz-kc/s) | Espacement<br>Separation<br>Separación<br>(kHz-kc/s) | Bande<br>Band<br>Banda<br>(kHz-kc/s) | Espacement<br>Separation<br>Separación<br>(kHz-ko/s) |
|---|---|---|---|
| 2850 - 3025 | 6 | 8815 - 8965 | 6 |
| 3400 - 3500 | 6 | 10005 - 10100 | 6 |
| 4650 - 4700 | 6 | 11275 - 11400 | 6 |
| 5450 - 5680 | 6 | 13260 - 13360 | 6 |
| 6525 - 6685 | 6 | 17900 - 17970 | 6 |

a) Ce tableau est à utiliser à partir du ler janvier 1975.

b) A partir du ler janvier 1975, les stations utilisant des émissions à bande latérale unique (A3A ou A3J), dans une seule voie, fonctionneront dans la moitié supérieure ou dans la moitié inférieure des voies dont les fréquences centrales sont indiquées au tableau D.

a) This Table shall be used as from 1 January 1975.

b) Stations using single sideband single channel emissions (A3A or A3J) as from 1 January 1975 should operate either in the upper half or in the lower half of the channels designated by the centre frequencies in the Table D.

a) Este cuadro se utilizará a partir del 1.° de enero de 1975.

b) A partir del 1.° de enero de 1975, las estaciones que utilizan emisiones de banda lateral única (A3A o A3J) en un solo canal, funcionarán en la mitad superior o en la mitad inferior de los canales cuyas frecuencias centrales se indican en el Cuadro D.

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Tableau D **)
Table D **)
Cuadro D **)

kc/s - kHz

| 2850 - 3025 | 4650 - 4700 | 6525 - 6685 |
|---|---|---|
| 2855, 2861, 2867, 2873, 2879, 2885, 2891, 2897, 2903, 2909, 2915, 2921, 2927, 2933, 2939, 2945, 2951, 2957, 2963, 2969, 2975, 2981, 2987, 2993, 2999, 3005, 3011, 3017, *3021.5 — (R) (channels 29 (voies (canales | 4654, 4660, 4666, 4672, 4678, 4684, 4690, 4696 — (R) (channels 8 (voies (canales | 6530, 6536, 6542, 6548, 6554, 6560, 6566, 6572, 6578, 6584, 6590, 6596, 6602, 6608, 6614, 6620, 6626, 6632, 6638, 6644, 6650, 6656, 6662, 6668, 6674, 6680 — (R) (channels 26 (voies (canales |
| 3400 - 3500 | 5450 - 5680 | 8815 - 8965 |
| 3405, 3411, 3417, 3423, 3429, 3435, 3441, 3447, 3453, 3459, 3465, 3471, 3477, 3483, 3489, 3495 — (R) (channels 16 (voies (canales | 5454, 5460, 5466, 5472, 5478, 5484, 5490, 5496, 5502, 5508, 5514, 5520, 5526, 5532, 5538, 5544, 5550, 5556, 5562, 5568, 5574, 5580, 5586, 5592, 5598, 5604, 5610, 5616, 5622, 5628, 5634, 5640, 5646, 5652, 5658, 5664, 5670, 5676 — (R) (channels 38 (voies (canales | 8820, 8826, 8832, 8838, 8844, 8850, 8856, 8862, 8868, 8874, 8880, 8886, 8892, 8898, 8904, 8910, 8916, 8922, 8928, 8934 — (R) (channels 25 (voies (canales |

Tableau D (suite)**)
Table D (contd.)
Cuadro D (cont.)

| 8815 - 8965 (cont.) | |
|---|---|
| 8940<br>8946<br>8952<br>8958<br>*8962.5 | |

| 10005 - 10100 | |
|---|---|
| 10009<br>10015<br>10021<br>10027<br>10033<br>10039<br>10045<br>10051<br>10057<br>10063<br>10069<br>10075<br>10081<br>10087<br>10093<br>*10097.5 | (R)<br>(channels<br>16 (voies<br>(canales |

| 11275 - 11400 | |
|---|---|
| 11279<br>11285<br>11291<br>11297<br>11303<br>11309<br>11315<br>11321<br>11327<br>11333<br>11339<br>11345<br>11351<br>11357<br>11363<br>11369<br>11375<br>11381<br>11387<br>11393<br>*11397.5 | (R)<br>(channels<br>21 (voies<br>(canales |

| 13260 - 13360 | |
|---|---|
| 13265<br>13271<br>13277<br>13283<br>13289<br>13295<br>13301<br>13307<br>13313<br>13319<br>13325<br>13331<br>13337<br>13343<br>13349<br>13355 | (R)<br>(channels<br>16 (voies<br>(canales |

| 17900 - 17970 | |
|---|---|
| 17905<br>17911<br>17917<br>17923<br>17929<br>17935<br>17941<br>17947<br>17953<br>17959<br>17965 | (R)<br>(channels<br>11 (voies<br>(canales |

*) Cette fréquence ne doit être utilisée que pour les émissions de classe A1 ou pour des émissions à bande latérale unique dans une seule voie.

Available for A1 emission or Single Sideband Single Channel emission only.

Esta frecuencia sólo se utilizará para emisiones de clase A1 o para emisiones de banda lateral única en un solo canal.

**) Ce tableau est à utiliser à partir du 1er janvier 1975.

This table shall be used from 1 January 1975.

Este cuadro se utilizará a partir del 1.° de enero de 1975.

# AERONAUTICAL CONFERENCE

Document No. I-4-E
11 december 1963
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

The International Frequency Registration Board

REPORT ON FREQUENCY REQUIREMENTS FOR COMMUNICATIONS WITH TRANSPORT AIR-SPACE VEHICLES

1. The Extraordinary Administrative Radio Conference, Geneva, 1963, considered, inter alia, the question of communications to transport air-space vehicles intended to fly both between and beyond the major part of the earth's atmosphere and adopted the following Recommendation:

RECOMMENDATION No. 6A

RELATING TO THE FREQUENCY REQUIREMENTS IN THE HF BANDS EXCLUSIVELY ALLOCATED TO THE AERONAUTICAL MOBILE (R) SERVICE.

The Extraordinary Administrative Radio Conference, Geneva, 1963,

considering

a) that for the safety of all airoraft it is essential to provide communications for routine flight of transport air-space vehicles intended to fly between points on the earth's surface both within and beyond the major part of the atmosphere;

b) that frequencies in the HF bands (between 2850 and 22000 kc/s) are technically suitable for such communications as well as those frequencies above 100 Mc/s now available to the aeronautical mobile (R) service;

recommends

that at the Extraordinary Administrative Radio Conference to be called to revise Appendix 26 to the Radio Regulations in accordance with Resolution No. 13, Geneva, 1959, the necessary measures be taken to provide the high-frequency channels required for this purpose.

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2. This question was also considered by the I.C.A.O. Special Communications Meeting (1963) in relation to communication requirements for supersonic aircraft and aerospace craft. The Meeting made the following recommendations:

1) that, when systems are being developed to provide communications with supersonic civil aircraft, States give first consideration to the maximum feasible use of very high frequencies to satisfy this communication requirement. (Recommendation No. 3/1);

2) that when the I.T.U. Aeronautical E.A.R.C. (1964/1965) revises the HF Allotment Plan for the Aeronautical Mobile (R) Service, Appendix 26, I.T.U. Radio Regulations, the Plan be made sufficiently flexible to provide for the possible need to use high frequencies for communication with supersonic aircraft, noting that there is no requirement, at this time, for the allotment of high frequencies exclusively for communications with supersonic aircraft. (Recommendation No. 3/2).

3. While the provision of the facilities in question will be a matter for the second Session of the Aeronautical Conference, the question may have some bearing on the number of channels which should be made available, in the various frequency bands, in the revised Allotment Plan for the Aeronautical Mobile R Service, and hence on the channel widths and channel separations to be established by the first Session of the Conference.

# AERONAUTICAL CONFERENCE

Document No. I-5-E
11 December 1963
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

International Frequency Registration Board

## REPORT ON STUDIES RELATING TO POSSIBLE CHANNELING ARRANGEMENTS IN A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE R SERVICE

### 1. Introductory

1.1 The basic technical factors which have to be taken into consideration in determining the channel separations to be used in a revised Allotment Plan for the Aeronautical Mobile R Service are :

a) the classes of emission for which provision should be made;

b) the necessary bandwidth, for each class of emission, required to carry the intelligence which is to be transmitted;

c) the allowance to be made for the frequency tolerance of the stations using the channel.

1.2 Further factors, of a practical and economic character, which have to be taken into consideration are :

d) the minimum number of channels, in relation to the requirements of the various areas for high frequencies, which might be required to enable a satisfactory Allotment Plan to be established;

e) the paramount need for spectrum economy in the high frequency bands;

f) the cost of modifying or replacing existing equipment of aeronautical and aircraft stations to provide for satisfactory operation in any modified channelling arrangements which the Conference may wish to adopt;

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g) any difficulties in equipment design which might arise from the choice of specific channel separations in relation to the class of emission to be employed.

1.3 In establishing the channelling arrangements to be adopted in a revised Allotment Plan, the Conference may have to seek a reasonable balance between the somewhat conflicting aspects of some of these factors. For example, should the Conference attach very great importance to minimising the cost of modifying or replacing existing equipments, it would be difficult to provide additional channels which may be required to meet new high frequency communications requirements in various parts of the world; and the present use of the high frequency spectrum by the Aeronautical Mobile Service, which is extravangnt in respect of the channel widths allowed for A3 communications, would tend to be perpetuated. On the other hand, too much emphasis on the need to provide additional channels, and hence to obtain more effective use of the spectrum, might result in costs for the replacement of equipments which would impose a very heavy economic burden on Administrations and Airline Companies and might introduce design difficulties which would tend to increase the complexity of the new equipments.

## 2. Technical factors

### 2.1 Classes of emission

2.1.1 The present Allotment Plan for the Aeronautical Mobile R Service provides for the following classes of emission :

A1, A2, A3, A4 and F1.

2.1.2 The I.C.A.O. Special Communications Meeting (1963), recommended that, in the revised Allotment Plan, provision should be made to enable at least the following classes of emission to be employed:

a) Telephony, Amplitude modulated :

| | | |
|---|---|---|
| 1) | Double side band | (A3) |
| 2) | Single side band, reduced carrier | (A3A) |
| 3) | Single side band, full carrier | (A3H) |
| 4) | Single side band, suppressed carrier | (A3J) |
| 5) | Two independent side bands | (A3B) |

b) Telegraphy (including automatic data systems) :

1) without the use of a modulating audio frequency (by on-off keying) (A1)

2) automatic (data), DSB, amplitude modulated, by on-off keying of amplitude modulating audio frequency(ies), or by on-off keying of the modulated emission (A2)

3) automatic (data), frequency modulated, by the on-off keying of a frequency modulating audio frequency or by the on-off keying of a frequency modulated emission (F2)

4) automatic (data), SSB, amplitude modulated reduced carrier, multichannel voice frequency telegraphy (A7A)

5) automatic (data), SSB, amplitude modulated, full carrier, multichannel voice frequency telegraphy (A7H)

6) automatic (data), SSB, amplitude modulated, suppressed carrier, multichannel voice frequency telegraphy (A7J)

2.1.3 In making the foregoing recommendation, the I.C.A.O. Special Communications Meeting "considered that it would be inappropriate to attempt to reach agreement on what systems other than 6A3 would actually be introduced into operation during the life of the new Allotment Plan for the Aeronautical Mobile R Service but the Meeting felt that any new systems which might be proposed in the future would of necessity have to be capable of operation within a channel width not greater than that required for 6A3 and preferably less."

2.2 Necessary bandwidths

2.2.1 The I.F.R.B. sees no reason to differ from the recommendations of the I.C.A.O. Special Meeting as described in paragraph 2.1.2 above; and since it is clear that A3 (double-sideband telephone) emission will continue to provide the primary means of high frequency communication in the Aeronautical Mobile R Service for some time, at least, after the new plan is brought into force, it would seem that the channelling arrangements adopted in the revised Allotment Plan should be based on the necessary bandwidth required for

double sideband telephone transmissions; but that consideration should be given, when considering the channel widths and channel separations to be adopted in the various high frequency bands, to facilitating the introduction of other classes of emission envisaged by the I.C.A.O. Meeting.

2.2.2 Although it has become rather customary to designate double sideband radiotelephone emissions as "6A3", it should perhaps be noted that satisfactory intelligibility can be obtained on operator-to-operator communications using double sideband radiotelephony, such as those of the Aeronautical Mobile R Service, with a necessary bandwidth which is appreciably less than 6 kc/s. However, if the use of A3B emissions is to be eventually envisaged, the necessary bandwidth for this class of emission, in order to provide for an audio bandwidth of about 300 - 2700 cycles/sec in each of the independent sideband channels, would be about 6 kc/s. Hence it would appear desirable to retain a nominal bandwidth for double sideband emissions of 6 kc/s in order to afford, ultimately, the possibility of splitting each double sideband channel into two independent sideband channels.

2.3 Frequency tolerance

2.3.1 As regards the allowance for the frequency tolerance of the transmitters, any revised channelling arrangements which may be adopted for the Aeronautical Mobile R service should ensure that the emissions from aeronautical or aircraft stations, operating near the edge of a frequency band which is allocated to that service, should not spread into an adjacent band which is allocated to another type of service (as required by No. 116 of the Radio Regulations). Since aeronautical stations and aircraft stations communicate on the same channel, this means that the allowance for tolerance, in respect of the highest and lowest channels in any band, should be the wider tolerance applicable to aircraft stations rather than the narrower tolerance applicable to aeronautical stations. In this connection, the tolerance applicable to aircraft stations, in the frequency bands 4 - 29.7 Mc/s, is 200 parts in $10^6$ until 1970, after which the tolerance for aircraft stations is reduced to 100 parts in $10^6$. It would be somewhat unfortunate if a revised Frequency Allotment Plan, established in 1965 and possibly not brought into force until 1967 or 1968, had to be based on tolerances wider than those which would have to be observed within a year or two thereafter. Also all aircraft transmitters installed after 1 January 1964 should conform to the stricter "1970" tolerance

and it seems probable that, when the new Plan goes into operation, a large number of the aircraft transmitters in use at that time will be capable of meeting this stricter tolerance. It is therefore thought that the new Plan might be based, insofar as the channels at the edges of the band are concerned, on a tolerance of aircraft transmitters of 100 parts in $10^6$ coupled, if necessary with a recommendation that all aircraft transmitters using such channels should be capable of meeting the "1970" tolerance by the time the revised Allotment Plan goes into force.

2.3.2 Fortunately there is no real problem in providing adequate separation between the edges of the band and the centre frequency of the highest and lowest channels in most of the frequency bands. This arises from the fact that, having established a tentative channel width, and having fitted in the maximum number of channels which can be accommodated in the band, there is some "surplus" spectrum in each band and this can be used, at the top and bottom of the band, to reduce the possibility of interference to other types of service working in the adjacent bands.

2.3.3 When the question of channel widths, and hence the separation between adjacent channels within any frequency band, is considered, a somewhat different situation arises. In order to minimise the possibility of adjacent channel interference, the width of each channel should be the necessary bandwidth of the emission plus twice the absolute value of the frequency tolerance of the aircraft stations using the channel. This would mean, however, that each channel, and particularly those in the higher frequency bands, would have to be very wide, especially in relation to the spectrum actually occupied by the aeronautical stations operating in the channel. As all aeronautical stations having a power of more than 500 watts supplied to the antennae will have to observe a tolerance of 50 parts in $10^6$ and since many aircraft transmitters, although having a permissible tolerance of 100 parts in $10^6$ will in practice have a much narrower tolerance, it might be considered practicable in the interest of obtaining additional double-sideband channels to base the width of each such channel on a nominal bandwidth of the emission of 6 kc/s plus a station tolerance of 50 parts in $10^6$. Such an arrangement might appear to give rise to a serious danger of adjacent channel interference from aircraft stations operating outside a tolerance of 50 parts in $10^6$; but it should be borne in mind that the bandwidth which

is actually necessary for speech transmission is appreciably narrower than the nominal bandwidth of 6 kc/s, and that, even within the bandwidth actually occupied, the energy on the higher frequencies of speech transmission is usually low.

2.3.4 In the case of the single-sideband system of telephony, very much smaller allowances for frequency tolerance can, of course, be used in assessing channel widths, since it will be an inherent feature of the single-sideband system, even if controlled carrier working is used, that aeronautical station and aircraft station transmitters should have a very high accuracy of initial setting and high stability, probably not exceeding ± 50 cycles/sec. The question of frequency tolerance can therefore, in effect, be ignored altogether.

## 3. Other factors

### 3.1 Number of channels

3.1.1 The Conference is likely to be faced with new or additional requirements for high frequency communications in various parts of the world. For example, the I.C.A.O. Special Communications Meeting considered that a new Caribbean Major World Air Route Area should be established and the possibility of the creation of still further Major World Air Route Areas may have to be considered. The I.C.A.O. Special Communications Meeting also recommended that the I.T.U. Aeronautical E.A.R.C. should make every endeavour to allot appropriate high frequency families for meteorological broadcasts in the African, South-East Asian and South American areas and that it should examine the possibility of allotting a separate high frequency family for meteorological broadcasts exclusively to the ME - MET area, to replace the frequency family now shared with the Atlantic-MET area, and thereby resolve existing operational difficulties. Further high frequency requirements may result from having to provide for the needs of supersonic aircraft and air-space vehicles. And the enormous growth in flying operations, both in Major World Air Route Areas and also in Regional and Domestic Air Route Areas, as compared with 1948/49 when the present Allotment Plan for the Aeronautical Mobile R Service was formulated, may give rise to the need for the allotment of additional families of high frequencies to some of these Areas.

3.1.2 On the other hand, the much greater use which is now being made of VHF communications as compared with 1948/49, including long-range VHF systems, should reduce materially the need for high frequency communications, particularly in Areas where an efficient AFTN exists.

3.1.3 The net result of the foregoing considerations cannot be accurately assessed until up-to-date flight statistics have been compiled by all Administrations and analysed and collated in terms of requirements for high frequencies. These latter data can only be considered by the Second Session of the Aeronautical Conference. The Board considers, however, that in establishing revised channelling arrangements, it would be prudent to plan for an increase in the number of available channels, as compared with those in the existing Allotment Plan, particularly in the higher frequency bands for which the requirements may not be very materially affected by the expanded use of VHF communications.

3.2 Spectrum economy

3.2.1 The congestion in the high frequency bands is well known and has given rise to such serious problems, particularly in providing for the communication requirements of new and developing countries, that the Union decided to establish a Panel of Experts to consider measures to reduce congestion in the bands between 4 and 27.5 Mc/s. The recommendations of the Panel of Experts, which will be considered by the Administrative Council at its 1964 Session, aim at improving the effectiveness of the use of the high frequency spectrum by all classes of service.

3.2.2 The I.F.R.B. considers that the present high-frequency Allotment Plan for the Aeronautical Mobile Service provides for the very effective use of the available spectrum insofar as it provides for the operation of very large numbers of aeronautical and aircraft stations on the same frequencies. But the Board, which has been requested by the Panel of Experts to invite the Administrations of Members and Associate Members of the Union to implement progressively, and to the extent possible, these recommendations, considers that the Aeronautical Mobile Service should seek to use the high frequency spectrum more effectively than it does at present in respect of the channel widths used almost exclusively for A3 radiocommunications.

3.3 Cost of modifying or replacing existing equipment

3.3.1 Any drastic changes in the present channelling arrangements, or the introduction of radically new systems of communication (such as a suppressed carrier single sideband system) will inevitably involve considerable costs in modifying, or even completely replacing, the equipment of existing aeronautical and aircraft stations. Because of the large number of civil aircraft carrying

high frequency equipment, and the large number of aeronautical stations communicating with such aircraft, the investment by Administrations and Airline Companies in high frequency communications equipment is very high.

3.3.2 There may be a good deal of reluctance, therefore, on the score of cost, to changing existing channelling arrangements and existing systems of communication; but similar problems have had to be faced by other classes of Service, for example the Fixed and Maritime Mobile Services, in order to achieve improvements in their communications and provide additional channels of communication for new services and expanding traffic.

3.4 Design difficulties

3.4.1 Because of the very wide range of high frequencies which has to be covered by the transmitting and receiving equipments of Aeronautical and Aircraft stations, the generation of discreet "channel frequencies" presents a difficult design problem. This problem is reduced, and the complexity and cost of the equipment is also reduced, if the "channel frequencies" are generated only on multiples of 1 kc/s. The I.C.A.O Special Communications Meeting recommended that States should encourage the design of new HF airborne equipment which would afford complete flexibility in planning channel arrangements, the intention of this recommendation being that such new HF airborne equipments should be capable of generating channel frequencies on multiples of 0.5 kc/s or even on multiples of 0.1 kc/s. Further information on this question may be made available, by Administrations, to the Conference.

3.4.2 Meantime, the I.F.R.B. can only furnish the comment that, while it appreciates the difficulties of the problem and the undesirability of complicating, still further, already-complex airborne equipment, a restriction in the generation of channel frequencies only to multiples of 1 kc/s may prevent the creation of additional channels which might otherwise be made available, and hence result in less effective use of the available spectrum.

## 4. Channelling arrangements

4.1 A number of channelling arrangements, based on some of the foregoing considerations, are given in Annexes 1 to 5. It should be mentioned that, in Annexes 2 to 5 inclusive, the figure in parenthesis given in the column entitled "lowest channel frequency", is the centre frequency of the lowest channel which

would provide, with the channel widths and the number of channels given in each Annex, the maximum separation between the lowest channel (and also the highest channel) and the edge of the band concerned. Other centre frequencies of the lowest channel, for example those in the present Plan, could frequently be used.

4.2 Annex 1 shows the channelling arrangements, and the number of available channels in each band, in the present Allotment Plan for the Aeronautical Mobile R Service.

4.3 Annex 2 shows the maximum number of channels which could be accommodated if the full "1970" tolerance for aircraft transmitters (100 parts in $10^6$) is allowed for both at the edges of the band and in the individual channels. It will be seen that, even with centre channels frequencies which have multiples of 0.1 kc/s, a new channelling arrangement on this basis would scarcely provice a sufficient number of additional channels to justify a change in the present channelling arrangements. If the channel frequencies had to be rounded up to multiples of 0.5 kc/s, the number of additional channels, as compared with the number in the existing Plan, would only be 1 additional channel in each of the 10 Mc/s and 11 Mc/s bands. Such an arrangement cannot therefore be recommended.

4.4 Annex 3 shows the maximum number of channels which could be accommodated if the full "1970" tolerance for aircraft station transmitters is allowed for at the edges of the band and the tolerance for aeronautical stations of 500 watts or above (50 parts in $10^6$) is allowed for in individual channels. Such an arrangement would give a substantial number of additional channels as compared with the number in the present Plan but would require that double-sideband equipments should be capable of generating carrier frequencies on multiples of 0.1 kc/s. It would not be possible for each channel in the lower frequency bands to be converted, ultimately, to two single-sideband or two independent sideband channels, each having a nominal bandwidth of 3 kc/s, unless the carrier frequencies associated with these classes of emission could also be generated on multiples of 0.1 kc/s. Such an arrangement would therefore be liable to introduce equipment design difficulties and high costs in the replacement of existing airborne equipments; and it could only be recommended if the Conference were to decide that there was an overriding need, in view of the need for spectrum economy or of potential requirements for high frequencies, for the maximum possible number of additional double-sideband channels to be made available.

4.5 Annex 4 shows a channelling arrangement using the same frequency tolerances as those used in Annex 3 but with the channel widths, and the centre frequencies of each channel, rounded up to multiples of 0.5 kc/s. This arrangement would still give an appreciable increase in the number of double-sideband channels, particularly in the higher frequency bands, as compared with the number of channels in the present Plan. Later use of

single-sideband or independent sideband systems would not appear to present any major difficulties if the carrier frequencies associated with these classes of emission could be generated on multiples of 0.5 kc/s, with a nominal bandwidth of each channel of 3 kc/s. Such an arrangement might enable somewhat less complex equipments to be used than in the arrangement shown in Annex 3.

4.6 There are many other possible channelling arrangements which could be considered in endeavouring to secure, on the one hand, a reasonable increase in the number of double-sideband channels without, on the other hand, unduly increasing the complexity of airborne equipments.

4.7 Annex 5 shows one example of such an arrangement using a uniform channel width of 7 kc/s in the lower frequency bands and a uniform channel width of 8 kc/s in the higher frequency bands. Such an arrangement would enable two 3 kc/s single-sideband or independent sideband channels to be operated, eventually, in each channel of the lower frequency bands even if the centre frequencies of some of the double-sideband channels in these bands were on multiples of 0.5 kc/s, and single-sideband carrier frequencies could only be generated on multiples of 1 kc/s. Also it would still be possible, under these conditions, to have compatibility of double-sideband (A3) transmissions and single-sideband full carrier (A3H) transmissions, (on carrier frequencies 0.5 kc/s apart) during transition from double-sideband to single-sideband operation. While such a channelling arrangement would not provide, in the meantime, any additional double-sideband channels in the lower frequency bands, and hence additional requirements for short range and medium range communications would have to be satisfied by VHF systems, it would have the merit of not involving any changes in the present channelling arrangements in these bands. An arrangement of this kind may provide the best balance between the conflicting factors outlined in Sections 2 and 3 of this report.

## 5. Introduction of single sideband operation

5.1 The channelling arrangement shown in Annex 5 has been extended to show the number of single sideband (or independent sideband) channels which might eventually be derived, from the double-sideband channels, in each frequency band. It is apparent from the final two columns of this Annex that by far the most significant factor in regard to increasisng the number of channels, as compared with those at present available, would be the introduction of the single-sideband system of communication. It would clearly be impracticable, on account of the great number of aeronautical stations and aircraft stations in present use and the cost and other operational

considerations involved in the conversion or replacement of the equipments of these stations, to plan for a general changeover to the single-sideband system when the new Allotment Plan comes into force, possibly in 1967 or 1968. The I.T.U. Panel of Experts has recommended (Recommendation No. 4) however, that the Extraordinary Administrative Radio Conference concerned with the revision of the Allotment Plan for the Aeronautical Mobile R Service, in the bands between 2850 kc/s and 18030 kc/s, should give consideration to the possibility of an early and progressive conversion to single sideband operation in these bands. The I.F.R.B. hopes that the Conference will adopt this recommendation and prepare a programme to give effect to this early and progressive conversion to single-sideband operation commencing, posxibly, with the most heavily loaded international air routes. Such a transition, which would also result in improved long-distance communications to and from aircraft, would be similar to that which is being introduced in the Maritime Mobile Service in respect of telephony services in the high frequency bands. The conversion from double-sideband operation to single-sideband operation would be facilitated if new single-sideband equipments could operate with full carrier (A3H) as well as reduced carrier (A3A) or suppressed carrier (A3J) emissions, in order to provide compatibility of double-sideband and single-sideband operations during the transitional period.

5.2 It should perhaps be mentioned, in this connection, that a considerable conversion to the single-sideband system of communication has already taken place in the Aeronautical Mobile OR Service. A survey of the assignments to Aeronautical OR Stations arecorded in the Ma ter Register in the high frequency bands on 15 November 1963, reveals that out of a total of about 18,000 such assignments, approximately 2,600 are recorded as using single-sideband emissions (mostly 3A3J but also in some cases 3A3A, 3A7J, 3A9J and 6A3B). As many of the aeronautical stations concerned are believed to communicate with very high speed aircraft, the problems associated with "doppler effects" seem to have been satisfactorily overcome and the capacity of the allotments to a number of countries and areas has already been considerably augmented through the use of the narrower bandwidths associated with the single-sideband system.

Annexes: 5

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# A N N E X 1

## AERONAUTICAL MOBILE R BANDS

## CHANNEL WIDTHS AND NUMBER OF CHANNELS IN EXISTING ALLOTMENT PLAN

| Band (kc/s) | Width of band (kc/s) | Channel width (kc/s) | Number of channels | Lowest channel frequency |
|---|---|---|---|---|
| 2850 - 3025 | 175 | 7 | 24*) | (2854) |
| 3400 - 3500 | 100 | 7 | 14 | (3404.5) |
| 4650 - 4700 | 50 | 7 | 7 | (4654.5) |
| 5450 - 5480 (Reg.2) | 30 | 7.5 | 4 | (5454) |
| 5480 - 5680 | 200 | 7.5 | 26*) | (5484) |
| 6525 - 6685 | 160 | 7.5 | 21 | (6529.5) |
| 8815 - 8965 | 150 | 8.5 | 18 | (8820) |
| 10005 - 10100 | 95 | 9 | 10 | (10012) |
| 11275 - 11400 | 125 | 9.5 | 13 | (11280.5) |
| 13260 - 13360 | 100 | 10 | 10 | (13264.5) |
| 17900 - 17970 | 70 | 10 | 7 | (17906.5) |

*) plus provision for 3023.5 kc/s and 5680 kc/s channels

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# ANNEX 2

## AERONAUTICAL MOBILE R BANDS

## MINIMUM CHANNEL WIDTHS AND MAXIMUM NUMBER OF AVAILABLE CHANNELS ALLOWING FULL "1970" AIRCRAFT STATION TOLERANCES AT EDGE OF EACH BAND AND IN INDIVIDUAL CHANNELS (CARRIER FREQUENCIES ON MULTIPLES OF 0.1 kc/s)

| Band (kc/s) | Width of band (kc/s) | Channel width (kc/s) | Number of channels | Increase in number of channels | (Lowest channel frequency) |
|---|---|---|---|---|---|
| 2850 - 3025 | 175 | 6.6 | 25*) | 1 | (2854) |
| 3400 - 3500 | 100 | 6.7 | 14 | 0 | (3406.5) |
| 4650 - 4700 | 50 | 7 | 7 | 0 | (4654) |
| 5450 - 5480 (Reg.2) | 30 | 7.1 | 4 | 0 | (5454.5) |
| 5480 - 5680 | 200 | 7.2 | 27*) | 1 | (5484) |
| 6525 - 6685 | 160 | 7.4 | 21 | 0 | (6530.5) |
| 8815 - 8965 | 150 | 7.8 | 19 | 1 | (8819.8) |
| 10005 - 10100 | 95 | 8 | 11 | 1 | (10012) |
| 11275 - 11400 | 125 | 8.3 | 15 | 2 | (11279.3) |
| 13260 - 13360 | 100 | 8.7 | 11 | 1 | (13266.5) |
| 17900 - 17970 | 70 | 9.6 | 7 | 0 | (17906.2) |

*) plus provision for 3023.5 kc/s and 5680 kc/s channels

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# A N N E X 3

## AERONAUTICAL MOBILE R BANDS

## MINIMUM CHANNEL WIDTHS AND MAXIMUM NUMBER OF AVAILABLE CHANNELS ALLOWING FULL "1970" AIRCRAFT STATION TOLERANCES AT EDGES OF BAND AND AERONAUTICAL STATION TOLERANCES IN INDIVIDUAL CHANNELS

## (CARRIER FREQUENCIES ON MULTIPLES OF 0.1 KC/S)

| Band (kc/s) | Width of band (kc/s) | Channel width (kc/s) | Number of channels | Increase in number of channels | (Lowest channel frequency) |
|---|---|---|---|---|---|
| 2850 - 3025 | 175 | 6.3 | 26*) | 2 | (2856.4) |
| 3400 - 3500 | 100 | 6.4 | 15 | 1 | (3405.2) |
| 4650 - 4700 | 50 | 6.5 | 7 | 0 | (4655.5) |
| 5450 - 5480(Reg.2) | 30 | 6.6 | 4 | 0 | (5455.1) |
| 5480 - 5680 | 200 | 6.6 | 29*) | 3 | (5485.8) |
| 6525 - 6685 | 160 | 6.7 | 23 | 2 | (6531.3) |
| 8815 - 8965 | 150 | 6.9 | 21 | 3 | (8821) |
| 10005 - 10100 | 95 | 7 | 13 | 3 | (10010.5) |
| 11275 - 11400 | 125 | 7.2 | 17 | 4 | (11279.9) |
| 13260 - 13360 | 100 | 7.4 | 13 | 3 | (13265.6) |
| 17900 - 17970 | 70 | 7.8 | 8 | 1 | (17907.7) |

*) plus provision for 3023.5 kc/s and 5680 kc/s channels

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# ANNEX 4

## AERONAUTICAL MOBILE R BANDS

## MINIMUM CHANNEL WIDTHS AND MAXIMUM NUMBER OF AVAILABLE CHANNELS ALLOWING FULL "1970" AIRCRAFT STATION TOLERANCES AT EDGES OF BAND AND AERONAUTICAL STATION TOLERANCES IN INDIVIDUAL CHANNELS (CARRIER FREQUENCIES ON MULTIPLES OF 0.5 KC/S)

| Band (kc/s) | Width of band (kc/s) | Channel width (kc/s) | Number of channels | Increase in number of channels | (Lowest channel frequency) |
|---|---|---|---|---|---|
| 2850 - 3025 | 175 | 6.5 | 26*) | 2 | (2854) |
| 3400 - 3500 | 100 | 6.5 | 15 | 1 | (3404.5) |
| 4650 - 4700 | 50 | 6.5 | 7 | 0 | (4655) |
| 5450 - 5480 (Reg.2) | 30 | 7 | 4 | 0 | (5454.5) |
| 5480 - 5680 | 200 | 7 | 28*) | 2 | (5484) |
| 6525 - 6685 | 160 | 7 | 22 | 1 | (6531) |
| 8815 - 8965 | 150 | 7 | 21 | 3 | (8820) |
| 10005 - 10100 | 95 | 7 | 13 | 3 | (10010.5) |
| 11275 - 11400 | 125 | 7.5 | 16 | 3 | (11281.5) |
| 13260 - 13360 | 100 | 7.5 | 13 | 3 | (13265) |
| 17900 - 17970 | 70 | 8 | 8 | 1 | (17905) |

*) plus provision for 3023.5 kc/s and 5680 kc/s channels

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# ANNEX 5

## AERONAUTICAL MOBILE R BANDS

## NUMBER OF AVAILABLE CHANNELS ON BASIS OF UNIFORM CHANNEL WIDTH OF 7 KC/S IN LOWER FREQUENCY BANDS AND 8 KC/S IN HIGHER FREQUENCY BANDS

| Band (kc/s) | Width of band (kc/s) | Channel width (kc/s) | Number of double-sideband channels | Increase in number of double-sideband channels | (Lowest channel frequency) | Number of single-sideband channels | Increase over present number of double-sideband channels |
|---|---|---|---|---|---|---|---|
| 2850 - 3025 | 175 | 7 | 24*) | 0 | (2854) | 48*) | 24 |
| 3400 - 3500 | 100 | 7 | 14 | 0 | (3404.5) | 28 | 14 |
| 4650 - 4700 | 50 | 7 | 7 | 0 | (4654.5) | 14 | 7 |
| 5450 - 5480(Reg.2) | 30 | 7 | 4 | 0 | (5454.5) | 8 | 4 |
| 5480 - 5680 | 200 | 7 | 28*) | 2 | (5484) | 56*) | 30 |
| 6525 - 6685 | 160 | 7 | 22 | 1 | (6531) | 44 | 23 |
| 8815 - 8965 | 150 | 7 | 21 | 3 | (8820) | 42 | 24 |
| 10005 - 10100 | 95 | 8 | 11 | 1 | (10010) | 23 | 13 |
| 11275 - 11400 | 125 | 8 | 15 | 2 | (11280) | 31 | 18 |
| 13260 - 13360 | 100 | 8 | 12 | 2 | (13266) | 24 | 14 |
| 17900 - 17970 | 70 | 8 | 8 | 1 | (17905) | 17 | 10 |

*) plus provision for 3023.5 and 5680 kc/s channels

AERONAUTICAL CONFERENCE

Document No. I-6-E
11 December, 1963
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

International Frequency Registration Board

# USE OF THE SINGLE SIDEBAND SYSTEM OF COMMUNICATION IN THE AERONAUTICAL MOBILE (R) SERVICE

1. The I.T.U. Panel of Experts was established, in accordance with Resolution No. 3 of the Administrative Radio Conference (Geneva, 1959), with international representation selected by the Administrative Council from candidates put forward by Administrations, to study measures to reduce congestion in the bands between 4 and 27.5 Mc/s. The Panel, during its first Session (Geneva, September, 1961), considered the question of the use of the single sideband system by the Aeronautical Mobile Radio-telephone Service and included the following observations in its interim report:

Radio-telephone systems in the mobile services

The Panel is also of the opinion that considerable economy in the use of the spectrum could be effected by the general adoption of single sideband transmission for the aeronautical mobile radio-telephone service. The Panel noted Appendix 26 to the Radio Regulations, which governs the use of the frequency bands allocated exclusively to the aeronautical mobile service between 2850 kc/s and 27.5 Mc/s. The Panel would draw the attention of Administrations and of I.C.A.O. to its opinion that, should radio-telephony continue to be an important system of communication in the aeronautical mobile service in the HF bands, steps should be taken as early as possible to convert such systems to single sideband operation.

Advantages in the use of single sideband systems in the fixed and mobile services

The Panel would draw the attention of Administrations to the technical and economic advantages in the use of single sideband systems as compared with double sideband systems. As is well-known, a single sideband system will occupy approximately only half the spectrum space required by a

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comparable double sideband system The discontinuance of double sideband operation must therefore reduce the congestion in the HF spectrum. In addition, however, the use of single sideband confers many additional advantages. The quality of the circuit is greatly improved due to the increase in the signal-to-noise ratio, the reduction of distortion due to selective fading and the reduction of interference from various causes. C.C.I.R. Recommendation No. 100 gives information regarding the improvement in signal-to-noise ratio that is obtained with single sideband systems and methods of obtaining further improvements. In particular, the use of single sideband permits a very considerable reduction in transmitter power for the same signal-to-noise ratio. This reduction in transmitter power reduces the operating costs of transmitters, which offsets the cost of conversion to single sideband operation.

2. The I.C.A.O Special Communications Meeting (April-May, 1963) devoted a great deal of attention to the question of the possible use of the single sideband system of communication in the Aeronautical Mobile (R) Service. After reviewing operational and economic considerations which would be involved in a change to the single sideband system, the Meeting recommended :

i) that the Planning principles to be used in respect of channel widths should continue to provide frequency separation adequate to accommodate double sideband amplitude-modulated radio-telephony (6A3) but that these principles should in no way exclude the use of other forms of modulation which may be agreed upon internationally and which can be accommodated within the same bandwidth.

ii) that only those HF single sideband systems which are compatible with existing HF double sideband systems should be permitted. This requirement implies that the sideband shall be transmitted with a carrier having a power level that is not less than one fourth of the peak envelope power.

iii) use in the international communications of the Aeronautical Mobile (R) Service of a single sideband system complying with the requirements in (ii) shall be subject to co-ordination between the Administrations concerned.

3. The I.T.U. Panel of Experts, during its second Meeting (Geneva, June, 1963), in the course of which it established its final report, took account of the above-mentioned recommendations of the I.C.A.O. Special Communications Meeting on this question. After due consideration, the Panel of Experts decided to include in its final report the following comment and recommendation to the Extraordinary Administrative Aeronautical Radio Conference :

Aeronautical mobile service

The Panel is also of the opinion that considerable economy in the use of the spectrum could be effected by the general adoption of single-sideband transmission for the aeronautical mobile radio-telephone service and that, moreover, improved long distance communications to and from aircraft would result thereby. The Panel noted that Appendix No. 26 to the Radio Regulations, which governs the use of the frequency bands allocated exclusively to the aeronautical mobile (R) service between 2850 and 18030 kc/s, is due to be revised at an I.T.U. Extraordinary Administrative Radio Conference to be held in 1964 and 1965. The Panel has noted in this connection the recommendation of I.C.A.O. that when this revision is made, while compatible single-sideband operation could be introduced on a permissive basis by agreement between Administrations concerned, the use of double-sideband operation in aeronautical mobile (R) bands between 2850 and 18030 kc/s should be continued for an indefinite period.

RECOMMENDATION (No. 4)

The Extraordinary Administrative Radio Conference (1964 - 1965) concerned with the revision of the Allotment Plan for the aeronautical mobile (R) service in the bands between 2850 kc/s and 18030 kc/s should give consideration to the possibility of an early and progressive conversion to single-sideband operation in these bands.

4. The I.T.U. Panel of Experts also recommended that :

1) The I.F.R.B. shall prepare a Circular-letter transmitting the final report of the Panel of Experts to Administrations and transmit the final report to the Administrative Council for consideration at its 19th Session.

2) The I.F.R.B. shall request Administrations to implement progressively and to the extent possible, the recommendations of the Panel of Experts, and shall request them to inform the Board periodically of the progress made in this respect.

4.1 The I.T.U. Panel of Experts also prepared a draft Resolution for consideration and adoption by the Administrative Council, which included the following clause in the substantive part of the Resolution :

That the attention of the appropriate Administrative Conference shall be drawn to the Recommendations listed in the Annex to this Resolution. (Note: This latter Annex included Recommendation No. 4 which is contained in paragraph 2 above).

5. Since the next Session of the Administrative Council will not be held until April-May 1964, the Council had not had the opportunity of considering the final report of the Panel of Experts. The I.F.R.B. considers however that, in the light of the further Recommendations referred to in paragraph 4 above, it is appropriate to bring the Recommendation of the I.T.U. Panel of Experts, in regard to the use of the single sideband system in the Aeronautical Mobile (R) Service, to the attention of the Extraordinary Administrative Aeronautical Radio Conference.

# AERONAUTICAL CONFERENCE

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E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

International Frequency Registration Board

## REPORT ON STUDIES RELATING TO THE USE OF THE CHANNELS IN THE PRESENT ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE R SERVICE

1. The information given in the attached Annexes in regard to the number of assignments to aeronautical R stations which were still recorded, on 15 November 1963, in the Master International Frequency Register as operating in the channels of the present Allotment Plan for the Aeronautical Mobile R Service (Appendix 26 to the Radio Regulations), may be of interest to the first Session of the Aeronautical Conference.

2. Annex 1 shows, in the format used on page 36 of Appendix 26 to the Radio Regulations, the total number of assignments to aeronautical R stations recorded in the Master Register in each channel, and the distribution of these assignments in each channel among the respective Areas of allotment. The number of aeronautical stations using channels allotted to Meteorological Broadcasts (Volmet) is shown separately at the end of the Annex.

3. Annex 2 shows, in the format used on page 30 of Appendix 26 to the Radio Regulations, the number of assignments to aeronautical R stations recorded in the Master Register which are in conformity with the allotments to Major World Air Route Areas (MWARA's).

4. Annex 3 gives an analysis, by Areas, of the number of assignments to aeronautical R stations recorded in the Master Register as operating in channels which are not allotted to the Areas concerned.

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5. In summary, there are approximately 15,500 assignments to Aeronautical R Stations recorded in the Master Register in the frequency bands between 2,850 kc/s and 17,970 c/s. Of these assignments, approximately 12,150 (79% of the total) are in channels which are in conformity with the allotments in the Plan ; about 1250 assignments (8% of the total) are in channels which are not allotted to the Area concerned but afford a signal-interference protection ratio of 15 db or more to the Areas to which the channels are allotted; and about 2,100 assignments (approximately 13% of the total) are in channels which are not allotted to the Areas concerned and which afford a signal-interference protection ratio of less than 15 db to the Areas to which they are allotted.

6. It can be seen, from the statistics given in Annex 1, that many of the channels are used by very large numbers of aeronautical R stations. Apart from the "worldwide" channels of 3023.5 kc/s (524 assignments) and 5680 kc/s (299 assignments), and also the widely-shared channels of 2973 kc/s (318 assignments and 3495.5 kc/s (241 assignments), in respect of the use of which severe power restrictions are imposed, other channels are very heavily "loaded", for example : 2875 kc/s (289 assignments); 3411.5 kc/s (404 assignments); 3446.5 kc/s (201 assignments); 4661.5 kc/s (339 assignments); 4668.5 kc/s (355 assignments); 5649 kc/s (219 assignments); 5664 kc/s (275 assignments); 6552 kc/s (203 assignments); 6589.5 kc/s (193 assignments); 8961.5 kc/s (178 assignments); 10093 kc/s (122 assignments); 11328 kc/s (111 assignments); 13344.5 kc/s (140 assignments), and 17956.5 kc/s (205 assigmments).

6.1 The foregoing statistics relate to the total assignments to aeronautical R stations, throughout the world, in the channels concerned. However, similarly-striking figures of the "loading" of channels, within their individual Areas of allotment, can also be ascertained from the statistics given in Annex 1, for example : 2875 kc/s (208 assignments in Sub-RDARA 12C); 3411.5 kc/s (248 assignments in Sub-RDARA 10A); 4661.5 kc/s (186 assignments in RDARA's 2 and 3); 5664 kc/s (193 assignments in RDARA's 2 and 3); 6664.5 kc/s (119 assignments in Sub-RDARA 7B); 8939 kc/s (56 assignments in Sub-RDARA 6A); 10093 kc/s (86 assignments in RDARA 2); 13264.5 kc/s (87 assignments in RDARA 3); 13344.5 kc/s (87 assignments in RDARA 2); and 17956.5 kc/s (181 assignments in RDARA's 2 and 3).

6.2 It can also be noted from Annex 1 that although a few allotments to individual MWARA's and RDARA's have not been taken into use, the great majority of the allotments seem to be extensively used.

6.3 In considering these foregoing statistics, it has to be observed that the "loading" of any particular channel is not necessarily proportional to the number of aeronautical stations which have been recorded as using the channel since, for example, the volume of radio units exchanged by a small number of aeronautical stations serving routes of high density air traffic - such as the North Atlantic routes - may easily exceed the volume of radio-communications from a much larger number of aeronautical stations serving Areas in which the density of air traffic is much lower and the radio-communications from individual aeronautical stations are very intermittent. Also, with the increased use of VHF communication, and the increased service ranges now available from many VHF equipments, it is quite likely that a number of the stations currently recorded as using HF communication, may now effect the majority of their ground-air communications on VHF.

7. Similarly, the fact that a channel has been recorded as being used, in practice, in an Area to which it is not allotted, does not always signify that satisfactory sharing of the channel is possible between the Area of its allotment and the Area in which it is recorded as being in use. As can be ascertained from Annex 3, about 2,100 (about 63%) of the 3,350 assignments in channels which are not allotted to the Area concerned, have the date of receipt of the notice recorded in Column 2b of the Master Register, that is, the calculated signal-interference protection ratio to the Area to which the channel is allotted is less than the value of 15 db prescribed in Section 2 of Part 1 of Appendix 26 to the Radio Regulations. It is noteworthy, however, that no complaints of harmful interference have ever been received by the I.F.R.B. in respect of the present usage of frequencies in Areas outside those to which the channels are allotted.

8. The information may be of interest to the Conference when considering the number, and boundaries, of the MWARA's and RDARA's on which the revised Allotment Plan should be based. It may also be of interest in connection with the question of affording relief to the high frequency bands by the increased use of VHF communication.

Annexes : 3

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ANNEXE 1

Service mobile aéronautique R

Nombre des assignations à des stations aéronautiques, inscrites dans chaque voie dans le Fichier de référence international des fréquences

Note 1 - Le nombre entre parenthèses qui suit l'indicatif de la zone est le nombre des assignations à des stations aéronautiques inscrites dans la zone intéressée.

Note 2 - Le nombre figurant dans la colonne intitulée "Autres zones" est celui des assignations à des stations aéronautiques inscrites dans des zones auxquelles la voie n'est pas allotie et des assignations à des stations dont les émissions empiètent sur une voie adjacente.

| Fréquence centrale de voie | Total des assignations | Répartition des assignations par zone | | |
|---|---|---|---|---|
| kHz | | ZLAMP | ZLARN | Autres zones |
| 1. | 2. | 3. | 4. | 5. |

ANNEX 1

Aeronautical Mobile R Service

Number of assignments to aeronautical stations recorded in the Master International Frequency Register in each channel

Note 1 - The number in parenthesis, following the area designator, is the number of assignments to aeronautical stations recorded in the area concerned.

Note 2 - The number in column "Other areas", is the number of assignments to aeronautical stations recorded in areas to which the channel is not allotted and assignments to stations whose emissions spread into an adjacent channel.

| Channel frequency kc/s | Total of assignments | Distribution of assignments by areas | | |
|---|---|---|---|---|
| | | MWARA | RDARA | Other areas |
| 1. | 2. | 3. | 4. | 5. |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 2854 | 100 | | 1 (43), 2B (15), 3B (11), 7D (3), 9 (0), 11F (5), 13J (10) | 13 |
| 2861 | 67 | | 1E (0), 3A (14), 6E (10), 9B (4), 10C (8), 12D (9), 13F (1) | 21 |
| 2868 | 139 | FE2 (20), NA (15) | 2B (17), 7 (12), 13G (18) | 57 |
| 2875 | 289 | SA (15) | 3 (36), 9D (0), 12C (208) | 30 |
| 2882 | 96 | | 2 (57), 6C (1), 7E (9), 10E (4), 12E (0), 13L (5) | 20 |
| 2889 | 54 | EU (14), NSAM1 (23) | 6B (1), 9E (0) | 16 |
| 2896 | 59 | | 1 (8), 3C (13), 7E (0), 9E (0), 11G (14), 13K (4) | 20 |
| 2903 | 56 | | 1B (0), 3B (17), 3C (9), 5B (5), 5C (1), 5D (0), 9D (2), 11B (10), 12D (0) | 12 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 2910 | 84 | EU (15), EU Ext. (11)<br>NSAM2 (29) | 6B (1), 9D (0) | 28 |
| 2917 | 74 | | 1 (12), 3C (10), 7E (0), 9D (4), 10B (24), 13C (4) | 20 |
| 2924 | 134 | | 2 (60), 4B (6), 6C (1), 11G (6), 13E (24) | 37 |
| 2931 | 68 | NA Ext. (17) | 6A (6), 6E (5), 9D (0), 10A (8), 13L (9) | 23 |
| 2938 | 99 | | 1 (19), 2B (19), 3B (10), 7D (3), 9D (9), 11B (10),<br>12D (2), 13F (1), 13H (4) | 22 |
| 2945 | 157 | NA (7), SP (16) | 2C (21), 6A (12), 6E (11), 6F (1), 13K (1) | 88 |
| 2952 | 193 | | 1 (28), 3B (23), 3C (15), 7E (0), 9E (0), 10C (33), 12J (41)<br>13G (27) | 26 |
| 2959 | 47 | | 1 (18), 3B (0), 6A (5), 9A (0), 11H (8), 13J (2) | 14 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 2966 | 85 | CWP (9), NSA2 (27), NSAM2 (25) | 9E (1) | 23 |
| 2973 | 318 | | 1 (21), 2 (106), 3 (95), 4 (7), 5 (8), 6 (10), 7 (8), 8 (0), 9 (0), 10B (11), 12D (7), 13L (13) | 32 |
| 2980 | 104 | | 2B (16), 12G (51), 13H (8) | 29 |
| 2987 | 98 | FE1 (11), NA (10), NP (6) | 2C (29), 7B (5), 13I (19) | 18 |
| 2994 | 110 | | 2 (38), 3 (33), 7D (3), 9D (1), 11C (11), 13D (0) | 24 |
| 3001 | 17 | | 12E (3) | 19 |
| 3008 | 190 | | 2 (51), 3 (20), 7 (17), 9A (0), 9D (8), 10D (4), 13G (26), 13H (25) | 39 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 3015 | 123 | | 1D (21), 1E (2), 3 (34), 9B (0), 11D (13), 13E (24) | 29 |
| 3023.5 | 524 | AAA | (518) | 6 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 3404.5 | 91 | ME (16), ME Ext. (1) NSAM2 (14) | 2A (17), 3B (2), 9 (14) | 27 |
| 3411.5 | 404 | NSA1 (24) | 6 (21), 10A (248), 12C (50), 13I (3) | 58 |
| 3418.5 | 52 | | 1B (0), 1C (7), 1D (2), 1E (0), 6B (1), 9D (1), 11E (4), 13L (24) | 13 |
| 3425.5 | 107 | | 1 (6), 3C (20), 6D (2), 7E (0), 12J (5), 13G (6) | 68 |
| 3432.5 | 110 | CEP (0), SA (12) | 3 (59), 6A (10), 6E (6), 7E (0), 9D (2) | 21 |
| 3439.5 | 75 | | 2 (52), 6C (1), 7D (4), 10D (4), 13E (0) | 14 |
| 3446.5 | 201 | CEP (0), ME (54) | 3 (59), 9D (2), 12F (36), 13F (0) | 50 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 3453.5 | 91 | | 1 (6), 3C (17), 6D (1), 7E (0), 11F (3), 12A (1), 13C (4) | 59 |
| 3460.5 | 198 | | 2 (54), 3 (10), 7D (10), 9B (18), 10E (6), 12C (37), 13K (21) | 42 |
| 3467.5 | 67 | CEP (3), EU (14) | 6B (1), 9E (0), 12F (25) | 24 |
| 3474.5 | 55 | | 1B (0), 6A (6), 7B (5), 9D (3), 10C (4), 13I (2) | 35 |
| 3481.5 | 137 | CEP (3), EU (32) | 3A (28), 6D (2), 9D (5), 12H (7), 13H (11) | 49 |
| 3488.5 | 99 | | 2 (22), 3 (14), 9A (0), 10D (17), 13J (11) | 35 |
| 3495.5 | 241 | | 1 (18), 2 (66), 3 (55), 4 (37), 5 (20), 6 (18), 7 (40)<br>8 (2), 9 (0), 11H (8), 13D (0) | 23 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 4654.5 | 121 | EU (12) | 2B (27), 9A (0), 9B (0), 9D (0), 9E (0), 11C (16), 13E (12) | 54 |
| 4661.5 | 339 | | 2 (91), 3 (95), 9D (2), 10D (11), 12C (91), 13K (0) | 49 |
| 4668.5 | 355 | | 1 (7), 3C (13), 6C (1), 6D (25), 10A (240), 11D (16) 13G (13) | 40 |
| 4675.5 | 172 | | 1 (23), 3A (15), 9D (0), 12C (91), 13F (1) | 42 |
| 4682.5 | 123 | | 1D (7), 3 (58), 5A (0), 7E (0), 9D (2), 10E (14), 11B (6) 12G (2), 13H (5) | 29 |
| 4689.5 | 66 | EU (17), EU Ext. (12) | 3B (0), 6D (0), 10C (14), 12D (6), 13F (0) | 17 |
| 4696.5 | 137 | NSAM1 (21) | 2 (85), 7D (3), 9D (0) | 28 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 5454 (Reg.2) | 81 | | 10E (4), 12C (63), 13E (3) | 11 |
| 5461.5 (Reg.2) | 51 | | 10B (12), 12D (7), 13L (20) | 12 |
| 5469 (Reg.2) | 19 | | 11H (9), 13D (0) | 10 |
| 5476.5 (Reg. 2) | 20 | | 11F (5), 12F (10) | 5 |
| 5484 | 89 | | 1E (0), 2B (14), 3B (9), 4B (7), 7D (17), 9 (5), 11H (8), 13J (17) | 12 |
| 5491.5 | 97 | | 2C (26), 6 (24), 7E (0), 11F (3), 12G (0), 13G (19) | 25 |
| 5499 | 140 | | 1 (19), 7 (8), 8A (0), 9B (19), 9D (12), 10C (9), 12D (11) | 62 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 5506.5 | 72 | CWP (9), NSA2 (18) | 11D (7), 13K (4) | 34 |
| 5514 | 78 | | 2A (7), 2C (27), 6A (3), 6B (1), 6E (4), 9 (0), 10C (6), 12D (10) | 20 |
| 5521.5 | 77 | NP (6), NSA1 (31) | 12E (0) | 40 |
| 5529 | 53 | | 1B (0), 3B (0), 5A (0), 6D (0), 9D (0), 11D (7), 12H (8) | 38 |
| 5536.5 | 155 | | 2 (35), 5D (14), 6C (12), 10D (17), 12C (21), 13J (14) | 42 |
| 5544 | 55 | | 1 (8), 6B (1), 7 (10), 9B (0), 10A (14), 11D (0), 12G (0), 13G (9) | 13 |
| 5551.5 | 76 | CEP (3), EU (11) | 9E (0), 13H (9) | 53 |
| 5559 | 8 | | | 8 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 5566.5 | 100 | NSAM2 (19) | 3 (49), 6A (4), 6E (5) | 23 |
| 5574 | 13 | | 7 (8) | 5 |
| 5581.5 | 126 | NSAM2 (26) | 3 (66), 6A (6), 6E (5) | 23 |
| 5589 | 75 | | 1 (24), 6B (1), 7 (8), 9A (0), 11C (6), 12F (12) | 24 |
| 5596.5 | 194 | | 2 (66), 3 (38), 4B (3), 6D (1), 9D (1), 11G (11), 13C (4), 13K (27) | 43 |
| 5604 | 71 | CEP (3), ME (21), ME Ext. (2) | 13H (6) | 39 |
| 5611.5 | 130 | FE2 (15), NA Ext. (15) | | 100 |
| 5619 | 140 | | 1D (5), 3B (0), 6D (27), 9D (0), 12J (28), 13H (26) | 54 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 5626.5 | 53 | NA (18) | 9B (0) | 35 |
| 5634 | 84 | | 2C (23), 6 (12), 7B (5), 11B (2), 12F (4) | 38 |
| 5641.5 | 63 | NA (6), SP (15) | | 42 |
| 5649 | 219 | | 1 (20), 3 (62), 6E (8), 7D (18), 10D (13), 12C (33) 13I (19) | 46 |
| 5656.5 | 69 | | 1E (0), 5B (4), 5C (2), 5D (1), 6C (1), 9D (2), 11G (7), 13C (8), 13L (18) | 26 |
| 5664 | 275 | | 2 (98), 3 (95), 4A (0), 7D (3), 9 (4), 10D (23), 12C (14), 13E (0) | 38 |
| 5671.5 | 52 | FE1 (15), NA (9) | | 28 |
| 5680 | 299 | AAA | (294) | 5 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 6529.5 | 82 | | 1B (0), 1C (4), 1D (4), 3B (0), 6A (6), 6E (7), 7B (5), 9B (12), 11C (2), 12F (31), 13L (4) | 7 |
| 6537 | 124 | | 4 (35), 5 (26), 6F (3), 9D (3), 11B (6), 12D (13) | 38 |
| 6544.5 | 124 | | 1D (4), 3A (4), 6A (9), 9E (0), 11F (0), 12C (84), 13J (10) | 13 |
| 6552 | 203 | EU (20) | 3 (54), 6C (2), 7 (36), 10D (11), 12C (19), 13G (31) | 30 |
| 6559.5 | 89 | | 2A (15), 4B (37), 6A (10), 6B (1), 6E (9), 9 (1), 11D (2), 13F (1) | 13 |
| 6567 | 114 | NSAM2 (22) | 1 (14), 3A (14), 6A (18), 7D (11), 7E (0), 9D (0), 10A (23) | 12 |
| 6574.5 | 51 | | 2A (16), 4A (0), 6B (1), 9 (14), 11D (4), 12H (1) | 15 |
| 6582 | 182 | EU (12), EU Ext. (9) | 6 (16), 7E (0), 10C (4), 12C (100), 13I (12) | 29 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 6589.5 | 193 | | 2 (49), 3 (68), 4B (4), 6D (14), 9D (2), 11E (4), 12F (22), 13K (6) | 24 |
| 6597 | 104 | SA (14) | 2B (15), 6F (30), 7B (6), 7C (1), 7D (4), 7E (2), 10B (12), 12D (0) | 20 |
| 6604.5 | 58 | | 1E (0), 3C (10), 5B (6), 6C (1), 11F (0), 12C (20) 13C (7), 13K (0) | 14 |
| 6612 | 155 | CEP (0), SA (15) | 2A (7), 2C (29), 3B (0), 6E (7), 9A (12), 9B (18), 9D (6), 9E (19), 10E (6), 12E (3) | 33 |
| 6619.5 | 73 | | 2 (42), 6C (1), 6D (1), 11B (8), 12D (5), 13D (4) | 12 |
| 6627 | 132 | ME (7), ME Ext. (20) | 3C (12), 7B (5), 9 (1), 10C (15), 11G (0), 12F (4), 13E (0), 13J (42) | 26 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 6634.5 | 56 | | 1 (9), 3B (0), 6A (7), 9B (0), 11B (5), 12D (0), 13K (21) | 14 |
| 6642 | 150 | | 2 (61), 3 (29), 4B (8), 6D (16), 9D (0), 11F (4), 12G (0), 13G (19) | 13 |
| 6649.5 | 133 | | 1 (15), 3B (0), 6A (25), 7 (38), 8A (2), 9A (0), 9E (0), 11G (0), 12A (1), 13J (29) | 23 |
| 6657 | 121 | | 2 (40), 3 (37), 4B (6), 6D (0), 9D (0), 11H (6), 12G (2) | 30 |
| 6664.5 | 183 | NSAM1 (20) | 1 (25), 6B (1), 7B (119), 9A (0), 9B (0), 9D (0), 9E (0), 10D (5) | 13 |
| 6672 | 123 | | 2 (38), 3 (45), 4B (8), 6C (1), 6D (4), 9D (0), 11E (7), 12F (4) | 16 |
| 6679.5 | 58 | CEP (0), SA (7) | 3B (1), 6A (8), 6E (8), 7B (6), 7E (0), 9 (1), 10E (8) | 19 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 8820 | 64 | NSA1 (33)<br>NSAM1 (18) | 6C (2), 6D (1) | 10 |
| 8828.5 | 11 | | | 11 |
| 8837 | 70 | | 1 (18), 6F (10), 12D (24), 13F (0) | 18 |
| 8845.5 | 70 | ME (21), NSAM2 (23),<br>SP (15) | 3B (0) | 11 |
| 8854 | 40 | | 1 (14), 6F (6), 11D (1), 13K (13) | 6 |
| 8862.5 | 49 | CWP (9), NA (6) | 7 (11), 13G (18) | 5 |
| 8871 | 64 | EU (13), EU Ext.(3),<br>FE2 (12), NSAM2 (16) | 7D (7) | 13 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 8879.5 | 38 | CEP (3), FE1 (5), SA (14) | 7E (6), 10E (3) | 7 |
| 8888 | 23 | NA (8) | 6A (8), 6F (1), 9D (0), 13L (4) | 2 |
| 8896.5 | 73 | | 4 (5), 5 (16), 9 (15), 10B (17), 13C (5) | 15 |
| 8905 | 6 | | | 6 |
| 8913.5 | 68 | NA (16) | 3C (12), 7B (7), 9B (7), 13E (1) | 25 |
| 8922 | 120 | | 2 (50), 3 (22), 7D (3), 9 (14), 12C (16), 13L (8) | 7 |
| 8930.5 | 70 | CEP (3), EU (10) FE1 (9) | 7E (0), 12H (9) | 39 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 8939 | 142 | NP (5), SA (11) | 6A (56), 9A (10), 12F (9) | 51 |
| 8947.5 | 111 | NA Ext. (15) | 3B (28), 3C (15), 7 (28), 8A (0), 9 (0), 13H (9) | 16 |
| 8956 | 58 | NSA2 (17) | 6B (1), 11B (1), 13J (11), 13K (11) | 17 |
| 8961.5 | 178 | | 1 (6), 2 (49), 3 (27), 4 (9), 5 (6), 6 (16), 7 (8), 8 (0), 9 (5), 10 (0), 11 (0), 12 (9), 13 (39) | 4 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 10012 | 51 | | 2 (14), 3 (29), 11C (1), 13L (4) | 3 |
| 10021 | 44 | ME (7), ME Ext. (9) | 9D (0), 12J (19) | 9 |
| 10030 | 89 | | 2 (36), 3 (40), 11H (6), 13I (2) | 5 |
| 10039 | 84 | | 2 (31), 3 (37), 7E (0), 10D (4), 13E (3) | 9 |
| 10048 | 24 | CEP (0), SA (6) | 6A (4), 6D (1), 6E (5), 6F (2) | 6 |
| 10057 | 31 | | 2 (2), 3A (14), 3C (3), 9D (0), 9E (0), 10C (4), 12G (0) | 8 |
| 10066 | 24 | | 1 (7), 6F (1), 11E (9), 13D (0) | 7 |
| 10075 | 127 | | 2 (38), 3 (68), 7E (0), 11G (3), 13H (17) | 1 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 10084 | 16 | CEP (0) | 1 (6), 6C (1), 13J (2) | 7 |
| 10093 | 122 | | 2 (86), 3A (5), 3C (12), 9B (0), 9D (0), 9E (0), 11F (2), 13K (9) | 8 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 11280.5 | 27 | | 3C (11), 9D (0), 11B (1), 13L (5) | 10 |
| 11290 | 60 | NSAM2 (7) | 2 (32), 3A (15), 9D (0) | 6 |
| 11299.5 | 18 | CEP (0), EU (11)<br>EU Ext. (4) | 13J (1) | 2 |
| 11309 | 54 | | 2 (37), 9B (0), 10D (0), 13G (10) | 7 |
| 11318.5 | 22 | CEP (0) | 7 (11), 8A (2), 13J (2), 13K (3) | 4 |
| 11328 | 111 | | 3 (54), 7E (1), 9D (0), 10 (14), 11 (0), 12 (19),<br>13 (21) | 2 |
| 11337.5 | 26 | NSAM2 (11) | 6 (12) | 3 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 11347 | 37 | | 2 (15), 3 (11), 11C (4) | 7 |
| 11356.5 | 15 | | 1 (6), 9 (0), 10C (3), 13E (1) | 5 |
| 11366 | 89 | | 2 (60), 3 (26), 12D (2) | 1 |
| 11375.5 | 50 | | 2 (23), 9 (6), 10E (3), 13K (9) | 9 |
| 11385 | 33 | | 4 (12), 5 (9), 12C (10) | 2 |
| 11394.5 | 50 | | 2 (16), 3A (14), 9B (0), 11E (7), 13H (4) | 9 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 13264.5 | 99 | NA (6) | 3 (87) | 6 |
| 13274.5 | 31 | NP (5), SA (17) | | 9 |
| 13284.5 | 29 | FE2 (12), NA (8) | | 9 |
| 13294.5 | 59 | | 6F (3), 10 (3), 11 (5), 12C (4), 12D (2), 12F (5), 12E (5) 12G (0), 12H (0), 12J (14), 13 (11) | 7 |
| 13304.5 | 35 | CEP (3), NSA1 (26) | 6C (1) | 5 |
| 13314.5 | 34 | NSAM1 (17) | 1 (11) | 6 |
| 13324.5 | 37 | FE1 (7), NA (16) | | 14 |
| 13334.5 | 41 | CEP (7), ME (16), NSA2 (8) | | 10 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 13344.5 | 140 | NSAM2 (33), SP (12) | 2 (87) | 8 |
| 13354.5 | 25 | CWP (9), NA Ext. (10) | | 6 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 17906.5 | 25 | CWP (8), EU (4)<br>EU Ext. (2), NP (4) | | 7 |
| 17916.5 | 68 | NSAM1 (17), NSAM2 (17) | 3A (17), 3C (13) | 4 |
| 17926.5 | 26 | CEP (4), ME (4), NSA2 (7) | | 11 |
| 17936.5 | 68 | | 4 (3), 5 (6), 7 (9), 10 (0), 11 (3), 12C (2),<br>12D (2), 12E (1), 12F (5), 12G (0), 12H (0),<br>12J (10), 13 (19) | 8 |
| 17946.5 | 42 | NSA1 (14), SA (11),<br>SP (10) | | 7 |
| 17956.5 | 205 | | 2 (90), 3 (91), 10 (0), 11 (0), 12C (1), 12D (0),<br>12E (0), 12F (4), 12G (0), 12H (1), 12J (0), 13 (12) | 6 |
| 17966.5 | 29 | FE1 (5), FE2 (7),<br>NA Ext. (10) | | 7 |

FREQUENCES VOLMET - VOLMET FREQUENCIES - FRECUENCIAS VOLMET

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 2980 | 9 | Pacif. MET. (4)<br>EU MET. (5) | | 0 |
| 3001 | 20 | Atlant. MET. (7)<br>ME MET. (8) | | 5 |
| 5559 | 20 | Atlant.MET. (7)<br>ME MET. (8) | | 5 |
| 5574 | 7 | EU MET. (3), Pacif. MET.(4) | | 0 |
| 8828.5 | 21 | Atlant. MET. (7)<br>ME MET. (8) | | 6 |
| 8905 | 12 | Pacif.MET.(8)<br>EU MET.(4) | | 0 |

ANNEXE 2

Service mobile aéronautique R

Le nombre entre parenthèses qui suit la fréquence est le nombre des assignations à des stations aéronautiques inscrites dans chaque zone de passage des lignes aériennes mondiales principales (ZLAMP)

ANNEX 2

Aeronautical Mobile R Service

The number in parenthesis, following each frequency, is the number of assignments to aeronautical stations recorded in each Major World Air Route Area (MWARA)

ANEXO 2

Servicio móvil aeronáutico R

El número entre paréntesis que sigue a la frecuencia es el de asignaciones a las estaciones aeronáuticas inscritas en cada zona de paso de rutas aéreas mundiales principales (ZRMP)

| Bandes Bands Bandas MHz Mc/s | 3 | 3.5 | 4.7 | 5.6 | 6.6 | 9 | 10 | 11.3 | 13.3 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|
| ZLAMP MWARA ZRMP | kHz kc/s | kHz kc/s | kHz kc/s | kHz kc/s | kHz kc/s | kHz kc/s | kHz kc/s | kHz kc/s | kHz kc/s | kHz kc/s |
| CEP | | 3432.5 (0)<br>3446.5 (0)<br>3467.5 (3)<br>3481.5 (3) | | 5551.5 (3)<br>5604 (3) | 6612 (0)<br>6679.5(0) | 8879.5 (3)<br>8930.5 (3) | 10048(0)<br>10084(0) | 11299.5 (0)<br>11318.5 (0) | 13304.5 (3)<br>13334.5 (7) | 17926.5 (4) |
| CWP | 2966 (9) | | | 5506.5 (9) | | 8862.5 (9) | | | 13354.5 (9) | 17906.5 (8) |
| EU | 2889(14)<br>2910(15) | 3467.5(14)<br>3481.5(32) | 4654.5(12)<br>4689.5(17) | 5551.5(12) | 6552 (20)<br>6582 (13) | 8871 (13)<br>8930.5(10) | | 11299.5(11) | | 17906.5 (4) |
| EU(Ext) | 2910(11) | | 4689.5(12) | | 6582 ( 9) | 8871 ( 3) | | 11299.5( 4) | | 17906.5 (2) |
| FE1 | 2987(11) | | | 5671.5(15) | | 8879.5(5)<br>8930.5(9) | | | 13324.5(7) | 17966.5 (5) |
| FE2 | 2868(20) | | | 5611.5(15) | | 8871 (12) | | | 13284.5(12) | 17966.5 (7) |
| ME | | 3404.5(16)<br>3446.5(54) | | 5604 ( 21) | 6627 (7) | 8845.5(21) | 10021(7) | | 13334.5(16) | 17926.5 (4) |
| ME(Ext) | | 3404.5 (1) | | 5604 (2) | 6627 (20) | | 10021(9) | | | |

| Bandes<br>Bands<br>Bandas<br>MHz Mc/s | 3 | 3.5 | 4.7 | 5.6 | 6.6 | 9 | 10 | 11.3 | 13.3 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|
| ZLAMP<br>MWARA<br>ZRMP | kHz<br>kc/s | kHz<br>kc/s | kHz<br>kc/s | kHz<br>kc/s | kHz<br>kc/s | kHz<br>kc/s | kHz<br>kc/s | kHz<br>kc/s | kHz<br>kc/s | kHz<br>kc/s |
| NA | 2868(15)<br>2945 (7)<br>2987(10) | | | 5626.5(18)<br>5641.5 (6)<br>5671.5 (9) | | 8862.5 (6)<br>8888 (8)<br>8913.5(16) | | | 13264.5 (6)<br>13284.5 (8)<br>13324.5(16) | |
| NA(Ext) | 2931(17) | | | 5611.5(15) | | 8947.5(15) | | | 13354.5(10) | 17966.5(10) |
| NP | 2987 (6) | | | 5521.5( 6) | | 8939 ( 5) | | | 13274.5( 5) | 17906.5( 4) |
| NSA1 | | 3411.5(24) | | 5521.5(31) | | 8820 (33) | | | 13304.5(26) | 17946.5(14) |
| NSA2 | 2966(27) | | | 5506.5(18) | | 8956 (17) | | | 13334.5( 8) | 17926.5( 7) |
| NSAM1 | 2889(23) | | 4696.5(21) | | 6664.5(20) | 8820 (18) | | | 13314.5(17) | 17916.5(17) |
| NSAM2 | 2910(29)<br>2966(25) | 3404.5(14) | | 5566.5(19)<br>5581.5(26) | 6567 (22) | 8845.5(23)<br>8871 (16) | | 11290 ( 7)<br>11337.5(11) | 13344.5(33) | 17916.5(17) |
| SA | 2875(15) | 3432.5(12) | | | 6597 (14)<br>6612 (15)<br>6679.5( 7) | 8879.5(14)<br>8939 (11) | 10048(6) | | 13274.5(17) | 17946.5(11) |
| SP | 2945(16) | | | 5641.5(15) | | 8845.5(15) | | | 13344.5(12) | 17946.5(10) |
| | | | | | | | | | | |
| Atlant. MET | 3001 ( 7) | | | 5559 ( 7) | | 8828.5( 7) | | | | |
| EU-MET | 2980 ( 5) | | | 5574 ( 3) | | 8905 ( 4) | | | | |
| ME-MET | 3001 ( 8) | | | 5559 ( 8) | | 8828.5( 8) | | | | |
| Pacif. MET | 2980 ( 4) | | | 5574 ( 4) | | 8905 ( 8) | | | | |

ANNEXE 3

Service mobile aéronautique R

Analyse de l'utilisation des voies dans des zones autres que celles de leur allotissement primaire, telle qu'elle résulte des inscriptions du Fichier de référence international des fréquences.

Note 1 - Le nombre entre parenthèses qui suit l'indicatif de la zone est le nombre des assignations à des stations aéronautiques inscrites dans la zone intéressée.

| Fréquence centrale de voie kHz | Allotissements primaires (ZLAMP et ZLARN) | Assignations dans d'autres zones | | Total des assignations (Col. 3 et 4) |
|---|---|---|---|---|
| | | avec la date du 3.12.51 dans la colonne 2b | avec la date de réception de l'avis de notification par l'I.F.R.B. dans la colonne 2b | |
| 1. | 2. | 3. | 4. | 5. |

ANNEX 3

Aeronautical Mobile R Service

Analysis of recorded use of channels in areas outside those of their primary allotment.

Note 1 - The number in parenthesis, following the area designator, is the number of assignments to aeronautical stations recorded in the area concerned.

| Channel frequency kc/s | Primary Allotments (MWARA and RDARA) | Assignments in other Areas | | Total number of assignments (Col. 3 and 4) |
|---|---|---|---|---|
| | | with date of 3.12.51 in column 2b | with date of receipt of the notice by the I.F.R.B. in column 2b | |
| 1. | 2. | 3. | 4. | 5. |

ANEXO 3

Servicio móvil aeronáutico R

Análisis de la utilización inscrita de canales en zonas ajenas a las que fueron adjudicadas a título primario

Nota 1 - El número entre paréntesis que sigue al distintivo de zona es el de asignaciones a las estaciones aeronáuticas inscritas en la zona considerada.

| Frecuencia del canal kc/s | Adjudicaciones a título primario (ZRMP y ZRRN) | Asignaciones en otras zonas | | Total de asignaciones (Col. 3 y 4) |
|---|---|---|---|---|
| | | con la fecha 3.12.51 en la Columna 2b | con la fecha de recepción de la notificación por la I.F.R.B. en la Columna 2b | |
| 1. | 2. | 3. | 4. | 5. |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 2854 | 1, 2B, 3B, 7D, 9, 11F, 13J | 11 (3) | 2B (2), 2C (4), 3A (1), 3B (1), 3C (1), 5B (1) | 13 |
| 2861 | 1E, 3A, 6E, 9B, 10C, 12D, 13F | 3C (2), 10E (11) | 1D (1), 2A (2), 2B (2), 2C (1), 3C (1), 10E (1) | 21 |
| 2868 | FE2 NA 2B, 7, 13G | 3A (1), 10B (1), 11 (1), 12A (1) | 1C (4), 1D (4), 2A (3), 2C (6), 3C (3), 6D (1), 6E (2), 9E (1), 10B (2), 10D (2), 10E (3), 13 (22) | 57 |
| 2875 | SA 3, 9D, 12C | 2B (1), 10A (1), 10B (10), 10D (1) | 1D (1), 2A (2), 2B (1), 2C (12), 3C (1) | 30 |
| 2882 | 2, 6C, 7E, 10E, 12E, 13L | 3A (2), 3C (1), 10B (5) | 2A (1), 2B (6), 2C (3), 3C (2) | 20 |
| 2889 | EU, NSAM1 6B, 9E | | 1C (1), 2A (3), 2B (1), 2C (4), 3A (2), 3B (1), 3C (1), 13 (3) | 16 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 2896 | 1, 3C, 7E, 9E, 11G, 13K | 10B (3) | 2B (4), 2C (4), 3A (4), 3B (3), 3C (2) | 20 |
| 2903 | 1B, 3B, 3C, 5B, 5C, 5D, 9D, 11B, 12D | 10E (1) | 1D (2), 2A (1), 2C (4), 3C (1), 11 (3) | 12 |
| 2910 | EU, EU Ext., NSAM2 6B, 9D | 10B (16), 13 (1) | 2B (5), 2C (5), 13 (1) | 28 |
| 2917 | 1, 3C, 7E, 9D, 10B, 13C | 3A (1), 10D (10), 10E (2) | 2B (1), 2C (2), 3A (3), 6A (1) | 20 |
| 2924 | 2, 4B, 6C, 11G, 13E | 6E (1), 11 (1) | 1D (1), 2C (2), 6A (4), 6D (1), 11 (13), 12 (14) | 37 |
| 2931 | NA Ext. 6A, 6E, 9D, 10A, 13L | | 1D (8), 1E (1), 2A (4), 2B (1), 2C (1), 3B (1), 3C (1), 5C(1), 5D (1), 12 (2), 13 (2) | 23 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 2938 | 1, 2B, 3B, 7D, 9D, 11B, 12D, 13F, 13H | 3C (1) | 2A (1), 2B (6), 2 (9), 3A (2), 3B (1), 3C (2) | 22 |
| 2945 | NA, SP 2C, 6A, 6E, 6F, 13K | 3A (1), 10A (78) | 1C (1), 2A (1), 2B (2), 3A (1), 3B (3), 6C (1) | 88 |
| 2952 | 1, 3B, 3C, 7E, 9E, 10C, 12J, 13G | 10B (2), 10D (8) | 2A (1), 2B (4), 2C (6), 3A (2), 3B (1), 3C (1), 11 (1) | 26 |
| 2959 | 1, 3B, 6A, 9A, 11H, 13J | - | 1C (1), 1D (6), 2A (1), 2B (1), 6A (1), 6E (1), 11 (3) | 14 |
| 2966 | CWP, NSA2 NSAM2 9E | 2B (2), 8A (1), 11 (1) | 2A (1), 2B (7), 2C (3), 3A (1), 3B (1), 3C (1), 3D (1), 6C (1), 11 (2), 12 (1) | 23 |
| 2973 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10B, 12D, 13L | 10D (2) | 1D (1), 2A (1), 2B (3), 2C (10), 3B (1), 3C (4), 6A (2) 10A (3), 10D (5) | 32 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 2980 | 2B, 12G, 13H | 3A (1), 10C (1), 10D (1),10E (7) | 2A (3), 2B (1), 2C (3), 3B (1), 3C (4), 12 (7) | 29 |
| 2987 | FE1, NA, NP 2C, 7B, 13I | 10A (1), 12A (1) | 2C (8), 3A (1), 3B (1), 3C (3), 9B (1), 9E (1), 10B (1) | 18 |
| 2994 | 2, 3, 7D, 9D, 11C, 13D | - | 2A (4), 2B (5), 2C (1), 3A (2), 3C(1), 6B (2), 10B (1), 11 (8) | 24 |
| 3001 | 12E | 11 (6) | 2A (1), 2B (7), 2C (1), 3A (1), 3C (1), 11 (2) | 19 |
| 3008 | 2, 3, 7, 9A, 9D, 10D, 13G, 13H | 9B (5), 10B (2), 10C (15), 10E (1) | 1D (2), 2A (1), 2B (1), 2C (2), 3A (1), 3B (2), 9B (7) | 39 |
| 3015 | 1D, 1E, 3, 9B, 11D, 13E | 2B (7) | 2A (1), 2B (8), 2C (4), 3A (3), 3B (1), 3C (1), 11 (4) | 29 |
| 3023.5 | AAA | - | 1D (1), 2A (1), 2B (1), 3B (1), 3C (2) | 6 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 3404.5 | ME, ME Ext., NSAM2<br>2A, 3B, 9 | 10B (8) | 1D (5), 2A (1), 2B (2), 2C (2), 3B (2) 5A (1), 6B (5), 6D (1) | 27 |
| 3411.5 | NSA1<br>6, 10A, 12C, 13I | 10B (15), 10D (6)<br>10E (8) | 1D (5), 2A (3), 2B (5), 2C (6), 3C (2), 6A (3), 6B (1), 10B (3)<br>12 (1) | 58 |
| 3418.5 | 1B, 1C, 1D, 1E, 6B,<br>9D, 11E, 13L | 11 (2) | 2A (2), 2B (1), 3A (1), 3B (1), 3C (1), 13 (5) | 13 |
| 3425.5 | 1, 3C, 6D, 7E, 12J,<br>13G | 10B (1), 10C (38),<br>10D (2), 10E (4) | 2A (4), 2B (2), 2C (5), 3A (2), 3B (1), 3C (9) | 68 |
| 3432.5 | CEP, SA<br>3, 6A, 6E, 7E, 9D | 6B (2), 11 (7) | 1C (1), 1D (1), 2A (1), 2B (4), 2C (2), 3B (1), 3C (1), 6A (1) | 21 |
| 3439.5 | 2, 6C, 7D, 10D,<br>13E | 3A (1), 10C (3) | 1C (1), 1D (1), 2B (4), 2C (1), 3B (1), 3C (1), 10E (1) | 14 |
| 3446.5 | CEP, ME<br>3, 9D, 12F, 13F | 10D (20), 10E (11) | 1C (1), 2A (3), 2B (3), 2C (5), 3A (2), 3B (1), 3C (2), 5A (2) | 50 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 3453.5 | 1, 3C, 6D, 7E, 11F, 12A, 13C | 6A (1), 11 (25) | 2A (2), 2B (3), 2C (6), 3A (2), 3B (2), 3C (6), 6A (8), 6E (4) | 59 |
| 3460.5 | 2, 3, 7D, 9B, 10E, 12C, 13K | 10C (14), 10D (1), 13 (7) | 2A (1), 2B (2), 2C (2), 3B (2), 3C (1), 6A (2), 6E (3), 9A (6) 9D (1) | 42 |
| 3467.5 | CEP, EU 6B, 9E, 12F | - | 1D (1), 2A (1), 2B (2), 2C (11), 3A (2), 3B (2), 3C (3), 6A (2) | 24 |
| 3474.5 | 1B, 6A, 7B, 9D, 10C, 13I | 10D,(24) | 1D (1), 2A (4), 2B (1), 3A (1), 3B (1), 3C (2), 6E (1) | 35 |
| 3481.5 | CEP, EU 3A, 6D, 9D, 12H, 13H | 3B (1), 10D (7), 10E (5) | 1C (1), 1D (1), 2A (3), 2B (12), 2C (6), 3A (1), 3B (1), 3C (4), 12 (1), 13 (6) | 49 |
| 3488.5 | 2, 3, 9A, 10D,13J | 10B (1), 10C (17), 10E (1) | 2B (3), 2C (5), 3A (1), 3B (1), 3C (2), 6A (3), 6D (1) | 35 |
| 3495.5 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 11H, 13D | 10C (1), 10D (1) | 2A (3), 2B (4), 2C (7), 3A (4), 3B (1), 3C (1), 8A (1) | 23 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 4654.5 | EU<br>2B, 9A, 9B, 9D, 9E<br>11C, 13E | - | 1C (15), 2A (4), 2B (12), 3A (2), 3C (1), 6A (4), 11 (16) | 54 |
| 4661.5 | 2, 3, 9D, 10D, 12C,<br>13K | 10B (3), 10C (10),<br>10E (17) | 1D (1), 2A (1), 2B (1), 2C (6), 5A (1), 6A (4), 10C (3),<br>10E (1), 12 (1) | 49 |
| 4668.5 | 1, 3C, 6C, 6D, 10A,<br>11D, 13G | 6A (3), 10C (23) | 2B (1), 2C (3), 3A (2), 3B (1), 3C (2), 11 (4), 12 (1) | 40 |
| 4675.5 | 1, 3A, 9D, 12C,13F | 3B (1), 6A (3),<br>10B (7), 10D (10),<br>10E (1) | 1D (1), 2B (3), 2C (2), 3A (1), 3B (1), 3C (10), 6B (2) | 42 |
| 4682.5 | 1D, 3, 5A, 7E,<br>9D, 10E, 11B, 12G,<br>13H | 10D (10) | 1C (1), 1D (1), 2A (1), 2B (1), 3A (1), 3B (1), 3C (3),<br>10D (4), 12 (6) | 29 |
| 4689.5 | EU, EU Ext.<br>3B, 6D, 10C, 12D,<br>13F | 10B (1), 10D (6),<br>10E (1) | 1D (1), 2A (1), 2B (1), 2C (2), 6A (3), 10E (1) | 17 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 4696.5 | NSAM1<br>2, 7D, 9D | 3A (1), 10B (1),<br>10D (11), 10E (8) | 2C (2), 3B (1), 10B (1), 10D (2), 12 (1) | 28 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 5454 (Reg.2) | 10E, 12C, 13E | 10B (2), 10C (9) | - | 11 |
| 5461.5 (Reg. 2) | 10B, 12D, 13L | 10D (4), 10E (6) | 13 (2) | 12 |
| 5469 (Reg.2) | 11H, 13D | 11 (10) | - | 10 |
| 5476.5 (Reg. 2) | 11F, 12F | 11 (3) | 12 (2) | 5 |
| 5484 | 1E, 2B, 3B, 4B, 7D, 9, 11H, 13J | 2A (2), 2C (2), 3A (1), 3C (2) | 1C (1), 2B (1), 3A (1), 3C (1), 12 (1) | 12 |
| 5491.5 | 2C, 6, 7E, 11F 12G, 13G | 11 (8) | 1C (1), 2B (2), 2C (5), 3A (1), 3B (2), 6A (2), 12 (4) | 25 |
| 5499 | 1, 7, 8A, 9B, 9D, 10C, 12D | 3C (1), 9A (1), 10A (2), 10D (19), 10E (12) | 1D (1), 2C (3), 3C (4), 5B (1), 10A (1), 11 (1), 12 (15), 13 (1) | 62 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 5506.5 | CWP, NSA2<br>11D, 13K | - | 1C (14), 2B (2), 2C (4), 3A (1), 3B (2), 3C (2), 6B (5), 6C (1), 6D (1), 8A (1), 9E (1) | 34 |
| 5514 | 2A, 2C, 6A,6B,<br>6E, 9, 10C, 12D | 10B (1), 10D (12),<br>10E (2) | 1D (1), 2B (1), 2C (2), 10D (1) | 20 |
| 5521.5 | NP, NSA1<br>12E | 10D (7), 10E (9) | 2A (3), 2B (2), 2C (4), 3B (3), 3C (5), 6A (3), 10A (1), 10D (1), 10E (2) | 40 |
| 5529 | 1B, 3B, 5A, 6D,<br>9D, 11D, 12H | 6A (2), 11 (10) | 3C (1), 6A (3), 12 (15), 13 (7) | 38 |
| 5536.5 | 2, 5D, 6C, 10D,<br>12C, 13J | 3A (1), 6A (3),<br>6B (3), 10B (8),<br>10C (4), 10E (14),<br>12A (1) | 2A (2), 2C (1), 3A (3), 3C (2) | 42 |
| 5544 | 1, 6B, 7, 9B,<br>10A, 11D, 12G<br>13G | 6A (1), 11 (3) | 2A (2), 3A (1), 3C (2), 12 (4) | 13 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 5551.5 | CEP, EU,<br>9E, 13H | 6A (3), 6D (1),<br>10B (2), 10C (1),<br>10D (13), 10E (14) | 1D (1), 2A (5), 2C (4), 3A (2), 3C (1), 6A (1), 6E (3),<br>10E (1), 12 (1) | 53 |
| 5559 | | 6A (1), 6B (1),<br>6D (1), 12A (1) | 2C (3), 3A (1) | 8 |
| 5566.5 | NSAM2<br>3, 6A, 6E | - | 1D (1), 2A (1), 2B (2), 2C (2), 3A (1), 3B (2), 3C (1), 12 (13) | 23 |
| 5574 | 7 | - | 3A (1), 3B (2), 3 (1), 6A (1) | 5 |
| 5581.5 | NSAM2<br>3, 6A, 6B | 1D (3) | 2A (1), 2B (1), 2C (3), 3A (6), 3B (1), 3C (3), 6A (3),<br>6D (1), 13 (1) | 23 |
| 5589 | 1, 6B, 7, 9A,<br>11C, 12F | 10C (2), 11 (10) | 1D (1), 2A (1), 2C (5), 3C (1), 10C (1), 11 (3) | 24 |
| 5596.5 | 2, 3, 4B, 6D,<br>9D, 11G, 13C, 13K | 11 (1), 13 (11) | 1C (1), 2A (3), 2C (3), 3A (4), 3B (3), 3C (4), 6A (2), 6D (2)<br>10B (4), 10D (3), 12 (1), 13 (1) | 43 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 5604 | CEP, ME, ME Ext. 13H | 10B (1), 10C (2), 10D (12), 10E (19) | 3A (2), 5A (1), 6A (2) | 39 |
| 5611.5 | FE2, NA Ext. | 10A (70) | 1E (2), 2A (3), 2B (3), 2C (4), 3A (2), 3B (1), 3C (2), 6A (2), 6E (2), 9E (1), 10A (3), 12 (4), 13 (1) | 100 |
| 5619 | 1D, 3B, 6D, 9D, 12J, 13H | 10B (14), 10C (19), 10E (12) | 2A (1), 2B (2), 2C (3), 3C (2), 11 (1) | 54 |
| 5626.5 | NA 9B | 6A (2) | 1C (4), 1D (1), 2A (2), 2B (1), 2C (4), 3A (3), 3B (2), 3C (4), 6A (3), 10C (2), 10D (2), 10E (3), 13 (2) | 35 |
| 5634 | 2C, 6, 7B, 11B, 12F | 3A (1), 10D (3), 10E (4), 11 (12) | 2A (1), 2C (2), 3A (2), 3C (1), 11 (11), 12 (1) | 38 |
| 5641.5 | NA, SP | 3C (1) | 1D (15), 2A (7), 2B (2), 2C (3), 3B (2), 3C (1), 6A (6), 6C (1), 13 (4) | 42 |
| 5649 | 1, 3, 6E, 7D, 10D, 12C, 13I | 2B (1), 10B (6), 10C (23), 10D (1), 10E (1) | 1C (1), 1D (1), 2A (2), 2C (3), 3B (1), 3C (5), 6D (1) | 46 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 5656.5 | 1E, 5B, 5C, 5D, 6C, 9D, 11G, 13C, 13L | 6A (4), 6E (1), 11 (3) | 1D (4), 2A (1), 2B (2), 2C (2), 3A (1), 3B (1), 3C (2), 6A (3), 6D (1), 6E (1) | 26 |
| 5664 | 2, 3, 4A, 7D, 9, 10D, 12C, 13E | 10B (1), 10C (29), 10D (2), 10E (5) | 3A (1) | 38 |
| 5671.5 | FE1, MA | - | 1C (1), 1D (1), 2A (2), 2B (1), 2C (3), 3A (2), 3B (1), 3C (3), 6A (6), 6C (1), 9B (1), 9E (1), 10C (5) | 28 |
| 5680 | AAA | - | 2C (3), 3C (1), 12 (1) | 5 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 6529.5 | 1B, 1C, 1D, 3B, 6A, 6E, 7B, 9B, 11C, 12F, 13L | 11 (1) | 10C (2), 11 (4) | 7 |
| 6537 | 4, 5, 6F, 9D, 11B, 12D | - | 2A (4), 2B (2), 2C (3), 3B (1), 3C (5), 6A (2), 9A (6), 9B(5) 9D (2), 11 (2), 12 (6) | 38 |
| 6544.5 | 1D, 3A, 6A, 9E, 11F, 12C, 13J | 3B (1), 3C (4), 10A (3) | 2B (2), 2C(1), 6E (2) | 13 |
| 6552 | EU 3, 6C, 7, 10D, 12C, 13G | 6A (6), 6D (1), 10B (3) 10C (6) 10E (6) | 1C (1), 1D (2), 3C (1), 6A (3), 13 (1), | 30 |
| 6559.5 | 2A, 4B, 6A, 6B, 6E, 9, 11D, 13F | 11 (3) | 2C (4), 3B (1), 4A (2), 4B (1), 6D (1), 12 (1) | 13 |
| 6567 | NSAM2 1, 3A, 6A, 7D, 7E, 9D, 10A | 3C (2), 10A (3) | 2A (1), 3B (1) 3C (1), 11 (1), 12 (2), | 12 |
| 6574.5 | 2A, 4A, 6B, 9, 11D, 12H | 11 (10), 13 (1) | 2A (1), 2C (1), 11 (2) | 15 |
| 6582 | EU, EU Ext. 6, 7E, 10C, 12C, 13I | 10D (2) | 3C (1), 6D (1), 7B (22), 12 (2), 13 (1) | 29 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 6589.5 | 2, 3, 4B, 6D, 9D, 11E, 12F, 13K | 6A(4), 11(2) | 1D (1), 2A (2), 2B (1), 3B(1), 3C (1), 5A (3), 5B (1), 6A (5), 6E (2), 12 (1) | 24 |
| 6597 | SA 2B, 6F, 7B, 7C, 7D, 7E, 10B,12D | 3A (1), 6A (3), 10E (2), 13 (1) | 2A (1), 3A (1), 3C (1), 6A (1), 6D (1), 6E (6), 11 (1), 12 (1) | 20 |
| 6604.5 | 1E, 3C, 5B, 6C, 11F, 12C, 13C, 13K | 3A (1), 3B (1), 7C (1), 13 (3) | 1D (1), 2B (1), 2C (1), 3A (1), 6A (4) | 14 |
| 6612 | CEP, SA 2A, 2C, 3B, 6E, 9A, 9B, 9D, 9E, 10E, 12E | 10B (2), 10C (2), 10D (3) | 2A (1) 2C (3), 3A (1), 6A (3), 6C (16), 10D (1), 12 (1) | 33 |
| 6619.5 | 2, 6C, 6D, 11B, 12D, 13D | 3A (1) | 1D (2), 2A (2), 2B (1), 2C (3), 3C (1), 6A (2) | 12 |
| 6627 | ME, ME Ext. 3C, 7B, 9, 10C 11G, 12F, 13E, 13J | 2A (1), 3A (1), 3B (1) 10B (2) 10C (1) | 1C (1), 1D (1), 2A (1), 2B (3), 2C (2), 3A (1), 3B (1), 3C (2), 4A (1), 5A (2), 6A (3), 6D (1), 13 (1) | 26 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 6634.5 | 1, 3B, 6A, 9B 11B, 12D, 13K | 11 (2), 13 (8) | 2B (1), 6A (1), 6B (1), 13 (1) | 14 |
| 6642 | 2, 3, 4B, 6D 9D, 11F, 12G, 13G | 6A (1), 10B (1), 10C (1), 11 (2) | 1D (2), 2A (1), 3C (1), 12 (4) | 13 |
| 6649.5 | 1, 3B, 6A, 7, 8A, 9A, 9E, 11G, 12A, 13J | 10D (1), 11 (1) | 2A (1), 2B (3), 2C (2), 3C (2), 6E (1), 13 (12) | 23 |
| 6657 | 2, 3, 4B, 6D 9D, 11H, 12G | 6A (2), 11 (2) | 1D (13), 2A (2), 2C (2), 6A (2), 10D (1) 11 (1) 12 (5) | 30 |
| 6664.5 | NSAM1 1, 6B, 7B, 9A, 9B, 9D, 9E, 10D | 6A (1), 10C (1), 10E (1) | 2C (1), 3C (2), 6A (5), 6E (2) | 13 |
| 6672 | 2, 3, 4B, 6C, 6D, 9D, 11E, 12F | 10C (3), 11 (4) | 1D (1), 3A (1), 3C (1), 6A (6) | 16 |
| 6679.5 | CEP, SA 3B, 6A, 6E, 7B, 7E. 9, 10E | 10C (1), 10D (5) | 1D (1), 2A (2), 3A (1), 3B (1), 13 (8) | 19 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 8820 | NSA1 NSAM1<br>6C, 6D | 3B (3) | 11 (7) | 10 |
| 8828.5 | | 7B (3) | 2A (1), 2C (2), 3A (1), 3C (1), 5D (1), 6B (2) | 11 |
| 8837 | 1, 6F, 12D, 13F | 10B (3), 10C (2) | 2A (1), 2B (2), 2C (2), 3B (1), 11 (3), 12 (4) | 18 |
| 8845.5 | ME, NSAM2, SP<br>3B | 3C (1), 4B (1) | 1D (1), 2B (2), 2C (1), 3C (2), 5A (1), 6C (1), 13 (1) | 11 |
| 8854 | 1, 6F, 11D, 13K | - | 2A (1), 2B (1), 2C (1), 3A (1), 3C (2) | 6 |
| 8862.5 | CWP, NA<br>7, 13G | - | 2A (1), 2C (1), 3C (2), 6C (1) | 5 |
| 8871 | EU, EU Ext., FE2,<br>NSAM2<br>7D | 10A (2), 10B (1),<br>10C (1), 11 (1) | 2A (2), 2B (1), 2C (1), 3C(1), 6E (2), 9E (1) | 13 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 8879.5 | CEP, FE1, SA<br>7E, 10E | - | 1D (1), 2A (1), 2B (1), 2C (1), 3A (1), 3C (1), 6B (1) | 7 |
| 8888 | NA<br>6A, 6F, 9D, 13L | - | 3C (2) | 2 |
| 8896.5 | 4, 5, 9, 10B, 13C | 10D (2), 10E (2) | 1D (3), 2B (1), 2C (2), 3A (1), 3B (1), 3C (2), 6D (1) | 15 |
| 8905 | | 12 (1) | 2A (3), 2C (1), 3C (1) | 6 |
| 8913.5 | NA<br>3C, 7B, 9B, 13E | 3A (1), 3B (1) | 1C (3), 1D (1), 2A (1), 2B (1), 3A (1), 3B (1), 3C (1),<br>6A (3), 7B (1), 10D (7), 10E (2), 12 (1) | 25 |
| 8922 | 2, 3, 7D, 9, 12C,<br>13L | 4B (4) | 2C (1), 3A (1), 13 (1) | 7 |
| 8930.5 | CEP, EU, FE1<br>7E, 12H | 13 (4) | 2A (1), 2B (1), 3A (1), 3C (1), 6B (2), 13 (29) | 39 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 8939 | NP, SA<br>6A, 9A, 12F | 9D (6), 9E (1),<br>10A (1), 10D (1) | 2C (1), 3B (2), 3C (1), 6E (22), 9B (6), 9D (2), 9E (8) | 51 |
| 8947.5 | NA Ext.<br>3B, 3C, 7, 8A,<br>9, 13H | - | 1E (2), 2A (1), 3A (2), 3B (5), 12 (2), 13 (4) | 16 |
| 8956 | NSA2<br>6B, 11B, 13J, 13K | 8A (1) | 2B (1), 2C (1), 3A (2), 7E (2), 9E (1), 11 (9) | 17 |
| 8961.5 | 1, 2, 3, 4, 5, 6,<br>7, 8, 9, 10, 11,<br>12, 13 | - | 3C (1), 5A (1), 6A (2) | 4 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 10012 | 2, 3, 11C, 13L | 7B (1) | 2B (1), 3C (1) | 3 |
| 10021 | ME, ME Ext.<br>9D, 12J | 3B (1), 3C (1) | 1C (1), 2B (1), 3A (1), 3B (1), 3C (1), 5A (1), 11 (1) | 9 |
| 10030 | 2, 3, 11H, 13I | - | 2B (1), 3C (1), 11 (3) | 5 |
| 10039 | 2, 3, 7E, 10D,<br>13E | 4A (1), 10C (3) | 3C (1), 4B (2), 10C (1), 10E (1) | 9 |
| 10048 | CEP, SA<br>6A, 6D, 6E, 6F | - | 1C (1), 2B (1), 2C (2), 3C (1), 13 (1) | 6 |
| 10057 | 2, 3A, 3C, 9D,<br>9E, 10C, 12G | - | 2B (2), 3B (1), 3C (1), 12 (4) | 8 |
| 10066 | 1, 6F, 11E, 13D | 10C (2), 11 (1) | 2C (2), 3A (1), 3C (1) | 7 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 10075 | 2, 3, 7E, 11G, 13H | - | 3C (1) | 1 |
| 10084 | CEP<br>1, 6C, 13J | 3C (1) | 2A (2), 2C (2), 3C (2) | 7 |
| 10093 | 2, 3A, 3C, 9B, 9D,<br>9E, 11F, 13K | 11 (3) | 2A (1), 2B (1), 3B (1), 3C (1), 11 (1) | 8 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 11280.5 | 3C, 9D, 11B, 13L | - | 2A (1), 3A (2), 3B (1), 10C (1), 10D (1), 11 (3), 13 (1) | 10 |
| 11290 | NSAM2<br>2, 3A, 9D | 3B (1), 3C (5) | - | 6 |
| 11299.5 | CEP, EU, EU Ext.<br>13J | - | 2C (1), 3C (1) | 2 |
| 11309 | 2, 9B, 10D, 13G | 10C (1) | 2A (2), 2B (2), 2C (1), 3C (1) | 7 |
| 11318.5 | CEP<br>7, 8A, 13J, 13K | 1E (1) | 1D (1), 2C (1), 3C (1) | 4 |
| 11328 | 3, 7E, 9D, 10,<br>11, 12, 13 | - | 3A (1), 3C (1) | 2 |
| 11337.5 | NSAM2<br>6 | - | 1C (1), 2C (1), 3A (1) | 3 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 11347 | 2, 3, 11C | 7B (2) | 2B (1), 2C (1), 7B (1), 11 (2) | 7 |
| 11356.5 | 1, 9, 10C, 13E | 10A (2), 11 (1) | 2B (1), 6A (1) | 5 |
| 11366 | 2, 3, 12D | - | 3C (1) | 1 |
| 11375.5 | 2, 9, 10B, 13K | 13 (3) | 2B (1), 3C (1), 6A (1), 12 (3) | 9 |
| 11385 | 4, 5, 12C | - | 2C (2) | 2 |
| 11394.5 | 2, 3A, 9B, 11E 13H | 3C (2), 11 (3) | 3C (1), 5B (1), 6A (1), 6D (1) | 9 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 13264.5 | NA<br>3 | - | 2A (1), 2B (2), 2C (1), 3B (2) | 6 |
| 13274.5 | NP, SA | - | 1C (1), 2A (1), 2B (2), 2C (1), 3C (1), 10A (1), 10D (1), 12A (1) | 9 |
| 13284.5 | FE2, NA | - | 2A (1), 2B (2), 3A (1), 3B (1), 3C (2), 6E (1), 9E (1) | 9 |
| 13294.5 | 6F, 10, 11, 12C, 12D, 12E, 12F, 12G, 12H, 12J, 13 | - | 2A (2), 2B (2), 3B (1), 3C (2) | 7 |
| 13304.5 | CEP, NSA1<br>6C | - | 2A (2), 2B (2), 3C (1) | 5 |
| 13314.5 | NSAM1<br>1 | - | 2C (1), 3A (2), 3C (1), 12 (1), 13 (1) | 6 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 13324.5 | FE1, NA | - | 2C (1), 3C (2), 9B (1), 9E (1), 10D (3), 10E (4), 12 (2) | 14 |
| 13334.5 | CEP, ME, NSA2 | - | 1C (1), 2C (1), 3A (1), 3B (1), 3C (3), 5A (1), 8A (1), 9E (1) | 10 |
| 13344.5 | NSAM2, SP 2 | 3A (1) | 2A (1), 2B (2), 2C (1), 6C (1), 11 (1), 13 (1) | 8 |
| 13354.5 | CWP, NA Ext. | - | 2A (2), 3C (2), 6C (1), 12 (1) | 6 |

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 17906.5 | CWP, EU, EU Ext., NP | - | 2B (3), 2C (1), 3B (1), 3C (2) | 7 |
| 17916.5 | NSAM1, NSAM2 3A, 3C | - | 2A (2), 3A (1), 13 (1) | 4 |
| 17926.5 | CEP, ME, NSA2 | - | 1C (1), 2B (2), 2C (2), 3A (1), 3C (1), 4B (2), 8A (1), 9E (1) | 11 |
| 17936.5 | 4, 5, 7, 10, 11, 12C, 12D, 12E, 12F, 12G, 12H, 12J, 13 | - | 2A (3), 2B (2), 2C (1), 3C (1), 8A (1) | 8 |
| 17946.5 | NSA1, SA, SP | - | 1C (1), 2A (1), 2C (2), 3C (2), 6A (1) | 7 |
| 17956.5 | 2, 3, 10, 11, 12C, 12D, 12E, 12F, 12G, 12H, 12J, 13 | - | 1C (1), 2A (1), 2B (1), 2C (2), 13B (1) | 6 |
| 17966.5 | FE1, FE2, NA Ext. | - | 2B (1), 3A (1), 3C (1), 9E (1), 10D (1), 10E (1), 12 (1) | 7 |

## FREQUENCES VOLMET - VOLMET FREQUENCIES - FRECUENCIAS VOLMET

| 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|
| 2980 | Pacif. MET.<br>EU MET. | | | 0 |
| 3001 | Atlant. MET.<br>ME MET. | 7B (3) | 7B (2) | 5 |
| 5559 | Atlant.MET.<br>ME MET. | - | 5A (1), 5D (1), 7B (3) | 5 |
| 5574 | EU MET.<br>Pacif. MET. | | | 0 |
| 8828.5 | Atlant. MET.<br>ME MET. | 7B (3) | 5D (1) | 4 |
| 8905 | Pacif. MET.<br>EU MET. | | | 0 |

AERONAUTICAL
CONFERENCE

Document No. I-8-E
12 December 1963
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

International Frequency Registration Board

# REPORT ON STUDIES RELATING TO THE BASIC CONCEPTS OF ALLOTMENTS IN A REVISED FREQUENCY ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE R SERVICE

1. The I.C.A.O. Special Communications Meeting, (1963), considered that the existing Allotment Plan for the Aeronautical Mobile R Service, based on the concepts of Major World Air Route Areas (MWARA's) and Regional and Domestic Air Route Areas (RDARA's) had proved to be satisfactory during the period since the plan was developed in 1949, and that nothing had occurred in practice to suggest the need for basing the plan on new concepts. The Meeting considered, however, that some changes in operational requirements had occurred which might permit some simplification of the Plan particularly in regard to overlap areas; also that some new air routes not covered by the existing MWARA's had been established since the Plan was adopted. The Meeting therefore recommended, inter alia, that some amenements should be made to the boundaries of existing MWARA's, including the establishment of a new MWARA for the Caribbean region and extension of the North Atlantic MWARA to include Arctic polar routes.

2. The above-mentioned I.C.A.O. Meeting did not propose any specific changes to RDARA's but recommended that changes to existing RDARA boundaries should be considered by the countries concerned, in consultation with adjacent countries if necessary, with a view to improving the present HF Allotment Plan; and that, when studying changes in RDARA boundaries, the following factors should be taken into consideration :

a) the extent of implementation of VHF in the area concerned;

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b) improvements in ground-to-ground communications;

c) changes in the operational use of MWARA and RDARA frequency allotments;

d) recommendations for changes in the MWARA boundaries.

3. The I.F.R.B., while it believes that the distinction between Major World Air Route operations and Regional and Domestic Air operations is now less marked than was the case when the present Allotment Plan was established (since in many cases the same airports and communications facilities are now used by aircraft flying international, regional and domestic routes and in fact, a number of RDARA frequencies are now used for MWARA operations), considers that the present Allotment Plan has proved to be very flexible in readily providing for changes in operational requirements, in providing for the establishment of additional aeronautical and aircraft stations associated with increased air traffic, and has led to a very effective use of the high frequency spectrum insofar as the use of the same frequencies by a large number of aeronautical and aircraft stations is concerned. The Board therefore supports the I.C.A.O. conclusions that the revised Allotment Plan for the Aeronautical Mobile R Service should continue to be based on the concept of allotements to Major World Air Route Areas and Regional and Domestic Air Route Areas.

4. The I.F.R.B. is of the opinion that the final establishment of Area boundaries, both in respect of MWARA's and RDARA's, should be made only when an analysis of up-to-date flying statistics has been made and presented to the Second Session of the Aeronautical Conference. However, it seems desirable that the First Session of the Conference should endeavour to take some account of any additional Areas which the Conference might ultimately wish to establish, as this will have a bearing on the number of families of frequencies which may have to be made available and hence on the channel widths to be adopted in the revised Allotment Plan.

5. The I.F.R.B. is of the opinion that the question of possible simplification of the Allotment Plan by a reduction in the overlap between the present MWARA boundaries should be studied by the Extraordinary Administrative Aeronautical Radio Conference. In regard to changes in RDARA boundaries, the I.F.R.B. hopes that the revised Allotment Plan will provide for simplification of the RDARA boundaries in I.T.U. Region 2, i.e. RDARA's 10, 11, 12, and 13 with their existing sub-divisions 10A - 10E, 11A - 11I, 12A - 12J and 13A - 13M. The very considerable overlap between these sub-areas makes it very difficult, if not impossible, to identify the particular sub-Area in which an aeronautical station, using a given frequency, is situated; and the Board would hope that in the revised Allotment Plan, a simplified layout of the RDARA's in Region 2, for example on lines of that adopted in Africa or Asia, could be introduced. This question is also of importance in regard to the form in which flying statistics, in respect of Regional and Domestic Air operations, are to be presented and analysed.

AERONAUTICAL CONFERENCE

Document No. I-9-E
12 December 1963
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

International Frequency Registration Board

# REPORT ON STUDIES ON FACILITIES FOR HIGH FREQUENCY METEOROLOGICAL BROADCASTS IN A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE R SERVICE

1. The I.C.A.O. Special Communication Meeting (1963) recommended that VHF should be used for the satisfaction of all local and regional meteorological broadcast requirements, whenever technically, operationally and economically feasible; that use should be made of VHF facilities to satisfy new requirements for meteorological broadcast to the extent that adequate coverage could be provided to meet operational needs and when the use of VHF is technically and economically feasible; and that studies should be made of the extent, if any, to which existing meteorological broadcasts on high frequencies could be transferred to VHF to reduce demands for high frequency allotments within the Aeronautical Mobile R Service frequency bands.

2. The I.F.R.B. strongly supports the I.C.A.O. recommendations in paragraph 1 above, which are in conformity with the general recommendations of the I.T.U. Panel of Experts that the use of high frequencies should be avoided in all cases where the required service can be technically and economically provided by other means of communication.

3. The I.C.A.O. Special Communications Meeting (1963), however, made the following additional recommendations in regard to high frequency facilities for meteorological broadcasts :

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1. "that the existing allotments of high frequencies to the ATlantic-MET, Pacific-MET and EU-MET areas, for meteorological broadcasts exclusively, be maintained by the I.T.U. Aeronautical E.A.R.C. (1964/1965) and that these frequency families be supplemented by :

   Atlantic-MET - Allotment of a 13 Mc/s frequency for meteorological broadcasts exclusively.

   Pacific-MET - Allotment of a higher order of frequency, preferably in the 13 Mc/s band, or, if this is not feasible, in the 11 Mc/s band.

   EU-MET - Allotment of an 11 Mc/s or 13 Mc/s frequency.

2. "that the I.T.U. Aeronautical E.A.R.C. (1964/1965) examine the possibility of allotting a separate high frequency family for meteorological broadcasts exclusively to the ME-MET area, to replace the frequency family now shared with the Atlantic-MET area, and thereby resolve existing operational difficulties.

3. "that the I.T.U. Aeronautical E.A.R.C. (1964/1965) make every endeavour to allot appropriate high frequency families for meteorological broadcasts exclusively in the African, South East Asian and South American areas. "

4. In regard to the I.C.A.O. recommendations in paragraph 3 above, the I.F.R.B. believes that the establishment of an effective system of long-range meteorological broadcasts in certain areas, such as the North Atlantic area, has very greatly reduced the loading on the normal ground-air channels which formerly carried a considerable amount of "request-reply" meteorological traffic. It seems quite probable, therefore, that the establishment of long-range meteorological broadcasting systems in other areas where they do not at present exist, while involving the allotment of special families of frequencies to these areas for such broadcasts, would not necessarily involve a total increase in the number of high frequencies to be allotted to the areas concerned due to the resulting more effective use of the ground-air channels for Air Traffic Control purposes.

5. The allotment of frequencies to afford the above-mentioned facilities for meteorological broadcasts will, of course, be a matter for the Second Session of the Aeronautical Conference. However, it would appear

desirable that the First Session of the Aeronautical Conference should take account of the I.C.A.O. recommendations that the additional high-frequency facilities, described in paragraph 3 above, should be provided, as this may have a bearing on the total number of families of frequencies which should be made available in the revised Allotment Plan and hence on the channel widths and number of channels to be established by the First Session of the Conference.

AERONAUTICAL CONFERENCE

Document No. I-10-E
19 December 1963
Original : English/ French/ Spanish

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

International Frequency Registration Board

# REPORT ON STUDIES RELATING TO AIRCRAFT OPERATION STATISTICS

1. The Administrative Council of the I.T.U., in consultation with Members and Associate Members of the Union, adopted at its 18th Session (Geneva, March - April, 1963) the agenda for the first session of the Extraordinary Administrative Radio Conference for the preparation of a revised Allotment Plan for the Aeronautical Mobile Service.

In accordance with this agenda, this Conference is charged, inter alia :

- to establish the operational principles on which requirements for high frequencies for Aeronautical Mobile (R) Service communications should be assessed;

- to determine the form in which such requirements should be submitted to the Union and to fix the date by which they should be submitted.

2. The I.C.A.O. Special Communication Meeting (Montreal, 1963) considered the matter of obtaining and presenting appropriate flight statistics and in this respect recommended :

2.1 for simplification of the collection of data and the presentation of the results of the statistics, the points of departure, intermediate stops, and arrival should be indicated, instead of by the name of the individual airports concerned, by the corresponding numbered areas shown in the map attached as Annex 1 to this document;

2.2 the statistics should be based on actual operating conditions of one week's duration for a period to be chosen by the first session of the Aeronautical E.A.R.C.

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3. The International Frequency Registration Board, having made studies on the utilisation of its electronic computer for compiling and analysing aircraft operation statistics, has prepared two forms (attached as Annexes 2/1 and 3/1 to this report) which the Board suggests might be used for notifying the relevant information in respect of Major World Air Route operations and Regional and Domestic Air Route operations, respectively. The Board is of the opinion that the following items should be included in the information to be supplied by the Administations :

- flight identification;
- type of flight;
- aircraft speed;
- areas of departure, intermediate and final stops;
- Major World Air Route Areas (MWARA's) or Regional and Domestic Air Route Areas (RDARA's) in which the flight operates;
- time of flight (day or night);
- days of flight;
- distance per stage
- part of the distance per stage covered by VHF communication.

Fuller particulars about the foregoing information are given in paragraph 2 of Annex 2/2 for the MWARA's, and in paragraph 2 of Annex 3/2 for the RDARA's.

4. The I.F.R.B. anticipates obtaining the following results from the analysis of the information supplied :

- the number of aircraft operating during the one week period over any flight segment, if required, or within any given MWARA or RDARA;
- taking the concentration factor(s) K as established by the Conference, the maximum number of aircraft that would require communication in any one hour in any given MWARA or RDARA;
- taking the time of flight (day or night) into account, the maximum number of aircraft requiring communication during the one week period on day or night frequencies.

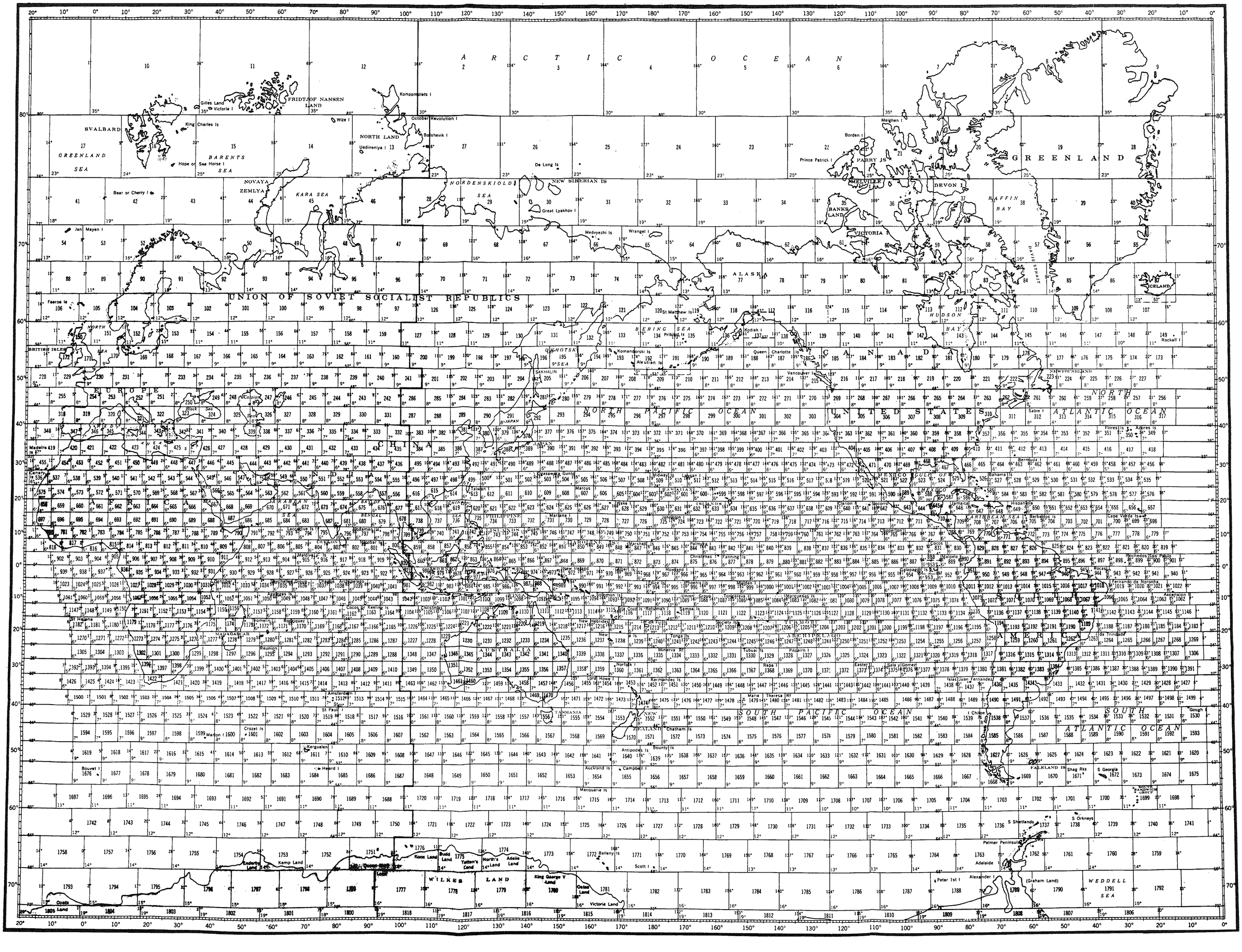
Annexes : 4

PROPOSED WORLD MAP FOR THE REPORTING OF AIRCRAFT OPERATION STATISTICS

PLANISPHERE PROPOSE POUR LA PRESENTATION DES STATISTIQUES CONCERNANT L'EXPLOITATION DES AERONEFS

MAPA MUNDIAL PROPUESTO PARA PRESENTAR LOS INFORMES ESTADITISCOS SOBRA OPERACIONES DE AERONAVES

ANNEX 1
ANNEXE 1
ANEXO 1



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AIRCRAFT OPERATION STATISTICS
MAJOR WORLD AIR ROUTE AREAS
NOTIFICATION FORM

PAGE No

| | SURVEY No | COUNTRY | SERIAL No | FLIGHT IDENTIFICATION | TYPE OF FLIGHT | AIRCRAFT SPEED | LINE CODE | ORIGIN AREA | ORIGIN MWARA | ORIGIN TIME OF DEPARTURE | ORIGIN DAYS OF FLIGHT M | Tu | W | Th | F | Sa | Su | STOP AREA | STOP MWARA | STOP L | STOP $L_{vhf}$ | STOP TIME OF FLIGHT | STOP AREA | STOP MWARA | STOP L | STOP $L_{vhf}$ | STOP TIME OF FLIGHT | STOP AREA | STOP MWARA | STOP L | STOP $L_{vhf}$ | STOP TIME OF FLIGHT | STOP AREA | STOP MWARA | STOP L | STOP $L_{vhf}$ | STOP TIME OF FLIGHT | STOP AREA | STOP MWARA | STOP L | STOP $L_{vhf}$ | STOP TIME OF FLIGHT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 4 | 5 7 | 8 14 | | 15 | 16 | 17 | 18 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 34 | 35 | 36 37 | 38 39 | 40 | 41 44 | 45 | 46 47 | 48 49 | 50 | 51 54 | 55 | 56 57 | 58 59 | 60 | 61 64 | 65 | 66 67 | 68 69 | 70 | 71 74 | 75 | 76 77 | 78 79 | 80 |
| EXAMPLE 1 | | SU | 1 | SR8010 | 1 | 3 | 1 | 2531 | 1 | J | + | + | + | + | + | + | + | 3110 | 3 | 64 | 42 | J | | | | | | | | | | | | | | | | | | | | |
| EXAMPLE 2 | | F | 202 | AF1410 | 1 | 2 | 1 | 2301 | 1 | J | + | | | | | + | | 3211 | 1 | 11 | 40 | J | 4226 | D | 21 | 25 | | | | | | | | | | | | | | | | | |
| EXAMPLE 3 | | 1 | 25 | AZ7701 | 1 | 3 | 1 | 3211 | 1 | J | | | + | | | | | 3399 | D | 34 | 25 | N | 5501 | D | 19 | | N | 6738 | D | 8 | | J | 6781 | B | 31 | | J | 8601 | B | 14 | | J |
| | | 1 | 25 | AZ7701 | 1 | 3 | 2 | | | | | | | | | | | 1099 | B | 31 | | N | 1456 | B | 31 | | N | | | | | | | | | | | | | | | |

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# A N N E X 2/2

## AIRCRAFT OPERATION STATISTICS
## MAJOR WORLD AIR ROUTE AREAS

### Instructions for completing the Notification Form

1. General Remarks

1.1 In view of the great volume of data which will have to be processed and, possibly, the short time which may be available for such processing, the I.F.R.B. has endeavoured to devise a form which would enable the information to be punched directly on to 80 Column Cards without any intermediate processing by the I.F.R.B. It is, therefore, very important that extreme care be exercised to avoid the entering of information in a faulty or inaccurate way.

1.2 The Form is divided into 80 Columns to correspond with the 80 Column Card to be used by the I.F.R.B. for data input to its Electronic Data Processing System. The Columns are numbered from 1 to 80 and guide lines are provided for correct inclusion of the information to be furnished.

1.3 The Form for notifying the aircraft operation over Major World Air Route Areas (see Annex 2/1) can be broadly divided into three sections from the standpoint of the information to be provided :

- the first section, Columns 1 to 16, is meant for inclusion of the information of a general and administrative nature;
- the second section, Columns 18 to 30, is provided for the details concerning the point of origin of the flight;
- the third section, Columns 31 to 80, seeks the information regarding any intermediate and final stops.

2. Explanation of the titles and subtitles used in the Notification Form

2.1 COUNTRY - This place on the form is provided for the country symbol of the country submitting the Notification Form to the I.F.R.B. A copy of the Table of Country symbols from the Preface to the International Frequency List, is given in Annex 4.

2.2 SERIAL No. indicates the sequential number of all flights pertaining to one country.

2.3 FLIGHT IDENTIFICATION for airline flights, consists of the airline abbreviations followed by the trip number. In all other cases, the notifying country may give an appropriate national identifying symbol.

2.4 TYPE OF FLIGHT - Flights are grouped into two categories :

- scheduled flights;
- non-scheduled flights (including military transports flying along international civil air routes).

2.5 AIRCRAFT SPEED - Aircraft have been grouped into three categories :

- speeds of less than 350 knots;
- speeds from 350 knots to 500 knots;
- speeds greater than 500 knots.

2.6 LINE CODE - This Column is provided for entering the number of line or lines on the Form which contain information concerning one flight.

2.7 AREA refers to one of the 1818 numbered subdivisions shown on the World Map in Annex 1.

2.8 MWARA is the abbreviation for Major World Air Route Area, as defined in Appendix 26 to the Radio Regulations, Geneva, 1959, and shown on Map I accompanying this Appendix.

2.9 TIME OF FLIGHT - indicates whether the flight takes place predominantly during day hours or during night hours.

2.10 DAYS OF FLIGHT (G.M.T.) indicate day or days if the week during which flights, having the same flight identification, originate.

2.11 L indicates the distance per stage of flight in hundreds of kilometres.

2.12 $L_{vhf}$ indicates for each stage the distance covered by VHF communication, in tens of kilometers.

3. Detailed Instructions concerning information to be entered in the specific columns of the form

<table>
<tr><th>Title</th><th>Column(s)</th><th>Instructions</th></tr>
<tr><td>SURVEY No.</td><td>1</td><td>This column is for use by the IFRB and should be left blank.</td></tr>
<tr><td>COUNTRY</td><td>2 to 4</td><td>The country symbol (see Annex 4) of the notifying country should be entered in consecutive columns, commencing with column 2. Any columns not required should be left blank.<br><br>Example : The country symbols of, for instance, Afghanistan, France and Sweden should be written as follows :<br><br>
<table>
<tr><th colspan="3">COUNTRY</th></tr>
<tr><th>2</th><th>3</th><th>4</th></tr>
<tr><td>A</td><td>F</td><td>G</td></tr>
<tr><td>F</td><td></td><td></td></tr>
<tr><td>S</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>SERIAL No.</td><td>5 to 7</td><td>The serial number of each flight should be entered in these columns. (If more than one aircraft is covered by the same serial flight number, indicate each aircraft on a separate line). Any columns not required should be left blank.<br><br>Example :
<table>
<tr><th colspan="3">SERIAL No.</th><th></th></tr>
<tr><th>5</th><th>6</th><th>7</th><th></th></tr>
<tr><td></td><td></td><td></td><td>= Serial No.8</td></tr>
<tr><td></td><td>1</td><td>6</td><td>= Serial No.16</td></tr>
<tr><td>3</td><td>1</td><td>5</td><td>= Serial No.315</td></tr>
</table></td></tr>
</table>

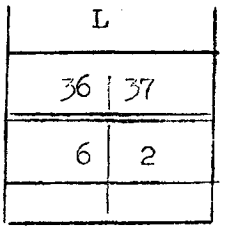
<table>
<tr><th>Title</th><th>Column(s)</th><th>Instructions</th></tr>
<tr><td>FLIGHT IDENTIFICATION</td><td>8 to 14</td><td>The information should be entered in consecutive columns commencing with column 8. Any columns not required should be left blank.<br><br>Example:
<table>
<tr><th colspan="7">FLIGHT IDENTIFICATION</th></tr>
<tr><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td></tr>
<tr><td>Q</td><td>F</td><td>5</td><td>8</td><td>7</td><td></td><td></td></tr>
<tr><td>R</td><td>K</td><td>3</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>A</td><td>F</td><td>1</td><td>8</td><td>9</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>TYPE OF FLIGHT</td><td>15</td><td>In case of a scheduled flight, the digit 1 should be entered here.<br><br>For all other types of flight (including military), the digit 2 should be entered.</td></tr>
<tr><td>AIRCRAFT SPEED</td><td>16</td><td>The digits 1, 2 or 3 should be entered here according to the aircraft speed category:<br><br>1 - for speeds less than 350 knots<br>2 - for speeds from 350 knots to 500 knots<br>3 - for speeds greater than 500 knots.</td></tr>
<tr><td>LINE CODE</td><td>17</td><td>The digit 1 should be entered here.</td></tr>
<tr><td>ORIGIN</td><td>18 to 30</td><td>The information relevant to the origin of the flight should be entered in columns 18 to 30, as explained below.</td></tr>
<tr><td>AREA</td><td>18 to 21</td><td>The number of the area, in accordance with the world map in Annex 1 containing the airport from which the flight departs, should be entered in columns 18 to 21. Any columns not required should be left blank.</td></tr>
</table>

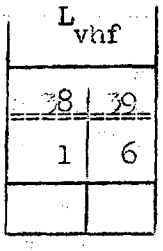
| Title | Column(s) | Instructions |
|---|---|---|
| | | Example: The 'area' for the flights originating, for instance, from London, Karachi and Capetown airports would be written as follows : |

| AREA | | | | |
|---|---|---|---|---|
| 18 | 19 | 20 | 21 | |
| | 2 | 3 | 0 | London Airport |
| | 5 | 5 | 0 | Karachi Airport |
| 1 | 4 | 2 | 2 | Capetown Airport |

| | | |
|---|---|---|
| MWARA | 22 | The code for MWARA (see Annex 2/3) in which flight originates should be entered here. As an example, a flight originating in MWARA EU would be shown by the digit 1 in column 22. |
| TIME OF DEPARTURE | 23 | 1) In case the flight originates during day hours (0600 - 1800 hours, Local Time), the letter J should be entered here.<br>2) In case the flight originates during night hours (1800 - 0600 hours, Local Time), the letter M should be entered here. |
| DAYS OF FLIGHT | 24 to 30 | The day(s) (G.M.T.) of the week on which the flight originates should be indicated here with a + sign.<br>Example: |

| | ORIGIN | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AREA | | | | MWARA | TIME OF FLIGHT | DAYS OF FLIGHT | | | | | | |
| | | | | | | | M | Tu | W | Th | F | Sa | Su |
| | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| (a) | | 6 | 8 | 7 | G | J | + | + | + | + | + | + | + |
| (b) | 1 | 0 | 2 | 7 | F | J | | | | + | | | + |
| (c) | | 2 | 3 | 0 | 3 | N | | + | | | | | |

| Title | Column(s) | Instructions |
|---|---|---|
| | | The entry identified by (a) means that the flight originates during day hours in area 687, MWARA NSA-2 and is scheduled seven days a week.<br><br>The entry in (b) means that the flight originates during day hours in the area 1027, MWARA NSA-1, and is scheduled each Thursday and Sunday.<br><br>The entry in (c) means that the flight originates during night hours in the area 230, MWARA NA, and is scheduled each Tuesday. |
| STOP | 31 to 40 | These columns are meant to contain the flight particulars of an intermediate stop or of the final stop. |
| AREA | 31 to 34 | The area of the intermediate stop or of the final stop should be entered here in a similar manner as explained for columns 18 to 21. |
| MWARA | 35 | The code of the Major World Air Route Area (see Annex 2/3) in which the stop takes place should be entered here. |
| L | 36,37 | The distance covered per stage, rounded to the nearest 100 km. should be entered here.<br><br>Example: A distance of 6235 km. will be shown as:<br><br>  <br> |

| Title | Column(s) | Instructions |
|---|---|---|
| $L_{vhf}$ | 38,39 | That part of the distance per stage, covered by VHF communication should be entered here, rounded to the nearest 10 km.<br>Example: A distance of 165 km will be shown as:  |
| TIME OF FLIGHT | 40 | 1) In case the flight between the two points of a stage takes place predominantly during day hours, the letter J should be entered here.<br>2) In case the flight between the two points of a stage takes place predominantly during night hours, the letter N should be entered here. |
| STOP | 41 to 50 | In case the flight does not terminate with the STOP, the particulars of which are shown in columns 31 to 40, the particulars of the subsequent STOP should be entered in columns 41 to 50 in the same manner as for the preceding STOP (see Annex 2/1, Example 2). |
| STOP | 51 to 60 | In case the flight does not terminate with the STOP, the particulars of which are shown in columns 41 to 50, the particulars of the subsequent STOP should be entered in columns 51 to 60. |
| STOP | 61 to 70 | In case the flight does not terminate with the STOP, the particulars of which are shown in columns 51 to 60, the particulars of the subsequent STOP should be entered in columns 61 to 70. |

| Title | Column(s) | Instructions |
|---|---|---|
| STOP | 71 to 80 | In case the flight does not terminate with the STOP, the particulars of which are shown in columns 61 to 70, the particulars of the subsequent STOP should be entered in columns 71 to 80 |

In case the flight does not terminate with the last STOP on the first line, particulars of subsequent stops should be entered on the second line in the following manner (see Annex 2/1, Example 3) :

- the information contained in columns 2 to 16 (inclusive) of the first line should be repeated in the same columns of the second line;

- the digit 2 should be entered in column 17 of the second line;

- the remainder of the flight information should be entered on the second line, commencing with column 31.

In case the number of intermediate stops is ten or more, the remainder of the flight information should be entered on the third line in the following manner :

- the information contained in columns 2 to 16 (inclusive) of the second line should be repeated in the same columns of the third line;

- the digit 3 should be entered in column 17 of the third line;

- the remainder of the flight information should be entered on the third line, commencing with column 31.

# A N N E X 2/3

## MWARA CONVERSION TABLE

| MWARA | CODE |
|---|---|
| EU | 1 |
| EU Ext | 2 |
| NA | 3 |
| NA Ext | 4 |
| SA | 5 |
| NSAM-1 | 6 |
| NSAM-2 | 7 |
| NP | 8 |
| CEP | 9 |
| CWP | 0 |
| SP | A |
| FE-1 | B |
| FE-2 | C |
| ME | D |
| ME Ext | E |
| NSA-1 | F |
| NSA-2 | G |

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# AIRCRAFT OPERATION STATISTICS
## REGIONAL AND DOMESTIC AIR ROUTE AREAS
## NOTIFICATION FORM

| | SURVEY Nº | COUNTRY | SERIAL Nº | FLIGHT IDENTIFICATION | TYPE OF FLIGHT | AIRCRAFT SPEED | LINE CODE | ORIGIN | | | | | | | | | | | STOP | | | | | STOP | | | | | STOP | | | | | STOP | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | AREA | RDARA | TIME OF DEPARTURE | DAYS OF FLIGHT | | | | | | | | AREA | RDARA | L | $L_{vhf}$ | TIME OF FLIGHT | AREA | RDARA | L | $L_{vhf}$ | TIME OF FLIGHT | AREA | RDARA | L | $L_{vhf}$ | TIME OF FLIGHT | AREA | RDARA | L | $L_{vhf}$ | TIME OF FLIGHT |
| | | | | | | | | | | | M | Tu | W | Th | F | Sa | Su | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 4 | 5 8 | 9 15 | 16 | 17 | 18 | 19 22 | 23 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 36 | 37 38 | 39 41 | 42 43 | 44 | 45 48 | 49 50 | 51 53 | 54 55 | 56 | 57 60 | 61 62 | 63 65 | 66 67 | 68 | 69 72 | 73 74 | 75 77 | 78 79 | 80 |
| EXAMPLE 1 | | J | 18 | JL014 | 1 | 1 | 1 | 5 0 0 | 3 9 | J | | | | + | | | | 3 8 3 | 3 9 | 1 2 0 | 3 5 | J | | | | | | | | | | | | | | | |
| EXAMPLE 2 | | PAK | 7 | PK600 | 1 | 1 | 1 | 5 5 0 | 3 8 | J | + | + | + | - | + | + | + | 4 4 1 | 3 8 | 6 0 | | J | 4 4 0 | 3 8 | 4 0 | | J | 4 4 0 | 3 8 | 4 0 | | J | | | | | |
| EXAMPLE 3 | | URS | 113 | SU472 | 1 | 1 | 1 | 2 3 3 | 2 5 | J | + | + | + | + | + | + | + | 2 3 4 | 2 9 | 3 0 | 3 9 | J | 2 1 9 | 2 8 | 2 0 | | J | 3 2 4 | 2 8 | 6 0 | | J | 3 2 4 | 2 9 | 1 2 | | J |
| | | URS | 113 | SU472 | 1 | 1 | 2 | | | | | | | | | | | 3 2 5 | 2 8 | 2 5 | | J | | | | | | | | | | | | | | | |

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# A N N E X 3/2

## AIRCRAFT OPERATION STATISTICS

## REGIONAL AND DOMESTIC AIR ROUTE AREAS

### Instructions for completing the Notification Form

1. General Remarks

1.1 In view of the great volume of data which will have to be processed and, possibly, the short time which may be available for such processing, the I.F.R.B. has endeavoured to devise a form which would enable the information to be punched directly on to 80 column cards without any intermediate processing by the I.F.R.B. It is, therefore, very important that extreme care be exercised to avoid the entering of information in a faulty or inaccurate way.

1.2 The form is divided into 80 columns to correspond with the 80 column card to be used by the I.F.R.B. for data input to its Electronic Data Processing System. The columns are numbered from 1 to 80 and guide lines are provided for correct inclusion of the information to be furnished.

1.3 The form for notifying the aircraft operation in Regional and Domestic Air Route Areas (see Annex 3/1) can be broadly divided into three sections from the standpoint of the information to be provided :

- the first section, columns 1 to 17, is meant for inclusion of the information of a general and administrative nature;
- the second section, columns 19 to 32, is provided for the details concerning the point of origin of the flight;
- the third section, columns 33 to 80, seeks the information regarding any intermediate and final stops.

2. Explanation of the titles and subtitles used in the Notification Form

2.1 COUNTRY - This place on the form is provided for the country symbol of the country submitting the Notification Form to the I.F.R.B. A copy of the table of country symbols from the Preface to the International Frequency List, is given in Annex 4.

2.2 SERIAL No. indicates the sequential number of all flights pertaining to one country.

2.3 FLIGHT IDENTIFICATION for airline flights, consists of the airline abbreviations followed by the trip number. In all other cases, the notifying country may give an appropriate national identifying symbol.

2.4 TYPE OF FLIGHT - Flights are grouped into two categories :

- scheduled flights;
- non-scheduled flights (including military transports flying along national or international civil air routes).

2.5 AIRCRAFT SPEED - Aircraft have been grouped into three categories :

- speeds less than 350 knots;
- speeds from 350 knots to 500 knots;
- speeds greater than 500 knots.

2.6 LINE CODE - This column is provided for entering the number of line or lines on the form which contain information concerning one flight.

2.7 AREA refers to one of the 1818 numbered subdivisions shown on the World Map in Annex 1.

2.8 RDARA is the abbreviation for Regional and Domestic Air Route Area, as defined in Appendix 26 to the Radio Regulations, Geneva 1959, and shown on Map II accompanying this Appendix.

2.9 TIME OF FLIGHT indicates whether the flight takes place predominantly during the day hours or during the night hours.

2.10 DAYS OF FLIGHT (G.M.T.) indicate day or days of the week during which flights, having the same flight identification, originate.

2.11 L indicates the distance per stage of flight, in tens of kilometers.

2.12 $L_{vhf}$ indicates for each stage the distance covered by VHF communications, in tens of kilometers.

3. Detailed instructions concerning information to be entered in the specific columns of the form

<table>
<tr><th>Title</th><th>Column(s)</th><th>Instructions</th></tr>
<tr><td>SURVEY No.</td><td>1</td><td>This column is for use by the I.F.R.B. and should be left blank.</td></tr>
<tr><td>COUNTRY</td><td>2 to 4</td><td>The country symbol (see Annex 4) of the notifying country, should be entered here in consecutive columns, commencing with column 2. Any column not required should be left blank.<br><br>Example : The country symbols of, for instance, Afghanistan, France and Sweden should be written as follows :<br><br>
<table>
<tr><th colspan="3">COUNTRY</th></tr>
<tr><td>2</td><td>3</td><td>4</td></tr>
<tr><td>A</td><td>F</td><td>G</td></tr>
<tr><td>F</td><td></td><td></td></tr>
<tr><td>S</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>SERIAL No.</td><td>5 to 8</td><td>The serial number of each flight should be entered in these columns. (If more than one aircraft is covered by the same flight serial number, indicate each aircraft on a separate line). Any columns not required should be left blank.<br><br>Example :
<table>
<tr><th colspan="4">SERIAL No.</th><th></th></tr>
<tr><td>5</td><td>6</td><td>7</td><td>8</td><td></td></tr>
<tr><td></td><td></td><td></td><td>8</td><td>= Serial No. 8</td></tr>
<tr><td></td><td></td><td>1</td><td>6</td><td>= Serial No. 16</td></tr>
<tr><td></td><td>3</td><td>1</td><td>5</td><td>= Serial No. 315</td></tr>
</table></td></tr>
<tr><td>FLIGHT IDENTIFICATION</td><td>9 to 15</td><td>The information should be entered in consecutive columns commencing with column 9. Any columns not required should be left blank.</td></tr>
</table>

| Title | Column(s) | Instructions |
|---|---|---|
| FLIGHT IDENTIFICATION (Cont.) | | Example : FLIGHT IDENTIFICATION<br>9 10 11 12 13 14 15<br>Q F 5 8 7<br>R K 3 0 0 0<br>A F 1 8 9 |
| TYPE OF FLIGHT | 16 | In case of a scheduled flight, the digit 1 should be entered here.<br>For all other types of flight (including military), the digit 2 should be entered here. |
| AIRCRAFT SPEED | 17 | The digits 1, 2 or 3 should be entered here according to the aircraft speed category :<br>1 - for speeds less than 350 knots<br>2 - for speeds from 350 knots to 500 knots<br>3 - for speeds greater than 500 knots. |
| LINE CODE | 18 | The digit 1 should be entered here. |
| ORIGIN | 19 to 32 | The information relevant to the origin of the flight should be entered in columns 19 to 32 as explained below. |
| AREA | 19 to 22 | The number of the area, in accordance with the world map in Annex 1, containing the airport from which the flight departs should be entered in columns 19 to 22. Any columns not required should be left blank.<br>Example : The "area" for the flights originating, for instance, from London, Karachi and Capetown airports would be written as follows :<br>AREA<br>19 20 21 22<br>2 3 0 London Airport<br>5 5 0 Karachi Airport<br>1 4 2 2 Capetown Airport |

| Title | Column(s) | Instructions |
|---|---|---|
| RDARA | 23, 24 | The code for RDARA (see Annex 3/3)in which flight originates should be entered here. As an example, a flight originating in RDARA 6A would be shown by the number 38 in columns 23, 24. |
| TIME OF DEPARTURE | 25 | 1) In case the flight originates during day hours (0600 - 1800 hours, Local Time), the letter J should be entered here.<br>2) In case the flight originates during night hours (1800 - 0600 hours, Local Time) the letter N should be entered here. |
| DAYS OF FLIGHT | 26 to 32 | The day(s) (GMT) of the week on which the flight originates should be indicated here with a + sign.<br>Example : |

| | ORIGIN | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AREA | | | | RDARA | | Time of flight | DAYS OF FLIGHT | | | | | | |
| | | | | | | | | M | Tu | W | Th | F | Sa | Su |
| | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| (a) | | 2 | 3 | 0 | 2 | 2 | J | + | + | + | + | + | + | + |
| (b) | | 5 | 5 | 0 | 3 | 8 | N | + | | | | | | + |
| (c) | 1 | 4 | 2 | 2 | 4 | 8 | N | | + | | | | | |

The entry identified by (a) means that the flight originates during day hours in area 230, situated in RDARA 1B, and is scheduled seven days a week.

The entry identified by (b) means that the flight originates during night hours in area 550 situated in RDARA 6A, and is scheduled each Monday and Sunday.

The entry identified by (c) means that the flight originates during night hours in area 1422, situated in RDARA 7E, and is scheduled each Tuesday.

| Title | Column(s) | Instructions |
|---|---|---|
| STOP | 33 to 44 | These columns are meant to contain the flight particulars of an intermediate stop or of the final stop. |
| AREA | 33 to 36 | The area of the intermediate stop of the final stop should be entered here in a similar manner as explained for columns 19 to 22. |
| RDARA | 37, 38 | The code of the Regional and Domestic Sub-Area (see Annex 3/3) in which the stop takes place should be entered here. |
| L | 39 to 41 | The distance covered per stage, rounded to the nearest 10 km should be entered here.<br>Example : A distance of 1045 km will be shown as :<br>L<br>39 \| 40 \| 41<br>1 \| 0 \| 4 |
| $L_{vhf}$ | 42, 43 | That part of the distance per stage, covered by VHF communication should be indicated here rounded to the nearest 10 km.<br>Example : A distance of 165 km will be shown as :<br>$L_{vhf}$<br>42 \| 43<br>1 \| 6 |
| TIME OF FLIGHT | 44 | 1) In case the flight between the two points of a stage takes place predominantly during day hours, the letter J should be entered here.<br>2) In case the flight between the two points of a stage takes place predominantly during night hours, the letter N should be entered here. |

| Title | Column(s) | Instructions |
|---|---|---|
| STOP | 45 to 56 | In case the flight does not terminate with the STOP, the particulars of which are shown in columns 33 to 44, the particulars of the subsequent STOP should be entered in columns 45 to 56 in the same manner as for the preceding STOP (see Annex 3/1, Example 2). |
| STOP | 57 to 68 | In case the flight does not terminate with the STOP, the particulars of which are shown in columns 45 to 56, the particulars of the subsequent STOP should be entered in columns 57 to 68. |
| STOP | 69 to 80 | In case the flight does not terminate with the STOP, the particulars of which are shown in columns 57 to 68, the particulars of the subsequent STOP should be entered in columns 69 to 80. |

In case the flight does not terminate with the last STOP on the first line, particulars of subsequent stops should be entered on the second line in the following manner (see Annex 3/1, Example 3) :

- the information contained in columns 2 to 17 (inclusive) of the first line should be repeated in the same columns of the second line;
- the digit 2 should be entered in column 18 of the second line;
- the remainder of the flight information should be entered on the second line, commencing with column 33.

In case the number of intermediate stops is eight or more, the remainder of the flight information should be entered on the third line in the following manner :

- the information contained in columns 2 to 17 (inclusive) of the second line should be repeated in the same columns of the third line;
- the digit 3 should be entered in column 18 of the third line;
- the remainder of the flight information should be entered on the third line, commencing with column 33.

# A N N E X 3/3

## RDARA CONVERSION TABLE

| RDARA | CODE |
|---|---|
| 1 | 01 |
| 2 | 02 |
| 3 | 03 |
| 4 | 04 |
| 5 | 05 |
| 6 | 06 |
| 7 | 07 |
| 8 | 08 |
| 9 | 09 |
| 10 | 10 |
| 11 | 11 |
| 12 | 12 |
| 13 | 13 |

| SUBRDARA | CODE |
|---|---|
| 1A | 21 |
| 1B | 22 |
| 1C | 23 |
| 1D | 24 |
| 1E | 25 |
| 2A | 26 |
| 2B | 27 |
| 2C | 28 |
| 3A | 29 |
| 3B | 30 |
| 3C | 31 |
| 4A | 32 |
| 4B | 33 |
| 5A | 34 |
| 5B | 35 |
| 5C | 36 |
| 5D | 37 |
| 6A | 38 |
| 6B | 39 |
| 6C | 40 |
| 6D | 41 |
| 6E | 42 |
| 6F | 43 |
| 7A | 44 |
| 7B | 45 |
| 7C | 46 |
| 7D | 47 |
| 7E | 48 |
| 8A | 49 |
| 9A | 50 |
| 9B | 51 |
| 9C | 52 |
| 9D | 53 |
| 9E | 54 |

| SUBRDARA | CODE |
|---|---|
| 10A | 55 |
| 10B | 56 |
| 10C | 57 |
| 10D | 58 |
| 10E | 59 |
| 11A | 60 |
| 11B | 61 |
| 11C | 62 |
| 11D | 63 |
| 11E | 64 |
| 11F | 65 |
| 11G | 66 |
| 11H | 67 |
| 11I | 68 |
| 12A | 69 |
| 12B | 70 |
| 12C | 71 |
| 12D | 72 |
| 12E | 73 |
| 12F | 74 |
| 12G | 75 |
| 12H | 76 |
| 12I | 77 |
| 12J | 78 |
| 13A | 79 |
| 13B | 80 |
| 13C | 81 |
| 13D | 82 |
| 13E | 83 |
| 13F | 84 |
| 13G | 85 |
| 13H | 86 |
| 13I | 87 |
| 13J | 88 |
| 13K | 89 |
| 13L | 90 |
| 13M | 91 |

# A N N E X 4

## COUNTRY SYMBOLS

N.B. : The following symbols have a geographical significance only

| Symbol | Name of the country | Symbol | Name of the country |
|---|---|---|---|
| ADN | Aden | BOL | Bolivia |
| AFG | Afghanistan | BRM | Union of Burma |
| AFS | Republic of South Africa and Territory of South-West Africa | BRN | North Borneo |
| | | BRU | Brunei |
| AGL | Angola | BUL | People's Republic of Bulgaria |
| ALB | People's Republic of Albania | | |
| ALS | State of Alaska, United States of America | CAF | Central African Republic |
| | | CAN | Canada |
| ALG | Algeria | CAR | Caroline Islands |
| AMS | New Amsterdam Island | CBG | Cambodia |
| AND | Andorra | CGO | Republic of the Congo (Leopoldville) |
| AMF | French Territories in the Antarctic | CHL | Chile (except Easter Island) |
| | | CHN | China |
| AOE | Spanish Province in West Africa | CHR | Christmas Island (Indian Ocean) |
| ARG | Argentine Republic | CKH | Cook Islands |
| ARS | Saudi Arabia | CKN | Cook Islands (Northern Group) |
| ASC | Ascension | | |
| ATN | Netherlands Antilles | CLM | Republic of Colombia |
| AUS | Commonwealth of Australia | CLN | Ceylon |
| AUT | Austria | CME | Federal Republic of the Cameroon |
| AZR | Azores | CNR | Canaries |
| | | COG | Republic of the Congo(Brazzaville) |
| | | COM | Comores |
| B | Brazil | CPV | Cape Verde Islands |
| BAH | Bahamas | CTI | Republic of the Ivory Coast |
| BAS | Basutoland | CTR | Costa Rica |
| BCH | Bechuanaland | CUB | Cuba |
| BEL | Belgium | CVA | Vatican City State |
| BER | Bermuda | CYP | Republic of Cyprus |
| BDI | Kingdom of Burundi | D | Germany |
| BLR | Bielorussian Soviet Socialist Republic | DAH | Republic of Dahomey |

| Symbol | Name of the country | Symbol | Name of the country |
|---|---|---|---|
| DNK | Denmark | GUI | Republic of Guinea |
| DOM | Dominican Republic | GUM | Guam |
| E | Spain | HKG | Hongkong |
| EGY | United Arab Republic | HNB | British Honduras |
| EQA | Ecuador | HND | Republic of Honduras |
| ETH | Ethiopia | HNG | Hungarian People's Republic |
| | | HOL | Netherlands |
| F | France | HTI | Republic of Haiti |
| FJI | Fiji Islands | HVO | Republic of Upper Volta |
| FLK | Falkland Islands & Dependencies | HWA | State of Hawaii, United States of America |
| FNL | Finland | HWL | Howland Island |
| G | United Kingdom of Great Britain and Northern Ireland | I | Italy |
| | | ICO | Cocos Keeling Islands |
| GAB | Gabon Republic | IND | India |
| GCA | Territories & Colonies of the United Kingdom in Region 1 | INP | Portuguese India |
| | | INS | Republic of Indonesia |
| GCB | Territories & Colonies of the United Kingdom in Region 2 | IOB | British West Indies |
| GCC | Territories & Colonies of the United Kingdom in Region 3 | IRL | Ireland |
| | | IRN | Iran |
| GDL | French Department of Guadeloupe | IRQ | Iraq |
| GHA | Ghana | ISL | Iceland |
| GIB | Gibraltar | ISR | State of Israel |
| GIL | Gilbert & Ellice Islands Colony | IWA | Iwo-Jima |
| GLP | Persian Gulf | | |
| GMB | Gambia (Bathurst) | J | Japan |
| GNE | Spanish Province in the Gulf of Guinea | JAR | Jarvis Island |
| | | JMC | Jamaica |
| GNP | Portuguese Guinea | JON | Johnston Island |
| GRC | Greece | JOR | Jordan |
| GRL | Greenland | | |
| GTM | Guatemala | KEN | Kenya |
| GUB | British Guiana | KER | Kerguelen Islands |
| GUF | French Department of Guiana | KOR | Republic of Korea |

| Symbol | Name of the country | Symbol | Nmae of the country |
|---|---|---|---|
| KRE | People's Democratic Republic of Korea | NOR | Norway |
| KWT | Kuwait | NPL | Nepal |
| LAO | Laos | NYA | Nyasaland |
| LBN | Lebanon | NZL | New Zealand |
| LBR | Liberia | OCE | French Polynesia |
| LBY | Libya | ONC | Stations of the "United Nations Military Observer Group in India and Pakistan" |
| LUX | Luxembourg | | |
| MAC | Macao | PAK | Pakistan |
| MAU | Mauritius | PAP | Territories of Papua |
| MCO | Monaco | PAQ | Chile (Easter Island) |
| MCS | Marcus Island | PHL | Republic of the Philippines |
| MDG | Malagasy Republic | PHX | Phoenix Islands |
| MDR | Madeira | PLM | Palmyra Island |
| MDW | Midway Islands | PNR | Republic of Panama |
| MEX | Mexico | PNZ | Panama Canal Zone |
| MLA | Malaysia | POL | People's Republic of Poland |
| MLD | Maldive Islands | POR | Portugal |
| MLI | Republic of Mali | PRG | Paraguay |
| MLT | Malta | PRU | Peru |
| MNG | Mongolian People's Republic | PTC | Pitcairn Island |
| MOZ | Mozambique | PTR | Puerto Rico |
| MRA | Mariana Islands | REU | French Department of Reunion |
| MRC | Kingdom of Morocco | RHN | Northern Rhodesia |
| MRL | Marshall Islands | RHS | Southern Rhodesia |
| MRN | Marion Island | ROD | Rodrigues |
| MRT | French Department of Martinique | ROU | Roumanian People's Republic |
| MTN | Islamic Republic of Mauritania | RRW | Republic of Rwanda |
| NCG | Nicaragua | RYU | Ryu-Kyu Islands |
| NCL | New Caledonia & Dependencies | S | Sweden |
| NGR | Republic of the Niger | SDN | Republic of Sudan |
| NGU | Territory of New Guinea | SEN | Republic of the Senegal |
| NHB | New Hebrides (British-French Condominium) | | |
| NIG | Federation of Nigeria | | |

| Symbol | Name of the country | Symbol | Name of the country |
|---|---|---|---|
| SEY | Seychelles | TKL | Tokelau islands |
| SHN | S. Helena | TMP | Portuguese Timor |
| SLM | Solomon Islands | TON | Tonga |
| SLV | Republic of El Salvador | TRC | Tristan da Cunha (Station of the Republic of South Africa) |
| SMA | American Samoa | TRD | Trinidad and Tobago |
| SMF | French Somaliland | TUN | Tunisia |
| SMO | Western Samoa | TUR | Turkey |
| SMR | Republic of San Marino | | |
| SNG | Singapore | UGA | Uganda |
| SOM | Somali Republic | UKR | Ukrainian Soviet Socialist Republic |
| SPM | S. Pierre and Miquelon | URG | Uruguay |
| SRL | Sierra Leone | URS | Union of Soviet Socialist Republics |
| SRW | Sarawak | USA | The 48 contiguous States of the United States of America (excludes the States of Alaska and Hawaii) |
| STP | S.Thome and Principe | | |
| SUI | Switzerland | | |
| SUR | Surinam | | |
| SWN | Swan Island | VEN | Venezuela |
| SYR | Syrian Arab Republic | VIR | Virgin Islands |
| | | VTN | Republic of Viet-Nam |
| TCD | Republic of the Chad | WAK | Wake Island |
| TCH | Czechoslovak Socialist Republic | | |
| TGK | Tanganyika | YEM | Yemen |
| TGO | Togolese Republic | YUG | Yugoslavia |
| THA | Thailand | ZAN | Zanzibar |

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Addendum to
Document No.I-11-E
5 February 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

Republic of India

PROPOSAL No.10

Concerning adjustment of RDARA boundaries 6A and 6E
(Reference Document No.I-11, Proposals 3 and 6)

Introduction

In the original proposals of the Administration of India as set out in Document No.I-11, it was stated that the present demarcation of RDARA boundary between 6A and 6E should be retained. It had also been stated that sufficient number of common frequencies might be made available to RDARA sub-regions 6A and 6E. However, on further consideration of the matter it is now felt that the RDARA's 6A and 6E are merged as such a step leads to advantages such as avoiding changing of frequencies in aircraft flying on domestic routes.

Proposal

The RDARA's 6A and 6E should be merged and that this merged RDARA should be considered for submitting the RDARA statistics.

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E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Republic of India

# PROPOSAL FOR THE REVISION OF THE HF ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE

1. Concepts of MWARAs and RDARAs

Proposal: The existing MWARA and RDARA concepts underlying the current HF Allotment Plan should continue to be used as the geographical basis for the revised plan.

Reasons: Frequency assignments based on the MWARAs and RDARAs established in the current HF Allotment Plan which was employed in 1949 have proved to be satisfactory since then. Nothing has occurred in practice to suggest a need for basing the plan on new concepts.

2. Changes in the boundary of MWARA ME region

Proposal: The following readjustment of MWARA ME boundary based on existing and foreseeable international air routes is proposed: The eastern boundary of MWARA ME may be moved to the west to exclude Calcutta, Colombo and Madras.

Reasons: The above readjustment of MWARA boundary is based on the existing air route patterns and future foreseeable air route operation requirements.

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3. Changes in RDARA boundary

Proposal: The present demarcation of RDARA boundary between 6A and 6E should be retained.

Reasons: India considers the present demarcation of the boundary between 6A and 6E as satisfactory. But India would not be opposed to changes in the boundary by mutual agreement between the administrations concerned.

4. Channel width principles

Proposal: In any revision of the criteria for modifying the HF Allotment Plan, channel width should continue to be adequate to accommodate amplitude modulated double side band telephony emissions (6A3). Other forms of modulation may be agreed upon internationally provided they are compatible with amplitude modulated double side band radio telephony emissions.

Reasons: It is felt that due to economic considerations, amplitude modulated DSB radiotelephony will continue to be used in India for many years to come.

5. Reduction of channel spacing to derive more channels from the existing Aeronautical Mobile (R) bands

Proposal: Closer channel spacing may be agreed to in order to increase the number of assignable frequencies in the Aeronautical Mobile (R) bands. This is possible by the use of tighter frequency tolerances and by the use of compatible SSB/DSB operation.

Reasons: This is necessary because the number of frequencies available in the Aeronautical Mobile (R) band is limited and there is a requirement for additional channels.

Note : In order to prevent enormous expenditure to states for replacing their existing ground and airborne radio equipment by more sophisticated ones, it is proposed that closer channel spacing should, to start with, be applied to frequencies above 10 Mc/s. This will provide 6 additional channels as shown below:

| Band k/cs | Present Channel width | Proposed channel width | No. of Channels available at present | Proposed number of channels | Increase in the number of channels |
|---|---|---|---|---|---|
| 10005 - 10100 | 9 | 8.5 | 10 | 11 | 1 |
| 11275 - 11400 | 9.5 | 8 | 13 | 15 | 2 |
| 13260 - 13360 | 10 | 8 | 10 | 12 | 2 |
| 17900 - 17970 | 10 | 8.5 | 7 | 8 | 1 |

6. Frequencies for RDARA sub-regions 6A and 6E

Proposal: Sufficient number of common frequencies may be made available to RDARA sub-regions 6A and 6E.

Reasons: To avoid frequency changing in aircraft on domestic routes in India while operating from one sub-region to another.

7. IAARC formula for calculating the number of frequencies or families of frequencies for any operational area

Proposal: The formula previously adopted by I.T.U. IAARC for determining the number of frequencies (or families of frequencies) required to handle a given volume of communications should be amended by using the aircraft speed figure of 500 for routes served predominantly by jet aircraft.

Reasons: It is unrealistic to employ an aircraft speed of 200 MPH these days. It is reasonable to employ the aircraft speed of 500 where routes are flown predominantly by jet aircraft.

8. Frequencies for Meteorological Broadcasts

Proposal: The Conference should make available two channels each in bands 3, 6 and 11 Mc/s for meteorological broadcasts for the South East Asian and ME-MET areas.

Reasons: The presently available channels in the MWARA SEA and ME regions are not adequate to meet the demands of meteorological broadcasts.

9. Continued use of 3023.5 kc/s and 5680 kc/s

Proposal: The provisions governing the use of 3023.5 kc/s and 5680 kc/s as detailed in Appendix 26 of RR, should be retained.

Reasons: There is still a requirement for these frequencies for domestic operations. The VHF radio equipment for Terminal Area Communications both on the ground and in aircraft has to be duplicated before the use of 3023.5 kc/s and 5680 kc/s as supplementary channels can be discontinued.

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PLENARY MEETING

International Frequency Registration Board

# REPORT ON STUDIES RELATING TO CHANNEL CAPACITIES IN A REVISED HIGH FREQUENCY ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE R SERVICE

1. The International Frequency Registration Board in its report on studies relating to Aircraft Operation Statistics (see Document No. I-10), has prepared two forms which might be used for notifying the relevant information on aircraft operating on Major World Air Routes and Regional and Domestic Air Routes.

2. Following the recommendations of the I.C.A.O. Special Communications Meeting (Montreal 1963), these two forms are based on the principle that the statistics should be provided by the Administration on operating conditions of one week's duration for a period to be chosen by the first session of the Aeronautical E.A.R.C.

3. The I.C.A.O. meeting recommended that within MWARA's, for the assessment of channel capacities, the following formula and factors could be taken into account :

3.1 The expected peak number (N) of aircraft that would require communication in any one hour might be given by the following formula :

$$N = \frac{K(L - L_{vhf})}{7 \times 24} \left( \frac{Fs}{Vs} + \frac{Fns}{Vns} \right)$$

where :

K = concentration factor

L = total route length in km.

$L_{vhf}$ = route length covered by VHF in km.

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Vs = aircraft speed of scheduled flights in km per hour

Vns = aircraft speed of unscheduled flights in km per hour

Fs = number of scheduled flights per week

Fns = number of non-scheduled flights per week

3.2 The concentration factor K, derived from dividing the peak number of aircraft in any hour by the average number of aircraft per hour, might be taken to be 2.4.

3.3 The maximum number of aircraft which could be served in one hour by a family of frequencies might be taken to be 12.

3.4 The maximum number of aircraft which could be served in one hour by a single frequency might be taken to be 10.

4. The I.C.A.O. meeting recognized that the value 2.4 for the concentration factor K had been established on the basis of studies relating only to the flight operations over the North Atlantic, and recommended that additional studies be conducted on the value of concentration factor(s) for other parts of the world (Recommendation 8/1). The figures concerning the relationship between the numbers of aircraft and a family of frequencies or a single frequency should be also studied. (Recommendation 8/5).

5. The I.C.A.O. meeting examined the possible application of the formula and concentration factor proposed for Major World Air Routes to Regional and Domestic Air Routes. Taking into account :

a) the extremely high preponderance of non-scheduled flights;

b) the large number of inter-connected routes within small areas;

c) the existence of network operation organization, procedures and types of message which differ from those encountered in international operations;

the meeting concluded that the strict application to RDARA's of the formula and concentration factor may not be feasible (Recommendation 8/6). Also doubts were expressed with regard to the validity of the figures of 10 and 12 as the maximum number of aircraft in one hour which could be accommodated on a single RDARA frequency, or family of frequencies, respectively (Recommendation 8/5).

6. It is clearly of great importance, in the interest of expeditious disposal of message traffic, that the occupancy of a channel, even during peak traffic hours, should not be too high, since an effective occupancy of more than about 50% is liable to give rise to appreciable delay in the clearance of messages which may be of an urgent character. (In this

connection I.C.A.O. recommends that the maximum occupancy of a single channel AFTN circuit should not exceed 40% in the average peak hour in the peak season of the year). The number of aircraft which can be served within a given occupancy depends, of course, on the length of each message and the time taken to establish contact with the respective aircraft.

7. It must be recalled, however, that the I.A.A.R.C., Geneva, 1948/1949, had to reduce the numbers of families of frequencies for most areas (calculated by a formula substantially the same as that given in paragraph 3.1 above but uncorrected for VHF coverage) in order to keep the total number of frequencies within the total number of available channels; and the increased volume of air traffic now prevailing in most areas, as compared with that in 1948/1949, may give rise to similar difficulties in finding a sufficient number of frequencies even allowing for increased aircraft speeds and improved VHF coverage. It is possible, therefore, that in some areas, some overloading of the channels during peak hours may have to be tolerated.

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PLENARY MEETING

International Freqnebcy Registration Board

# REPORT ON STUDIES OF TECHNICAL PRINCIPLES WHICH MIGHT BE USED IN THE ESTABLISHMENT OF A REVISED HIGH FREQUENCY ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE R SERVICE

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1. The International Administrative Aeronautical Radio Conference (I.A.A.R.C.), Geneva, 1948/49, established a number of technical principles and standards which were used in the development of the present high frequency Allotment Plan for the Aeronautical Mobile R Service. These technical principles and standards were approved by the Extraordinary Administrative Radio Conference (Geneva, 1951), when formulating regulatory provisions for the implementation of the Plan. It would seem therefore that, in considering a revision of the Plan, a review should be made of these technical principles and standards with a view to assessing their continued applicability, or otherwise, in the light of the practical experience gained in the operation of the present Plan, technical developments in respect of equipment characteristics, and the latest available propagation data.

2. Radiated powers

2.1 The I.A.A.C. decided that the Allotment Plan should be based on the following radiated powers :

a) Al emissions :

| | |
|---|---|
| Ground station | 1.0 kilowatt radiated (peak) |
| Aircraft | 50 watts radiated (peak) |

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b) A3 emissions

| | |
|---|---|
| Ground station | 4.0 kilowatts radiated (peak) (100% modulated) |
| Aircraft | 200 watts radiated (peak) (100% modulated) |

2.2 It will be for the first session of the Extraordinary Administrative Aeronautical Radio Conference to consider whether the foregoing powers should be maintained or whether, for example, with developments in miniaturization and transistorization which have taken place in recent years, some increase in the powers might now be permissible, particularly in respect of aircraft stations.

2.3 The I.F.R.B. is of the opinion that, in framing the technical principles to be applied in a revision of the present Allotment Plan for the Aeronautical Mobile R Service, it would be preferable to discontinue the designation of the power of aeronautical and aircraft stations in terms of "radiated power". Under the provisions of Article 9 of, and Appendix 1 to, the Radio Regulations the power of land stations (including aeronautical stations) in the high frequency bands should be expressed as the power supplied to the antenna transmission line, notified, according to the class of emission, as follows :

a) Carrier power ($P_c$) for A3 sound broadcasting (see RR No. 97);

b) Mean power ($P_m$) for other amplitude modulated emissions using unkeyed full carrier, and for all frequency modulated emissions (see RR No. 96);

c) Peak envelope power ($P_p$) for all classes of emission other than those referred to in a) or b), including A5 television (vision) (see RR No. 95).

2.4 If therefore the designation of power in notices of assignments to aeronautical stations, in the high frequency bands, is brought into line with the present provisions of the Radio Regulations:

1) the power of A1 emissions should be expressed in terms of peak power supplied to the antenna transmission line;

2) the power of A3 emissions should be expressed in terms of the mean power supplied to the antenna transmission line;

3) the power of other classes of emission (such as A2, A3A, A7J, etc.,) should be notified in terms of the peak power supplied to the antenna transmission line

2.5 Based on the foregoing concepts, the power of Aeronautical stations in the revised Allotment Plan might be expressed, for example, as follows:

| | | |
|---|---|---|
| a) | A1 emissions | 1 kilowatt peak |
| b) | A3 and A3H emissions | 1.5 kilowatt mean (100% modulated) (corresponding to 4 kilowatts peak power) |
| c) | Other authorized emissions (A2, A3A, A7J, etc.) | 4 kilowatts peak (100% modulated) |

The corresponding figures for aircraft stations would be :

| | | |
|---|---|---|
| a) | A1 emissions | 50 watts peak |
| b) | A3 and A3H emissions | 75 watts mean (100% modulated) (corresponding to 200 watts peak power) |
| c) | Other authorized emissions (A2, A3A, A7J, etc.) | 200 watts peak (100% modulated) |

2.6 It might be argued that, if the foregoing values were to be prescribed as maximum permissible powers, the power of some existing equipments would have to be reduced because there is a loss in the antenna system and the power actually supplied to the antenna transmission line by these equipments is therefore greater than the values mentioned in paragraph 2.5, in order to obtain the "radiated" powers specified in the present Allotment Plan. The radiation efficiency of the antenna depends to a degree, of course, on the operating frequency in relation to the physical dimensions of the antenna but, for a typical aeronautical station, may have an average value of the order of 66%. If therefore, allowance is to be made for the loss in the antenna system, the permissible powers supplied to the antenna transmission line should perhaps be increased by, say, 50% as compared with those mentioned in the preceding paragraph.

2.7 The adoption of values of power such as those suggested in the two preceding paragraphs would not involve any substantial difference from those prescribed in the present Allotment Plan, and the effect on existing sharing patterns would be negligible. But the expression of the power in the terms prescribed in Appendix 1 to the Radio Regulations would not only bring the designation of the transmitter power of aeronautical and aircraft stations into line with that used, in the high frequency bands, for similar emissions from transmitters of other classes of service, but would avoid the need, which has occurred in many instances in the past, of converting "transmitter output power" notified by some Administrations in respect of aeronautical stations, into "radiated power" by applying a somewhat arbitrary factor for the radiation efficiency of the antenna in the various frequency bands.

2.8 Since the eventual use of single sideband emissions is envisaged, consideration should perhaps be given by the Conference to the relative interference which might be caused by : a) single sideband (A3H, A5A, or A3J) emissions and b) double sideband (A3) emissions, all having the same peak envelope power. In the case of A3H (single sideband full carrier) emissions, there should be very little in interference potential as compared with A3 (double sideband) emissions. In the case of A3A (single-sideband, reduced carrier), or A3J (single-sideband, suppressed carrier) emissions the situation is somewhat different as the single-sideband, containing the intelligence to be transmitted, is radiated at a much higher level than in the case of A3 or A3H emissions. Against this the low level, or complete absence, of the carrier reduces considerably the possibility of interference with other transmissions, as compared with A3 emissions, from beat notes between the carrier frequencies when, due to tolerances, these are not on the same frequencies; and the mean power radiated with speech modulation is lower than in the case of A3 emissions. The I.F.R.B. therefore suggests that, on balance, the possible peak envelope power delivered to the antenna in the case of single-sideband emissions might be the same as the peak envelope power delivered to the antenna which is adopted for double sideband radiotelephone emissions.

3. Noise levels

3.1 The I.A.A.R.C. assumed that the level of local noise on an aircraft would be 5 $\mu$V/m and that, with future aircraft and proper servicing of existing aircraft, it would be possible for the noise level to be reduced below this value.

3.2 The I.F.R.B. has little data available on the noise level of modern aircraft but understands that the level of local noise, in flight, of a Convair 880 aircraft varies between about 3 μV/m and 7 μV/m, in a 6 kc/s bandwidth, in the various frequency ranges. If these values are typical of the noise levels on modern aircraft, the assumptions made by the I.A.A.R.C. would still appear to be valid.

3.3 In regard to atmospheric noise level, the I.A.A.R.C. used a series of charts for different noise grades (based on C.R.P.L. Report No. 462) and estimated the field strength necessary to provide a 15 db signal-to-noise ratio, for 90% of the time, for the reception of A3 by a receiver having a bandwidth of 6 kc/s.

3.4 More refined data on atmospheric noise levels in the various areas of the world is now available as a result of the studies of the C.C.I.R. (Report No. 65). On the basis of the noise grades given in the maps contained in this Report, the I.F.R.B. has established the minimum field strength required for a satisfactory operator-to-operator A3 radio-telephone circuit in any area. This minimum field strength varies from about 20 db to 35 db relative to 1 μV/m, by day, depending on the geographical location of the receiving point, and a minimum field strength between about 25 db and 50 db relative to 1 μV/m, by night, again depending on the geographical location of the receiving point. This later information would not appear to affect, significantly, the general principles on which the present Allotment Plan was based.

4. Antennae

4.1 The I.A.A.R.C. assumed an effective height of 1 metre for aircraft antennae and that the efficiency of the antennae of aeronautical stations would be sufficiently great that receiver noise would never be a controlling factor in limiting the maximum range.

4.2 The I.F.R.B. believes that no appreciable change has taken place with respect to the characteristics of antennae at the majority of aeronautical stations although the use of directive antennae and log-periodic antennae has become more widespread. In the case of aircraft, where different antennae technique are now being used, particularly for jet aircraft, the I.F.R.B. believes that the results obtained are not sufficiently different to warrant any change of the principles used by the I.A.A.R.C.

5. Required field strengths

5.1 The I.A.A.R.C. assumed a minimum required field strength of 20 μV/m for A3 emissions and 5 μV/m for A1 emissions. These values were chosen on the assumption that it would be possible to reduce the noise level on an aircraft below 5 μV/m. If the level of local noise on a modern aircraft is indeed of the order of 5 μV/m (see paragraph 3 above) these figures would not appear to require any material alteration.

## 6. Signal-to-interference protection ratios

6.1 The I.A.A.R.C. held the view that signal-interference protection ratios of 25 db for A3 emissions and 15 db for A1 emissions, respectively, were necessary to provide sound standards for aeronautical mobile communications. However, in order to increase the possibilities of repetition of frequencies in an Allotment Plan, these figures were reduced to 15 db. The question of the continued applicability of this protection ratio of 15 db was considered by the I C.A.O. Special Communications Meeting (1963) which found that it had proved acceptable in practice and that no change should therefore be proposed.

6.2 The I.F.R.B. believes that the First Session of the Extraordinary Administrative Aeronautical Radio Conference may wish to review this figure in the light of the following considerations:

1) the protection ratio 15 db is afforded under the most unfavourable circumstances, when the aircraft is at the limit of its service range. Consequently, under more typical conditions, the protection ratio is actually very much higher;

2) while a signal-interference protection ratio of 15 db is considered by the I.F.R.B. to be insufficient for public service telephone circuits (where due to poor landline extensions, the speech level may be low and received by inexperienced subscribers), a signal-interference protection ratio of 15 db is considered by the I.F.R.B. to be adequate on operator-to-operator calls in which the transmitter is fully modulated and fairly standard terminology is employed;

3) although complaints of difficulties have been received in respect of the actual operation of the present Allotment Plan, these complaints have generally been in the following categories :

   a) interference due to the operation of other classes of station in the Aeronautical Mobile R frequency bands;

   b) complaints due to the extended use of ground-air channels in certain areas for aeronautical fixed service traffic, thus delaying access to the channel frequency, by other stations in the same area, for air traffic control messages;

   c) interference, in another area of allotment, by the misuse of A1 meteorological channels for the ground-to-ground exchange of meteorological information;

d) complaints of interference due to certain sharing patterns in the present plan, such as the use of the same family of frequencies for meteorological broadcasts in the North Atlantic and Middle East areas;

e) complaints of delay in passing urgent communications due to too many stations sharing the same frequencies in the same area;

4) in no case has the I.F.R.B. been advised of interference caused by stations using frequencies which are not allotted to the area concerned even although the protection ratio to an aircraft, at the limit of its service range with respect to the area to which the frequency is allotted, has been less than 15 db.

6.3 The foregoing considerations tend to indicate, on balance, that the present protection ratio of 15 db for co-channel signal-to-interference may perhaps be too generous and that, in fact, assignments may be over-protected. In putting forward this view, the I.F.R.B. would not suggest that the present figure of 15 db should be changed unless additional sharing patterns are deemed to be necessary and these could be achieved with a slight sacrifice in the signal-to-interference protection ratio.

7. Adjacent channel interference

7.1 The I.A.A.R.C., in establishing the present Allotment Plan endeavoured to avoid, as far as possible, the Allotment of adjacent channels within the same areas, in the interests of avoiding the possibility of adjacent channel interference.

7.2 The I.F.R.B. believes that, in general, this principle is sound and should continue to be followed whenever practicable. However, modern aircraft receivers equipped with sharp cut-off intermediate-frequency filters are believed to introduce an attenuation of at least 20 db at $\pm$ 3.5 kc/s from the received frequency. It would seem therefore, that, if necessary, adjacent channels might be allotted within the same area provided that the use of the respective frequencies, within the area, were such as to avoid the possibility of an aircraft receiver, seeking to receive a weak signal on one of the frequencies, being "blocked" by a very strong signal from a local aeronautical station working on the other frequency.

AERONAUTICAL CONFERENCE

Document No. I-14-E
31 December, 1963
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E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

International Frequency Registration Board

# REPORT ON STUDIES RELATING TO PROPAGATION AND FREQUENCY-SHARING CRITERIA WHICH MIGHT BE USED IN THE ESTABLISHMENT OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE R SERVICE

## 1. Basic Propagation data and Interference Ranges

1.1 The International Administrative Aeronautical Radio Conference (I.A.A.R.C.) Geneva 1948/49, in establishing the present Allotment Plan for the Aeronautical Mobile R Service, based its studies of propagation and frequency-sharing on Circular 462 of the U.S. National Bureau of Standards (N.B.S.). The Conference devoted a great deal of consideration to the service ranges which might be achieved in aircraft radiocommunications, and the interference ranges within which the use of the same frequencies in different areas of the world would not be permissible, having regard to propagational considerations in the various latitudes and the variations in the level of local atmospheric noise. Finally the Conference decided that, in the interests of establishing a simple plan for application in all latitudes and for all seasons of the solar cycle, propagation conditions relating to temperate latitudes during equinox conditions of medium sun-spot activity should be taken as the basis on which the frequency-sharing patterns in the Plan should be constructed. On this basis the Conference adopted the values of service ranges and interference ranges given in the following table; and the interference ranges, which were reproduced as contour charts, were taken to indicate the minimum acceptable distance separating two ground stations for producing, for the frequencies concerned, a protection ratio of 15 db of desired signal to interfering signal on the same frequency at an aircraft operating at the limit of the service range of the desired ground transmitter.

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Service and Interference ranges used in the establishment of the present Allotment Plan for the Aeronautical Mobile R Service

| Frequency band kc/s | Service range Day km | Service range Night km | Interference range Day km | Interference range Night km |
|---|---|---|---|---|
| 2850 - 3025 | 100 | 500 | 700 | 3500 |
| 3400 - 3500 | 100 | 800 | 700 | 4000 |
| 4650 - 4700 | 350 | 1400 | 1200 | 5500 |
| 5450 - 5480 | 450 | 1800 | 1500 | 6500 |
| 5480 - 5680 | 450 | 1800 | 1500 | 6500 |
| 6525 - 6685 | 650 | 2200 | 1900 | 8000 |
| 8815 - 8965 | 1000 | 3400 | 3800 | 11000 |
| 10005 - 10100 | 1250 | - | 5500 | - |
| 11275 - 11400 | 1500 | - | 6000 | - |
| 13260 - 13360 | 1900 | - | 7700 | - |
| 17900 - 17970 | 2600 | - | >10000 | - |

1.2 Although methods of estimating propagation criteria have been refined since 1948/49, no alternative method for the establishment of such criteria has so far been agreed by a Conference or Meeting of the I.T.U. in replacement of the procedures given in N.B.S. Circular 462. The most recent information available for ready application to the development of an Allotment Plan for the Aeronautical Mobile R Service is contained in Report 7617*) of the U.S. National Bureau of Standards. In this Report, which sets out the basic assumptions on which the conclusions were framed, and for which the calculations were made by electronic computer, the recommended "mean" distance separations in kilometres between stations sharing the same frequency to assure a 15 db ratio of desired to undesired signals on 50% of the days are given in the following table :

*) N.B.S. Report 7617: "Technical considerations in the allocation of radio frequencies for the Aeronautical Mobile R Service in band 7" by Haydon, Lucas and Hanson.

Distance Separations recommended in N.B.S. Report No. 7617

| Frequency band kc/s | Distance Separations (km) Day | Night |
|---|---|---|
| 2850 - 3025 | 600 | 4000 |
| 3400 - 3500 | 800 | 4000 |
| 4650 - 4700 | 1300 | 5000 |
| 5450 - 5480 | 1500 | 6000 |
| 5480 - 5680 | 1500 | 6000 |
| 6525 - 6685 | 1800 | 6000 |
| 8815 - 8965 | 3000 | - |
| 10005 - 10100 | 4000 | - |
| 11275 - 11400 | 4000 | - |
| 13260 - 13360 | 4000 | - |
| 17900 - 17970 | 6000 | - |

1.3 If the values of interference range used by the I.A.A.R.C. in 1948/49 in establishing the frequency-sharing patterns of the present Allotment Plan (as given in the Table in paragraph 1.1 above) are compared with the figures of distance separation recommended in N.B.S. Report 7617 (as given in the Table in paragraph 1.2 above), it will be seen that there is very close agreement between the two sets of figures for all frequencies up to and including 6 Mc/s by day, and up to and including 5 Mc/s by night. It must be remembered, too, in this connection, that the figures of distance separation recommended in N.B.S. Report 7617 represent the mean figures for each megacycle order for all latitudes between 0° and 90° and that the selection of the mean figures could be subject to slight variations in either direction. For frequencies of 8 Mc/s and above by day, and for 6 Mc/s and 8 Mc/s by night, the separation distances recommended in N.B.S. Report 7617 are shorter than the interference ranges used by the I.A.A.R.C. indicating that the latter interference ranges were perhaps more than adequate to ensure satisfactory sharing of the frequencies, under the relevant conditions, in their respective areas of allotment. In these circumstances, the I.F.R.B. considers that the interference ranges used in the establishment of the present allotment plan could continue to be used in the establishment of a revised plan, at least at the outset; but that it should be borne in mind that some reduction could perhaps be made in the interference ranges in the 8, 10, 11, 13 and 17 Mc/s bands by day and in the 6 and 8 Mc/s band by night, should it be found necessary to obtain additional sharing on these frequencies.

1.4 In expressing this view, the I.F.R.B. has also taken into consideration the fact that the sharing patterns in the present Allotment Plan have, in practice, given very satisfactory results and that mutual interference between stations in Areas to which the same frequencies have been allotted has, in general, been almost negligible when the technical principles of the Plan have been observed.

2. Assessment of interference in polar areas

2.1 The I.A.A.R.C. did not consider propagation conditions in latitudes North or South of about 60° because, at that time, few aircraft operated in higher latitudes. With the development of air traffic on polar routes, particularly in the Northern hemisphere, consideration should be given by the Conference to the conditions prevailing in very Northerly and Southerly latitudes. Under quiet ionospheric conditions, signals are propagated by day, with much less attenuation in very high latitudes than in equatorial or temperate latitudes, particularly on frequencies below about 10 Mc/s. However, in polar areas, signals are frequently subject to heavy auroral absorption, particularly at night when signals traversing these areas are usually subject to greater attenuation than in lower latitudes; and this, together with the relatively short ranges of interference on the lower megacycle orders of day frequencies and the small numbers of aeronautical and aircraft stations operating in such areas even at present, makes it d doubtful as to whether it would be desirable to adopt different values of interference range in the polar areas as compared with those adopted in temperate latitudes. If different values were adopted, the use of contour chart overlays to determine possible interference between stations in polar areas and stations in temperate or equatorial zones would be considerably complicated. The I.F.R.B. therefore suggests that the values of interference range, in the various megacycle orders of frequencies, should be the same in the polar areas as those used in lower latitudes.

2.2 If the possibilities of interference to and from stations in polar areas are to be assessed by the use of interference-range contours, it will be necessary, however, to use maps which are different to the Mercator projection maps used in conjunction with the present Allotment Plan, as the Mercator projection does not lend itself to the measurement of interference distances in latitudes greater than about 60° North or 60° South.

2.3 An alternative map which could possibly be used for all latitudes would be in the form of a modified cylindrical projection, shown in Annex 1 to this Report. Such a map is now in general use in the I.T.U. for the presentation of propagation data, the delineation of broadcasting areas etc. While the use of such a map would have the merit that only a single

set of interference range contours would have to be prepared, this projection, although much superior to the Mercator projection in respect of high latitude distances, still gives increasing distortion of east-west distances with increasing latitudes; and the calculation of trans-polar distances involves abrupt discontinuities.

2.4 The view has been expressed, moreover, and this view was endorsed by the I.C.A.O. Special Communications Meeting (Montreal, April/May 1963), that the use of the present contour charts, in association with a Mercator projection map of the world, has become so well-known that it would be desirable to retain the present arrangements for the calculation of interference ranges within latitudes between 60° North and 60° South. If this is done, additional special maps for the Northern and Southern polar areas would have to be prepared, and such maps could probably best be based on a "gnonomic projection" of the type shown in Annexes 2 and 3 to this Report. Such maps give a much more accurate representation of distances in the high latitudes than in the case of Mercator projection maps or modified cylindrical projection maps, but give increasing distortion of distances with decreasing latitudes. Special contour overlays would, of course, have to be prepared for use in association with these maps.

2.5 If maps using two different projections are to be used with their associated interference-range contour overlays, it would be desirable to have a certain amount of overlap between the two projections to facilitate the calculation of interference on paths crossing temperate latitudes. The I.F.R.B. therefore suggests that this overlap area should cover latitudes between 30° and 60° in each hemisphere; in other words, that the gnonomic polar projection maps should extend from 90° to 30° latitude in each case. In these circumstances the Board considers that, in rare cases of long interference ranges when it might be necessary to use maps with both projections, such use would be quite straightforward and would not lead to difficulties.

## 3. Conditions of frequency sharing

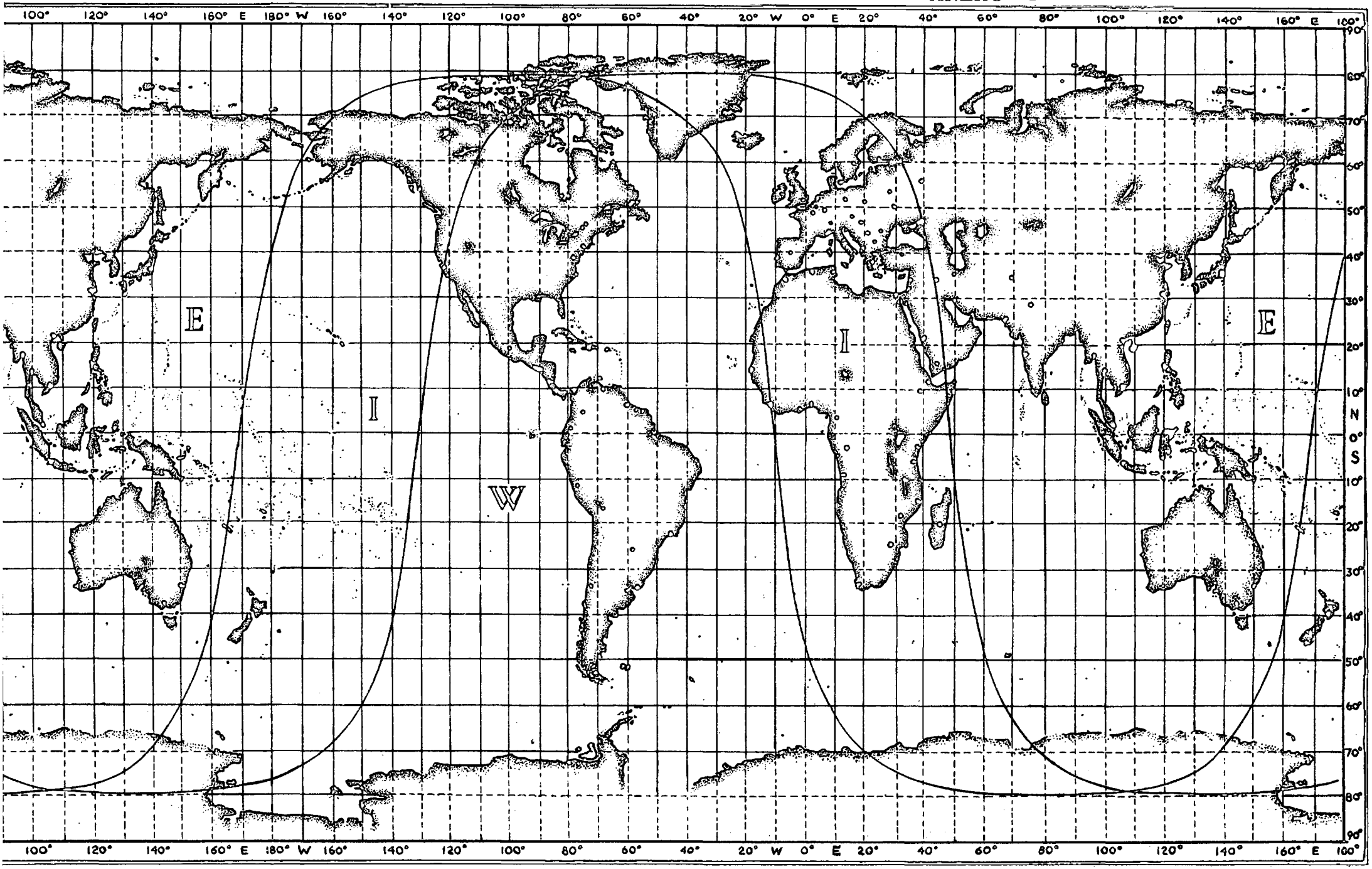
3.1 The I.A.A.R.C. used as the basis for the allotment of frequencies to the various areas, the following sharing conditions.

| Areas | Bands between : Mc/s | Sharing Conditions |
|---|---|---|
| MWARA to MWARA | 3 - 6.6 | night propagation |
| | 9 - 11.3 | day propagation |
| | 13 - 18 | time separation |
| MWARA to RDARA | 3 - 5.6 | night propagation |
| | 6.6 - 11.3 | day propagation |
| | 13 - 18 | time separation |
| RDARA to RDARA | 3 - 4.7 | night propagation |
| | 5.6 - 11.3 | day propagation |
| | 13 - 18 | time separation |

3.2 The I.F.R.B. considers that these sharing conditions, which generally represent the conditions of use of the frequencies in the types of Areas concerned, have given satisfactory results in the present Allotment Plan and should be continued.

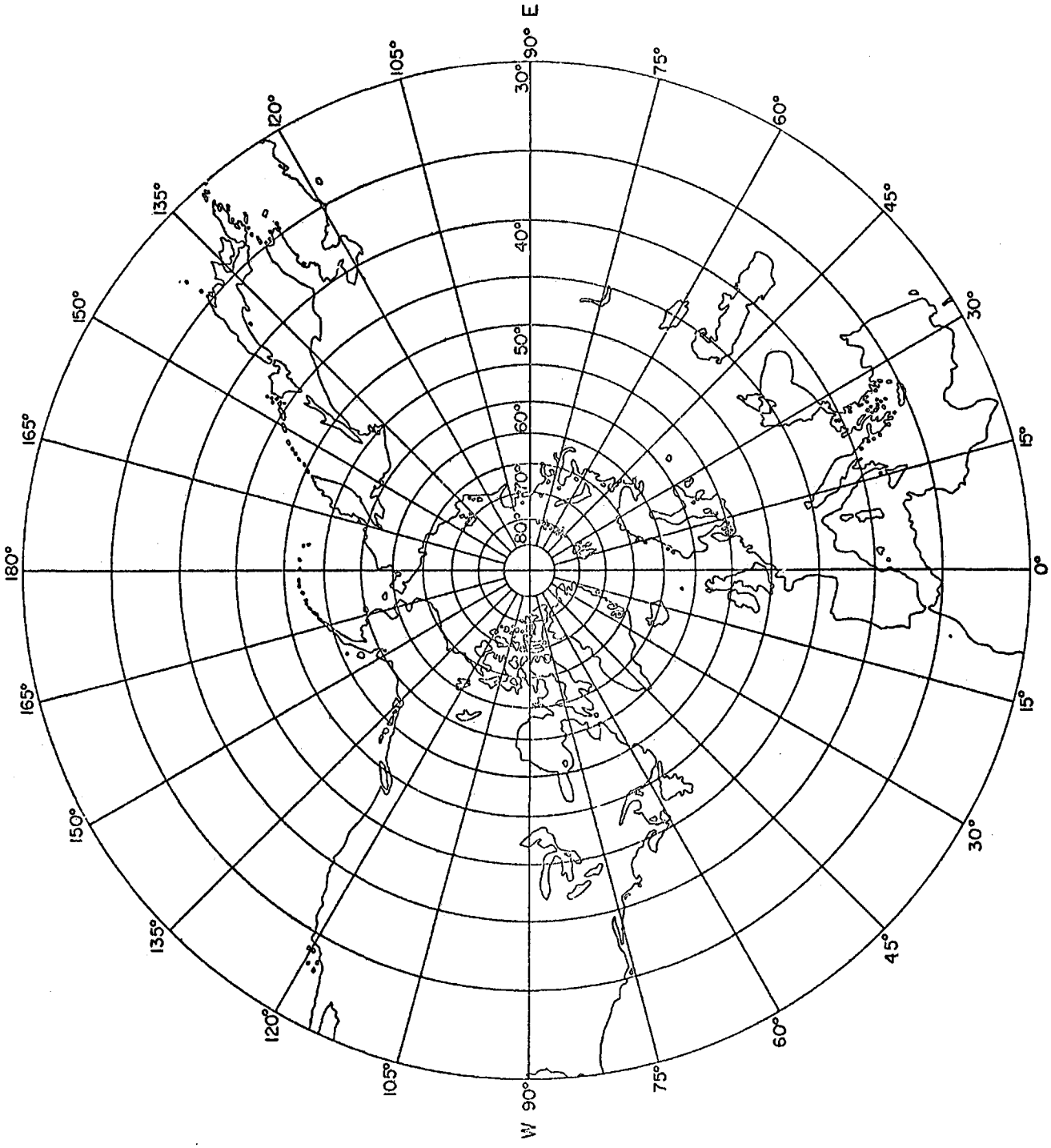
Annexes : 3

ANNEXE 1 ANNEX 1 ANEXO 1



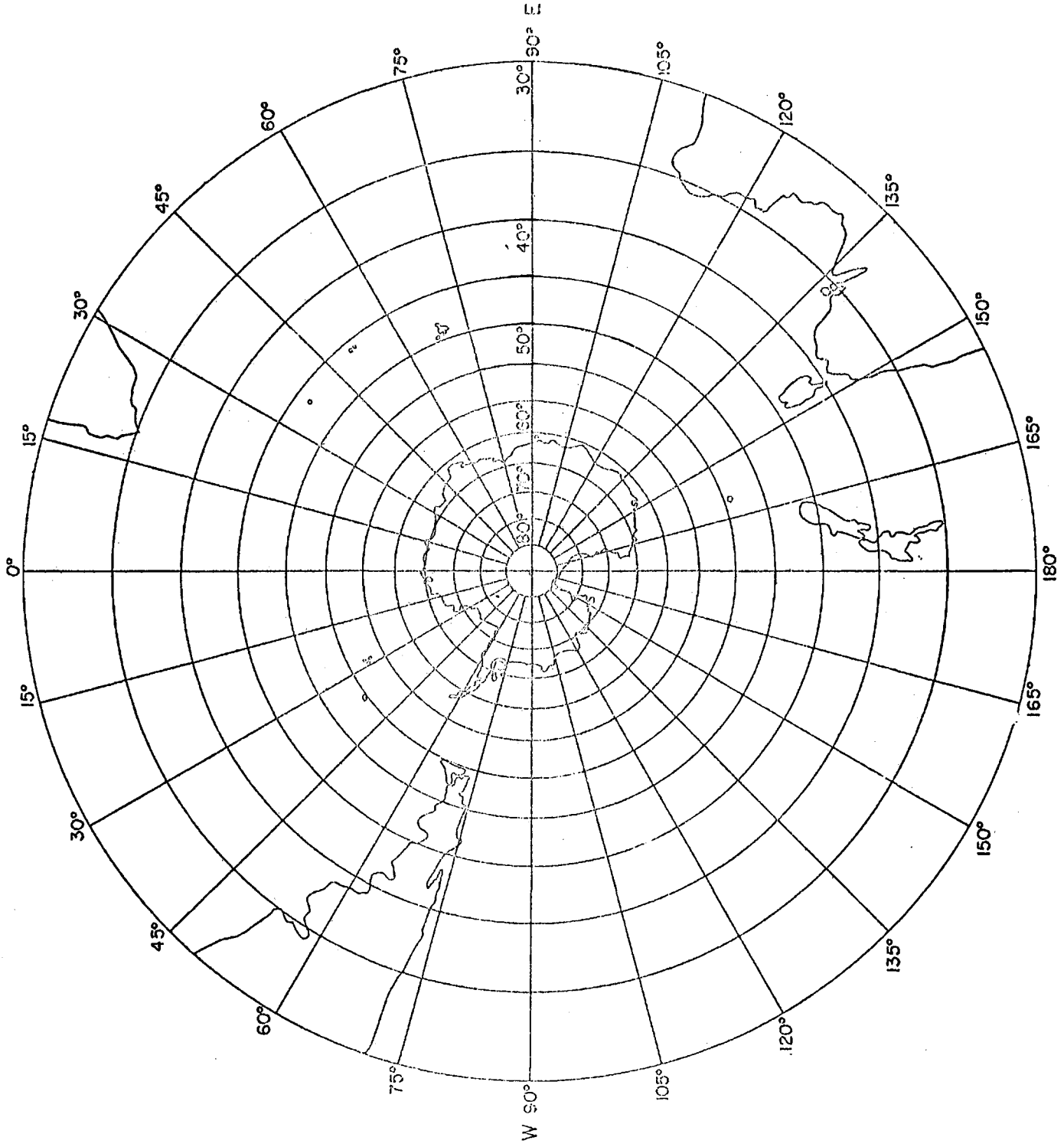

PROJECTION CYLINDRIQUE MODIFIEE
MODIFIED CYLINDRICAL PROJECTION
PROYECCIÓN CILÍNDRICA MODIFICADA

ANNEXE 2
ANNEX 2
ANEXO 2




PROJECTION GNOMONIQUE, REGION ARCTIQUE
GNOMONIC PROJECTION NORTH POLAR AREA
PROYECCIÓN GNOMÓNICA DE LA REGIÓN POLAR ÁRTICA

ANNEXE 3
ANNEX 3
ANEXO 3




PROJECTION GNOMONIQUE, REGION ANTARCTIQUE

GNOMONIC PROJECTION SOUTH POLAR AREA

PROYECCIÓN GNOMÓNICA DE LA REGIÓN POLAR ANTÁRTICA

# AERONAUTICAL CONFERENCE

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E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

RECOMMENDATIONS, REPORTS, OPINIONS, QUESTIONS AND STUDY PROGRAMMES ADOPTED BY THE Xth PLENARY ASSEMBLY OF THE C.C.I.R.

I have the honour to submit to the Conference the attached texts of the Recommendations, Reports, Opinions, Questions and Study Programmes adopted by the Xth Plenary Assembly of the C.C.I.R. that may be of special interest to the Conference.

I would point out in this connection that the Documents of the Xth Plenary Assembly are now available as printed volumes. Participants in the Conference may consult them in the C.C.I.R. rooms at Conference headquarters or in the C.C.I.R. Secretariat at I.T.U. headquarters. Like all other I.T.U. publications, they are also on sale at I.T.U. headquarters. Further information can be obtained from the documents distribution desk.

Gerald C. GROSS,
Secretary-General

Annex : 1

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# LIST OF C.C.I.R. DOCUMENTS TO BE SENT TO THE E.A.R.C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE

# A N N E X

## LIST OF C.C.I.R. DOCUMENTS TO BE SENT TO THE E.A.R.C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE

## List of C.C.I.R. documents to be sent to the E.A.R.C. for the preparation of a revised allotment plan for the Aeronautical mobile (R) service

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RECOMMENDATION 326 *

POWER OF RADIO TRANSMITTERS

Relationships between the peak envelope power, the mean power and the carrier power of a radio transmitter

The C.C.I.R. (Geneva, 1951-Los Angeles, 1959-Geneva, 1963)

considering

a) that the Radio Regulations, Geneva 1959, Article 1, No. 94, lay down that, when the power of a radio transmitter is referred to, it shall be expressed in one of the following terms :

- peak envelope power;

- mean power;

- carrier power;

but that indication of one only of those powers is adequate only for certain classes of emission and for certain uses, whereas in many cases it is desirable to express the transmitter power in other forms (see Appendix I of the Radio Regulations, Geneva, 1959);

b) that the direct measurement of each of these powers, or the deduction of one of them from a measurement of another, can only be effected under very precisely defined operating conditions ;

c) that a specification of emitted power is advantageous for use in calculation of radio propagation, spacing between assigned frequencies, signal-to-interference ratios and signal-to-noise ratios involved in radiocommunication;

d) that, to act as a basis for administrative regulations or for the calculations mentioned under § c), the relationships between values of power expressed in various terms with different types and levels of the modulating signal, must be known for each class of emission;

e) that the automatic recorders, which may be used in monitoring emissions or measuring the field strength of received signals, more often indicate average, rather than peak field strength; and that, depending on the class of emission, this mean field intensity may or may not be affected by the modulation;

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* This Recommendation replaces Recommendation 228

f) that, consequently, it is always necessary for the field-strength, as measured by such equipment, to be interpreted befofe being related to the power of the transmitter;

g) that Article 2 of the Radio Regulations Geneva, 1959, introduces a new classification of emissions and new terminology;

unanimously recommends

1. Terminology and definitions

That the following terminology and definitions should be used in dealing with questions relating to the power of radio transmitters and to the relationships between the various forms of that power.

Power

1.1 Peak envelope power of a radio transmitter (Radio Regulations, Geneva, 1959, Article 1, No. 95)

The average power supplied to the antenna transmission line by a transmitter during one radio-frequency cycle at the highest crest of the modulation envelope, taken under conditions of normal operation.

Note 1.1.1 - Applies to French text only.

1.2 Mean power of a radio transmitter (Radio Regulations, Geneva, 1959, Article 1, No. 96)

The power supplied to the antenna transmission line by a transmitter during normal operation, averaged over a time sufficiently long compared with the period of the lowest frequency encountered in the modulation. A time of 0.1s during which the mean power is greatest will normally be selected.

1.3 Carrier power of a radio transmitter (Radio Regulations, Geneva, 1959, Article 1, No. 97)

The average power supplied to the antenna transmission line by a transmitter during one radio-frequency cycle under conditions of no modulation. This definition does not apply to pulse-modulated emissions.

Carriers

1.4 Full carrier

Carrier emitted at a power level of 6 db or less below the peak envelope power.

Note 1.4.1 - Double-sideband amplitude-modulated emissions normally comprise a full carrier with a power level exactly 6 db below the peak envelope power at 100% modulation.

Note 1.4.2 - In single-sideband full-carrier emissions, a carrier at a power level of 6 db below the peak envelope power is generally emitted, to enable the use of a receiver designed for double sideband full-carrier operation.

1.5 Reduced carrier

Carrier emitted at a power level between 6 db and 32 db below the peak envelope power and preferably between 16 db and 26 db below the peak envelope power.

Note 1.5.1 - A reduced carrier is generally emitted to achieve automatic frequency control and/or gain control at the receiver.

1.6 Suppressed carrier

Carrier restricted to a power level more than 32 db below the peak envelope power and preferably 40 db or more below the peak envelope power.

Intermodulation

1.7 Intermodulation component (in a radio transmitter for amplitude-modulated emissions)

Sinusoidal oscillation produced in an imperfectly linear amplitude-modulated radio transmitter in response to sinusoidal oscillations applied at the input to the transmitter, the frequency of which is, at the output of the transmitter, the sum or difference of the frequencies of the normal sideband components resulting from the modulation of a carrier by the exciting oscillations, or the sum or difference of integral multiples of these frequencies.

The frequency of an intermodulation component at the output of the transmitter is given by the formula :

$$F = p(F_o \pm f_1) \pm q(F_o \pm f_2) \text{ with } p, q = 1, 2, 3 \ldots$$

where $F_o$ is the carrier frequency, $f_1$ and $f_2$ the frequencies of the exciting oscillations.

The positive sign between the two terms of the sum corresponds to much higher frequency oscillations with, as a general rule, very low amplitudes; this case is of minor interest for the purpose of this Recommendation.

1.8 Intermodulation products (for amplitude-modulated emissions)

All the intermodulation components produced in an amplitude-modulated transmitter in response to given sinusoidal oscillations applied to the input.

1.9 Order of an intermodulation component (in a radio transmitter for amplitude-modulated emissions)

Sum $n = p + q$ of the two positive integral coefficients determining the frequency of an intermodulation component at the output of an amplitude-modulated radio-transmitter with a given carrier frequency, as a function of the frequencies of two sinusoidal oscillations applied simultaneously at the input to the transmitter.

2. Conversion factors between the different forms of power

In the following tables conversion factors are given, which can be used to obtain the power of a radio transmitter expressed in one of the forms defined above from the power given in another of those forms.

2.1 Conversion factors with respect to the peak envelope power

2.1.1 Table I gives the conversion factors applicable when the peak envelope power is taken as unity.

2.1.2 Column 5 gives the theoretical values of the mean power which would be obtained, with linear transmitters for amplitude modulation. In practice, the imperfect linearity of the transmitter and other causes may increase the mean power above the figures shown in the table.

2.1.3 As the conversion factors depends on the modulating signal, one or more examples described in Column 2 have been chosen to enable representative values for the factors in Column 5 to be determined.

2.1.4 Similarly, Column 4 gives the theoretical carrier power in the specific conditions of no signal modulation described in Column 3, and chosen so as to make that carrier power easily measurable.

Table I

| Class of emission | Applied modulating signal | Condition of no signal modulation | Conversion factor | |
|---|---|---|---|---|
| | | | Carrier power/ Peak envelope power | Mean power/ Peak envelope power |
| (1) | (2) | (3) | (4) | (5) |
| Amplitude-modulation Double-sideband<br>A1<br>Telegraphy without modulation by a periodic oscillation | Series of rectangular dots; equal alternating marks and spaces; zero mark amplitude (Note 1) | Continuous emission | 1 | 0.500 (-3.0 db) (Note 1) |
| F2<br>Telegraphy by the on-off keying of an emission frequency-modulated by a low frequency periodic oscillation | Series of rectangular dots; equal alternating marks and spaces; single sine-wave oscillations modulating the emission during space periods (Note 1) | Continuous emission | 1 | 0.500 (-3.0 db) (Note 1) |
| A2<br>Telegraphy by on-off keying of one or more periodic oscillations low-frequency amplitude modulating the emission, or by keying of the emission modulated by those oscillations (see Table II) | Series of rectangular dots; equal alternating marks and spaces; single sine-wave modulating the emission at 100%<br>(a) modulating oscillation keyed | Continuous emission modulating oscillation suppressed (carrier only) | 0.250 (-6.0 db) | 0.312 (-5.1 db) |
| | (b) modulated emission keyed (Note 1) | Continuous emission with modulating oscillation | 0.250 (-6.0 db) | 0.187 (-7.3 db) (Note 1) |
| A2<br>Continuous signal of an emission amplitude-modulated by low-frequency periodic oscillation (Example : some radio beacons) | Single sine-wave oscillation modulating emission to 100%; no keying | Continuous emission modulating oscillation suppressed (carrier only) | 0.250 (-6.0 db) | 0.375 (-4.3 db) |

Table I (Contd.)

| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| A3<br>Double-sideband telephony, full carrier (See Table II) | (a) single sine-wave audio-frequency oscillation modulating emission at 100% | Carrier only | 0.250<br>(-6.0 db) | 0.375<br>(-4.3 db) |
| | (b) smoothly read text (Note 2) | Carrier only | 0.250<br>(-6.0 db) | 0.262<br>(-5.8 db) |
| Amplitude-modulation Single-sideband<br>A2H<br>Continuous signal of an emission amplitude-modulated by periodic oscillation, full carrier | Single sine-wave oscillation modulating emission at 100%; no keying | Modulating oscillation suppressed (carrier only) | 0.250<br>(-6.0 db) | 0.500<br>(-3.0 db) |
| A3A<br>Single-sideband telephony, reduced carrier | (a) two periodic sine-wave oscillations modulating transmitter to peak envelope power | Reduced carrier only | 0.025<br>(-16.0 db)<br>0.0025<br>(-26.0 db) | 0.379<br>(-4.2 db)<br>0.454<br>(-3.4 db) |
| | (b) smoothly read text (Note 2) | Reduced carrier only | 0.025<br>(-16.0 db)<br>0.0025<br>(-26.0 db) | 0.096<br>(-10.2 db)<br>0.093<br>(-10.3 db) |
| A3H<br>Single-sideband telephony, full carrier | (a) single periodic sine-wave oscillation modulating an emission at 100% | Carrier only | 0.250<br>(-6.0 db) | 0.500<br>(-3.0 db) |
| | (b) smoothly read text (Note 2) | Carrier only | 0.250<br>(-6.0 db) | 0.275<br>(-5.6 db) |
| A3J<br>Single-sideband telephony, suppressed carrier | (a) two periodic amplitude sine-wave oscillations modulating transmitter to peak envelope power | Suppressed carrier | $<$0.0001<br>($<$-40 db) | 0.500<br>(-3.0 db) |
| | (b) smoothly read text (Note 2) | Suppressed carrier | $<$0.0001<br>($<$-40 db) | 0.100<br>(-10 db) |

Table I (Contd.)

| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| Amplitude-modulation Independent-sideband<br>A3B<br>Two independent telephony sidebands, carrier reduced or suppressed | (a) single periodic sine-wave oscillation on each sideband, modulating the transmitter to peak envelope power, both bands being modulated to the same level | Reduced carrier only | 0.025<br>(-16 db)<br>0.0025<br>(-26 db) | 0.379<br>(-4.2 db)<br>0.454<br>(-3.4 db) |
| | | Suppressed carrier | < 0.0001<br>(< -40 db) | 0.500<br>(-3.0 db) |
| | (b) smoothly read text on each of two sidebands simultaneously (one channel per sideband) (Notes 2 and 3) | Reduced carrier only | 0.025<br>(-16 db)<br>0.0025<br>(-26 db) | 0.061<br>(-12.1 db)<br>0.048<br>(-13.2 db) |
| | | Suppressed carrier | < 0.0001<br>(< -40 db) | 0.050<br>(-13 db) |
| | (c) smoothly read text on each of the four channels simultaneously (two per sideband) (Notes 2 and 3) | Reduced carrier only | 0.025<br>(-16 db)<br>0.0025<br>(-26 db) | 0.096<br>(-10.2 db)<br>0.093<br>(-10.4 db) |
| | | Suppressed carrier | < 0.0001<br>(< -40 db) | 0.100<br>(-10 db) |
| Amplitude-modulation Facsimile<br>A4<br>Facsimile: direct modulation of the main carrier by the picture signal | Black and white chequerboard picture giving square wave: modulating the carrier as for A1 | Continuous emission | 1 | 0.500<br>(-3.0 db) |
| A4<br>Facsimile: sub-carrier frequency-modulated by the picture signal, and amplitude-modulating the main carrier | Any picture, 100% amplitude modulation of main carrier (the conversion factors are independent of the form of the picture signal) | Main carrier only | 0.250<br>(-6.0 db) | 0.375<br>(-4.3 db) |

Table I (Contd.)

| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| A4A<br>Facsimile: sub-carrier frequency-modulated by the picture signal and amplitude modulating the main carrier, single sideband, reduced carrier | For this class of emission, the modulation by the picture signal alters the power distribution within the occupied bandwidth without affecting the total power | Reduced carrier only | 0.025<br>(-16.0 db)<br>0.0025<br>(-26.0 db) | 0.733<br>(-1.3 db)<br>0.905<br>(-0.4 db) |
| A4J<br>Facsimile: sub-carrier frequency-modulated by the picture signal and amplitude-modulating the main carrier, single-sideband, suppressed carrier | For this class of emission, the modulation by the picture signal alters the power distribution within the occupied bandwidth without affecting the total power | Suppressed carrier | <0.0001<br>(< -40 db) | 1 |
| Amplitude-modulation Television<br>A5C<br>Television, vestigial sideband, picture only | (a) All white<br>- 405 lines, 50 fields, positive modulation<br>- 525 lines, 60 fields, negative modulation<br>- 625 lines, 50 fields, negative modulation<br>- 819 lines, 50 fields, positive modulation | (Note 4) | | 0.800<br>(-1.0 db)<br>0.164<br>(-7.9 db)<br>0.177<br>(-7.5 db)<br>0.742<br>(-1.3 db) |
| | (b) All black<br>- 405 lines, 50 fields, positive modulation<br>- 525 lines, 60 fields, negative modulation<br>- 625 lines, 50 fields, negative modulation<br>- 819 lines, 50 fields, positive modulation | (Note 4) | | 0.080<br>(-11.0 db)<br>0.608<br>(-2.2 db)<br>0.542<br>(-2.7 db)<br>0.085<br>(-10.7 db) |

Table I (Contd.)

| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| **Multichannel Telegraphy**<br>A7A and A7B<br>(Note 5) | | | | |
| Multichannel voice-frequency telegraphy. Single or independent sideband, reduced carrier | Frequency-shift or 2-tone voice-frequency channel telegraphy | Reduced carrier only | | |
| | 2 channels | | 0.025 (-16.0 db)<br>0.0025 (-26.0 db) | 0.379 (-4.2 db)<br>0.454 (-3.4 db) |
| | 3 channels | | 0.025 (-16.0 db)<br>0.0025 (-26.0 db) | 0.261 (-5.8 db)<br>0.302 (-5.2 db) |
| | 4 or more channels (Note 6) | | 0.025 (-16.0 db)<br>0.0025 (-26.0 db) | 0.202 (-6.9 db)<br>0.228 (-6.4 db) |
| A7J | | | | |
| Multichannel voice-frequency telegraphy, single-sideband, suppressed carrier | Frequency-shift or 2-tone voice-frequency channel telegraphy | Suppressed carrier | | |
| | 2 channels | | $< 0.0001$ ($< -40$ db) | 0.500 (-3.0 db) |
| | 3 channels | | $< 0.0001$ ($< -40$ db) | 0.333 (-4.8 db) |
| | 4 or more channels (Note 6) | | $< 0.0001$ ($< -40$ db) | 0.250 (-6.0 db) |
| A9B<br>(Note 5) | | | | |
| Combination of speech and multichannel telegraphy. Independent sideband, reduced or suppressed carrier | Smoothly read text on one channel and one group of multichannel telegraph signals; 4 or more channels (Notes 6 and 7) | Reduced carrier only | 0.025 (-16.0 db)<br>0.0025 (-26.0 db) | 0.132 (-8.8 db)<br>0.138 (-8.6 db) |
| | | Suppressed carrier | $< 0.0001$ ($< -40$ db) | 0.151 (-8.2 db) |

Table I (Contd.)

| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| A9B (continued) | Smoothly read text on two channels and one group of multichannel telegraph signals; 4 or more channels (Notes 6 and 7) | Reduced carrier only | 0.025 (-16.0 db) | 0.105 (-9.8 db) |
| | | | 0.0025 (-26.0 db) | 0.105 (-9.8 db) |
| | | Suppressed carrier | <0.0001 (< -40 db) | 0.113 (-9.5 db) |
| Frequency or phase modulation | | | | |
| F1 | For these classes of emission the modulation changes the distribution of power in the frequency spectrum while leaving the total power unchanged | Various | 1 | 1 |
| F2 (frequency displacement on modulating oscillation) | | | 1 | 1 |
| F3 | | | 1 | 1 |
| F4 | | | 1 | 1 |
| F5 | | | 1 | 1 |
| F6 | | | 1 | 1 |
| F9 | | | 1 | 1 |
| Pulse modulation | | | | |
| P0 | | | | |
| Continuous emission of a series of periodic pulses for radiodetermination (See Note 8 for definition of d) | Periodic series of identical non-modulated pulses: amplitude, width (duration), repetition frequency of pulses is constant | Without change | d | d |
| Telegraphy by the on-off keying of a periodic oscillation which modulates a series of periodic pulses. (See Note 8 for the definition of d) | Series of rectangular dots; equal alternating marks and spaces; a single sine-wave oscillation modulating the pulses | | | |

Table I (Contd.)

| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| P2D<br>Periodic oscillation modulating the amplitude of the pulses | Amplitude of pulses modulated by sine-wave oscillation at 100% | | | |
| | (a) modulating oscillation keyed | Continuous periodic series of pulses, modulating oscillation suppressed | 0.250d (-6.0 + 10 log d) db | 0.312d (-5.1 + 10 log d) db |
| | (b) modulated emission keyed (Note 1) | Continuous series of pulses with modulating oscillation | 0.250d (-6.0 + 10 log d) db | 0.187d (-7.3 + 10 log d) db (Note 1) |
| P2E<br>Periodic oscillation modulating the width (duration) of pulses to constant mean width (duration) | (a) modulating oscillation keyed | Continuous periodic series of pulses with modulating oscillation suppressed | d | d |
| | (b) modulated emission keyed (Note 1) | Continuous series of pulses with modulating oscillation | d | 0.500d (-3.0 + 10 log d) db (Note 1) |
| P2F<br>Periodic oscillation modulating the phase or position of the pulses to constant mean spacing | (a) modulating oscillation keyed | Continuous periodic series of pulses with modulating oscillation suppressed | d | d |
| | (b) modulated emission keyed | Continuous series of pulses with modulating oscillation | d | 0.500d (-3.0 + 10 log d) db |
| Pulse modulation<br>Telephony<br>P3D<br>Pulses amplitude-modulated by telephone signal | (a) single sine-wave oscillation modulating pulses at 100% | Periodic series of non-modulated pulses | 0.250d (-6.0 + 10 log d) db | 0.375d (-4.3 + 10 log d) db |
| | (b) smoothly read text | Periodic series of non-modulated pulses | 0.250d (-6.0 + 10 log d) db | 0.262d (-5.8 + 10 log d) db |

Table I (Contd.)

| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| P3E<br>Pulses width (duration) - modulated to constant mean width (duration) by telephone signal | The mean width (or duration) and spacing being constant, the conversion factors are independent of the modulating signal | Periodic series of non-modulated pulses | d | d |
| P3F<br>Pulses phase (or position) modulated to constant mean spacing by telephone signal | | | | |

2.2 Conversion factors from the carrier power

2.2.1 Table II gives the conversion factors applicable when the carrier power is taken as the unit, as is the common practice at least for the two classes of amplitude-modulated emissions A2 and A3.

2.2.2 Column 5 gives the theoretical mean power obtained with the modulating signals described in Column 2, with practically linear transmitters. The conversion factors shown are the quotients of the corresponding factors in Columns 5 and 4 of Table I.

2.2.3 Similarly, Column 4 gives the theoretical peak envelope power. The conversion factors shown are the reciprocals of the corresponding factors in Column 4 of the table.

2.2.4 Column 3 gives the conditions of no signal modulation from which the carrier power chosen as the unit can be determined and measured.

Table II

| Class of emission | Applied modulating signal | Condition of no signal modulation | Conversion factor | |
|---|---|---|---|---|
| | | | Carrier power/ Peak envelope power | Mean power/ Peak envelope power |
| (1) | (2) | (3) | (4) | (5) |
| A2<br>Telegraphy with on-off keying of one or more periodic oscillations amplitude-modulating the emission, or with keying of the emission modulated by those oscillations | Series of rectangular dots; equal alternating marks and spaces; single sinusoidal oscillation modulating the emission at 100%<br>(a) modulating oscillation keyed | Continusous emission modulating oscillation suppressed (carrier only) | 4(+ 6.0 db) | 1.25 (+ 1.0 db) |
| | (b) modulated emission keyed (Note 1) | Continusous emission with modulating oscillation | 4(+ 6.0 db) | 0.75 (-1.3 db) (Note 1) |
| A3<br>Double-sideband telephony, full carrier | (a) single sine-wave audio-frequency sinusoidal oscillation modulating emission at 100% | Carrier only | 4 (+ 6.0 db) | 1.5 (+ 1.8 db) |
| | (b) smoothly read text (Note 2) | Carrier only | 4(+ 6.0 db) | 1.05 (+ 0.2 db) |

2.3 Explanatory notes

Note 1 - When the modulating signal, instead of consisting of a series of alternating marks and spaces, is coded with the help of a telegraph alphabet, the conversion factors in Column 5 should be multiplied by the following coefficients :

Morse alphabet : 0.49/0.50 = 0.98 (-0.1 db)

International telegraph alphabet No. 2 : 0.58/0.50 = 1.16 (+ 0.6 db)

Seven-unit alphabet as in Recommendation 342 : 0.5/0.5 = 1.

Note 2 - For smoothly read text, it is assumed that the mean power level of the speech signal is 10 db lower than the level of a reference sinusoidal oscillation. (This does not apply to broadcast emissions).

For A3 and A3H emissions, the reference oscillation drives the transmitter to 100% modulation.

For A3A and A3J single channel emissions, the reference oscillation drives the transmitter to peak envelope power.

For A3B emissions and for A3A and A3J multi-channel emissions, two sinusoidal oscillations of equal amplitude, each of reference level, applied simultaneously drive the transmitter to peak envelope power.

Although these practices do not correspond in all cases with those adopted by some Administrations, they result in practical average values in Column 5.

Note 3 - For independent-sideband emissions (A3B), of up to 4 channels, it is assumed that a different modulating signal is applied to each channel.

Note 4 - The condition of no signal modulation cannot be defined exactly because of the highly complex and asymmetric nature of the modulation; the figures given in Column 5 are average figures which may vary according to the tolerance in width of the synchronizing pulses and of the black level. Detailed characteristics of the television systems are given in Report 308.

Note 5 - The power relationships in multi-channel voice frequency telegraphy depend on the number of channels and not on the bandwidth they occupy. Therefore, either one or both sidebands can be occupied, and there is no distinction to be made here between A7A and A7B emissions.

Telegraph signals can occupy all the channels of an emission as in A7A and A7B telegraphy, or can occupy one or more channels of a compromise (A9B) emission. It is therefore convenient to regard the group of voice frequency telegraph channels as equivalent to a normal speech channel or channels.

Note 6 - When more than four telegraph channels are used, it is the normal practice to increase the power in each channel above that for which the total peak power allocated to the group of channels would never be exceeded. The mean power of the emission may thus be increased without exceeding the total admissible peak envelope power for more than

a specified small fraction of the time. The ratios given in the table are typical of present practice in which the channel power is determined on the basis of voltage additions for the first four channels and power additions for the remainder. Thus, if n is the number of channels of identical peak power, the admissible peak power of each channel is given by :

$$\frac{\text{Total admissible peak power}}{n^2} \quad \text{when } n = 2 \text{ or } 3$$

$$\frac{\text{Total admissible peak power}}{4n} \quad \text{when } n \geq 4$$

The total peak power is not exceeded for more than about 1% to 2% of the time when n is greater than 4.

Note 7 - For composite emissions, the mean levels in speech channels are normally adjusted to the values as set out in Note 2 for A3B. To avoid interference from the group of telegraph channels, the level of this group is reduced, relative to the level as set out in Note 6, by 3 db when one channel is used for speech and by 6 db when more than one channel is so used.

Note 8 - For pulse emissions, it is assumed that the pulses are rectangular and that the peak envelope power is unity. The duty cycle d is the ratio of pulse duration to pulse repetition period, and is a constant for amplitude-modulated pulses. Where the duty cycle is variable as with position or width modulated pulses, d is to be taken as the average value.

## 3. Measurement of peak envelope power

That the determination and measurement of the useful peak envelope power of a radio transmitter should be made on the basis of the following considerations and methods.

### 3.1 General considerations

For amplitude-modulated transmitters, it is not always possible to measure directly the peak envelope power. For an ideal, perfectly linear transmitter this can be calculated theoretically from measurement of the mean power or of the carrier power of the emission, but the difference between the true peak envelope power and the value thus calculated depends primarily on the degree of non-linearity of an actual transmitter.

Moreover, the coincidence of the measurements of the ratio of the mean power to the carrier power with the theoretical values is not a sure criterion of the linearity of the transmitter because of the distorsion which may, as a function of the input level, increase the mean power linearly without proportionally increasing the peak envelope power.

The peak envelope power of a perfectly linear, double-sideband transmitter with full carrier (A2, A3 or A4), modulated at 100%, would be four times greater than the carrier power. But all transmitters are to some extent non-linear, and this defect produces signal distortion and also an increase in out-of-band radiation. To keep these undesirable effects to the minimum, it is necessary to limit the peak envelope power to a useful value which, for a double-sideband transmitter with full carrier, is equivalent to limiting the useful modulation depth to less than 100%.

The useful peak envelope power is limited by the acceptable intermodulation distortion. The method recommended for defining and measuring the useful peak envelope power of a single-sideband or independent-sideband transmitter (A3A, A3B, etc. emissions) is described below. The same method may also be used for double-sideband transmitters (A3 emission).

## 3.2 Intermodulation

### 3.2.1 Principle for the measurement of intermodulation distortion

The imperfect linearity of amplitude-modulated radio transmitters can be expressed as a function of the level of the intermodulation products. To determine that level, it is convenient to measure separately, the amplitude of each intermodulation oscillation resulting from the application, at the input of the transmitter, of two periodic modulating sinusoidal oscillations with frequencies $f_1$ and $f_2$.

As a rule, the amplitudes of the two modulating oscillations are adjusted in such a way that they produce, at the output of the transmitter, fundamental components of equal amplitude at the radio frequencies $F_o + f_1$ and $F_o + f_2$ (or $F_o - f_1$ and $F_o - f_2$).

Only the intermodulation products corresponding to integral coefficients whose difference is unity ($p - q = 1$), fall within the necessary band or near enough to it and have an appreciable amplitude. The intermodulation products of the third order ($p + q = 3$) generally have the greatest amplitude, but for certain transmitters higher orders - for example of the fifth order ($p + q = 5$), may also show appreciable amplitudes. To limit these intermodulation products, which may cause excessive out-of-band radiation, a level, valid for all orders of intermodulation products, should be fixed.

3.2.2 Choice of frequencies for modulating oscillations

To measure the amplitude of the intermodulation products, it is desirable to use modulating oscillations whose frequencies are near the limits of the audio-frequency passband. The audio-frequency passband to be considered here is the band at the input of the transmitter which corresponds, at the output, not to a single telephone channel but to the whole of a sideband of the emission, at least when the transmitter provides several channels on a single sideband.

Moreover, to separate the intermodulation products from the harmonics of the modulating oscillations at the output of the transmitter, the frequencies of these oscillations should be chosen in such a way that they are not in harmonic relation. In practice, frequencies, the ratio of which is in the neighbourhood of one integer and a half will be chosen. For an audio-frequency passband between 300 c/s and 3 kc/s, for example, a value in the neighbourhood of 700 or 1100 c/s will be chosen for $f_1$, and in the neighbourhood of 1700 or 2500 c/s for $f_2$.

3.2.3 Acceptable intermodulation level

The intermodulation level considered here is expressed in terms of the ratio, generally in decibels, between the powers of the largest intermodulation component at radio frequency, $p(F_o \pm f_1) - q(F_o \pm f_2)$ and the power of the fundamental component at radio frequency ($F_o \pm f_1$ or $F_o \pm f_2$) produced by one of the two $f_1$ and $f_2$ modulating oscillations applied singly at the input of the transmitter, the amplitudes of which are adjusted as indicated above (§ 3.2.1, 2nd paragraph).

The intermodulation level that can be regarded as acceptable depends on the class of emission and the service for which the transmitter is intended. From this aspect, three main categories of transmitter can be considered.

First category

Single channel radiotelephone emissions without a privacy device :

- single-sideband (A3A, A3J, A3H).

  For these classes of emission, the major part of the energy of the modulating signal is concentrated in the part of the spectrum containing relatively low audio frequencies. If, after modulation, the high power components remain near to the carrier, fairly high levels of intermodulation can be tolerated without serious increase in out-of-band radiation or noticeable distortion.

  The acceptable intermodulation level can be taken as -25 db or less.

  If an emission of the same class is used with a privacy device which may transpose the high power components to any position in the necessary band, the preceding condition is not met, and the emission must be transferred to the second category.

Second category

- Independent-sideband radiotelephone emissions (A3B)

- Multi-channel VF telegraph emissions (A7A and A7B)

- Independent-sideband multiplex emissions (A9B)

- Single-sideband or double-sideband single-channel radiotelephone emissions (A3, A3A, A3J, A3H) with a privacy device.

  For these classes of emissions, intermodulation products cause interference between channels or undesirable out-of-band radiation. Their level must be more strictly limited.

  The acceptable intermodulation level may be taken as -35 db or less.

Third category

Double-sideband amplitude-modulated emissions.

The useful peak envelope power of double-sideband transmitters may also be measured by means of the method recommended in § 3.3. This is mainly of use in determining the out-of-band radiation characteristics of the transmitter.

Some Administrations prefer to use the harmonic distortion method of measurement using a single sinusoidal modulating oscillation. For acceptable performance the modulation depth does not normally exceed 90%.

## 3.3 Methods for measuring the peak envelope power

It results from the foregoing that, because of non-linearity in the transmitters, the measurement of the useful peak envelope power must take into consideration the accepted intermodulation level for the transmitter in question, and that different measuring methods may give results which do not agree.

Hence it is desirable to adopt a single measuring method which is as simple and certain as possible.

The following method is recommended :

### 3.3.1 Single- or independent-sideband amplitude-modulated transmitters with reduced or suppressed carrier

a) A voltage-calibrated oscilloscope is coupled to the antenna feed or to the transmitter load, so as to display the output voltage, with its envelope curve.

b) The carrier of the transmitter is suppressed.

c) The transmitter is modulated by a single sinusoidal oscillation so as to obtain a mean output power of about half the useful peak envelope power.

Measurements are made of the mean power by a calorimetric method or by a wattmeter previously calibrated by this method.

The peak voltage obtained on the oscilloscope is measured.

d) The single modulating oscillation is replaced by two sinusoidal oscillations whose frequencies are chosen as indicated in § 3.2.2. The amplitudes of those two oscillations are adjusted so that the power of the largest intermodulation component measured with appropriate equipment, with a filter if necessary, reaches the acceptable intermodulation level (as defined in § 3.2.3) and that simultaneously the two oscillations produce fundamental components of equal amplitude at the output of the transmitter (§ 3.2.1).

The peak voltage corresponding to the maximum of the envelope obtained on the oscilloscope is again measured.

e) The peak envelope power is given by the formula :

$$\text{Useful peak envelope power} = \text{Mean power} \left[ \frac{\text{Peak voltage obtained with two oscillations}}{\text{Peak voltage obtained with one oscillation}} \right]^2$$

3.3.2 Single-sideband or double-sideband amplitude-modulated transmitters with full carrier

A measuring method similar to that described in § 3.3.1 can be used.

- The carrier of the transmitter is not suppressed.
- The modulation used in § (c) above is suppressed.
- The mean reference power mentioned in § (c) is replaced by the carrier power and the corresponding peak voltage replaced by the carrier amplitude.
- The rest of the measurement proceeding as before, the peak envelope power is given by the formula :

$$\text{Useful peak envelope power} = \text{Carrier power} \left[ \frac{\text{Peak voltage obtained with two oscillations}}{\text{Carrier amplitude}} \right]^2$$

REPORT 213*

# FACTORS AFFECTING MULTI-STATION ACCESS IN COMMUNICATION-SATELLITE SYSTEMS

(Study Programme 235E(IV))

(Geneva, 1963)

## 1. Introduction

Radiocommunication on a world-wide basis in the communication-satellite service must provide ultimately not only for independent working between individual pairs of earth stations, but also for multiple interconnection between many earth stations. It is assumed that the communication-satellite service will be capable of accommodating telephony, telegraphy, data, facsimile, television, and perhaps other categories of usage.

For the purpose of this Report, the term "access" will be used in the sense of the ability of an earth station to join in and use a communication-satellite system. Multi-station access is a property of the system itself and of how the system can be used by its earth stations. There are two quite different ways in which communication satellites may be used by earth stations to provide interconnection. In the paired-terminal method, any two earth stations may use a space station for two-way communication between themselves, much as if they were connected by a cable of equal base-band capacity. In the multi-station method, more than two earth stations may use a single space station as a point of interconnection, so that each of these earth stations may communicate with any or all of the remaining earth stations.

This Report considers only the various techniques applicable to communication-satellite systems from the point of view of multi-station access. Specifically, the Report does not consider the practicability of achieving an economical, operational system using any specific technique within a given time frame. These are receiving extensive study at the present time. It is therefore too early to draw any conclusions regarding the most appropriate system for a given set of circumstances.

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* This Report, which was adopted unanimously, has been brought to the attention of the Extraordinary Administrative Radio Conference, Geneva, 1963.

2. General considerations

For multi-station access through a single space station, all earth stations must be able to use the space station at the same time. With non-stationary satellites, this requires that the earth stations be capable of simultaneous hand-over, with the result that their locations must be within the area of overlapping coverage of two satellites at the time of hand-over. With a stationary satellite, no hand-over is required.

Service can be extended to adjacent areas served by another satellite through the use of additional relays: e.g. by intermediate earth station relay, direct satellite-to-satellite relay, or terrestrial systems.

3. Single-hop aspects

Two stations which are to be interconnected must be within the "mutual coverage zone", which is determined by the separation of the earth stations and the altitude of the satellite. Such a zone also exists when additional stations must be interconnected, but, in general, it becomes smaller as the number of earth stations and their separations increase.

To secure multi-station access on a continuous basis with non-stationary satellites, a "new" satellite must have entered the mutual coverage zone as the one in use moves out of the zone. Many ingenious orbit arrangements have been proposed to assure this. Since the mutual coverage zone becomes larger as the orbit altitude increases, the number of satellites required to give continuous multi-station access decreases with the higher orbits, and, for the stationary satellite, is continuous with a single satellite.

4. Multi-hop aspects

Long routes may be between antipodal points of the earth, separated by a great-circle distance of 20 000 km. This distance is some 3 000 km greater than the longest path possible with even a stationary satellite, assuming minimum angles of elevation of 5° for the earth antennae. Such long paths will require extension by means of terrestrial links, or the use of two or more satellite relays. In any case, terrestrial links must be used to permit interconnection between earth stations and the parties using the circuit.

For multi-satellite circuits, direct relaying between satellites is a future possibility. However, with non-stationary satellites, the use of an intermediate earth relay-station is probable at an earlier date. Such an earth relay-station must be within the overlap area of visibility of two suitably situated space stations. With stationary satellites, an earth relay-station would only need to be within the fixed overlap area of visibility of its two satellites. Earth relaying between stationary satellites, for

telephony, seems undesirable because the time-delay over two hops would exceed the tentative maximum values recommended by the C.C.I.T.T. However, for such connections, the delay can be held within these values by using terrestrial communication facilities in connection with a single stationary satellite.

5. Multiplexing and modulation aspects

When simultaneous access to a system is desired by a number of earth stations, channels can be combined by using time-division multiplex, frequency-division multiplex, a combination of the two, or other methods now undergoing evaluation. Frequency-division multiplex may be achieved by various methods. Time-division multiplex may be achieved through digital methods such as pulse code modulation or delta modulation. Each of the several methods or combinations thereof may be found advantageous for certain applications and conditions.

In communication-satellite systems, using low or medium altitude orbits, the relative velocities of satellites are of different magnitudes and direction with respect to each earth station. The resultant Doppler effects, at the order of frequency being considered, are large and variable and need suitable correction.

For reasons of simplicity and reliability of the space station, taking into consideration limitations in radio-frequency power and the need for suitable quality of transmission, the use of frequency-modulation both to and from the space station has merit. The space station can then be a simple heterodyne converter which translates the received signal spectrum to another frequency band for retransmission.

The use of frequency modulation is attractive for many reasons, such as its relatively low transmitter power requirement, resistance to Doppler frequency-shifts and ease of preserving satisfactory quality of a multiplicity of voice channels. It is also a thoroughly understood and established technique for line-of-sight radio-relay systems.

In relation to simultaneous access or feasibility of interconnection, it is impracticable for several earth stations to use a common carrier frequency for FDM-FM transmission to the satellite. Hence, each earth station would frequency modulate its own radio-frequency carrier in a separate sub-channel, all of which would be received by the satellite. If the satellite repeater is a linear frequency translator, these sub-channels will be retransmitted to the earth station receivers for separation, individual detection and subsequent selection of the desired voice (or other) signals. An alternate method involves signal processing in the satellite, requiring selection and detection of the radio-frequency sub-channels and translation of their signal channels to a common baseband for FM retransmission with a single carrier frequency. Such signal processing provides flexibility in accommodating traffic peaks, periodic traffic redistributions and signals having greatly different baseband widths.

Doppler-shift effects are minimized in stationary systems, and single-sideband techniques may be attractive. The maximum number of individual communication channels within a given bandwidth can be obtained by single-sideband techniques. However, the overall spectrum conservation achieved by use of such a technique is a function of a number of system parameters besides the method of modulation.

Consideration is being given to a system wherein the earth-to-space station transmissions employ SSB-FDM transmission and the space-to-earth station transmissions employ FDM-PM, this modulation change being accomplished in the satellite without detection to base-band. Such systems would add little complexity in the space station. Consideration might also be given to a system employing SSB-FDM transmission in both directions at such time as increased radio-frequency power becomes available in space stations.

Time-division multiplexing may offer the possibility of working with lower power at the expense of increased bandwidth. However, interleaving of pulses from several earth stations at the satellite would require difficult synchronization techniques. Hence, such a time-division system appears less desirable than one employing frequency-division.

OPINION 3*

DATA ON TRAFFIC LOADING AND ROUTING FOR USE
IN DEVELOPING COMMUNICATION-SATELLITE SYSTEM FACILITIES
(Question 235(IV))

(Geneva, 1963)

The C.C.I.R.,

considering

a) that communication-satellite systems promise to provide a means of communication between countries on a global scale;

b) that the design and operation of a global communication-satellite system or systems should depend, amongst other factors, upon the traffic density and its characteristics and locations;

c) that in planning global communication-satellite facilities, it will be necessary to examine the world's regional and inter-regional traffic patterns to forecast the volume and routing of traffic, which might be accomodated via such facilities; and

d) that the Plan Committee (Joint C.C.I.T.T./C.C.I.R. Committee) is preparing a questionnaire for submission to the Administrations to collect data on global traffic in preparation for its meeting in Rome in November-December 1963;

is unanimously of the opinion

that the Plan Committee should provide, for use by interested Administrations at the Extraordinary Administrative Radio Conference, Geneva, 1963, and subsequently:

1. information as to the nature, volume and routing of international, regional and global traffic, from or to the different countries, for 1962 and for such subsequent years for which it might assemble such information;

2. forecasts for 1968, and, if possible, up to 1975, of the volume of global traffic, from or to the different countries, and its routing which might be accommodated via communication-satellite systems, the forecasts being revised as opportunities offer.

* This Opinion has been brought to the attention of the Extraordinary Administrative Radio Conference, Geneva, 1963.

## QUESTION 235(IV)*

## TECHNICAL CHARACTERISTICS OF COMMUNICATION-SATELLITE SYSTEMS

(Geneva, 1963)

The C.C.I.R.,

considering

a) that active or passive communication-satellite systems may well be an important means in the future for fixed and mobile communication, both regional and global;

b) that the frequency bands to be used by such systems should be the subject of international agreement, not only to facilitate the setting up of communication links between earth stations in different countries, but also to avoid interference to and from other satellite systems and terrestrial services which may share the same frequency bands;

c) that the choice of preferred frequency bands for such systems is determined by a number of factors including the characteristics of wave propagation, radio noise levels, the feasibility of frequency sharing with terrestrial services, the beamwidths and size of antennae, tracking considerations and pay-load limitations;

d) that the scope for development and future application of such systems will depend to a great extent upon the feasibility of sharing frequency bands used by terrestrial services, without mutual interference;

e) that the total frequency space required by such systems will be determined in part by the technical characteristics employed, including the arrangement and method of modulation of the radio-frequency carriers, having regard to spectrum economy;

f) that the establishment of such systems would require international agreement on the technical characteristics to be employed, including the baseband, modulation and radio-frequency characteristics;

unanimously decides that the following question shall be studied:

1. what are the preferred types of orbits and characteristics for active and passive communication-satellite systems for the following applications:

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* This Question, together with Question 242(IV), replaces Question 209.

1.1 fixed services for multi-channel telegraphy and telephony, television and data transmission;

1.2 mobile services providing telegraphy, telephony and data transmission, between fixed earth stations and/or mobile stations;

2. what are the preferred frequency-bands for these applications;

3. under what conditions and to what extent is it feasible for communication-satellites, operating in the same system or operating in different systems, to share these preferred frequency bands;

4. under what conditions and to what extent would it be feasible for communication-satellite systems to share these preferred frequency bands with terrestrial services;

5. should radio-frequency channelling or preferred reference-frequency arrangements be employed in all or a portion of the preferred bands by communication-satellite systems used for the applications referred to in paragraph 1, and if so, what channelling arrangements are preferred;

6. what are the preferred baseband and modulation characteristics for these applications ?

STUDY PROGRAMME 235E(IV)*

FACTORS AFFECTING FREEDOM OF ACCESS IN COMMUNICATION-SATELLITE SYSTEMS

(1962 - Geneva, 1963)

The C.C.I.R.,

considering

a) that communication-satellite systems may require simultaneous use by large numbers of earth stations at various locations, this being termed "freedom of access";

b) that this freedom of access may be affected by the orbital design of the system;

c) that this freedom of access may be affected by the choice of modulation techniques used;

d) that this freedom of access may be affected by the interference characteristics of the system or systems used;

e) that multiple access requirements may dictate a system design, different from that which may be optimum for limited access systems;

unanimously decides that the following studies should be carried out:

1. what factors determine the accessibility of a communication-satellite system to a number of earth stations simultaneously or in random order;

2. to what extent does the choice of orbital parameters affect this freedom of access, and are there preferred orbits for such freedom of access;

3. to what extent does the type of modulation and channel arrangement employed affect freedom of access, and are there preferred types of modulation and channel arrangements for such freedom of access;

4. what are the effects of the preferred choices resulting from paragraphs 2 and 3 on the possibilities of sharing with terrestrial services and with other satellite systems of the same and of different type ?

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* This Study Programme replaces Study Programme 178.

RECOMMENDATION 258 *

SINGLE-SIDEBAND AERONAUTICAL AND MARITIME MOBILE RADIOTELEPHONE EQUIPMENTS

(Question 162)

The C.C.I.R. (Los Angeles, 1959)

considering

a) that the main advantages of single-sideband working (SBB), as compared with double-sideband (DSB), for mobile radiotelephony, are as follows:

a.a reduction of bandwidth required per channel;

a.b increase in signal-to-noise ratio or, alternatively, reduction in transmitter power (and hence antenna voltage), for the same signal-to-noise ratio, improvements dependent upon the degree of carrier suppression;

a.c reduction of the type of distortion that is due to selective fading;

a.d reduction of interference, particularly that due to beat notes, between carriers dependent on the degree of carrier suppression;

a.e reduction of interference, due to cross-modulation between adjacent channel transmissions;

b) that the disadvantages of SSB compared with DSB for mobile radiotelephony, are as follows:

b.a more rigorous requirements for transmitter and receiver frequency stability;

b.b greater complexity of apparatus;

b.c higher prices of the equipment;

b.d higher maintenance costs for the equipment;

b.e impracticability of conversion of existing mobile DSB equipments for SSB operation;

b.f Doppler effects, that are significant for very high-speed mobile units;

* This Recommendation terminates the study of Question 162. The references to the Radio Regulations have been inserted subsequently.

c) that the MF-radiotelephony bands, used in the maritime services (i.e. world-wide 1605 to 2850 kc/s and additionally, in Region 1, 3155 to 3800 kc/s):

c.a include the international calling and distress frequency 2182 kc/s;

c.b are shared with fixed services;

c.c are used by many low tonnage ships, some compulsorily and others voluntarily fitted exclusively with DSB MF-radiotelephony equipments;

d) that the parts of the HF bands (i.e. 4000 kc/s and 23,000 kc/s for mobile maritime and 2850 kc/s to 24000 kc/s for aeronautical use), allocated to the respective services;

d.a do not include any international distress frequency;

d.b are exclusively allocated to these services;

e) that in the maritime mobile services, the advantages of SSB operation predominate over the disadvantages to a greater extent in the HF than in the MF band;

f) that, in the maritime mobile services, in the interests of safety of life at sea, the introduction of SSB operation should not be allowed to discourage the extension of voluntary fitting of DSB MF-radiotelephony equipment;

unanimously recommends

1. for the maritime mobile services (see also Appendices 15 and 17 to the Radio Regulations, Geneva, 1959, and Recommendation No. 28 of the Administration Radio Conference, Geneva, 1959);

1.1 that SSB operation be introduced as far as operationally required in the MF and HF radiotelephony bands;

1.2 that coast stations be prepared to communicate with DSB and SSB shipborne equipment;

1.3 that for SSB equipment the following technical characteristics be employed:

1.3.1 for an interim period the degree of carrier reduction should be 16 to 26 db below the peak envelope power and every endeavour should be made to achieve a carrier suppression of at least 40 db as soon as possible;

1.3.2 the carrier frequency of the transmitters should be maintained within the following tolerances:

1.3.2.1 for coast stations ± 20 c/s;

1.3.2.2 for ship stations the short-term limits (of the order of 15 min.) should be ± 40 c/s*;

1.3.2.3 for ship stations long-term limits of ± 350 c/s (in the 8, 12, 16 and 22 Mc/s bands) and ± 100 c/s (in the 2 and 4 Mc/s bands) should be permitted for an interim period and every endeavour should be made to achieve limits of ± 100 c/s as soon as possible in all bands;

1.3.3 the carrier frequency stability of SSB receivers should be maintained within the following tolerances:

1.3.3.1 for coast stations ± 20 c/s;

1.3.3.2 for ship stations the short-term limits should be ± 40 c/s*;

1.3.3.3 if spot frequency (i.e. fixed frequency pre-tuned) shipborne receivers are used, long-term limits of ± 350 c/s should be permitted for an interim period and every endeavour should be made to achieve limits of ± 100 c/s as soon as possible;

1.3.4 the upper sideband should be used (see Appendix 15, Section B and Appendix 17 of the Radio Regulations, Geneva, 1959);

1.3.5 the channel arrangements should be such, that two SSB channels are accommodated within each existing DSB channel and the bandwidth of the SSB emissions should be kept within such limits as will permit this to be done (it is proposed that the precise arrangement of these SSB channels should be further discussed at the Administrative Radio Conference);

1.3.6 the transmitter audio-frequency band should be 350 to 2700 c/s, with a permitted amplitude variation of 6 db;

1.3.7 the unwanted frequency modulation of the SSB carrier should be sufficiently low to prevent harmful distortion;

1.3.8 in the MF maritime mobile radiotelephony bands, SSB ship stations should be able to insert a carrier at a level sufficient to permit satisfactory reception by DSB receivers when communicating with DSB stations;

1.3.9 in the particular case of transmissions on the radiotelephone calling and distress frequency 2182 kc/s, all transmissions

* This value may be maintained either manually or by other means.

should be made either by DSB, or by SSB, with carrier insertion sufficient to permit satisfactory reception by DSB receivers;

1.4 that the attention of Administrations should be drawn to the fact that, there would be technical and operational advantages in designating certain frequencies for international common use for ship-shore and inter-ship working;

2. that for the aeronautical mobile service, the Director, C.C.I.R. should:

2.1 formally acquaint the I.C.A.O. of the interest of the C.C.I.R. in the study of SSB working in the aeronautical and maritime mobile services;

2.2 invite the I.C.A.O. to advise the C.C.I.R. of any technical or operational problems on which they would like the assistance of the C.C.I.R.;

2.3 offer to keep the I.C.A.O. informed of progress made by the C.C.I.R. in the study of the application of SSB working in the maritime mobile services;

2.4 request the I.C.A.O. to keep the C.C.I.R. informed of progress made by the I.C.A.O. in the study of the application of SSB working in the aeronautical mobile services.

## QUESTION 272 (XIII)

## SIGNAL-TO-INTERFERENCE PROTECTION RATIOS AND MINIMUM FIELD-STRENGTHS REQUIRED IN THE MOBILE SERVICES

The C.C.I.R. (Geneva, 1963)

considering

a) that full effect should be given to the studies which the Administrative Radio Conference, Geneva, 1959, in its Recommendation No. 3, invited the C.C.I.R. to continue for all services;

b) that for certain kinds of mobile services, partial data relating to interference protection ratios and minimum field strengths required, exist in documents of some Conferences of the I.T.U., for example, in the Final Acts of the International Administrative Aeronautical Radio Conference, Geneva, 1948-1949 and of the Special Regional Conference, Geneva, 1960;

c) that such documents, however, do not constitute a complete and consistent set of data relating to all kinds of mobile services operating in all frequency ranges, particularly with respect to VHF mobile services;

unanimously decides that the following question should be studied:

1. what are the signal-to-interference protection ratios which define the threshold of harmful interference for the several mobile services;

2. what are the signal-to-noise ratios and the minimum field-strengths required for satisfactory reception of the different classes of emission in the several mobile services;

3. what are the appropriate fading allowances in the several mobile services?

Note 1 - The above studies should be continued simultaneously and with the same urgency.

Note 2 - Particular attention should be given to those studies which will assist the further refinement of the technical standards used by the International Frequency Registration Board.

Note 3 - The above-mentioned studies should be carried on permanently and recommendations and possible revisions be published as soon as practicable.

# AERONAUTICAL CONFERENCE

Document No. I-16-E
15 October, 1963
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Commonwealth of Australia

## PROPOSAL RELATING TO THE DETERMINATION OF FREQUENCY REQUIREMENTS FOR REGIONAL AND DOMESTIC AIR ROUTE OPERATIONS

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SUMMARY

This paper discusses the application of queueing theory to an aeronautical mobile channel in order to establish an appropriate peak-hour channel utilization factor to which frequency requirements may then be related.

1. Introduction

1.1 The I.C.A.O. Special Communications Meeting, Montreal, 1963, confirmed, with modifications, the approach used in 1948 by the I.A.A.R.C. for the determination of frequency requirements for international (MWARA) operations. At the same time, it recognised that, because of the widely differing forms of flight operations encountered in some RDARA's the strict application to RDARA's of the formulae developed from MWARA's may not be feasible.

1.2 Recommendation 8/6 of the above meeting encourages States to undertake studies in advance of the Aeronautical E.A.R.C. that will permit the Conference to develop an appropriate method for determining frequency requirements for RDARA operations.

1.3 Australian investigations of communication traffic loading on aeronautical mobile channels have made use of queueing theory to calculate the number of channels required in terms of acceptable message delays. It is believed that this method could be of value to the E.A.R.C. in establishing the principles on which requirements for RDARA operations should be assessed.

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2. The development of a formula for determination of RDARA frequency requirements

2.1 The following comments on the situation in Australia, the need for the development of a formula and a suggested method of approach are included because it is considered that other countries at a similar stage of development are likely to encounter similar problems.

2.2 Because of its relatively large geographical area and low population density, Australia is forced by economic factors to rely largely upon HF to provide Aeronautical mobile communications. In the more densely populated areas in the East and South-East of the continent the use of VHF has been developed to the greatest extent practicable and the major inter-capital air routes between Adelaide, Melbourne, Sydney and Brisbane are now served almost entirely by VHF. However, large areas of the continent will require HF communication services for many years to come.

2.3 The ratio of domestic to international movements in Australia is very high, being in excess of 40 to 1 for scheduled services. For this reason, and in view of the reliance placed on HF to provide communications for domestic operations, it is considered that there is a very strong case for the development of an appropriate method for determining frequency requirements for RDARA operations so that an equitable division of frequencies between MWARA and RDARA operations may be maintained.

2.4 Two major factors have influenced the development of a satisfactory method for the determination of RDARA frequency requirements in Australia :-

a) The pattern of non-scheduled domestic movements is so random and so complex that a division into routes would be impracticable.

b) Reference to Appendix 1 will show that in certain areas the ratio of actual aircraft movements to scheduled aircraft movements is as high as 20 : 1.

2.5 It is therefore suggested that statistics for RDARA operations should be based on designated geographical areas rather than on route structure and further comment on the choice of these areas appears at Paragraph 3.

2.6 Since it is desirable to keep to a minimum the amount of work associated with the collection of statistics, it is considered that the determination of stage lengths for non-scheduled operations should be avoided if practicable since this could involve a detailed examination of each flight. As an alternative, this paper proposes that the requirements for RDARA operations can be best assessed by direct measurements on the existing frequency channels - either in terms of the channel occupancy

(utilization factor) or in terms of the number of aircraft requiring service which can be related to the utilization factor. Paragraphs 4, 5 and 6 of this paper discuss the matter in which this may be accomplished.

3. Choice of appropriate geographical areas

Sub-paragraph 2.5 suggests that a revision of the RDARA portion of the Frequency Allotment Plan should be based on designated areas. These areas should be of an optimum size. Each should be small enough to ensure that the practicability of frequency sharing with another area does not vary greatly within the area and should be sufficiently large to obviate unnecessary detail. Furthermore, it is desirable that the frequency networks on which measurements are made should be related as closely as possible to the designated areas. The geographical division of the world into RDARA's and their sub-areas as defined by the existing Allotment Plan meets these requirements and it is considered that these areas should be used to indicate the areas for which statistics are required. It is suggested that where two or more countries fall within the one RDARA or sub-area, their individual frequency requirements may be stated separately and, when necessary, combined to indicate the total requirement for the area.

4. Queueing delays

The application of queueing theory to the calculation of expected delays on a communications channel requires a knowledge of :

(i) The holding (or service) time ($\frac{1}{\mu}$), which is the mean time occupied in obtaining service from a facility. In the case of an aeronautical mobile communications channel this may be considered equal to the average message contact length.

(ii) The inter-arrival (or headway) time ($\frac{1}{\lambda}$), which is the mean interval between the start of successive message contacts.

4.1 In practice it is often more convenient to measure the channel utilization factor, U, which is the fraction of time the channel is in use. It can also be shown that :

$$U = \frac{\lambda}{\mu} \qquad (1)$$

4.2 Cassidy (Reference 1) has shown that for practical purposes the holding times and the inter-arrival times on a typical aeronautical mobile channel both have approximately a negative exponential distribution.

4.3 A formula developed by Morse (Reference 2) can be applied to such a channel, to calculate the queueing delay. The probability, $P_T$ of a queueing delay of $T_d$ or more, may be expressed in the following manner :

$$P_T = U \exp\left(-(1-U)\,\mu\, T_d\right) \qquad (2)$$

4.4 In the application of this formula to aeronautical mobile communications it is more convenient to express the queueing delay in terms of the channel utilization factor. This may be obtained by re-arrangement of (2) as follows :

$$T_d = \frac{\ln U - \ln P_T}{(1-U)\,\mu} \qquad (3)$$

and

$$\mu\, T_d = \frac{\ln U - \ln P_T}{1-U} \qquad (4)$$

4.5 This formula (4), which has been plotted in graphical form at Appendix 2, may be used to estimate the queueing delay (expressed in units of the average holding time as measured from a sample). $P_T$, the probability of a queueing delay, is, of course, equal to the proportion of messages delayed and the latter definition is used for clarity on the graph.

4.6 The minimum acceptable grade of service on an aeronautical mobile channel may be specified by the queueing delay which is suffered by a given percentage of messages. Having determined the magnitude of message delays which are acceptable on the channel and having measured the average holding time, it is also possible by use of the graph at Appendix 2 to specify the maximum permissible channel utilization factor for these conditions.

4.7 As measured in Australia, typical peak-hour values for the HF aeronautical mobile service are as follows :-

Holding time, $\frac{1}{\mu}$ = 16 to 20 seconds

Inter-arrival time, $\frac{1}{\lambda}$ = 60 to 140 seconds

4.8 To illustrate the use of the graph at Appendix 2, assume that the average holding time on an aeronautical mobile channel is 18 seconds and that delays of 30 seconds or more (equivalent to 1.7 units of average holding time) are acceptable on 5 per cent of the contacts; then the maximum permissible channel utilization factor would be approximately 0.2. Using the curves for 1% and 10% it can also be deduced that for this utilization, 1% of the messages will suffer a delay of 3.8 units (68 seconds) or more and 10% of the messages will be delayed approximately 0.9 units (16 seconds) or more.

4.9 Throughout this paragraph it has been assumed that service is given in strict order of the queue and that users do not leave the queue voluntarily.

4.10 It is noted that I.C.A.O. Doc. 8259 - COM/553 - Manual on the Planning and Engineering of the Aeronautical Fixed Telecommunication Network (Reference 3) gives some information on queueing delays in Part III - Performance of the AFTN. The basis for calculation of queueing delays is the same as used in this paper although the method of presenting it here in terms of the percentage of messages which suffer delay is felt to be more satisfactory than considering an average delay figure for all messages. In addition, it is considered unwise to draw too close a parallel between the fixed service and aeronautical mobile service particularly in respect to setting criteria for permissible delay to messages.

## 5. The significance of acceptable message delay

5.1 The significance of message delays is related to the basic function of aeronautical mobile communications which form part of a control loop [(aircraft)-(pilot) - (ground-controller) - (pilot)-(aircraft)] over which information must pass. This control loop exhibits some characteristics of a feed-back loop and the response time of the portion [(pilot) - (ground-controller) - (pilot)] may extend up to 100 seconds but is typically 20-25 seconds and is dependent among other things on the stage of the flight and the degree of control exercised. In discussing this, Cassidy (1) has suggested that the allowable response time in the control loop is a function of collision probability and hence of absolute and relative aircraft speeds and traffic density as it affects air traffic controller and communications officer workload and communications channel delays.

5.2 On international aeronautical mobile channels a peak-hour utilization factor of about 0.4 appears to have received general acceptance. This means that on the average at the peak hour 20% of the messages are delayed by 1.2 units of the average holding time, 5% by 3.5 units and 1% by 6.2 units of the average holding time. In Australia, where domestic traffic density is relatively high and separation standards are small, a channel utilization factor of 0.2 corresponding to a delay on 5% of the messages of approximately 1.7 units of average holding time (i.e., 1.7 x 18 = 30 seconds) has been selected as most appropriate.

5.3 To summarize, for a given criterion of acceptable message delay there is a corresponding channel utilization factor which should not be exceeded at the peak hour. It is considered that these are the factors on which the frequency requirements of an aeronautical mobile communications service should be based.

## 6. Determination of frequency requirements

6.1 As discussed in Paragraph 4, the required grade of service on an aeronautical mobile channel may be expressed in terms of the probability of a certain percentage of messages encountering a particular queueing delay. This in turn may be related to an acceptable channel utilization factor by reference to Appendix 2. This is illustrated by the example shown in sub-paragraph 4.8.

6.2 Where facilities are available for the direct measurement of peak-hour holding time and channel utilization factor, the latter may be compared with the acceptable channel utilization factor (or delay criterion) to establish the number of channels required.

6.3 Such an approach has been used in Australia to determine the frequency requirements of an HF Aeronautical Mobile network. The procedure adopted was as follows :

a) Establish the acceptable channel utilization factor in the light of operational requirements and the related acceptable message delay. (Refer sub-paragraph 4.8)

b) Determine the actual peak-hour utilization factor. This may be done by using traffic analyser equipment which samples the channel each second of time and records the engaged periods by means of telephone-type registers. Alternatively, this information may be obtained from an anlysis of tape recordings of peak-hour communications using a stop-watch or other appropriate time-recording device.

c) Compare the acceptable and actual peak-hour utilization factors and deduce therefrom the frequency channel requirements.

6.4 For example, if the acceptable channel utilization is taken as 0.2 and the actual utilization is 0.4, then the requirement is for one additional channel. It should be remembered that if the actual channel utilization is excessively high (i.e., approaching 1), the relationship between frequency requirements and utilization does not necessarily remain linear. In this case, if the actual utilization is 0.8, then it is likely that more than three additional channels would be required. This is brought about by the fact that the excessively high utilization factor causes expedients such as the omission of certain position reports or weather information or the use of non-standard procedures to be adopted in an attempt to reduce the channel utilization.

## 7. Relationship between utilization factor and number of aircraft on a channel

7.1 A channel utilization factor of U corresponds to a total time of U x 3600 seconds per hour during which the channel is occupied. When N is the number of aircraft on the channel and M is the number of contacts generated per hour per aircraft and $\frac{1}{\mu}$ is the holding time in seconds, then

$$U \times 3600 = N \times M \times \frac{1}{\mu}$$

and
$$N = \frac{3600 \times \mu \times U}{M} \qquad (5)$$

7.2 It will be seen that in order to assess the number of aircraft which may be supported on an aeronautical mobile channel, only one additional factor, M requires measurement, and this may be obtained by examination of recordings referred to in a sub-paragraph 6.3(b).

7.3. Observation of Australian HF aeronautical mobile channels shows that aircraft generate on the average, between 4 and 5 contacts per hour. Using typical values of $\frac{1}{\mu}$ = 18 seconds, $\frac{1}{\lambda}$ = 90 seconds (giving U = 0.2) and M = 4.5, the number of aircraft, $(N_p)$, which may be accommodated on a channel at the peak hour is obtained from :

$$N_p = \frac{3600 \times 0.2}{18 \times 4.5}$$

$$= 9 \text{ aircraft (approximately)}$$

7.4 Hence, if more convenient, the number of aircraft accommodated by a channel at the peak hour may be used as a measure of the frequency requirements. Nevertheless, it is believed that the approach described herein which establishes requirements directly in terms of the peak-hour channel utilization factor is to be preferred to one which amasses volumes of statistics of aircraft movements and then proceeds to derive requirements by means of a number of generalisations and assumptions.

## 8. Proposed action

Australia proposes that in developing an appropriate method for determining frequency requirements for RDARA operations the Conference should consider the use of data based on acceptable message delays as described herein.

## References

1. Commonwealth of Australia : Department of Civil Aviation :

"An Engineering Evaluation of the Communications Requirements for the Provision of Air Traffic Services" (written by M. Cassidy, 1962) *)

2. Morse, P.M. "Queues, Inventories and Maintenance", John Wiley and Sons Inc. 1958.

3. I.C.A.O. Doc. 8259 - COM.553 - Manual on the Planning and Engineering of the Aeronautical Fixed Telecommunications Network.

Appendices: 2

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*) A restricted number of copies of this document can be made available to the Conference.

# A P P E N D I X 1

## COMMONWEALTH OF AUSTRALIA

## DEPARTMENT OF CIVIL AVIATION

### Comparison of Actual and Scheduled Aircraft Movements

### 1961/62

| Station | Scheduled Movements | Actual Movements*) | Ratio of Actual to Scheduled Movements |
|---|---|---|---|
| Adelaide | 14,762 | 11,376 / | 0.77 |
| Alice Springs | 2,349 | 12,748 | 5.42 |
| Brisbane | 18,487 | 27,006 / | 1.46 |
| Broken Hill | 1,743 | 11,788 | 6.77 |
| Cairns | 3,248 | 11,872 | 3.65 |
| Carnarvon | 910 | 5,226 | 5.74 |
| Charleville | 1,054 | 24,774 | 23.4 |
| Cloncurry | 1,395 | 26,938 | 19.3 |
| Darwin | 4,944 | 13,398 / | 2.71 |
| Dubbo | 1,496 | 24,240 | 16.1 |
| Longreach | 1,754 | 19,500 | 11.1 |
| Melbourne | 36,628 | 43,938 / | 1.20 |
| Perth | 6,272 | 22,976 / | 3.65 |
| Pt. Hedland | 1,860 | 8,066 | 4.34 |
| Sydney | 52,579 | 32,652 / | 0.62 |
| Townsville | 6,506 | 13,222 / | 2.03 |

*) Derived from H.F. flight data display strips.

/ The total actual movements at Adelaide, Brisbane, Darwin, Melbourne, Perth, Sydney and Townsville are greater than the number shown, because this table does not include aircraft using VHF only.

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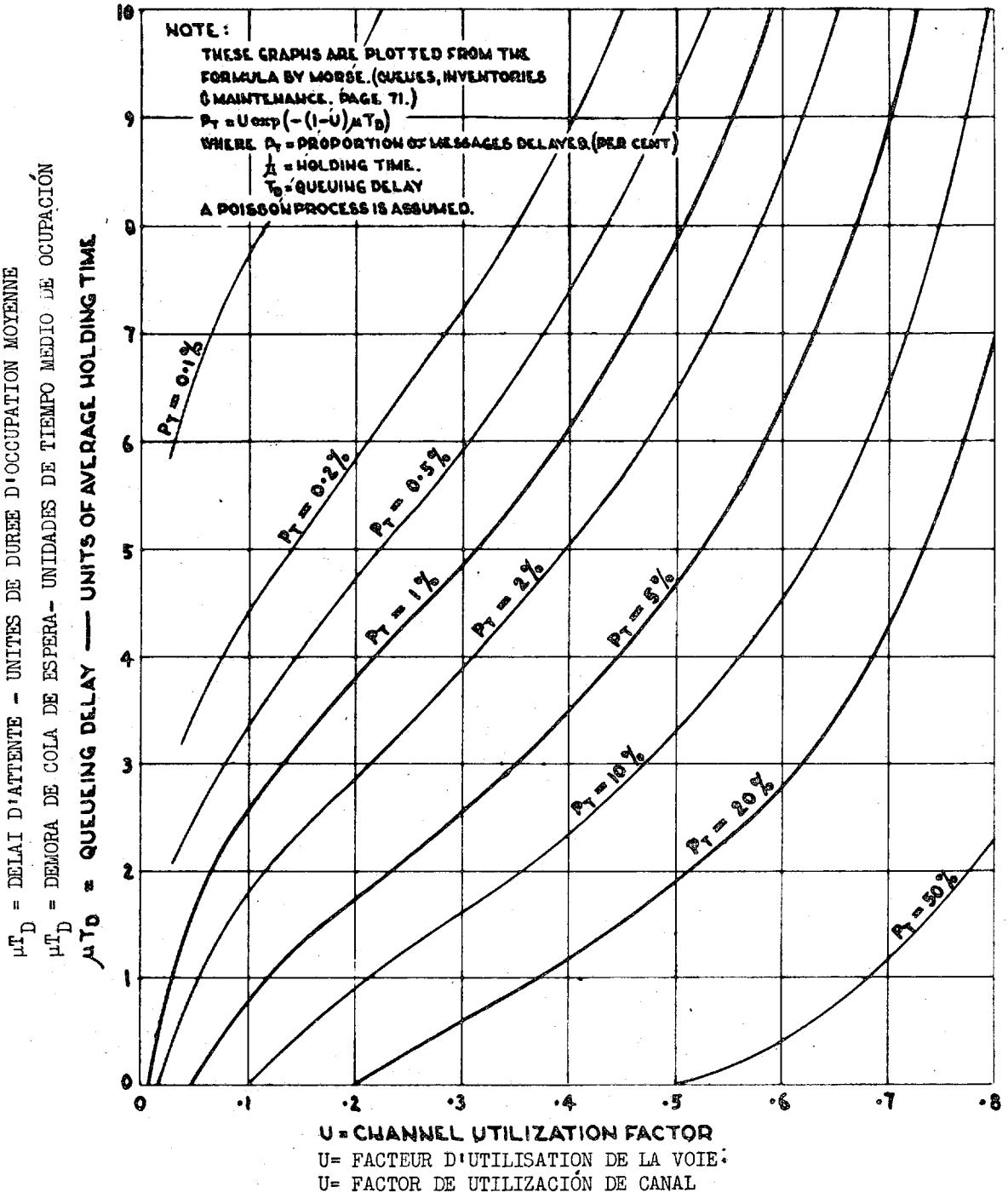


## GRAPH OF QUEUEING DELAY v CHANNEL UTILIZATION

VARIATIONS DU DELAI D'ATTENTE EN FONCTION DE L'UTILISATION DE LA VOIE

GRÁFICO DE LA DEMORA DE COLA DE ESPERA EN FUNCIÓN DE LA UTILIZACIÓN DE CANAL

NOTE:

CE GRAPHIQUE A ETE ETABLI D'APRES LA FORMULE DE MORSE. ("QUEUES, INVENTORIES & MAINTENANCE", PAGE 71).

$P_T = U \exp(-(1-U)\ \mu\ T_D)$

OU $P_T$ = POURCENTAGE DE MESSAGES AYANT SUBI UN DELAI D'ATTENTE

$\frac{1}{\mu}$ = DUREE D' OCCUPATION

$T_D$ = DELAI D' ATTENTE

(DANS L'HYPOTHÈSE D' UN PROCESSUS DE POISSON).

NOTA:

SE HAN TRAZADO LOS GRÁFICOS A PARTIR DE LA FÓRMULA DE MORSE. (COLAS DE ESPERA, INVENTARIOS Y MANTENENCIA, PÁG. 71)

$P_T = U \exp(-(1-U)\ \mu\ T_D)$

DONDE $P_T$ = PROPORCIÓN DE MENSAJES DEMORADOS (PORCENTAJE)

$\frac{1}{\mu}$ = TIEMPO DE OCUPACIÓN

$T_D$= DEMORA DE "COLA DE ESPERA"

SE SUPONE QUE SE TRATA DE UNA DISTRIBUCIÓN DE POISSON.

# AERONAUTICAL CONFERENCE

Corrigendum to
Document No. I-17-E
27 January 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

## A N N E X 2

On pages 9 to 14, add a cross in the column "Invitation accepted" opposite the following :

5. Argentine Republic
12. Brazil
16. Cameroon (Federal Republic of)
24. Colombia (Republic of)
28. Costa Rica
37. Spain
39. Ethiopia
46. Guinea (Republic of)
54. Iraq (Republic of)
59. Jamaica
112. Territories of the United States of America
113. Overseas Territories for the international relations of which the Government of the United Kingdom of Great Britain and Northern Ireland are responsible
118. U.S.S.R.

ARCHIVES U.I.T. GENÈVE

# AERONAUTICAL CONFERENCE

Document No. I-17-E
23 January, 1964
Original: French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Note by the Secretary-General

INVITATIONS TO THE CONFERENCE

In accordance with Chapter 3 of the General Regulations annexed to the International Telecommunications Convention, the Secretary-General has taken the necessary steps, in the absence of an inviting Government and by agreement with the Government of the Swiss Confederation, to convene and organize the preparatory meeting of the Extraordinary Administrative Radio Conference for the preparation of a Revised Allotment Plan for the Aeronautical Mobile (R) Service.

1. Invitations to Members and Associate Members

On 27 May, 1963, invitations were sent to the Administrations of the Members and Associate Members of the Union (see Annex 1).

1.1 The opening date of the Conference - scheduled originally for 10 February - had to be brought forward to 27 January since it was impossible to obtain suitable premises. The Administrations were consulted about this change in date by Circular-telegram No. 65/22 dated 22 October, 1963, and a majority of the Administrations accepted that the opening date of the Conference be brought forward to 27 January.

1.2 By 23 January, 1964, replies to the invitations were as shown in Annex 2.

2. Invitations to the United Nations and the Specialized Agencies

In accordance with Chapter 1 of the General Regulations annexed to the Convention, the United Nations and the following Specialized Agencies have been invited to send observers in an advisory capacity :

International Atomic Energy Agency (I.A.E.A.)
International Development Association (I.D.A.)
International Bank for Reconstruction and Development (I.B.R.D.)
International Monetary Fund (I.M.F.)
International Civil Aviation Organization (I.C.A.O.)

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United Nations Food and Agriculture Organization (F.A.O.)
United Nations Educational, Scientific and Cultural Organization (U.N.E.S.C.O.)
Inter-Governmental Maritime Consultative Organization (I.M.C.O.)
International Labour Organization (I.L.O.)
World Meteorological Organization (W.M.O.)
World Health Organization (W.H.O.)
International Finance Corporation (I.F.C.)
Universal Postal Union (U.P.U.)

By 23 January, 1964, only I.C.A.O. had announced that it was certain to participate. I.M.C.O. said that it would do its utmost to be represented. The other organizations declined the invitation.

3. Notification to International Organizations

The International Air Transport Association (I.A.T.A.), having been advised that the Conference was going to meet, submitted a request to be admitted.

In addition, the International Broadcasting and Television Organization (I.B.T.O.) Prague, when informed about the Conference, expressed its intention of sending observers. This organization has communicated that it is particularly interested in technical problems relative to frequency usage in the bands allocated to the aeronautical mobile service in the neighbourhood of those allocated for broadcasting.

It should be noted that the Administrative Council has exempted these Organizations from any share in the expenses of I.T.U. Conferences, in accordance with No. 212 of the Convention.

Gerald C. GROSS
Secretary-General

Annexes : 2

# A N N E X 1

International Telecommunication Union

General Secretariat

No 3941/62/AEI

Geneva, 27 May 1963

Subject : Extraordinary Administrative Radio Conference for the preparation of a Revised Allotment Plan for the Aeronautical Mobile (R) Service

Dear Sir,

The Administrative Radio Conference, Geneva, 1959, resolved that, when the Administrative Council deemed it appropriate and timely, an Extraordinary Administrative Radio Conference should be convened to review Appendix No. 26 to the Radio Regulations and the provisions of the Regulations associated therewith.

During its 17th session, the Administrative Council decided that such a conference should be held in two parts, the first, a preparatory session, to be held in February or March 1964, and the second or main session to be held early in 1965 (Decision No. D 282).

At its 18th session, the Council decided that there was an urgent need to review and revise that portion of Appendix No. 26 relating to the allotment of frequencies for the Aeronautical Mobile (R) Service, and proposed that the First (Preparatory) Session of an Extraordinary Administrative Radio Conference for the preparation of a revised allotment plan for that Service should be convened in Geneva on 10 February 1964 for a duration of four weeks.

The agenda for the Session, as proposed by the Council, is contained in Resolution No. 525 (see Annex 1).

The Council agreed to consider at its 1964 Annual Session the date and duration of the Second (main) Session, which will also be held in Geneva.-

The proposals of the Council were submitted to all Members of the Union by circular-telegram No. 25/26, on 26 April 1963, and have now been approved by a majority of the Members of the Union. The conditions for convening the First Session are therefore fulfilled.

In accordance with the provisions of Chapters 2 and 3 of the General Regulations annexed to the International Telecommunication Convention, Geneva, 1959, I now have the honour to invite the Government of your country to send a delegation to the "First (Preparatory) Session of the Extraordinary Administrative Radio Conference for the preparation of a revised allotment plan for the Aeronautical Mobile (R) Service", which will open in Geneva on 10 February 1964 with the agenda specified in paragraph 2 of the Resolution contained in Annex 1 to this letter. Should you so desire, you may inform the private operating agencies recognized by your Administration of this invitation.

I should be grateful if you could let me know, at your earliest convenience, whether you accept this invitation.

Under the provisions of Chapter 4 of the General Regulations annexed to the Convention, I should be obliged if you would send me your proposals for the work of the Session at the earliest possible moment, preferably before 15 September 1963.

I would also draw your attention to the provisions of Article 16 of the Convention concerning the use of languages at conferences of the Union.

It would be of great assistance to us, in connection with the organization of the Session, if you could arrange to send, at your earliest convenience, but in any case not later than 31 December 1963, particulars of each member of your delegation, in the form indicated in Annex 2 to this letter.

Yours faithfully
For the Secretary-General

(signed) M.B. SARWATE
Deputy Secretary-General

Annexes : 2

Annex 1

to letter No. 3941/62/AEI of 27 May, 1963

No. 525.- EXTRAORDINARY ADMINISTRATIVE RADIO CONFERENCE FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE SERVICE
(cf. Docs. 3040, 3096 and 3105/CA18 - March/April 1963)

The Administrative Council,

considering

a) that the Administrative Radio Conference, Geneva, 1959, in its Resolution No. 13, resolved that :

"When the Administrative Council deems it appropriate and timely, an Extraordinary Administrative Radio Conference be convened under the provisions of Article 7 of the International Telecommunication Convention to review Appendix 26 and the provisions of the Radio Regulations associated therewith and to complete its work before the next Ordinary Administrative Radio Conference;" and

b) that it is urgent that the Plan for the Allotment of Frequencies for the Aeronautical Mobile (R) Service in the exclusive bands between 2850 and 17970 kc/s and the pertinent technical and operational considerations contained in Appendix 26 to the Radio Regulations, Geneva, 1959, be reviewed and revised to provide more adequately for the communication requirements of international scheduled airline operations;

c) that the said Resolution No. 13, as well as Resolution No. 14, enumerate some of the problems relating to the use of frequencies by the Aeronautical Mobile (R) Service;

d) that it is desirable to confine the Extraordinary Administrative Radio Conference referred to in Resolution No. 13 to a revision of only those portions of Appendix 26 which are in urgent need of revision;

having noted

the recommendations of I.C.A.O. reported in Document No. 2759/CA17 and the report by the Secretary-General of I.C.A.O. on the Special COM Meeting of I.C.A.O. annexed to Document No. 3058/CA18.

resolves

1. that there is an urgent need to review and revise that portion of Appendix 26 relating to the allotment of frequencies for the Aeronautical Mobile (R) Service;

2. to propose to Administrations that a preparatory session of an Extraordinary Administrative Radio Conference for the preparation of a revised allotment plan for the Aeronautical Mobile (R) Service should be convened on 10 February 1964 for a duration of four weeks with the following agenda :

2.1 to establish technical criteria on which any revision of the Frequency Allotment Plan for the Aeronautical Mobile (R) Service, contained in Appendix 26 to the Radio Regulations, should be based;

2.2 to establish any other criteria which should be taken into account in any revision of this Frequency Allotment Plan and the Radio Regulations associated therewith;

2.3 to establish the operational principles on which requirements for high frequencies for Aeronautical Mobile (R) Service communications should be assessed;

2.4 to determine the form in which such requirements should be submitted to the Union and to fix the date by which they should be submitted;

3. to consider at its 1964 annual Session the date and duration of the main session with the following agenda :

on the basis of the decisions taken by the preparatory session of the Conference and the preparatory work undertaken by the I.F.R.B., to review and, to the extent considered necessary, revise the Frequency Allotment Plans for the Aeronautical Mobile (R) Service contained in Appendix 26 to the Radio Regulations, and the Radio Regulations associated therewith;

4. that both sessions will be held in Geneva;

5. that the Conference, if convened, shall be financed in accordance with No. 197 of the Convention;

instructs the Secretary-General

to consult the Members of the Union regarding the above proposals in accordance with No. 65 of the Convention, applying, if necessary, the provisions of Nos. 548 to 550 thereof

---

Annex 2

to letter No. 3941/62/AEI

of 27 May, 1963

International Telecommunication Union

FIRST SESSION : AERONAUTICAL CONFERENCE

Geneva, February 1964

REGISTRATION FORM FOR PARTICIPANTS

(Please use block letters)

1. Country or Organization : .....

2. Mr. Mrs. Miss .....
(name) (first name) (title)

3. Title in Administration : .....

4. Head of delegation : ☐ representative : ☐

deputy : ☐ observer : ☐

delegate : ☐ delegation secretariat : ☐

adviser : ☐

5. Number of documents required : French ..... English ..... Spanish .....

6. Accompanied by : ..... (members of family)

7. Address in Geneva : ..... Tel. No. .....

8. Home address of family : ..... Tel. No. .....
(for free telephone calls)

Signature .....

Date .....

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# A N N E X 2

## MEMBERS AND ASSOCIATE MEMBERS OF THE UNION

| Member | Invitation accepted | Invitation declined |
|---|---|---|
| 1. Afghanistan | | |
| 2. Albania (People's Rep. of) | | |
| 3. Algeria (Dem. & Pop. Rep. of) | + | |
| 4. Saudi Arabia (Kingdom of) | | |
| 5. Argentine Republic | | |
| 6. Australia (Commonwealth of) | + | |
| 7. Austria | + | |
| 8. Belgium | + | |
| 9. Bielorussian (Sov. Soc. Rep.) | | |
| 10. Burma (Union of) | | + |
| 11. Bolivia | | |
| 12. Brazil | | |
| 13. Bulgaria (People's Rep. of) | | |
| 14. Burundi (Kingdom of) | | + |
| 15. Cambodia (Kingdom of) | | |
| 16. Cameroon (Fed. Rep. of) | | |
| 17. Canada | + | |
| 18. Central African Republic | | |
| 19. Ceylon | + | |
| 20. Chile | | |

| Member | Invitation accepted | Invitation declined |
|---|---|---|
| 21. China | + | |
| 22. Cyprus (Republic of) | | + |
| 23. Vatican City State | | + |
| 24. Colombia (Republic of) | | |
| 25. Congo (Rep. of the) (Brazzaville) | | |
| 26. Congo (Rep. of the) (Leopoldville) | + | |
| 27. Korea (Republic of) | | |
| 28. Costa Rica | | |
| 29. Ivory Coast (Republic of the) | | + |
| 30. Cuba | + | |
| 31. Dahomey (Republic of) | | + |
| 32. Denmark | + | |
| 33. Dominican Republic | | |
| 34. El Salvador (Republic of) | | |
| 35. Group of Territories represented by the French Overseas Post and Telecommunication Agency | + | |
| 36. Ecuador | | |
| 37. Spain | | |
| 38. United States of America | + | |
| 39. Ethiopia | | |
| 40. Finland | + | |
| 41. France | + | |

| Member | Invitation accepted | Invitation declined |
|---|---|---|
| 42. Gabon Republic | | |
| 43. Ghana | + | |
| 44. Greece | | + |
| 45. Guatemala | | |
| 46. Guinea (Republic of) | | |
| 47. Haiti (Republic of) | | |
| 48. Upper Volta (Republic of) | | |
| 49. Honduras (Republic of) | | |
| 50. Hungarian People's Republic | | |
| 51. India (Republic of) | + | |
| 52. Indonesia (Republic of) | | |
| 53. Iran | | |
| 54. Iraq (Republic of) | | |
| 55. Ireland | + | |
| 56. Iceland | | |
| 57. Israel (State of) | | + |
| 58. Italy | + | |
| 59. Jamaica | | |
| 60. Japan | + | |
| 61. Jordan (Hashemite Kingdom of) | | |
| 62. Kuwait | + | |
| 63. Laos (Kingdom of) | | |
| 64. Lebanon | | |

| Member | Invitation accepted | Invitation declined |
|---|---|---|
| 65. Liberia (Republic of) | | |
| 66. Libya (United Kingdom of) | | |
| 67. Liechtenstein (Principality of) | | |
| 68. Luxembourg | | + |
| 69. Malaysia | | |
| 70. Malagasy (Republic of) | | + |
| 71. Mali (Republic of) | | |
| 72. Morocco (Kingdom of) | | |
| 73. Mauritania (Islamic Republic of) | | |
| 74. Mexico | + | |
| 75. Monaco | + | |
| 76. Nepal | | |
| 77. Nicaragua | | |
| 78. Niger (Republic of the) | | + |
| 79. Nigeria (Federation of) | | + |
| 80. Norway | + | |
| 81. New Zealand | + | |
| 82. Uganda | | |
| 83. Pakistan | | |
| 84. Panama | | |
| 85. Paraguay | | + |
| 86. Netherlands (Kingdom of) | + | |

| Member | Invitation accepted | Invitation declined |
|---|---|---|
| 87. Peru | | + |
| 88. Philippines (Republic of the) | | |
| 89. Poland (People's Republic of) | + | |
| 90. Portugal | | + |
| 91. Spanish Provinces in Africa | | |
| 92. Portuguese Oversea Provinces | | + |
| 93. Syrian Arab Republic | | |
| 94. United Arab Republic | | + |
| 95. Federal Republic of Germany | + | |
| 96. Federal Socialist Republic of Yugoslavia | | |
| 97. Ukrainian Soviet Socialist Republic | | |
| 98. Somali Republic | | |
| 99. Southern Rhodesia | | |
| 100. Roumanian People's Republic | + | |
| 101. United Kingdom of Great Britain and Northern Ireland | + | |
| 102. Rwanda (Republic of) | | |
| 103. Senegal (Republic of the) | | + |
| 104. Sierra Leone | | + |
| 105. Sudan (Republic of the) | | + |
| 106. South Africa (Republic of) and Territory of South-West Africa | | + |
| 107. Sweden | + | |
| 108. Switzerland (Confederation) | + | |

| Member | Invitation accepted | Invitation declined |
|---|---|---|
| 109. Tanganyika | | |
| 110. Chad (Republic of the) | | |
| 111. Czechoslovak Socialist Republic | + | |
| 112. Territories of the United States of America | | |
| 113. Overseas Territories for the international relations of which the Government of the United Kingdom of Great Britain and Northern Ireland are responsible | | |
| 114. Thailand | + | |
| 115. Togolese Republic | | + |
| 116. Tunisia | | |
| 117. Turkey | | |
| 118. Union of Soviet Socialist Republics | | |
| 119. Uruguay (Oriental Republic of) | | |
| 120. Venezuela (Republic of) | + | |
| 121. Viet-Nam (Republic of) | + | |
| 122. Yemen | | |
| Associate Members | | |
| 123. Kenya | | |
| 124. Singapore-British Borneo Group | | |

# AERONAUTICAL CONFERENCE

Document No. I-18-E
22 January 1964
Original: French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Note by the Secretary-General

CONFERENCE SECRETARIAT

In accordance with the provisions of Number 565 of the Convention, one of the tasks of the first plenary meeting is to establish a Secretariat for the Conference. In this connection, we propose the following arrangement:

| | |
|---|---|
| Secretary of the Conference: | Mr. Jean Kunz<br>Head of the Radio Division |
| assisted by: | Mr. Alf Winter-Jensen<br>Head of the Telegraph and Telephone Division |
| Technical Division: | Mr. A. Maqbool<br>Mr. A.A. Matthey<br>Mme B. Arnold |
| Documents Division and Linguistic Services: | Mr. Adrian David<br>Head of Conference and General Services |
| assisted by: | Mr. U. Petignat |
| Interpretation Services: | |
| Coordination: | Mr. C. Vonwiller |
| Translation Services: | |
| French Section: | Mr. Brodsky |
| English Section: | Mr. N. Langford |
| Spanish Section: | Mr. C. Cardena |
| Administrative Services: | Mr. R. Prélaz |
| Delegates Services: | Mme M.M. Pauli |
| Official in charge of press relations: | Mr. C. Mackenzie |

The rest of the Secretariat will consist of officials detached from Headquarters and of supernumerary staff recruited, whenever posible, in Geneva.

Gerald C. GROSS
Secretary-General

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# AERONAUTICAL CONFERENCE

Document No. I-19-E
22 January 1964
Original: French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

BUDGET CONTROL
COMMITTEE

## BUDGET OF THE CONFERENCE

For the information of the Budget Control Committee, the Annex to this document contains the budget of the Aeronautical Conference as approved by the Administrative Council of the Union at its 18th session, Geneva, 1963.

With regard to the apportionment of the costs of the Conference, it should be noted that the expenses fall within the normal budget of the Union and are covered by the annual contributions of Members and Associate Members of the Union for the year 1963. No additional accounts relating to the costs of the Conference will therefore be sent to the Members or Associate Members of the Union.

Annex: 1

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# A N N E X

Details of expenditure in Section 7.6 - Extraordinary Administrative Radio Conference to prepare revised allotment plans for the aeronautical mobile service (first meeting).

Basis: Place of the conference: Geneva Duration: 4 weeks

| | Budget 1964 |
|---|---|
| | Swiss Francs |
| I. Staff expenses | |
| 7.601 Administration | 70.000 |
| 7.602 Languages | 315.000 |
| 7.603 Reproduction | 27.000 |
| 7.604 Insurance | 2.000 |
| II. Premises and equipment | |
| 7.605 Premises, furniture, machines | 75.000 |
| 7.606 Document production | 45.000 |
| 7.607 Office supplies and overheads | 30.000 |
| 7.608 Simultaneous interpretation and other technical equipment | 15.000 |
| 7.609 Unforeseen | 11.000 |
| III. I.F.R.B. preparatory work | |
| 7.610 I.F.R.B. preparatory work | 50.000 |
| | 640.000 |

# AERONAUTICAL CONFERENCE

Document No. I-20-E
22 January 1964
Original: French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

HEADS OF DELEGATION

DRAFT AGENDA

FOR THE OPENING PLENARY MEETING

Monday, 27 January 1964 at 3.30 p.m.

1. Opening of the Conference (No. 560 of the Convention)
2. Election of the Chairman of the Conference (No. 562 of the Convention)
3. Election of the Vice-Chairmen of the Conference (No. 563 of the Convention)
4. Statements by the Secretary-General, the Chairman of the I.F.R.B., and the Acting Director of the C.C.I.R.
5. Establishment of the Committees of the Conference (Document No. I-2 and Corrigendum) (No. 564 of the Convention)
6. Election of the Chairmen and Vice-Chairmen of the Committees (No. 564 of the Convention)
7. Establishment of the Secretariat of the Conference (Document No. I-18) (No. 565 of the Convention)
8. Dateline for formulation of its conclusions by the Credentials Committee (No. 535 of the Convention)
9. Admission of International Organizations (Document No. I-17 para. 3) (No. 519 of the Convention)
10. Timetable of the Conference
11. Any other business

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# AERONAUTICAL CONFERENCE

Addendum N° 1 au
Document N° I-21-F/E/S
27 janvier 1964

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

SEANCE PLENIERE

La carte ci-jointe doit être annexée comme page 20 du Document N° I-21.

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PLENARY MEETING

The attached chart constitutes page 20 of Document No. I-21.

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SESIÓN PLENARIA

La carta adjunta debe figurar como anexo de la página 20 del Documento N.° I-21.

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Annexe : 1
Annex: 1
Anexo: 1

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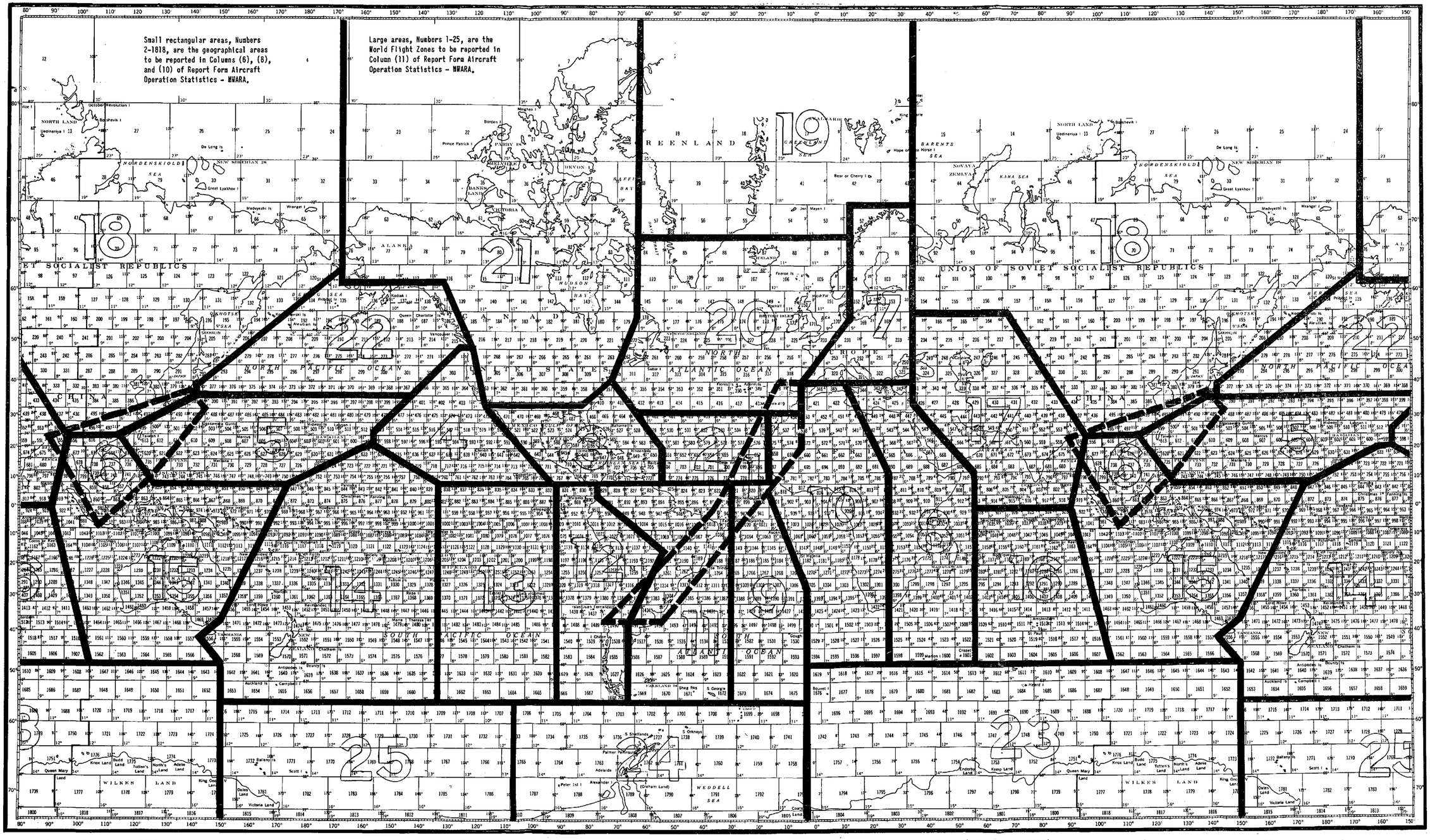
REGIONS AERIENNES MONDIALES
WORLD AERONAUTICAL CHART SERIES
PLANISFERIO PARA LA NAVEGACIÓN AERONÁUTICA

Echelle - Scale of Series - Escala : 1/1.000.000






Les numéros de 2 à 1818 figurant dans les petits rectangles désignent les zones géographiques et sont à inscrire dans les colonnes (6), (8) et (10) du formulaire "Statistiques sur l'exploitation des aéronefs - ZLAMP"

Les numéros de 1 à 25 figurant dans les grandes surfaces désignent les régions aériennes mondiales et sont à inscrire dans la colonne (11) du formulaire "Statistiques sur l'exploitation des aéronefs - ZLAMP"

Las pequeñas superficies rectangulares (números 2 a 1818) son las áreas geográficas que deben indicarse en las columnas (6), (8) y (10) del Formulario estadístico de movimiento de aeronaves - ZRMP.

Las grandes superficies (números 1 a 25) representan las Zonas de vuelo que deben inscribirse en la columna (11) del Formulario estadístico de movimiento de aeronaves - ZRMP.

# AERONAUTICAL CONFERENCE

Document No. I-21-E
21 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

United States of America

In consequence of further study in the United States and experience gained through a pilot survey including compilation, tabulation and printing of aircraft operation statistics for a major U.S. airline showing all its international flights during a period of one week in 1963, it has been found that some modification in the method of reporting will assist materially in submitting, processing and using the information. Accordingly, changes are being proposed in the Aircraft Operation Statistics - MWARA reporting form and in the instructions for use of the form as they originally appeared in the Conference Document I-1-E. This material supersedes the material contained in the reference document under U.S. Proposal No. 18 and should be considered in lieu thereof.

Additional United States Proposals numbered 18B through 18E inclusive, which also are for consideration of the Preparatory Session, 1964, are INSTRUCTIONS TO THE GENERAL SECRETARIAT with respect to:

a) transfer of aircraft operation statistics from reporting forms (submitted by Administrations) to data punch cards;

b) sorting of data cards; and

c) preparation of printed lists by the I.T.U. General Secretariat prior to convening the Main Session of the Conference in 1965.

ARCHIVES U.I.T. GENÈVE

## Background

The following is a step-by-step summation of the procedural operations that should follow agreements reached at the Preparatory Session of the Aeronautical EARC with respect to the collection and compilation of aircraft operation statistics.

1. The agreements of the Preparatory Session with respect to the statistics that are to be collected by the member countries will form a part of the Final Report of the Preparatory Session.

2. Administrations will have a period of several months within which to prepare for collection of these statistics. It may be expected, during this period, that blank report forms will be prepared and made available for use by Administrations within their own countries together with instructions for their use.

3. Aircraft Operation Statistics will be collected for a one-week period in the Summer of 1964.

4. Countries will collect Aircraft Operation Statistics for their aircraft operations and assemble them in the agreed format. This material will then be submitted to the I.T.U. not later than 10 December, 1964.

## Supplementary Material with Respect to

## Aircraft Operation Statistics - MWARA

Subsequent to preparation of the U.S. Proposals in Conference Document No. I-1-E, a pilot survey was made from published information concerning the international flights of a major U.S. airline covering a period of one week. The resulting tabulation of the data compiled is being introduced in the Preparatory Session as an example of the use of the format proposed by the United States for tabulating and collating aircraft operation statistics.

As a result of operating experience gained through the pilot survey, the Reporting Form for the Aircraft Operation Statistics - MWARA, which appears on page 71 of the United States Proposals in Conference Document I-1-E, has been changed. The new, amended reporting form is included as an Annex to this paper. No changes are proposed in the substance of the information to be reported.

By comparison of the new reporting form with the form previously proposed, it will be found that the new form gives added consideration to economy, assessability of statistics, ease of preparation, ease of reading, and the facility with which card punch operators may transcribe the information to data cards.

Modifications of the Instructions for Completing the Report Form Aircraft Operation Statistics - MWARA in U.S. Proposal No. 18, Document No. I-1-E, are required to reflect the changes associated with the new reporting form. In order to avoid duplication of effort and unnecessary confusion that could result from consideration of detailed amendments to U.S. Proposal No. 18 in Document No. I-1-E, a complete new set of instructions has been prepared and U.S. Proposal No. 18, together with the proposed amendments are presented here as a single document. This material should be considered by the Preparatory Session as superseding the material in Document I-1-E, pages 67 through 71.

PROPOSAL No. 18

It is proposed that the following information be adopted by the preparatory session of the Aeronautical EARC for use as instructions for completing their reports using the Reporting Format "Aircraft Operation Statistics - MWARA." (see Annex)

INSTRUCTIONS FOR COMPLETING THE REPORT FORM

AIRCRAFT OPERATION STATISTICS - MWARA

General: Aircraft flights should be reported by the Administration of Registry; except in the case of leased aircraft where the Administration authorizing the operation or operating the aircraft is different than the Administration under which the aircraft is registered, the Administration operating or authorizing the operation shall be responsible for supplying aircraft operation statistics. International flights or segments of international flights not requiring HF communications shall not be reported.

Administration providing data: Enter country of registry of aircraft whose flights are reported.

Representative week selected: Enter calendar week in GMT selected by the Preparatory Session for the survey. (See U.S. Proposal No. 15 in Conference Doc. I-1-E).

Column (1) Ref. No.: Enter ITU 3-letter designation of Administration taken from the Preface to the International Frequency List followed by sequentially numbered flights expressed in five (5) digits a period and data card number expressed in two (2) digits. Example: USA00001.01 This number corresponds to the first line entry of the first flight reported by the United States of America.

Note: Each line entry in the reporting form will be transcribed to a single data punch card. Several line entries (not less than two and as many as seven or more) may be required to record a single flight from area of origin through its intermediate stops to its area of termination. By including the number of the line entry after the period in the reference number, the sequence of the data cards prepared from the report may readily be determined and the flight segment will be positively identified even when a single data card is inspected out of sequence or otherwise.

Column (2) Flight Date(s): Enter date (corrected to correspond to the date at Greenwich) on which flight begins at Area of Stop Under Consideration (Column (8)).

Column (3) Flight Identification: If an airline, indicate airline two-letter designation (shown in Annex, pages 73-84 to U.S. Proposals in Conference Document I-1-F/E/S) and trip number. If the name of the airline operation does not appear in the attached list of two-letter designators, Administrations should indicate an appropriate national flight identification.

Column (4) Type of Flight: 1) Scheduled airline.

2) Non-scheduled airline (including Military).

3) General aviation.

Note 1: Categories 2 and 3 are to be treated in respect to the MWARA formula as non-scheduled aircraft.

Note 2: In category 2, "Military" means transport types which are operated routinely in the civil system on Aeronautical Mobile (R) Frequencies.

Column (5) Aircraft Speed (knots): Enter 1, 2 or 3 corresponding to the aircraft speed category in the following list:

1 - Below 350 knots.

2 - 350 - 500 knots.

3 - Above 500 knots.

Column (6) Area of Previous Stops: Select appropriate numerical small area identification number by reference to the attached chart (page 85 in Conference Document I-1-E) of defined areas of the world.

Column (7) Miles: Figures supplied are to correspond with stage lengths in nautical miles from airport to airport, limiting the entries to the lowest number feasible.

Column (8) Area of Stop Under Consideration: List numerical small area identification number by reference to the attached chart (page 85) in Conference Document I-1-E) of defined areas of the world. When the stop under consideration is the origin of the flight, no entries will appear in Columns (6) or (7) on this line. When the stop under consideration is an intermediate stop (neither the origin nor the termination of the flight), entries will be placed on this line in Columns (6), (7), (8), (9) and (10). When the stop under consideration is the termination of the flight, entries will be placed in Columns (6), (7) and (8) but none will appear in either Columns (9) or (10).

Column (9) Miles: Figures supplied are to correspond with stage lengths in nautical miles from airport to airport, limiting the entries to the lowest number feasible.

Column (10) Area of the Next Stop: Select appropriate numerical small area identification number by reference to the attached chart (page 85 in Conference Doc. I-1-E) of defined areas of the world.

Column (11) World Flight Zone: (Numbered 1-25). These Zones are depicted in the attached chart (page 85 in Conference Doc. I-1-E) and include a number for each Zone. These Zones are intended to represent, in a general way, the major areas of the world in which international flights, having common requirements for high frequencies, are conducted. List the number of the World Flight Zone which corresponds to the area number listed on the same line entry in Column (8). As a special case where a flight crosses a Zone and may be expected to be served by high frequency families in the Zone but makes no stop therein, a separate line entry should be made on which Columns (6), (7), (8), (9) and (10) are left blank and the appropiate Zone number is listed in Column (11).

Column (12) Day (GMT) of Flight Departure: Insert "X" under the day of the week which corresponds to the day the flight departed as shown in Column (8). The day inserted should be corrected to correspond with the day at Greenwich. This will correspond, also, to the date tabulated in Column (2).

Reason: It is essential that Administrations use identical terms in reporting aircraft operations:

The proposal of the I.C.A.O. Special COM Meeting 1963 that a Column include "Distance (Nautical Miles) covered per stage by VHF" has been replaced by a Column showing World Flight Zone(s) for reasons such as the following.

1) To avoid the necessity for one Administration to supply figures showing the limits of coverage of radio facilities furnished by another Administration.

2) VHF coverage will be of use to the main session of the Conference in its determination of the high frequencies required. The extent of VHF coverage should be determined by the Conference at the main session for use on an area basis.

3) VHF coverage need not be reported for each individual flight since it will be applicable to all flights in the area.

4) World Flight Zone(s) will assist the Conference to identify the area of operation of a flight without listing each separate block flown through.

5) To simplify machine processing.

In completing the Report Form - AIRCRAFT OPERATION STATISTICS - MWARA, Administrations should take particular care with respect to selection of World Flight Zone[1] to be recorded in those instances where the numerical small area[2] under consideration (Column (8) in the Reporting Form) could be recorded in either of two or more overlapping World Flight Zones. In each of these instances, a World Flight Zone should be selected which most nearly describes the route or route segment of the international flight (see following examples).

A special problem of this type occurs at intersections of World Flight Zones where these intersections are common dividing points between such Zones. (For example, Area 599 encompasses a major portion of the Hawaiian Islands including Honolulu and is common to three World Flight Zones). From the chart on page 85 of the Proposal of the United States, it will be seen that Hawaii lies at a common terminus for World Flight Zones Nos. 4, 5 and 14. Similar examples will be found in several other places on the chart. These intersections have been so located that many of the international flights beginning or terminating in these points will fall without question in one World Flight Zone. Thus, flights from Tokyo (Area of Departure No. 389) to Honolulu (Area of Termination No. 599) fall unquestionably as a flight in World Flight Zone No. 5. Similarly, a flight from Honolulu (Area of departure No. 599) to Melbourne, Australia, (Area of Termination No. 1470), will be included in World Flight Zone No. 14.

World Flight Zones No. 1 and No. 6 contain a second type of problem requiring special care. It will be noted, for instance, that the numerical small areas within World Flight Zone No. 1 could be identified also with World Flight Zones 12, 11, 9, 2, 10 and 20 as the case may be. Again it is necessary for the reporting Administration to identify the correct World Flight Zone in reporting the flight in order that the flight may be included in and form a part of the total of all international flights in the zone having common requirements for high frequencies.

The following examples will provide guidance to Administrations in choosing the World Flight Zone to be entered in Column (11) of the Aircraft Operation Statistics - MWARA Reporting Form :

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1) The term World Flight Zone or Zone as used throughout this paper refers to the large irregularly shaped areas of the world (numbered 1 to 25) shown on the World Aeronautical Chart, page 85, in the USA Proposals, Conference Document No. I-1-E (copy attached).

2) The terms area, area under consideration, area of previous stop, area of next stop and numerical small area as used throughout this paper refer to the small rectangular areas of the World (numbered 2-1818) shown on the World Aeronautical Chart, page 85, in the USA Proposals, Conference Document No. I-1-E.

Flights that begin in a numerical small area common to World Flight Zones Nos. 1 and 11 and terminate in another numerical small area in World Flight Zone No. 11 but outside World Flight Zone No. 1 should not be reported as World Flight Zone No. 1 Flights. These flights should be reported as flights in World Flight Zone No. 11.

By similar reasoning, flights which proceed from a numerical small area in World Flight Zone No. 1 in South America to a numerical small area in World Flight Zone No. 1 in North Africa or beyond should be reported in World Flight Zone No. 1 rather than World Flight Zones Nos. 11 or 12.

A third case may arise where a World Flight Zone may be overflown without being reported. For example, a flight may originate in central Europe (World Flight Zone No. 7) and terminate in central North America (World Flight Zone No. 21) without making an intermediate stop. This flight should appear as a part of the communications load to be served by high frequencies in World Flight Zone No. 20 or No. 19, depending upon the path flown. In these instances, it will be particularly important that the reporting Administration record the appropriate Zones for the flight in Column No. (11) of the Aircraft Operation Statistics Report Form, either World Flight Zone No. 19 or No. 20, as the case may be even though no stop was made in Zone 19 or 20. Under these circumstances, no entries would appear on this line in the Reporting Form in Columns (6), (7), (8), (9) and (10).

PROPOSAL No. 18B

The I.T.U. General Secretariat shall assemble the aircraft operation statistics submitted by the contributing countries and shall transcribe the material to data punch cards for use with data processing equipment. Between the time that data punch cards are prepared and the beginning of the Main Session of the I.T.U. Aeronautical E.A.R.C., (1965) the General Secretariat shall prepare and print lists of statistics and collate the punch cards in accordance with the detailed instructions of the Preparatory Session.

PROPOSAL No. 18C

To this end, it is proposed that :

a) The Conference agreements with respect to collection and tabulation of aircraft operation statistics (MWARA) be published in the Final Report of the Preparatory Session.

b) Administrations collect and tabulate aircraft operation statistics (MWARA) in accordance with procedures and format as agreed by the Preparatory Session.

c) Statistical material transmitted to the General Secretariat should reach the seat of the Union in Geneva not later than December 10, 1964.

d) The General Secretariat shall prepare data punch cards and tapes, as required, and prepare printed lists for use at the Main Session (1965) in accordance with instructions to the General Secretariat agreed by the Preparatory Session (1964).

## INSTRUCTIONS TO THE GENERAL SECRETARIAT

PROPOSAL No. 18D

a) It is proposed that the following material be adopted by the Preparatory Session (1964) to provide detailed instructions to the General Secretariat for collection, tabulation and use of international aircraft operation statistics.

b) The statistics submitted by Administrations be transferred to data punch cards in the order of their receipt. At the time the data cards are punched, two additional similar copies of the cards will be punched for use as hereinafter described.

## MASTER FILE BY COUNTRIES AND MASTER LIST BY COUNTRIES

c) The data cards in this file prepared pursuant to PROPOSAL NO. 18E shall be referred to as the "Master File by Countries"; the list printed from data cards in this file will be referred to as the "Master List by Countries".

d) The data punch cards shall be arranged alphabetically by country and in the order of reference numbers as reported in Column (1) of the Aircraft Operation Statistics - MWARA Reporting Form.

e) The data cards in the Master File by Countries will be retained for the duration of the Conference and as long thereafter as may be required.

f) A print-out shall be made of the data cards in the Master File by Countries and printed copies shall be prepared and distributed for use at the Conference.

g) The Master File by Countries shall be kept up to date as new, amended or supplemental material is received from Administrations. Addenda to the Master List by Countries will be prepared and supplied to the members of the Conference on a daily basis or as otherwise required by the Main Session.

NUMERICAL SMALL AREA MASTER FILE AND NUMERICAL SMALL AREA MASTER LIST

h) Data punch cards, prepared pursuant to PROPOSAL No. 18E shall be sorted and filed in the order of the numbers of the small rectangular areas taken from the Chart on page 85 of the USA Proposals, Conference Document No. I-1-E (copy attached).

i) This collection of data cards will be referred to as the "Numerical Small Area Master File" and lists printed from the data cards in this file will be referred to as "Numerical Small Area Master List".

j) Within the Numerical Small Area Master File, data punch cards shall be filed in ascending sequence of numbered small areas of the Stop Under Consideration, Column (8), of the Reporting Form; then by small area numbers of Area of Previous Stops, Column (6) of the Reporting Form; and, then by small area numbers of Area of Next Stop, Column (10) of the Reporting Form. Data cards may then be sorted alphabetically by country and by reference numbers, Column (1) of the Reporting Form.

k) After the data cards have been filed in the order indicated in the preceding paragraphs, this file shall remain intact as a printing file and shall not be arranged in a different order.

l) A print-out shall be made of the data cards in Numerical Small Area Master File and printed copies of the Numerical Small Area Master List shall be prepared and distributed for use at the Main Session of the Conference (1965).

WORLD FLIGHT ZONE FILE AND WORLD FLIGHT ZONE LISTS

m) This file will be referred to as the "World Flight Zone File", and lists printed from the data cards in this file will be referred to as "World Flight Zone Lists".

n) Data punch cards, prepared pursuant to PROPOSAL No. 18E shall be sorted and filed in the order of World Flight Zones.

o) Each World Flight Zone (WFZ) will constitute a complete and separate section of the World Flight Zone File. The data punch cards marked in WFZ No.1 will form one section. The data punch cards marked for filing in WFZ No. 2 will form the second section. Those marked for filing in WFZ No. 3 will form the third section, etc. This order will be followed for each WFZ so that the last complete section will contain the data punch cards, if any, marked for filing in WFZ No. 25.

p) Data punch cards within a World Flight Zone File shall be filed in ascending sequence of numbered small areas of the Stop Under Consideration Column (8) of the Reporting Form; then by small area numbers of the Areas of Previous Stops, Column (6); and then by small area numbers of Next Stops, Column (10) of the Reporting Form. Data cards may then be sorted alphabetically by country and reference numbers, Column (1) of the Reporting Form.

q) The data cards in the World Flight Zone File shall be retained for the duration of the Conference and as long thereafter as may be required.

r) A print-out shall be made of the data cards in the World Flight Zone Master File and copies of the World Flight Zone Tests shall be printed and distributed for use at the Conference.

PROPOSAL No. 18E

a) That the following instructions to the General Secretariat be adopted by the Preparatory Session of the Aeronautical EARC.

INSTRUCTIONS WITH RESPECT TO DATA FORM "AIRCRAFT OPERATION STATISTICS - MWARA" - TRANSCRIPTION OF DATA FORM REPORTING FORMS TO DATA PUNCH CARDS

b) Data punch cards shall be made directly from the material submitted by Administrations, or from direct translations of the material, as appropriate.

c) A total of 3 sets of data punch cards are required. One set for the Master File by Countries, one set for the Numerical Small Area Master File, and one set for the World Flight Zone File. These sets of cards are identical, therefore, the second and third sets may be made by duplicating the original set.

d) In order to assist in distinguishing the data cards in one file from the data cards in another file, each of the three decks of file cards should be of separate and distinct colors. For example, all data cards in the Master File by Countries may be made on white data cards. The data cards in the Numerical Small Area Master File may be punched on green data cards and the data cards in the World Flight Zone File may be punched on orange colored cards.

e) The data submitted by Countries shall be punched in columns as shown in the Attachment AIRCRAFT OPERATION STATISTICS COLUMN FORMAT. It will be noted that the column numbers in the column format are in consonance with the column numbers which are included at the base of the column headings on the AIRCRAFT OPERATION STATISTICS - MWARA Reporting Form.

These data cards will be sorted in accordance with the instructions in Proposal No. 18D herein. An example of the order of filing is as follows:

MASTER FILE BY COUNTRIES

ADN 00001.01

ADN 00001.02

ADN 00002.01

ADN 00002.02

etc.

AFG 00001.01

AFG 00001.02

AFG 00002.01

AFG 00002.02

etc.

NUMERICAL SMALL AREA MASTER FILE

Principle sort by Column (8) in sequence of area numbers.

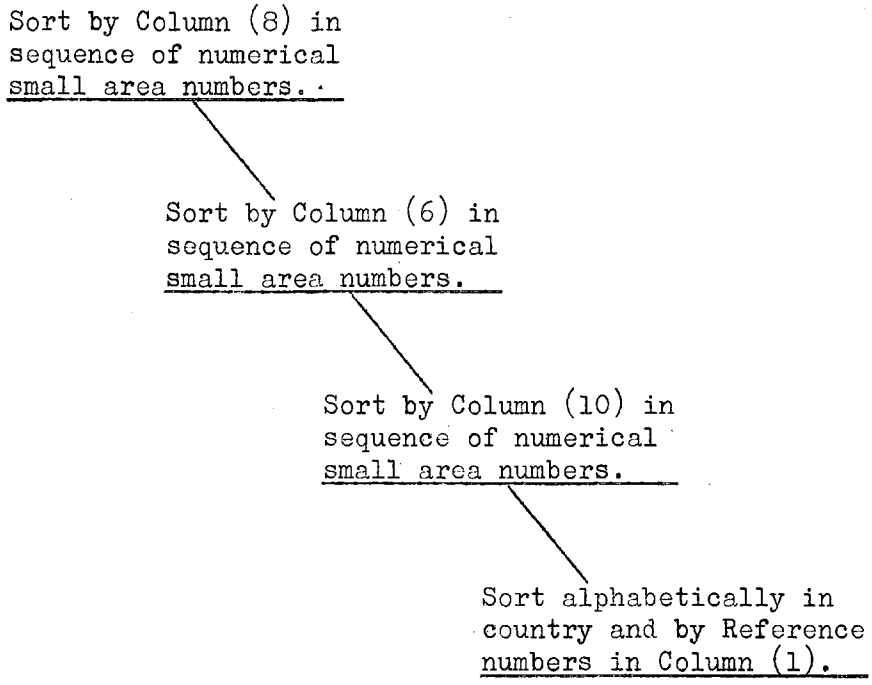
Sort by Column (6) on sequence of numerical small area numbers.

Sort by Column (10) in sequence of numerical small area numbers.

Sort alphabetically by country and numbers in Column (1).

## WORLD FLIGHT ZONE FILE

Principle sort in numerical sequence of Zone numbers in Column (11).




Annex: 1

# A N N E X

## AIRCRAFT OPERATION STATISTICS - MWARA

Administration providing data: _____

Representative week selected: (GMT Sunday 0001, 2 August 1964 to Saturday 2400, 8 August 1964 inclusive)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8) | 9 | 10 | 11) | 12) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ref. No. | Flight Date/s | Flight Identification | Type of Flight | Aircraft Speed (knots) | Area of Previous Stops | Miles | Area of Stop Under Consideration | Miles | Area of Next Stop | World Flight Zone(s) | Day (GMT) of Flight Departure | | | | | | |
| 22-32 | 33-39 | 40-46 | 47 | 48 | 49-52 | 53-56 | 57-60 | 61-64 | 65-68 | 69-70 | 71-77 | | | | | | |
| | | | | | | | | | | | S | M | T | W | T | F | S |
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# AIRCRAFT OPERATION STATISTICS - MWARA

Administration providing data : United States of America

Representative week selected : (GMT Sunday 0001, 2 August 1964 to Saturday 2400, (8 August 1964 inclusive)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ref. No. | Flight Date/s | Flight Identification | Type of Flight | Aircraft Speed (knots) | Area of Previous Stops | Miles | Area of Stop Under Consideration | Miles | Area of Next Stop | World Flight Zone(s) | Day (GMT) of Flight Departure | | | | | | |
| 22-32 | 33-39 | 40-46 | 47 | 48 | 49-52 | 53-56 | 57-60 | 61-64 | 65-68 | 69-70 | 71-77 | | | | | | |
| | | | | | | | | | | | S | M | T | W | T | F | S |
| USA00001.01 | 2 Aug.64 | TWA 802 | 1 | 3 | | | 310 | 3146 | 230 | 20 | x | | | | | | |
| USA00001.02 | 2 Aug.64 | TWA 802 | 1 | 3 | 310 | 3146 | 230 | 319 | 252 | 20 | x | | | | | | |
| USA00001.03 | 2 Aug.64 | TWA 802 | 1 | 3 | 230 | 319 | 252 | 284 | 321 | 7 | x | | | | | | |
| USA00001.04 | 3 Aug.64 | TWA 802 | 1 | 3 | 252 | 284 | 321 | | | 7 | | x | | | | | |
| - - - - - - - | - - - - - | - - - - - | - - - - - | - - - - - | - - - - - | - - - - | - - - - - | - - - - - | - - - - - | - - - - - | - | - | - | - | - | - | - |
| USA00002.01 | 2 Aug.64 | TWA 702 | 1 | 3 | | | 310 | 2987 | 230 | 20 | x | | | | | | |
| USA00002.02 | 2 Aug.64 | TWA 702 | 1 | 3 | 310 | 2987 | 230 | 353 | 231 | 20 | x | | | | | | |
| USA00002.03 | 2 Aug.64 | TWA 702 | 1 | 3 | 230 | 353 | 231 | | | 20 | x | | | | | | |
| - - - - - - - | - - - - - | - - - - - | - - - - - | - - - - - | - - - - - | - - - - | - - - - - | - - - - - | - - - - - | - - - - - | - | - | - | - | - | - | - |
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| | | | FOR ILLUSTRATIVE PURPOSES ONLY | | | | | | | | | | | | | | |
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# REPARTITION DES COLONNES POUR LES STATISTIQUES SUR L'EXPLOITATION DES AERONEFS
# AIRCRAFT OPERATION STATISTICS COLUMN FORMAT
# FORMULARIO DE DATOS ESTADÍSTICOS DEL TRÁFICO AÉREO

Numéro de référence - Reference Number - Número de referencia

Date(s) du vol - Flight Date(s) - Fecha(s) del vuelo

Identification du vol - Flight Identification - Identificación del vuelo

Type de vol - Type of Flight - Tipo del vuelo
Vitesse de l'aéronef(noeuds)-Aircraft Speed (knots)-Velocidad de la aeronave (nudos)

Zone des arrêts précédents - Area of Previous Stops - Zona de escalas anteriores

Milles - Miles - Millas

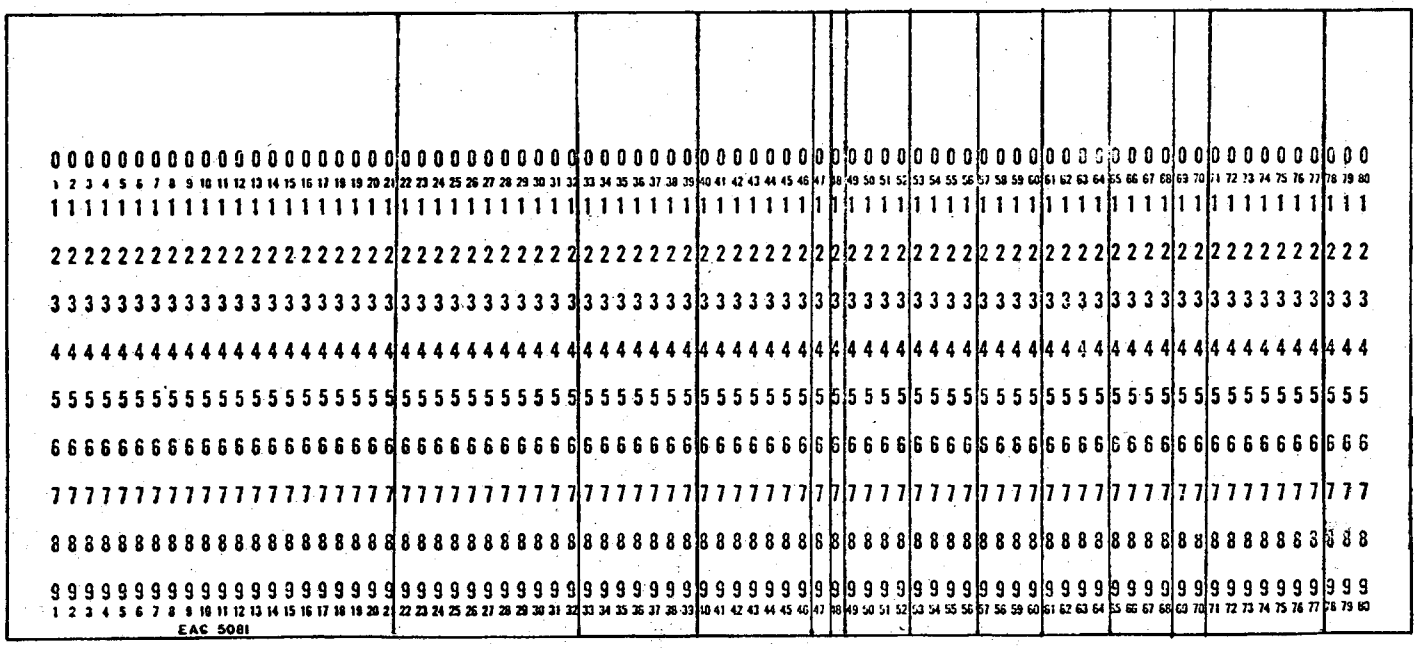
Zone de l'arrêt considéré-Area of Stop Under Consideration-Zona de la escala considerada

Milles - Miles - Millas

Zone de l'arrêt suivant - Area of Next Stop - Zona de la escala siguiente

Zone(s) aérienne(s) mondiale(s)-World Flight Zone(s)-Zona(s) mundial(es) de vuelo

Jour de départ (TMG) - Day (GMT) of Flight Departure - Día (TMG) de salida



EAC 5081

# AERONAUTICAL CONFERENCE

Document No. I-22-E
24 January 1964
Original: Spanish

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Argentina

PROPOSALS Nos. 1, 2 AND 3

## REARRANGEMENT OF APPENDIX 26 OF THE RADIO REGULATIONS

### 1. General considerations

1.1 Proposals have been made by I.C.A.O. for the rearrangement of provisions of an aeronautical nature in the Radio Regulations with a view to preparing a separate document, approved by an appropriate I.T.U. conference, and intended to facilitate their future revision by conferences dealing exclusively with the aeronautical services.

1.2 The I.T.U., through the working group set up in compliance with Administrative Council Resolution No. 494, is studying a rearrangement of the RR with a view to presenting them in a more convenient and practical form.

1.3 The Special Communication Meeting of I.C.A.O. (Montreal 1963) recognized the advantages of grouping together the aeronautical provisions of the RR and that, if the results of the I.T.U. study carried out in accordance with Council Resolution No. 494 are available, the matter could be considered at the E.A.R.C. (1965).

1.4 I.C.A.O., at its Special Meeting, sent the Secretary-General of the I.T.U. a telegram containing this suggestion (Point 13.9 of the Final Report, COSP II).

1.5 I.C.A.O. has also recommended to countries that they should support the views expressed, as set out in the preceding paragraphs (Recommendation 13/2 COSP II).

1.6 The Frequency Plan being revised will modify Appendix 26 of the RR as regards the Aeronautical Mobile (R) Service, in as much as proposals have been offered by a country as a basis for the preparation of an additional Appendix (No. 27), thus leaving the present Appendix 26 to deal with the Aeronautical Mobile (OR) Service.

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1.7 Appendix 26, attached to the RR by the Administrative Radio Conference of Geneva (1959) is a reference document dealing exclusively with aeronautical matters and is of considerable size (76 pages with 10 maps attached).

2. Arguments

2.1 It would seem appropriate, irrespective of the results emerging from the study by the I.T.U., to use Appendix 26 as a basis for a final grouping of references in the RR pertaining exclusively to the aeronautical services since it is a separate and rearranged document, until, pending a future decision about a sub-division of the RR, it forms a separate document or one including other mobile services.

2.2 Consequently, the Argentine Delegation believes that, since a basic instrument is available in the shape of Appendix 26, it should be amplified in such a way as to produce a practical and separate collection of the remaining Radio Regulations dealing with the Aeronautical Mobile Service, without altering the RR and its references.

2.3 To that end, Appendix 26 could be divided into two parts, for the R and OR Frequency Plans (coinciding, in that respect with the U.S.A. proposal) but preceded by a first part grouping all provisions of a general nature relating to the Aeronautical Mobile Service in the RR and in Appendix 26, including the relevant parts of the service allocation tables and notes. These references would not be deleted from the RR but merely transferred to this first part.

2.4 Basically, the proposal offered by this delegation is to divide Appendix 26 into three parts:

APPENDIX 26

PART A - Aeronautical Mobile Service - General Provisions

PART B - Aeronautical Mobile (R) Service - Particular Provisions and Frequency Allotment Plan

PART C - Aeronautical Mobile (OR) Service - Particular Provisions and Frequency Allotment Plan.

2.5 The Conference will propose, insofar as the progress of work will permit it, the contents of each of the three parts of Appendix 26. It will also decide whether the various countries and the I.T.U. should consider the inclusion of other parts such as "Procedures", "Aeronautical radionavigation", etc.

2.6 Finally, the following draft resolution is proposed for consideration by the Aeronautical E.A.R.C. (1965).

Proposals

In accordance with the foregoing, the Argentine Delegation makes the following proposals:

PROPOSAL No. 1

1. That the Extraordinary Aeronautical Administrative Radio Conference (1964) should adopt the following division of Appendix 26 into three parts:

A - General provisions for the Aeronautical Mobile Service

B - Frequency allotment plan for the Aeronautical Mobile (R) Service

C - Frequency allotment plan for the Aeronautical Mobile (OR) Service.

2. That each Committee should be assigned the task of specifying the part of Appendix 26 to which the provisions dealt with would correspond, or which would relate to the work assigned, in accordance with the divisions 26 A and 26 B.

3. That the Drafting Committee should prepare a draft version of Appendix 26 thus divided for consideration by the E.A.A.R.C. (1965).

PROPOSAL No. 2

That the Aeronautical E.A.R.C. (1964)should adopt the following recommendation:

RECOMMENDATION No. .....

Rearrangement of Appendix 26

The Extraordinary Aeronautical Administrative Radio Conference recommends Member countries to consider, when preparing their work for the next Extraordinary Administrative Conference, the desirability of including in Appendix 26 other parts referring to the Aeronautical Mobile Service in particular so that this question may be discussed in 1965.

PROPOSAL No. 3

That the Aeronautical E.A.R.C. (1964) should adopt the following resolution referring to the new composition of Appendix 26:

RESOLUTION No. ...

The Extrarodinary Aeronautical Administrative Radio Conference (Geneva 1964)

Considering

That it is desirable to sub-divide Appendix 26 into at least three parts containing the general provisions for the Aeronautical Mobile Service and frequency allotment plans for the R and OR service in separate form;

that I.C.A.O. has requested the Aeronautical E.A.R.C. (1965) to deal with the re-arrangement of those provisions of the RR which refer to the Aeronautical Mobile Service so that they may be issued in separate form, for practical considerations (they would be easier to handle) and to facilitate future revisions;

that there exist studies effected in response to I.T.U. Administrative Council Resolution No. 494 regarding the re-arrangement of the RR;

that the wishes of I.C.A.O. can be satisfied on this occasion up to a certain point without altering the structure of the RR for the time being;

that the arrangement of aeronautical provisions of a general nature falls within the terms of reference of administrative conferences since the latter can revise their substance, not to mention their form.

Resolves:

a) to request the Aeronautical E.A.R.C. (1965) to adopt the division of Appendix 26 into three or more parts, as indicated in the Final Report of this Conference ( ..... ) and to consider the possibility of amplifying it with other provisions of an exclusive or direct aeronautical interest;

b) to instruct the Administrative Council of the I.T.U. and the I.F.R.B. to study, during the period of recess of the Aeronautical E.A.R.C., the possibility of converting the appendix concerned as soon as practicable into the part of the RR which would contain the essential statutory information that is particular to aeronautical services, and to submit the studies in question to the 1965 session;

c) to request I.C.A.O. and the Administrations to submit to the next session of the Aeronautical E.A.R.C., concrete proposals for the integration of Appendix 26 in the most suitable form for its practical service application.

# AERONAUTICAL CONFERENCE

Document No. I-23-E
24 January 1964
Original: Spanish

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Argentina

PROPOSAL No. 4

## ALLOTMENT OF A FAMILY OF FREQUENCIES FOR METEREOLOGICAL BROADCASTS IN SOUTH AMERICA

1. General Considerations

1.1 The present Frequency Plan makes no provision for a family of frequencies for metereological broadcasts from South America for that area and the adjacent areas.

1.2 The need to have such means has been increasing progressively in recent years and it is essential that such broadcasts should be established for the safety of international flights, and in particular to satisfy the operational requirements of aircraft flying in the Upper Regions, and the imminence of flights at greater heights, which emphasize the need to have a knowledge of the terminal areas.

1.3 The case of Buenos Aires and other South Atlantic terminals where critical conditions (Atlantic crossings and flights over extensive forest areas) calls for continuous information whose transmission should not, whenever possible, be subjected to transmission by fixed circuits.

1.4 At its preparatory meeting (COSP-II, 1963), I.C.A.O recognized the need for such broadcasts for South America and issued Recommendation No. 5/3 requesting the E.A.A.R.C. (1964-1965) to make every effort to allot a family of high frequencies for the exclusive use of metereological broadcasts.

2. Arguments

2.1 It is considered that a single suitably selected family of frequencies will be sufficient to answer the needs of metereological broadcasts for MWARA in South America, through co-ordinated and shared use within the area by agreement at I.C.A.O. Regional meetings in which all the countries concerned have had past experience of an excellent and exemplary co-operation in aeronautical matters.

2.2 It would be sufficient for the Buenos Aires transmissions to be limited to 15 minutes per hour, an arrangement which would make it possible to have 4 transmissions in the region on the same frequency.

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2.3 Metereological broadcasts should cover the areas NSAM-1 and NSAM-2, as far as their boundaries with the projected CAR area, in accordance with Appendix A of the Final Report of the COSP-II, I.C.A.O. (Montreal 1963), as regards the continental part.

2.4 For the Atlantic (SA), where metereological information must be available (whenever operationally required) from the start in Europe and as far as Buenos Aires, for present and future flights, high frequencies must be envisaged within the allotted set of frequencies to satisfy this requirement efficiently.

2.5 Finally, the Argentine delegation deems it necessary that the Extraordinary Aeronautical Administrative Radio Conference should consider the allotment of a family of frequencies for metereological broadcasting in South America and that this family should be calculated in such a way as to cover, 24 hours a day, the abovementioned continental areas (2.3) and the furthest point of the area the Europe-Buenos Aires flight area over the whole extent of the SA area as far as Buenos Aires.

2.6 Proposal

The Argentine delegation proposes:

PROPOSAL No. 4

1. That the Extraordinary (Aeronautical) Administrative Radio Conference, when preparing the revised provisions of Appendix 26, should consider the allotment of a family of frequencies for the exclusive use of metereological information broadcasts for aircraft flying in the NSAM-1, NSAM-2 and SA areas, in the first two areas as far as their boundaries with the projected CAR (COSP-II, I.C.A.O.) and in the whole of the third area as far as Buenos Aires.

2. That the E.A.A.R.C. should recommend to the Conference in 1965 the inclusion of such broadcasts in the revised regulations and that the allotted family of frequencies should afford satisfactory coverage for the areas mentioned in 1.

# AERONAUTICAL CONFERENCE

Document No. I-24-E
24 January, 1964
Original : Spanish

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Argentina

PROPOSAL No. 5

## GRADUAL INTRODUCTION OF SSB EMISSIONS IN THE AERONAUTICAL MOBILE (R) SERVICE

1. Background

1.1 For more than six years, the I.C.A.O. has included in the agendas of its special and departmental conferences an item concerning the examination of the possibility of passing from DSB, in the Aeronautical Mobile (R) Service on HF, to SSB.

1.2 Similarly, the I.T.U., through the Panel of Experts set up by the Administrative Council in accordance with Resolution No. 3 of the Administrative Radio Conference (Geneva, 1959), paid attention to the transfer of mobile services to SSB operation, since this was one of the most important ways of relieving the congestion existing throughout the VHF bands.

1.3 Both the I.T.U. and I.C.A.O. - either jointly or independently - have repeatedly recommended the Administrations to use VHF for aircraft communications wherever possible. The transfer of communications from HF to VHF is imperative to ensure reliable connections and better flight protection.

1.3.1 These recommendations have appeared since the E.A.A.R.C. (1948-49) right up to the last I.C.A.O. report (Recommendation M13-EAARC and Nos. 4/3, 4/4 of COSP II). Among them, there are more than a dozen recommendations which have been made by the I.T.U. and I.C.A.O. to the same effect; these will certainly be repeated in the present Conference with even greater emphasis if that were possible.

1.4 The Special Communications Meeting (COSP-II) convened by I.C.A.O. considered that revision of the Frequency Allotment Plan should be based on DSB operation with the permissive use of other types of emission. In particular, referring to the "permissive" use of SSB, it agreed that the E.A.A.R.C. should take into account existing SSB equipment tuned every 1.0 kc/s and include the following provisions in the new allotment plan.

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a) Only those HF SSB systems shall be allowed which are compatible with existing HF DSB systems. This requirement means that the sideband must be transmitted with a carrier which has a power level of at least one fourth of the peak envelope power.

b) Use for international communications of the Aeronautical Mobile (R) Service with an SSB system satisfying the requirements under a) shall be subject to coordination between the Administrations concerned.

1.5 In general, the above-mentioned meeting of I.C.A.O. came to the conclusion that, owing to operational, financial and technical problems, a plan based on channel separation for SSB could not be accepted for introduction on the date which would probably be adopted by the Aeronautical E.A.R.C. (1965); hence, it could not be forecast with certainty when it would be possible to introduce a plan revised to such an extent (point 9.7 of the Final Report COSP-II).

1.5.1 It was considered that SSB might be used exclusively in future and note was taken of the possibility of segregating DSB and SSB, at least in some channels along the air routes having the greatest flight densities, so that measures should be taken to investigate the possibility of constructing aircraft SSB equipment which could select frequencies based on integral multiples of 1.0, 0.5 and 0.1 kc/s (9.8 of Report COSP-II). This led to the adoption of recommendations 9/1, 9/2 and 9/3.

1.6 The I.T.U. Panel of Experts (Resolution No. 3, Geneva, 1959) at its Meeting in June 1963, recommended that the E.A.A.R.C. (1964-65) should examine the possibility of passing gradually and as soon as possible from DSB to SSB operation as a way of reducing congestion in the HF bands. This opinion was conveyed to I.C.A.O. before the VII Conference COM 1962.

1.7 At the I.C.A.O. Meeting (COSP-II), the Argentine Delegation submitted a proposal for the gradual use of SSB techniques in the Aeronautical Mobile Service, with 1 January 1974 as the tentative date by which the transfer should be completed, subject to a previous decision by an appropriate conference in 1970. This final stage was to be preceded by preliminary stages including the adoption, by agreement between the Administrations concerned, and with the coordination defined in Appendix 26, part I, Section II A, para. 4, of ground-air SSB emissions, i.e. solely by the aeronautical stations, without SSB transmissions being compulsory for the aircraft, with authorization for ground-ground-air transmissions using SSB in the aeronautical stations and connecting the aircraft with them by VHF.

1.7.1 This proposal was based on the need to make use of the advantages of SSB without delay, to draw up a plan which would give the desired results in the manufacture of suitable equipment (the definite pattern of trends being known) and to facilitate the fulfilment of the recommendations on the use of VHF.

1.7.2 In the preliminary stages, it is only assumed that use will be made of SSB adaptors in existing aircraft equipment or, at the very most, of AM/SSB equipment, and that greater use will be made of the VHF equipment on board, with the well-known advantages of freedom from interference by atmospheric discharges or high-level noise in the zone in the latter case.

1.7.3 In this way, in accordance with the proposal submitted by Argentina (WP 43/COSP-II) a technical effort was promoted to solve the few problems which arise at present in the use of SSB; at the same time, economic efforts were postponed (changes to aircraft transmitting equipment) while aircraft reception was improved, in the preliminary stage, and considerable spectrum economy or better protection between channels, according to circumstances, was obtained in the meantime.

1.8 COSP-II was unable to consider the whole of the Argentine proposal despite the manifest goodwill of those present, since it considered that the proposal included other points which it considered fell outside the agenda and which many delegations were not qualified to discuss. Nevertheless, it recognized that the proposal contained new ideas which could in future bring about improvements in the aeronautical telecommunication service as a whole (3.11, 3.12, 3.13, 3.14 of the Final Report COSP-II).

1.9 The Argentine Delegation withdrew its proposal, reserving the right to re-submit it more suitably to the present Conference, relating some of its points more closely to the final conclusions of COSP-II. As suggested by some delegations which supported this proposal, it was submitted to the I.T.U. Panel of Experts when it met in June 1963 (Document No. 8), which took due note of it for the purposes of its report.

2. Arguments

2.1 It is the opinion of the Argentine Delegation that when the I.T.U. Aeronautical Conference works out the bases for a new Frequency Allotment Plan, it must make a thorough examination of the aeronautical requirements of ground-air-ground communications arising in the various areas of the world and try to ensure that use of aeronautical mobile channels of HF will serve and guarantee links between aircraft and aeronautcial centres and vice versa.

2.2 The E.A.A.R.C. (1964-65) can agree to make any changes it considers desirable in the bands allotted for the Aeronautical Mobile (R) Service on HF and in the relevant provisions, provided such changes do not affect other services.

2.3 These principles are not binding and the old patterns can be broken if necessary in the interests of the safety of flight in civil aviation, just as they have been broken in satellite communications. This is of particular interest when such a course might help many countries, which do not possess adequate technical and economic means, to find a satisfactory solution to the problem of efficient communications in the Aeronautical Mobile Service for the benefit of their civil aviation or of foreign airlines which cross their territory.

2.4 On these bases, three fundamental and inter-dependent points arise for the adoption of SSB emissions and their full application to aeronautical mobile communications, i.e. :

1) The determination to make the required transfer, definitively and totally, by a reasonable date.

2) The soonest possible use of the considerable advantages offered by SSB emissions in the interests of better communications.

3) The replacement of certain A3 mobile circuits in ground-ground-air connections to facilitate the exclusive (or almost-exclusive) use of VHF in certain air routes.

2.4.1 With respect to the first point, i.e. definitive transfer to SSB, the following should be mentioned :

a) The use of SSB instead of DSB has been adopted throughout the world without argument. It is an anachronism to try to argue against its use. The only aspect open to discussion is the time-limit by which its use should be made compulsory, for economic reasons and - to a lesser extent - technical reasons.

b) The gain in power, the improvement in the signal-to-noise ratio, the smaller degree of propagation distortion, relegate the economic factors to the background, if we bear in mind the high cost of modern aircraft in relation to their equipment and the safety required for the greater number of passengers and heavier freight, together with other operational requirements. Furthermore, renewal of the aircraft equipment is to be expected by the date for complete transfer to SSB which it is decided to fix.

c) The technical factors will be adequately solved if the world electronic industry is acquainted of the decision to transfer operations to SSB, and suitable equipment will exist by the date fixed ..... and well beforehand. But no progress can be made if the uncertainty continues as to whether SSB is to be adopted or not.

d) Economy in the use of the frequency spectrum, particularly in the HF bands, is an important consequence of the use of SSB, but not the main reason for its adoption. It will enable unsatisfied requirements to be met and any requirements which may arise due to an increase in operations, while in future a portion of the band could be ceded to other related and priority services. However, these advantages happen to coincide and this is not the chief reason for adopting the system.

e) In view of the great economic impact on international civil aviation caused by the complete change of equipment - particularly transmitters - and bearing in mind that a period of ten years was recommended for the fixed service (No. 465 of the Radio Regulations, Geneva 1959), the date of 1 January 1974 would be a suitable target date for the exclusive use of SSB in the service and the bands concerned. In this period, the renewal of existing radio equipment would be carried through and the costs paid off so that this aspect would cease to constitute an economic drawback.

f) Nevertheless, the extraordinary progress of aeronautical communications which is evident in the intensive use of VHF with long-range equipment (either directive or via relays), the development of automatic data transmission and past experience together with future plans for fixed (synchronised) satellites for re-transmission make it desirable for the final decision to be adopted in 1970 by an appropriate conference in the light of all this progress, including the results obtained from the installation of ground-air and ground ground-air stages. This point will be dealt with below.

2.4.2. The second basic point (see 2) of the proposal is to make use as soon as possible of SSB emissions as part of a preliminary stage for the definitive transfer as analysed in the preceding paragraph. Ground-air transmissions are encouraged only while aircraft transmit with conventional equipment in class 6A3, and in no case will they be required to make SSB transmissions before 1 January 1974.

2.4.2.1 This is an essential part of the preliminary stage for the installation of SSB and its development is intimately connected with the final favourable decision for definitive use to be taken in 1970. In this respect, it should be pointed out that:

a) SSB emissions from an aeronautical station offer the considerable gain of this technique to aircraft reception, greatly outweighing the inherent drawbacks of HF.

b) Aircraft would only require an adaptor or a new receiver for 6A3 AB/SSB, whose cost does not give rise to drawbacks when compared with the efficiency obtained.

c) The equipment of the aeronautical station can be applied to other services, so that the investment can always be amortized.

d) Emissions will be compatible, initially, with the carrier percentage recommended by COSP-II (see 1.4 of that document). Subsequently, the carrier of the land emission will be reduced as and when the receiving equipment in the aircraft is perfected and completed on the same route.

e) Meteorological broadcasts (VOLMETs) will receive an important improvement in the form of the efficiency required by long-distance and high-speed flights. The Doppler effect does not restrict these advantages.

f) Economy in the bandwidth would arise through a better protection between adjacent channels since the aeronautical station, which is of greater power, would be separated from the next lower channel by 3 kc/s. This would enable the I.F.R.B. to make possible additional assignments, or allow the protection of the adjacent channels to be improved.

g) Adoption of ground-air SSB emissions would form the subject of coordination between the Administrations concerned through I.C.A.O. and the airlines affected, with relevant intervention by the I.T.U. (I.F.R.B.). The Regional Conferences of I.C.A.O. would draw up the corresponding plans when this is proposed.

2.4.3 The third point of the proposal covers the additional use of transmissions during this preliminary stage between aeronautical stations operating with SSB for receiving communications from aircraft on VHF, or directed to the latter for their transmission (additional or exclusive) also on VHF. This constitutes an extension of the authority bestowed by No. 415 of the RR (which in this case is considered as a special circumstance) and promotes the practical transfer to VHF in circuits or parts of circuits where this is feasible.

2.4.3.1 This aspect is of special interest to many countries which, for physical or economic reasons, cannot effect the changeover to VHF despite the unfavourable conditions of the area, whereas it does not offer great advantages in those areas where adequate means are available for the transmission of speech and signalling to operate outlying stations or long-range directive installations on VHF.

2.4.3.2 The following points may be made on this basic aspect of the proposal:

a) The aeronautical stations which operate with SSB, as proposed under 2.4.2, occupy half of the 6A3 channel width. If aircraft, which occupy the whole of the channel width with their emissions were to use VHF in satisfactory fashion for operations, the rest of the channel could be cleared for other requirements on certain routes, particularly the RDARAs.

b) The aeronautical stations are in an excellent position, equipped in this way, to carry the additional air-ground traffic transmitted on HF and re-transmitted to the control centre via the ground station. Also, traffic for the aircraft, instead of being received by the latter on SSB, can be received direct via the VHF channel which it is using.

c) In this way the requirements for passage to VHF would be fulfilled wherever feasible and at the same time frequency economy would be ensured and a contribution made to relieve congestion as advocated by the I.T.U.

d) The transfer to VHF, in addition to the use of SSB in the ground stations, is a solution for many countries having a large surface area and/or subjected to a high level of noise by reason of their situation in tropical or adjacent zones and which do not possess the means, for the time being, to pass completely to VHF both on the ground and in the air.

e) This obviously implies that the aeronautical stations should work as relays between the VHF station and the control centres, such communications being permitted in special circumstances by No. 415 of the RR. The extension of this permission to the case in question is a matter for the aeronautical service since it does not interfere with other services. Quite the contrary, it leads to greater efficiency and economy in the use of frequencies.

f) VHF provides more reliable links with aircraft than HF, from the point of view of safety of flights, so that any efforts or facilities that are concentrated or granted for these purposes contribute to the efficiency of the Aeronautical Mobile Service.

g) I.C.A.O. recognized that the use of VHF instead of HF could be increased, or HF could even be completely replaced if rapid and reliable AFS links were available between aeronautical stations, so that any of the VHF stations associated with

these aeronautical stations could be used for air-ground communications between the aircraft and the pertinent control or operational centres (see COSP-II, 4.5.2.c).

h) This Conference must encourage any action to satisfy these requirements of reliability of mobile links and frequency economy, particularly if they are satisfied simultaneously within the framework of a progressive plan, leaving the action to be carried through simply by the imperative nature of these requirements and by the will of the Administrations which wish to apply them.

j) Although the HF link, even with the advantages of SSB, constitutes a restrictive factor in the case of atmospheric discharges as far as communications in aeronautical stations are concerned, the efforts to complete the air-ground-ground cycle are the responsibility of the aeronautical station which has received the message by VHF - removing this task from the aircraft, which uses VHF exclusively (with or without SSB reception), with benefits which may prove to be of enormous importance for the safety of the aircraft.

k) If SSB reception (whether compulsory or optional) is not withdrawn in aircraft, the circuit continues to have its ground-air character and permits simultaneous attention to the aeronautical station emissions and to VHF communications, which reduces the maximum load factor to a certain degree.

l) Also, the existence of previous information in the aeronautical station possessing the VHF equipment (by reason of the SSB/HF link and its traffic with the control or operational centres) permits the former to satisfy, partially or completely, many requests from aircraft in VHF, thus reducing the load on the HF circuits.

m) A factor of primary importance is that the economic use of equipment is promoted to the utmost degree so that many countries may be able to solve the serious problems with which they are faced, i.e. the high cost of remote VHF stations and the imperative need to reduce the inefficient aspects of the aeronautical mobile circuits they operate.

2.5 The three basic points referred to in 2.4 and discussed in detail subsequently, have led the Argentine Delegation to consider it essential for this Conference to formulate a plan for the gradual establishment of SSB operation which will satisfy the three points in question - considered by the Argentine Delegation as inter-connected and inseparable.

2.6 Concern about the various operational and technical details must not give rise to doubts preventing or delaying the adoption of the proposed plan since, in the agreements to be concluded between the Administrations, with coordination in ICAO, as suggested in Appendix 26, and finally in the I.T.U. (through the I.F.R.B.) due consideration will be given to solutions for adoption by Administrations.

3. Proposals

That the E.A.A.R C. (1964) should adopt the following resolutions concerning the gradual establishment of single sideband (SSB) operation.

RESOLUTION No.....

The Extraordinary Administrative Aeronautical Radio Conference, Geneva, 1964

Considering

1. that the use of SSB constitutes a technical advantage which increases the efficiency of communications and that it also encourages better economy in the use of the bands allocated to services in general;

2. that the I.T.U., through the Panel of Experts set up in accordance with Resolution 3 of the Administrative Radio Conference (Geneva, 1959), has recommended the adoption of measures as soon as possible for the conversion from DSB operation to SSB operation in the Aeronautical Mobile Service;

3. that nevertheless there are certain operating, technical and economical problems which have to be faced by the Administrations and commercial air companies which hinder the definitive and complete transfer to SSB operation;

4. that at the same time the progress made in certain techniques (e.g. extended range with VHF, automatic data transmission, and artificial satellites) may alter any predetermined date for this definitive transfer;

5. that the gradual passage to SSB can begin from the date of application of the revised Frequency Allotment Plan dealt with by this Conference, by means of the permitted use - by agreement between the Administrations concerned - of compatible transmissions in SSB, by the aeronautical stations, while the aircraft maintain their present 6A3 emissions;

6. that ground-air transmissions in compatible SSB constitute a preliminary stage which can be accomplished in many regional areas or major air routes, while the adaption or changeover of aircraft receiving equipment does not imply an excessive cost in relation to the advantages offered by the use of SSB technique in the sense referred to (ground equipment is normally applied to other services and is an investment which can in any case be recovered);

7. that the SSB equipment in the aeronautical stations can permit of the more extensive use of VHF by aircraft, relieving the communications on 6A3 which they must effect during the preliminary period, since better conditions are offered for connection with the flight control centres, and complying - where there are no remote VHF facilities - with the recommendations for the use of HF, for reasons of reliability in the Aeronautical Mobile Service;

8. that these air-ground ground transmissions (VHF-HF/SSB) and vice versa are a requirement of the Aeronautical Mobile Service enabling HF SSB communications to be provided for part of a route or for the entire route, with the consequent frequency economy, advocated by the I.T.U. Panel of Experts, with immediate benefit to inter-channel protection and clearing the remaining free part of the 6A3 bandwidth for other priority needs;

9. that the use of communications between aeronautical stations is permitted by No. 415 of the RR in special circumstances, a concept which must be extended - with the necessary restrictions - to transmissions to (or from) aircraft using VHF. Since aircraft can receive aeronautical stations direct with SSB, if they so desire or if it is convenient, the circuit continues to retain its character of mobile circuit (particularly in meteorological broadcasting);

10. that the predictions of this Conference must be complete, both in its final resolutions and in those offering guidance, pending the functional completion of communications in the Aeronautical Mobile Service capable of ensuring the safety of civil aviation flights, and bearing in mind the different conditions in each country in order to facilitate the means, available to this Meeting (Appendix 26) to ensure the flight of aircraft of any nationality by means of suitable links with the aeronautical stations, particularly with those ensuring flight control;

11. that the provisions about the use of compatible SSB transmissions and air-ground ground circuits must be settled and imposed by agreement between the Administrations concerned and by the coordination with I.C.A.O. laid down in Appendix 26, so that all the advantages and drawbacks, together with other details arising during application, will be the subject of due attention, with statutory intervention in the I.F.R.B. agreements concerned, as regards frequency assignment;

12. that, hence, the standards and general authorizations must be drawn up to prepare the way for such agreements, and to establish a definitive guiding plan bearing in mind the foregoing considerations.

Resolves

1. To recommend to the Extraordinary Administrative Aeronautical Radio Conference, 1965, to adopt the following Plan for the gradual passage from DSB to SSB operation for HF communications of the Aeronautical Mobile Service :

a) To fix 1 January 1974 as the provisional date for the transfer of operation from channels in the aeronautical mobile (R) service on HF to SSB operations. The final decision will be adopted by an appropriate Conference convened by the I.T.U. in 1970, at which aeronautical interests will be duly represented;

b) The Administrations are recommended to negotiate mutual agreements and ensure the coordination referred to under Appendix 26, part I, Section IIA, point 4, so as to start introducing SSB technique, as a preliminary stage up to 1 January 1974, at least in the conditions outlined below :

   i) After 1 January 1967, aeronautical stations will be able to transmit in compatible SSB. Aircraft will transmit in 6A3 and no SSB may be required of them until 1 January 1974, provided that the conference to be convened in 1970, as mentioned under a), has previously definitively adopted complete passage to this type of operation. Compatible SSB (as defined in of the report of this Conference) could be reduced in the carrier, provided it is so agreed among the Administrations concerned, in the light of operating experience and provided there is suitable receiving equipment in the aircraft;

ii) During this preliminary stage, aircraft may - in those route sections agreed upon by Administrations - use VHF for transmitting to aeronautical stations operating with SSB, receiving with this type of emission and/or VHF, so that the channel 6A3 used is reduced to the bandwidth occupied by the ground emission. The free portion of the channel will be cleared to cover other priority requirements of the aeronautical service, to increase the protection of adjacent channels in the same or other areas, or to meet new requirements.

Aeronautical stations operating with SSB are authorized, during this preliminary stage, to transmit to each other information from and to aircraft, received or for transmission, on VHF, as an extention of the provisions of No. 415 of the RR.

2. To consider and adopt pertinent admendments to Appendix 26 and the related provisions of the RR to permit of the gradual fulfilment of the Plan set out in para. 1) above.

# AERONAUTICAL CONFERENCE

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E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Argentina

PROPOSAL No.6

## GENERAL PROVISIONS FOR THE AERONAUTICAL MOBILE SERVICE

Insert the following provision in Appendix 26, Part I:

Communication between aeronautical stations

1. An aeronautical station in the aeronautical mobile (R) service may communicate with other aeronautical stations in the same service, as an exception to the normal methods of working, in the following special circumstances:

1) On a secondary basis, in accordance with Number 415 of the Radio Regulations.

2) For the transmission of information to or from an aircraft in flight and of secondary communications, during the first stage of the passage of the aeronautical mobile (R) service to single side-band operation (until 1 January 1974) and provided that:

a) Aeronautical stations use single side-band operation, within the classes of emission and channels defined in this Appendix;

b) That aircraft transmit on VHF and receive aeronautical station transmission on VHF with SSB operation.

c) That the Administrations introducing this type of operation, free, one year after the date in which its bringing into service is notified, and in the area or part of the area concerned, one half of the bandwidth of channel 6A3, allotted in accordance with the relevant Plan, and in any case, not less than 40% of that bandwidth.

Note: This provision should be inserted in Part B of Appendix 26 "Aeronautical Mobile (R) Service", in accordance with Argentine proposal No 1/3.

Reason: 1) To achieve greater efficiency in the aeronautical mobile service, encouraging at the same time wider use of VHF and considerable frequency economy in the HF bands (see Argentine proposal No 8).

2) To take the necessary measures for the application of a Progressive Plan for passage to single side-band (preliminary stage).

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# AERONAUTICAL CONFERENCE

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E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Argentina

PROPOSAL No.7

## ADOPTION OF ABBREVIATIONS OR SYMBOLS TO SIMPLIFY THE MENTION OF OR REFERENCE TO THE SERVICES AND STATIONS DEALT WITH IN APPENDIX 26, TOGETHER WITH THE BANDS IN WHICH THEY OPERATE

Add the following text to Part I, Section I (Definitions) of Appendix 26:

2a) For the purposes of this Appendix, the following abbreviations shall be used whenever practical and unlikely to cause confusion:

FA7- Aeronautical mobile service, aeronautical stations (including aircraft stations, when the reference is general) operating on HF, or relating to this service and its operation;

FA8- Aeronautical mobile service, aeronautical stations (including stations on board aircraft, when the reference is general) operating on VHF, or relating to that service or stations and their operation;

MA7- Reference to aircraft stations operating on HF or relating to such stations and their operation;

MA8- Reference to aircraft stations operating on VHF or relating to such stations and their operation.

Note: The abbreviation (OR) will be added whenever specific reference is made to this service or to stations operating in it. Without this abbreviation, it will be understood that reference is made to the aeronautical mobile service (R) or stations operating therein.

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Reason: To simplify in Appendix 26 and in the work of E.A.A.R.C. the references "Aeronautical mobile service operating on HF", "Aeronautical mobile service operating on VHF", "Aeronautical station", etc. Combined use is made of the abbreviations FA and MA, used in service documents (Appendix 10 of the the RR) and of the band number (Number 112 of the RR).

# AERONAUTICAL CONFERENCE

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E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

Argentina

PROPOSAL No. 8

AMENDMENT OF THE BOUNDARIES AND DESCRIPTION OF MWARA NSAM-1 AND NSAM-2
(PART II, ARTICLE I, SECTION I OF APPENDIX 26)

That the Aeronautical E.A.E.C. (1964) should recommend the adoption of the new boundaries for the Major World Air Route Areas NSAM-1 and NSAM-2 as shown in Appendix A to Part 2 of Document No. 8329, COSP II of I.C.A.O., and amend the designation to SAM-1 and SAM-2 respectively.

Reason : Result of study by the Special Communication Meeting of I.C.A.O. (1963) and its Recommendation No. 2/10.

ARCHIVES U.I.T. GENÈVE

# AERONAUTICAL CONFERENCE

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PLENARY MEETING

Memorandum by the Secretary-General

SITUATION OF CERTAIN COUNTRIES WITH RESPECT TO THE CONVENTION

1. In relation to No. 233 of the Convention which reads as follows :

"After the end of a period of two years from the date of entry into force of this Convention, a signatory government which has not deposited an instrument of ratification in accordance with the provisions of 231 shall not be entitled to vote at any conference of the Union, or at any session of the Administrative Council or at any meeting of the permanent organs of the Union until it has so deposited such an instrument."

attention is drawn to the fact that the following countries which signed the Geneva Convention, have not yet ratified that Convention :

Afhganistan
Burma (Union of)
Bolivia
Brazil
Dominican Republic
El Salvador (Republic of)
Greece
Iran
Iraq (Republic of)
Libya (United Kingdom of)
Nicaragua

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Turkey

Uruguay (Oriental Republic of)

Venezuela (Republic of)

2. Furthermore the following countries which were Members of the Union under a previous Convention, have not yet acceded to the Geneva Convention :

Cambodia (Kingdom of)

Chile

Honduras (Republic of)

Yemen

Gerald C. GROSS
Secretary-General

# AERONAUTICAL CONFERENCE

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E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

United Kingdom

## METHODS OF COMMUNICATION AND TYPES OF EMISSION FOR WHICH PROVISION SHOULD BE MADE IN THE REVISED PLAN

Proposal

It is proposed that provision should be made for the possible use of the following types of emission :

a) Telephony, amplitude modulated :

| | | |
|---|---|---|
| i) | Double sideband | (A3) |
| ii) | Single sideband, reduced carrier | (A3A) |
| iii) | Single sideband, full carrier | (A3H) |
| iv) | Single sideband, suppressed carrier | (A3J) |
| v) | Two independent sidebands | (A3B) |

b) Telegraphy (including automatic data systems) :

| | | |
|---|---|---|
| i) | without the use of a modulating audio frequency (by on/off keying) | (A1) |
| ii) | Automatic (data), DSB, amplitude modulated, on/off keying of amplitude modulating audio frequency(ies) or by on/off keying of the modulated emission | (A2) |
| iii) | Automatic (data), DSB, frequency modulated by the on/off keying of a frequency modulating audio frequency or by the on/off keying of a frequency modulated emission | (F2) |

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iv) Automatic (data), SSB, amplitude modulated, reduced carrier, multi-channel voice frequency telegraphy (A7A)

v) Automatic (data), SSB, amplitude modulated, full carrier, multi-channel voice frequency telegraphy (A7H)

vi) Automatic (data), SSB, amplitude modulated, suppressed carrier, multi-channel voice frequency. (A7J)

Reasons

In order to conserve the frequency spectrum, to improve reliability of communication, and to meet changing operational circumstances, requirements to introduce modes of communication other than those in current use (6A3, SELCAL A2 and 0, 1A1), could arise during the life span of the revised plan. It is desirable that these requirements to the extent that they can be foreseen, should be borne in mind, and provision included for their use, subject to appropriate International agreement and the observance of relevant I.C.A.O. and I.T.U. regulations.

It will be premature to attempt to reach detailed agreement on what system would actually be introduced. All that it appears reasonably possible to do is to indicate in the plan what systems might conceivably need to be accommodated.

Clearly, systems not now foreseen might well come to the fore at a later date; the list of systems specified cannot therefore be considered to be exclusive.

# AERONAUTICAL CONFERENCE

Document No. I-30-E
27 January, 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

United Kingdom

## USE OF HIGH FREQUENCIES IN COMMUNICATION WITH SUPER-SONIC AIRCRAFT

Proposal

It is proposed :

a) that communication requirements for supersonic aircraft should be met as far as possible by the use of VHF;

b) that the revised HF Allotment Plan for the Aeronautical Mobile (R) Service should be made sufficiently flexible to provide for the possible need to use HF communication for supersonic aircraft. At present no requirement can be stated for the exclusive allocation of frequencies for this purpose.

Reason

It is possible that supersonic transport aircraft (SST) will be introduced into operational service on some civil routes within the time period 1967-1970.

It is unlikely that a final assessment of communication requirements for this type of aircraft can be made until actual experience has been gained of its operation in an A.T.C. environment. Further any conclusions regarding the best method of meeting the communication requirements must await firm information regarding the availability of new communication techniques, such as satellite relays and data links.

In the light of the foregoing observations it is concluded that initial planning must be based on existing methods of communication which will be in use when the SST is introduced into service.

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In the interest of conserving the HF spectrum it is recommended that where possible the maximum feasible use is made of VHF.

Where, however, owing to prevailing circumstances VHF cannot be employed, communication requirements will of necessity be reliant on the use of HF and must be taken into account in the revised plan. It is therefore recommended that in revising the HF plan sufficient flexibility be provided to permit the use of families of frequencies on a shared basis with sub-sonic aircraft. The allotment of HF families exclusively for communications with supersonic aircraft is not considered to be a necessity at the present time.

# AERONAUTICAL CONFERENCE

Document No. I-31-E
27 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

United Kingdom

TRANSMISSION, PROPAGATION AND RECEPTION

Proposal

It is proposed :

a) that the basic technical criteria employed by I.A.A.R.C. in developing the present Aeronautical Mobile (R) Service H.F. Allotment Plan should continue to be used;

b) that interference range contours and charts for the Polar areas should be developed, and the charts for these areas should be based on a Polar gnomonic projection;

c) that the interference range contours for latitudes between 60°N and 60°S which were included in Appendix 26 should be retained without revision.

Reasons

In order to prepare the H.F. Aeromobile Plan, the International Administrative Aeronautical Radio Conferences of 1948 and 1949 adopted certain technical standards. These are stated in the I.A.A.R.C. document AER Document No. 231E.

Subjecting the I.A.A.R.C. frequency allotment plan to a critical examination, in the light of operational experience during recent years, should give a lead as to where and to what revision of the technical criteria is necessary. Such an examination reveals that there has been a marked absence of criticism of the work of the plan. This would indicate that the criteria adopted by the I.A.A.R.C. have been amply justified.

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With regard to the interference range contours, those developed by I.A.A.R.C. and included in Appendix 26 to the Radio Regulations extend from latitude 60°N to latitude 60°S. This information must now be expanded to include the polar regions. A cylindrical projection for charts wherein the distance between lines of latitude remains constant has the advantage that it could be used for all latitudes but suffers from the disadvantage that routes near the poles would be badly distorted. A polar gnomonic projection is therefore to be preferred for the polar regions with the existing charts based on a mercator's projection being retained for latitudes between 60°N and 60°S.

# AERONAUTICAL CONFERENCE

Document No. I-32-E
27 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

United Kingdom

REVIEW OF THE ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE

1. Introduction

The 1964 Preparatory Session of the E.A.R.C. is a most important step towards the full implementation of Resolution No. 13 of the 1959 Ordinary Administrative Radio Conference. Foremost amongst its tasks is the consideration of the many factors directly bearing on the work of the Main Session (to be held later) and not least is it faced with the need to reconcile some of those factors which apparently conflict. Only by so doing can a reliable foundation be laid and can the principles be established as are required by the agenda.

In other documents the United Kingdom has presented proposals, in the most part self-explanatory, directly related to certain aspects of the agenda. In general these proposals are in full accord with the views expressed by the United Kingdom at the I.C.A.O. Special COM Meeting, 1963, and with the recommendations resulting therefrom. At the same time it is recognised that these proposals are by no means comprehensive nor can the Final Report of the I.C.A.O. Meeting be expected to answer every question likely to confront the Conference. Were this not so the need for a Conference would scarcely arise.

In view of the comparatively short time available to the Preparatory Session this document is presented as a contribution towards isolating the major issues and concentrating effort on those areas in which results of greatest value to the Main Session are likely to be achieved.

2. Background

The Ordinary Administrative Radio Conference in 1959 incorporated the Aeronautical Mobile (R) Plan as part of Appendix 26 to the Radio Regulations. Prior to that this Plan had existed only as the I.A.A.R.C. 1949 Plan or as Annex VIII of the 1951 E.A.R.C. Agreement.

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The O.A.R.C. appreciated that the Plan was then over ten years old and the aviation representatives present were only too aware of the changes in civil flying that had taken place in those ten years. The Conference therefore has reasonable doubts whether the Plan was fully satisfactory at that time or could be relied upon to remain so until the next opportunity would arise to review it.

Resolution No. 13 was accordingly adapted in recognition of this situation and the "considering clauses" set out in detail the factors which decided the O.A.R.C. to call for this E.A.R.C. to re-examine the Plan. In the United Kingdom's view there has been no substantial change in those factors as listed in 1959 apart from the draft Report of the Panel of Experts established under Resolution No. 3 of the same O.A.R.C.

One of the important features contained in Resolution No. 13 is that whilst the 1959 Conference had full competence under the Convention to revise Appendix 26 it did not do so. Its reasons for not doing so are set out in Clauses (k) and (l) of the Resolution.

3. The operational requirement

As the logical development of what has been said above the primary task for the Preparatory Session of the E.A.R.C. is to ensure that the 1965 Session is in possession of the essential information it requires and which the O.A.R.C. in 1959 lacked. It naturally follows that the 1964 Session itself is virtually in no better position than the O.A.R.C. to revise the Plan and any attempt to do so could only qualify as "inspired guess work".

The work that this Conference must do in deciding what statistics are required and how they are collected and submitted is therefore extremely important. The success of the 1965 Session must largely depend on the results obtained.

Whilst the United Kingdom has submitted no proposals specifically on this aspect it fully supports those already before the Conference which reflect those also developed at the I.C.A.O. Special COM Meeting. It is hoped that with the cooperation of the Secretariat the Conference will have the opportunity of testing the application of these proposals using machine processing to assess the result. This would serve also to demonstrate the form of presentation with which the 1965 Session will be faced.

To reemphasise the importance of this aspect may seem superfluous but the long experience of the I.T.U. and I.F.R.B. Secretariats in establishing a completely reliable picture of any world wide traffic or channel requirements must assuredly support our belief that it is no simple task. In this case however, the picture to be drawn will be of aircraft operations and the frequency requirements can only emerge as a second-stage conversion after that.

The establishment of the requisite forumlae to permit of this conversion is one on which the United Kingdom has submitted proposals under the heading of "Permissible Loading". It is felt the Conference will wish to examine these proposals in the light of studies which Administrations may have carried out in accordance with Recommendations No. 8/1 and 8/5 of the I.C.A.O. Special Meeting.

4. Principles for frequency allotment

On the basis of what has been said already the United Kingdom therefore endorses the view expressed by the I.F.R.B. in Para. 3.1.3 of Document No. 1-5 viz. that the requirements will only be fully known to and can be considered by the Second Session of the Aeronautical Conference.

To some extent therefore the First Session is put in the dilemma of having to decide on the planning principles without knowing the full extent of the requirement for which the Plan must cater. Whilst this clearly applies most forcibly to the number of channels needed, of which more later, it also bears on the basic principles such as the M.W.A.R.A. and R.D.A.R.A. allotment design and sharing criteria etc.

It is felt that such a problem may best be treated by eliminating first those elements wherein the least uncertainty exists. In this connection there is one outstanding factor and that is the success with which the present Plan serves its purpose. Whatever reasons may be suggested for this, or however many new requirements may be identified, the fact remains that to the best of our knowledge the world's civil flying operations do not suffer unduly from any restrictions imposed by the (R) Plan or its application.

The Conference may wish to consider the extent to which this belief is justified as it is on this basis that the United Kingdom, proposes the retention of the M.W.A.R.A. and R.D.A.R.A. principles and the criteria for frequency repetition used in the present Plan. In addition, the considerations which influenced the 1959 Conference in resolving to review Appendix 26 have been mentioned above and as most of these have been accommodated without disaster within the provisions of the Plan says a great deal for its flexibility and the foresight of its original architects.

Whilst stating this it is pertinent to recall that the I.A.A.R.C. 1949 agreement contained several expressions of doubt that the available spectrum would be sufficient. These doubts were based on thethen foreseen growth in civil flying but even so the 1949 planners could never have foreseen nor accepted the quite phenomenal growth that has in fact taken place. The answer to this apparent paradox lies, in our view, in the equally spectacular growth of VHF communications in the (R) Service and to changes in Air Traffic Control practices which both have afforded compensating relief. The United Kingdom is confident that these or similar trends can be relied upon to continue.

In the light of considerations such as these no proposals are being put forward for changes in the basic principles of the Plan irrespective of the extent to which the need to change area boundaries or frequency components may be eventually demonstrated. Such changes ought to be regarded as matters of detailed planning, whence, as a result the major issue remaining would seem to be that of deciding on the number of channels available.

5. Channel spacing and planning proposals

The questions of channel spacing as a determinant of the number of channels available for planning and that of the communications systems appropriate to the spacing selected are complex ones. The I.C.A.O. Special COM Meeting was much exercised with them and in Document 1-5 the I.F.R.B. has clearly set out their salient features. In their objective of achieving the greatest economy of spectrum space the Panel of Experts has invited this Conference to consider the applicability of single side band as a means of producing more channels for the Aeronautical (R) Service.

Appreciating that the Panel of Experts Report has not yet been considered by the Administrative Council the United Kingdom nevertheless believes the Conference should take account of the relevant recommendation together with others of equal concern. However, past experience suggests that the question of single sideband is too readily capable of promoting discussions of length far out of proportion to their relative importance.

In this connection the United Kingdom has submitted proposals aimed at what is held to be a reasonable and logically phased progression towards ultimate conversion to this technique.

Summarised these amount to first a basis for a revised Plan capable of early introduction and secondly the acceptance of a target date for the further conversion of this first stage to another achieving greater spectrum economy.

The first stage is essentially in line with the views agreed at the I.C.A.O. Special COM Meeting and requires changes to channel spacing at orders above 10 Mc/s. By including adequate regulatory provisions for the use of SSB during this stage a readier transition to this mode is possible whilst inherently the continuance of DSB is safeguarded. Such a policy is considered to represent a recognition of the factors involved in amending a plan which in practice forms a delicate balance between what is desirable and what is feasible.

An objection to such a proposal could be that it affords but a few extra channels whereas the 1965 Session may be confronted with requirements for many more, which is the essence of the dilemma mentioned earlier.

It is felt nevertheless that for the first Stage it is essential to achieve a Plan capable of introduction by 1967 rather than an ideal satisfying all needs on paper but impossible of application until a much later date. In this regard the United Kingdom view is influenced by the firm belief that the replanning needed to meet the changes in air routes and areas of emphasis ought not to be delayed and in themselves constitute the major task. If the 1965 Session can successfully carry out these essential amendments it will have done very well indeed and later improvements will certainly follow if the opportunity exists in the provisions for them to do so.

The aim of spectrum economy for its own sake is unquestionably important as a foreseen consequence of the increase in all forms of radio communications. At the same time if any single service were to be judged on its merits in this respect it should not, in our view, be restricted to a consideration solely of Recommendation No. 4 of the Panel of Experts. As a potential relief for the H.F. Bands the effects of Recommendation No. 25, for example, far exceed the others and the Aeronautical (R) Service can justly claim to have excelled in this direction. That it has of course is mainly due to the obvious fact that aircraft operations permit of the use of VHF and UHF far more than surface operations. By comparison the shortcomings of HF communications are such that it can safely be asserted that aviation uses high frequencies only to the extent that it is compelled to. Whenever practical and feasible VHF is employed which is a fact which will undoubtedly emerge from the statistics to be collected for the 1965 Session

With regard to the foregoing it could be said that some of the shortcomings of H.F may be overcome by single side band systems and reference is made to the Panel of Experts considerations leading up to Recommendations No. 1. There can be little argument that on circuits at extreme ranges such as are encountered in the Fixed and Maritime Mobile Services these are important factors. In the aeronautical case such a requirement is an exception in the system of operation that has now evolved. Under the normal Air Traffic Control concept aircraft communicate with the centre of the immediate area in which they are flying. Where this can be served by a network of stations the nearest is usually employed in which circumstances some of the technical advantages of single side band technique tend to lose their importance In this respect it is even possible to draw a distinction between the Aeronautical (R) and (OR) Services. The latter, as the definition implies, are less tied to regular routes and the need to communicate at extreme ranges often arises and thus the operational incentive to employ single side band is enhanced.

In the light of these considerations and the fact that as yet no commonly accepted system characteristics exist apart from those now used in the aeronautical (R) service the United Kingdom proposals in support of the I.C A.O. Special COM recommendations are submitted. As a policy for the attainment in 1965 of a Plan capable of introduction in 1967 the changes involved are the maximum feasible.

At the same time it is considered that this opportunity should not be lost to look forward to the next step and unrealistic to ignore current trends in development and production of airborne equipment. The target date suggested for consideration by the Conference is not unrelated to known expectations of current investments in aircraft and radio alike bearing in mind that an acceptable pace for the majority is less than that of the fastest runner. The Conference will doubtless wish to debate the validity of this suggestion and what would be involved to achieve it or an earlier one in some detail.

# AERONAUTICAL CONFERENCE

Document No. I-33-E
27 January, 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

United Kingdom

## PERMISSIBLE LOADING OF A FREQUENCY OR FAMILY OF FREQUENCIES

Proposal

It is proposed :

a) that the same basic approach taken by I.A.A.R.C. in 1948/1949 to determine the required number of frequencies for any route be followed.

b) that either formula (2) or (3) in the following text be employed to calculate "N". Formula (2) is to be preferred if flight statistics submitted by States indicated that the same rounded-off figure for aircraft speed can be used for scheduled and non-scheduled flights without introducing significant error.

c) the impact of VHF be allowed for by multiplying "N" by the following factor :

$$\frac{\text{(Total route length)} - \text{(Route length covered by VHF)}}{\text{(Total Route Length)}}$$

d) that the E.A.R.C. consider the adoption of a concentration factor K equal to 2.4 for all Major World Air Routes, except where it is agreed by the Conference that another value is more appropriate in the light of statistics submitted by States.

e) that the E.A.R.C. adopt the figures of 12 and 10 as the number of aircraft per hour that can be accommodated by a family of frequencies and a single frequency respectively, except where it is agreed by the Conference that these should be amended in the light of statistics submitted by States.

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Reasons

The number of frequencies or families of frequencies required for aircraft operations on route or in a given area was established by the International Administrative Aeronautical Radio Conference, Geneva, 1948 from the following information :

a) the expected peak number of aircraft on a route during one hour;

b) the channel capacity in terms of the number of aircraft that can be accommodated on a single frequency or a family of frequencies.

The division of a) by b) gives the required number of frequencies for any given route or area.

The empirical formula adopted by I.A.A.R.C. to determine the peak number of aircraft on a route during one hour is expressed as follows :

N = the expected peak number of aircraft that would be in the air in any one operation during one hour.

$$= \frac{K \text{ (route miles x scheduled flights per week)}}{200 \times 7 \times 24} + \% \text{ allowed for non-scheduled operations.}$$

where K is the probable concentration factor = 2.4 for MWARA's

200 = rounded off figure for aircraft speeds
7 = days per week
24 = hours per day

For channel capacity the conference determined that for a Major World Air Route, a family of frequencies could be expected to accommodate a maximum of 12 aircraft in one hour, but if a route was served by a single frequency, 10 aircraft could be accommodated. There were insufficient frequencies to meet these standards everywhere and it was found impossible to apply a single figure uniformly.

There is no strong evidence to support the adoption of an alternative approach to the problem of calculating frequency requirements. On the contrary, it would appear that the approach taken by the I.A.A.R.C. has been fully justified by experience within the Aeronautical Mobile (R) Service.

It is evident however that the rounded off figure for aircraft speed used by I.A.A.R.C. in applying the formula is no longer realistic. Values assigned to the other factors may also need to be amended in the light of changed operational circumstances.

The implementation of VHF since the I.A.A.R.C. plan was developed, which clearly reduces requirements for HF channels, must also be taken into account.

Factor K

The value to be assigned to the factor K will clearly depend on the traffic pattern. There is evidence to support the continued use of the I.A.A.R.C. figure of 2.4 for the North Atlantic MWARA; elsewhere the conference would agree that another value is more appropriate in the light of information submitted by States.

Scheduled or Non-Scheduled Operations

In the I.A.A.R.C. formula, a percentage is added for non-scheduled operations. Where firm figures for non-scheduled operations can be simply derived from operational statistics submitted by States, these should be used in preference to the percentage correction.

Aircraft Speed

For the latest jet aircraft on scheduled operations a speed of 500 knots would be appropriate. The speed of aircraft engaged on non-scheduled flights is probably lower and where a firm figure can be derived from statistics submitted by States, this should be used if its effect on the final answer is significant.

The I.A.A.R.C. formula would therefore be amended as follows :

$$N = K \left( \frac{L \times Fs}{Vs \times 7 \times 24} + \frac{L \times Fns}{Vns \times 7 \times 24} \right) \quad - \quad (1)$$

which can be simplified to read

$$N = \frac{KL}{168} \left( \frac{Fs}{Vs} + \frac{Fns}{Vns} \right) \quad - \quad (2)$$

where

N = the maximum number of aircraft that would require communication in any one hour

K = Concentration factor

L = Total route length
Vs = Rounded off figure for scheduled aircraft speed
Vns = Rounded off figure for non-scheduled aircraft speed
} expressed in same system units.

Fs = Scheduled flights per week

Fns = Non-scheduled flights per week

7 = days per week

24 = hours per day

A further simplification of the formula (2) is possible if it can be demonstrated from a study of flight statistics submitted that the same figure for the speed of non-scheduled and scheduled aircraft can be used on all routes without introducing significant errors. The formula then becomes :

$$N = \frac{KL}{168}\left(\frac{F}{V}\right) \qquad - \qquad (3)$$

Where F = total flights, scheduled and non-scheduled,

V = rounded off figure for aircraft speed (applying to both scheduled and non-scheduled aircraft).

Impact of the use of VHF

It is possible to take account of the use of VHF by subtracting the route length covered by VHF from the total route length in the formula for N

$$N^1 = \frac{K\,(L-Lvhf)}{7 \times 24}\left(\frac{Fs}{Vs} + \frac{Fns}{Vns}\right) \qquad - \qquad (X)$$

or alternatively if considered more convenient

$$N^1 = N\,\frac{(\text{Total route length} - \text{Route length cover by VHF})}{(\text{Total Route length})}$$

$$= N\,I$$

Where I is defined as the "Impact of VHF factor"

Number of Aircraft on a frequency or family of frequencies

I.A.A.R.C. assumed that a family of frequencies could be expected to accommodate a maximum of 12 aircraft in one hour but if a route was served by a single frequence, 10 aircraft per hour was appropriate. The view has been expressed that, at least for the more heavily loaded families (e.g. B and C for North Atlantic), the figure of 12 is often exceeded, although the resulting delay in access to the channels is not known.

However unless more accurate figures can be derived from statistics submitted by States, it is considered that the figures 12 and 10 should be retained.

# AERONAUTICAL CONFERENCE

Document No. I-34-E
27 January, 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

United Kingdom

## PRESERVATION OF MWARA'S AND RDARA'S

Proposal

It is proposed:

that the basic MWARA and RDARA concept should continue to be the geographical basis for allocating frequencies in the revised plan.

Reasons

Civil Air Routes are inter-continental, inter-regional or regional and domestic.

Many routes transcend national boundaries and the International Administrative Aeronautical Radio Conference of 1948 and 1949, at which the present Frequency allotment Plan for the (R) Service was developed, concluded that the most appropriate method of allocating frequencies was on the basis of areas embracing major portions of the civil route structure having a community interest. The concept was adopted in preference to the allocation of frequencies nationally, the basis on which the (OR) Plan was developed.

Accordingly Major World Air Route Areas (MWARA) and Regional and Domestic Air Route Areas (RDARA) were defined.

MWARA - is an area embracing a certain number of Major World Air Routes which generally follow the same traffic pattern, and are so related geographically that the same frequency families may logically be applied.

RDARA - embraces all those areas using the Aeronautical Mobile (R) Service not covered by the definition of Major World Air Route Areas.

Nothing has occurred in practice to indicate that the decision to adopt the concept of MWARA's RDARA's was fundamentally wrong, and the plan so derived has proved to be satisfactory in practice.

Since there appears to be no logical alternative basis for allocating frequencies which would permit greater economy in the use of the frequency spectrum or improvements to the operational service, the preservation of MWARA's and RDARA's as the geographical basis for the revised plan is amply justified.

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# AERONAUTICAL CONFERENCE

Document No. I-35-E (Rev.)
29 January 1964
Original: French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

COMMITTEE STRUCTURE

(approved at the first Plenary Meeting)

---

COMMITTEE 1 : Steering Committee

Chairman of the Conference and Chairmen of the Committees

---

COMMITTEE 2 : Credentials Committee

India : Mr. A.R. RAMANATHAN

Mexico : Mr. J. HERNANDEZ G.

---

COMMITTEE 3 : Budget Control

Ghana :

Federal Republic of Germany : Mr. U. MOHR

---

COMMITTEE 4 : Technical and Operating Questions

United Kingdom : Mr. J.T. PENWARDEN

Thailand : Dr. C. WACHARASINDHU

---

COMMITTEE 5 : Operating Statisticals

Group of Territories represented by the French Overseas Post and Telecommunication Agency : Mr. M. CHEF

Argentina : Mr. J. MARINSALDA

Poland : Mr. J. RUTKOWSKI

---

COMMITTEE 6 : Drafting Committee

Belgium : Mr. P. BOUCHIER

Spain : Mr. M. SANTIAGO SHAW

Canada : Mr. R.O. HEWITT

ARCHIVES U.I.T. GENÈVE

# AERONAUTICAL CONFERENCE

Document No. I-35-E
27 January 1964
Original: French

E.A.R.C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

## COMMITTEE STRUCTURE

(approved at the first Plenary Meeting)

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Argentina :

Poland : Mr. J. RUTKOWSKI

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COMMITTEE 6 : Drafting Committee

Belgium : Mr. P. BOUCHIER

Spain :

Canada : Mr. R.O. HEWITT

# AERONAUTICAL CONFERENCE

Document No. I-36-E
28 January 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 6

DRAFT AGENDA FOR THE
FIRST MEETING OF THE DRAFTING COMMITTEE

29 January, 1964, at 3 p.m. in Room XV

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1. Appointment of rapporteurs
2. How the Committee's work should be organized
3. Proposals for the Plenary Meeting as to how the fruits of the Conference's deliberations should be set forth
4. Any other business

Chairman
P. BOUCHIER

ARCHIVES U.I.T. GENÈVE

# AERONAUTICAL CONFERENCE

Document No. I-37-E
28 January 1964
Original : French, English, Spanish

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

## COMMITTEE STRUCTURE

1. The Annex shows the Committee Structure of the First Session of the Aeronautical Radio Conference as approved by the Plenary Assembly, their terms of reference, which for Committees 4 and 5, are based on the agenda of the Conference as proposed by the Administrative Council and approved by the Members and Associate Members of the Union, and the allocation of documents published to date among these Committees as approved by the Steering Committee.

2. No attempt has been made to refer to specific sections or subdivisions of documents, as it is understood that some of these are in the course of being reviewed and changed.

3. Some proposals of Administrations, such as those appearing in Part IV of Document No. I-1 (United States of America) and in part of Document No. I-22 (Argentina), do not appear to fall within the terms of reference of the first session of the Aeronautical Radio Conference. The Plenary Assembly may wish to consider, in due course, how such proposals should be dealt with.

Annex : 1

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# A N N E X

1. Steering Committee

(The Chairman and Vice-Chairmen of the Conference, and the Chairmen of committees)

Terms of reference

To co-ordinate committee work, set up the schedule of meetings, provide guidance to facilitate the functioning of the Conference, etc.

2. Credentials Committee

Terms of reference

In accordance with No. 535 of the Convention.

3. Budget Control Committee

Terms of reference

In accordance with the provisions of Rule 5 of the General Regulations annexed to the Convention.

- Document No. I-19-E.

4. Committee 4 - Technical and Operational Committee

Terms of Reference

To consider and recommend the technical and operational principles on which any revision of the Frequency Allotment Plan for the Aeronautical Mobile R Service should be based.

Allocation of documents

Note - The order in which the following items are listed is not intended to imply the order of priority for their consideration.

| | | Document No. | Submitted by |
|---|---|---|---|
| 1. | Propagation criteria | | |
| | a) for use in temperate latitudes | I-1 | USA |
| | | I-14 | IFRB |
| | | I-31 | G |
| | | Volume II, C.C.I.R., X Plenary Assembly, C.C.I.R. Atlas of propagation | |
| | b) for use in polar areas | I-1 | USA |
| | | I-14 | IFRB |
| | | I-15 | CCIR |
| | | I-31 | G |
| 2. | Protection ratios and interference ranges | I-1 | USA |
| | | I-13 | IFRB |
| | | I-15 | CCIR |

(continued)

| Committee 4 (continued) | | Document No. | Submitted by |
|---|---|---|---|
| 3. | Types of emission | I-1 | USA |
| | | I-13 | IFRB |
| | | I-15 | CCIR |
| | | I-24 | ARG |
| | | I-25 | ARG |
| | | I-29 | G |
| 4. | Power of emission | I-1 | USA |
| | | I-13 | IFRB |
| | | I-15 | CCIR |
| 5. | Channel separations | I-1 | USA |
| | | I-3 | J |
| | | I-5 | IFRB |
| | | I-11 | IND |
| | | I-15 | CCIR |
| 6. | Basic concepts for the allotment of frequencies | I-1 | USA |
| | | I-7 | IFRB |
| | | I-8 | IFRB |
| | | I-11 | IND |
| | | I-32 | G |
| | | I-34 | G |

(continued)

| Committee 4 (continued) | | Document No. | Submitted by |
|---|---|---|---|
| 7. | Frequency sharing between areas | I-1 | USA |
| | | I-7<br>I-14 | IFRB |
| 8. | Continued need for common R and OR frequencies | I-1 | USA |
| | | I-11 | IND |
| 9. | Use of single sideband emissions | I-1 | USA |
| | | I-6 | IFRB |
| | | I-24 | ARG |
| | | I-29 | G |
| 10. | Use of VHF | I-1 | USA |
| 11. | Improvements in communication techniques | I-1 | USA |
| 12. | Number of aircraft which can be served on a frequency or family of frequencies | I-1 | USA |
| | | I-11 | IND |
| | | I-12 | IFRB |
| | | I-16 | AUS |

5. Committee 5 - Aircraft Operation Statistics Committee

Terms of Reference

Bearing in mind the Grouping of Air Routes, to consider and recommend the form and date by which statistical flight information should be submitted to the I.T.U.; the manner in which such data should be analysed; and the form in which the results should be presented to the main session of the Conference.

| Allocation of documents | | Document No. | Submitted by |
|---|---|---|---|
| 1. | Grouping of International Air Routes (MWARA's) | I-1 | USA |
| | | I-3 | J |
| | | I-7<br>I-8 | IFRB |
| | | I-11 | IND |
| | | I-27 | ARG |
| 2. | Grouping of Regional and Domestic Air Routes (RDARA's) | I-1 | USA |
| | | I-7<br>I-8 | IFRB |
| | | I-11 | IND |
| 3. | Requirements for supersonic aircraft | I-1 | USA |
| | | I-4 | IFRB |
| | | I-30 | G |

(continued)

| Committee 5 (continued) | | Document No. | Submitted by |
|---|---|---|---|
| 4. | Dissemination of meteorological information | I-1 | USA |
| | | I-3 | J |
| | | I-9 | IFRB |
| | | I-11 | IND |
| | | I-23 | ARG |
| 5. | To consider for MWARA's and RDARA's : | | |
| a) | the type and nature of information concerning flight operations which should be submitted to the I.T.U.; | I-1 | USA |
| | | I-10 | IFRB |
| | | I-21 | USA |
| b) | the duration and time of year when flight operation statistics should be reported; | I-1 | USA |
| | | I-21 | USA |
| c) | the format in which such statistics should be reported, with associated instructions; | I-10 | IFRB |
| | | I-21 | USA |

(continued)

| Committee 5 (continued) | Document No. | Submitted by |
|---|---|---|
| d) the manner in which such statistics should be analysed and the results presented to the main Session of the Conference. | I-21 | USA |

6. Editorial Committee

Terms of Reference

In accordance with Rule 21 of the General Regulations annexed to the Convention. Furthermore, the Editorial Committee will make proposals as to the form to be given to the Final Acts of the First Session of the Aeronautical Radio Conference.

AERONAUTICAL CONFERENCE

Document No. I-38-E
28 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

U.S.S.R.

# PROPOSALS RELATING TO THE DETERMINATION OF FREQUENCY REQUIREMENTS FOR REGIONAL AND DOMESTIC AIR ROUTE OPERATIONS

PROPOSAL No. 1

In order to determine HF requirements for aeronautical mobile service (R) in the regional and domestic air route areas (RDARA) it is suggested to assume as a basis the formula, that was recommended by the Special Meeting I.C.A.O. (Montreal, April-May 1963, paragraph 8 3.3) for MWARA.

To facilitate preparation, collection and processing of statistical data it is suggested that the mentioned above formula may be transformed in such a way that the statistical data relating to the length of the stages and speed of aircrafts be replaced by the time aircrafts spend in the air, namely :

$$N = K \left( \frac{L \times F_s}{V_s \times 7 \times 24} + \frac{L \times F_{ns}}{V_{ns} \times 7 \times 24} \right);$$ which can be simplified to read :

$$N = K \left( \frac{F_s}{168} \cdot \frac{L}{V_s} + \frac{F_{ns}}{168} \cdot \frac{L}{V_{ns}} \right) \qquad (1)$$

where :

N = the maximum number of aircraft that would require communication in any one hour

K = concentration factor

L = total route length

$V_s$ = rounded-off figure for scheduled aircraft speed

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$F_s$ = scheduled flights per week

$F_{ns}$ = non-scheduled flights per week

168 = hours per week,

as $\frac{L}{V_s} = t_s$ - is the mean time for scheduled aircraft operations in the air on the given route

and $\frac{L}{V_{ns}} = t_{ns}$ - is the mean time for non-scheduled aircraft operations in the air on the given route,

Then $N = K\left(\frac{F_s t_s}{168} + \frac{F_{ns} t_{ns}}{168}\right)$;

as $F_s \cdot t_s = T_s$ - is the time of all the scheduled aircraft operations in the air on the given route

and $F_{ns} \cdot t_{ns} = T_{ns}$ - is the time of all the non-scheduled aircraft operations in the air on the given route.

Then $N = \frac{K}{168}(T_s + T_{ns})$ where :

$T_s + T_{ns} = T_n$ - that is the total time of all the aircraft operations in the air on the given route.

Thus, formula (1) in regard to all the aircrafts operating on all the routes be amended as follows :

$$N \text{ total} = \frac{KT \text{ total}}{168} \qquad (2)$$

where :

T total - is the total time that all the aircrafts spend in the air operating on all the domestic routes or within RDARA per week.

Number of aircrafts that can be served by a single frequency or by a single frequency channel is accepted equal to 10 or 12 respectively. To reduce the requirements in high frequency by means of utilizing VHF on routes or their stages it is suggested to mark the time of aircraft was in the area covered by any form of VHF by $T_{VHF}$, then the formula 2 would be as follows :

$$N'_{\text{total}} = \frac{K(T \text{ total} - T_{VHF})}{168} \qquad (3)$$

PROPOSAL No. 2

In connection with stated above the form of operation aircraft statistics for determination of requirements in HF in RDARA is suggested.

Reason : 1) Statistical data for the time of aircraft operations in the air is the most widely used form of report systematically completed as account of aviation activity in some countries.

2) These statistical data provide more accurate results about the number of aircrafts operating in the air in any one peak hour as instead of intervals of speed the real speed is counted.

Instructions for Completing the Report Form "Aircraft Operation Statistics - RDARA"

General : Aircraft flights requiring HF should be reported by the Administration of Registry or by the Administration using these aircrafts. Reports by subdivision of countries such as by State, or Province, or by geographical areas may be employed at the discretion of the Administration, however, such subdivision should not be made where the longest air route in country does not exceed 1000 nautical miles.

Part A Reporting Administration.

Part B I.T.U. designation of Administration. Use abbreviation appearing in Preface to International Frequency List.

Part C Enter calendar week in GMT selected for survey.

Part D Aircraft Operation statistics :

Column 1 : Name of I.T.U. frequency area.
Column 2 : Total time of aircraft operations in the air per week (in hours)
Column 3 : Total time of aircraft operations in areas covered by VHF communication per week (in hours).

Part E Sum total

Example

## Aircraft Operation Statistics - RDARA

A. Reporting Administration : U.S.S.R.

B. I.T.U. designation of Administration : U.S.S.R.

C. The representative week selected :

(Sunday, 0016 GMT, August 4, 1963 to
Saturday, 2400 GMT, August 10, 1963 inclusive)

D. Aircraft Operation Statistics.

| Frequency Area I.T.U. | Total time of aircraft operations in the air during this week (in hours) | Total time of aircraft flight in area, covered by VHF communication during this week (in hours) |
|---|---|---|
| 2a<br>2b<br>2c<br>3a<br>3b<br>3c | 17,500 | 10,000 |

E. Sum total.

# AERONAUTICAL CONFERENCE

Document No. I-39-E
28 January 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

AGENDA

FOR THE FIRST MEETING OF THE

OPERATING STATISTICS COMMITTEE

29 January, 1964, at 0930 a.m., in Room XVI

---

1. Appointment of rapporteurs
2. Organization of the Committee's work
3. General review of questions to be studied
4. Any other business

Maurice CHEF
Chairman

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# AERONAUTICAL CONFERENCE

Document No. I-40-E
28 January 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

AGENDA

FOR THE FIRST MEETING OF THE TECHNICAL COMMITTEE

29 January, 1964, at 09.30 a.m. in Room XV

---

1. Appointment of rapporteurs

2. Preliminary consideration of subjects to be studied - Document No. I-37, Section 4 refers

3. Preparation of work programme

4. Any other business

J. T. PENWARDEN
Chairman

ARCHIVES U.I.T. GENÈVE

# AERONAUTICAL CONFERENCE

Document No. I-41-E
28 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

United Kingdom

PROPOSALS FOR THE PREPARATORY SESSION OF THE EXTRAORDINARY ADMINISTRATIVE RADIO CONFERENCE

## Separation of the (R) and (OR) Plans

### Proposal

It is proposed :

a) that the revised Frequency Allotment Plan for the Aeronautical Mobile (R) Service be the subject of a new and separate regulation;

b) that the existing Appendix 26 be applicable to the Aeronautical Mobile (OR) Service only;

c) that the foregoing should form the basis of a Recommendation for the Guidance of the Second Session of the E.A.R.C. and for appropriate provision in its agenda if necessary.

### Reasons

The task of the E.A.R.C. is confined by its agenda to the revision of the Frequency Allotment Plan for the Aeronautical Mobile (R) Service only. (See Radio Regulation No. 429).

However, certain aspects of the existing (R) plan, in particular the Technical Principles on which it is based, also apply to the (OR) Plan. The areas of overlap appear under the heading "General Provisions" in Part I of Appendix 26 to the Radio Regulations, in which both plans are incorporated.

In the foregoing circumstance, when making changes in the areas of overlap, an appropriate method of effecting the changes must be devised in order that the interests of the (OR) service may be protected.

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The most convenient, if not the only workable, solution to the problem would appear to be the separation of the plans, new and separate provisions being inserted as a sub-section of Appendix 26 for the revised (R) plan, with the relevant material of Appendix 26 being retained but applicable to the (OR) services only. This solution will enable the Conference to concentrate its efforts on the revision of the (R) plan and permit, if so desired, the adoption of entirely different planning criteria.

# AERONAUTICAL CONFERENCE

Document No. I-42-E
29 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

United States of America

## REPORT ON LONG DISTANCE VHF COMMUNICATIONS SYSTEM BEING DEVELOPED IN THE UNITED STATES

The attached Report was prepared by the Federal Aviation Agency. Minor modifications were made for purpose of presentation to the Aeronautical Extraordinary Administrative Radio Conference (E.A.R.C.). Due to press of time it was not possible to include Figs. 2, 4 - 6, 8 - 10, 12 - 13 and 16 - 17.

Although some of the results shown in the Report appear encouraging, it must be clearly understood that the United States feels that not enough experimental data has been obtained to date to reach firm conclusions about the system. It would, therefore, be premature at this time to do much more than note the U.S. program in this area and the results obtained thus far.

The U.S. is continuing long range VHF studies and experiments and hopes to make more definitive information available for distribution at the 1965 I.T.U. Aeronautical Conference.

Annex : 1

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Electronic Systems Development Division
Systems Research and Development Service
Federal Aviation Agency, Washington, D.C.
Development of Long Distance VHF Communications System
by Urban H. Polking, 10 pp., incl. 21 illus.,
Memorandum Report (Project No. 116-10D)

## ABSTRACT

The Federal Aviation Agency has initiated a program to extend air/ground communication ranges of VHF frequencies used in air traffic control.

To implement this program the Federal Aviation Agency has installed two experimental VHF Communication Facilities, one at Barnstable, Massachusetts, and the other at Palmer, Puerto Rico. These facilities are described along with the system parameters used to determine component requirements. Equipment developments associated with this program are also described. Some results of the flight test program are included. Detailed information on the test phases of the program will be the subject of a report by NAFEC and, hence, are not included.

## INTRODUCTION

This program had its origin in the Development Division of the Bureau of Research and Development (now Systems Research and Development Service). Personnel of the Communications Branch aware of work done by others in the field of Long Distance Communication, such as research by the Bureau of Standards and operational programs of Pan American World Airways and ARINC, periodically during 1958-60 proposed program implementation plans. A plan submitted on 30 August, 1960, to the Director of the Bureau of Research and Development by the Chief of the Development Division resulted in a formal ARDS Program Plan, Serial No. 9-60 dated 28 September, 1960, and in a Requirements Statement CAG-1 dated 17 October, 1960. This programme was known as "Development of Long Distance VHF Communications, Project 113-8". (Subsequently the program was redesigned "Project 116-10").

## PROGRAM DOCUMENTATION

Under the current SRDS Program Structure, the program is in the Long Distance Navigation Area (116-10) with three project titles :

a) Development of Long Distance VHF Communication System, 116-10D

b) Long Distance VHF Communication System Tests, 116-10X

c) Evaluate Long Distance VHF Communication System, 116-10V.

### General

Communications between air traffic control facilities and trans-oceanic aircraft are presently being conducted using direct high frequency radio at some locations, or by indirect manual VHF relay stations. The high frequency bands are less than ideal for this communication environment since high frequency radio is subject to severe interference, sustained periods of ionospheric disturbance with occasional complete auroral blackouts, and due to congestion, lacks expansion capability for new requirements. The need for developing a system which will provide reliable direct two-way radio voice communications between air traffic control facilities and aircraft to a range of 500 or more miles along oceanic routes, coupled with requests from aviation organizations such as the Air Transport Association (ATA), Aeronautical Radio, Inc. (ARINC), and several commercial airlines to extend the valuable exploratory work of Pan American World Airways, resulted in the inauguration of FAA's Long Distance VHF Communication Program.

Our present program is in the 118-136 Mc Aeronautical Services band used for air/ground communications. At the present time, the FAA is not engaged in development of extended range communications in the UHF 225-400 Mc part of the spectrum. (The Air Force is conducting an experimental program in this band.)

### Objectives

The objectives of this program are to :

1. Determine system parameters for the design of a VHF amplitude-modulated ground/air communication system suitable for use in the Air Traffic Control System and with a capability of 600 nautical miles in range;

2. Establish an experimental system based upon these parameters;

3. Operate this system in a suitable test environment in order to determine whether the theoretical range of 600 miles can be attained reliably under operational conditions;

4. Obtain test data (path loss factor, signal-to-noise ratio measurements, etc.) to determine the equipment requirements for a system to provide reliable service over the range determined to be practically feasible; and

5. Evaluate the equipments developed in support of this program.

The primary aim of this program is to develop a complete long range VHF communications system using the "forward scatter" principle. This program is based upon several criteria. First, positive, two-way communications are considered paramount. To achieve this goal, efforts have been made to provide reasonable circuit balance, e.g., improvements were made in the aircraft system as well as in the ground system, but it was attempted to keep those improvements in balance so that the ground/air path is not vastly superior to the air/ground path where transmitter power and antenna design are limited. Secondly, the complete system could have sufficient frequency flexibility to allow operation over the range of 118-136 Mc, the currently assigned band for VHF air/ground communications.

The FAA approach to system design was based on designing system components to overcome known path losses. Extension of the range of ground/air VHF communications is a problem mainly of providing more power (radiated and also received) to compensate for the large transmission losses occurring over the horizon. (Just beyond radio line-of-sight distance, the path loss may exceed 1 db per mile; at somewhat greater distances the rate of loss may decrease to 0.1 db per mile below free space losses.) In designing the system components emphasis was placed upon improvement of ground transmitting and receiving equipments and also on adding to and improving existing airborne components. These improvements were centered on increased ground antenna transmitting and receiving gain and sensitivity.

System parameters

In Appendix 1 are listed the system parameters required to obtain a range of 600 nautical miles (at a frequency of 127.0 Mc). This method of determining these parameters follows the method of Norton [1] with certain variations. The value used for scatter loss was chosen after a review of the literature [2], [3], since Norton's and DeBettencourt's data agreed quite

---

1) Kenneth A. Norton, "Transmission Loss in Radio Propagation," Proc. IRE, Vol. 41, pp. 146-159, January 1953.

2) Pickard and Burns, "Final Report, VHF Air/Ground Communication Beyond the Horizon," AFCRC-TR-57-194, 19 July, 1957.

3) L.P. Yeh, "Tropospheric Scatter System Design," Westinghouse Technical Report No. 5, UHF Section, Communication Equipment Engineering, 15 October, 1957.

closely in the 200 to 600-mile region, and lie midway between the date of Yeh and Bullington, their curves for scatter loss were used (Scatter Loss = 51 + 0.1 d, where d is in miles) and (Fig. 16). Also a large factor in the choice of system parameters was the coverage area desired, namely, 30 degrees and 4 degrees respectively.

Site establishment and air route coverage

The area chosen for the establishment of the experimental system and conduct of the test program lies along the East Coast Atlantic Ocean area extending from Cape Cod to the island of Puerto Rico. Site implementation including the antenna and equipment installation has been completed at the two locations chosen. One site is near Barnstable, Massachusetts, approximately midway between Otis Air Force Base and Hyannis, Massachusetts (Fig. 1). The other site is near Palmer, Puerto Rico, about 18 miles east of San Juan, Puerto Rico (Fig. 2). The sites and the antennas are located so as to provide test operations over several of the air traffic routes between the USA East Coast and Puerto Rico. Good coverage is expected in the shaded area depicted in Fig. 3; reduced coverage on beam edges is also expected. The ATC routes in these areas are listed below and shown in Fig. 4.

ATC Air Traffic Routes

| | |
|---|---|
| Tuna-San Juan | (Oscar) |
| Tuna-Bermuda | (Bravo) |
| Bass-San Juan | (Whiskey) |
| Bermuda-San Juan | (Lima) |
| Tuna-Nassau | (Papa) |
| Haddock-Bermuda | (Alfa) |
| Shad-Bermuda | (Cocoa) |
| Bass-Bermuda | (Delta) |
| Smelt-San Juan | (X-Ray) |
| Y-2 San Juan | (Yankee) |

Figs. 5 and 6 show electrical plans of the Cape Cod (Barnstable) and the Puerto Rican (Palmer) sites. Both sites have provisions for the installation of a duplicate set of equipment; the Palmer site has been equipped with air conditioning and has additional floor space for an engine generator should one be required. The Barnstable site is connected to the Air Route Traffic Control Center (Oceanic) at New York by land-line; the Palmer site is connected to the Air Route Traffic Control Center (Oceanic) at San Juan, Puerto Rico by UHF link.

The Eastern Region, FAA, has leased the Barnstable site from the Ann-John Trust renewable yearly until 30 June, 1972. Access to the site by automobile is best from Exit 4, Route 6, on the Chase Road and then proceeding south 1.6 miles to the intersection with Popple Buttom Road, then proceeding east for 0.6 miles; the antenna is visible at the top of the hill 300 yards away.

The Palmer site is under lease to the Southeast Region by the landowner, Mr. Leonardo Bonano-Marquez, until 30 June, 1964, renewable annually for ten years. The site can best be reached by automobile by following Route 3 east from the San Juan International Airport to Mameyes (Palmer) and then following Route 968 north for a distance of three miles.

Appendix 3 lists characteristics and parameters pertaining to the two sites and to the system.

A system for Barnstable is shown in Fig. 7. That for San Juan is similar. A functional diagram of the ground system is shown in Fig. 8. Figs. 9 through 14 show several views of the antenna and associated system equipment. Fig. 15 shows antenna foundation details. The Palmer, P.R., installation is essentially the same as Barnstable with the exception of the routing of the rf cables into the building; these enter the building at ground level rather than above ground level as at Barnstable.

Equipment development

Two major equipment development programs were carried out to date in support and implementation of this program. One was the development of the antenna system used for both transmission and reception, the associated preamplifiers, matrix network, and receiver combining system. That was FAA Contract BRD-373 with Page Communications Engineers, Inc. The other was the development of the 4 kW Linear Amplifier (Transmitter) under Contract ARDS-400 with Temco Electronics. This amplifier made use of two previous developments to reduce the developmental cost and time required for development, namely the 8-watt Transmitter-Exciter and the 100-watt Linear Amplifier. These two units are used to generate and drive the 4 kW Linear Amplifier. The receivers used are standard FAA audio combining scheme.

The 4 kW Linear Amplifier was tested at the Temco Electronics Company; a final report on this development dated 18 October 1962 is available from the Federal Aviation Agency. During design phases of the antenna, the corner antenna was tested full scale (simulated full length) to prove out the design. The final antenna system was tested at its site location at Barnstable. A final report on this development is also available from the Federal Aviation Agency.

The airborne equipment is essentially standard with the exception of the 250-watt outboard amplifier which was procured "off-the-shelf." The airborne receivers are standard VHF commercial receivers with the front end modified to a low-noise configuration by means of a cascode nuvistor stage. Two test aircraft are employed in the program. One, a Grumman Gulfstream, is used for altitudes up to 25,000 feet and is equipped with top-side and belly-mounted standard VHF blade antennas. The other, a C-135, similarly equipped, will be used for high altitude tests.

System components are described in Appendix 4.

System description

The antennas are installed to cover the air traffic routes shown in Figs. 3 and 4. The half-power beam widths are 30 degrees in the horizontal plane and 4 degrees in the vertical plane. Coverage extends out to a 60-degree sector at reduced ranges. The vertical beam width was limited to four degrees as several experimenters reported that this was the maximum desirable. The thirty-degree beam width seemed optimum for most air route applications.

The theoretical patterns of the transmitting antenna (one corner) and of the receiving system with matrix (eight corners) are shown in Figs. 17, 18 and 19. Theoretical gains are 24 db and 33 db respectively. Fig. 20 shows the receiving patterns from three of the nine receivers; patterns of the other receivers are similar. This was made with the receiving system operating with the matrix and with a tone-modulated test-transmitter in the aircraft flying a uniform circle around the site. The pattern of the receiving system when used without the matrix is identical with the single corner pattern since there are no rf phase elements in the system. For signals above threshold, additional gain is obtained after detection in the audio combining system and should be added to the 24 db individual corner gain; this added gain is equal to 10 log 8 or 9 db. Back lobe radiation and the side lobe radiation are down 20 db and 12 db respectively from main lobe radiation, both theoretical and measured. Side lobe radiation in the vertical plane is 17 db below the main lobe (theoretical/empirical).

The experimental system can be explained by referring to Figs. 7 and 8. The transmitting portion of the system is standard except for the effective radiated power and antenna directivity. This system uses a linear amplifier consisting of linear stages throughout down to the main frequency determining stages. The 4 kW final, including power supply, is completely solid state except for the two 7007 power tubes.

A Class C-amplifier type transmitter could be used in those locations where no problems will arise from intermodulation products, and with some savings in cost. One corner antenna is used in the transmit mode with a coaxial switch transferring the corner to receive as required. All eight corner bays are used for the receive mode.

The receiving array produces nine separate 4° beams simultaneously. Beam maxima are oriented to cover the 30° beam width. The matrix network is the beam-collimating component of the system. An incoming plane wave from any particular azimuth has a linear phase gradation across the eight bays; the time of arrival of the wave at a particular corner is directly related to the angle of incidence of the wave and to the separation of the individual bays. The function of the delay lines is to extract energy from each corner (through the dividing pads) and delay this energy. An amount equal to the time delay experienced by the wave in arrival at the individual corners so

that the combination rf signals at the junction are in-phase for the particular beam output desired. A total of 72 delay lines extract the energy from the eight dividing pads and feed them to the nine combining functions to make up the nine 4° beams.

Actually, the individual antenna outputs are fed directly to low-noise preamplifiers with gains of 33 db before being fed to the dividing pads in the matrix. These low-noise preamplifiers are required because of the 9 db mismatch loss and 3 db resistance loss in the matrix, thus preserving the original signal-to-noise ratio. Measured losses were about 15 db.

The combining function outputs go directly to RD-9 receivers. An alternate beam forming system is being tested, namely a hybrid-network matrix. Becasue of the low losses associated with it, the preamplifiers will be connected to the output of the matrix rather than the input. In this case the gain of the preamplifiers need be only 20 db or so, in order to overcome the relatively poor noise figure of the RV-9. With a good low-noise receiver, the preamplifiers could be dispensed with. With the RV-9 receivers, the same AGC and audio combining network will be used as before. It is described below.

RV-9 Receiver and AGC/Audio Combiner

The RV-9 receivers are standard FAA VHF ground communication receivers modified to allow the receivers to operate in conjunction with the AGC combiner. In operation, the individual AGC voltages of the individual receivers are fed to the AGC combiner through diodes where they are combined and used to drive a cathode follower. The outputs of the cathode follower is applied to the AGC control circuits of all of the receivers. Thus, the receiver having the greatest signal input is the controlling source for the AGC's (and hence the gains) of all the receivers. The audio outputs of all the receivers are combined (although usually only one or two contribute audio) in the audio portion of the combiner. With the system used as shown in Figs. 9 and 10, the audio combiner will contribute little if any additional gain over that provided by the antenna/matrix gain. In both cases it provides a common output to the regular FAA terminal equipment. The overall gain of the antenna system connected in this manner is 33 db based upon a 9 db improvement in Signal plus Noise-to-Noise ratio. Ground tests bear this out.

The combiner operation with the matrix bypass connecting the preamplifier's outputs directly to the RV-9 receiver inputs is somewhat different. The AGC selector would be bypassed in this method, but the Audio-Combiner would be connected and used as before. In this instance the audio voltages add directly and coherently whereas the noise powers add incoherently. This so-called "post detection" combining also has a gain (above threshold) of 9 db in improved Signal-to-Noise ratio; tests seem to bear this out.

All receivers are effective in contributing audio-output through the combiner. Operation in this manner has some advantages in regard to simplicity of adjustment and maintenance. The audio output of the combiner is fed to local or remote terminal equipment in the usual manner.

Site criteria and antenna information

A large number of factors go into the choice of a particular site. Figs. 1 and 2 show topography of the Barnstable and Palmer sites. Both sites are relatively low in elevation with rough, uneven terrain falling away rapidly in front of each antenna. This contributes to a "non-site conscious" antenna location and makes for a "free-space" pattern. Even considering the pattern "free-space," the beam maximum does not lie on the horizon. Palmer, for example, lies approximately 0.13 degrees above the radio horizon. With a 4-degree vertical beam width, it is apparent that beam tilt is unnecessary.

For antennas installed at higher elevations, beam tilt may be necessary. The method is to add sections of varying lengths to the harness of all of the antennas (see Fig. 21). The plane wavefront will be progressively delayed proceeding from the top of the antenna downward, thus tilting the beam downward so that its beam maximum lies just on the radio horizon.

For an antenna installed atop a 10,000-foot mountain, the following beam tilt would be required. Two assumptions are now made. First, standard propagations conditions exist, i.e., radio line-of-sight follows the 4/3 earth criteria. Second, the antenna radiation pattern is considered a free-space pattern. This seems to be a reasonable assumption because of the nature of mountain top sites; if near the sea, the surface is normally not smooth and consistent in elevation. The beam for this situation should be tilted 0.76° downward. For the 24-foot spacing between radiation centers on the antenna, the number 2B section of 7/8 Heliax (91.6% velocity of propagation) should be lengthened by 3.53 inches, the number 3B section by 7.06 inches, and the number 4B section by 10.6 inches. This does not agree with Table 2-1 in the System Instruction Book in which it is believed the antenna was considered as radiating over a smooth surface.

The antenna specification called for VSWR of 2 to 1. Measured VSWR's at Barnstable were 1.5 to 1 or better and at Palmer were similar except for one corner bay which was 1.7 to 1. The 2 to 1 specification is realistic, however, since only 0.5 db mismatch loss occurs and, if beam tilt is required, VSWR's may rise slightly since the individual dipoles are not as effectively isolated from each other impedance-wise as with no beam tilt.

FAA Test Program

1. To obtain quantitative path loss data by the transmission of test zones in both directions, and suitably instrumenting the equipment.

2. To obtain a qualitative evaluation of the suitability of this type of transmission over long ranges by communicating with both test aircraft and routing commercial aircraft.

The first phase, using the two FAA instrumented aircraft, consists of path loss measurements, antenna pattern coverage tests, and range limitations. The second phase will utilize the system in a regular operational environment, i.e. with the sites tied into the New York and San Juan ATC Centers. The first phase has been completed at Barnstable; testing at Palmer will be completed by September 1. Second phase testing will be conducted from September 1963 to July 1964. During the first phase testing some limited testing was also conducted with Pan American Airways and Eastern Airlines.

One or both of these sites will be used for additional experimental work under this program. Further work planned includes tests in both the audio and rf areas. Equipments considered are speech limiter equipment, the use of a hybrid combiner network in place of the matrix now used, and the use of preamplifiers with wider beam width and lower noise figure.

If resources permit, additional antenna work will be done on the airborne antenna. Two additional types of antenna will be considered. The first, a diamond array of 4 monopoles (about 9 db gain), requires an aircraft the size of a DC-7 or larger, to provide a large ground plane. It has the capability of switching its directivity. The second antenna configuration considered is the forward-looking Yagi array developed by Boeing for use on one of the air carriers. If this is obtained, it will be installed in the radome of the KC-135. New receivers under development will also be tried in the ground system.

## TEST RESULTS

Tests with FAA and commercial carriers have been conducted at both sites. Preliminary information on the Barnstable tests is included in Appendix 5. This shows a 90% communication probability of 360 miles. Unfortunately no tests were conducted at Barnstable during the summer when propagation conditions occasionally are better than winter months due to the presence of propagation supporting mechanisms, other than true tropospheric scatter. Appendix 6 shows preliminary data at Palmer. Tests at Palmer during July with the FAA Aircraft KC-135 showed ranges of from 500 to 600 miles. The FAA aircraft had 10 db greater transmitter power than the commercial aircraft. Tests during Phase 1 were run mainly with the Matrix bypassed, i.e. with the preamplifier outputs connected directly to the receiver inputs. Controlled ground tests showed that the operation with the Matrix and nine receivers showed an improvement (gain) of 9 db in Signal-to-Noise ratio over a single receiver. Operation of the system with squelch was unsatisfactory with the modified RV-9 receivers; hence, the 9 db figure could not be realized in practice because of the noise contribution of the "unsquelched inactive receiver". It was found that a good gain in Signal-to-Noise ratio could be realized (above threshold) by operating the system with audio combining post-detection only. This method of operation has an attendant advantage of simplicity because it removed the requirement of maintaining the rf phase stability in the preamplifier and antenna transmission lines.

Tests at Barnstable were conducted during the season of the year when the transmission path was supported by almost pure tropospheric scatter propagation. Tests at San Juan were conducted during the summer when the propagation conditions were considerably better and the path could have been supported to an appreciable extent by duct or elevated layer considerations. The difference in ranges attained between San Juan and Barnstable were probably mainly due to the difference in refractivity. Another factor, however, may be the site noise conditions that were prevalent. For example, the 115,000-volt transmission line which is within one-half mile to the rear of the antenna at Barnstable contributed noise, thus reduced the air-to-ground range. The Palmer site is clear of high-tension lines in all directions.

A detailed report on test results attained will be issued by NAFEC. In comparing results (either ranges attained or measured path loss) some comments are in order. The original path loss of 222 db upon which the system design was based is too low; 232 db appears to be a truer value based upon revised calculations. If the blade antenna used on the aircraft has a gain of 4 db, this represents a departure of 8 db from the 12 db used in the design parameters. There is an estimated loss of 1 db in aircraft rf cable. This detracts directly from transmitter power outputs and almost

directly from the receiver noise figure. Adding these dbs (10 + 8 + 1 = 19) we have an affective system deficiency of 19 db. This could result in a reduction in range of 190 statute miles. Other factors to be considered are the noise conditions of the aircraft, site elevation, powerline noise, etc. The commercial airlines participating, in general, had receivers with low-noise front ends and 25-watt transmitters. Monopole antennas were used.

## CONCLUSION

The information and data presented from the early Barnstable tests was of an operational nature. The test results presented from the May-June San Juan tests were from tests not rigorously controlled. Therefore, no specific conclusions could be drawn. The following observations were made, however, based upon these results.

VHF communication well beyond the current radio line-of-site is possible and practical for use in the air traffic control service. This is obtainable at the present time with moderately expensive ground equipment and with existing commercial airlines airborne equipment.

Increasing aircraft equipment to 250 watts transmitting power and lower noise receivers would increase both ground-to-air and air-to-ground ranges.

Air-crews are pleasantly surprised at the increased over-water ranges available.

Communication ranges are affected by meteorological conditions.

For the limited number of measurements taken, the difference in the aircraft altitude involved did not appear to be a significant factor in range.

Appendices : 6

## Appendix 1

## Desirable VHF Tropospheric Scatter System Parameters To Obtain 600 Nautical Miles Coverage at 127 Mc

### Air/Ground Path

| | | |
|---|---|---|
| A. | Basic transmission loss | 222 db |
| B. | Ground receiver antenna gain | 33 db |
| C. | Airborne transmitter antenna gain | 12 db |
| D. | Net transmission loss (A-B-C-) | 177 db |
| E. | Airborne transmitter power (250 watts) | 24 dbw |
| F. | Ground-received power (E-D) | -153 dbw |
| G. | Median S/N/radio (based on receiver noise figure of 4 db, bandwidth 5 kc) | 10 db |

### Ground/Air Path

| | | |
|---|---|---|
| A. | Basic transmission loss | 222 db |
| B. | Ground transmitter antenna gain | 24 db |
| C. | Airborne receiver antenna gain | 12 db |
| D. | Net transmission loss (A-B-C) | 186 db |
| E. | Ground transmitter power (4000 watts) | 36 dbw |
| F. | Airborne received power (E-D) | -150 dbw |
| G. | Median S/N ratio (based on receiver noise figure of 7 db, bandwidth 5 kc) | 10 db |

600 N. M. = 690 statute miles

Ground antenna height = 500 feet

Aircraft altitude = 24,000 feet

Radio line of sight = $\sqrt{2h_t} + \sqrt{2h_r}$ = 250 miles

Scatter distance = 690 minus 250 = 440 miles

Line-of-sight path loss = 37 + 20 log f + 20 log d = 127 db

Scatter loss (Norton) = 50 + 0.1 d = 95 db

Total loss = 127 + 95 = 222 db

## Appendix 2

## Site and Equipment Characteristics and Specifications

### Frequency Assignment and Authorizations

| | | | | | |
|---|---|---|---|---|---|
| 135.8 | mc | @ | 4 | kW | (Cape Cod) |
| 121.8 | mc | @ | 100 | watts | " |
| 128.95 | mc | @ | 100 | watts | " |
| 135.8 | mc | @ | 4 | kW | (San Juan) |
| 129.95 | mc | @ | 4 | kW | " |
| 119.4 | mc | @ | 4 | kW | " |

### Effective Radiated Power :

1 megawatt

### Frequency Range :

118 - 136 Megacycles

### Design Frequency :

The geometrical mean of the aeronautical communication band (118 - 136 Mc), namely 126.65. Actually, 127 Mc were used.

### Antenna (Cape Cod and San Juan)

| | |
|---|---|
| Gain, Transmit | 24 db |
| Gain, Receive | 33 db |
| Beam width, Transmit | 30° H plane (Horizontal) |
| | 4° E plane (Vertical) |
| Beam width, Receive | 30° H plane (Horizontal) |
| | 4° E plane (Vertical) |

Reduced Coverage to 60° Horizontal

### Directivity :

| | | |
|---|---|---|
| Cape Cod | - - - - | 175° True |
| San Juan | - - - - | 335° True |

### VSWR :

Less than 1.4 to 1

Site Location :

| | | |
|---|---|---|
| Cape Cod | Latitude | N41°41'57" |
| | Longitude | W70°25'05" |
| San Juan | Latitude | N18°23'45" |
| | Longitude | W65°46'56" |

Distance between sites 1416 nautical miles

Site Elevation (Antenna Center)

| | |
|---|---|
| Cape Cod | 263 feet MSL |
| San Juan | 298 feet MSL |

Transmitter (Cape Cod and San Juan)

| | |
|---|---|
| Power Output : | 4 kW |
| Type : | Liner Amplifier |

Receiving System (Cape Cod and San Juan)

| | | |
|---|---|---|
| Type : | Antenna, 9RV-9 Receivers, (36 kC IF bandwidth), 5 kC Audio Bandwidth | |
| Noise Figure : | System | - - - 3.2 db |
| | Preamplifier | - - - 3.0 db |
| | RV - 9 | - - -11-15 db |

Antenna, Airborne

| | |
|---|---|
| Type : | Vertical Stub |
| Gain : | 2.0 to 4.0 db |
| Type (future) : | Forward-Looking Yagi |
| Gain (future) : | 8.8 db |

Transmitter, Airborne

| | |
|---|---|
| Type : | Class C |
| Power Output : | 250 watts |

Receiver, Airborne

| | |
|---|---|
| Type : | Standard AM (36 kC IF bandwidth) 5 kC Audio Bandwidth |
| Noise Figure : | 6 db |

Type Signal :

Simplex, AM, Type 6A3 emission

Other specifications of the system, e.g. input and output terminal equipment, are not described since they are not considered part of the test program.

Thermal noise power = KTB = -204 dbw/cycle

Eff. bandwidth = 5000 cps = 37 db ref. 1 cycle

Total thermal noise = -167 dbw

Thermal noise + noise figure + S/N ratio = rec. power

## Appendix 3

## System Components

### Components of the Ground Transmitting and Receiving Facility

One Type FA-5433, Long Distance VHF Communications Ground Antenna Array consisting of 8 vertical corner arrays; 1 corner is used for transmitting, 8 are used for receiving. Each corner has 16 colinear dipoles fed with equal in-phase currents. Each corner has an aperture of 60°. The dipoles, 2 inches in diameter, are spaced 0.775 wavelengths (6 feet at 127 mc) on centers and are centered 0.55 wavelengths (51 inches at 127 mc) from the corner apex. They are 36-7/8 inches long, or 0.397 wavelengths at 127 mc. This antenna will withstand wind velocity of 130 mph with no ice and has a design safety factor of 1.65. Winds of 150 mph will stress the steel to just below its yield point. The antenna impedance is nominally 50 ohms. It will handle 4 kilowatts of transmitter power (one corner) with peak envelope power up to 16 kilowatts. It will operate at temperature ranges of -55°C to +55°C up to 10,000 feet altitude in a humidity of 0 to 100 percent.

One (1) Antenna Delay Equalizer, FA-5433/3 consisting of 8 adjustable 50 ohm delay lines.

Nine (9) Preamplifiers FA-5433/3 (eight active plus one spare) of 30 - 35 db gain (adjustable within 0.25 db); 50 ohms input and output impedance.

One (1) Antenna Combiner and Beam Forming Matrix FA-5433/5 consisting of dividing and combining networks, 76 delay lines and matching transformer. Signal loss of 6.4 db and noise loss of 15.4 db. The VSWR at any input or output terminal is 2/1 with other terminals terminated in 50 ohms.

Ten (10) Receivers RV-9 (nine active plus one spare).

One (1) AGC Selector and Audio Combiner. Matches ten 600-ohm receiver outputs to one common 600-ohm output (if less receivers are used, unused inputs should be terminated in 600 ohms); selects and controls AGC of all receivers.

One (1) Jennings RC-6 Coaxial Switch.

One (1) Regulated Power Supply, Lambda Electronics Corporation Model C-881

One (1) Dehydrator, Andrew, Type 1910B

One (1) Dc Power Coupler, Type FA-5433/6

One (1) 4 kW VHF Linear Amplifier, Type FA-5438

One (1) VHF Transmitter-Coupler Amplifier, Type FA-5270 (100 watts)

One (1) VHF Low Level Exciter, Type TV-24 (8 watts)

This linear amplifier operates in the 118-136 mcps range with an input signal requirement of 100 watts of rf amplitude modulated (supplied by FA-5270). It will supply 4,000 watts of carrier power and up to 16,000 watts of peak envelope power. Input and output impedances are 50 ohms nominal; isolation is 30 db minimum; distortion is 5% maximum. Power requirements are three-phase, 60 cps, 208 volts, 4 wire ac. It weighs 3,000 lbs crated and 2,400 lbs uncrated.

Two (2) Regulated Output Amplifiers, CA-1785 (or equivalent)

One (1) VF Remote Control Relay Panel, CA-1620/3

One (1) Tone Control Equipment, CA-1621

Two (2) Lambda Regulated DC Power Supply C/88/M

One (1) DC Power Coupler, FA-5433/6

One (1) Dual Channel Amplifier, CA-1785

One (1) Farinon PT-400 UHF Link Equipment with LD Multiplex System (at San Juan only)

One (1) 48 vdc Supply, FAA

Primary power requirements for all system components other than the 4 kW Linear Amplifier are 1,150.60 cycles ac.

## Appendix 4

### Program and Major Development Responsibilities

Program Manager, Systems Management Division

Project Manager (Site and Equipment), Development Division, SRDS

Project Manager (Test & Evaluation), Experimentation Division

Facility Establishment

Cape Cod, FAA Eastern Region
San Juan, FAA Southern Region

FAA Equipment (RV-9's, Link, and Terminal Equipment), Installation and Material Service

Antenna System, Page Communications Engineers, Incorporated, Washington, D.C.

4 kW Transmitter, Temco Electronics, Dallas, Texas

Test Aircraft, NAFEC

Outside Support : Pan American World Airways
Aeronautical Radio, Incorporated.

## Appendix 5

### Test Information and Preliminary Test Results - Barnstable

This part is based upon information received from the Experimentation Division, National Aviation Facilities Experimental Center, and describes methods and procedures, and gives some of the test results of their current test program conducted under the supervision of the System Management Division. For the most part, the data is from test flights which occurred during the February and March 1963 period.

The following data was collected during test periods:

a) Signal strength (AVC from both receivers and associated topside and bottom vertical antennas)

b) Signal-plus-noise to noise (audio measurement)

c) Temperature (outside of test aircraft)

d) Air pressure (outside of test aircraft)

e) Water vapor content (outside of test aircraft)

f) Transmitter power output

g) Transmitter side tone

h) Ground-transmitted signals received in the aircraft

Note : Items a) through f) are recorded on a chart recorder; items g) and h) are recorded on a tape recorder.

Ground data

a) Signal strength (AVC from individual receivers and from AGC combiner if applicable)

b) Signal-plus-noise to noise (audio measurement)

c) Transmitter power output

d) Transmitter side tone

e) Airborne-transmitted signals received on the ground receivers (combined output)

Note : Items a) through c) are recorded on a chart recorder; items d) and e) are recorded on a tape recorder. Meteorological measurements and observations are recorded at the ground site on an hourly basis during the flight.

In obtaining the above data, a time-sharing plan was used; 55 seconds of voice and 5 seconds of tone are transmitted sequentially by both air and ground stations.

In addition to the weather information and data recorded aboard the aircraft and at the ground site, the United States Weather Bureau provides normal weather information (forecast) and pressure, temperature, and water vapor data from Nantucket. (This will also be obtained later at San Juan.) Twelve hours in advance of scheduled test flights, weather forecasts describe the weather conditions to be expected generally in the test area; the Weather Bureau also states the refractive index existing at several stations adjacent to, or within, the test area. Correlation of this data from several stations enables a prediction of the refractive index over an intended flight path. From knowledge of rate of change of refractive index with altitude, a prediction of the propagation conditions to be expected over a particular path can be made. Flight plans (altitude, flight path, and time of day) generally were altered during the tests conducted so far, so as to avoid signal strength enhancement because of abnormal atmospheric conditions. Flights were not cancelled because of steep gradients in refractive predictions, but altered as explained above.

Figure 5-1 shows data obtained during radial checks. Prior to 1 March, the Gulfstream Aircraft was used; subsequent 1 March, all data was obtained using the KC-135 Aircraft. These points represent maximum ranges based upon operator's reports; maximum range is defined as occurring when the audio (voice) signal level drops almost to the audible voice level, estimated to be about 5 to 8 db S/N.

Flights were both outbound and inbound along the radials. There were four possibilities of equipment usage since the aircraft were equipped with two antennas and two receivers. This information was not recorded in Figure 5-1, however. The ground equipment generally was connected with each antenna feeding each preamplifier (and receiver) directly and not using the matrix. Seven or eight corners were used for receiving, depending upon the operational condition of the Jennings switch. Data was also obtained during Pan American flights, but is not shown; in general, maximum ranges were affected by the atmospheric refractive index.

The longest ranges were obtained during the passage of a warm front with high local temperatures, e.g., 13 March and 28 March. Steep gradients of refractive index were observed. During the 28 March period, tests with Pan American showed long ranges with up to 480 nautical miles on the 155-degree radial.

Normal ranges occurred when measured refractive index gradients were normal (well mixed path). On 19 February, this was true. The data obtained on 8 April, was taken after the passage of a cold front with snow flurries in evidence (350 n. m. ranges).

Table 5-1 shows some actual ground-to-air data. This is the same data used in part of Figure 5-1, and the same criteria as described previously apply. Figure 5-2 shows this data plotted in probability terms. This data includes only ground-to-air and hence does not represent the probability of a two-way path being established as the data showed better ground-to-air than air-to-ground ranges and should have been included for a true probability curve.

A more comprehensive report based upon results obtained will be issued upon completion of further tests and final data reduction and analysis.

Tableau 5-1 - Table 5-1 - Cuadro 5-1

Données relatives aux communications sol-air - Ground-to-Air-Data
Datos relativos a las comunicaciones tierra-aire

| Date Fecha (1963) | Position angulaire vraie (degrés) Bearing (Degrees True) Marcación verdadera (en grados) | Altitude de vol (milliers de pieds) Flight Altitude (Thous.ft.) Altura de vuelo (miles de pies) | Niveau du signal Signal level Nivel del suelo (-dbm) | Distance (milles marins) Range (nautical miles) Distancia (millas marinas) |
|---|---|---|---|---|
| Janvier-January-Enero 1 | 175 | 20 | 87 | 300 |
| Février-February-Febrero 19 | 175 | 20 | 120 | 350 |
| " " " 19 | 175 | 20 | 120 | 350 |
| " " " 19 | 175 | 20 | 120 | 300 |
| " " " 20 | 175 | 20 | 105 | 440 |
| " " " 20 | 175 | 20 | 106 | 355 |
| " " " 20 | 175 | 20 | 120 | 500 |
| " " " 20 | 175 | 20 | 120 | 500 |
| " " " 21 | 175 | 20 | 120 | 500 |
| " " " 21 | 175 | 20 | 120 | 500 |
| Mars-March-Marzo 11 | 175 | 39 | 107 | 380 |
| " " " 12 | 190 | 35 | 113 | 470 |
| " " " 12 | 175 | 35 | 113 | 470 |
| " " " 13 | 160 | 37 | 114 | 465 |
| " " " 13 | 165 | 37 | 102 | 445 |
| " " " 13 | 170 | 37 | 101 | 460 |
| " " " 13 | 175 | 37 | 95 | 440 |
| " " " 13 | 180 | 37 | 93 | 450 |
| " " " 13 | 185 | 37 | 107 | 455 |
| " " " 13 | 190 | 37 | 107 | 455 |
| " " " 14 | 165 | 25 | 117 | 440 |
| " " " 14 | 165 | 25 | 118 | 420 |
| " " " 14 | 170 | 25 | 108 | 400 |
| " " " 14 | 175 | 25 | 116 | 455 |
| " " " 14 | 180 | 25 | 117 | 430 |
| " " " 14 | 185 | 25 | 117 | 360 |
| " " " 14 | 190 | 35 | 115 | 450 |
| " " " 14 | 185 | 35 | 115 | 450 |
| " " " 14 | 170 | 35 | 116 | 430 |
| " " " 14 | 185 | 35 | 118 | 435 |
| " " " 28 | 180 | 40 | 117 | 490 |
| " " " 28 | 175 | 40 | 115 | 490 |
| " " " 28 | 175 | 40 | 115 | 490 |
| " " " 28 | 170 | 40 | 116 | 490 |
| " " " 28 | 165 | 40 | 116 | 520 |
| " " " 28 | 160 | 40 | 117 | 470 |

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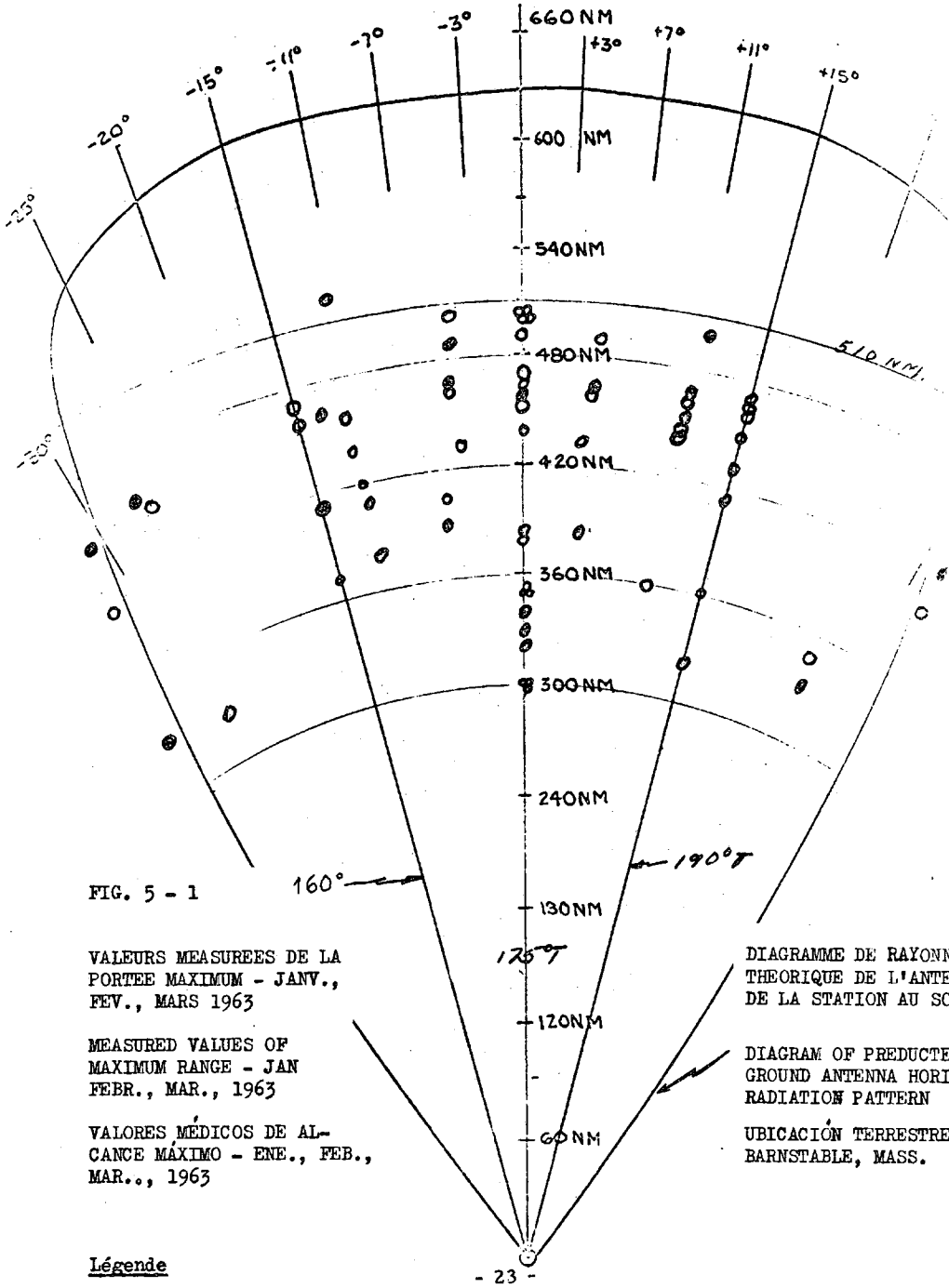


FIG. 5 - 1

VALEURS MEASUREES DE LA PORTEE MAXIMUM - JANV., FEV., MARS 1963

MEASURED VALUES OF MAXIMUM RANGE - JAN FEBR., MAR., 1963

VALORES MÉDICOS DE ALCANCE MÁXIMO - ENE., FEB., MAR.., 1963

DIAGRAMME DE RAYONNEMENT THEORIQUE DE L'ANTENNE DE LA STATION AU SOL DANS LE PLAN HORIZONTAL

DIAGRAM OF PREDUCTED GROUND ANTENNA HORIZONTAL RADIATION PATTERN

UBICACIÓN TERRESTRE DE F.A.A. BARNSTABLE, MASS.

Légende

SOL - AIR ⊛
AIR - SOL ○

Legend

GROUND TO AIR ⊛
AIR TO GROUND ○

Símbolos

TIERRA-AIRE ⊛
AIRE-TIERRA ○

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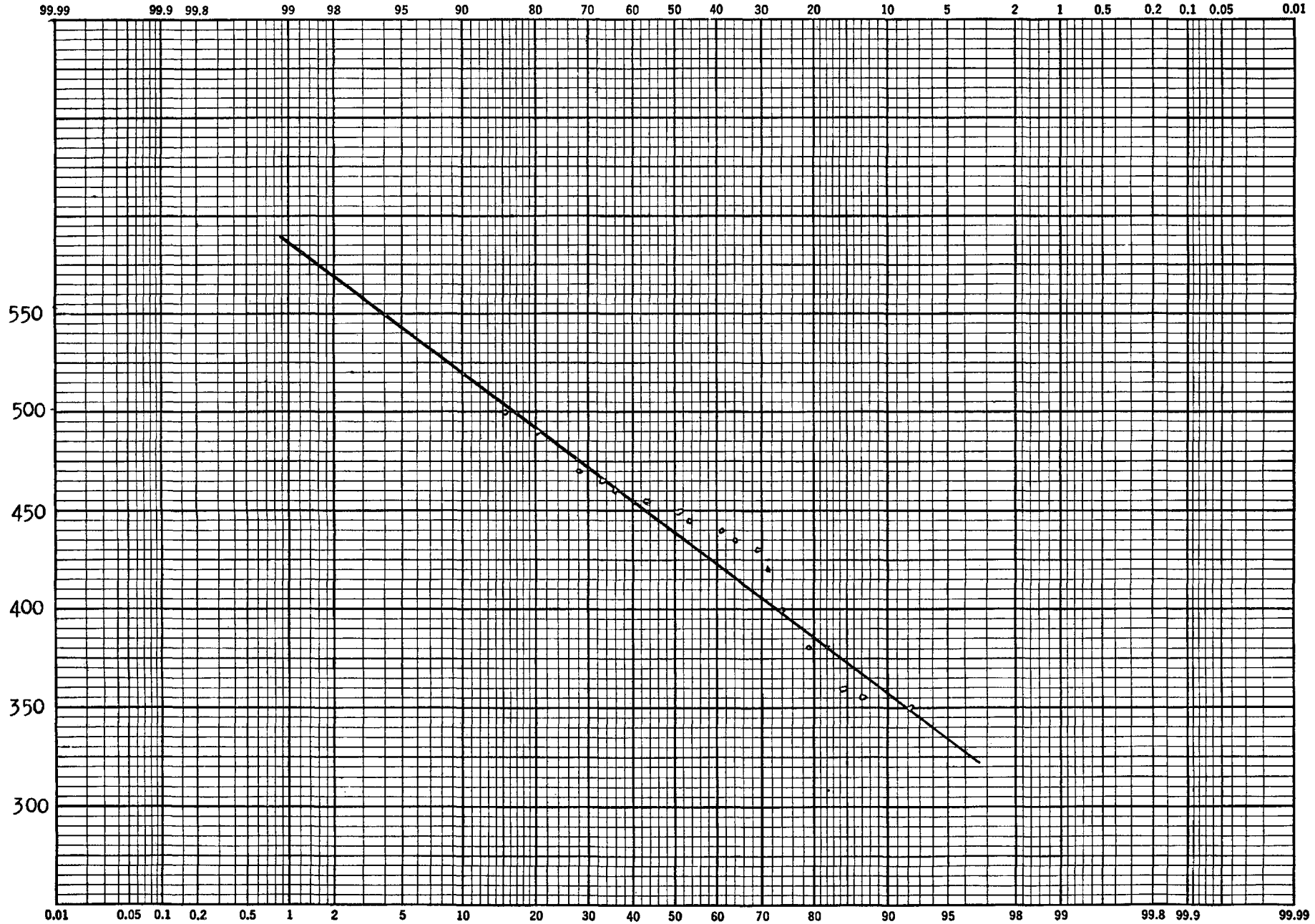


Fig. 5-2

PROBABILITE DE RECEPTION DE LA STATION DE BARNSTABLE PAR LES AERONEFS
PROBABILITY OF AIRCRAFT RECEIVING BARNSTABLE, MASS
PROBABILIDAD DE QUE UNA AERONAVE RECIBA BARNSTABLE, MASS.

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## Appendix 6

### Preliminary Test Results - Palmer

Operational tests with Pan American and Eastern Airlines were made on 28 May, 4 June, 6 June and 7 June. Pan American and Eastern were using conventional transmitting and receiving equipment and antennas. Pan American was using Boeing 707s and Eastern was using DC-8s. Both used conventional transmitting and receiving equipment. The Pan American flights used vertical stubs above and below the fuselage; Eastern used a vertical stub above and also a flush tail-mounted vertically polarized antenna. Several of the participating flight crews were briefed prior to the flights on 28 May and 7 June. Participating flights included :

| Flight | Dates | Route |
|---|---|---|
| Pan American 292 | 28 May | 353° |
| " 213 | " | 353° |
| " 212 | " | 353° |
| " 214 | " | 353° |
| Eastern 714 | " | 315° |
| Pan American 456 | 4 June | 315° |
| " 212 | " | 353° |
| " 214 | " | 353° |
| Eastern 714 | " | 315° |
| " 800 | 6 June | 353° |
| Pan American 292 | " | 353° |
| Eastern 800 | 7 June | 353° |
| " 802 | " | 353° |
| Pan American 292 | " | 353° |
| Eastern 803 | " | 353° |

Flight altitudes were generally 24,000 and 28,000 feet for the 707s and 31,000 feet for the DC-8s. On the three days of testing, our data did not show any correlation between altitudes. Also, no definite pattern could be deduced from the different aircraft antennas (actually no procedure was set up to do this); in most cases the flight crews were believed to have used the best system, i.e., top or bottom, or top or tail in the case of the DC-8. Then, when they would lose communications, they would transfer to the alternate system. This procedure actually did not guarantee increased ranges since communications could have been lost in a "fade" and regained in a period of signal enhancement.

All estimates are subjective; no instrumentation was used; receivers were used with AGC and ranges were based upon loudspeaker output in a rather high ambient noise level (transmitter equipment room); where fades are indicated, it means fades at relatively weak signal strength or strong (deep) fades at relatively strong signal strength. All miles are in nautical miles.

Ranges generally were about 15% greater toward Idlewild than toward Miami. One test (4 June) showed less of a difference; during this test there was severe thunderstorm activity toward Miami over Ramey AFB, about 50 miles across by 30 miles deep, but weather conditions toward IDL were normal. Fades (Pan American 456) which began at 415 miles continued with temporary loss of signal at 460 miles back to S3R3, but took on a rapid deep fade at 475 miles. No attempt was made to continue. An hour and a half later, Eastern 714 was fading badly at 350 miles; he reported we were also fading badly. Changing antennas helped little, if any. We both were weak to 425 miles; communication was lost at 425-450 miles. On the same afternoon Pan American 212 and 214 were worked out to 500 and 470 miles, respectively. Fading began at 400 miles; we began to fade at 425 miles. On 28 May (normal weather both to Miami and IDL), Eastern 714 (Miami) was lost at 400 miles and several flights to IDL were worked up to 480 to 525 miles, the same ranges attained with Pan American 212 on 4 June. The receiving system was normal, i.e., used with matrix, during these tests.

Additional tests were conducted on 6 June, using the matrix less one corner, and also with one corner feeding one preamp to one receiver. Weather was normal or standard. On Eastern 800, reception seemed comparable out to 530 miles where it was S2R2 on both setups, except for a period to 240 miles where fading was experienced on the single corner/receiver combination, whereas, no fading was noted on the matrix. This fading could have been due to an aircraft altitude change. Eastern 800 was at 31,000 feet. Pan American 292 was 5 X 5 (as was Eastern 800) out to 400 miles when he dropped 3 X 3 from 400 to 490 miles, comparable on both setups. At 525 miles, at last contact, he was 2 X 2 on the matrix and 1 X 1 on the single corner receiver setup. Pan American 292 was at 24,000 feet. A signal readability of 3 X 3 is considered to be the minimum quality acceptable for reliable communications.

On 7 June, early PM, tests were conducted using a setup bypassing the matrix with seven corners/preamps/receivers, and one corner/preamp/receiver combination. Flights worked were Eastern 800 (31,000 ft.) and Pan American 292 (24,000 ft.). With Eastern 800, 5 X 5 communication was maintained to 350 miles, his transmission dropping to 5 X 4 on both setups at 410 miles; he heard us 5 X 5, however. At 460 he faded to 3 X 3 on the 7 corner setup and 0 X 0 on the single receiver. At 480 miles he had faded to 0 X 0 on both setups; he was still reading us 3 X 3, however, but fading rapidly (relayed by 292). With 292 he was 5 X 5 both setups at 390 miles

dropping to 3 X 3 on both setups at 415 miles with us at 5 X 5. At 440 miles he had dropped to 0 X 0 on the single receiver but still 3 X 3 on the 7 corners. We were still 5 X 5. At 455 miles he faded and so did we but at 480 miles was back up to 3 X 3 on the 7 corners. At 495 miles he had risen to 5 X 5 on the 7 corners and 3 X 3 on the single corner. From 500 miles to 525 miles he faded, varying up and down from 4 X 4 to 1 X 1 on the 7 corners and 0 X 0 on the single corner. At 525, our last contact, he was 1 X 1 on the 7 corners; we were 3 X 3.

Additional tests were run on June 6 and June 7. Tests on June 6 with Eastern 800 ($352^{\circ}$ and 31,000) and Pan American 292 ($345^{\circ}$ and 24,000) were with one corner/pre-amp/receivers vs. 7 corners/pre-amp/matrix receivers. Communications with Eastern 800 was maintained on both setups out to 530 miles; he heard us out to 570 miles. There was no noticeable difference between the two setups although at the last point of contact he was 2 X 2. With Pan American 292, communications were maintained out to 500 miles equally, but at 525 miles the 7 corner/matrix was 2 X 2 and the single corner was 1 X 1.

On June 7 tests were run with Eastern 800 and Pan American 292 using one corner/pre-amp/receiver and 7 corners/pre-amps/receivers. Eastern 800 at 31,000 feet began to fade at 410 miles with 5 X 4 on both setups. At 460 miles, Eastern 800 dropped to 3 X 3 on the combiner and 0 X 0 on the single corner we were reported 5 X 5. At 500 miles we could not hear him, but he received us at 3 X 3, with very rapid fading. Pan American 292 at 31,000 feet was 3 X 3 at 415 miles on both setups. At 455 he dropped to 2 X 2 on the combiner and 0 X 0 on the single corner. At 495 miles he was 5 X 5 and 3 X 3 with our signal 5 X 5. He was fading and at 525 went from 3 X 3 to 1 X 1 on the combiner with 0 X 0 on the single corner. We dropped to 3 X 3 at 525 miles, our last contact.

On June 7 tests with Eastern 802 were run using a single corner/pre-amp/receiver and 7 corners/pre-amp/matrix. Signals were 5 X 5 out to 465 miles in both setups. At 500, Eastern 802 was 2 X 2 and 0 X 0 for the combiner and single receiver, respectively. At 535 miles he was barely perceptible. Our signal started to fade at 500 miles, but we were heard out to 600 miles.

## Conclusion

While these tests were subjective, and in addition were carried out with limited equipment and therefore subject to errors, several observations can be made. Two-way communication was possible for 100-150 miles after first fades or first reduction in signal strength were noted. Usually communications were possible for some distance beyond the point of first signal dropout. Time, distance, or both were factors. It was interesting to observe how signals would sometimes build back up to solid signals after being completely lost. Also interesting was the fact that signals held up

(after initially fading) for long distances. There didn't seem to be any noticeable difference between the 24,000-foot and 31,000-foot flight levels. In the comparison tests with the several receiving configurations, it appears that the relative difference in ranges between the single corner/pre-amplifier/receiver combination, and the matrix configuration on one hand, and the non-matrix configuration on the other, seemed greater between the nonmatrix configuration and single corner. A logical conclusion would be that ranges to be attained with the nonmatrix would slightly exceed those reached with the matrix. Another observation is that the ground-to-air path seemed better by about 30 miles than the air-to-ground path. The participating aircraft used 25-watt transmitters. The use of a 250-watt transmitter (10 db) amplifier should extend the air-to-ground path somewhat for selected ranges and altitudes. The use of a lower noise receiver would have increased the ground-to-air range likewise, but probably not so much. A higher gain airborne antenna should have increased both paths an equal amount.

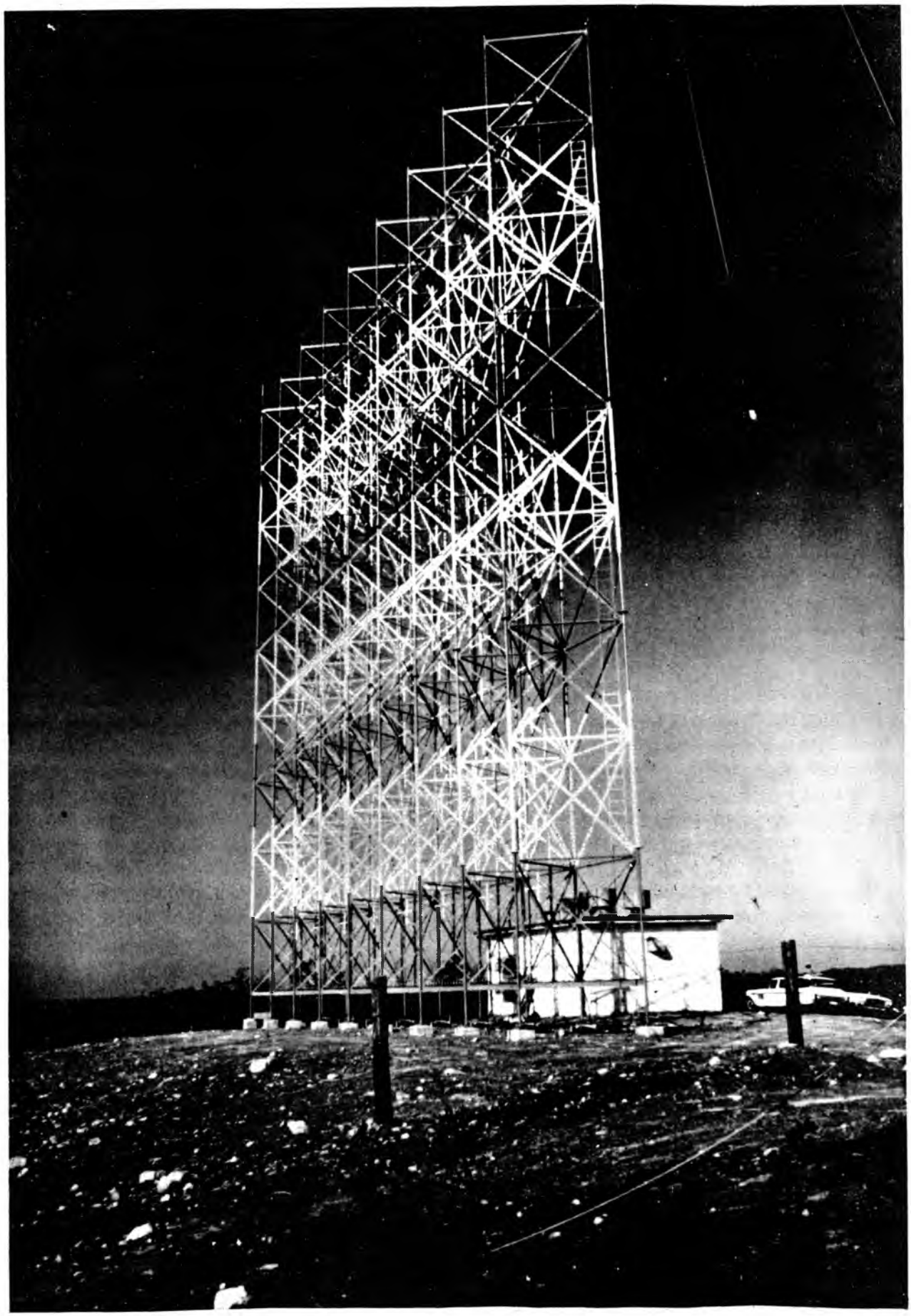

Fig. 1

VUE DE L'ANTENNE DE BARNSTABLE, MASS.
BARNSTABLE, MASS. SITE
VISTA DE LA ANTENA DE BARNSTABLE, MASS.

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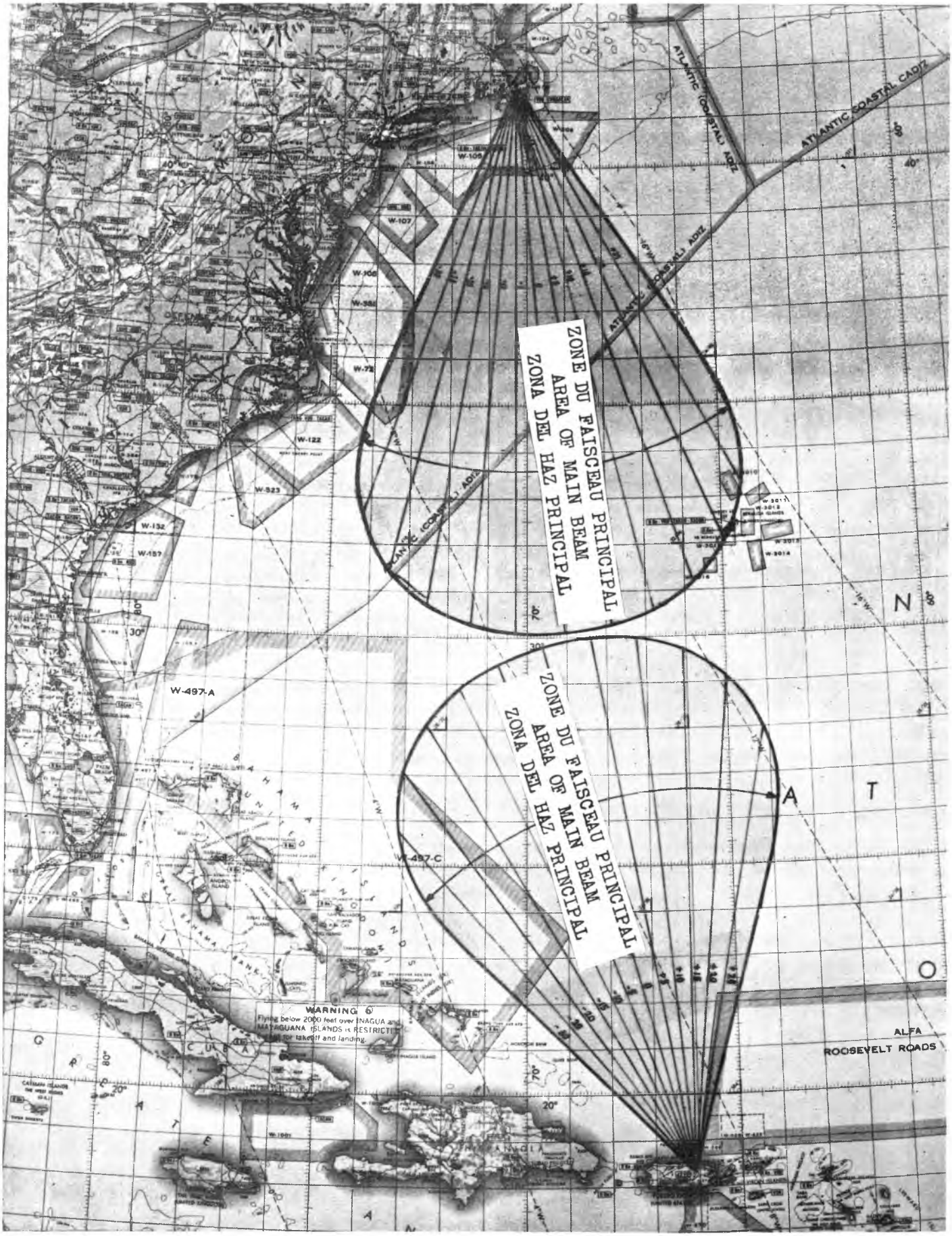


COUVERTURE DESIREE POUR LE FAISCEAU PRINCIPAL DES STATIONS EXPERIMENTALES A ONDES METRIQUES

Fig. 3

DESIRED MAIN BEAM COVERAGE OF EXPERIMENTAL VHF SITES

COBERTURA DESEADA DEL HAZ PRINCIPAL DE LAS ESTACIONES EXPERIMENTALES DE ONDAS METRICAS

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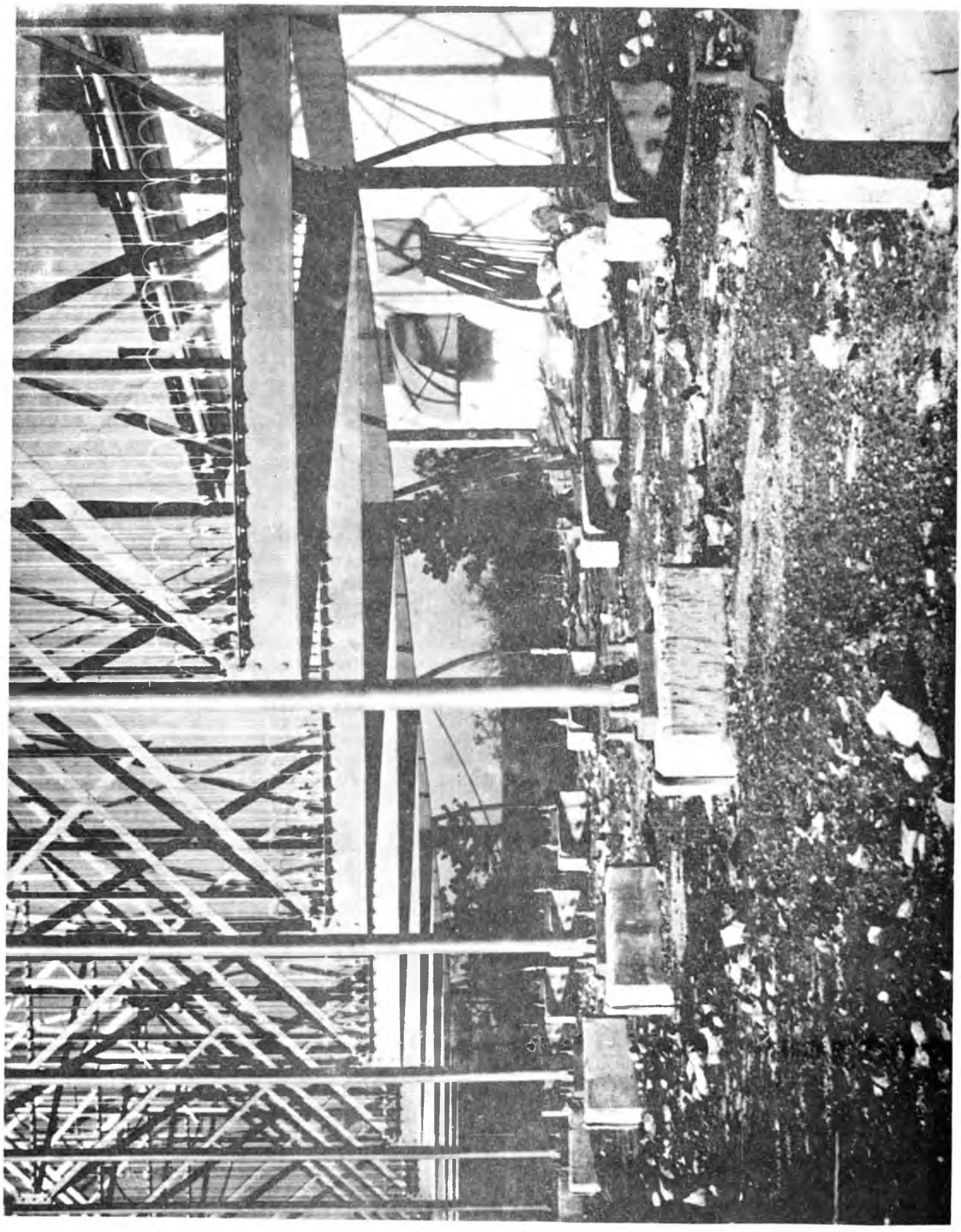

Fig. 11

VUE DE LA PARTIE INFERIEURE DE L'ANTENNE - BARNSTABLE, MASS.
ANTENNA, BOTTOM VIEW - BARNSTABLE, MASS.
VISTA DE LA BASE DE LA ANTENA - BARNSTABLE, MASS.

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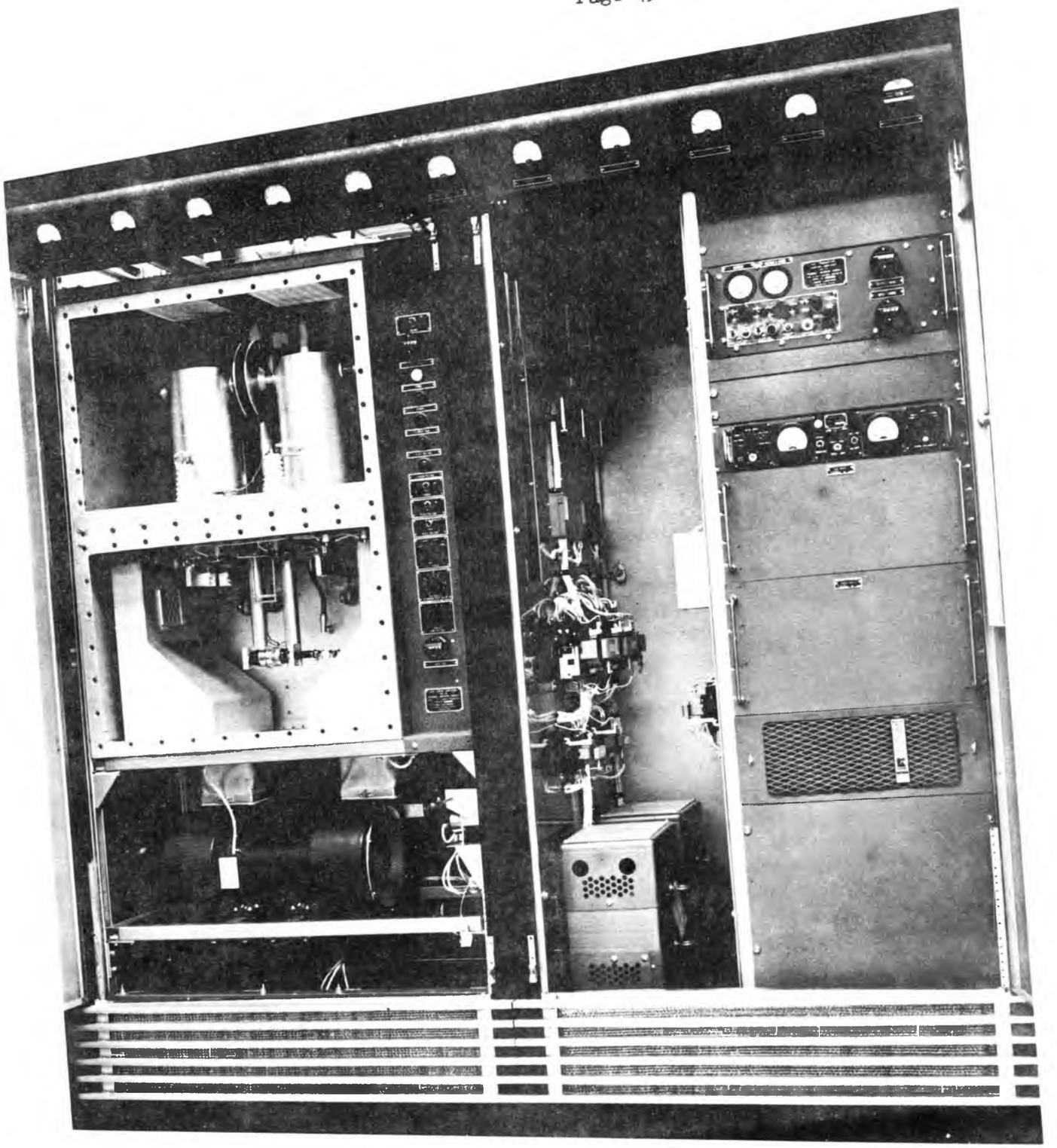

Fig. 14 EMETTEUR 4 KW
TRANSMITTER 4 KW
TRANSMISOR DE 4 KW

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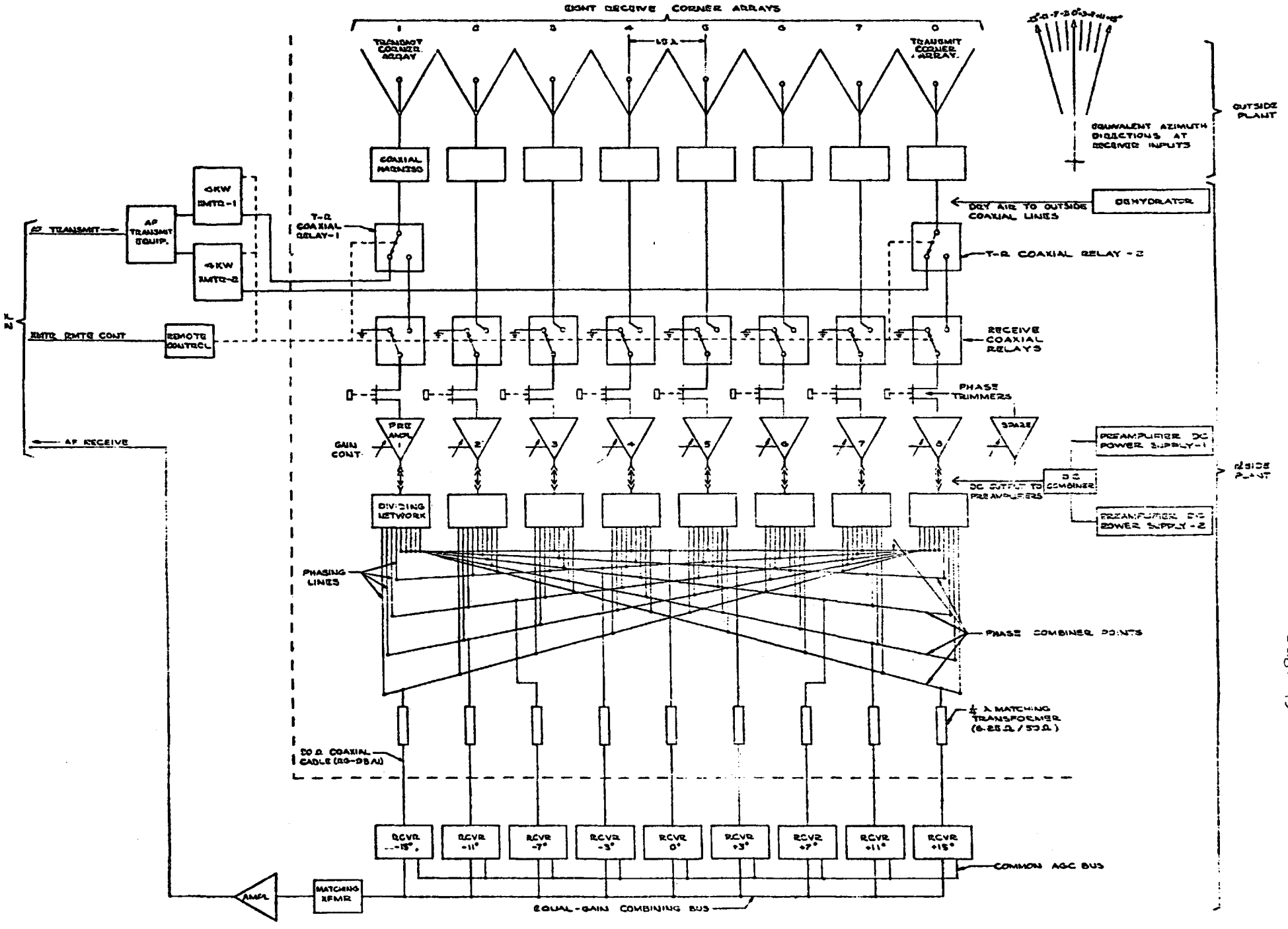


Figure 7. Tentative System Layout

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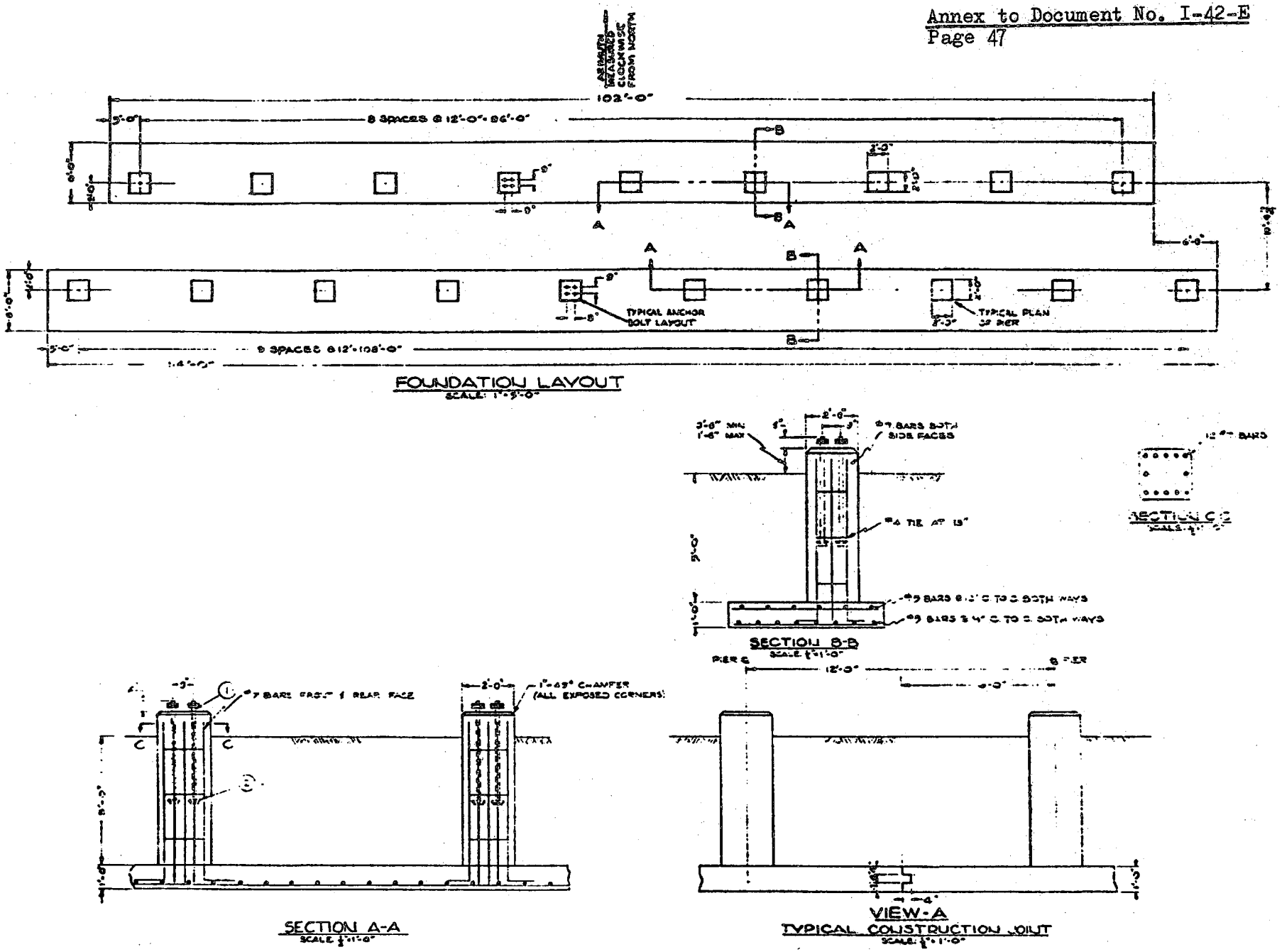


Figure 15. Antenna Foundation Details

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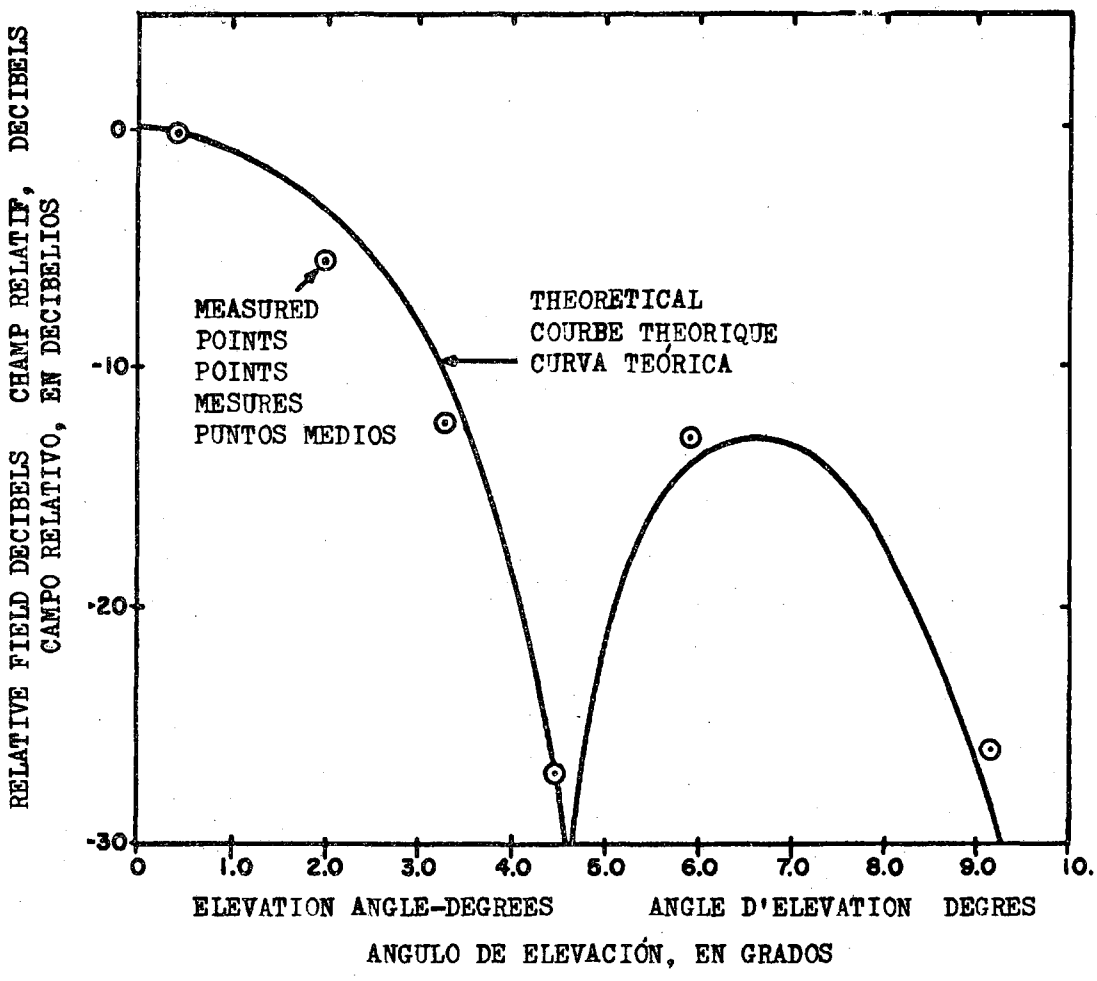


Fig. 18 Vertical Free Space Pattern of Transmitting Antenna (No Beam Tilt, All Dipoles in Phase)

Fig. 18 Diagramme de rayonnement vertical de l'antenne d'émission dans l'espace (Faisceau non incliné, tous les dipôles en phase)

Fig. 18 Diagrama de radiación vertical de la antena transmisora en el espacio libre (Haz sin inclinación, todos los dipolos en fase)

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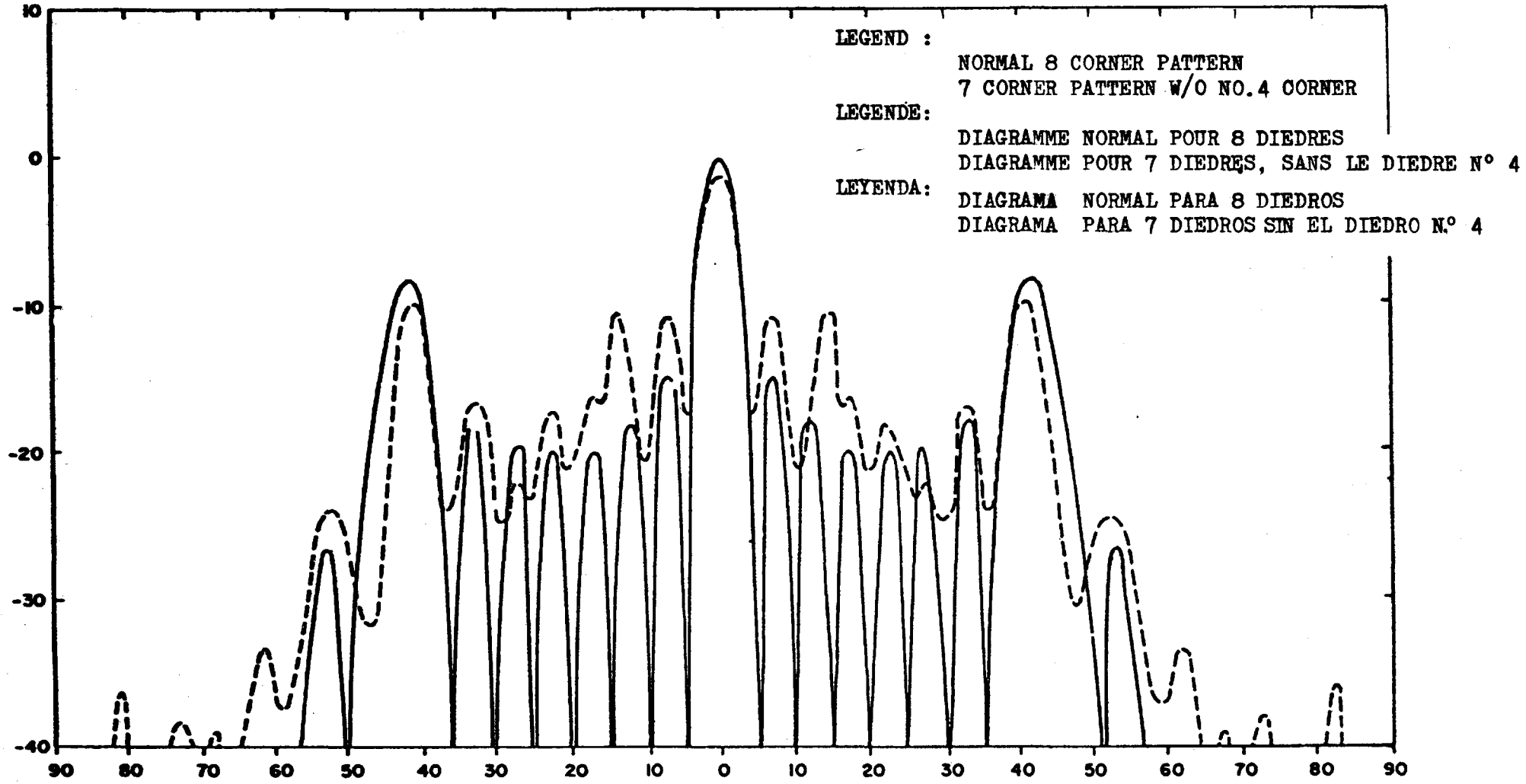


Fig. 19 Calculated 0° Receiving Antenna Patterns

Fig. 19 Diagrammes d'antennes de réception A 0° (calculés)

Fig. 19 Diagramas calculados a partir de 0° de la antena utilizada en recepción

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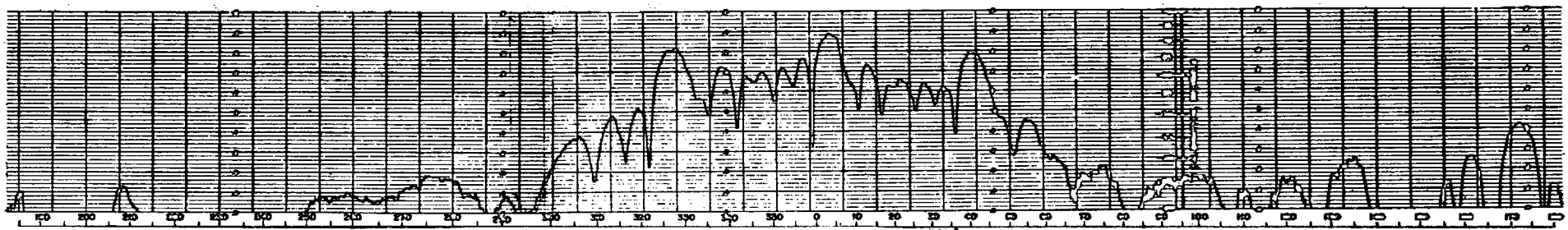
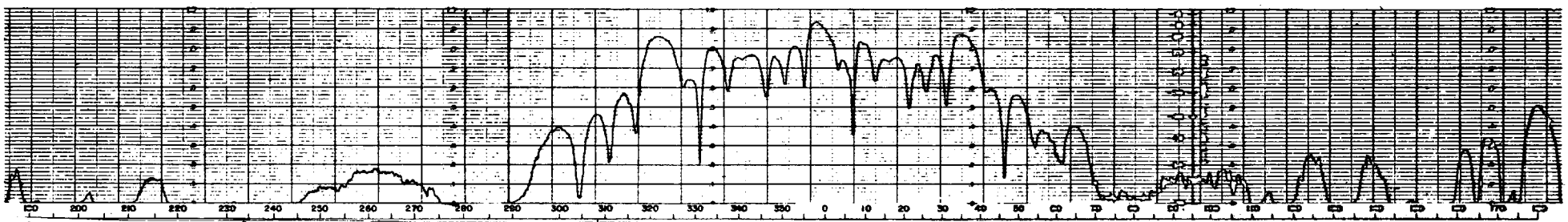
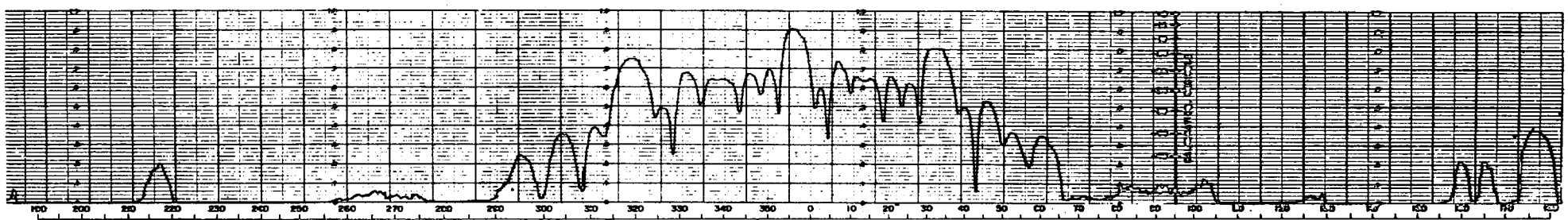


6 NOVEMBER 1962 3° R RECEIVING ANTENNA PATTERN 135.8 MC 400' ELEVATION RECORDER NO. 2



6 NOVEMBER 1962 0° RECEIVING ANTENNA PATTERN 135.8 MC 400' ELEVATION RECORDER NO. 3



6 NOVEMBER 1962 3° L RECEIVING ANTENNA PATTERN 135.8 MC 400' ELEVATION RECORDER NO. 4

FIG. 20 - Receiving Antenna Patterns, 135.8 mc (Azimuths 3° Left, 0°, and 3° Right of Array Centerline).

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DIPOLES
VERTICAUX

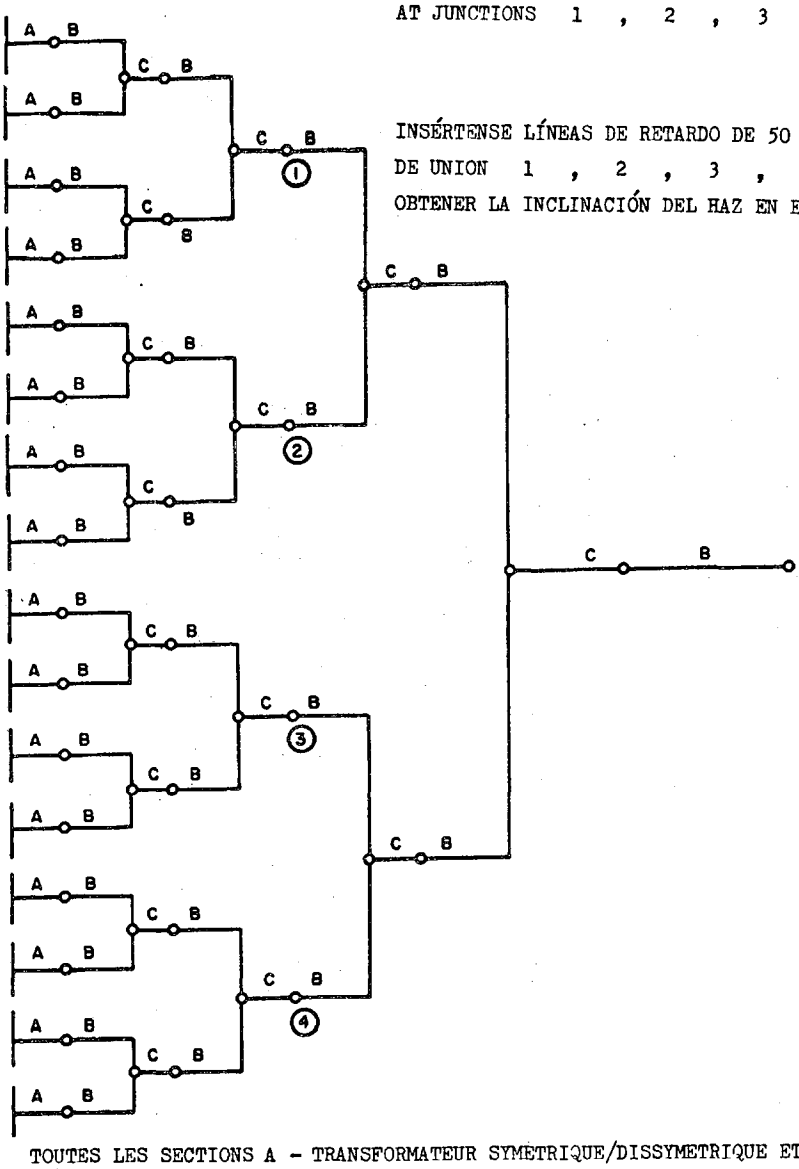
VERTICAL
DIPOLES

DIPOLOS
VERTICALES

INSERER DES LIGNES A RETARD DE 50 OHMS AUX POINTS DE JONCTION 1 , 2 , 3 , ET 4 POUR OBTENIR L'INCLINAISON DU FAISCEAU DANS LE PLAN VERTICAL

FOR VERTICAL BEAM TILT, INSERT 50 OHM DELAY CABLES AT JUNCTIONS 1 , 2 , 3 , AND 4

INSÉRTENSE LÍNEAS DE RETARDO DE 50 OHMS EN LOS PUNTOS DE UNION 1 , 2 , 3 , Y 4 PARA OBTENER LA INCLINACIÓN DEL HAZ EN EL PLANO VERTICAL




TOUTES LES SECTIONS A - TRANSFORMATEUR SYMETRIQUE/DISSYMETRIQUE ET TRANSFO. DIPOLE
SECTIONS B - CABLE COAXIAL 50 OHMS
SECTIONS C - CABLE COAXIAL QUART D'ONDE 35 OHMS

ALL A SECTIONS - BALUN AND DIPOLE TRANSFORMER
B SECTIONS - 50 OHM COAXIAL CABLE
C SECTIONS - QUARTER WAVE 35-OHM COAXIAL CABLE

TODAS LAS SECCIONES A - TRANSFORMADORES SIMÉTRICO-ASIMÉTRICO Y DE DIPOLO
SECCIONES B - CABLE COAXIAL 50 OHMIOS
SECCIONES C - CABLE COAXIAL DE 1/4 DE ONDA 35 OHMIOS

Fig. 21. Système d'alimentation de l'antenne

Fig. 21. Antenna Feed System

Fig. 21. Sistema de alimentación de la antena.

AERONAUTICAL CONFERENCE

Document No. I-43-E
29 January 1964
Original: English

E.A.R.C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

United States of America

# CONCERNING A NEW TYPE OF HIGH FREQUENCY ANTENNA THAT MAY BE APPLICABLE IN THE AERONAUTICAL MOBILE "R" SERVICE

## Wire-grid lens antenna for HF communication

A radical departure from conventional antenna technology is demonstrated in the design of a high frequency lens antenna developed for the Federal Aviation Agency by Dr. R.L. Tanner of TRG-West. This antenna, the first full scale model of its kind, is located at the International Flight Service Receiver Station on the island of Molokai, Hawaii. Signals transmitted from Anchorage, San Francisco, Sydney, Tokyo, and other points in the Pacific Ocean are received at the International Flight Service Station and relayed to the Air Traffic Control Center at Honolulu. Rhombic antennas previously installed to receive these transmissions occupy approximately 1100 acres of land. The Molokai wire-grid lens antenna, which is 850 feet in diameter, is capable of simultaneous reception of signals over operational circuits from seven directions at different frequencies in the 3 to 30 Mc band. Annex 1 reflects the general performance characteristics specified in the FAA contract.

The wire-grid lens antenna consists of two circular grids, suspended one above the other, and surrounded by a radial wire horn. Electromagnetic waves traveling through space are intercepted by the horn, concentrated in the vertical direction, and transferred to the lens as depicted in Fig. 1. Refraction within the lens causes the wave front to bend and converge at a focal point on the diametrically opposite side, where a feed assembly or transmission line coupler is located. As many as thirty-six couplers may be installed in the lens to provide coverage in as many different directions. The outputs from the feeds could also be combined to provide a steerable beam for full azimuth coverage.

### Design Principles

Lens techniques, based on optical theory developed by the late Dr. R.K. Luneburg (Reference 1) have been applied in the design of relatively small microwave and UHF antennas. In these antennas, wave focusing is generally accomplished by use of a dielectric foam material, the refractive index of which is made to vary over the cross section in a prescribed

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fashion. The Luneburg lens may be constructed in spherical or disc form. The concept has not heretofore been extended to the lower frequencies because of the impracticability of using solid dielectric materials in large structures.

The wire-grid lens antenna invented by Dr. Tanner (Reference 2) has properties which resemble the disc-type Luneburg lens. The solid dielectric is eliminated and the focusing properties of the lens are achieved by varying the spacing between a pair of wire grids in a systematic manner. The index of refraction is made to vary as a parabolic function across the aperture of the lens and the velocity of propagation varies between the free space value, at the circumference of the grids, to approximately 70 per cent of the free space value at the center of the grids. This variation in the velocity of propagation of an electromagnetic wave entering the lens may be explained in the following manner:

> At the edges of the lens where the spacing between the grids is large relative to the mesh size, the grids simulate a pair of metal plates and the wave in this region propagates at nearly the speed of light. At the center of the lens, where the spacing between the grids is small relative to the mesh size, the grids act as a network of interconnected open wire transmission lines and the wave in this region propagates at a slower rate, which has been shown in Reference 2 to be $1/\sqrt{2}$ times the velocity of light. The end result is that the plane wave front intercepted by the lens is transformed to a curved wave front, the rays of which converge at a focal point on the opposite side. The properties of the lens are independent of frequency, provided the mesh size is small compared to a wavelength at the highest operating frequency. Since the waves traveling between the grids have electric fields which are generally vertical, the antenna is essentially vertically polarized.

Radiation efficiency at the lower frequencies is preserved by use of the electromagnetic horn attached to the grid. This horn provides the proper impedance match between free space and the lens, and at the same time increases the vertical directivity.

## Construction

The wires which compose the grids are attached to rings fabricated from especially extruded aluminum sections. The upper and lower grids are identical. Each of the rings is 600 feet in diameter and the grid wires are spaced to form squares 5 feet on a side. The mesh is uniform from the center of the lens to a distance of $37\frac{1}{2}$ feet from the outer edge where satellite wires taper away from each of the major grid wires to form a mesh of $2\frac{1}{2}$ feet squares at the periphery of the lens.

The two grid rings are attached together by diagonal web members of impregnated hardwood to form a truss. The spacing between the upper and lower grids is 12 feet at the rings, and 6½ inches at the center of the lens. Proper spacing between the grids is maintained by insulating spacers. The average stress on the grid wires is 275 pounds and the truss is under a radial compression of 38,000 pounds with no wind loading.

The lens truss is suspended from 36 treated wood poles which average 30 feet high and are embedded in concrete footings. The poles are tied together by a series of crossed guy wires and each pole has a third radial guy wire, which is attached to a buried concrete "dead man".

The horn is composed of wires which extend radially from the lens rings to bridle cables attached to the 24 outer poles, which average 94 feet in height above the ground. There are 504 radial wires 145 feet long in the upper horn curtain and an equal number of wires 130 feet long in the lower curtain. Short lengths of wire are connected between the radial wires out to 1/5 of their length from the lens rings. These wires are necessary to provide paths for circumferential currents produced by the higher order propagation modes which would otherwise be strongly excited, due to the discontinuity, and contribute to side and back lobe radiation.

The upper horn curtain is attached to the outer poles at points which are a constant height above the plane of the lens. The lower horn curtain is attached to the poles at points seven feet above the ground. The average angle between the horn curtains is 25 degrees.

Each of the outer poles is supported by three sets of guy wires at different heights. The top guy wires are stressed at approximately 2,700 pounds with no wind loading. The maximum stress on the top outer guy wires increases to 7,500 pounds with a 100 mph wind load. All wire used in the construction of the antenna is aluminum-clad steel. The steel wire is # 8 and the overall diameter, including the aluminum coating, is 0.128".

Transmission Line Coupler

The device used to couple the signal from the lens to the receiver transmission line is unique, as is the wire-grid lens itself. The coupler assembly consists of a pair of feeds as shown schematically in Fig. 2. This design, which is described by Dr. Tanner as a modified ramp feed, evolved from a comprehensive series of experiments and calculations. In simplified form, the ramp feed consists esentially of one or more conductors extending diagonally between the lower and upper grids of the lens. Since the ramp has vertical current components along its slope, it may be considered as a series of vertical current elements which couple to the electric fields of the waves traveling between the grids. The pattern of such an array is a cardioid with its null in the rearward direction.

The ramp feed by itself, did not produce clean radiation patterns, particularly at the lower frequencies, because it provided coupling to higher order circumferential modes circulating within the lens. These modes produced excessive side and back lobe radiation. The modified ramp feed has additional current elements at each end of the ramp which alter the radiation pattern of the feed and produce nulls in the circumferential direction thereby reducing coupling to the circulating modes. The radiation patterns were optimized by adjustment of the phase and amplitude of the currents in the end elements.

The actual feeds extend 75 feet into the lens, as shown in Fig.3. Each feed consists of a pair of wires spread apart along their lengths to provide a constant impedance. Maximum coupling between the lens and the feed occurs when the phase velocity along the feed is slightly slower than that of the lens. This wave slowing was accomplished by the addition of capacitive loading in the form of aluminum plates connected across the wires of the ramp. The phase velocity along the feed is slowed from the free space velocity by the ratio of 1.2 : 1.

Broad banding of the feed is accomplished by use of a constant resistance network in which $R = \sqrt{\frac{L}{C}}$. The current in the end elements are fed in the proper phase relationship with respect to the ramp by means of phase-inverting transformers connected to each of the current elements.

The coupler is made up to two identical feeds spaced 30 feet apart at the circumference of the lens. The pattern characteristics of the feed are such that less of the lens aperture is illuminated at the higher frequencies and therefore the beamwidth is essentially constant at frequencies above 10 Mc.

## Performance

The results of preliminary tests have indicated that the antenna is performing in accordance with design predictions. The impedance match to the transmission line surpassed expectations. The highest standing wave ratio measured for any of the couplers over the entire frequency band was less than 2.1 at the antenna coupler output. The beams are well defined with a minimum of side and back lobe radiation.

Throughout the development cycle, two valuable tools were employed to optimize the design parameters. The first was a 1/40th scale model of the lens and horn structure, shown in Fig. 4, and the second, a high speed digital computer equipped with an automatic pattern plotter. Analytical methods were employed to derive the differential equations describing wave propagation in the lens and the feeds. These equations were solved directly by the computer and the scale model was used for experimentation to improve the feed and coupling methods. A complete set of calculated patterns was produced by the computer. Examples of calculated patterns for frequencies near both ends of the band are shown in Fig. 5.

As is generally recognized, it is extremely difficult to obtain full scale radiation patterns of antennas operating in the HF frequency band. This being the case, the results of calculations or measurements using scale models, are usually accepted as final results. In the case of the wire-grid lens antenna, however, there exists such widespread interest in its application for communications and other purposes that full scale pattern measurements are mandatory. As an initial approach to this objective, pattern measurements were made using a vehicle upon which was mounted a test transmitter and antenna.

The receiver site on Molokai was surrounded by a network of roads, and it was possible to define a path which was sufficiently distant from the antenna to be in the far field of radiation. Forty-three test stations were established along this path and their azimuthal directions from the antenna were defined with reasonable precision. By moving the vehicle from one test station to another, it was possible to define the main beam of one feed and the side and back lobe radiation from another. The results were pieced together to form fairly complete patterns. Examples of the actual patterns obtained by this method are shown in Fig. 6.

The irregularities of the measured radiation patterns are attributable to two causes. First, the contours of the terrain on the island and the geography of the roads available for running the vehicle containing the test transmitter were such that it was impossible to obtain line-of-sight measurements. The patterns taken, therefore, represented signal fringing over the edge of hills between the antenna and the transmitter. Second, the antenna used as a reference was found to be far from omni-directional. Actually, two antennas were used for this purpose; a tuned whip with the grids of the lens acting as a counter poise, and a huge biconical composed of the upper and lower lens and horn segments. Neither of these reference antennas was omni-directional, but it appeared from the data that the biconical feed to the lens provided the most uniform reference. This antenna was used to plot the data shown in Fig. 6.

In spite of the aforementioned difficulties it was possible to show that the radiation patterns were well defined and of the proper beamwidth, and that the back and side lobe radiation was well within the design limits.

Preliminary operational tests of the lens antenna, in comparison with the rhombics, indicated that although the signal level received via the lens was lower than that received via the rhombics, the improved signal-to-noise ratio from the lens resulted in increased readability at the lower signal levels.

The Federal Aviation Agency is preparing for a comprehensive evaluation of the wire-grid lens antenna with support from the U.S. Army Electronic Research and Development Laboratory at Fort Monmouth and the U.S. Navy.

The program, which will be spearheaded by Mr. M.L. Musselman, Head of the Antenna Section, Naval Research Laboratory, will include flight test measurements of the full scale radiation patterns and operational tests to determine the performance of the antenna in comparison with the conventional rhombic antennas over operational circuit paths.

References:

R.K. Luneburg, "Mathematical Theory of Optics",
Brown University Graduate School Lecture Notes,
Providence, R.I.; pp. 208-213; 1944

R.L. Tanner,
M.G. Andreason, "A Wire Grid Lens Antenna of Wide Application",
IRE Transactions, PGAP; pp. 408-429; July 1962

Annexes: 3

# ANNEX 1

## GENERAL PERFORMANCE CHARACTERISTICS

The contract executed with TRG-West for design and construction of a high frequency wire-grid lens antenna was prefaced on the design criteria and performance characteristics listed below :

| | |
|---|---|
| Frequency Range | 3 to 30 megacycles |
| Polarization | Vertical |
| VSWR | 2.5:1 maximum |
| Directive Gain (over isotrope) | 3 Mc - 8 db minimum<br>10-30 Mc - 16 db minimum |
| Azimuthal Main Beamwidth (half-power points) | 3 Mc - 30° minimum<br>10 Mc - 15° minimum<br>30 Mc - 10° minimum |
| Vertical Uptilt of Main Beam | Betwenn 0° and 10° nominal |
| Side-Lobes and Front-to-Back Ratio | Above 10 Mc, at least 15 db below main beam |
| Impedance | 50 ohms (75 ohms actual) |
| Number of Transmission Line Couplers | Eight, aligned on specific azimuths (seven actual) |
| Angular Separation of Couplers | 10° minimum |
| Power-Handling Capability | Receiving application |
| Operational Environment | 100 mph wind, without ice |
| Site Area Requirements | 950-foot circular plot, level terrain |
| Height of Supporting Poles | 150 feet maximum |
| Transmission Lines | Low-loss coaxial cable |
| Vertical Main Beamwidth (half-power points) | 50° maximum at 3 Mc<br>25° nominal at 10 Mc |

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# ANNEX 2

## ILLUSTRATIONS

No Figure Number - Overall view(s) of Antenna

Figure 1 - Artist's conception of wave energy being concentrated by the wire-grid lens

Figure 2 - Pictorial schematic of transmission line coupler (Suggest dotted line boxes be made smaller relative to size of ramp feeds and monopoles actually extend all the way between upper and lower grids.)

Figure 3 - Transmission line coupler assembly installed in lens. Assembly consists of two modified ramp feeds

Figure 4 - Scale model of wire-grid lens antenna. Model is 1/40th of the size of the actual antenna. Horn aperture is doubled to simulate the effect of antenna image in ground.

Figure 5 - Calculated radiation patterns of full scale wire-grid lens antenna

Figure 6 - Measured radiation patterns of full scale wire-grid lens antenna beamwidths, back and side-lobe radiation correspond to predictions. Irregularities are due to conditions of tests

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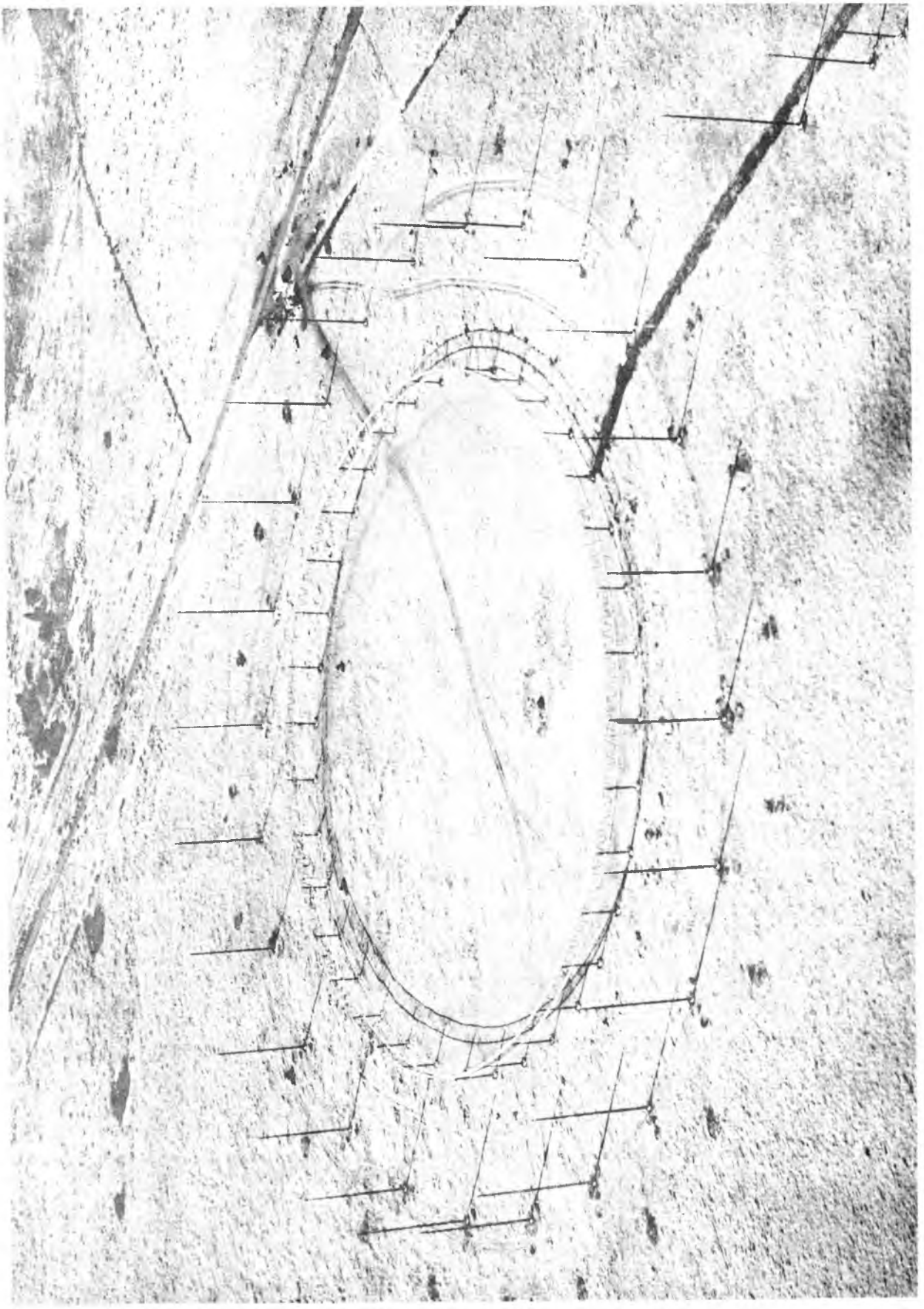

VUE AERIENNE DE L'ANTENNE
AERIAL VIEW OF ANTENNA
VISTA AEREA DE LA ANTENA

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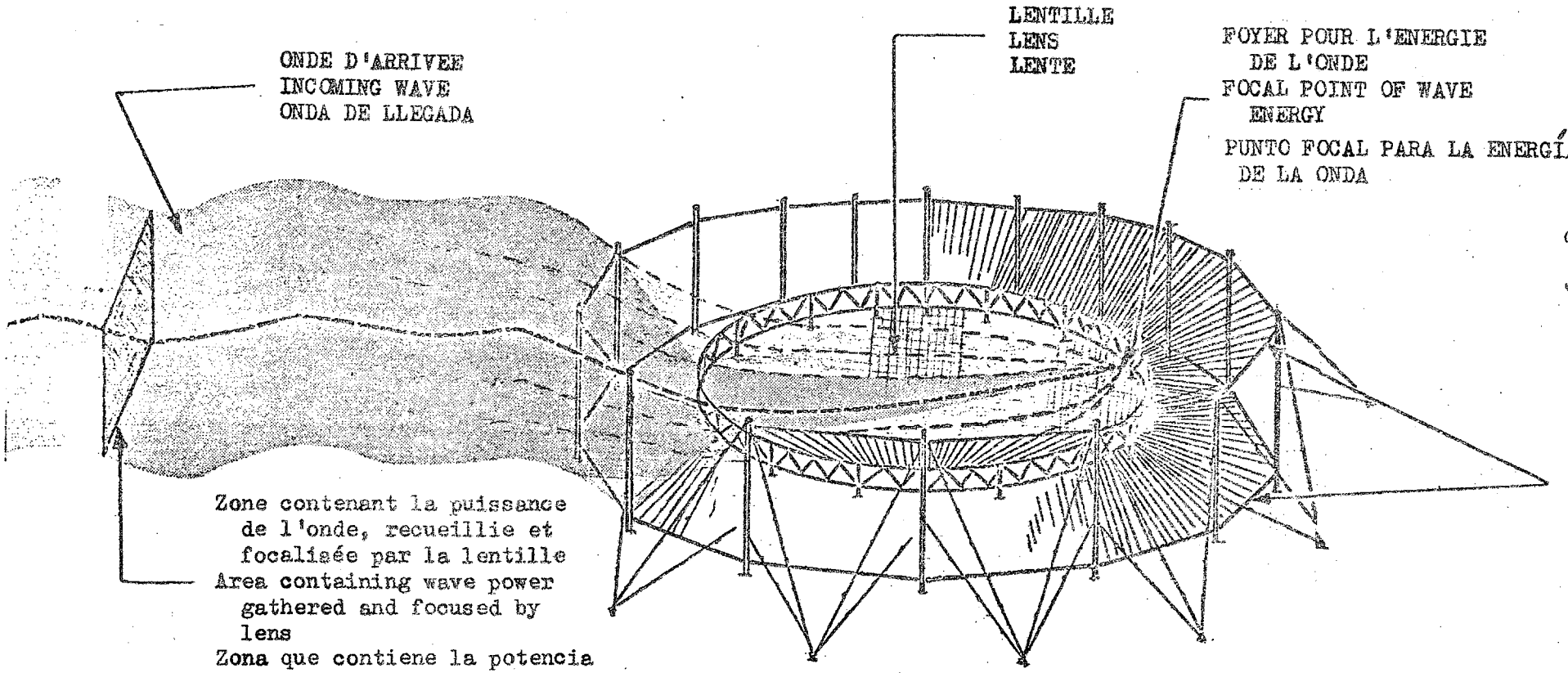
ONDE D'ARRIVEE
INCOMING WAVE
ONDA DE LLEGADA
LENTILLE
LENS
LENTE
FOYER POUR L'ENERGIE DE L'ONDE
FOCAL POINT OF WAVE ENERGY
PUNTO FOCAL PARA LA ENERGÍA DE LA ONDA
Zone contenant la puissance de l'onde, recueillie et focalisée par la lentille
Area containing wave power gathered and focused by lens
Zona que contiene la potencia de la onda, recogida y focalizada por la lente

FIG. 1

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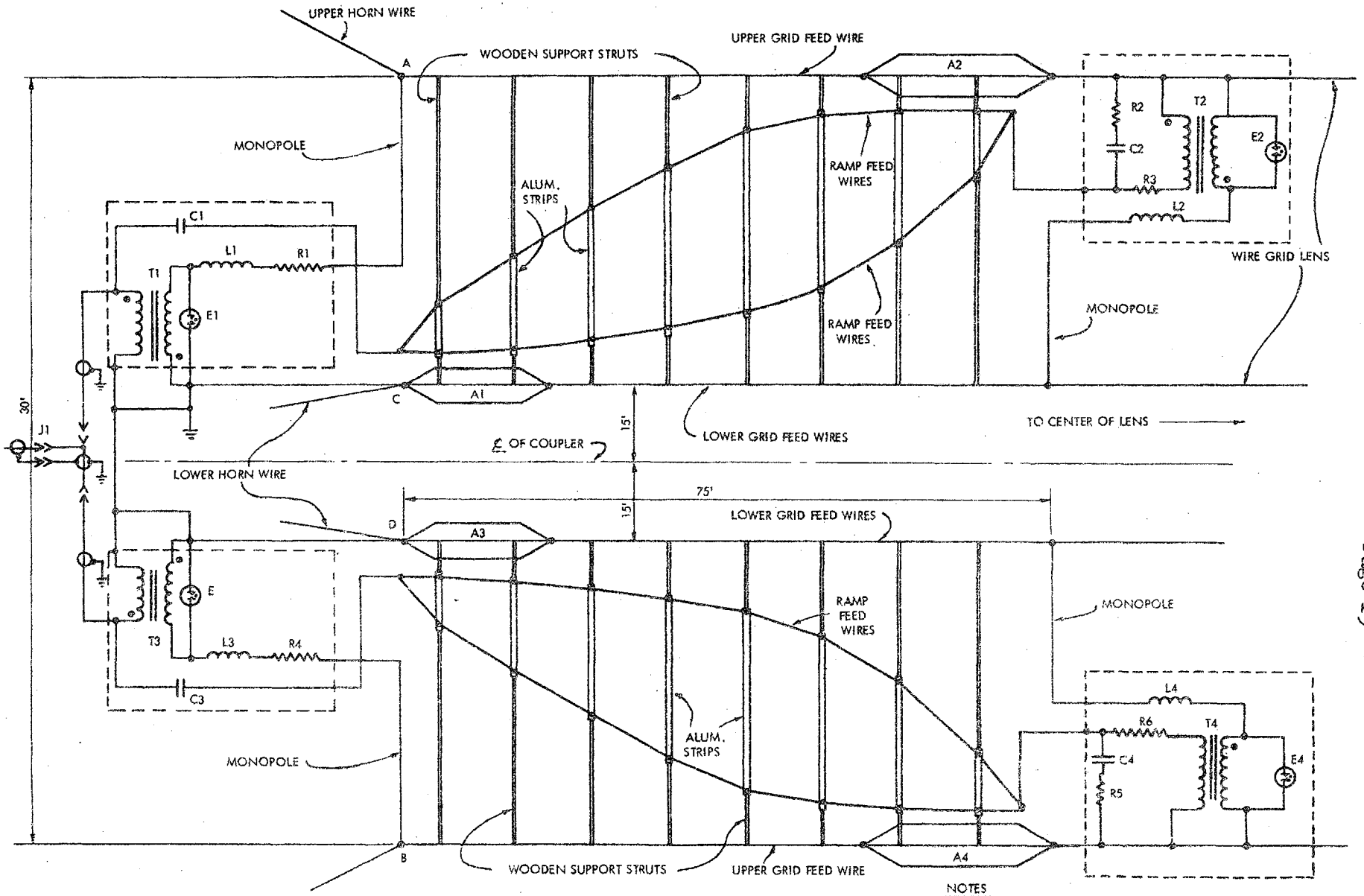


FIG. 2

PICTORIAL SCHEMATIC OF A TRANSMISSION LINE COUPLER

NOTES

1. POINTS AB AND CD REPRESENT UPPER AND LOWER TRUSS CHORDS, RESPECTIVELY.
2. A1, A2, A3 AND A4 ARE WIRE GROUND PLANES INTER-CONNECTED IN PLANE OF EACH GRID.
3. EACH FEED WIRE IS INTER-CONNECTED IN THE PLANE OF THE GRIDS.

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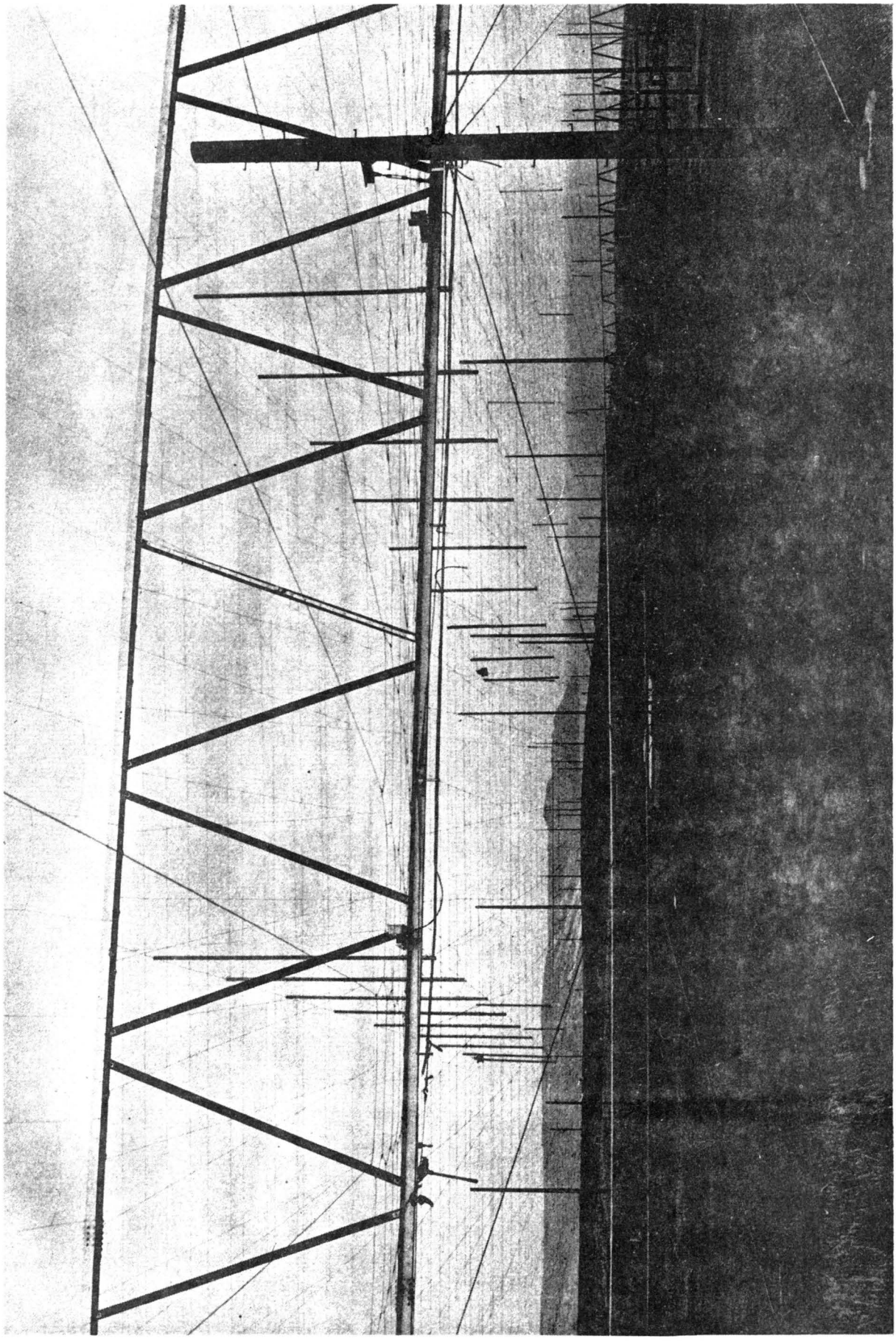

FIG. 3

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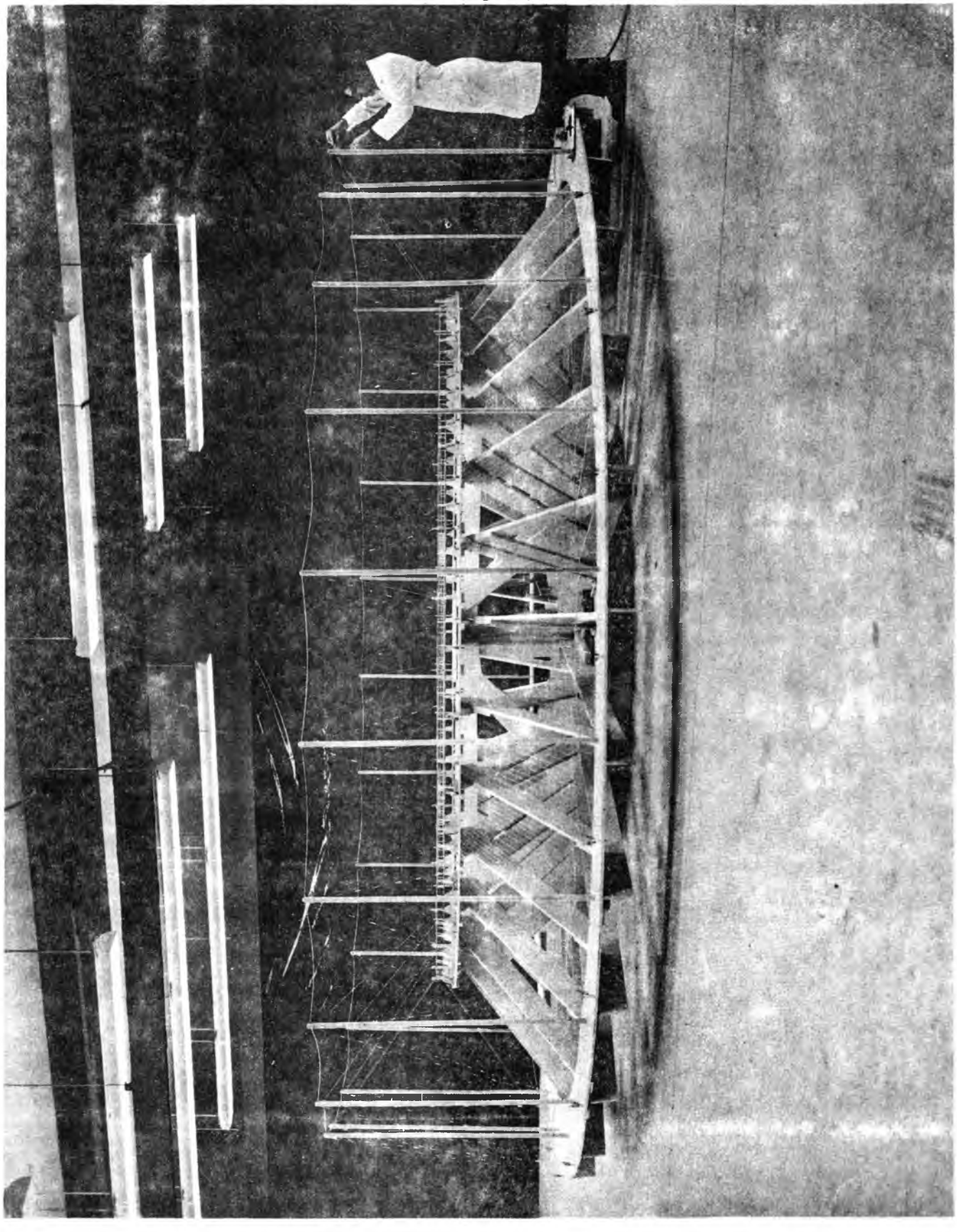

Fig. 4

MAQUETTE AU 1/40ème DE L'ANTENNE LUNEBURG A LENTILLE ET A GRILLE METALLIQUE POUR ONDES DECAMETRIQUES
1/40th SCALE MODEL WIRE-GRID HF LUNEBURG LENS ANTENNA
MAQUETA A ESCALA 1/40 DE LA ANTENA LUNEBURG DE LENTE Y REJILLA METÁLICA PARA ONDAS DECAMÉTRICAS

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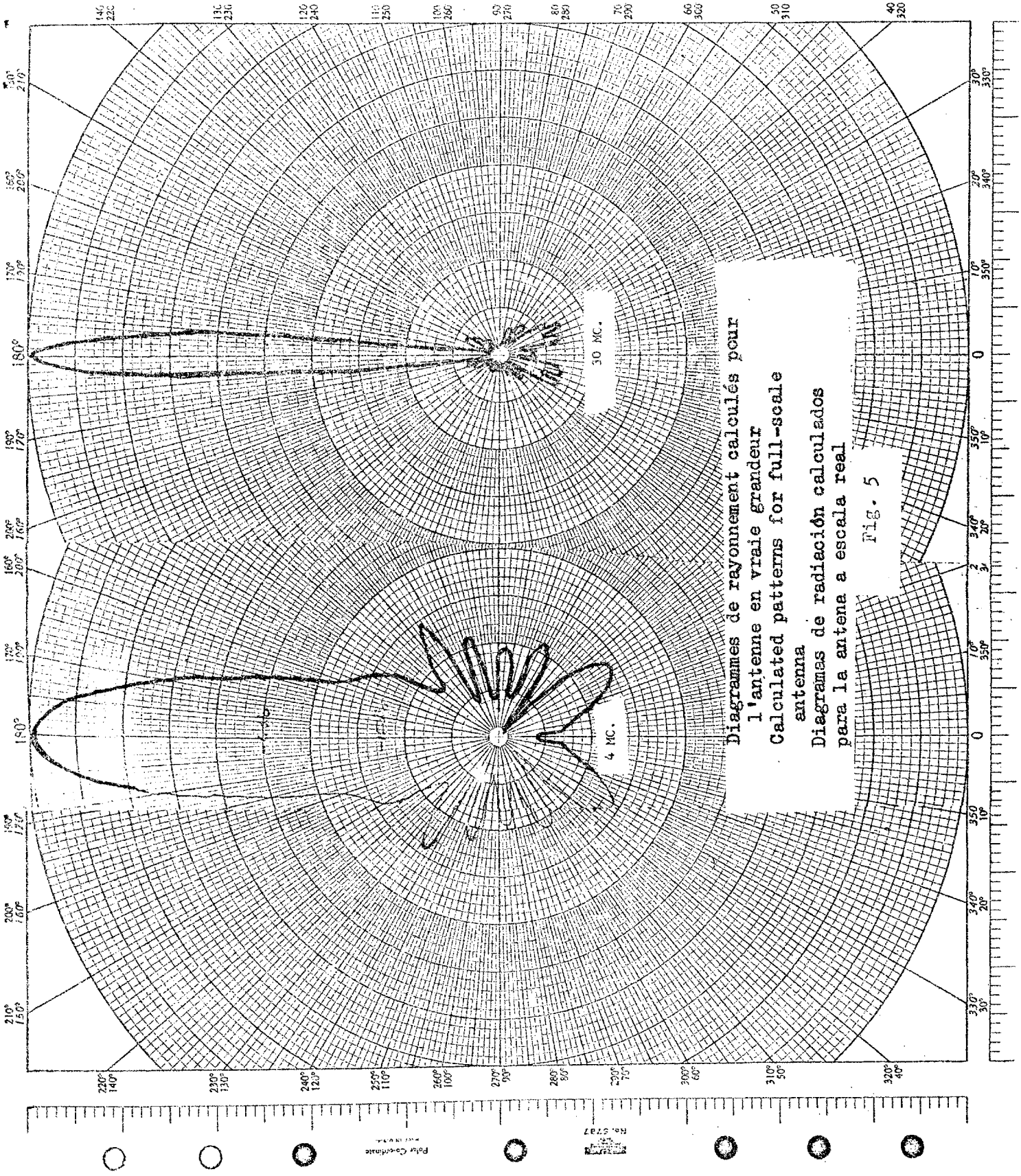


Diagrammes de rayonnement calculés pour l'antenne en vraie grandeur
Calculated patterns for full-scale antenna
Diagramas de radiación calculados para la antena a escala real
Fig. 5

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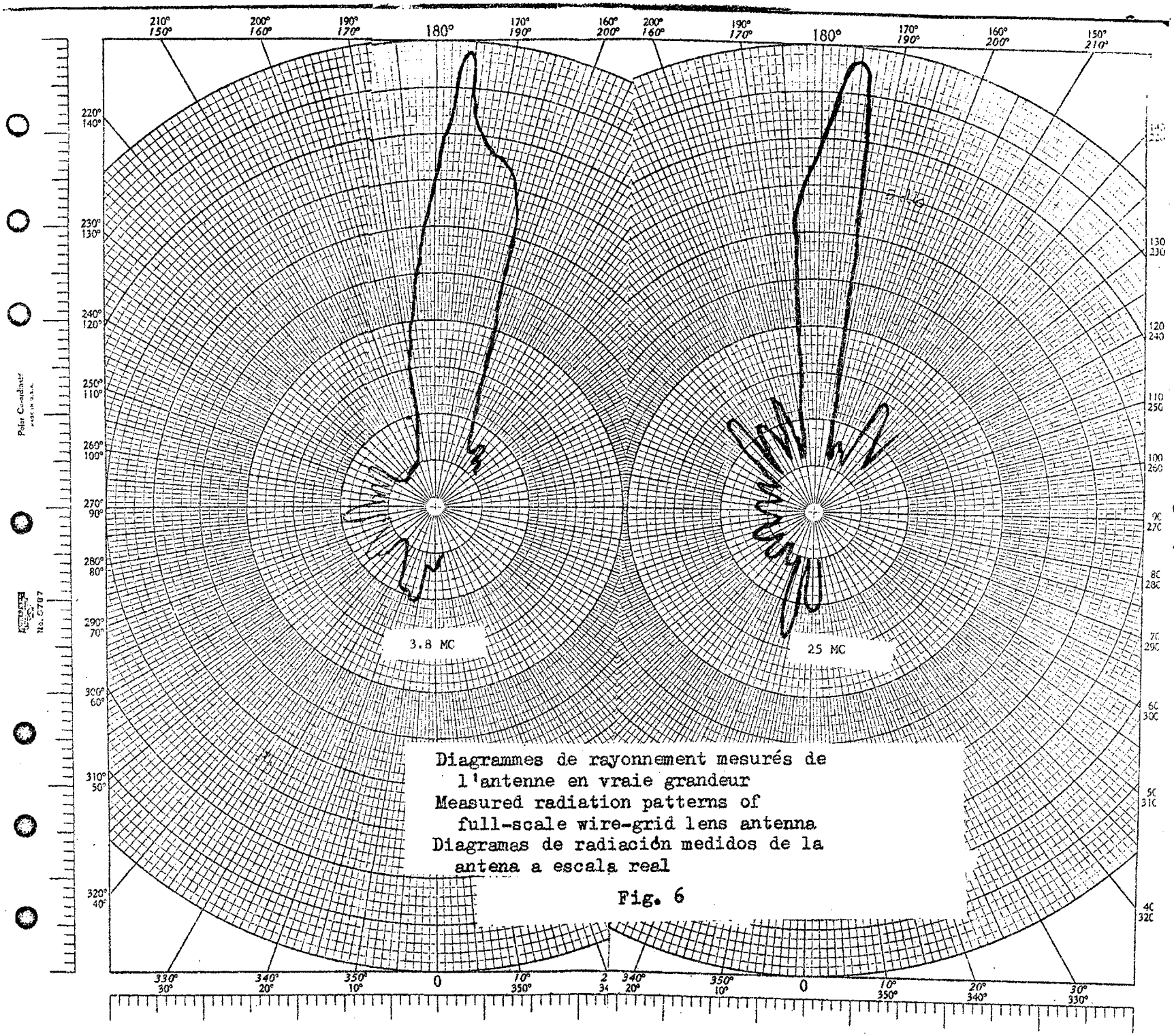


Diagrammes de rayonnement mesurés de l'antenne en vraie grandeur
Measured radiation patterns of full-scale wire-grid lens antenna
Diagramas de radiación medidos de la antena a escala real

Fig. 6

AERONAUTICAL CONFERENCE

Document No. I-44-E
29 January 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

United States of America

# REPORT ON H-F SECTOR-COVERAGE LOG-PERIODIC ANTENNA

## Description

The h-f sector-coverage log-periodic antenna array, or "Rosette", is designed for applications requiring full Azimuth coverage combined with the power gain and front-to-back ratio advantages of directional antennas. A sketch of this antenna is shown in Fig. 1-1. The ground screen network is not shown for clarity, however, the ground screen outline is shown in Fig. 3 for two different frequency ranges.

Figs. 1 and 2 show the radiation patterns of the "Rosette" in the Azimuth plane and elevation plane respectively. Since this antenna is basically a quarter wave antenna which requires a ground screen, the effect of the ground conductivity on the take-off angle of the beam maximum and the antenna gain is also shown in Fig. 2.

Through the use of a combination of multicouplers and switching networks, it is possible to connect several receivers (or transmitters) to each of the "Rosette" elements as illustrated in Fig. 4.

This antenna is being considered by the Federal Aviation Agency for high frequency air/ground communications.

## Theory of operation

It seems appropriate at this time to discuss briefly the theory of a log-periodic antenna and then discuss how this antenna was used to form the "Rosette" antenna.

A log-periodic antenna essentially consists of a feedline and radiators arranged so that the electrical length of each element and spacing between elements causes the input impedance and radiation patterns to be repeated periodically with the logarithm of the driving frequency. An r-f signal is applied to the high frequency end of the structure, from which it

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travels along the feedline and radiating structure in the form of a "transmission line wave". When this signal encounters a group of elements which are nearly resonant, the energy is extracted from the feedline at this point and launched into space as a "radiated wave".

The "Rosette" antenna is basically composed of four vertically polarized broad band log-periodic monopole antennas supported from a common central tower, with their axes in the four quadrant directions.

The electrical portions of the antenna consist of the input impedance transformers, the feedlines, the radiator assemblies and the ground screen. The input impedance transformer accepts the unbalanced 125 ohm output level which the feedline provides from the radiators and converts this to an unbalanced coaxial output suitable for matching the coaxial input transmission line.

Through the use of a 1 x 4 switching matrix, this antenna can be sector scanned in Azimuth and thus provide a comparatively small h-f steerable antenna to cover the h-f spectrum. More complex switching arrangements can be used to obtain greater flexibility.

As mentioned before, the energy fed into a log-periodic antenna seeks a resonant group of elements at which point the energy is radiated into free space. Thus, the lower the frequency, the farther back the wave travels on the antenna to transfer its energy. This, then, indicates that the radiating phase center moves along the axis of the antenna when the frequency is changed.

By suspending four log-periodic antennas from the same rear tower and operating near the low frequency end of the antenna, it becomes apparent that problems could arise due to mutual coupling. This is indeed the case. Therefore, if each of the four elements had an individual frequency range of from 2.5 to 32 Mcs, it becomes necessary to raise the low frequency limit to 3.0 Mcs when the elements are configured as a "Rosette". At the low frequency end, the mutual coupling is down by -30 db. As you approach the high frequency end, the mutual coupling is typically -45 db to -50 db.

A word of caution. It appears at first glance that the "Rosette" antenna will provide a broad band, high gain <u>omni-directional</u> antenna. This is not the case at all due to the movement of the radiating phase center. The spacing between the radiating phase centers of the orthogonal elements rapidly exceeds one-half wave length as the frequency is increased above the low frequency cut-off. Elementary electromagnetic theory tells us that radiation pattern lobing occurs when two sources are separated by more than one-half wave length. The "Rosette" antenna helps prove this theory.

Operational characteristics and specifications

The "Rosette" antenna may be used for either transmitting or receiving applications. It is especially well suited for use on ground-to-air circuits, and has been used in this capacity for several years with a great deal of success. For frequencies below 3 Mcs, it is not uncommon to use a conical monopole antenna to provide coverage down to 2 Mcs.

Electrical specifications, for each antenna of the array, are:

| | | |
|---|---|---|
| Frequency Range | 3 to 32 Mcs. | 4 to 32 Mcs. |
| Polarization | Vertical | |
| Directive Gain | 11 db over an isotropic radiator | |
| Azimuth Beamwidth | 110 degrees plus or minus 10% (see Fig. 1) | |
| Elevation Beamwidth | 30 degrees plus or minus 10% (see Fig. 2) | |
| Front-to-Back Ratio | 14 db | |
| Input Impedance | 50 ohms | |
| Maximum VSWR | 2:1 nominal | |
| Power Handling Capability | 20 Kw peak, 10 Kw average (higher power levels available on request) | |

Mechanical specifications are:

| | | |
|---|---|---|
| Tower Height | 140 Feet | 100 Feet |
| Front Pole Height (above ground) | 24 Feet | 17 Feet |
| Curtain Length | 210 Feet | 150 Feet |
| Back Guy | 110 Feet | 80 Feet |
| Front Guy | 24 Feet | 17 Feet |
| Ground Screen | 620 Feet by 620 Feet | 500 Feet by 500 Feet |
| Environmental Conditions | 120 knots wind, no ice<br>50 knots wind, $1\frac{1}{2}$ inch radial, ice | |

| | | |
|---|---|---|
| Connectors | Transmitting antennas supplied with 50 ohm 1-5/8" EIA flange, female. Receiving antennas supplied with type BC, female. Other connectors available on optional basis. | |
| Shipping Weight | 12,000 Pounds | 7,600 Pounds |
| Shipping Volume | 1,080 cu. ft. | 435 cu. ft. |

Siting considerations

An h-f log-periodic antenna is subject to the same siting criteria as any other h-f antenna of the same polarization and gain. There must be no large metallic obstacles in the radiation path. The only other installation requirement is a reasonably flat site with sufficient area for installation of all parts of the antenna, including the ground screen. Since this antenna is vertically polarized, vertical metallic obstacles, such as towers for other antennas, water towers, and tall light standards, will act as reflecting obstacles.

A vertically polarized antenna imaged against a perfectly conducting, infinite ground plane will have its radiation maximum on the horizon at 0 degree elevation angle. Because of imperfect ground conditions existing throughout the world, ground losses occur and the radiation at very low angles is absorbed. This gives the effect of raising the angle of beam maximum and reducing the gain. The lower half power point of the elevation plane radiation pattern will occur at approximately 6 degrees over average soil. If reflecting objects are of such a height that they lie within a 6 degree vertical angle from the antenna, and outside the 3 db point of the Azimuth plane pattern, they will cause a negligible amount of interference.

It can be seen from Fig. 3 that the ground screen outline appears somewhat unusual. Again, since the elements of the "Rosette" antenna are log-periodic monopole antennas, it is necessary to have a ground screen which will provide an impedance match. The outline of this ground screen is shown as a square in Fig. 3, and is that portion of the ground screen directly under the antenna curtains. The 100 feet extension of the ground screen is strongly recommended since it will provide some elevation plane radiation pattern control. Since the 100 feet extension is longer, in terms of wave lengths, at the higher frequencies, the pattern will tend toward the horizon and thus provide better coverage for longer circuits.

Cost estimates

Depending on the low frequency cut-off and the power capability requirements of the "Rosette" antenna, its kit cost can vary from approximately $ 24,000.00 to $ 31,000.00. This cost includes the "Rosette" antenna but not the switching matrices.

It is estimated that installation costs would run approximately $ 10,000.00, depending upon the site.

Annexes : Figs. 1-1; 1 - 4, inclusive

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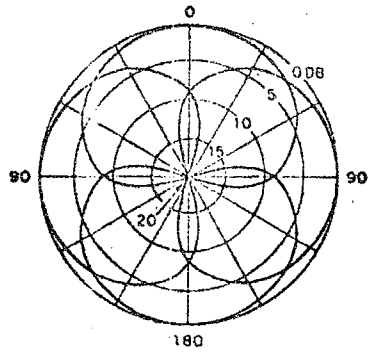
# A N N E X



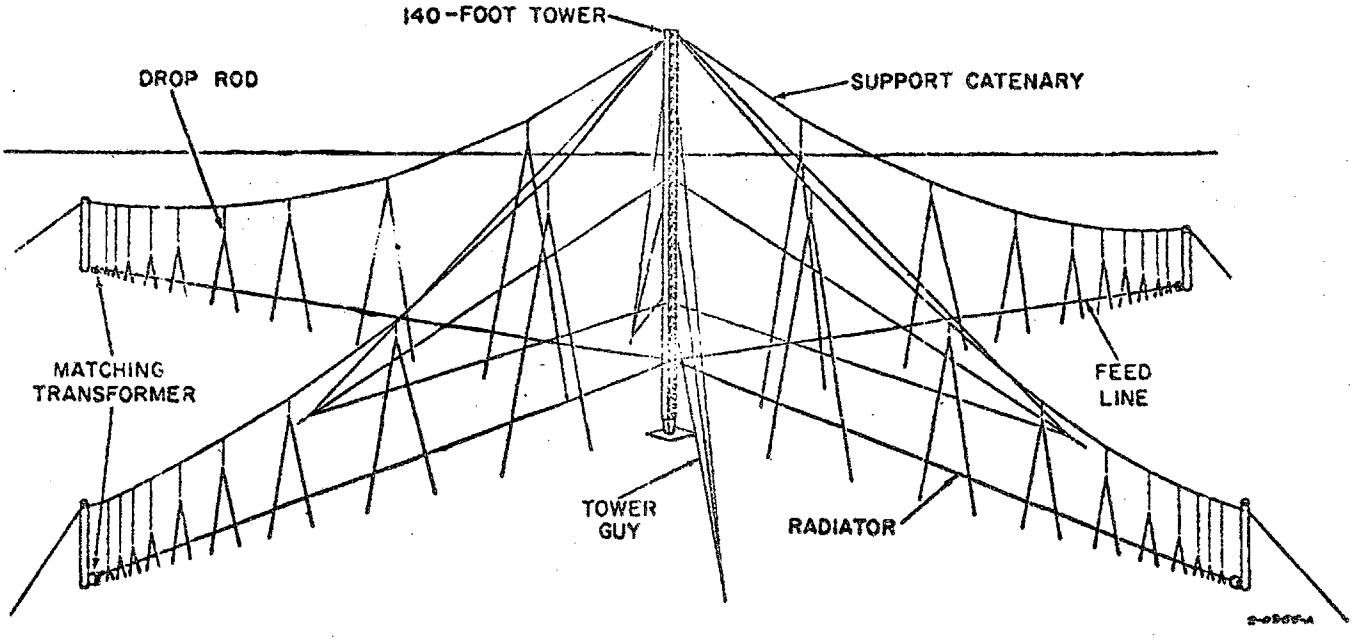




Figure 1-1. H. F. Sector-Coverage Log-Periodic Antenna Array.

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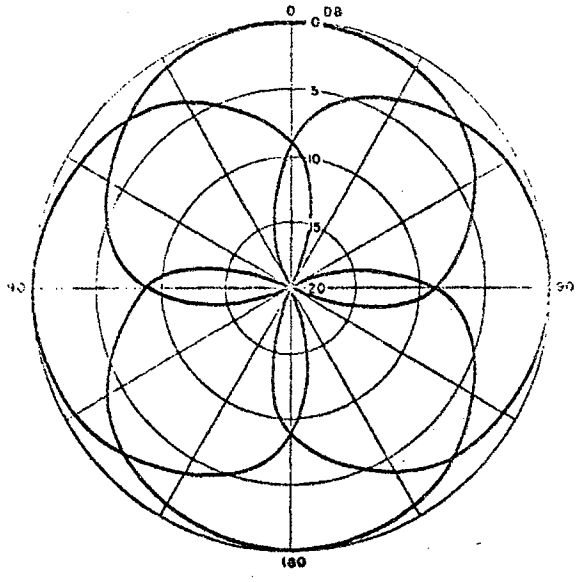


FIG. 1 AZIMUTH PLANE RADIATION PATTERN

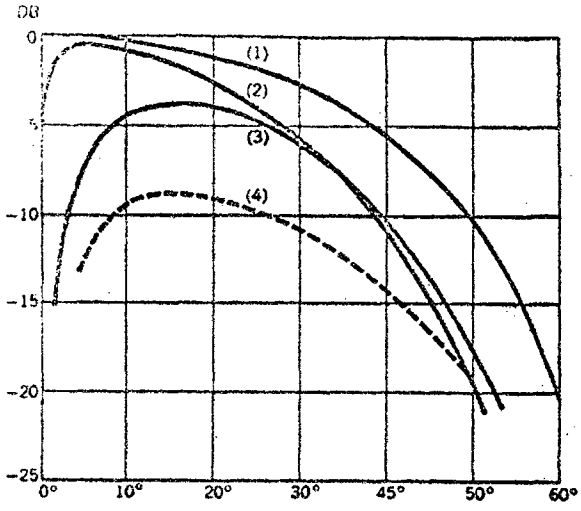


FIG. 2 ELEVATION PLANE RADIATION PATTERNS

(1) over perfectly conducting ground

(2) over ocean water $\sigma = 5$ mhos/meter
$\epsilon = 81$

(3) over average soil $\sigma = 10^{-2}$ mhos/meter
$\epsilon = 15$

(4) for comparison, $\lambda/4$ monopole over average soil
$\sigma = 10^{-2}$ mhos/meter
$\epsilon = 15$

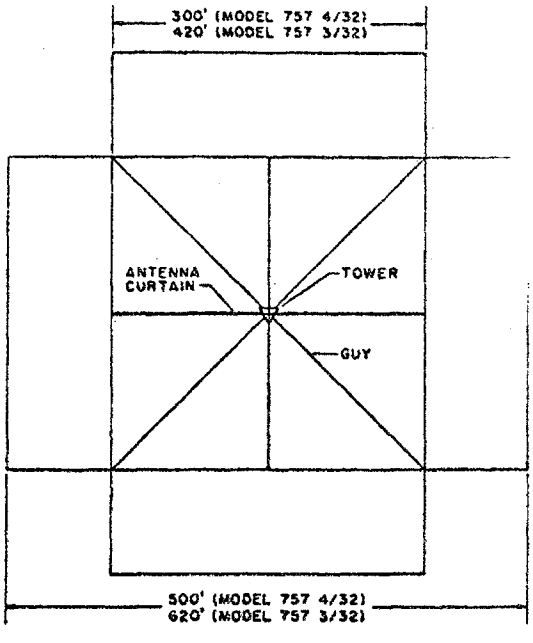


FIG. 3 OUTLINE OF GROUND SCREEN
(Note different size of screens for 3 and 4-Mc models)

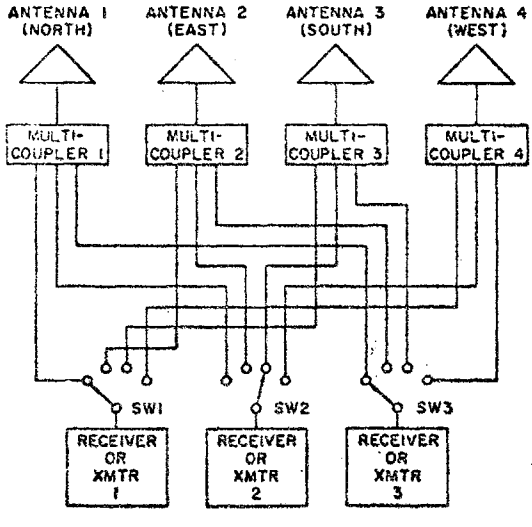


FIG. 4 SWITCHING ARRANGEMENT: MULTIPLE TRANSMITTERS
Permits independent, instantaneous switching of each transmitter or receiver between individual antennas.

# AERONAUTICAL CONFERENCE

Document No. I-45-E
29 January 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEES 4 AND 5

United States of America

## CONCERNING INTRODUCTION OF SUPERSONIC TRANSPORTS (SSTs) INTO SCHEDULED SERVICE OVER INTERNATIONAL AIR ROUTES

Resolution No. 13, paragraph (i), stresses the need that appropriate consideration be given, during revision of Appendix 26 to the I.T.U. Radio Regulations, Geneva,1959, to new aeronautical communication techniques. Similarly, Resolution No. 13, paragraph (e), accents the impact of higher speed aircraft upon the requirements for frequencies and, by inference, the need to take into account new or changing requirements for high frequencies introduced by such aircraft.

It is expected that Supersonic Transport (SST) aircraft will be introduced into scheduled service over international air routes within the next decade. It seems reasonable to conclude that these high speed aircraft may have requirements which differ, to some degree from those of current piston and jet aircraft. It is, however, too early to forecast with accuracy the degree of difference in communications requirements which may exist between current and SST aircraft. The national and international coordination which has been heretofore effected has produced tentative operational characteristics for the SST. While these operational characteristics have not been finalized, they provide material to help in the assessment of the likely nature of the communication needs of the SST. By using these tentative operational characteristics and applying thereto various of the currently accepted communication techniques, it is possible to form generalized conclusions concerning (some of) the communication needs of SSTs. In that regard, particular attention must be given to those needs having impact upon use of high frequencies and the revision of Appendix 26 to the I.T.U. Radio Regulations.

Annex 1 hereto summarizes currently available information concerning the basic characteristics of (a) the Anglo-French Concorde and (b) the U.S.A. Supersonic civil air transport aircraft. While similar aircraft may be under development by other countries, these two examples may serve to illustrate the operational characteristics of SSTs likely to be placed in commercial service during the next decade. These operational

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characteristics may be employed to assess the impact of SSTs upon utilization of high frequencies in the aeronautical mobile (R) service and, thus, give guidance to the Conference in its revision of Appendix 26.

Annex 2 describes the operation of an SST (Mach 3) over the idealized great circle route between New York and Paris and illustrates (a) route coverage which may be anticipated from use of VHF frequencies; (b) that portion of the route where VHF cannot be employed, or, conversely, where it is anticipated that high frequencies will be required. While Annex 2 takes the North Atlantic as an example, it is apparent that high frequencies will continue to be required over international air routes in other areas of the world.

From Annex 2 approximately 39% of the total flight distance over the New York - Paris route will be beyond VHF communication range and must be served by use of high frequencies. Further, because of the higher reliability obtained from use of VHF and as shown by Annex 2 (page 9 ), it is also concluded that VHF frequencies will be required for communication with SSTs.

The United States has carefully surveyed and analyzed the possible techniques for improving over-ocean surface to air communications. The results of the analysis indicated that VHF satellite relay may provide the means for achieving the reliability, fast access, and communication traffic capacity needed for post 1970. If such a technique is developed and aeronautical communication satellite relay systems become usable prior to, or about the same time as the SST becomes operational, then the need for high frequency communication for support of the SST will not be as great in those areas where satellite coverage can be provided.

Although the U.S. is convinced that use of communication satellite relays for aeronautical air/ground purposes is technically feasible, there are many practical obstacles that could delay implementation of such communication systems until after the SST is in regular service. In view of the uncertainty in timing of these events, it would seem good planning to make provision for at least initial use of high frequencies for the long over-ocean communication requirements of the SST.

The United States recommends the Aeronautical E.A.R.C. accept the concept that high and very high frequencies (HF and VHF) will be required for communication between supersonic civil air transport aircraft and ground stations.

## AIRCRAFT TECHNICAL PERFORMANCE INFORMATION

For the past decade, and more, extensive consideration has been given to use of automatic means such as air-ground digital communications for the handling of routine advisory and/or repetitious type of communications between aircraft and ground stations.

In its study of digital communications systems for the handling of communications between aircraft and ground, the U.S. has recognized the continuing need for voice communications between the pilot and ground station (controller or dispatcher). The United States will strive to assure that the digital communications system ultimately selected will be usable with the radiotelephone equipment currently installed aboard aircraft and, if practicable, will share the voice channel. Radiotelephony transmitting and receiving equipment will continue to be required and will serve for transmission and reception of both digital and voice communications between the aircraft and ground station(s).

Within the United States, as well as within other countries, there is a continuing investigation of ways and means of improving the safety, efficiency, and regularity of scheduled air transportation. Knowledge of potential or specific difficulties of a technical or maintenance nature aboard the aircraft, in advance of its arrival, could improve such efficiency and regularity of flight. The potentiality exists for the use of digital communications for air-ground exchange of information of this type.

To transmit information of this type from the aircraft to ground, it may be necessary that high frequencies be employed - at least in the oceanic areas - for this purpose. As illustrated by Annex 2 (page 9), the aircraft will be beyond communications range of VHF or UHF frequencies. Unless, of course, satellite relay systems for the aeronautical services are operational at that time, the requirement for use of high frequencies for transmission of technical or maintenance information may be appreciably less.

It is believed that handling of aircraft technical performance information in digital form, if required, could be, at least initially, superimposed on the frequency complements being allotted to satisfy the other communication requirements which are approved by the Aeronautical E.A.R.C.

Annexes : 2

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# ANNEX 1

## BASIC CHARACTERISTICS OF THE ANGLO-FRENCH CONCORDE

(Reference : Draft Docket 8366-AN/880 10/10/63)

| | | |
|---|---|---|
| Cruising Speed | - | Mach 2.2 |
| Range | - | 3,200 nautical miles |
| Cruising Altitude | - | 16,600 - 19,400 metres (53,000 - 62,000 ft) |
| Weights : | | |
| Maximum Take-off Weight | - | 126 tonnes (280,000 lb) |
| Payload | - | 9.1 tonnes (20,050 lb) |
| Passenger capacity | - | 100 |
| General Arrangement : | | |
| Fuselage | - | Small cross section; total length about 52 metres (170 ft) |
| Wings | - | Slender delta shape; span 23.5 metres (77 ft) |
| Control Surface | - | Single rear fin; 3 pairs of elevons for pitch and roll control |
| Landing Gear | - | Tricycle landing gear: 2 four-wheeled bogies and one twin nose wheel assembly; track - 7.50 metres (24.6 feet); wheel base - 15 metres (49.2 feet) |
| Powerplant | - | 4 turbojet engines mounted in pairs beneath the wing; provision for after-burning for acceleration to trans-sonic speeds, if required by the permissible flight profile. |
| Structure | - | Main structure of light alloy |

Performance :

Approach Speed - 160 knots

Landing Speed - 140 knots

Take-off distance - 2600 metres (8,500 ft)
(Sea level; ISA + 10°C)

Landing distance - 1900 metres (6,500 ft)
(Sea level; ISA + 10°C)

Braking - Wheel brakes and thrust reversers

Sonic Boom - The nominal overpressure of the Concorde is not expected to exceed 7.32 kg/m$^2$ (1.5 lb/sq ft). This can be achieved during the critical acceleration period by limiting the speed on the climb to a maximum of Mach 1.15 until an altitude of at least 11,000 metres (36,000 ft) is reached.

BASIC CHARACTERISTICS OF THE U.S. SCAT (SUPERSONIC CIVIL AIR TRANSPORT)

(Reference : Draft Docket 8366-AN/880
10/10/63)

| | | |
|---|---|---|
| Cruising Speed | - | Mach 2.2 or faster |
| Range | - | 3.480 nautical miles |
| Weights : | | |
| Payload | - | 13.6 to 18.1 tonnes (30,000 to 40,000 lb) |
| Passenger Capacity | - | 125 to 160 |
| Cargo and Mail Capacity | - | 2,270 kg (5,000 lb) |
| Landing Gear : | | |
| Wheel Loading | - | must permit operating from airports currently used by the larger subsonic jet transports. |
| Runway Roughness | - | acceptable for operation of subsonic jet transports must be acceptable for operation of SCAT. |
| Normal Ground Turning Radius | - | of SCAT must be comparable with that of current subsonic jets used in international services. |
| Performance : | | |
| Subsonic Performance and Flying Qualities | - | comparable with airport take-off and landing operations and approach and departures and holding procedures utilized by subsonic jet transports used in international services. |
| Take-off and Landing Speeds | - | comparable with present inter-continental subsonic jet aircraft. Lift-off speed at maximum gross take-off weight about 160 kt. EAS. Boundary speed, 135 kt. or less EAS. |

| | | |
|---|---|---|
| Take-off Distance | - | ability to take-off from a 3,200 m. (10,500 ft) runway at maximum design take-off gross weight in an ISA + 15°C hot-day atmosphere at sea level. |
| Landing Distance | - | not more than 2,440 m. (8,000 ft) under wet runway conditions at maximum authorized landing gross weight. |
| Cross-wind Capability | - | ability to take-off and land in 30 kt., 90° cross winds. |

# A N N E X 2

## NEW YORK-PARIS ROUTE CONSIDERATION

There is general agreement that the North Atlantic (NA) major world air route area (MWARA) has the most dense international flight activity. The study by I.C.A.O. (Document No. 8087-C/925-August 1960) forecast that nearly half the world requirement for long range supersonic transports in 1967 will stem from operations on North Atlantic routes. For the purpose of this example, the terminals of New York and Paris were selected. It is believed that the provision of reliable aeronautical mobile communications service in the North Atlantic area has proven as difficult, if not more so, than any other area having international air routes. These difficulties in HF communications are inseparably related to adverse ionospheric propagation conditions and, because of the large ocean area, inability to widely employ VHF.

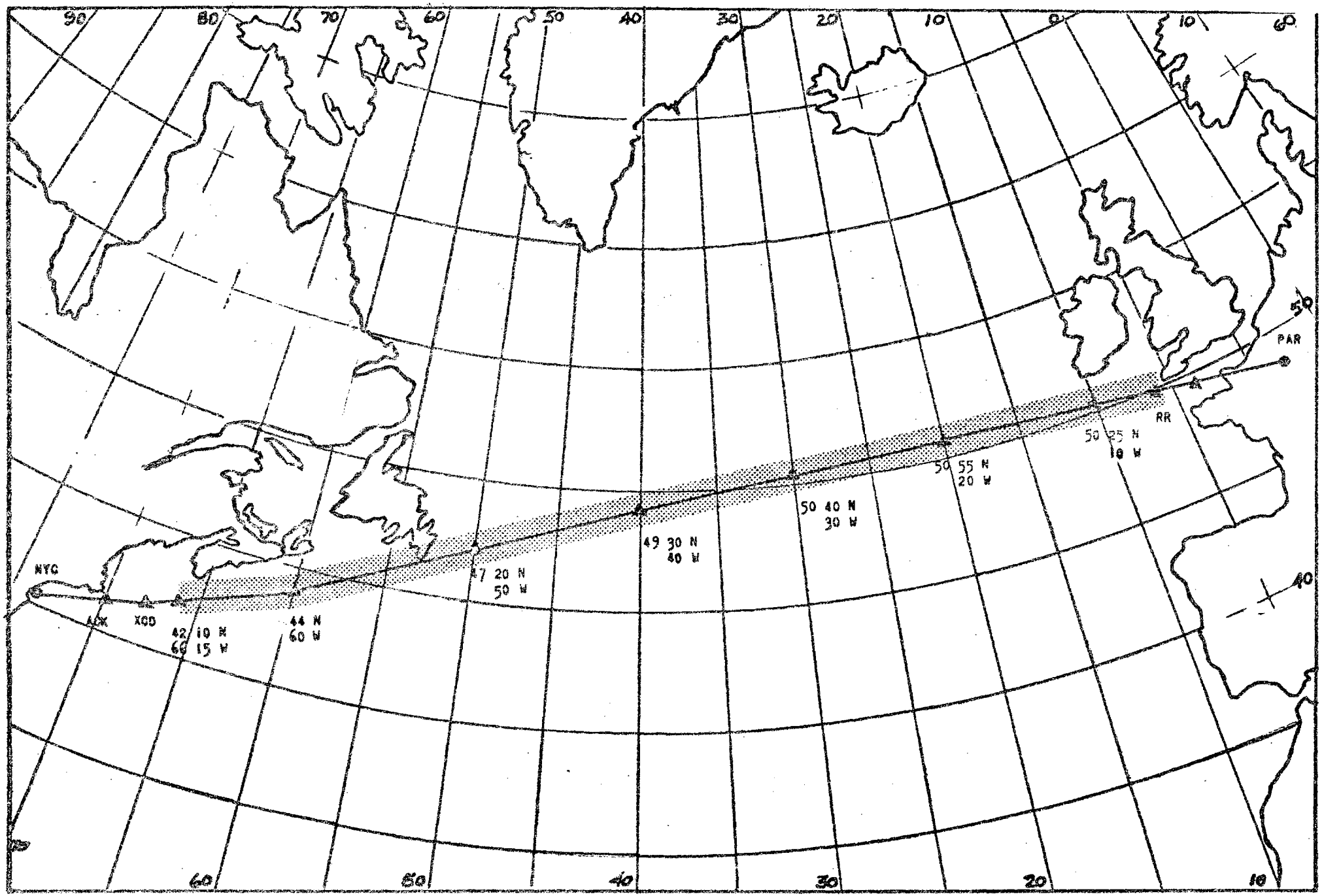
Annex 2 (page 11) illustrates the approximate great circle course between New York and Paris. The shading on page 11 indicates that portion of the route which might be operated at supersonic speeds. The example chosen assumes the SST will cruise at 1700 knots during supersonic flight and at 477 knots during subsonic portions of the flight, for a total flight time of two hours fifty-eight minutes. Of the 3188 nautical miles involved, 2478 nautical miles would be operated at supersonic speed (requiring 1 hour 27 minutes). Thus, the supersonic portion of the flight would comprise 77.7% of the distance and 49.5% of the flight duration. (Subsonic : 22.3% of the distance, 50.5% of the flight duration.)

At a cruising altitude of 65,000 feet, effective earth radius of 4/3, ground station antenna height of 100 feet, the theoretical radio horizon line is at a distance of 325 nautical miles. Relying on VHF communication service provided by the New York (Mt. Washington, N.H.), Gander, Shannon and Paris ground stations, and using a VHF communication range of 325 nautical miles, it is apparent from Annex 2 (page 13) approximately 1448 nautical miles of the New York-Paris route are beyond the communications range of VHF. It is also noted that these 1448 nautical miles fall within the supersonic portion of the flight and represents 45% of the total flight distance.

Reference of the documents listed in Annex 2 (page 16) will serve to justify the conclusion that a VHF range of 325 nautical miles is a conservative estimate. This is consistent with the requirement for a high degree of reliability in VHF service and results in the intervening distance representing the maximum over which the use of high frequencies will be required. If the long range VHF techniques now under study prove to be

successful, the distance over which VHF communications may be used will be extended with the consequent reduction in the HF requirement.

Annex 2 (page 15) provides typical routine aircraft position report requirements over the great circle route New York-Paris, of (a) piston aircraft DC7-C; (b) subsonic turbo jet aircraft - B707-320; and (c) those anticipated by an SST (at Mach 3).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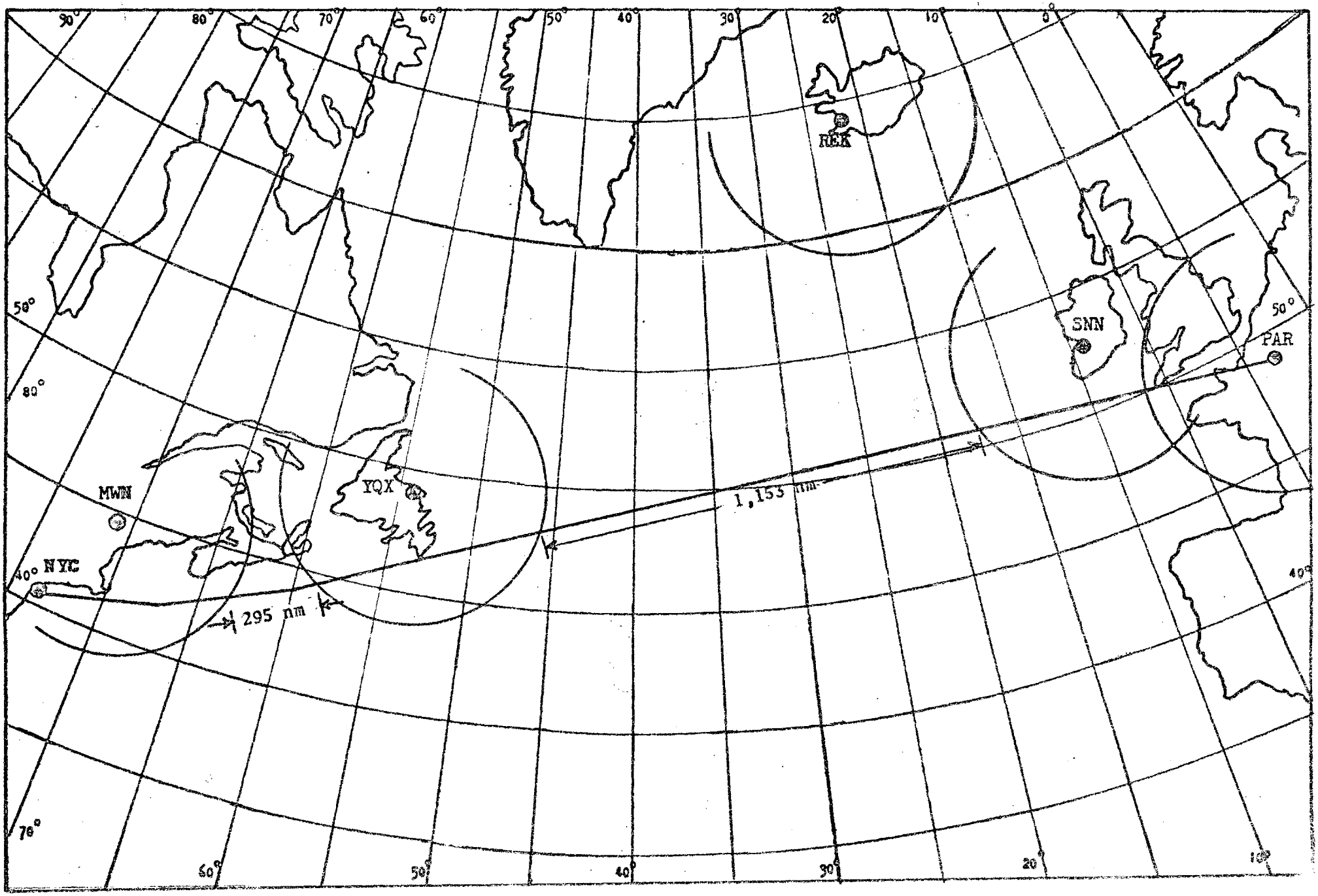
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## New York - Paris Flight - Position Reports on Enroute Frequencies

| | | | | DC7-C @ 278 knots | | | B-707-320 @ 477 knots | | | **)Supersonic @ 1700 knots | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Distance from Previous Position (n. m.) | Cumulative Distance from Origin (n. m.) | Distance to Destination (n. m.) | *)Flight Time from Previous Position | Elapsed Time Since Departure | Flight Time Remaining to Destination | *)Flight Time from Previous Position | Elapsed Time Since Departure | Flight Time Remaining to Destination | *)Flight Time from Previous Position | Elapsed Time Since Departure | Flight Time Remaining to Destination |
| Off Idlewild | 0 | 0 | 3188 | - | - | 11:25 | - | - | 6:42 | - | - | 2:58 |
| Nantucket | 177 | 177 | 3011 | :38 | :38 | 10:47 | :23 | :23 | 6:19 | :23 | :23 | 2:35 |
| Cod Intersection | 99 | 276 | 2912 | :21 | :59 | 10:26 | :12 | :35 | 6:07 | :12 | :35 | 2:23 |
| 42 10 N. 66 15 W.***) | (74) | 350 | 2562 | - | - | - | - | - | - | :09 | :44 | 2:14 |
| 44 N. 60 W. (SA) | 380 | 656 | 2532 | 1:22 | 2:21 | 9:04 | :48 | 1:23 | 5:19 | :11 | :55 | 2:03 |
| 47 20 N. 50 W. | 478 | 1134 | 2054 | 1:43 | 4:04 | 7:21 | 1:00 | 2:23 | 4:19 | :17 | 1:12 | 1:46 |
| 49 30 N. 40 W. | 415 | 1549 | 1639 | 1:29 | 5:33 | 5:52 | :52 | 3:15 | 3:27 | :15 | 1:27 | 1:31 |
| 50 40 N. 30 W. | 390 | 1939 | 1249 | 1:24 | 6:57 | 4:28 | :49 | 4:04 | 2:38 | :14 | 1:41 | 1:17 |
| 50 55 N. 20 W. | 373 | 2312 | 876 | 1:20 | 8:17 | 3:08 | :47 | 4:51 | 1:51 | :13 | 1:54 | 1:04 |
| 50 25 N. 10 W. | 375 | 2687 | 501 | 1:21 | 9:38 | 1:47 | :47 | 5:38 | 1:04 | :13 | 2:07 | :51 |
| Round Island****) | 141 | 2828 | 360 | :30 | 10:08 | 1:17 | :18 | 5:56 | :46 | :05 | 2:12 | :46 |
| 49 35 N. 04 08 W. | 85 | 2913 | 275 | :18 | 10:26 | :59 | :11 | 6:07 | :35 | :11 | 2:23 | :35 |
| Orly | 275 | 3188 | 0 | :59 | 11:25 | - | :35 | 6:42 | - | :35 | 2:58 | - |

*) Flight time from previous position computed based on mean cruising speed; i.e. changes in ground speed during climb and descent disregarded.

**) 1700 knots during supersonic portion of flight; 477 knots during subsonic portions of flight.

***) Point 350 nautical miles from origin, at which supersonic aircraft change from cruise at subsonic to supersonic speed.

****) Point 360 nautical miles from destination, at which supersonic aircraft change from cruise at supersonic to subsonic speed.

1. K.A. Norton, P.L. Rice and L.E. Vogler, The Use of Angular Distance in Estimating Transmission Loss and Fading Range for Propagation Through a Turbulent Atmosphere over Irregular Terrain, Proc. of the I.R.E., Vol. 43, No. 10, 1955.

2. K.A. Norton, L.E. Vogler, W.V. Mansfield and P.J. Shoot, The Probability Distribution of the Amplitude of a Constant Vector plus a Rayleigh - distributed Vector, Proc. of the I.R.E., Vol. 43, October 1955.

3. K.A. Norton, System Loss in Radio Wave Propagation, Journal of Research, NBS, Vol. 63D, No. 1, July-August, 1959.

4. A.P. Barsis, P.L. Rice and K.A. Norton, The Use of Measurements in Predicting the Performance of Tropospheric Communication Circuits, NBS Report 6043, February 24, 1959.

5. K.A. Norton, Carrier Frequency Dependence of the Basic Transmission Loss in Tropospheric Forward Scatter Propagation, NBS Technical Note No. 53, May 12, 1960.

6. A.F. Barghausen and C.F. Peterson, Path Loss Measurements Versus Prediction for Long Distance Tropospheric Scatter Circuits, NBS Report 6730, November 16, 1960.

7. A.P. Barsis, K.A. Norton, P.L. Rice and P.H. Elder, Performance Predictions for Single Tropospheric Communication Links and for Several Links in Tandern, NBS Technical Note No. 102, August, 1961.

8. R.S. Kirby, P.L. Rice and L.J. Maloney, Characteristics of Point to Point Tropospheric Propagation and Siting Considerations, NBS Technical Note No. 95, October 19, 1961.

# AERONAUTICAL CONFERENCE

Document No. I-46-E
29 January 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

United States of America

## INFORMATION CONCERNING "INTEGRAL ELECTRONICS" (MICROELECTRONICS), A NEW MANUFACTURING TECHNIQUE WHICH WILL HAVE BENEFICIAL IMPACT UPON FUTURE EQUIPMENT USED ABOARD AIRCRAFT AND AT GROUND STATIONS

Discussions in earlier international conferences point to the desirability that the Preparatory Session Aeronautical EARC carefully weigh new techniques to determine their potential of improving aeronautical mobile communications, in particular those having impact upon use and/or allotment of frequencies and the revision of Appendix 26. The United States is in full sympathy with the view that the Preparatory Session of the Aeronautical E.A.R.C. effect such review, as appropriate.

While it is readily apparent that micro-miniaturization of electronic circuit packaging, known as "integral electronics", will have a substantial impact upon the size, weight, configuration, reliability and potential cost of future electronic equipment employed aboard aircraft and at ground locations, it is not apparent at this time that this manufacturing technique will have a direct substantial impact upon (a) the spacing between frequencies in the aeronautical mobile (R) service bands, or (b) upon the geographic spacing between allotments of the same frequency or adjacent frequencies in those bands. Thus, since this manufacturing technique does not appear to have impact in either of these two areas, it is appropriate to conclude that no particular consideration need be given to integral electronics by the Preparatory Session of the Aeronautical E.A.R.C. in its revision of Appendix 26. Because of the potential benefit which will accrue to aviation through development and application of this technique, it is the view of the United States that the following information be made available for the information of the participants at the Preparatory Session of the Aeronautical E.A.R.C.

Integral electronic devices (IED), for example those of the semi-conductor type, permit the combination of all of the components of one circuit (i.e., the transistor and its associated components) into one unit of extremely small dimensions which, by combination with other similar units, can form a piece of electronic equipment. It must be borne in mind, however, that there

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are various circuit functions which cannot be performed by integral electronics, as presently defined. Such circuit functions specifically include those involving a requirement for high voltage, high power, etc. Integral electronics are particularly applicable to digital operations, low power and low signal level circuitry.

The major advantages of IED falls within the areas of (a) high reliability, (b) smaller size, (c) less weight, and (d) potential of decreased cost.

## High Reliability

On the basis of statistical data and test results available from a limited quantity of IED equipment, there is basis to believe that IED will provide a worthwhile increase in reliability over that currently obtained from conventional equipment. Fig. I was prepared for other purposes, however, it serves to illustrate the basis for optimism concerning future reliability. It will be noted from the position of Point M on Fig. I that, potentially, substantial improvement in reliability can be expected by using IED techniques.

## Smaller Size

The circuitry of IED may be approximately three thousand times smaller than that available in regular equipment. It is, of course, necessary that these components be encapsulated. Encapsulation increases the size approximately one hundred times, other components must be used that cannot be reduced as yet. Thus, integral electronics permits a decrease in size, over regular equipment, of between two and ten times, at the present state of the art.

## Less Weight

In consonance with the decrease in size described above, a weight decrease is obtained of between 1/2 to 1/10 the weight of conventional equipment.

## Potential of Decreased Cost

The rapid rate of developments in the field of IED and consequent limitation of production quantities does not permit full realization of cost saving at the present time. Thus, no near-final figures can now be provided concerning the future cost of integral electronic devices. It is, however, safe to conclude that the manufacturing processes will permit substantial reduction in cost, below that of conventional electronic equipment obtainable today. This trend is exemplified by the unit cost of one component which has decreased in cost to $12.00 from an earlier price of $50.00. Its conventional counterpart may have a value of $15.00.

Maintenance

Since integral electronic devices will be extremely small, repair is not feasible within the device. This, of course, is compensated by the low probability of failure. It does appear feasible, however, that kits may be provided for in-the-field replacement of integral electronic devices. The use of printed board construction offers benefits from the maintenance point of view and, if used, would facilitate replacement in event of failure. Faulty printed boards could then be returned to the manufacturer for repair, or devices could be replaced in specialized shops.

- - - - - - - - -

Note : As mentioned above, the substantial concentration of effort in the field of Integral Electronic Devices (IED) is causing very rapid changes in the state of the art. Thus, it must be pointed out that the status report included herein is, in the view of the U.S.A., an accurate assessment of the situation which existed during early November 1963.

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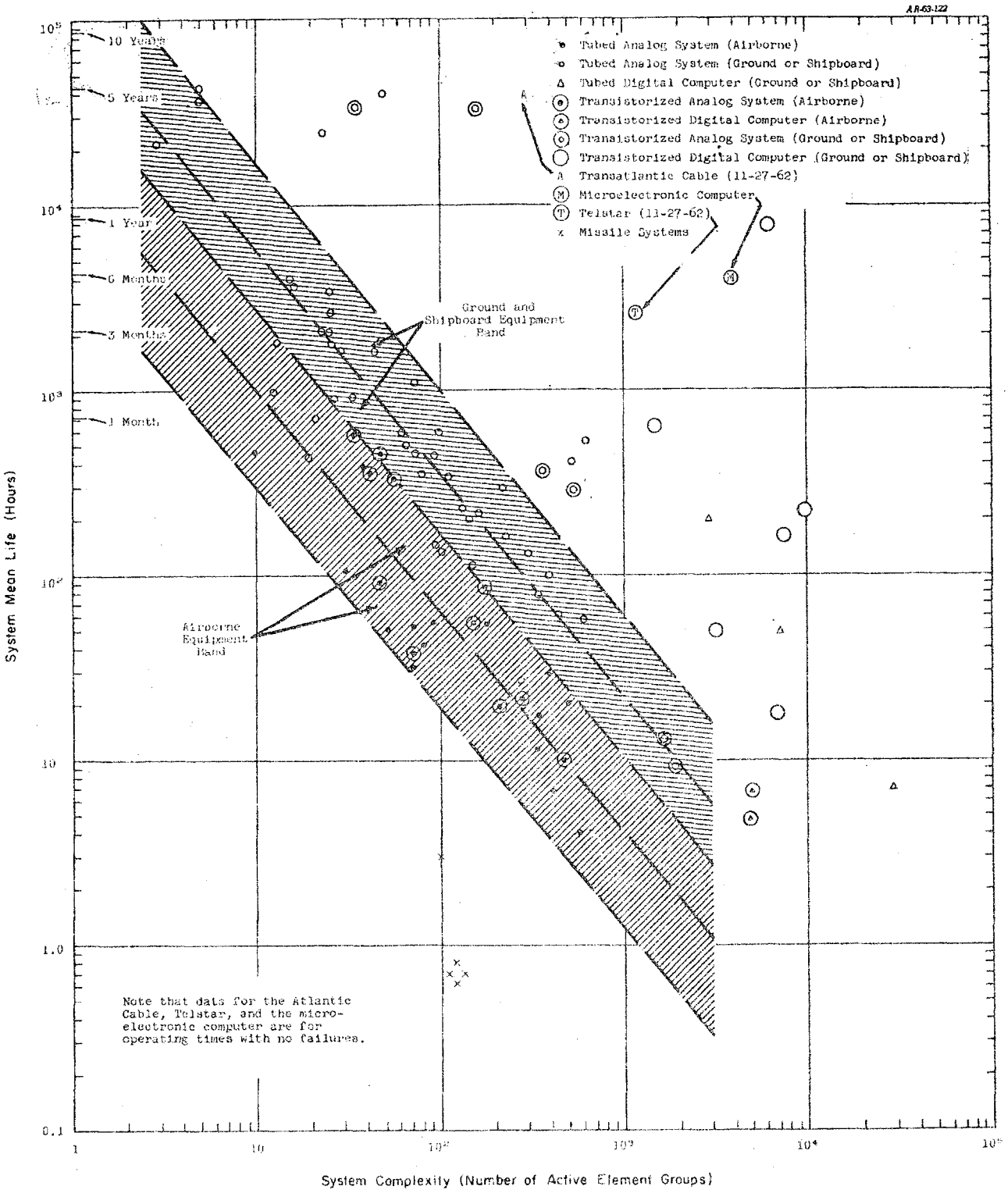


FIGURE 1

EFFECTS OF SYSTEM COMPLEXITY ON RELIABILITY

# AERONAUTICAL CONFERENCE

Document No. I-47-E
29 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

United Kingdom

CHANNEL SPACING

Proposal

It is proposed -

a) That the implementation of complex schemes during the life span of the revised plan should only be supported if it can be fully and clearly demonstrated that introduction of such schemes would be in the best interest of the Aeronautical Mobile (R) Service having regard to cost, operational difficulties associated with the implementation of a new scheme, and alternative communication techniques which are available, or are likely to become available, to reduce the demand for HF channels

b) That the implementation of schemes involving extensive equipment modification or replacement must be progressive and must permit an economic life to be obtained from equipment in use.

c) That channel spacing in the revised plan should be adequate for DSB radio telephony and be based on Scheme A in the following text (Para. 2) with an effective date of 1967.

d) That during the life span of the revised plan SSB radio telephony may be used on a permissive basis in accordance with provisions stated in the following text (Para. 3)

e) That consideration be given to the planned conversion from DSB radio telephony to SSB radio telephony, at the earliest opportunity. A further revision to provide for such conversion is proposed with an effective date of 1977.

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f) That the SSB frequency allotment plan should be based on Scheme 'D' in the following text.

Reasons

1. Channel Spacing in the current plan is shown in the following table:-

| kc/s | Separation (kc/s) | No. of Channels |
|---|---|---|
| 2850-3025 | 7 | 24 |
| 3400-3500 | 7 | 14 |
| 4650-4700 | 7 | 7 |
| 5450-5480 | 7 | 4 |
| 5480-5680 | 7.5 | 26 |
| 6525-6685 | 7.5 | 21 |
| 8815-8965 | 8.5 | 18 |
| 10005-10100 | 9 | 10 |
| 11275-11400 | 9.5 | 13 |
| 13260-13360 | 10 | 7 |
| 17900-17970 | 10 | 10 |
| TOTAL | | 154 |

Channel spacing within the revised Aeronautical Mobile (R) Plan must be arranged, insofar as is possible, to make the most economic use of the frequency spectrum and hence create additional channels.

A reasonable effective date for introduction of the revised plan could be about 1967 and, if possible, revision should cater for requirements for a period of at least 10 years thereafter.

The cost and impracticability of modifying or replacing equipment in the vast numbers of aeronautical and aircraft stations in operational use clearly precludes the widespread introduction, at an early date, of methods of communication other than those in current use. DSB radio-telephony will, therefore, continue to be the predominant modulation technique for many years.

It is probable, with the development of data links, satellite communication techniques and increased use of VHF, that the demand for HF radio telephony channels will decrease. However, it is unlikely that these new techniques will completely eliminate the necessity for HF radio telephony. For example, HF radio telephony is likely to fulfil an important support function and cost may prevent the introduction of the newer techniques especially where traffic density is low.

Therefore in the interests of spectrum economy the eventual conversion from DSB radio telephony to SSB radio telephony must be considered. In this connection Recommendation No.4 by the I.T.U. Panel of Experts regarding the early and progressive conversion to SSB is to be noted.

2. Channelling Schemes

The I.C.A.O. Special Communications Meeting examined a number of typical channel spacing arrangements. These are briefly outlined below, and the number of additional channels which accrue is indicated.

| Scheme | Channel Spacing | Extra DSB Channels |
|---|---|---|
| A | Unchanged below 10 Mc/s<br>10,005-10,000 Kc/s - 8.5 Kc/s<br>11,275-11,400 Kc/s - 8.0 Kc/s<br>13,260-13,360 Kc/s - 8.0 Kc/s<br>17,900-17,970 Kc/s - 8.5 Kc/s | 6 |
| B | Based on tuning at integral multiples of 0.5 Kc/s and Frequency tolerances of 0.10% at edge of band and 0.005% within band. | 19 |
| C | Based on tuning at integral multiples of 0.1 Kc/s and Frequency tolerances the same as those for Scheme B. | 22 |
| D | Uniform channel width of 7 Kc/s below 10 Mc/s<br>Uniform channel width of 8 Kc/s above 10 Mc/s | 12 |

A plan employing a completely new list of frequencies to be allotted cannot realistically be accepted for introduction on the anticipated effective date of the revised plan (1967). It will also be observed in connection with Schemes B, C and D that the yield of additional DSB channels is small. Scheme A is, therefore, to be preferred.

Scheme D has been considered as being capable of permitting the introduction of SSB (with appropriate frequency tolerances) on a planned channel splitting basis on some or all of the channels as necessary. It would, therefore, form the basis for preliminary consideration of the SSB problem at the E.A.R.C.

It has already been concluded previously that the revised plan must be based on the use of DSB radio telephony and will possibly cover the period 1967 to 1977.

3. Notwithstanding the foregoing SSB may be used on a permissive basis before 1977, for instance when in a particular area sufficient DSB channels are not available. To this end the following provisions shall be made:

a) That only those HF single side band systems which are compatible with the existing HF double side band systems shall be permitted.

b) Use in the international communications of the Aeronautical Mobile (R) Service of a single sideband system complying with the requirements in (a) shall be subject to co-ordination between the administrations concerned.

The year 1977 may, therefore, be considered as a possible planned date for the transition to SSB.

The period prior to that date will permit time to study and reach agreement on equipment standards and methods of resolving technical and operational problems which are likely to arise.

# AERONAUTICAL CONFERENCE

Document No. I-48-E
29 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

Canada

## PROPOSAL FOR AMENDMENT OF CHANNEL WIDTHS AND PROVISION FOR THE USE OF SSB EMISSIONS IN THE AERONAUTICAL MOBILE (R) BANDS

1. The main session of the Aeronautical E.A.R.C., on the basis of the decisions taken by the preparatory session of the Conference and the preparatory work of the I.F.R.B., must review and, to the extent considered necessary, revise the Frequency Allotment Plans for the Aeronautical Mobile (R) Service contained in Appendix 26 to the Radio Regulations, and the Radio Regulations associated therewith. Canada considers that this can best be done by restricting the existing Appendix 26 to the Aeronautical (OR) Service, and developing a new Appendix for the Aeronautical (R) Service, along the lines of Appendix 26.

2. Canada proposes that any revision of the Frequency Allotment Plans for the Aeronautical Mobile (R) Service should be based on the use of double sideband, amplitude-modulated emissions. Every effort should be made to obtain the maximum number of channels possible, consistent with the state of the art, particularly in the heavily-used portions of the spectrum at 5,6 and 8 Mc/s. Furthermore, it is considered essential that the revised plan should provide for at least the following types of emission :

a) Telephony, amplitude modulated :

| | | |
|---|---|---|
| i) | Double side band | (A3) |
| ii) | Single side band, reduced carrier | (A3A) |
| iii) | Single side band, full carrier | (A3H) |
| iv) | Single side band, suppressed carrier | (A3J) |
| v) | Two independent side bands | (A3B) |

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b) Telegraphy (including automatic data systems) :

i) Without the use of a modulating audio frequency (by on-off keying) (A1)

ii) Automatic (data), DSB, amplitude modulated, on-off keying of amplitude modulating audio frequency(ies), or by on-off keying of the modulated emission (A2)

iii) Automatic (data), DSB, frequency modulated by the on-off keying of a frequency modulating audio frequency or by the on-off keying of a frequency modulated emission (F2)

iv) Automatic (data), SSB, amplitude modulated, full carrier, multichannel voice frequency telegraphy (A7A)

v) Automatic (data), SSB, amplitude modulated full carrier, multichannel voice frequency telegraphy (A7H)

vi) Automatic (data), SSB, amplitude modulated, suppressed carrier, multichannel voice frequency. (A7J)

3. Section II-A of the current Appendix 26 contains a table of frequency separations for the Aeronautical Mobile bands between 2850 kc/s and 18030 kc/s. Considering the heavy demand for channels, and the current state of the art, Canada considers that channel separation in the Aeronautical (R) bands should be reduced to the lowest practicable value. Furthermore, the revised channelling plan should be sufficiently flexible to allow full transition to single sideband operation, should this be the decision of some future conference.

4. Canada has studied the various channelling arrangements suggested by the I.C.A.O. Special Communications Meeting, and proposes adoption of the scheme shown in Appendix D to the Report on Agenda Item 9, page 9-9 of I.C.A.O. Document 8329, COSP II. This scheme suggests channel widths of 7 kc/s below 10 Mc/s and 8 kc/s above 10 Mc/s, providing an increase of 12 in the number of double sideband channels available. Such an arrangement would necessitate acceptance of more stringent frequency tolerances before 1970, and would allow the introduction of SSB on a planned, channel-splitting basis. Moreover, equipment would be required to operate on integral multiples of 0.5 kc/s in order to allow full use of both halves of the double sideband channels.

5. While the channelling arrangement proposed in paragraph 4 would require SSB equipment capable of operating at 0.5 kc/s increments, it would seem appropriate to recognize the limitations of equipment operating on 1 kc/s increments by permitting its use, where necessary, with the carrier (reference) frequency displaced by 0.5 kc/s until a suggested cut-off date

of January 1, 1970. After that date, it is proposed that **all** SSB equipment operating in the Aeronautical Mobile (R) bands (MWARA's and RDARA's) should comply with the following conditions :

1. A station using single sideband, single channel emissions shall be considered to be operating in accordance with the Plan if the necessary bandwidth is confined respectively within the upper or lower half of the channel provided for double sideband emissions;

1.1 A station using SSB single channel emissions (A3A, A3H, A3J), may operate either in the upper half or in the lower half of the channels designated by the centre frequency in the Plan;

1.1.1 A station using SSB single channel emissions in the upper half of the channel shall use upper sideband emissions with its carrier (reference) frequency at the value listed in the Plan;

1.1.2 A station using SSB single channel emissions in the lower half of the channel shall use upper sideband emissions with its carrier (reference) frequency at the following value below the centre frequency listed in the Plan :

| Band | Carrier (Reference) Frequency Relative to Centre Frequency of Channel |
|---|---|
| 2, 3, 4, 5, 6 and 8 Mc/s | - 3500 cycles |
| 10, 11, 13 and 17 Mc/s | - 4000 cycles |

NOTE : In all cases the assigned frequency shall be the centre of the emission of the station.

# AERONAUTICAL CONFERENCE

Document No. I-49-E
29 January 1964
Original : French.

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

The Union of Soviet Socialist Republics

STATEMENT BY THE DELEGATION OF THE SOVIET UNION

The list of persons attending the Conference, published on 25 January, 1964, shows that Chiang Kai-Shek's men are present. This being so, this Delegation feels obliged to state that Chiang Kai-Shek's men, present here, do not represent China and cannot, on behalf of China, attend a conference convened by the Union. China can be legitimately represented in the I.T.U. only by representatives duly appointed by the Government of the People's Republic of China.

A. JAROV
Head of the Delegation of
the U.S.S.R.

ARCHIVES U.I.T. GENÈVE

# AERONAUTICAL CONFERENCE

Document No. I-50-E
30 January 1964
Original : French/English/Spanish

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

## List of documents of the Conference

(Documents Nos. 1 to 50)

| Document No. | Title | Origin | Destination |
|---|---|---|---|
| I-1 | Proposals for the work of the Conference | U.S.A. | Plenary Meeting |
| I-2 and Corr.1 | Proposal relating to the Conference structure, and respective terms of reference of each Committee, of the Aeronautical E.A.R.C. to accomplish the directives set forth in the Conference Agenda | U.S.A. | Plenary Meeting |
| I-3 and Add.1 | Proposals of the Japanese Administration | Japan | Plenary Meeting |
| I-4 | Report on frequency requirements for communications with transport air-space vehicles | I.F.R.B. | Plenary Meeting |
| I-5 | Report on studies relating to possible channeling arrangements in a revised allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-6 | Use of the single sideband system of communication in the aeronautical mobile (R) service | I.F.R.B. | Plenary Meeting |
| I-7 | Report on studies relating to the use of the channels in the present allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-8 | Report on studies relating to the basic concepts of allotments in a revised frequency allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |

ARCHIVES U.I.T. GENÈVE

| Document No. | Title | Origin | Destination |
|---|---|---|---|
| I-9 | Report on studies on facilities for high frequency meteorological broadcasts in a revised allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-10 | Report on studies relating to aircraft operation statistics | I.F.R.B. | Plenary Meeting |
| I-11 | Proposal for the revision of the HF allotment plan for the aeronautical mobile (R) service | Republic of India | Plenary Meeting |
| I-12 | Report on studies relating to channel capacities in a revised high frequency allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-13 | Report on studies of technical principles which might be used in the establishment of a revised high frequency allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-14 | Report on studies relating to propagation and frequency-sharing criteria which might be used in the establishment of a revised allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-15 | Recommendations, reports, opinions, questions and study programmes adopted by the Xth Plenary Assembly of the C.C.I.R. | S.G. | Plenary Meeting |
| I-16 | Proposal relating to the determination of frequency requirements for regional and domestic air route operations | Australia | Plenary Meeting |
| I-17 and Corrig. | Invitations to the Conference | S.G. | Plenary Meeting |
| I-18 | Conference Secretariat | Secretariat | Plenary Meeting |
| I-19 | Budget of the Conference | S.G. | Budget Control Committee |
| I-20 | Draft Agenda for the opening Plenary Meeting | Secretariat | Heads of Delegation |
| I-21 and Add.1 | Supplementary Material with Respect to Aircraft Operation Statistics -MWARA | U.S.A. | Plenary Meeting |

| Document No. | Title | Origin | Destination |
|---|---|---|---|
| I-22 | Rearrangement of Appendix 26 of the Radio Regulations | Argentine Republic | Plenary Meeting |
| I-23 | Allotment of a family of frequencies for metereological broadcasts in South America | Argentine Republic | Plenary Meeting |
| I-24 | Gradual introduction of SSB emissions in the aeronautical mobile (R) service | Argentine Republic | Plenary Meeting |
| I-25 | General provisions for the aeronautical mobile service | Argentine Republic | Plenary Meeting |
| I-26 | Adoption of abbreviations or symbols to simplify the mention of or reference to the services and stations dealt with in Appendix 26, together with the bands in which they operate | Argentine Republic | Plenary Meeting |
| I-27 | Amendment of the boundaries and description of MWARA NSAM-1 and NSAM-2 (Part II, Article I, Section I of Appendix 26) | Argentine Republic | Plenary Meeting |
| I-28 | Situation of certain countries with respect to the convention | S.G. | Plenary Meeting |
| I-29 | Methods of communication and types of emission for which provision should be made in the revised plan | U.K. | Plenary Meeting |
| I-30 | Use of high frequencies in communication with super-sonic aircraft | U.K. | Plenary Meeting |
| I-31 | Transmission, propagation and reception | U.K. | Plenary Meeting |
| I-32 | Review of the Allotment Plan for the Aeronautical Mobile (R) Service | U.K. | Plenary Meeting |
| I-33 | Permissible loading of a frequency or family of frequencies | U.K. | Plenary Meeting |
| I-34 | Preservations of MWARA'S and RDARA'S | U.K. | Plenary Meeting |
| I-35 and Rev. | Committee Structure | Secretariat | Plenary Meeting |
| I-36 | Draft Agenda for the first meeting of the Drafting Committee | Committee 6 | Committee 6 |
| I-37 | Committee Structure | Secretariat | - |

| Document No. | Title | Origin | Destination |
|---|---|---|---|
| I-38 | Proposals relating to the determination of frequency requirements for regional and domestic air route operations | U.S.S.R. | Committee 5 |
| I-39 | Agenda for the first meeting of the Operating Statistics Committee | Committee 5 | Committee 5 |
| I-40 | Agenda for the first meeting of the Technical Committee | Committee 4 | Committee 4 |
| I-41 | Proposals for the preparatory session of the extraordinary administrative radio conference | U.K. | Plenary Meeting |
| I-42 | Report on long distance VHF Communications system being developed in the United States | U.S.A. | Committee 4 |
| I-43 | Concerning a new type of high frequency antenna that may be applicable in the aeronautical mobile "R" service | U.S.A. | Committee 4 |
| I-44 | Report on H-F sector-coverage log-periodic antenna | U.S.A. | Committee 4 |
| I-45 | Concerning introduction of supersonic transports (SSTs) into scheduled service over international air routes | U.S.A. | Committees 4 & 5 |
| I-46 | Information concerning "integral electronics" (microelectronics), a new manufacturing technique which will have beneficial impact upon future equipment used aboard aircraft and at ground stations | U.S.A. | Committee 4 |
| I-47 | Channel spacing | U.K. | Committee 4 |
| I-48 | Proposal for amendment of channel widths and provision for the use of SSB emissions in the aeronautical mobile (R) bands | Canada | Committee 4 |
| I-49 | Statement by the Delegation of the Soviet Union | U.S.S.R. | Plenary Meeting |
| I-50 | List of documents of the Conference | Secretariat | Plenary Meeting |

# AERONAUTICAL CONFERENCE

Document No. I-51-E
29 January, 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

Brazil

PROPOSAL

Revision to the Appendix 26 to International Telecommunication Union Radio Regulations

PART I

General Provision.

Section II

Technical and Operational Principles used for the Establishment of the Plan. Allotment of - Frequencies in the Aeronautical Mobile (R) and (OR) Services.

A. Determination of Channel Width

1. Letter b). Frequency separation.

Taking into consideration the possibility of the development of new transmission techniques for high frequency channel operation allocated to aeronautical mobile service on the "R" and "OR" bands, which might be equally acceptable by I.T.U., it is suggested that, instead of mentioning the different classes of emission as now stated in letter b), the transcription of Recommendation 7/1 (I.C.A.O. Document No. 8329 - COSP-II), with the addition of the classes A4 and F-1 be made following letter b) to read as follows:

"b) The use of channels as derived from the above table, for the various classes of emission, will be subject to special arrangements by the administrations concerned in order to avoid the interference which may result from the simultaneous use of the same channel, for several classes of emission, no inherent priority will be given to any particular class of emission derived from the following list:

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a) Telephony, Amplitude modulated.

| | | |
|---|---|---|
| i) | Double sideband | (A3) |
| ii) | Single sideband, reduced carrier | (A3A) |
| iii) | Single sideband, full carrier | (A3H) |
| iv) | Single sideband, supressed carrier | (A3J) |
| v) | Two independent sidebands | (A3B) |

b) Telegraphy (including automatic data systems):

| | | |
|---|---|---|
| i) | Without the use of a modulating audio frequency (by on-off keying) | (A1) |
| ii) | Automatic (data), DSB, amplitude modulated, on-off keying of amplitude modulating audio frequency (ies) or by on-off keying of the modulated emission | (A2) |
| iii) | Automatic (data), DSB, frequency shift keying without the use of a modulating audio frequency: one or two frequencies being emitted at any instant | (F1) |
| iv) | Automatic (data), DSB, frequency modulated by the on-off keying of a frequency modulating audio frequency modulated emission | (F2) |
| v) | Automatic (data), SSB, amplitude modulated, reduced carrier, multichannel voice frequency telegraphy | (A7A) |
| vi) | Automatic (data), SSB, amplitude modulated, full carrier, multichannel voice frequency telegraphy | (A7H) |
| vii) | Automatic (data), SSB, amplitude modulated, suppressed carrier, multichannel voice frequency | (A7J) |

c) Fac-simile, with modulation of main carrier either directly or by a frequency modulated sub-carrier (A4) "

# AERONAUTICAL CONFERENCE

Document No. I-52-E
29 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

Brazil

PROPOSAL

## Revision to the Appendix 26 to International Telecommunication Union radio regulations

PART II

Plan for the Allotment of Frequencies for the Aeronautical Mobile (R) Service in Exclusive Bands between 2850 and 17970 kc/s.

### Section I

Description of the Major World Air Route Areas (MWARA) and Regional and Domestic Air Route Areas (RDARA) and Sub-RDARA Boundaries.

1. Inclusion of CAMPO GRANDE in the MWARAS SAM-I and SAM-2

The Brazilian Administration is planning to establish an Air Traffic Control Center (ACC) at CAMPO GRANDE (Lat. 20°28'S 54°40'W) and so-supports Recommendation 2/1 (I.C.A.O. Document No. 8329, COSP-II) with respect to the description of the MWARA SAM-1 and MWARA SAM-2 boundaries.

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# AERONAUTICAL CONFERENCE

Document No. I-53-E
29 January, 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

Brazil

PROPOSAL

Revision to the Appendix 26 to International Telecommunication Union Radio Regulations

PART II

Plan for the Allotment of Frequencies for the Aeronautical Mobile (R) Service in Exclusive Bands between 2850 and 17970 kc/s.

Section I

Description of the Major World Air Route Areas (MWARA) and Regional and Domestic Air Route Areas (RDARA) and sub-RDARA Boundaries.

1. Inclusion of Brasilia, Trindade Island and Monrovia (Liberia) in the MWARA South Atlantic (SA).

Considering that the Headquarters of the Brazilian Government was transferred to Brasilia - the new Capital - in 1960;

Considering that the aeronautical movement of this new capital is one of the greatest in Brazil;

Considering that the national plan will provide Brasilia - with an airport with adequate facilities for the operation of supersonic aircrafts;

Considering the necessity to provide an appropriate HF airground communications coverage it is suggested that Brasilia ($15^{\circ}51'S$ $47^{\circ}56'W$) be included in the MWARA SA; and still

Considering Brazil's interest in aeronautical interconnection with African continent;

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Considering that Trindade Island located away from Brazilian coast can be used to provide navigational and communication facilities to Brazil-Africa route;

Considering that to take care of operational requirements - of new route already being flown and others projected for the near future, it seems highly essential that Monrovia (Liberia) be included in MWARA SA.

For the purposes mentioned above the following description of the MWARA SA is suggested:

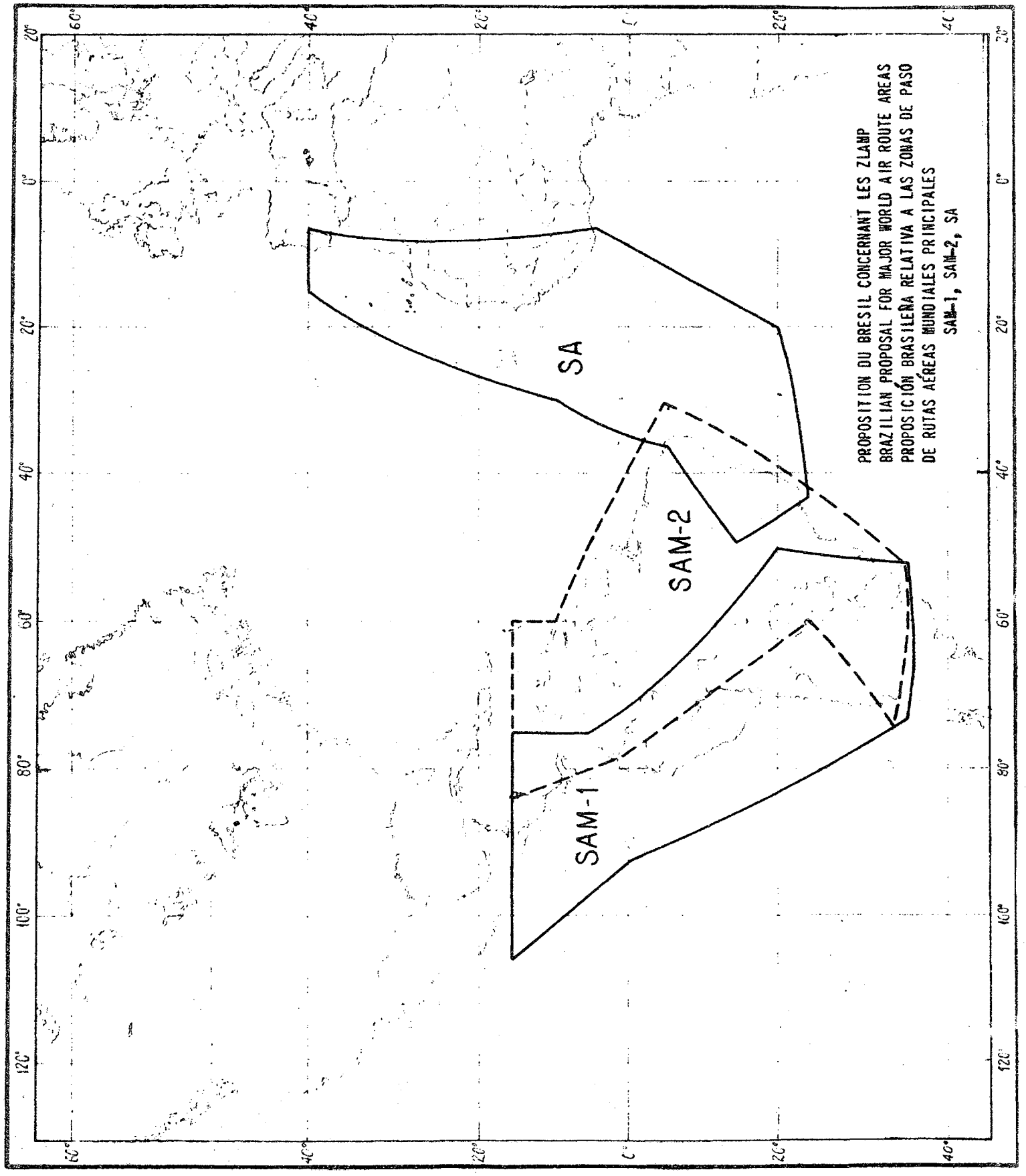
From the point 23°S 43°W, through the point 15°S 49°W, 5°S 36°W, 10°N 30°W, 40°N 15°W, 40°N 7°W, 5°N 7°W, 20°S 20°W, to the point 23°S 43°W.

2. Use of SA Frequencies at Buenos Aires

That a note should be appended to the MWARA SA in accordance with Recommendation 2/7 (I.C.A.O. Doc. 8329, COSP II).

Annex: 1

ANNEXE


SA
SAM-2
SAM-1
PROPOSITION DU BRESIL CONCERNANT LES ZLAMP
BRAZILIAN PROPOSAL FOR MAJOR WORLD AIR ROUTE AREAS
PROPOSICIÓN BRASILEÑA RELATIVA A LAS ZONAS DE PASO
DE RUTAS AÉREAS MUNDIALES PRINCIPALES
SAM-1, SAM-2, SA

# AERONAUTICAL CONFERENCE

Document No. I-54-E
29 January 1964
Original: French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

AGENDA

FOR THE 2nd MEETING OF THE COMMITTEE

ON OPERATING STATISTICS

30 January 1964 at 9.30 a.m. in Room XVI

---

1. General examination of questions to be studied (continued)

2. Examination of MWARA flight statistics

   a) type and nature of information on aircraft operation which should be submitted to the I.T.U.

   b) duration and time of year for which statistical information should be supplied

   c) form in which the statistics should be presented, with relevant instructions

3. Other business

Maurice CHEF,
Chairman

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# AERONAUTICAL CONFERENCE

Document No. I-55-E
29 January 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

AGENDA

FOR THE SECOND MEETING OF THE TECHNICAL COMMITTEE

30 January 1964 at 0930 a.m. in Room XV

---

1. To adopt the Summary Record of 1st Meeting (if available)
   Document No. I-56

2. To continue consideration of subjects to be studied
   Reference: Document No. I-37, Para. 4

| | | | |
|---|---|---|---|
| Item No. 6 - to consider first Working Draft - Document No. DT I/1 | | | |
| Item No. 8 - R and OR frequencies | Document I-1 | Pages 21 and 51 | |
| | Document I-11 | Page 4 | |
| Item No. 10 - Use of VHF | Document I-1 | Page 56 | |
| Item No. 11 - Improvements | | Pages 119, 120 | |

3. Any other business

J.T. PENWARDEN
Chairman

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# AERONAUTICAL CONFERENCE

Document No. I-56-E
29 January 1964
Original : French
English
Spanish

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

SUMMARY RECORD
OF THE FIRST MEETING OF COMMITTEE 4
(TECHNICAL COMMITTEE)

Wednesday, 29 January, 1964, 9.30 a.m.

Chairman : Mr. J.T. PENWARDEN (United Kingdom)

Vice-Chairman : Dr. C. WACHARASINDU (Thailand)

The meeting adopted the Agenda (Document No. 40) without amendment.

1. Appointment of Rapporteurs

The Delegates of Algeria and of Cuba undertook to provide rapporteurs for the French and Spanish languages respectively.

2. Organization of the work

The Chairman invited consideration of Document No. 37 in which the subjects for study were allocated to the Committee.

2.1 After a short discussion it was agreed to divide the subjects into three main sections as follows :

Section 1 - Item No. 6 - Basic concepts

Item No. 8 - Common R or OR frequencies

Item No. 10- Use of VHF

Item No. 11- Improvements in techniques

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Section 2 - Item No. 1 - Propagation

Item No. 2 - Protection ratios

Item No. 7 - Frequency sharing

Item No. 12- Number of aircraft to be served

Section 3 - Item No. 3 - Types of emission

Item No. 4 - Power of emission

Item No. 5 - Channel separations

Item No. 9 - Use of SSB

2.2. It was further agreed that after each item has been briefly considered in full Committee two Working Groups should be set up as follows :

Working Group 4A to study all Section 2 Items in detail, and

Working Group 4B to study all Section 3 Items. The appointment of Chairmen of Working Groups was deferred until later.

2.3 The meeting agreed to study all subjects of Section 1 in detail in the full Committee and recognising the difficulties of smaller delegations the simultaneous meetings of Working Groups were to be avoided.

3. Consideration of subjects to be studied. Item No. 6

3.1 The Delegates of those Administrations who had submitted proposals on the subject of "Basic Principles for the Allotment of Frequencies" presented their papers to the Meeting. The representative of the I.F.R.B. also presented the report of studies by the Board.

3.2 After a short discussion the meeting unanimously agreed that in any revision of the (R) Plan in Appendix 26 the basic principle of allotment of frequencies to MWARA's and RDARA's should be retained. The Chairman undertook to prepare a draft Working Paper on this subject for consideration by the Committee at the earliest opportunity.

4. There being no other business the meeting adjourned at 12.30 p.m.

Rapporteurs :

J.A. VALLADARES
YOUCEF-KHODJA

Chairman :

J.T. PENWARDEN

# AERONAUTICAL CONFERENCE

Document No.I-57-E
29 January, 1964
Original: English

E.A.R.C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 1

NOTES ON THE MEETING OF THE STEERING COMMITTEE

28 January, 1964, at 10.30 a.m.

Document No. DL/I-2 - Draft - Committee Structure

After an exchange of views as to the treatment of matters not strictly within the terms of reference of the Conference laid down by the Administrative Council, such as that covered in Document No. I-22 (ARG), the Delegate of Argentina agreed that they should be submitted to the Plenary Meeting.

The Chairman, speaking on behalf of the United States Delegation, agreed that Part IV of Document No. I-1 (USA) would not be considered at the present Session, unless this were found necessary and sufficient time were available.

The same was agreed in respect of Document No. I-22 (ARG).

On the suggestion of the Chairman of Committee 4, and with the agreement of the Chairman of Committee 5, it was agreed to transfer items 7, 8, 10 and 11 from Committee 4 to Committee 5. The Chairman of Committee 5 accepted those additional tasks; a first draft would be prepared for final decision by the Second Session.

The Chairman of Committee 4 drew attention to the note to the effect that the order in which the items were listed was not intended to imply the order of priority for their consideration.

At the suggestion of Mr. Jarov, Vice-Chairman of the Conference, it was agreed that the appropriate page numbers of documents would be referred to in the agenda of Committee meetings.

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Mr. Monnat, Vice-Chairman of the Conference, suggested that the expansion of the terms of reference of the Editorial Committee decided that the First Plenary Meeting should be referred to in order to enable delegates wishing to attend meetings of that Committee dealing with the subject of the form of the Final Acts of the First Session of the Conference to do so.

The Chairman pointed out that judicial aspects would also be involved as to the legal status of the Final Acts.

The Chairman of the Editorial Committee fully supported those views, and it was so agreed.

On a point raised by Mr. Monnat, Vice-Chairman of the Conference, as to the possibility of a large attendance at meetings of the Editorial Committee dealing with that subject, the Chairman of the Editorial Committee agreed that such a possibility had to be accepted. It was for the Editorial Committee to prepare the subject to the maximum extent possible and thus save time in Plenary Meeting. In any case, the other work of the Editorial Committee would not commence until after the first week of the Conference, which would allow time for the subject of the form of the Final Acts to be dealt with.

The Steering Committee as a whole supported that point of view.

The Committee structure and terms of reference set forth in the working document were approved, as amended, for distribution as Conference Document No. I-37.

The Meeting rose at 11.30 a.m.

Chairman :

Arthur L. LEBEL

AERONAUTICAL CONFERENCE

Document No.I-58-E
30 January, 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

Canada

# REPORT ON EXTENDED RANGE VHF DEVELOPMENT BY THE DEPARTMENT OF TRANSPORT IN CANADA

## Introduction

1. In an attempt to provide reliable communications between the Gander, Newfoundland Area Control Centre and aircraft flying within the Gander Oceanic Control Area, a decision was reached to exploit the advantages of a VHF tropospheric system. To effect this decision, planning was immediately initiated with actual installation work commencing in the Fall of 1962. In July of this year the system became operational and was turned over to the Gander ACC for preliminary evaluation. To the time of this writing only an interim report has been received as to the range being achieved - a copy of this report being attached as Annex "C".

2. The transmitting and receiving facilities were installed at separate sites on the Newfoundland coast area north of St. John's with control being effected over separate telecommunications circuits from the sites to Gander. A full description of the sites and equipment used in both the transmit and receive portions of this system will be found in Annex "A".

3. In addition to this, a list of system parameters has been prepared and will be found in Annex "B".

4. In regard to the ranges indicated in the preliminary report on the system an operating range of approximately 400 nautical miles is presently being indicated. It should be stressed here that this preliminary report was prepared from contacts made with commercial aircraft flying through the area of interest with no flights having been planned with the express purpose of flight checking the installation. Information on the equipment being used by the commercial airlines is therefore rather limited and does impose a certain restriction on any true evaluation of the long range system.

Annexes : 3

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# A N N E X  A

As will be indicated below, the present installation is operating on 118.2 Mc/s. Plans are rapidly proceeding, however, to install a second frequency of 127.1 Mc/s using the same antennae. The antennae being used are corner reflectors and are therefore broadband over the aeronautical frequency band. It is anticipated that this second frequency will be in operation for the summer of 1964.

Site and Equipment Characteristics and Specifications.

Frequency - 118.2 Mc/s
Effected Radiated Power - 50 kW
Signal - Simplex, AM Type 6A3 emission

Transmit Portion

Site - Robin Hood Bay, Nfld.
Lat. 47° 36' 30" N
Long. 52° 40' W

Antenna Elevation - 500 ft. ASL - base height
- 590 ft. ASL - centre height

The transmit antenna is on a cliff overlooking the Atlantic.

Antenna Specifications

- Sixteen (16) corner reflectors are mounted on a 150 ft. mast. At present 8 reflectors are being used on 118.2 Mc/s with the remaining 8 being reserved for operation on 127.1 Mc/s.
- Gain - 17 db over a $\frac{1}{2}\lambda$ dipole.
- Beamwidth - 50°H (half power points), 30 Vertical
- Directivity - 56° True

Transmitter - Redifon Type G-190
1 kW linear

Receive Portion

Site - Red Head, Nlfd.
Lat. 47° 43' N
Long. 52° 43' W

Antenna Elevation - 320 ft. ASL base height
- 410 ft. ASL centre height

Antenna Specifications - Dual space diversity is being used with the identical antennae being spaced approximatelz 18 wavelengths apart at 118.2 mc/s. Signal switching is employed in the diversity system. Each antenna is comprised of sixteen (16) vertically stacked corner reflectors.
- Gain - 20 db
- Beamwidth - 50°H
- 3°V
- Directivitz - 56°True

Receivers - Pye Model TCL-102
IF Bandwidth 30 kc/s
Audio Bandwidth ± 3 kc/s
Noise Figure - 5 db

Preamplifier - Noise Figure - 3.5 db

System NF - 3.7 db

Airborne Equipment

The details given here will, by necessity, be only approximate.

Transmitter Power Output - 25 W.
Type - Class C

Receiver Noise Figure - 7 db.
Audio B.W. - 6 kc/s

Antenna Gain - 0 db Omnidirectional

# ANNEX B

It will be noticed from the parameters listed below that ground to air communications should be reliably achieved with a Median signal to noise ratio of 9 db. On the air to ground path, however, it can be seen that problems may exist as the difference between ground received power and total thermal noise is indicated to be only 4 dbw. It must be realized here, however, that this may in effect be a pessimistic figure due to the assumed values employed for the equipment associated with the aircraft and to the approximate gain being attributed to the use of dual diversity reception.

## System Parameters

### Transmit Portion

Required Range = 400 NM or 460 S.M.
Ground Antenna Ht. = 590 ft.
Aircraft Altitude = 20,000 ft. and above.
Radio Line-of-Sight = 1.42 (  ) = 236 Mi.
Scatter Distance = 460 - 236 = 224 Mi.
Line-of-Sight Path Loss = 37 + 20 log f + 20 log d = 126 db
Scatter Loss = 50 + 0.1 d = 72.4 db
Total Loss = 126 + 72.4 = 198.4 db or 198 db.
Thermal Noise Power = KTB = -204 dbw/cycle.
Effective Bandwidth = 6 kc/s = 37.8 db ref. 1 cycle.
Total Thermal Noise = -166 dbw.

### Ground/Air Path

| | | |
|---|---|---|
| Basic Transmission Loss | = | 198 db |
| Ground Transmit Antenna Gain | = | 17 db |
| Aircraft Receive Antenna Gain | = | 0 db |
| Net Transmission Loss | = | 181 db |

Ground Transmitter Power = 1 kW = 30 dbW
Airborne Receive Power = -151 dbW

Median Signal-to-Noise Ratio (based upon Receiver Noise Figure 7 db, BW-6 kc/s = 9 db

### Receive Portion

Ground Antenna Height = 410 ft.
Aircraft Altitude = 20,000 ft.
Radio Line-of-Sight = 230 Mi.

Scatter Distance = 460-230 = 230 Mi.
Line-of-Sight Path Loss = 126 db
Scatter Loss = 73 db
Total Path Loss = 199 db

Air/Ground Path

| | |
|---|---|
| Basic Transmission Loss | = 199 db |
| Ground Transmit Antenna Gain | = 20 db |
| Dual Diversity - Switched - Approx. Gain | = 3 db |
| Airborne Transmitting Antenna Gain | = 0 db |
| Net Transmission Loss | = 176 db |
| Airborne Transmitter Power - 25 W | = 14 dbw |
| Ground Received Power | = -162 dbw |

# A N N E X  C

The data to be found in this Annex was gathered during the period 22 July to 2 August of this year. It will be noted in Tables I and II that the reports of the signals are given by the Signal Strength and Readibility system - see below. As there is no control over the airborne equipment, it has been necessary to rely upon the pilot's report as regards the quality and strength of the received signal. To this date, a similar approach has been used on the Air/Ground path, relying upon the judgement of the Air Traffic Controllers at the Gander Centre, for reports on the signals received.

The figures listed in Tables I and II have been plotted in Fig. 1 and Fig. 2. Although the points shown do not always indicate the maximum range, an indication is given of the antenna pattern, and of the fact that communications can be achieved out to approximately 400 nautical miles.

Signal Strengths

5 - Excellent
4 - Good
3 - Fair
2 - Poor
1 - Unusable

Readability

5 - Perfect
4 - Practically no difficulty
3 - With considerable difficulty
2 - Barely, occasional words distinguishable
1 - Unreadable

Tableau I - Table I - Cuadro I

Trajet sol-air - Ground-air path - Trayecto tierra-aire

| Position angulaire (degrés)<br>Bearing (Deg.)<br>Marcación (grados) | Altitude de vol (milliers de pieds)<br>Flight Altitude (Thousands of ft.)<br>Altura del vuelo (miles de pies) | Signal<br>Signal<br>Señal | Distance (milles marins)<br>Range (N.M.)<br>Distancias (millas marinas) |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 65 | 29 | 5 x 5 | 450 |
| 68 | 33 | 5 x 5 | 540 |
| 50 | 33 | 5 x 5 | 308 |
| 38 | 33 | 5 x 5 | 255 |
| 78 | 31 | 3 x 3 | 395 |
| 78 | 31 | 4 x 4 | 195 |
| 81 | 33 | 3 x 2 | 315 |
| 71 | 29 | 5 x 5 | 360 |
| 71 | 29 | 1 x 1 | 400 |
| 80 | 35 | 5 x 5 | 515 |
| 75 | 37 | 5 x 5 | 500 |
| 63 | 35 | 3 x 3 | 680 |
| 67 | 35 | 4 x 4 | 290 |
| 53 | 35 | 5 x 5 | 395 |
| 46 | 35 | 5 x 5 | 332 |
| 80 | 35 | 3 x 3 | 315 |
| 57 | 35 | 4 x 4 | 405 |
| 56 | 35 | 5 x 5 | 375 |
| 54 | 35 | 5 x 5 | 285 |
| 34 | 39 | 5 x 5 | 310 |
| 49 | 35 | 2 x 2 | 545 |
| 43 | 35 | 5 x 5 | 485 |
| 52 | 37 | 2 x 2 | 480 |

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| 36 | 37 | 5 x 5 | 340 |
| 37 | 35 | 5 x 5 | 325 |
| 53 | 33 | 5 x 3 | 285 |
| 56 | 33 | 4 x 4 | 460 |
| 55 | 33 | 5 x 5 | 445 |
| 56 | 31 | 3 x 3 | 405 |
| 55 | 31 | 5 x 5 | 370 |
| 66 | 37 | 2 x 2 | 335 |
| 55 | 37 | 5 x 5 | 250 |
| 72 | 33 | 4 x 5 | 375 |
| 73 | 35 | 3 x 5 | 300 |
| 73 | 35 | 1 x 3 | 400 |
| 54 | 37 | 4 x 4 | 335 |
| 78 | 37 | 3 x 3 | 360 |
| 67 | 35 | 5 x 5 | 470 |
| 61 | 35 | 5 x 5 | 350 |
| 60 | 35 | 5 x 5 | 320 |
| 60 | 35 | 2 x 3 | 330 |
| 44 | 39 | 4 x 5 | 410 |
| 51 | 37 | 5 x 5 | 250 |
| 58 | 37 | 5 x 5 | 390 |

Tableau II - Table II - Cuadro II

Trajet air-sol - Air-ground path - Trayecto aire-tierra

| Position angulaire (degrés)<br>Bearing (Deg.)<br>Marcación (grados) | Altitude de vol (milliers de pieds)<br>Flight Altitude (Thousands of ft.)<br>Altura del vuelo (miles de pies) | Signal<br>Signal<br>Señal | Distance (milles marins)<br>Range (N.M.)<br>Distancias (millas marinas) |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 68 | 33 | 2 x 5 | 540 |
| 38 | 33 | 3 x 3 | 250 |
| 78 | 31 | 4 x 4 | 195 |
| 81 | 33 | 1 x 1 | 315 |
| 71 | 29 | 2 x 2 | 360 |
| 75 | 37 | 1 x 1 | 500 |
| 63 | 35 | 5 x 5 | 360 |
| 67 | 35 | 3 x 3 | 290 |
| 46 | 35 | 5 x 5 | 332 |
| 80 | 35 | 2 x 2 | 315 |
| 56 | 35 | 5 x 5 | 375 |
| 54 | 35 | 1 x 1 | 285 |
| 34 | 39 | 4 x 5 | 310 |
| 43 | 35 | 2 x 4 | 485 |
| 37 | 35 | 3 x 2 | 325 |
| 59 | 33 | 3 x 3 | 390 |
| 53 | 33 | 5 x 5 | 285 |
| 55 | 33 | 3 x 5 | 445 |
| 55 | 31 | 3 x 3 | 370 |
| 66 | 37 | 2 x 2 | 335 |
| 55 | 37 | 4 x 5 | 250 |
| 72 | 33 | 3 x 5 | 375 |
| 73 | 35 | 5 x 5 | 300 |

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| 54 | 37 | 2 x 2 | 335 |
| 78 | 37 | 3 x 5 | 360 |
| 61 | 35 | 3 x 5 | 350 |
| 60 | 35 | 5 x 5 | 320 |
| 60 | 35 | 5 x 5 | 330 |
| 44 | 39 | 5 x 5 | 410 |
| 51 | 37 | 5 x 5 | 250 |

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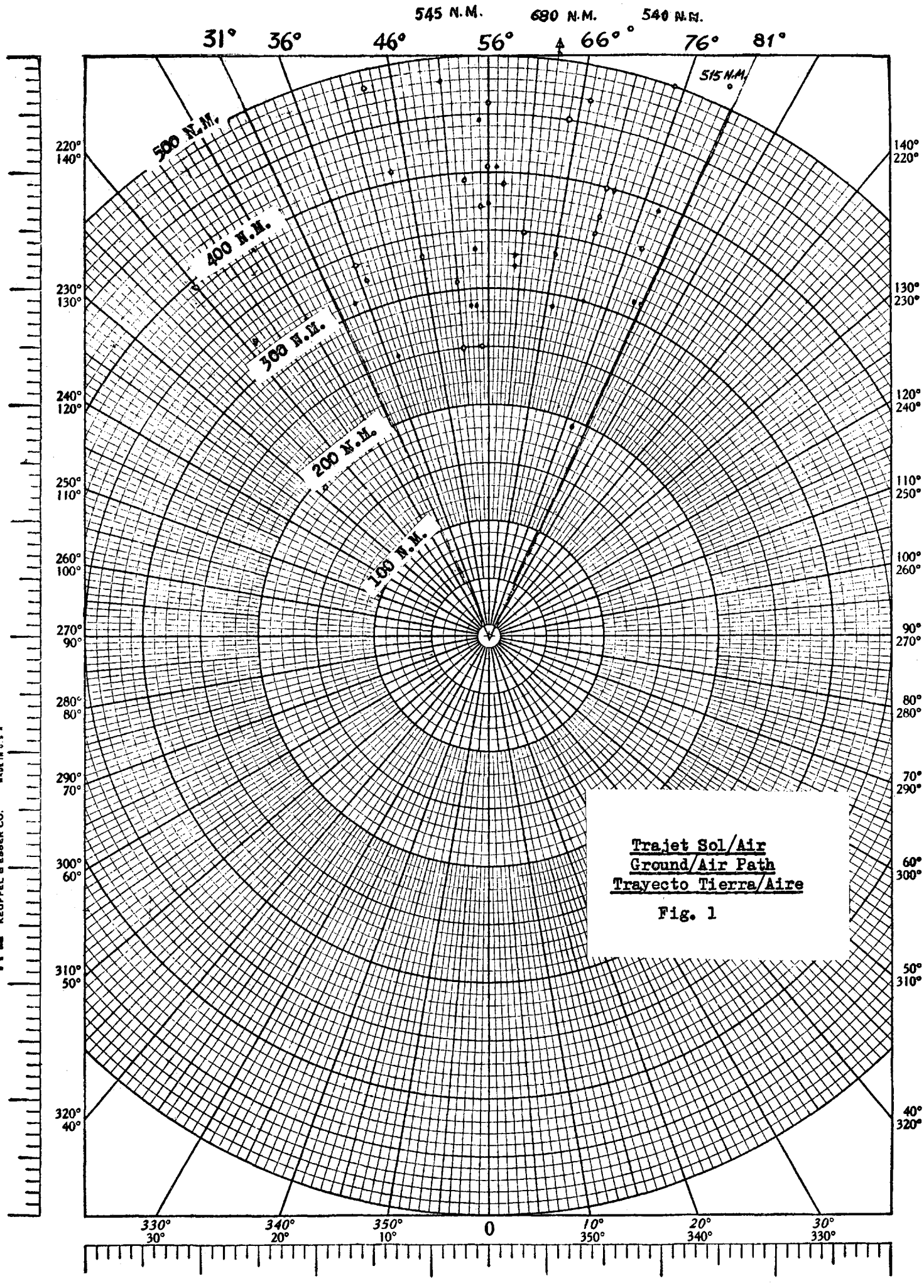


**Trajet Sol/Air**
**Ground/Air Path**
**Trayecto Tierra/Aire**

Fig. 1

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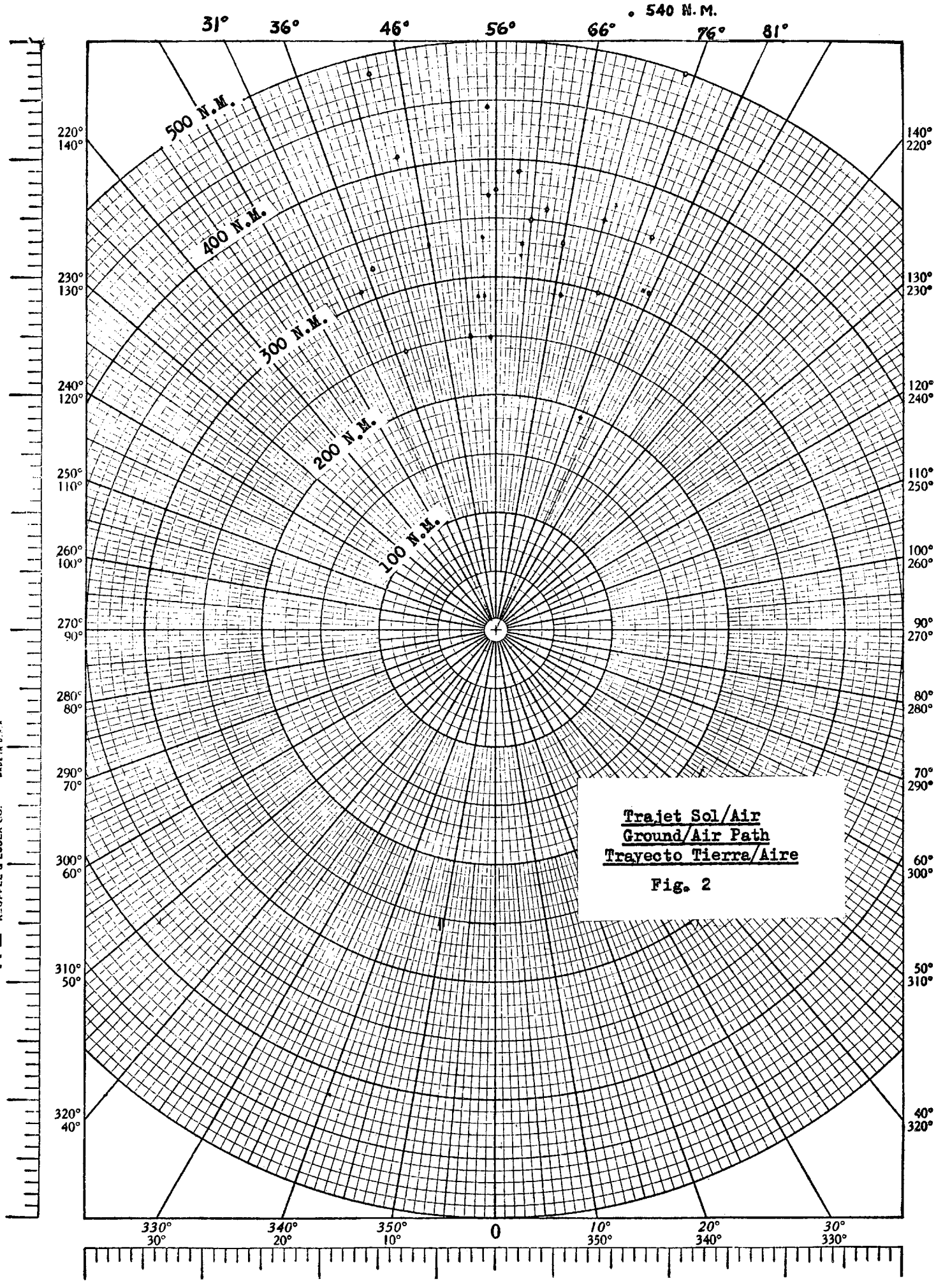


**Trajet Sol/Air**
**Ground/Air Path**
**Trayecto Tierra/Aire**

**Fig. 2**

AERONAUTICAL CONFERENCE

Document No. I-59-E
30 January 1964
Original : English

**E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA**

MINUTES

OF THE FIRST MEETING

OF THE HEADS OF DELEGATIONS

Monday, 27 January 1964, at 11 a.m.

Chairman : Mr. F. Henneberg (Austria)

Subjects discussed :

1. Nomination of the Chairman of the Meeting (Numbers 558 and 560 of the Convention)

2. Proposals concerning the Chairman and the Vice-Chairmen of the Conference (Numbers 562 and 563 of the Convention)

3. Establishment and structure of the Committees of the Conference (see proposal by the United States of America, Document No. I-2 and Corrigendum) (Number 564 of the Convention)

4. Secretariat of the Conference (Document No. I-18) (Number 565 of the Convention)

5. Date by which the Credentials Committee must formulate its conclusions (Number 535 of the Convention)

6. Admission of International Organizations (Document No. I-17, pararagraph 3) (Number 519 of the Convention)

7. Time-table of the Conference

8. Agenda for the first Plenary Meeting (Document No. I-20) (Number 557 of the Convention)

9. Any other business

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Present :

The Heads of Delegation of the following coutries :

Members :

Algeria (Democratic and Popular Republic of); Argentine Republic; Australia (Commonwealth of); Austria; Belgium; Brazil; Canada; Ceylon; China; Colombia (Republic of); Cuba; Denmark; Group of Territories represented by the French Overseas Post and Telecommunication Agency; United States of America; Ethiopia; Finland; France; India (Republic of); Ireland; Italy; Jamaica; Japan; Kuwait (State of); Mexico; Norway; New Zealand; Netherlands (Kingdom of the); Poland (People's Republic of); Federal Republic of Germany; Roumanian People's Republic; United Kingdom of Great Britain and Northern Ireland; Sweden; Switzerland (Confederation of); Czechoslovak Socialist Republic; Territories of the United States of America; Overseas Territories for the international relations of which the Government of the United Kingdom of Great Britain and Northern Ireland are responsible; Thailand; Union of Soviet Socialist Republics; Venezuela (Republic of); Viet-Nam (Republic of).

General Secretariat :

Mr. Gerald C. Gross, Secretary-General
Dr. Manohar B. Sarwate, Deputy Secretary-General

I.F.R.B. :

Mr. Mohamed N. Mirza, Chairman

C.C.I.R. :

Mr. Leslie W. Hayes, Acting Director

1. Nomination of the Chairman of the Meeting (Numbers 558 and 560 of the Convention

The Secretary-General, invoking the procedure laid down in paragraph 560 of the Convention, said the preliminary inquiries had shown the Dean of the Conference to be the representative of Austria and he accordingly suggested that Dr. F. Henneberg (Austria) be requested to take the Chair by reason of seniority.

The Meeting approved the designation of Dr. Henneberg as Chairman of the Meeting and he took the Chair.

2. Proposals concerning the Chairman and the Vice-Chairmen of the Conference (Numbers 562 and 563 of the Convention)

After adoption of the Draft Agenda for the first Meeting of Heads of Delegations (Document No. DL/I-1), the Chairman called for proposals concerning the Chairman and Vice-Chairmen of the Conference.

Mr. Rao (India) proposed Dr. Lebel, Head of the Delegation of the United States of America, as Chairman of the Conference, stating that his previous experience as Chairman of the 1948 Aeronautical Conference in Geneva and in the development of techniques for sharing bands for international usage would be most valuable.

Dr. Lebel (United States of America) thanked the representative of India and said that he would be happy to accept the nomination and, if selected by the Plenary Meeting, would do his utmost to make the Conference a success.

The Meeting approved the nomination of Dr. Lebel by acclamation.

Dr. Nicotera (Italy) proposed as first Vice-Chairman of the Conference Mr. Jarov, Head of the Delegation of the Union of Soviet Socialist Republics.

Mr. Farmer (United Kingdom) proposed Mr. Monnat, Head of the Delegation of Switzerland, as second Vice-Chairman.

Mr. Jarov (U.S.S.R.), after expressing his thanks for the honour done to his country, accepted the nomination.

Mr. Monnat (Switzerland) thanked the Meeting on behalf of his country for the honour in designating him as Vice-Chairman but explained that, as his delegation was limited in numbers, he trusted that the Conference would at times accept a substitute to replace him.

The nominations for the posts of Vice-Chairmen of the Conference were approved.

3. Establishment and structure of the Committees of the Conference (Document No. I-2 and Corrigendum)

The Chairman, referring to paragraph 3 of Document No. I-2, called for nominations for the posts of Chairman and Vice-Chairman of the various committees enumerated therein taking them in the order in which they were given.

1. Credentials Committee

Proposals had been submitted nominating a delegate of India as Chairman with a delegate of Czechoslovakia as Vice-Chairman.

The nomination of Mr. Ramanathan (India) as Chairman was approved. Owing to the inability of the Czechoslovak Delegation to accept the post of Vice-Chairman, the Chair requested further proposals and the nomination of Mr. Hernandez (Mexico) was then approved unanimously.

2. Budget Control Committee

A proposal had been submitted that the representative of Ghana, not present at the Meeting, should be Chairman and that Mr. Mohr (Federal Republic of Germany) should be Vice-Chairman.

The Meeting approved the nomination of the Vice-Chairman and agreed that the question of the Chairman should be left open for the time being, pending the arrival of the representative of Ghana.

3. Steering Committee

In accordance with established procedure, it was agreed that the Steering Committee would be composed of the Chairman and Vice-Chairmen of the Conference and the Chairmen of the Committees.

4. Editorial Committee

It had been proposed that Mr. Bouchier (Belgium) should be Chairman with representatives from Spain and Canada as Vice-Chairmen, which would cover the drafting needs in all three languages. In the absence of the representative of Spain, it was agreed to leave the post of Spanish Vice-Chairman open for the time being and to approve the nomination of Mr. Hewitt (Canada) as Vice-Chairman.

5. Technical and Operational Committee

The nominations of Mr. Penwarden (United Kingdom) as Chairman and of Mr. Wacharasindhu (Thailand) as Vice-Chairman were approved.

6. Aircraft Operation Statistics Committee

The Meeting approved the nominations of the representative of the French Overseas Territories as Chairman, and of the representative of the Argentine Republic as Vice-Chairman. At the suggestion of Mr. Jarov (U.S.S.R.), supported by Dr. Lebel (United States), the Meeting agreed to the nomination of a second Vice-Chairman, namely Mr. Rutkovski (People's Republic of Poland), who would shortly be arriving in Geneva to attend the Conference.

7. Allotment of R Frequencies Committee

Since it might not be necessary to set up such a Committee at the present session of the Conference, the matter was left for further study. Accordingly no officers were proposed.

Dr. Lebel (United States) explained that, although his delegation had proposed the establishment of such a committee, after consultation with other delegations in Geneva, it had decided to withdraw that part of its proposal. If, however, questions relating to allotment came up requiring solution at the first session, the Plenary Meeting could appoint an ad hoc committee to deal with specific questions.

Mr. Bouchier (Belgium) and Dr. Nicotera (Italy) supported the suggestion to set up an ad hoc group later if the need arose.

It was so agreed.

4. Secretariat of the Conference (Document No. I-18)

The Meeting approved the Conference Secretariat as listed in Document No. I-18.

5. Date by which the Credentials Committee must formulate its conclusions

The date suggested by the Secretary-General for the latest submission of credentials, namely Monday, 17 February, 1964, was approved.

6. Admission of International Organizations (Document No. I-17)

The Secretary-General said that an amended list would be issued on Tuesday, 28 January, and he would suggest the inclusion in it of I.A.T.A. and I.B.T.O. as Observers to the Conference.

It was so agreed.

7. Time-table of the Conference

The Meeting agreed on the usual time-table for conferences in Geneva, namely 9.30 a.m. to 12.30 p.m., and 3 p.m. to 6 p.m. from Monday to Friday, leaving Saturday free for the study of documents, though the hours could be modified should the need arise.

It was so agreed.

8. Agenda for the first Plenary Meeting (Document No. I-20)

The draft Agenda for the first Plenary Meeting (Document No. I-20) was approved.

9. Any other business

In reply to a question raised by Dr. Lebel (United States) regarding the allocation to appropriate committees of the various proposals submitted for study by the Conference, the Secretary-General said that a draft paper would be prepared as soon as possible and submitted to the Steering Committee, which could be empowered by the Plenary to deal with it.

Dr. Nicotera (Italy), while agreeing to that in principle, stressed that it was for the Plenary Meeting to approve that procedure and suggested the inclusion of the question on the Agenda of the first Plenary Meeting.

Mr. Mirza, Chairman of the I.F.R.B., expressed the willingness of the Board to assist with the preparation of any documents that might be necessary.

The Meeting rose at 12.20 p.m.

| Rapporteur | Secretary-General | Chairman |
|---|---|---|
| E.J. MENZEL | Gerald C. GROSS | F. HENNEBERG |

# AERONAUTICAL CONFERENCE

Document No. I-60-E
30 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

MINUTES

OF THE

OPENING PLENARY MEETING

Monday, 27 January, 1964 at 3.30 p.m.

Chairman : Mr. HENNEBERG (Austria) (for Items 1 and 2)

Later : Mr. Arthur LEBEL (United States of America)

Subjects discussed :

1. Opening of the Conference
2. Election of the Chairman
3. Election of the Vice-Chairmen
4. Statements by the Secretary-General, the Chairman of the I.F.R.B. and the Acting Director of the C.C.I.R.
5. Establishment of the Committees of the Conference and election of their Chairmen and Vice-Chairmen
6. Secretariat of the Conference
7. Dateline for formulation of its conclusions by the Credentials Committee
8. Admission of International Organizations
9. Working hours of the Conference
10. Any other business :
    - a) Approval of documentation
    - b) Allocation of documents to the various Committees
    - c) Organization of the work of the Conference

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Present :

The Heads of Delegation of the following countries :

Members :

Algeria (Democratic and Popular Republic of); Argentine Republic; Australia (Commonwealth of); Austria; Belgium; Brazil; Cameroon (Federal Republic of); Canada; Ceylon; China; Colombia (Republic of); Congo (Republic of the) (Léopoldville); Costa Rica; Cuba; Denmark; Group of Territories represented by the French Overseas Post and Telecommunication Agency; Spain; United States of America; Ethiopa; Finland; France; Guinea (Republic of); India (Republic of); Ireland; Italy; Jamaica; Japan; Kuwait (State of); Mexico; Norway; New Zealand; Netherlands (Kingdom of the) Poland (People's Republic of); Federal Republic of Germany; United Kingdom of Great Britain and Northern Ireland; Sweden; Switzerland (Confederation); Czechoslovak Socialist Republic; Territories of the United States of America; Overseas Territories for the international relations of which the Government of the United Kingdom of Great Britain and Northern Ireland are responsible; Thailand; Union of Soviet Socialist Republics; Venezuela (Republic of); Viet-Nam (Republic of).

Specialized Agencies :

International Civil Aviation Organisation

International Organizations :

International Air Transport Association
International Broadcasting and Television Organization

General Secretariat :

Mr. Gerald C. Gross, Secretary-General
Dr. Manohar B. Sarwate, Deputy Secretary-General

I.F.R.B. :

Mr. Mohamed N. Mirza, Chairman
Mr. R. Petit, Vice-Chairman
Mr. J.A. Gracie
Mr. J. Ziołkowski

C.C.I.R. :

Mr. Leslie W. Hayes, Acting Director

1. Opening of the Conference

Mr. Henneberg (Austria) announced that, in accordance with the provisions of No. 560 of the International Telecommunication Convention, he had been requested as Dean of the Conference to occupy the presidential Chair.

2. Election of the Chairman of the Conference

Mr. Henneberg (Austria) said that Dr. Arthur L. Lebel, Head of the United States Delegation, had been unanimously proposed for election as Chairman of the Conference by the Heads of Delegations at their meeting that morning.

Mr. Lebel (United States of America) was then elected Chairman of the Conference by acclamation, and took the Chair amid further applause.

The Chairman thanked the Delegates for the honour paid to his Government, country, delegation and to himself. It was a distinction which he had already received on a few occasions in the past, but to which he never became accustomed. He knew from past experience that he would be able to rely on the understanding, experience and support of all participants in the Conference, without which it would not be possible to accomplish all the complex and lengthy tasks which had to be performed in so short a time.

3. Election of the Vice-Chairmen of the Conference

The election of Mr. Alexandre Jarov (U.S.S.R.) and Mr. R. Monnat (Swiss Confederation) as Vice-Chairmen of the Conference, proposed by the meeting of Heads of Delegations, was approved by acclamation.

4. Statements by :

a) The Secretary-General

"Mr. Chairman, Ladies and Gentlemen: I am very happy to be able to welcome you on behalf of the I.T.U. to the First Session of this extremely important Aeronautical Conference in Geneva.

" May I extend personally to you, Mr. Chairman, my warmest congratulations on your election. We have had many pleasant associations over the past years. I would also like to congratulate Mr. Jarov of the U.S.S.R. and Mr. Monnat of Switzerland on their election as Vice-Chairmen of this important Conference.

" You are beginning today work which will not be completed for more than one year hence, when the new Frequency Allotment Plan for the Aeronautical Mobile Service finally emerges, and which is of crucial importance for the world today. The scientific and technological revolution of this century manifests its various achievements to us throughout the course of each day. Its greatest achievement, in my view, has been what it has done to bring the people of the world closer together by reducing the vast geographical distances that formerly separated them. And this it has done primarily through the modern marvels of flight and telecommunication.

" It is hard to know which of the two has developed more spectacularly. The airways of the world today are increasingly crowded by machines which not only fly faster and faster but which also approach nearer and nearer to technical perfection - to the day, that is, when it can be said that everything that can be done to provide absolute security has, in effect, been done. There is one element of security, however, which does not derive from technical advances in aircraft design, and that is the constant problem of maintaining contact with the ground. In fact, with the tremendous increase in flying that has been stimulated by the advances towards technical perfection, the element of security provided by radio and which is indispensable becomes more and more important.

" As the speeds at which aircraft can fly today and with the far greater number that do fly, slight differences in altitude or changes of their course can, in a very much shorter time than formerly, lead to situations where there is a threat of collision. And there is every sign that both the number and the speed of aircraft will continue to increase. It therefore becomes a matter of growing urgency to ensure that the plans for long-range high-frequency communications in the Aeronautical Mobile Service are adequate to the new, heavier and more complex demands being made on the radio links between aircraft and the ground.

" The Frequency Allotment Plan drawn up by the International Administrative Aeronautical Radio Conference in 1949, under your Chairmanship, Mr. Chairman, has over the years worked very well indeed. But fifteen years have now passed, and the whole activity and pattern of civil aviation has completely changed. There are many more aircraft flying, they fly higher and faster routes and they have opened up new routes. And there are other new factors which have to be taken into account. The development of VHF communications has reduced the use of high frequencies for short-range aeronautical communication in many parts of the world. It will not be very long hence before supersonic aircraft are introduced for commercial traffic. They are already flying for non-commercial traffic.

" Already in 1959, the Geneva Radio Conference recognized these facts and the necessity for revising the Aeronautical Mobile Service Plans. It was not able to obtain and study the material necessary for such a

revision, but it adopted a resolution - Resolution No. 13 of that Conference - to the effect that, when the Administrative Council considered it timely, this present Conference should be convened.

" You, ladies and gentlemen, are here today in response to that Resolution. Your immediate task, as you well know, is to decide on the operational and technical principles to be used by the Second Session of this Conference in drawing up the new Plan. What you decide here will determine the way in which Administrations will be required to submit the necessary information on flight activity which is to be processed by our computer in readiness for the Second Session.

" This task is essential to the future success of the new Plan. The growing complexity of the situation in international civil aviation to which I have already referred requires that this Plan shall be based on the most exact, detailed statistics it is possible to obtain.

" I would like to mention at this point how closely we have always worked with I.C.A.O. in Montreal and to salute our old friends Mr. Oomen and Mr. Acton representing that organization at this Conference. As you all know, Mr. Acton is a veteran of the Administrative Council and Radio Conferences of the I.T.U. and it is a great pleasure to have him among us again.

" I wish you, then, all success in your work. You are in the forefront of this latest combined advance by aeronautics and telecommunications, witnesses and executors of a partnership in science which, by diminishing physical distances, is also helping to diminish those of the mind.

" More and more, we are becoming airborne. Flying, which in former generations would have been regarded as miraculous, is nowadays routine. Suspended at great heights in a machine to which we have entrusted our lives without a qualm, we gaze down on the fleeting earth beneath with as little anxiety as if we were floating down a canal in a boat. The world too seldom realizes, however, that, to transform what was formerly miraculous into what is now routine, an immense amount of hard, painstaking effort is required. Your Conference, besides the intrinsic value of its work, will I am sure serve to draw the world's attention to this important effort.

Thank you, Mr. Chairman."

b) The Chairman of the I.F.R.B.

"Mr. Chairman, Ladies and Gentlemen: On behalf of the International Frequency Registration Board, permit me to join in the welcome to you all. This First Session of the Aeronautical Conference has to

establish the Technical and Operational principles on which a revised High Frequency Allotment Plan for the Aeronautical Mobile (R) Service is to be prepared. As you know, the situation now is more settled than it was at the time of the Aeronautical Conference held in 1948/1949. At that time, the Conference had to embark on a completely new venture and to adopt new concepts of planning such as the allotment of frequencies to areas rather than to individual stations. Secondly, at that time, the bands allotted exclusively to the Aeronautical Mobile (R) Service, by the Atlantic City Conference of 1947, were found to be fully occupied by stations of other kinds of services. After the 1948/49 Conference produced its plan, the frequency bands were progressively cleared by the endeavours of the I.F.R.B. and the collaboration extended by Administrations, and thus the plan was brought into force by stages throughout the world. Doing all this, of course, involved several hundreds of negotiations with individual Administrations.

" The I.F.R.B. has studied various aspects of the questions which you will have to consider, and has presented to this Conference ten papers which explain the up-to-date position and contain the tentative views and suggestions of the Board. It is our hope that these papers will be found helpful in your considering to what extent the principles used by the 1948/1949 Conference are still valid, or the changes that are desirable.

" The Board would suggest forms for getting statistics. These forms will be used along with the Board's computer in order to furnish the statistics required for the Second Session of the Conference. The Board will be glad to receive instructions from the Conference in this regard.

" In addition to its Chairman, who has to devote his attention to both the Conferences going on simultaneously now, the I.F.R.B. has nominated the following Board members to participate in the work of this meeting: Mr. Gracie and Mr. Ziołkowski. In addition, Mr. René Petit, Vice-Chairman of the Board, is also likely to take part in this meeting when he is free from the African Broadcasting Conference.

" As you perhaps know already, the Board has also designated a number of staff of its Specialized Secretariat, including Mr. Matthey, Mr. Maqbool and Madame Arnold, to assist in the work of the Conference as required.

May I, on behalf of the Board, wish the Conference all success.

Thank you Mr. Chairman, Ladies and Gentlemen."

c) The Acting-Director of the C.C.I.R.

The Acting-Director of the C.C.I.R. said that delegates would find much of the technical data they required in the documents of the C.C.I.R.

The Secretary-General had in fact been asked to issue Document No. I-15 containing a number of texts from the documentation of the recent Xth Plenary Assembly of the C.C.I.R. relevant to the work of the present Conference. In addition there were five technical volumes resulting from the Xth Plenary Assembly of the C.C.I.R. which had now been published and were available in the C.C.I.R. rooms at Conference and I.T.U. Headquarters, as pointed out in Document No. I-15. Furthermore the Conference might find useful the two Atlases of Propagation Curves published by the C.C.I.R. In conclusion he said that various members of the C.C.I.R. Secretariat were at the disposal of the Conference: the Acting-Director himself, Mr. Gadadhar, Senior Counsellor, Dr. Joachim, Counsellor, Dr. Mao and after 10th February, Mr. Froom.

The Chairman thanked the Secretary-General, the Chairman of the I.F.R.B. and the Acting-Director of the C.C.I.R. for their statements and offers of assistance. He was sure the success of the Conference would be greatly enhanced by the guidance and help of the staff members they had mentioned.

5. Establishment of the Committees of the Conference and election of their Chairman and Vice-Chairmen

The Secretary-General read out the following unanimous recommendations from the Heads of Delegations, which were unanimously approved:

| | | Chairman: | Vice-Chairmen: |
|---|---|---|---|
| Committee 1: | Steering Committee: | Chairman of the Conference | Vice-Chairmen of the Conference and Chairmen of the Committees |
| | | Delegates from: | |
| Committee 2: | Credentials Committee: | India | Mexico |
| Committee 3: | Budget Control: | Ghana | Federal Republic of Germany |
| Committee 4: | Technical and Operating Questions: | United Kingdom | Thailand |
| Committee 5: | Operating Statisticals: | French Overseas Territories | Argentine and Poland |
| Committee 6: | Drafting Committee: | Belgium | Spain and Canada |

It was understood that the delegations concerned would furnish members to carry out the functions of Chairman and Vice-Chairman.

The recommendation of the Heads of Delegations that the setting up of an Allotment of R Frequencies Committee should be left in abeyance until it became clear whether such a Committee was necessary, was unanimously approved.

The Delegate of the United States of America said that, although his Government had proposed in Document No. I-2 that the committee structure apply to both Sessions, after discussing the matter with various other delegations, it was now of the opinion that the Second Session should establish its own Committees as it deemed fit.

It was unanimously agreed that the committee structure of the Second Session of the Conference would be left for that Session to decide.

The Delegate of Italy asked whether the recommendations for committee structure emanated from the Secretary-General.

The Secretary-General pointed out that he had prefaced his remarks with the statement that the committee structure he read out represented the unanimous recommendations of the Heads of Delegations at their meeting that morning.

6. Secretariat of the Conference

The Secretary-General announced that the Heads of Delegations recommended the Secretariat of the Conference to be established as set forth in Document No. I-18. With Mr. Jean Kunz as Secretary of the Conference under the Chairmanship of Mr. Arthur Lebel, the partnership which had been so satisfactory in Geneva at the 1948 Aeronautical Conference would be re-established.

The Chairman said that many of the staff members listed in Document No. I-18 were well known to delegates. He mentioned in particular one, as representative of them all. He had worked with Mr. Jean Kunz for four months in 1948 and for 2 1/2 months in 1949 and had found him always willing to contribute unstinted efforts when needed, and provide sound advice.

The Conference Secretariat set forth in Document No. I-18 was unanimously approved.

7. Dateline for formulation of its conclusions by the Credentials Committee

The proposal by the Heads of Delegations that the Credentials Committee should submit its conclusions to the Plenary Assembly by 17th February 1964 was unanimously approved.

The Delegate of Italy raised a matter which he considered extremely important. In view of the fact that the present Session was in fact a preparatory meeting for the Second Session which would take place later, he proposed that the signature of the Final Acts should take place at the end of the Second Session.

The Delegate of Ceylon warmly supported that view.

The Chairman said that he had intended to place the matter before the meeting at a later stage. The Plenary meeting had to decide what form the outcome of the First Session of the Conference would take. Since it was not a matter of substance but rather of form, it might be appropriate for the Editorial Committee to consider it, preparing the groundwork for the discussion on the subject in Plenary.

There being no objection, the proposal by the Delegate of Italy, seconded by the Delegate of Ceylon, that the signature of the Final Acts of the Conference should take place at the end of the Second Session, was approved.

The Delegate of Belgium, speaking as Chairman of the Editorial Committee, said that the form which should be given to the outcome of the First Session of the Conference was indeed an editorial matter, also with legal aspects. He was therefore prepared to have it considered by the Editorial Committee which would then submit its suggestions to the Plenary Meeting.

It was so decided.

8. Admission of International Organizations

The Secretary-General referred the meeting to Document No. I-17 which gave full details of the invitations to the Conference. He pointed out that certain organizations such as the International Civil Aviation Organization were automatically admitted to participation in the Conference in accordance with Chapter 1 of the General Regulations annexed to the Convention; no confirmative action was therefore required by the Plenary Meeting.

Requests for admission as observers had also been received from the International Air Transport Association and the International

Broadcasting and Television Organization. If those requests were granted, the two organizations concerned would not share in the expenses of the Conference since the Administrative Council exempted them from such expenses on a reciprocal basis in accordance with No. 212 of the Convention.

The Heads of Delegations unanimously recommended the admission of the two organizations concerned to the Conference as observers.

That recommendation was unanimously approved.

9. Working hours of the Conference

The following working hours, proposed by the Heads of Delegations, were unanimously approved:

09.30 - 12.30 and 15.00 - 18.00 hours daily, initially on a five-day basis.

10. Any other business

a) Approval of documentation

The documentation so far published was approved for consideration, future documents to be approved by the Steering Committee (Committee 1).

b) Allocation of documents to the various Committees

It was decided that the allocation of documents to the various Committees would be handled by a small group of members of the I.F.R.B. and of the Secretariat, and ratified by the Steering Committee at a meeting to take place the following morning. Any documents submitted in the course of the Session would be submitted to the Steering Committee for allocation to a Committee.

c) Organization of the work of the Conference

The Chairman said that in view of the large amount of work to be dealt with by the Conference in the short period of four weeks, it might later become necessary for the Steering Committee to define the specific tasks of the First Session to ensure that time was not spent on matters which it was not essential for the First Session to handle. It was so agreed.

Delegates should also bear in mind that later in the year the Administrative Council would be meeting and would have to take a decision

on the duration required for the Second Session of the Aeronautical Conference and any amendments necessary to its agenda. He suggested that delegates keep those points in mind as the Session progressed.

The Delegate of Belgium, speaking as Chairman of the Editorial Committee, said that past experience had shown that the work of that Committee was greatly facilitated if the documents of the various other Committees were submitted to it in accordance with certain specific rules. He would therefore be convening a meeting of the Editorial Committee to draw up such rules.

The Chairman said that all those who had attended Radio Conferences in the past would appreciate the importance of the points raised by the Chairman of the Editorial Committee. All documents for their consideration should be submitted to the Committee as soon as they were ready, in an attempt to avoid a large number of night meetings of that Committee.

In reply to a question from the Delegate of Italy concerning the date of the Second Plenary Meeting, the Chairman said that the Steering Committee would meet immediately after the present meeting to work out the programme of meetings for the remainder of the week. He hoped to have the programme distributed to all delegates the following day. The schedule of meetings was also indicated each day on the blackboard at the entrance to the Conference quarters.

The meeting rose at 4.30 p.m.

| Rapporteur: | The Secretary of the Conference: | Chairman: |
|---|---|---|
| V. BOULADON | J. KUNZ | Arthur L. LEBEL |

# AERONAUTICAL CONFERENCE

Document No. I-61-E
30 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

FIRST REPORT OF COMMITTEE 4 (Technical)

Basic Principles for the Allotment of Frequencies

Following a study of proposals by Administrations to the Conference and of the reports of studies by the I.F.R.B., Committee 4 unanimously reached the conclusion which appears in the Annex attached hereto.

J.T. PENWARDEN
Chairman

Annex : 1

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# A N N E X

Principles of frequency allotment

In any revision of the Frequency Plan for the Aeronautical Mobile (R) Service in the exclusive bands between 2850 and 17970 kc/s the basic principle of the allotment of frequencies to geographic areas (defined as MWARA's and RDARA's in Part 1, Section I of Appendix 26) should be retained.

# AERONAUTICAL CONFERENCE

Document No. I-62-E
30 January 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

AGENDA

FOR THE THIRD MEETING OF THE TECHNICAL COMMITTEE

31 January 1964 at 0930 a.m. in Room XV

1. To continue consideration of subjects to be studied

   Reference: Document No. I-37. Para. 4

   Item No. 8 R and OR Common frequencies

   To consider draft second report - Document No. DT/I-2

   Item No.10 Use of VHF

   i) To consider draft third report - Document No. DT/I-3

   ii) Document No. I-1 page 119

   Item No.11 Improvements - Document No. I-1 page 120

2. Preliminary consideration of subjects ascribed to Working Group 4A, commencing with iten 12 (Document No. I-37, page 6 refers)

3. Any other business.

J. T. PENWARDEN
Chairman

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# AERONAUTICAL CONFERENCE

Document No. I-63-E
31 January 1963
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

SUMMARY RECORD
OF THE SECOND MEETING OF COMMITTEE 4
(TECHNICAL COMMITTEE)

Thursday, 30 January, 1964, 9.30 a.m.

Chairman: Mr. J.T. PENWARDEN (United Kingdom)

~~Vice-Chairman: Dr. C. WACHARASINDHU (Thailand)~~

1. Summary Record

The Meeting adopted the Summary Record of the first Meeting subject to the addition, in the English text only, at the end of Paragraph 2.3 of the words "as far as possible".

2. Consideration of subjects on the work programme

2.1 Item No. 6 (Continued) — The Meeting adopted the draft First Report on "Basic Principles" (Document No. DT/I-1) subject to the deletion of the second paragraph and noting the editorial changes in the Spanish text.

2.2 Item No. 6 (Concluded) — The Meeting considered a Proposal tabled by Japan relating to "Counter Measures against harmful interference". (Ref: Document No. I-3 Paragraph II). In support of the proposal the Delegate of Japan presented reports of monitoring surveys contained in Addendum No. 1 to Document No. I-3.

During discussion the Delegates of Argentine, Brazil and India confirmed the experience of Japan that certain aeronautical (R) frequencies are liable to harmful interference from the unauthorised emissions of stations of other Services.

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From the foregoing and the views expressed by the Delegate of Canada and the member of the I.F.R.B. it was established that:

a) The subject went rather beyond the Terms of Reference of Committee 4 and the problem was not unique to the Pacific Area.

b) As a basic principle for planning, the security of the exclusive (R) service bands must be assumed under the provisions of RR's 113, 114 and 115, ratified by Members of the Union.

c) Nevertheless due regard had to be paid to the fact that harmful interference could and does exist and in some cases was extremely difficult to cure.

The Meeting noted with regret that certain frequencies in the exclusive Aeronautical (R) bands were subject to harmful interference in the Far East.

It was agreed that the Japanese and any other Administrations concerned and affected be invited to increase their efforts to identify the interfering stations and render reports to the I.F.R.B. In this way further attempts may be made to eliminate the trouble.

The Delegate of Argentine reserved the right to table a specific proposal on this question at a later date.

2.3 Item No. 8
R and OR
Common frequencies

The Delegate of the United States presented his Administration's proposal in Document No. I-1, pages 21, 51 and 52, that the present Provisions for 3023.5 kc/s and 5680 kc/s be maintained. Supported by the Delegate of India with Document No. I-11 the Meeting unanimously adopted the proposals tabled with only very minor editorial change.

The Delegate of India reserved the right to return later to the question of the specific power restrictions on these frequencies.

2.4 Item No. 10
Use of VHF

The Delegate of the United States presented his Administration's proposal No. 8 in Document No. I-1, page 56, that a resolution on the use of VHF for MET Broadcasts be prepared.

The Meeting unanimously adopted this proposal as seconded by the Delegate of the Argentine.

3. In the absence of other business the meeting adjourned at 12.30 p.m.

Rapporteurs:

YOUCEF-KHODJA

J.A. VALLARDARES

Chairman:

J.T. PENWARDEN

# AERONAUTICAL CONFERENCE

Document I-64-E
30 January, 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

SUMMARY RECORD
OF THE FIRST MEETING OF COMMITTEE 5
(OPERATING STATISTICS)
on Wednesday, 29 January, 1964, at
9.30 a.m.

Chairman : Mr. M. CHEF (Territories represented by the French Overseas Posts and Telecommunication Agency)

Vice-Chairmen : Mr. J. MARINSALDA (Argentine Republic)
Mr. J. RUTKOWSKI (Poland, People's Rep.of)

1. The agenda (Document No. 39) was adopted unchanged.

2. Appointment of rapporteurs

The Delegations of the Argentine Republic and of the United States agreed to supply rapporteurs, the former delegation for Spanish and the latter for English. It was agreed that, in accordance with the Rules of Procedure (No. 649), minutes of meetings should take the form of summary records, mentioning merely the main points made and any proposals and findings.

Hence the following were appointed :

Mr. A. Barnabei (United States)
Mr. J. Marinsalda (Argentine Republic)

3. Organization

The Committee's terms of reference, together with a list of documents issued and submitted by 29 January, 1964, appear in Document No. 37.

The Chairman said that he intended to take up as many as possible of the questions with regard to which agreement on the principle involved was feasible. Little drafting groups would be set up to deal with the

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wording of texts. Sub-committees and working parties would be set up e only to discuss special problems which could not be settled in the Committee itself.

The Committee approved.

4. The questions to be considered

The Chairman suggested that the matters to be considered be classified under the following five main headings :

- the grouping of the MWARA
- the grouping of the RNARA
- MWARA flight statistics;
- RNARA flight statistics
- requirements for which no statistics are available :

a) making allowance for past experience, the dissemination of weather data

b) with an eye to the future, requirements for supersonic aircraft and space craft.

5. He had a preliminary proposal to make, namely, that zones be divided up into MWARA and RNARA for the purpose of assembling statistics in accordance with proposals made by a number of Administrations.

The Committee agreed on the procedure suggested.

6. The grouping of MWARA

After much discussion, it was agreed that there should be a review of the existing boundaries of the MWARA, and that areas of overlap should be reduced. Consideration should also be given to setting-up fresh MWARA or extending some of them (trans-Polar lines, for example).

No final decision on boundaries would, however, be possible before the second session of the Conference, when more would be known about flight paths and it would be possible to group them together, thanks to statistical data.

7. The grouping of RNARA

Very few proposals had been submitted for modification in the existing RNARA.

It was considered advisable to keep the boundaries as shown in Appendix 26.

The Committee took note of an I.F.R.B. suggestion to the effect that the existing overlap between Zones 10B, C, D, and E should be reduced.

It was felt that a final decision as to modification of RNARA boundaries should be taken at the second session.

8. Flight statistics

The Chairman drew attention to three things which he considered of capital importance :

a) the information to be assembled

b) the performance of the I.T.U. computer

c) clear and definite instructions should be given to Administrations, so that the information required might be readily transferred to punched cards by the I.F.R.B. Secretariat.

8.1. The Committee thereupon considered two proposals about MWARA statistics (Document No. 21, by the United States, and Document No. 16 by the International Frequency Registration Board). There seemed at first sight to be little basic difference between them.

The Committee observed that the proposals differed on the following minor points :

a) the number of cards required to transcribe long-distance flights with numerous intermediate stops;

b) communications which might be done by VHF;

c) the measurement units used;

d) the definition of flight zones;

e) calculation of point-to-point distances.

It was decided to set up a little working party (the United States, the Netherlands and the I.F.R.B.) to consider whether the two proposals might be merged.

Committee 5 would then undertake a detailed consideration of each heading in the form and would then decide on the points listed above.

8. The meeting rose at 12.30 p.m., the agenda having been exhausted.

Rapporteurs

A. BARNABEI
J. MARINSALDA

Chairman

M. CHEF

# AERONAUTICAL CONFERENCE

Document No. I-65-E
31 January 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

SUMMARY RECORD
OF THE SECOND MEETING OF COMMITTEE 5
(COMMITTEE ON OPERATING STATISTICS)

Thursday 30 January 1964, at 9.30 a.m.

Chairman : Mr. M. CHEF

Vice-Chairmen : Mr. J. MARINSALA
Mr. J. RUTKOWSKI

1. The Agenda (Document No. 54) was adopted without amendment.

2. General examination of questions for study

2.1 Regional and domestic flight statistics

The following documents were examined:

No. 1 (United States) - pages 89 to 92
No. 10 (I.F.R.B.) - pages 19 to 25
No. 38 (U.S.S.R.) - pages 3 and 4

After the documents had been introduced by the delegations concerned and the representative of the I.F.R.B., an extensive discussion took place during which many fairly divergent views were expressed as to the number and the form of presentation of domestic and regional data to be collected.

2.2 It was recognized that RDARA statistics could not be calculated directly from those for MWARA because of the diversity of their flights and because most of the flights had no regular schedules or fixed itineraries. Moreover, too abridged a collection of information might give rise to further requests for additional data at the second session with a view to fixing more accurate bases for the allotment of frequencies for RDARA.

2.3 The Committee considered that it should, nevertheless, provide for a minimum number of data which could be used easily and which would reflect the volume of RDARA flights requiring HF circuits.

2.4 The Delegation of Australia then presented Document No. 16 dealing with a specific method for determining the frequency requirements for RDARA.

After some discussion, the Committee decided that the Chairman should describe to the Steering Committee the coordination required between Committees 4 and 5 in order to arrive at a decision as to what additional constituents which might be incorporated in the statistics so as to facilitate the application of the Australian proposal.

2.5 The following points, to be dealt with in greater detail, emerged from the ensuing discussion on the form in which the statistics for RDARA should be presented.

a) choice of time interval during which the statistics would be collected

b) establishment of an annual weighting coefficient for irregular flights

c) an idea of the VHF circuits of certain RDARA flights

d) number of aircraft with HF equipment

e) average number of aircraft flying in RDARA below 200 KT.

3. Other requirements

As regards the requirements for the dissemination of meteorological information and the establishment of the needs of supersonic aircraft and space vehicles, the Committee decided, on the Chairman's proposal, to amalgamate the various proposals offered and to prepare a recommendation to cover all such needs for submission to the Aeronautical Conference.

4. Since no further questions were raised, the meeting rose at 12.30 p.m. Paragraph 2 of the Agenda (Document No. 54) would remain for discussion at the following meeting.

Rapporteurs :

A. BARNABEI
J. MARINSALDA

Chairman :

M. CHEF

# AERONAUTICAL CONFERENCE

Document No.I.66 E
31 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

Proposal

JAPAN

## Resolution relating to the Use of Frequency in the HF bands allocated exclusively to the Aeronautical Mobile (R) Service

The Aeronautical Extraordinary Administrative Radio Conference, Geneva, 1964,

considering

a) that monitering observations on the use of frequencies in the bands allocated exclusively to the Aeronautical Mobile (R) Service between 2850 and 17970 kc/s, show that a number of frequencies in these bands are being used by stations of services other than the Aeronautical Mobile (R) Service, causing harmful interference to Aeronautical Mobile (R) Communications conducted on some international air routes.

b) that the Aeronautical Mobile (R) Service is a safety service, to which exclusive frequency bands are specially allocated in order to ensure the safety and regularity of the national and international civil air transportation (RR 429);

c) that in order to protect the security of life and property in the air, and to develop aeronautical transportation services in a regular and effective manner, it is indispensable to have the aeronautical mobile communication channels kept free from harmful interference;

resolves

that all administrations, recogniying that the Aeronautical Mobile (R) Service is a safety service, should abstain as far as possible from using frequencies in the bands allocated exclusively to this service by stations of services other than the Aeronautical Mobile (R) Service.

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# AERONAUTICAL CONFERENCE

Document No.I-67-E
31 January 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

A Statement by
The Delegations of the People's Republic of Bulgaria,
the Roumanian People's Republic and
the Czechoslovak Socialist Republic

The Extraordinary Radio Conference which is to produce a revised allotment plan for the aeronautical mobile (R) service has difficult and important problems to solve in this particular field. Such problems can be solved only by close cooperation among all countries operating the service in question.

China is not, however, represented. The persons sent by the Chiang Kai-Shek group cannot take part in the activities of the Conference on behalf of China. The Government of the People's Republic of China is alone competent to appoint China's legitimate representatives at this Conference.

(Signed) M. VELKOV
Head of the Delegation
of the People's Republic
of Bulgaria

(Signed) I. PETRARU
Head of the Delegation
of the Roumanian
People's Republic

(Signed) M. ZAHRADNIČEK
Head of the Delegation
of the Czechoslovak
Socialist Republic

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# AERONAUTICAL CONFERENCE

Document No. I-68-E
29 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 6

SUMMARY REPORT
OF THE FIRST MEETING OF COMMITTEE 6
(EDITORIAL COMMITTEE)

Wednesday, 29 January 1964, 3 p.m.

Chairman : Mr. P. BOUCHIER (Belgium)

Vice-Chairmen - Mr. M. SANTIAGO SHAW (Spain)
Mr. R.O. HEWITT (Canada)

1. Appointment of Rapporteurs of the Editorial Committee

The Rapporteurs will be :

for French - the Chairman of Committee 6
for Spanish - the Vice-Chairman (Spain) of Committee 6
for English - the Vice-Chairman (Canada) of Committee 6

2. Organization of the work of the Editorial Committee

2.1 Mr. Winter-Jensen, was made responsible for looking after the Committee's material requirements with appropriate assistance from the Secretariat.

2.2 It was decided that by Friday, 31 January 1964, at latest, one French-speaking, one Spanish-speaking and one English-speaking delegate should be designated to participate actively in the work of the Editorial Committee.

Mr. Monnat (Switzerland) agreed to designate a French-speaking member of the Swiss Delegation. The Latin American Delegations, notably Mexico and Argentina, agreed to designate a Spanish-speaking delegate. Mr. Turl (United Kingdom Overseas Territories) agreed to participate as English-speaking delegate.

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2.3 To enable it to carry out its work expeditiously, the Editorial Committee considers it necessary to ask the Chairmen of the other committees, particularly those of Committees 4 and 5, to submit texts, even short ones, immediately they have been approved in committee in order to avoid an accumulation of work at the end of the conference.

2.4 **In order to facilitate the work, Chairmen of Committees should be requested to submit each document in triplicate in each of the three working languages (English, French, Spanish) in the form in which it has been approved. Chairmen of Committees should initial the text in their own language and Rapporteurs might initial the other two texts respectively. The Editorial Committee will base itself on the text submitted in the language of the Chairman.**

2.5 The first session of the conference will establish technical bases on which the second session should act and it also might make concrete suggestions regarding modifications of certain Articles of the Radio Regulations. If so suggestions for modifications to Articles or paragraphs of the Regulations should be submitted to the Editorial Committee in a form given in Annex 1, insofar as is compatible in view of the different numbering system of Appendix 26 of the Regulations. Symbols reading "MOD", "SUP", or "ADD" (Modification, Suppression, Addition) will thus be placed in the margin to the left of the text to be modified.

3. Presentation to the Plenary Meeting of the documents reviewed by the Editorial Committee

The text to be approved by the Plenary Meeting will be given two successive readings. It will appear first as a blue document, then as a pink document, and the final document will be white. Since the conference is intended to be preparatory with final decisions to be taken at the Second Session in 1965, the documents of the present session should be kept as simple as possible in order to save both work and expense. All three types of documents will thus be roneoed instead of printed though the white document might have a more imposing cover.

4. Form to give to the results of the First Session of the Aeronautical Extraordinary Administrative Radio Conference

4.1 After discussion it was agreed that the results of this First Session will be presented as a report to the Second Session and that in order to give it sufficient weight, this report should be signed by the delegations present at the First Session. It was also agreed that this Report should be presented to the Administrative Counsil and be circulated to all Members of the Union.

4.2 The Committee set up a small Working Group to draft a suggested framework of the Report, taking into account the opinions expressed during the discussion; this working group will consist of : the Chairman of Committee 6, his two Vice-Chairmen, a delegate of Belgium, and of the USA.

5. Other business

Mr. Chef, Chairman of Committee 5, suggested that printed proformas be sent to the Administrations together with the Report in order to insure uniform submission of statistics regarding flights etc. to the I.F.R.B.

The meeting was ajourned at 5.45 p.m. Next meeting on Friday 31, 3 p.m. to continue discussion point 3 of the Agenda.

Rapporteurs

M. SANTIAGO SHAW
R.O. HEWITT

Chairman

P. BOUCHIER

Annex : 1

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# A N N E X

## LAY-OUT OF TEXTS SUBMITTED TO THE EDITORIAL COMMITTEE

Former reference

Chapter:
Article:
Numbers:

Source

Committee No.

| Title | (MOD) | |
|---|---|---|
| | | . . . . . |
| | | . . . . . |
| | | . . . . . |
| | | . . . . . |
| 87 | SUP | |
| 87a | ADD | . . . . . |
| | | . . . . . |
| | | . . . . . |
| 88 | MOD | . . . . . |
| | | . . . . . |
| | | . . . . . |
| 90 | ADD | . . . . . |
| | | . . . . . |
| | | . . . . . |

# AERONAUTICAL CONFERENCE

Document No. I-69-E
31 January 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 2

AGENDA
OF THE FIRST MEETING
OF COMMITTEE 2
(CREDENTIALS)

Monday, 3 February 1964, at 4.45 p.m., Room XVI

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1. Designation of rapporteurs
2. Organization of the work
3. Any other business

A. R. RAMANATHAN
Chairman

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# AERONAUTICAL CONFERENCE

Addendum to
Document No. I-70-E
14 February 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

ADDENDUM TO SECOND REPORT OF COMMITTEE 4 (TECHNICAL)

Channels common to R and OR Services

Resulting from further study of the subject of "Power of emission", to which reference is made in the second paragraph of the Second Report, Committee 4 unanimously agreed to retain the power limitations appearing in paragraph 2a) and 2b) in the Remarks Column on pages 38 and 41 of Appendix 26 (pages 4 and 5 of Document No. I-70 refer). However, the Committee unanimously approved the following related amendment of paragraphs 2d) for the frequencies 3023.5 kc/s and 5680 kc/s :

Column 3, paragraph 2d), pages 38 and 41, Appendix 26 :

"d) the power of aeronautical stations which use this frequency and which operate under the conditions prescribed above may be increased to the extent necessary to meet certain operational requirements, subject to co-ordination between the Administrations directly concerned and those whose services may be affected;"

J.T. PENWARDEN
Chairman
Committee 4

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# AERONAUTICAL CONFERENCE

Document No. I-70-E
31 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

## SECOND REPORT OF COMMITTEE 4 (TECHNICAL)

Channels common to R and OR Services

Following a study of proposals by Administrations and of a report of studies by the I.F.R.B., Committee 4 unanimously reached the conclusions which appear in the Annex attached hereto.

In submitting the attached texts, Committee 4 recognized the possible need to amend the values of transmitter power quoted. Any need for such change would result from the Committee's studies on the subject of "Power of emission" (Document No. I-37 paragraph 4, Item 4 refers).

J.T. PENWARDEN
Chairman

Annex : 1

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# A N N E X

## CHANNELS COMMON TO R AND OR SERVICES

In any revision of the Frequency Plan for the Aeronautical Mobile R Service in the exclusive bands between 2850 and 17,970 Kc/s, the provision of channels common to the R and OR Services, as foreseen in paragraph 3 of Section II A in Part I of Appendix 26, should be retained.

---

Note : Minor amendments to paragraph 3, page 38, and paragraph 3, page 41 of Appendix 26 are attached hereto.

[Amend the particulars of use of 3023.5 kc/s, appearing on page 38 of Appendix 26, as follows] :

| Frequency kc/s<br>1 | Authorized area of use<br>2 | Remarks<br>3 |
|---|---|---|
| 3023.5 | World-wide | Authorized for world-wide use for the (R) and (OR) services as follows :<br>1) aboard aircraft for :<br>a) communications with approach and aerodrome control;<br>b) communication with an aeronautical station when other frequencies of the station are either unavailable or unknown;<br>2) at aeronautical stations for aerodrome and approach control under the following conditions:<br>a) for approach control with power limited to a value that will produce 20 μV/m at 100 km and in any case no more than 20 watts in the antenna circuit,<br>b) for aerodrome control with the power limited to a value that will produce 20 μV/m at 40 km and in any case no more than 20 watts in the antenna circuit,<br>c) special attention must be given in each case to the type of antenna used in order to avoid harmful interference,<br>d) the power of aeronautical stations which use this frequency and which operate under the conditions prescribed above may be increased through I.T.U. and/or I.C.A.O. regional agreements to the extent necessary to meet certain operational requirements;<br>3) for intercommunication between ~~mobile~~ stations <u>in the mobile services engaged</u> in co-ordinated search and rescue operations;<br>4) the specific application of this frequency for the above purposes may be decided at regional aeronautical conferences;<br>5) this channel may be used for A1 or A3 emissions, in accordance with special arrangements. It shall not be subdivided. |

[Amend the particulars of use of 5680 kc/s, appearing on page 41 of Appendix 26, as follows]:

| Frequency kc/s 1 | Authorized area of use 2 | Remarks 3 |
|---|---|---|
| 5680 | World-wide | Authorized for world-wide use for the (R) and (OR) services as follows :<br>1) aboard aircraft for:<br>a) communications with approach and aerodrome control,<br>b) communication with an aeronautical station when other frequencies of the station are either unavailable or unknown;<br>2) at aeronautical stations for aerodrome and approach control under the following conditions:<br>a) for approach control with power limited to a value that will produce 20 µV/m at 100 km and in any case no more than 20 watts in the antenna circuit,<br>b) for aerodrome control with the power limited to a value that will produce 20 µV/m at 40 km and in any case no more than 20 watts in the antenna circuit,<br>c) special attention must be given in each case to the type of antenna used in order to avoid harmful interference,<br>d) the power of aeronautical stations which use this frequency and which operate under the conditions prescribed above may be increased through I.T.U. and/or I.C.A.O. regional agreements to the extent necessary to meet certain operational requirements;<br>3) for intercommunication between ~~mobile~~ stations <u>in the mobile services engaged</u> in co-ordinated search and rescue operations;<br>4) the specific application of this frequency for the above purposes may be decided at regional aeronautical conferences;<br>5) this channel may be used for A1 or A3 emissions, in accordance with special arrangements. It shall not be subdivided. |

# AERONAUTICAL CONFERENCE

Document No. I-71-E
31 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

THIRD REPORT OF COMMITTEE 4 (TECHNICAL)

Use of VHF for Meteorological Broadcasts in the Aeronautical Mobile (R) Service

Following a study of a proposal by one Administration Committee 4 unanimously adopted the draft Resolution which appears in the Annex attached hereto.

J. T. PENWARDEN
Chairman

Annex : 1

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# A N N E X

## RESOLUTION No.____

## RELATING TO THE USE OF VHF FOR METEOROLOGICAL BROADCASTS IN THE AERONAUTICAL MOBILE (R) SERVICE

The Aeronautical Extraordinary Administrative Radio Conference, (Geneva, 1964),

considering

a) that the number of channels available for the Aeronautical Mobile (R) Service in its frequency bands between 2850 and 17970 kc/s is limited;

b) that the need for frequencies for aeronautical mobile (R) communications and for meteorological broadcasts to civil aircraft is increasing;

c) that the propagation characteristics of high frequencies make them essential for satisfaction of civil aviation requirements for transmission of necessary information over long distance;

d) that Recommendation No. 13 of the International Administrative Aeronautical Radio Conference (Geneva, 1949) and Resolution No. 14 of the Administrative Radio Conference (Geneva, 1959) urge Administrations "to make as great a use as possible of very high frequencies in order to lessen the load on the high frequency (R) bands";

e) that substantial technical progress has been made by civil aviation during the interim since 1949 in extending the useful range of very high frequencies (VHF) to meet the needs for communication by the Aeronautical Mobile (R) Service;

f) that this extension of the useful range of VHF offers the potential of satisfaction of a portion of the increasing needs for meteorological broadcasts to civil aircraft;

resolves

that Administrations, to the maximum extent feasible, employ VHF frequencies for the satisfaction of their requirements for meteorological broadcasts to civil aircraft.

# AERONAUTICAL CONFERENCE

Document No. I-72-E
31 January, 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

AGENDA

FOR THE FOURTH MEETING OF THE TECHNICAL COMMITTEE

3 February, 1964 at 9.30 a.m. in Room XV

1. Preliminary consideration of subjects ascribed to Working Group 4A, commencing with Item 12

   Item 12 Number of aircraft which can be served on a frequency or family of frequencies :

| | | | | |
|---|---|---|---|---|
| Document No. | I-1 | USA | page | 87 |
| " | I-11 | IND | " | 3 |
| " | I-12 | IFRB | " | 2 |
| " | 1-16 | AUS | " | 7 |
| " | I-33 | G | " | 5 |

2. To continue consideration of subjects to be studied

   Reference : Document No. I-37, Para. 4

   Item 10 Use of VHF

   To consider draft Fourth Report - Document No. DT/I-4

   Item 11 Improvements

   To consider draft Fifth Report - Document No. DT/I-5

3. Any other business.

Chairman :

J.T. PENWARDEN

ARCHIVES U.I.T. GENÈVE

# AERONAUTICAL CONFERENCE

Document No.I-73-E
3 February 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

SUMMARY RECORD
OF THE THIRD MEETING OF COMMITTEE 4
(TECHNICAL COMMITTEE)

Friday 31 January 1964, 9.30 a.m.

Chairman : J.T. PENWARDEN (United Kingdom)

Vice-Chairman : Dr. C. WACHARASINDU (Thailand)

1. Consideration of subjects of the Work Programme.

(Document No.I-37 paragraph 4 refers)

1.1 Item 8 - Channels common to "R" and "OR" Services

The Meeting adopted the draft second report as contained in Document No.DT/I-2 once the words "at the scene of the disaster" had been deleted from paragraph 3 on pages 3 and 4.

Noting the I.F.R.B. Member's interpretation that there was no power restriction on stations when engaged on search and rescue operations, the Committee accepted the possible need to change the power figures for aerodrome and approach control. This may arise from the Committee's study under the heading "Powers of Emission".

1.2 Item No.10(a) Use of VHF for meteorological broadcasts

The Meeting adopted unanimously the draft third report as contained in Document No.DT/I-3.

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1.3 Item No.10 (b) relating to the use of VHF

The Meeting considered a draft Resolution proposed by the United States of America concerning the treatment to be given to (R) service requirements capable of being met by VHF (proposal No.25, page 119 of Document No.I-1 refers).

Supported by the Delegate of the Argentine, this proposal became the subject of considerable discussion.

Many delegations expressed their concern at what was construed to be an obligation on Administrations to provide VHF cover if the second session of the Conference so decided. Despite these and other objections there was no dissent from the intent of the resolution and tentative agreement was reached on amendments to the text.

The Meeting agreed to re-examine the draft Resolution when a revised document had been prepared.

1.4 Item No.11 - Improvements in techniques

The Meeting then considered a draft resolution proposed by the United States of America relating to Administrations' plans for the future which may affect the use of HF. (Proposal No.26, page 120 of Document No.I-1 refers).

In discussion some delegations sought clarification of certain points and proposals for changes in the text were made. There was no objection raised at the principle behind the proposal and due note was taken of the I.F.R.B. Member's view that information to be obtained as a result would be very useful.

It was agreed to re-examine a draft incorporating the changes made.

2. Future work

(Ref. document No.I-56 - Summary record of 1st. meeting)

The Chairman reminded the meeting of its earlier decisions to allot subjects as between the full Committee and working groups 4A and 4B. As a result most of the tasks ascribed to the Committee under Section 1 had been carried to an advanced stage of completion.

Committee 5 had made an urgent request for Committee 4's guidance on matters affecting their work of preparing the formulae required for assessing channel requirements. In particular, decisions on Item No.12 were required.

The need for Working Group 4A to start its work was thus urgent and the Chairman invited nominations for a Chairman.

The Delegate for Australia drew attention to the valuable contributions made by the United States Administration to the subjects allotted to the Group and invited the United States Delegate if he could consider accepting the responsibility.

The Delegate for the United States responded and nominated Mr. G. W. HAYDON.

The Meeting readily accepted this offer and it was agreed to invite Mr. Haydon to convene W.G.4A as soon as convenient and to give priority to the consideration of Item 12.

3. In the absence of other business the meeting adjourned at 12.55 hrs.

| Rapporteurs | Chairman |
|---|---|
| M. YOUCEF-KHODJA | |
| M. YOUCEF-KHODJA | J.T. PENWARDEN |
| J. VALLADARES | |

# AERONAUTICAL CONFERENCE

Document No. I-74-E
31 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

Brazil

REVISION TO THE APPENDIX 26 TO INTERNATIONAL TELECOMMUNICATION UNION RADIO REGULATIONS

Study of Proposition

PART I

General Provisions

Section II

Technical and Operational Principles used for the Establishment of the Plan of Allotment of Frequencies in the Aeronautical Mobile (R) and (OR) Services.

A. Determination of Channel Width

1. .....

2. .....

3. Channels Common to (R) and (OR) Services

The Brazilian Administration supports Recommendation 4/1 (I.C.A.O. Document 8329, COSP II).

However, considering :

a) the need for improved reception conditions aboard aircraft

b) that airborne equipment has usually a power greater than 100 watts

c) that mobile stations engaged in search and rescue operations may be located at considerable distances as well as at tropical zones where noise level average is very high;

Suggests that besides the amendment proposed in the above mentioned recommendations it should be deleted the power limitations imposed (20 watts) as now prescribed for both frequencies (3023.5 and 5680 kc/s).

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# AERONAUTICAL CONFERENCE

Document No. I-75-E
31 January 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

Brazil

REVISION TO THE APPENDIX 26 TO INTERNATIONAL TELECOMMUNICATION UNION RADIO REGULATIONS

Study of Proposition

PART II

Plan for the Allotment of Frequencies for the Aeronautical Mobile (R) Service in Exclusive Bands between 2850 and 17970 kc/s.

Section I

Description of the Major World Air Route Areas (MWARA) and Regional and Domestic Air Route Areas (RDARA) and sub-RDARA Boundaries.

Article 2

Description of the Regional and Domestic Air Route Area (RDARA) 12-H Boundaries.

In reviewing the Regional and Domestic Air Route Areas (RDARA) 12-H, for the purpose of simplifying it and readjusting its limits to the present air traffic pattern, examination of this particular sub-area was made and the following observations made:

a) remarkable development in the Amazon region has been observed, with new airports being constructed for national airlines, some of them being placed close to neighbouring countries located in the same sub-area 12-H (see attached drawing);

b) the very air traffic growth in this region has required the Brazilian administration to plan for the installation of two new Area Control Centres (A.C.C.) at MANAUS and PORTO VELHO;

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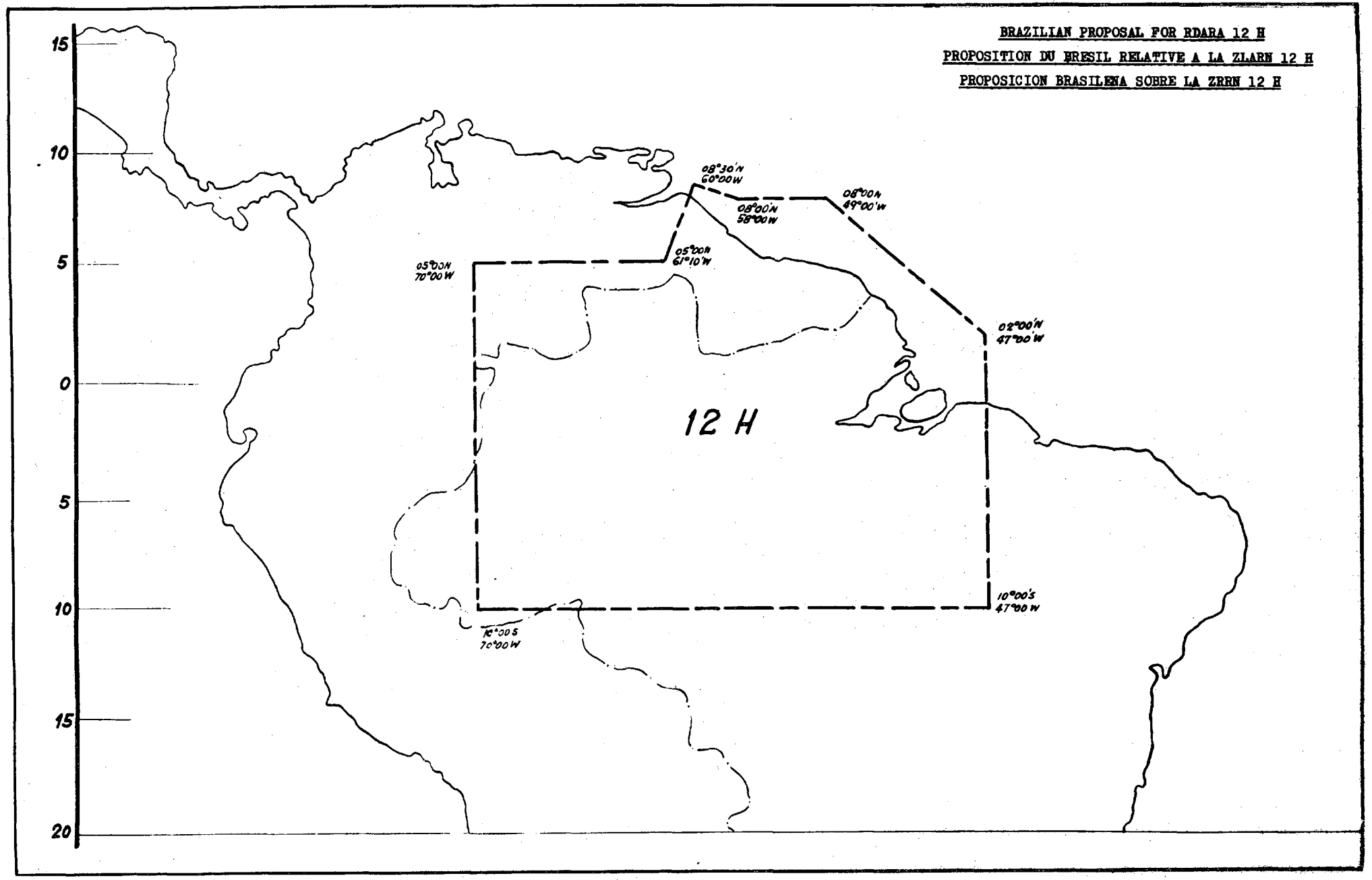
As a consequence of the above, Brazil considers of great importance that the present sub-area 12-H be modified, in order to meet the air traffic growth from its territory to neighbouring countries, and for this purpose suggests the study of the following proposition.

To amend the boundaries of sub-RDARA 12-H, to read: From the point 10°S 70°W, through the points 5°N 70°W, 5°N 61°10'W, 8°30'N 60°W, 8°N 58°W, 8°N 49°W, 2°N 47°W, 10°S 47°W to the point 10°S 70°W.

Annex : 1


BRAZILIAN PROPOSAL FOR RDARA 12 H
PROPOSITION DU BRESIL RELATIVE A LA ZLARN 12 H
PROPOSICION BRASILENA SOBRE LA ZRRN 12 H
15
10
5
0
5
10
15
20
08°30'N 60°00W
08°00N 49°00'W
08°00N 58°00W
05°00N 61°10'W
05°00N 70°00W
02°00'N 47°00'W
12 H
10°00'S 47°00 W
10°00 S 70°00 W

# AERONAUTICAL CONFERENCE

Document No I-76-E
3 February 1964
Original: Spanish

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

Argentina

PROPOSAL No. 9

concerning alterations of the boundaries of MWARA SA
(Appendix 26, Part II, Section I. Article 1).

That the Aeronautical Extraordinary Administrative Radio Conference should alter the present boundaries of MWARA SA as shown in Appendix 26, Part II, Sec I, Art. 1 so as to coincide with the recommendations made in the report COSP-II of I.C.A.O., with the inclusion of Brasilia, Trinidad and Monrovia, and a note to indicate that the frequencies noted in SA in the new Allotment Plan could be used in Buenos Aires when required by operations; and

That the family of frequencies should be calculated on the basis of the maximum length of the area, as amended, as far as Buenos Aires.

Reason: In accordance with Recommendations 2/1 and 2/7 of the Special Meeting of I.C.A.O. (COSP-II) and the proposal by Brazil (Document I-53), so as to meet existing and impending or future operations in this MWARA

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# AERONAUTICAL CONFERENCE

Document No. I-77-E
31 January 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

IRELAND

1. The I.C.A.O. Special Commissions Meeting Montreal, 1963, Recommendation Nos. 8/1 and 8/5 encouraged states to study the Concentration Factor K and the number of aircraft which can be accomodated on a single frequency and on a family of frequencies.

2. Arising from these Recommendations studies were carried out to determine the K Factor for MWARA-NA and also to test whether the figures of ten aircraft per frequency and twelve aircraft per family of frequencies are still valid.

3. K.Factor

The table below shows the results obtained for three different dates :

| | 12.7.63 | 14.7.63 | 23.8.63 |
|---|---|---|---|
| Busiest hour | 0400-0500 | 0400-0500 | 0400-0500 |
| Peak number of aircraft | 80 | 64 | 71 |
| Average number of aircraft | 37 | 29 | 33 |
| K Factor | 2.16 | 2.2 | 2.4 |

4. Number of aircraft that can be accomodated on a single frequency

The attached Table (Annex 1) shows the relationship between the number of aircraft in communication with the ground stations of the network during the busiest hour and the resulting occupancy of the channels. It can be seen that a figure of ten aircraft results in an occupancy of 43% for the frequency 5671 kc/s and a similar figure is arrived at for the frequencies 5641 kc/s, 2987 kc/s and 2945 kc/s if it is assumed that there is a

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linear relationship between the number of aircraft and channel occupancy. On this basis it appears that the figure of ten aircraft per frequency is satisfactory.

5. Number of aircraft which can be accomodated on a family of frequencies

The basis on which the figure of twleve aircraft per family of frequencies was determined is not known. It appears likely that the figure of twelve was arrived at on the assumption that only one frequency of a family is fully operational at any given time of the day. Observation of the frequency loading pattern at Shannon tends to show that there is a reasonable division of traffic load between two frequencies of a family at any period.

Graphs supporting this contention are attached as Annex 2.

In view of these considerations the Irish Delegation is of the opinion that the figure of twelve aircraft for a family of frequencies is pessimistic for the MWARA-NA.

However, the Irish Delegation do not wish to advance a revised figure but would welcome discussion on the matter.

Annexes : 2

# A N N E X 1

## CHANNEL LOADING AND CHANNEL CAPACITY

Survey carried out at Shannon Aeradio in accordance with Recommendation 8/5 contained in DOC 8329 COSP/11 in order to find out whether the figures 12 and 10 for the numbers of Acft that can be accommodated on a family of frequencies and a single frequency respectively are still valid.

### Procedure adopted

Tape recordings of the frequencies listed below were taken on the Recording Unit at ATC Shannon over a prolonged period. A count was made on each frequency for the total number of different aircraft in Flight for what was considered to be the busiest hour i.e. 0400-0500. A second run through each frequency for the same hour was made, this time to find out the percentage occupancy for each frequency using a stop watch.

### RESULTS

| Reel No. | Freq kc/s | Family | Duration of Recording | Date of Recording | Hour selected for Survey | Nr. of diff. Aircraft on Frequency | % Occupancy | R E M A R K S |
|---|---|---|---|---|---|---|---|---|
| 65 | 5641 | C.European | 2038/0900 | 7/8 Sep '63 | 0400-0500 | 17 | 85.5 | A good freq. Very smooth working. |
| 49 | 5671 | B.American | 0000/1340 | 9 Sep '63 | 0400-0500 | 10 | 43 | Freq.considered quiet.Static thru hour. |
| 113 | 2987 | B.American | 2242/1153 | 9/10 Sep '63 | 0400-0500 | 18 | 70.5 | Excellent wking freq.Catered well for the 18 acft. Sigs. loud and clear. |
| 130 | 2945 | C.European | 2053/0609 | 10/11 Sep '63 | 0400-0500 | 21 | 86.6 | Freq. appeared overcrowded. A lot of QRM due jamming each other resulting in rqsts for fill ins and some qucueing up. |
| 80/91 | 2931 | A.South | 1941/0452<br>0452/1357 | 11/12 Sep '63 | 0400-0500 | 1 | 1.6 | Nil doing on this freq. |
| 40 | 5611 | A.South | 2304/1221 | 12/13 Sep '63 | 0400-0500 | 6 | 42 | Hvy.bkgrnd.bkthru Rtty Xmission.Fading. |
| 4 | 2868 | D.North | 0054/1000 | 14 Sep '63 | 0400-0500 | 3 | 17 | Freq. very quiet. Static thru the hour. |
| 71 | 5626 | D.North | 1933/0920 | 14/15 Sep '63 | 0400-0500 | 17 | - | Static heavy on this freq. with sigs. fading and unreadable at times. |

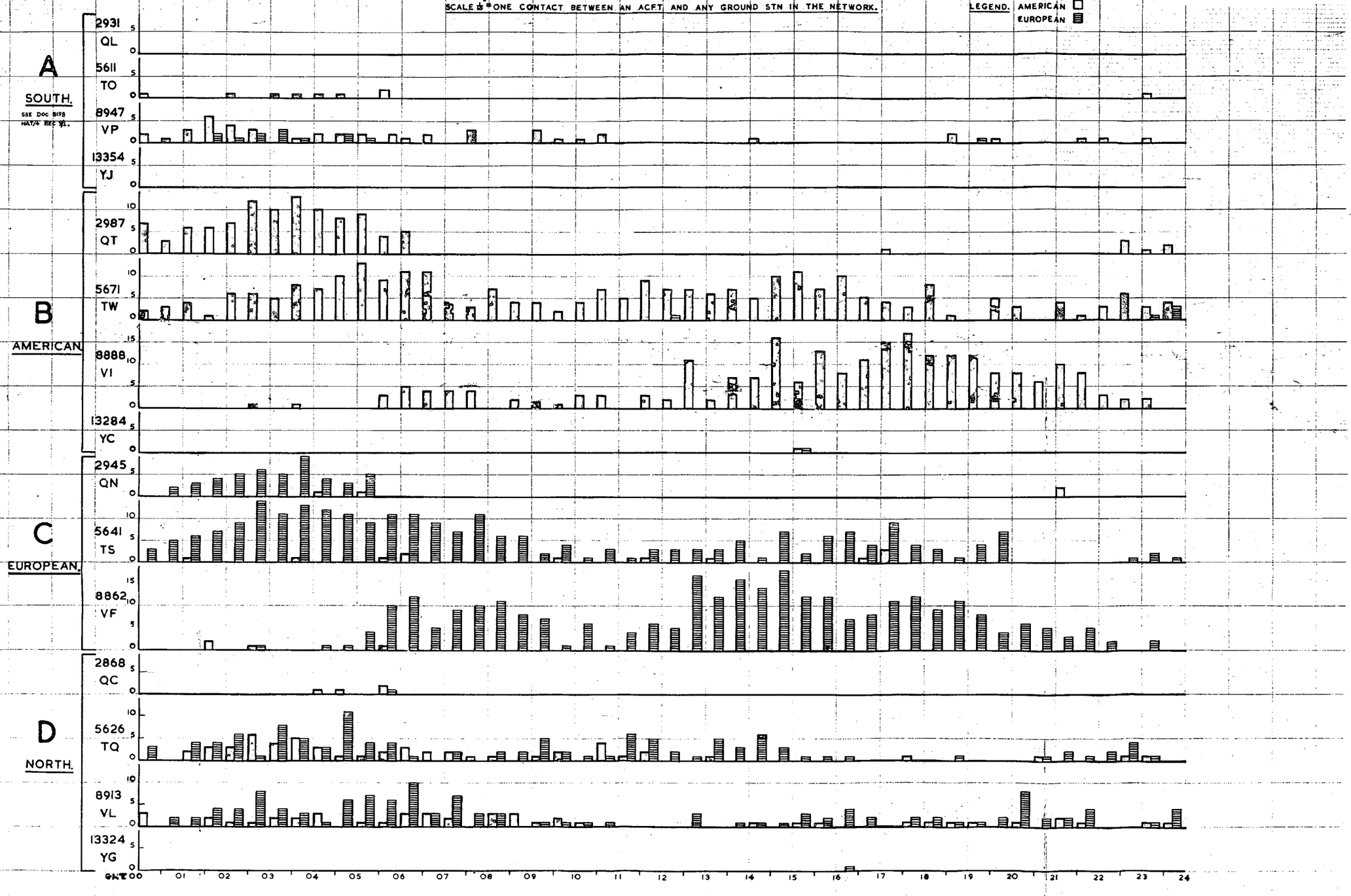
ANNEXE 2
ANNEX 2
ANEXO 2

DOC. I-77

# AIR – GROUND – AIR FREQUENCY LOADING 30·6·1962.

SCALE ☆ = ONE CONTACT BETWEEN AN ACFT AND ANY GROUND STN IN THE NETWORK.

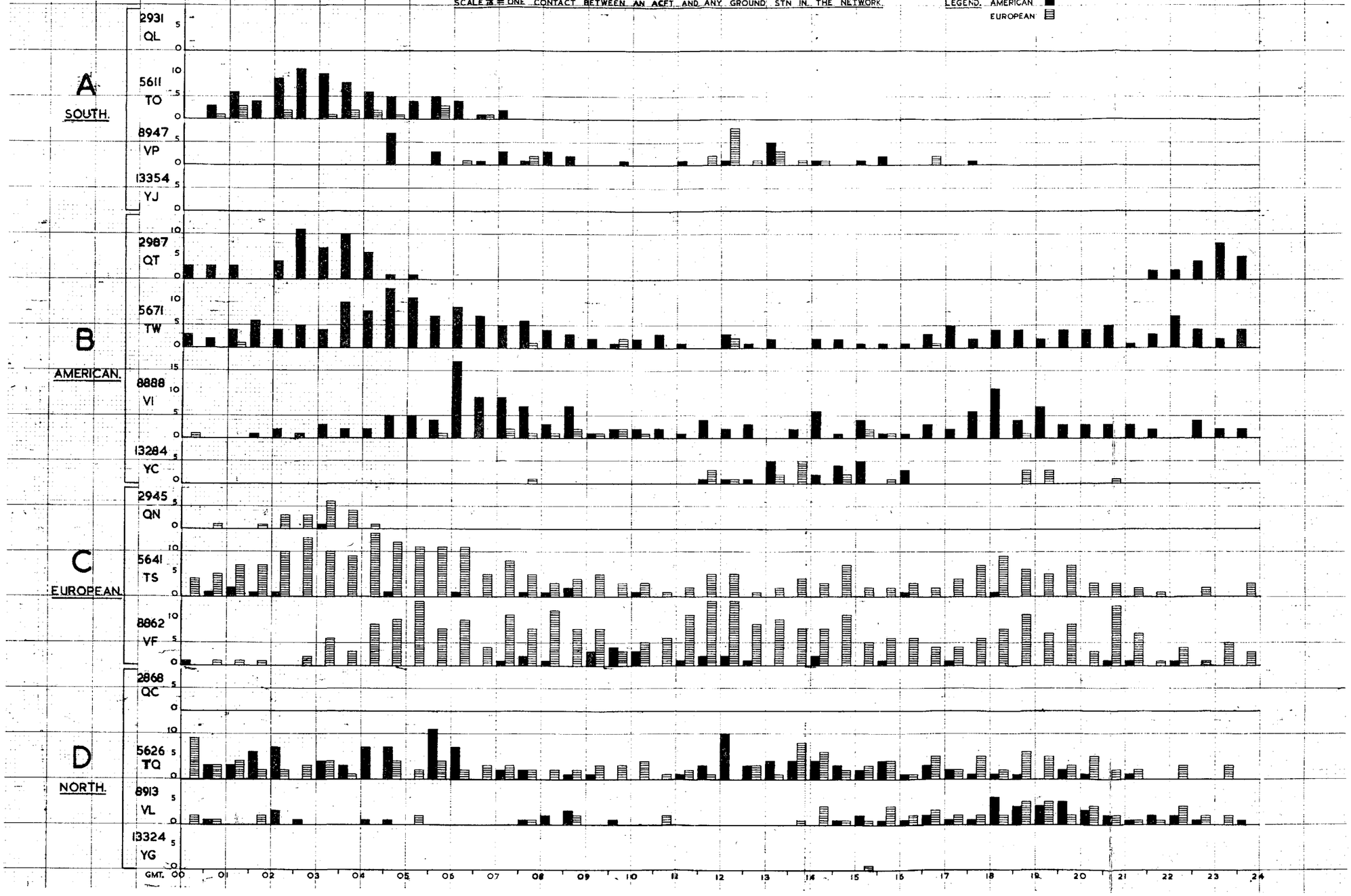
LEGEND. AMERICAN □ EUROPEAN ▤



# AIR – GROUND – AIR FREQUENCY LOADING 1·7·1961.

SCALE ½" = ONE CONTACT BETWEEN AN ACFT. AND ANY GROUND STN IN THE NETWORK.

LEGEND. AMERICAN ■
EUROPEAN ▤



# AERONAUTICAL CONFERENCE

Document No.I-78-E
1 February 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

Brazil

## REVISION TO THE APPENDIX 26 TO INTERNATIONAL TELECOMMUNICATION UNION RADIO REGULATIONS

Considering the necessity to meet the meteorological requirements of international aviation, operating over regions embraced by the MWARA South Atlantic (SA) and South America (SAM);

Considering the improved use of high speed aircraft over the region, and the respective delays in obtaining such meteorological informations by the present system of "request-and-reply" method;

Considering that, notwithstanding the present recommendations, regarding the use of VHF transmission for that purpose, our nowadays operational conditions are unsatisfactory to attend such requirements;

It is suggested that, when reviewing Appendix 26 to Radio Regulations of I.T.U., provision should be made for the allotment of one HF family of frequency to be exclusively employed in broadcasting transmission of meteorological informations to international aviation, in the portion of SA and SAM regions.

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# AERONAUTICAL CONFERENCE

Document No.I-79-E
1 February 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

STATEMENT
BY THE DELEGATION OF THE REPUBLIC OF CHINA
TO THE E.A.R.C. FOR THE PREPARATION
OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL
MOBILE (R) SERVICE - GENEVA

With reference to the statements by the U.S.S.R., (Doc. No.I-49-E, 29 January 1964) and by the Delegations of the People's Republic of Bulgaria, the Roumanian People's Republic and the Czechoslovak Socialist Republic (Doc. No. I-67-E, 31 January 1964), I wish to make the following statement:

> "The Government of the Republic of China which my delegation has the honour to represent is the only legally constituted Government of China recognized as such by the United Nations and its specialized agencies, including the I.T.U.
>
> My delegation rejects the implications contained in the two documents."

I request that this statement be issued as an official document of the Conference.

(Signed) Paonam CHENG

Ambassador

Head of the Delegation
of the Republic of China

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AERONAUTICAL CONFERENCE

Document No. I-80-E
1 February, 1964
Original : French

E.A.R.C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

SUMMARY RECORD

OF THE THIRD MEETING OF COMMITTEE 5

(OPERATING STATISTICS)

on Friday, 31 January, 1964, at 9.30 a.m.

Chairman : Mr. M. CHEF

Vice-Chairmen : Mr. J. MARINSALDA
Mr. J. RUTKOWSKI

1. The Committee continued with the agenda for the previous meeting (Document No. 54, paragraph 2).

2. Form for MWARA statistics

The Delegate of the United States and the representative of the I.F.R.B. introduced the first conclusions arrived at by the Working Party (5/1) asked to consider whether the two original proposals could be merged.

After some discussion, the Committee felt that the following factors were interdependent and could not readily be dissociated :

- the kind of information to be assembled
- the lay-out
- ease of entry
- later use of data.

The latter, especially, it was considered, will determine whether a computer can be used to set forth the data derived from analysis, or whether one can make do with a classical mechanical system with tabulator and card-sorting device, with possible manual operations as well.

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2.1 Working Party 5/1 was asked to continue its investigations and to draw up a list of pros and cons for each of the two procedures advocated (Documents Nos. 10 and 21), bearing in mind the following rules, agreed upon by the Committee :

a) the date of each stop en route must be specified

b) there is no need to cater for VHF coverage

c) the number representing the distance between landing points would have to be a whole number

d) the forms would not require particulars of flights when air/ground communications (ATC and OPN) are by VHF (such as London-to-Paris or Chicago-to-New York).

2.2 Inspection of the I.T.U. computer

Mr. Zio/kowski, member of the I.F.R.B. said that it would be possible to arrange for the members of the Committee to inspect the I.T.U. computer, together with the tabulator and card-sorting device, so that delegates might get some idea of the various operations required in evolving flight statistics.

The Chairman, thanking Mr. Zio/kowski, accepted the invitation on behalf of the Committee and said he would decide on a suitable date.

3. Preparation of a draft report

On a proposal by the Chairman, the Committee decided to set up a drafting group (5/2) to draw up a draft report on possible changes to be made, at the second session of the Conference, in the boundaries of the MWARA and RNARA.

The working party would also draw up a list of requirements in connection with the dissemination of weather information, and in connection with communications with supersonic aircraft and space craft.

To this end, it was agreed that the working party would bear in mind the various proposals submitted by Administrations, most of which reflected recommendations made by I.C.A.O.

The relevant documents are listed in paragraphs 5.1 to 5.4 of Document No. 37, to which must be added Document No. 53, submitted by Brazil.

3.1 Delegates and representatives of the following countries and organizations were appointed members of this working party :

- Canada
- United States
- United Kingdom of Great Britain and Northern Ireland
- I.F.R B
- I.C.A.O.
- I.A.T.A.

4. No other point being raised, the meeting rose at 12.30 p.m.

Rapporteurs

A. BARNABEI

J. MARINSALDA

Chairman

M. CHEF

# AERONAUTICAL CONFERENCE

Document No.I-81-E
1 February 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

AGENDA

FOR THE FOURTH MEETING OF THE

OPERATING STATISTICS COMMITTEE

on 3 February, 1964 at 9.30 a.m., in Room XVI

1. Adoption of the summary records of the first and second meetings (Documents Nos. 64 and 65)

2. Further consideration of MWARA flight statistics:
   a) the kind of data to be supplied to the I.T.U.
   b) how the figures should be analysed, and how the results should be set forth
   c) how the basic data should be set out

3. Any other business.

M. CHEF
Chairman

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# AERONAUTICAL CONFERENCE

Document No. I-82-E
3 February, 1964
Original: French
English
Spanish

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 6

SUMMARY RECORD

OF THE SECOND MEETING OF COMMITTEE 6

(EDITORIAL COMMITTEE)

Friday, 31 January, 1964, 3.00 p.m.

Chairman : Mr. P. BOUCHIER (Belgium)

Vice-Chairmen : Mr. M. Santiago SHAW (Spain)
Mr. R.O. HEWITT (Canada)

1. Form to give to the results of the work of the first session of the Conference

The Committee examined Document No. DL/I-4 prepared by the small drafting group formed at the first meeting (see point 4.2 of Document No. I-68). A number of amendments were discussed and these will be adopted during the third meeting of this Committee. The question of signatures to the report of the first session of the Conference will be also discussed during the third meeting.

2. Other business

The meeting was adjourned at 17.55. The next meeting will occur at 15.00 on 4 February in Room XVI.

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Chairman :

P. BOUCHIER

# AERONAUTICAL CONFERENCE

Document No. I-83-E
3 February 1964
Original: French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 6

AGENDA OF THE

THIRD MEETING OF THE DRAFTING COMMITTEE

Tuesday, 4 February at 3 p.m. in Room XVI

1. Approval of the summary records of the first and second meetings (Documents No. I-68 and I-82);

2. Discussion on the form in which the results of the first session of the Conference should be presented (continued) (Document No. DL/I-4(Rev.));

3. Other business.

P. BOUCHIER,
Chairman

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GENÈVE

# AERONAUTICAL CONFERENCE

Document No. I-84-E
3 February, 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

AGENDA

FOR THE FIFTH MEETING

OF THE TECHNICAL COMMITTEE

4 February, 1964, at 9.30 a.m. in Room XI

1. To adopt Summary Record of the third Meeting - Document No. I-73

2. To adopt draft sixth Report - Document No. DT/I-6

   Draft Resolution No. .....

   Relating to the use of frequencies in the HF bands allocated exclusively to the Aeronautical Mobile (R) Service

3. To continue consideration of subjects to be studied

   Reference : Document No. I-37, para. 4

   a) Item 10 - Use of VHF

      To consider draft fourth Report - Document No. DT/I-4 (Rev.) submitted by Mr. Powell's ad hoc group

   b) Item 11 - Improvements

      To consider draft fifth Report - Document No. DT/I-5

   c) Item 6 - Basic concepts for the allotment of frequencies

      Further proposal by Argentina - Document No. I-86

4. Preliminary consideration of subjects ascribed to Working Group 4B - Document No. I-56, para. 2.1 refers

5. Any other business.

J.T. PENWARDEN
Chairman

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# AERONAUTICAL CONFERENCE

Document No. I-85-E
3 February, 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

SUMMARY RECORD

FOURTH MEETING OF COMMITTEE 4

(Technical Committee)

Monday, 3 February, 1964, 9.30 a.m.

Chairman : Mr. J.T. PENWARDEN (United Kingdom)

Vice-Chairman : Dr. C. WACHARASINDU (Thailand)

1. Summary Record (Document No. I-63)

The Meeting adopted the Summary Record of the second Meeting subject to two amendments to the text of Paragraph 2.3 as follows :

i) Amend second sub-para. to read :

"The Delegate of India reserved the right to return later to the question of the specific signal limits and power restrictions on these frequencies."

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ii) Add new third sub-para. :

"The Delegate of Brazil reserved his right to return to this question also."

2. Record of second Meeting - Matters arising

Reference : Document No. 63, para. 2.2.

The Chairman referred to the Committee's discussion under item No. 6 of the work programme and to the Report of Monitoring Studies in Document No. I-3, Addendum No. 1. As a consequence of this the Meeting had before it a Resolution proposed by the Delegate of Japan.

Following a brief discussion, during which a number of amendments were made to the final paragraph, the Meeting adopted this Resolution subject to a consideration of its text in draft.

3. Preliminary consideration of Item No. 12 of the work programme

"Number of aircraft which can be served by a frequency or family of frequencies."

As a preliminary to a more detailed study of this problem in Working Group 4A, the Chairman invited delegates of those Administrations who had submitted proposals or reports of studies on the subject to present their papers.

The Delegates of Australia, Ireland, the United States, the United Kingdom and the member of the I.F.R.B. accordingly spoke to Documents Nos. 16, 77, 1, 33 and 12 respectively.

The Delegate of Brazil stated his Administration's view that for regular MWARA operations the figures of 10 or 12 were reasonable, but in areas where VOLMET broadcasts were not provided these figures might need to be lowered significantly. For RDARA operations eight was the maximum possible number suggested by his Administration.

Following a brief exchange of comments and views it was agreed to refer the subject to Working Group 4A for study, inviting them :

a) to confirm or amend as necessary the MWARA figures adopted by the I.A.A.R.C. 1948-1949;

b) to determine the extent to which an acceptable figure or figures can be found for RDARA's.

4. Continued study of items of the work programme

4.1 Item No. 10 - Use of VHF

The Meeting had before it Document No. DT/I-4 resulting from its earlier discussions on Proposal No. 25 by the United States and the work of a small ad hoc group.

In view of the fact that proposals had been received which suggested a need for possible changes it was agreed to refer the document back to the ad hoc group for review.

4.2 Item No. 11 - Improvements

Consideration of Document No. DT/I-5, draft fifth Report on Proposal No. 26 by the United States was deferred to the next meeting.

5. In the absence of other business the Meeting adjourned at 12.45 p.m.

Rapporteurs
M. YOUCEF-KHODJA
J. VALLADARES

Chairman
J.T. PENWARDEN

# AERONAUTICAL CONFERENCE

Document No. I-86-E
3 February 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

Argentina

PROPOSAL NO. 9

CONCERNING THE BASIC CONCEPTS FOR THE ALLOTMENT OF FREQUENCIES

(Reference: Document No. I-37, Paragraph 4 - Item No. 6)

1. Introduction

The Argentine Delegation has noted with interest the discussions in Committee 4 under Item No. 6 of the Work Programme and particularly those concerning the problem of harmful interference.

Whilst appreciating that a Resolution of this Session of the Conference based on that proposed in Document No. I-66 goes far to reflect the Meeting's feeling in this matter nevertheless the Argentine Administration considers the problem merits an additional mention in the Final Report.

2. Proposal

To this end a further paragraph under the heading of "Principles of Frequency Allotment" (see 1st Report of Committee 4 - Document No. I-61) is proposed on the following lines :

The Conference had the opportunity of considering reports of monitoring studies and other information showing the extent to which, in certain areas, frequencies of the Aeronautical Mobile (R) Service were liable to harmful interference from stations of other services.

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When dealing with Appendix 26 and related provisions in the Radio Regulations the 1965 Session should maintain Resolution No. ...., stressing the fact that the interference referred to adversely affects the safety of life and regularity of air operations. All means available to Administrations and to the Union must be applied most energetically to ensure the elimination of this interference.

As a basic principle of frequency planning the Conference must assume that all the frequency bands between 2850 and 17 970 kc/s allocated exclusively to the Aeronautical Mobile (R) Service are fully and absolutely available to that Service.

# AERONAUTICAL CONFERENCE

Document No. I-87-E
5 February, 1964
Original: French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

SUMMARY RECORD

OF THE FOURTH MEETING OF COMMITTEE 5

(OPERATING STATISTICS)

Monday, 3 February, 1964, at 9.30 a.m. and 3.00 p.m.

Chairman : Mr. M. CHEF

Vice-Chairman : Mr. J. MARINSALDA
Mr. J. RUTKOWSKI

1. The Chairman opened the fourth meeting by suggesting the addition of Document No. I-80 (Summary Record of the third meeting of Committee 5) to item 1 of the agenda (Document No. I-61); with this addition Document No. I-81 was adopted.

2. Adoption of Summary Records

a) Document No. I-64 (1st meeting) was adopted with one minor typing error in the English text : (read RDARA).

b) Document No. I-65 (2nd meeting) was adopted with minor modifications :

- para. 2.5, read 200 knots
- para. 2.4, delete "which" before "might".

c) Document No. I-80 was adopted with several minor editorial amendments to the English text :

- para. 2.1, add "f) there is no need to distinguish between day and night flights"
- para. 3.1, add "Overseas Territories of the United Kingdom"
- para. 2.1, read "day" instead of "date"
- para. 3 "RDARA"
- para. 3.1, read "United States of America"

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3. Further consideration of MWARA flight statistics

3.1 The Chairman suggested simultaneous consideration of the three subjects dealing with MWARA flight statistics, namely :

a) the kind of data to be supplied to the I.T.U.

b) how the figures should be analyzed and how the results should be set forth

c) how the basic data should be set out

3.2 The first discussion has been based on the preparation of statistics and complete agreement had not been reached, now the Chairman would like to reverse the discussion and consider what analyses should be done before the second session. The United States of America Document No. I-21 dealt with that. The United States proposed the compilation of reports from all countries which would include :

1. Total list of flights in alphabetical order.

2. Geographical areas (see Document No.I-1, page 85),

3. Departures and arrivals by area (instead of by airport names).

3.3 Committee 5 at the request of Committee 4 must also consider the concentration of flights according to areas. The Delegate of the United States concurred with the Chairman's foregoing explanation of United States Document No.I-21. The Chairman gave a very good example of a flight under the French flag from Tahiti to Los Angeles which was outside the purview of Appendix 26. The Delegates of the United States and the United Kingdom followed the Chairman's remarks with pertinent comments which in effect supported the Chairman's views.

3.4 The Chairman asked the I.F.R.B. as regards analysis of small geographical areas, what kind of programme would it be possible to give to the computer ? The I.F.R.B. representative replied that no difficulty was expected; it would only be a matter of preparation.

3.5 The Chairman expressed the thought that Committee 4 would ask questions and the Committee would be expected to consider them. Committee 4 had not completed its work so it was impossible to say how many statistical analyses would be required. The Chairman called attention to green Document No. DT/I-4 which contained a draft resolution relating to the use of VHF by the aeronautical (R) services. Committee 4 had asked Committee 5 to further

consider this draft resolution as to its scope. That was merely one example, and it appeared reasonable to assume there would be more. The Delegate of the U.S.S.R. expressed his views on the list of information that should be supplied by administrations in order that a new allotment plan might be devised. This statistical data should include :

a) flight number

b) intermediate stops

c) final destination

d) route flown

The form should be worked out and established at the present session. It should also include :

1. Flights per aircraft on MWARA per week

2. Use of MWARA zone by HF

3. Information on use of VHF

3.6 Summing up, the Chairman announced that Committee 4 would be asked to consider propagation aspects of HF and also as regards the use of VHF. The Chairman referred to Proposal No. 13 page 65 of United States Document No.I-1. The Delegate of Norway expressed the view that he preferred the United States forms regarding world flight zones as against the MWARA's since the MWARA's did not cover the globe. The Delegate of India felt that the second session might wish to have data about future trends of air traffic to provide frequencies for increased traffic. This information should be collected between the first and second session and furnished to the I.T.U. The Chairman replied that that would be difficult since the present plans would hold until 1975.

It was eventually agreed that the matter could be more effectively considered at the second session.

3.7 The I.F.R.B. representative felt two documents should be furnished at the second session, as follows :

1. The number of aircraft operating in any MWARA during a given week.

2. The maximum number of aircraft that would require communication in any one area or in any given MWARA.

4. The meeting recessed for lunch at 12:30 hours and reconvened at 15.00 hours, utilizing the same agenda as used at the morning session and expression of views regarding the type of information to be collected for MWARA flight statistics.

5. Several delegates (Canada, Australia and India) queried the Delegate of the United States concerning specific examples involving the United States form. After considerable discussion, the questions were answered to the satisfaction of all concerned. In the morning discussion the United Kingdom made a reference to existing MWARA's and said they might more readily identify flights but after listening to examples by the United States, he was now convinced that world flight zones would be the easiest to identify where flights took place.

6. The Chairman summarized the discussions as follows :

a) Unanimous agreement to establish statistics on bases of information supplied by countries

b) Agree on numbered areas instead of cities or airports for recording origins, stops and termination of flights.

c) Apparent agreement on there being a need for an attempt to widen geographical zones with two exceptions, Near East and North Atlantic.

7. No other points being raised, the meeting rose at 4:30 p.m.

Rapporteurs :

A. BARNABEI
J. MARINSALDA

Chairman :

Maurice CHEF

# AERONAUTICAL CONFERENCE

Document No. I-88-E
4 February, 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 2

STATEMENT OF EXPENDITURE OF THE AERONAUTICAL RADIO CONFERENCE AS AT 31 JANUARY, 1964

Rule 5 of Chapter 9 of the General Regulations annexed to the International Telecommunication Convention (Geneva 1959) lays down that the Budget Control Committee shall approve the accounts for expenditure incurred throughout the duration of the conference. It must also submit a report to the Plenary Assembly showing, as accurately as possible, the estimated total expenditure at the close of the conference.

In accordance with the aforementioned provisions, a statement of the expenditure incurred up to 31 January, 1964, by the Aeronautical Radio Conference is hereby submitted to the Budget Control Committee. The statement is supplemented by an estimate of the estimated total expenditure up to the close of the conference.

R. C. CHATELAIN
Head of the Finance Division
of the I.T.U.

Annex : 1 table

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# A N N E X

## STATEMENT OF ACCOUNTS AS AT 31 JANUARY 1964

| Item | Title | Budget approved by Admin. Council | Expenses as at 31.1.64 | Estimated Expenses | Total |
|---|---|---|---|---|---|
| | | | - Swiss francs - | | |
| Article I | Staff expenses | | | | |
| 7.601 | Administration | 70,000.— | 627.— | 56,373.— | 57,000.— |
| 7.602 | Languages | 315,000.— | 12,463.85 | 274,536.15 | 287,000.— |
| 7.603 | Reproduction | 27,000.— | 875.60 | 48,124.40 | 49,000.— |
| 7.604 | Insurance | 2,000.— | 1.65 | 7,998.35 | 8,000.— |
| Article II | Premises and equipment | | | | |
| 7.605 | Premises, furniture, machines | 75,000.— | - | 36,000.— | 36,000.— |
| 7.606 | Document production | 45,000.— | 3,862.95 | 30,137.05 | 34,000.— |
| 7.607 | Office supplies and overheads | 30,000.— | 16.75 | 18,983.25 | 19,000.— |
| 7.608 | Simultaneous interpretation and other technical equipment | 15,000.— | - | 1,000.— | 1,000.— |
| 7.609 | Unforeseen | 11,000.— | - | 11,000.— | 11,000.— |
| Article III | Preparatory work | | | | |
| 7.610 | Preparatory work by the I.F.R.B. | 50,000.— | 17,614.40 | 27,385.60 | 45,000.— |
| | | 640,000.— | 35,462.20 | 511,537.80 | 547,000.— |

# AERONAUTICAL CONFERENCE

Document No. I-89-E
4 February 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 3

AGENDA

FOR THE FIRST MEETING OF COMMITTEE 3

(BUDGET CONTROL)

Thursday, 6 February, 1964, at 3.00 p.m. in Room X

1. Appointment of Rapporteur
2. Terms of reference of the Budget Control Committee
   (Article 5 of Chapter 9 of the General Regulations annexed to the International Telecommunication Convention, Geneva, 1959)
3. Budget of the Conference (Document No. I-19)
4. State of accounts of the Conference (Document No. I-88)
5. Organization of the Committee's work
6. Other business

U. MOHR

Chairman

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# AERONAUTICAL CONFERENCE

Document No. I-90-E
4 February 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

AGENDA

FOR THE SIXTH MEETING

OF THE TECHNICAL COMMITTEE

5 February, 1964, at 9.30 a.m. in Room XI

1. To adopt Summary Record of the fourth meeting - Document No. I-85

2. To continue consideration of subjects to be studied
Reference : Document No. I-37, para. 4

   a) Item 11 - Improvements

   To further consider draft Fifth Report - Document No. DT/I-5

   b) Item 6 - Basic concepts for the allotment of frequencies

   Further proposal by Argentina - Document No. I-86

3. Preliminary consideration of remaining subjects ascribed to Working Group 4A

   Document No. I-37, para. 4, Items 2 and 7 refer

4. Preliminary consideration of subjects ascribed to Working Group 4B

   Document No. I-56, para. 2; in particular, Section 3 under para. 2.1 refers.

5. Any other business

J.T. PENWARDEN
Chairman

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# AERONAUTICAL CONFERENCE

Addendum No.1 to
Document No.I-91-E
10 February 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

ANSWER BY COMMITTEE 5 TO COMMITTEE 4

About the use of V.H.F. by the Aeronautical Mobile R Service (Document No. I-91)

1. At its seventh meeting, on 7 February, 1964, Committee 5 considered Document No.I-91, about use of V.H.F. by the aeronautical mobile R service, as requested by you.

2. Committee 5 gave no detailed consideration to the exact wording of the various paragraphs in the draft Resolution. It felt that the wording used was already in accordance with Decision No.1 of Resolution No.14 of the Radio Conference (Geneva, 1959 - see the Radio Regulations, page 539).

3. In considering the problem of flight statistics, Committee 5 took the following decisions:

a) In the initial stages, while statistics are being assembled, the idea of V.H.F. coverage should be discarded, the reason being that the Administration of an Administration or Associate Member would find it hard to assess what V.H.F. coverage was provided for the communicat ions exchanged by an aeroplane bearing its registration marks but flying over some other State. Hence no proper assessment of such coverage is feasible until the second session of the Conference convenes.

b) Nevertheless, there is no call for statistics relating to flights for which the air-ground communications (ATC and OPN) are conducted on V.H.F. exclusively. Examples are flights between London and Paris and Chicago and New York.

(cf. Document No.I-80, paragraphs 2.1.b) and 2.1.d); this document was adopted on 3 February, 1964).

Maurice CHEF
Chairman

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# AERONAUTICAL CONFERENCE

Document No. I-91-E
5 February 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

## FOURTH REPORT OF COMMITTEE 4
## (TECHNICAL)

Relating to the use of VHF by the Aeronautical Mobile (R) Services

Following a study of a proposal by one Administration, Committee 4 unanimously adopted the draft Resolution which appears in the Annex attached hereto.

Committee 4 recognizes that the inclusion of this resolution in the final document of this session of the Conference must depend upon prior further consideration by Committee 5 as to its efficacy.

The Committee expressed its appreciation to Mr. E.B. POWELL (Canada) and the members of the Ad Hoc Working Group for their success in reconciling conflicting points of view.

J.T. PENWARDEN
Chairman

Annex : 1

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# A N N E X

## RESOLUTION NO.

## RELATING TO THE USE OF VHF BY THE AERONAUTICAL MOBILE (R) SERVICES

The Aeronautical Extraordinary Administrative Radio Conference (Geneva, 1964),

considering

a) that from an aeronautical viewpoint, VHF provides a more reliable and more noise-free communication system than HF;

b) that from a technical and operational viewpoint the use of VHF by aviation has progressed appreciably since conception of the HF plan in Appendix 26 to the Radio Regulations;

c) that the use of VHF in its several modes could appreciably alleviate the requirements for aeronautical mobile high frequencies;

d) that, due to development in the general telecommunication networks in many areas of the world, the possibilities of providing VHF coverage are rapidly increasing;

resolves

1. that Administrations, to the maximum extent feasible, employ VHF frequencies for the satisfaction of their requirements for Aeronautical Mobile (R) Service;

2. that Administrations, when submitting statistical data concerning aircraft operations, shall take into account the possibilities of meeting the demands of the Aeronautical Mobile (R) Service by means of VHF techniques after due consideration of economic, technical and operational factors.

# AERONAUTICAL CONFERENCE

Document No. I-92-E
5 February 1964
Original: English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

## FIFTH REPORT OF COMMITTEE 4

## (TECHNICAL)

Relating to plans for the future which may affect the use of HF

Following a study of a proposal by one Administration, Committee 4 unanimously adopted the draft Resolution which appears in the Annex attached hereto.

J.T. PENWARDEN
Chairman

Annex : 1

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# A N N E X

## RESOLUTION No.

## RELATING TO PLANS FOR THE FUTURE WHICH MAY AFFECT THE USE OF HIGH FREQUENCIES

The Aeronautical Extraordinary Administrative Radio Conference (Geneva, 1964),

considering

a) that several administrations are actively engaged in the development of communication systems making use of either HF or VHF or in other work intended to improve the Aeronautical Mobile (R) Service;

b) that among the systems under consideration are : extended VHF, long range VHF, space radiocommunication techniques and other systems including automatic (data) communication;

c) that by the time of the main session of the Aeronautical E.A.R.C. some of the techniques and plans may have progressed to the point where actual operational plans will have been made for implementation of the new techniques within the time frame allotted for the new HF aeronautical mobile plan;

d) that such implementation could have a significant impact on the requirements for high frequencies during the time span of the new plan.

resolves

that administrations which have plans to meet the requirements of the Aeronautical Mobile (R) Service by means either of improved techniques and/or the use of other than high frequencies be requested to submit these to the main session of the Aeronautical E.A.R.C. (1965) indicating their anticipated implementation dates;

# AERONAUTICAL CONFERENCE

Document No. I-93-E
3 February 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

SIXTH REPORT OF COMMITTEE 4

(TECHNICAL)

Relating to the Use of Frequencies in the HF bands allocated exclusively to the Aeronautical Mobile (R) Service

Following a study of a proposal by one Administration, Committee 4 unanimously adopted the draft Resolution which appears in the Annex attached hereto.

J.T. PENWARDEN
Chairman

Annex : 1

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A N N E X

DRAFT RESOLUTION No.

RELATING TO THE USE OF FREQUENCIES IN THE HF BANDS
ALLOCATED EXCLUSIVELY TO THE AERONAUTICAL MOBILE (R) SERVICE

The Aeronautical Extraordinary Administrative Radio Conference, Geneva, 1964,

considering

a) that monitoring observations on the use of frequencies in the bands allocated exclusively to the Aeronautical Mobile (R) Service between 2850 and 17970 kc/s, show that a number of frequencies in these bands are being used by stations of services other than the Aeronautical Mobile (R) Service, causing harmful interference to Aeronautical Mobile (R) Communications conducted on some international air routes;

b) that the Aeronautical Mobile (R) Service is a safety service, to which exclusive frequency bands are specially allocated in order to ensure the safety and regularity of the national and international civil air transportation as defined in No. 429 of the Radio Regulations.

c) that in order to protect the security of life and property in the air, and to develop aeronautical transportation services in a regular and effective manner, it is indispensable to have the aeronautical mobile communication channels kept free from harmful interference;

resolves

that all administrations, recognizing that the Aeronautical Mobile (R) Service is a safety service, shall abstain from the use of frequencies in the bands allocated exclusively to this service by stations of services other than the Aeronautical Mobile (R) Service, except under the express conditions prescribed in No. 115 or No. 415 of the Radio Regulations.

# AERONAUTICAL CONFERENCE

Document No I-94-E
4 February, 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

SUMMARY RECORD

FIFTH MEETING OF COMMITTEE 4

(TECHNICAL COMMITTEE)

Tuesday, 4 February, 1964 at 9.30 a.m.

Chairman : Dr. C. WACHARASINDU (Thailand)

1. Summary Record (Document No. I-73)

The meeting had before it the Summary Record of the third meeting which was adopted subject to the following changes :

Para. 1.1 Amend second sentence of sub-para. 2 to read :

"This question would be further considered in the Committee's studies under the heading of "Powers of Emission"."

Para. 1.1 Add third sentence to sub-para. 2 as follows :

"The Delegate of Brazil reserved his administration's position with respect to the signal limits and power restrictions on these frequencies."

Para. 1.3 Item 10 (b) Sub-para. 3

Delete the sentence beginning "Despite" and ending with "text"

Para. 1.4 Item 11. Improvements Sub-para 2.

Add new sentence "The Delegate of Cuba reserved his administration's position with respect to this proposal".

2. Draft Sixth Report (Document No. DT/I-6)

The meeting had before it a draft Resolution relating to the use of frequencies in the exclusive Aeronautical Mobile (R) Service bands. This draft Report was adopted with only very minor editorial change.

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3. Draft Fourth Report (Document No. DT/I-4 (Rev.))

The Meeting had before it a draft Resolution relating to the use of VHF. Following a brief discussion, during which an amendment was made to sub-para. (b) and a new sub-para. (d) was added as shown below, this Fourth Report was adopted.

Sub-para.(b) Delete "economic"

Add new sub-para. (d) "that, due to developeent in the general telecommunication networks in many areas of the world, the possibilities of providing VHF coverage are rapidly increasing".

4. Preliminary consideration of Papers submitted on Work Item 1

In order to assist Working Group 4A to proceed with its studies the Chairman invited Delegations to present papers submitted by their administrations relating to Work Item 1(a) and (b) - Propagation Criteria.

In response, the Delegates of the United States, the United Kingdom and the members of the I.F.R.B. and the C.C.I.R. spoke of their Documents Nos. 1, 31, 14 and 15 respectively.

Arising from questions posed by other Delegations two main points emerged :

i) Studied against the latest data available the criteria used in 1948/49 appeared quite suitable for use in 1965. That Session however may be faced with an overwhelming demand for frequencies in the higher orders. The need for studying the wider sharing possibilities that now seem to exist may prove essential.

ii) It is most desirable that full details of the technical considerations on which the Plan is based be preserved in the Final Acts.

Following further discussion in which the Delegates of Australia, Ireland, Argentine and the Observer of I.A.T.A. took part, the Meeting agreed to refer the proposals and studies to Mr. Hayden for the attention of Working Group 4A.

5. Draft Fifth Report (Document No. DT/I-5)

The Meeting had before it a draft Resolution relating to Plans for the future which may affect the use of HF. During discussion the Delegates of Argentine, Canada, Cuba and India raised several points of issue and further consideration was postponed until the next Meeting.

6. In the absence of other business, the Meeting adjourned at 12.40 p.m.

Rapporteurs :
YOUCEF-KHODJA
J.A. VALLADARES

Chairman :
C. WACHARASINDU

# AERONAUTICAL CONFERENCE

Document No. I-95-E
5 February 1964
Original: French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

SUMMARY RECORD
OF THE FIFTH MEETING OF COMMITTEE 5
(OPERATING STATISTICS)
on Tuesday, 4 February, 1964, at 9.30 a.m.

Chairman: Mr. M. CHEF

Vice-Chairmen: Mr. J. MARINSALDA
Mr. J. RUTKOWSKI

1. The Chairman opened the Meeting by announcing that the agenda as set forth in Document No. I-81, Item 2, regarding MWARA flight statistics would be the basis for continued discussion that morning.

2. Visit to I.T.U. computer centre

The Chairman announced a visit to the I.T.U. Building for that afternoon for the purpose of observing computer operations. Delegates would assemble on the 5th floor, Room C, of the I.T.U. Building as follows:

| | |
|---|---|
| 2 English-speaking Groups (10 each) | 3.00 - 3.15 p.m.<br>3.15 - 3.30 p.m. |
| French-speaking Group | 3.30 - 3.45 p.m. |
| Spanish-speaking Group | 3.45 - 4.00 p.m. |

3. Form for MWARA statistics

In reply to a query by the Chairman as to the known preference, by delegates, for the U.S.A. or I.F.R.B. format, the Delegate of Norway indicated a preference for the U.S.A. format. The Delegate of the U.S.S.R. preferred the I.F.R.B. format in view of the fact that present MWARA and RDARA boundaries were utilized as opposed to the artificial boundaries utilized by the U.S.A. format. There was a lengthy discussion

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between the Chairman and the U.S.S.R. on the U.S.S.R. position, wherein a specific example using a proposed route Moscow to New York was considered. The I.F.R.B. confirmed the point that present MWARA boundaries did not cover the Moscow-New York example and that the present I.F.R.B. proposal would have to be amended accordingly. At that point, the Delegate of Brazil suggested that further comments be withheld until the Committee had visited the computer centre.

The Chairman acknowledged the comments of Brazil and indicated that discussion on the form of MWARA statistics would be suspended for the time being.

4. How the figures should be analysed and how the results should be set forth (Document No. I-37)

U.S. Proposal No. 15

4.1 A vast majority of the delegates expressed a preference for the collection of statistics during a period of one week, between 2 and 8 August, 1964, for the MWARA's. Accordingly the Chairman formalized the recommendation of the Committee to the effect that collection of MWARA statistics would last one week, from 2 to 8 August, 1964.

4.2 In connection with the collection of RDARA statistics the Chairman pointed out that there was only one proposal (U.S.A. No. 20) before the Committee and the duration and dates coincide with the MWARA collection. The Delegate of India proposed a week's period each during the last part of November 1964 and January 1965.

The I.F.R.B. required approximately 3 months to process the data received. The Chairman pointed out that the 2nd Session of the E.A.R.C. was to convene on 25 January, 1965, therefore all statistics must be received by the I.F.R.B. during October, 1964. Guinea proposed the first two weeks in May, 1964. Brazil suggested Administrations be given the latitude to decide on the most significant week for the RDARA statistics and that data be supplied to the I.F.R.B. during October 1964. Canada would prefer one year to one week. However, it supported the proposal of Brazil. Guinea, United Kingdom Overseas Territories, and the U.S.S.R. also supported the Brazilian proposal. In summary the Chairman stated that provisionally the decision regarding the week to be selected for the collection of RDARA data would be left to the Administration concerned. The decision was provisional and subject to change in the light of further discussion.

The Meeting rose at 12.35 p.m.

Rapporteurs:

A. BARNABEI
J. MARINSALDA

Chairman:

M. CHEF

# AERONAUTICAL CONFERENCE

Document No. I-96-E
4 February 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 4

## FIRST REPORT OF WORKING GROUP 4A TO COMMITTEE 4

Number of aircraft which can be served on a frequency or family of frequencies

Following a study of proposals by Administrations and a Report by the I.F.R.B., Working Group 4A unanimously reached the conclusion which appears in the Annex attached hereto.

George W. HAYDON

Chairman
Working Group 4A

Annex : 1

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# A N N E X

## NUMBER OF AIRCRAFT WHICH CAN BE SERVED ON A HIGH FREQUENCY OR A FAMILY OF HIGH FREQUENCIES TAKING INTO ACCOUNT ACCEPTABLE MESSAGE DELAYS

1. In Major World Air Route Areas (MWARA's) :

   - a family of high frequencies may be expected to serve a maximum number of 12 aircraft in one hour

   - a single frequency may be expected to serve a maximum number of 10 aircraft in one hour.

2. In Regional and Domestic Air Route Areas (RDARA's) :

   - the maximum number of aircraft which can be served on a family of high frequencies or a single high frequency may be highly variable, hence the figures in respect of MWARA's may not be applicable in all RDARA's.

# AERONAUTICAL CONFERENCE

Document No. I-97-E
5 February 1964
Original: French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 2

SUMMARY RECORD

OF THE FIRST MEETING OF COMMITTEE 2

(CREDENTIALS)

Monday, 3 February 1964 at 4.45 p.m.

Chairman: Mr. A.R. RAMANATHAN (India)
Vice-Chairman: Mr. José HERNANDEZ G. (Mexico)

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1. Agenda :

The agenda (Document No. 69) was adopted without change.

2. Appointment of Rapporteurs :

The Mexican and Swedish Delegations agreed to provide rapporteurs for Spanish and French. Mr. Kunz would fill that office for the English.

3. Terms of Reference :

These are as defined in No. 535 of Chapter 5 of the General Regulations annexed to the Geneva Convention (1959).

4. Organization of the Committee's work :

It was agreed that a working party, made up of the representatives of Belgium, the United States, the Federal Republic of Germany, and Mexico (the Chairman taking part as well) would examine the credentials handed in.

5. Meetings of the Working Party :

It was agreed that the Working Party should hold its first meeting on 4 February, at 9.30 a.m. (Office 653), a second meeting on 10 February, and a third on 13 February. Its report would be submitted to the Committee on 14 February.

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6. Information of Delegations :

The Chairman would ask the Secretariat to inform those delegations the credentials of which required additions or corrections.

The meeting rose at 5.20 p.m.

Rapporteurs:
R. MONNAT, J. HERNANDEZ G.,
J. KUNZ

Chairman:
A.R. RAMANATHAN

# AERONAUTICAL CONFERENCE

Document No. I-98-E
5 February 1964
Original : English

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

SUMMARY RECORD

OF THE SIXTH MEETING OF COMMITTEE 5

(OPERATING STATISTICS)

Wednesday 5 February, 1964 at 9.30 a.m.

Chairman : Mr. M. CHEF

Vice-Chairmen : Mr. J. MARINSALDA
Mr. J. RUTKOWSKI

1. The Chairman opened the sixth meeting of Committee 5 at 9.30 a.m. The Agenda contained in Document No. 81 still applies.

2. Visit to I.T.U. - Computer Centre

The Chairman acknowledged with thanks the very interesting tour, conducted by the I.F.R.B. of the I.T.U. computor which was held yesterday afternoon, 4 February, beginning at 3.00 p.m.

3. Further consideration of flight statistics compilation

3.1 After an exchange of comments between the Chairman, U.S.S.R. and U.S.A., the U.S.A. proposed the establishment of a small Working Group to work out a composite form. Brazil stated that after inspection of the I.T.U. computor yesterday, he is convinced now that the I.F.R.B. and U.S.A. formats both have advantages and disadvantages and he supports the idea of a small working group composed of technicians of the I.F.R.B. and the U.S.A. Brazil will be happy to participate. United Kingdom Overseas Territories supported this view and volunteered to participate in the small working group.

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3.2 The Chairman established Working Party No. 1 composed of the following: Australia, Brazil, Canada, Cuba, I.F.R.B., United Kingdom, U.S.A., U.S.S.R.

3.3 The terms of reference of the working party is as follows :

1. Method for collection of statistics by administrations.

2. The manner in which these statistics will be recorded.

Additionally, the Chairman furnished the Working Party with numerous suggestions for guidance purposes during the course of its work. The Chairman added that specific information to administration will be clearly inducted in order that there will be no misunderstanding in the completion of the form.

The Committee rose at 10.55 a.m. to allow Working Party No. 1 to complete its task. The next meeting of Committee 5 will be posted on the board.

Rapporteurs :

A. BARNABEI
J. MARINSALDA

Chairman :

Maurice CHEF

# AERONAUTICAL CONFERENCE

Document No. I-99-E (Rev.)
6 February 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

AGENDA
FOR THE SEVENTH MEETING OF THE
OPERATING STATISTICS COMMITTEE

7 February 1964 at 3 p.m., Room XVI

1. Adoption of the summary records of the fourth, fifth and sixth meetings (Documents Nos. 87, 95 and 98)

2. Adoption of draft reports by Working Party No. 2 :

   a) the grouping of MWARA (DT/I-9)
   b) the grouping of RDARA (DT/I-10)
   c) high-frequency requirements for supersonic aircraft and space transport vehicles (DT/I-11)
   d) frequency requirements for weather data dissemination (DT/I-14)

3. Partial consideration of the draft report by the Technical Committee, referred to Committee 5 for the latter's views (Document I-91)

4. Report on MWARA statistics, submitted by Working Party No. 1

5. Any other business.

Maurice CHEF
Chairman

ARCHIVES U.I.T. GENÈVE

# AERONAUTICAL CONFERENCE

Document No. I-99-E
5 February, 1964
Original : French

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

COMMITTEE 5

AGENDA

FOR THE SEVENTH MEETING OF THE

OPERATING STATISTICS COMMITTEE

on 7 February, 1964, at 15.00 hrs. in Room XVI

1. Adoption of the summary records of the fourth, fifth and sixth meetings (Documents Nos. 87, 95 and 98).

2. Adoption of the draft reports submitted by Working Party No. 2 :

   a) the grouping of MWARA (Document No. DT/I-9)

   b) the grouping of RNARA (Document No. DT/I-10)

   c) HF requirements of supersonic aircraft (Document No. DT/I-11)

   d) HF requirements for space transport vehicles (Document No. DT/I-12)

   e) frequencies required for the dissemination of weather data (Document No. DT/I-13)

3. Partial consideration of the draft report by the Technical Committee, submitted with a view to obtaining the Committee's opinion (Document No. I-91)

4. Consideration of the report on statistics. MWARA, as presented by Working Party 1.

5. Any other business.

Maurice CHEF

Chairman

# AERONAUTICAL CONFERENCE

Document No. I-100-E
6 February 1964
Original : French/English/
Spanish

E. A. R. C. FOR THE PREPARATION OF A REVISED ALLOTMENT PLAN FOR THE AERONAUTICAL MOBILE (R) SERVICE - GENEVA

PLENARY MEETING

## List of documents of the Conference

(Documents Nos. 1 to 100)

| Document No. | Title | Origin | Destination |
|---|---|---|---|
| I-1 | Proposals for the work of the Conference | U.S.A. | Plenary Meeting |
| I-2 and Corr.1 | Proposal relating to the Conference structure, and respective terms of reference of each Committee, of the Aeronautical E.A.R.C. to accomplish the directives set forth in the Conference Agenda | U.S.A. | Plenary Meeting |
| I-3 and Add.1 | Proposals of the Japanese Administration | Japan | Plenary Meeting |
| I-4 | Report on frequency requirements for communications with transport air-space vehicles | I.F.R.B. | Plenary Meeting |
| I-5 | Report on studies relating to possible channeling arrangements in a revised allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-6 | Use of the single sideband system of communication in the aeronautical mobile (R) service | I.F.R.B. | Plenary Meeting |
| I-7 | Report on studies relating to the use of the channels in the present allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-8 | Report on studies relating to the basic concepts of allotments in a revised frequency allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |

ARCHIVES U.I.T. GENÈVE

| Document No. | Title | Origin | Destination |
|---|---|---|---|
| I-9 | Report on studies on facilities for high frequency meteorological broadcasts in a revised allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-10 | Report on studies relating to aircraft operation statistics | I.F.R.B. | Plenary Meeting |
| I-11 and Add.1 | Proposal for the revision of the HF allotment plan for the aeronautical mobile (R) service | Republic of India | Plenary Meeting |
| I-12 | Report on studies relating to channel capacities in a revised high frequency allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-13 | Report on studies of technical principles which might be used in the establishment of a revised high frequency allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-14 | Report on studies relating to propagation and frequency-sharing criteria which might be used in the establishment of a revised allotment plan for the aeronautical mobile R service | I.F.R.B. | Plenary Meeting |
| I-15 | Recommendations, reports, opinions, questions and study programmes adopted by the Xth Plenary Assembly of the C.C.I.R. | S.G. | Plenary Meeting |
| I-16 | Proposal relating to the determination of frequency requirements for regional and domestic air route operations | Australia | Plenary Meeting |
| I-17 and Corrig. | Invitations to the Conference | S.G. | Plenary Meeting |
| I-18 | Conference Secretariat | Secretariat | Plenary Meeting |
| I-19 | Budget of the Conference | S.G. | Budget Control Committee |
| I-20 | Draft Agenda for the opening Plenary Meeting | Secretariat | Heads of Delegation |
| I-21 and Add.1 | Supplementary Material with Respect to Aircraft Operation Statistics -MWARA | U.S.A. | Plenary Meeting |

| Document No. | Title | Origin | Destination |
|---|---|---|---|
| I-22 | Rearrangement of Appendix 26 of the Radio Regulations | Argentine Republic | Plenary Meeting |
| I-23 | Allotment of a family of frequencies for metereological broadcasts in South America | Argentine Republic | Plenary Meeting |
| I-24 | Gradual introduction of SSB emissions in the aeronautical mobile (R) service | Argentine Republic | Plenary Meeting |
| I-25 | General provisions for the aeronautical mobile service | Argentine Republic | Plenary Meeting |
| I-26 | Adoption of abbreviations or symbols to simplify the mention of or reference to the services and stations dealt with in Appendix 26, together with the bands in which they operate | Argentine Republic | Plenary Meeting |
| I-27 | Amendment of the boundaries and description of MWARA NSAM-1 and NSAM-2 (Part II, Article I, Section I of Appendix 26) | Argentine Republic | Plenary Meeting |
| I-28 | Situation of certain countries with respect to the convention | S.G. | Plenary Meeting |
| I-29 | Methods of communication and types of emission for which provision should be made in the revised plan | U.K. | Plenary Meeting |
| I-30 | Use of high frequencies in communication with super-sonic aircraft | U.K. | Plenary Meeting |
| I-31 | Transmission, propagation and reception | U.K. | Plenary Meeting |
| I-32 | Review of the Allotment Plan for the Aeronautical Mobile (R) Service | U.K. | Plenary Meeting |
| I-33 | Permissible loading of a frequency or family of frequencies | U.K. | Plenary Meeting |
| I-34 | Preservations of MWARA'S and RDARA'S | U.K. | Plenary Meeting |
| I-35 and Rev. | Committee Structure | Secretariat | Plenary Meeting |
| I-36 | Draft Agenda for the first meeting of the Drafting Committee | Committee 6 | Committee 6 |
| I-37 | Committee Structure | Secretariat | - |

| Document No. | Title | Origin | Destination |
|---|---|---|---|
| I-38 | Proposals relating to the determination of frequency requirements for regional and domestic air route operations | U.S.S.R. | Committee 5 |
| I-39 | Agenda for the first meeting of the Operating Statistics Committee | Committee 5 | Committee 5 |
| I-40 | Agenda for the first meeting of the Technical Committee | Committee 4 | Committee 4 |
| I-41 | Proposals for the preparatory session of the extraordinary administrative radio conference | U.K. | Plenary Meeting |
| I-42 | Report on long distance VHF Communications system being developed in the United States | U.S.A. | Committee 4 |
| I-43 | Concerning a new type of high frequency antenna that may be applicable in the aeronautical mobile "R" service | U.S.A. | Committee 4 |
| I-44 | Report on H-F sector-coverage log-periodic antenna | U.S.A. | Committee 4 |
| I-45 | Concerning introduction of supersonic transports (SSTs) into scheduled service over international air routes | U.S.A. | Committees 4 & 5 |
| I-46 | Information concerning "integral electronics" (microelectronics), a new manufacturing technique which will have beneficial impact upon future equipment used aboard aircraft and at ground stations | U.S.A. | Committee 4 |
| I-47 | Channel spacing | U.K. | Committee 4 |
| I-48 | Proposal for amendment of channel widths and provision for the use of SSB emissions in the aeronautical mobile (R) bands | Canada | Committee 4 |
| I-49 | Statement by the Delegation of the Soviet Union | U.S.S.R. | Plenary Meeting |
| I-50 | List of documents of the Conference | Secretariat | Plenary Meeting |

| Document No. | Title | Origin | Destination |
|---|---|---|---|
| I-51 | Proposal - Revision to the Appendix 26 to International Telecommunication Union Radio Regulations | Brazil | Committee 4 |
| I-52 | Proposal - Revision to the Appendix 26 to International Telecommunication Union Radio Regulations | Brazil | Committee 5 |
| I-53 | Proposal - Revision to the Appendix 26 to International Telecommunication Union Radio Regulations | Brazil | Committee 5 |
| I-54 | Agenda for the 2nd Meeting of the Committee on operating statistics | Committee 5 | Committee 5 |
| I-55 | Agenda for the second Meeting of the Technical Committee | Committee 4 | Committee 4 |
| I-56 | Summary Record of the first Meeting of Committee 4 (Technical Committee) | Rapporteurs | Committee 4 |
| I-57 | Notes on the Meeting of the Steering Committee | Committee 1 | Committee 1 |
| I-58 | Report on extended range VHF development by the Department of Transport in Canada | Canada | Committee 4 |
| I-59 | Minutes of the first Meeting of the Heads of Delegations | Rapporteurs | Heads of Delegations |
| I-60 | Minutes of the opening Plenary Meeting | Rapporteurs | Plenary Meeting |
| I-61 | First report of Committee 4 (Technical) | Committee 4 | Plenary Meeting |
| I-62 | Agenda for the third Meeting of the Technical Committee | Committee 4 | Committee 4 |
| I-63 | Summary Record of the second Meeting of Committee 4 (Technical Committee) | Rapporteurs | Committee 4 |
| I-64 | Summary Record of the first Meeting of Committee 5 (Operating Statistics) | Rapporteurs | Committee 5 |
| I-65 | Summary Record of the second Meeting of Committee 5 (Committee on operating statistics) | Rapporteurs | Committee 5 |
| I-66 | Proposal - Resolution relating to the Use of Frequency in the HF bands allocated exclusively to the Aeronautical Mobile (R) Service | Japan | Committee 4 |

| Document No. | Title | Origin | Destination |
|---|---|---|---|
| I-67 | A statement by the Delegations of the People's Republic of Bulgaria, the Roumanian People's Republic and the Czechoslovak Socialist Republic | Bulgaria<br>Roumania<br>Czechoslovakia | Plenary Meeting |
| I-68 | Summary Report of the first Meeting of Committee 6 (Editorial Committee) | Rapporteurs | Committee 6 |
| I-69 | Agenda of the first Meeting of Committee 2 (Credentials) | Committee 2 | Committee 2 |
| I-70 | Second Report of Committee 4 (Technical) | Committee 4 | Committee 4 |
| I-71 | Third Report of Committee 4 (Technical) | Committee 4 | Committee 4 |
| I-72 | Agenda for the fourth Meeting of the Technical Committee | Committee 4 | Committee 4 |
| I-73 | Summary Record of the third Meeting of Committee 4 (Technical Committee) | Rapporteurs | Committee 4 |
| I-74 | Study of Proposition - Revision to the Appendix 26 to International Telecommunication Union Radio Regulations | Brazil | Committee 4 |
| I-75 | Study of Proposition - Revision to the Appendix 26 to International Telecommunication Union Radio Regulations | Brazil | Committee 5 |
| I-76 | Proposal No. 9 | Argentina | Committee 5 |
| I-77 | Ireland | Ireland | Committee 4 |
| I-78 | Revision to the Appendix 26 to International Telecommunication Union Radio Regulations | Brazil | Committee 4 |
| I-79 | Statement by the Delegation of the Republic of China to the E.A.R.C. for the preparation of a revised allotment plan for the Aeronautical Mobile (R) Service - Geneva | China | Plenary Meeting |
| I-80 | Summary Record of the third Meeting of Committee 5 (Operating Statistics) | Rapporteurs | Committee 5 |
| I-81 | Agenda for the fourth Meeting of the Operating Statistics Committee | Committee 5 | Committee 5 |
| I-82 | Summary Record of the second Meeting of Committee 6 (Editorial Committee) | Rapporteurs | Committee 6 |

| Document No. | Title | Origin | Destination |
|---|---|---|---|
| I-83 | Agenda of the third Meeting of the Drafting Committee | Committee 6 | Committee 6 |
| I-84 | Agenda for the fifth Meeting of the Technical Committee | Committee 4 | Committee 4 |
| I-85 | Summary Record fourth Meeting of Committee 4 (Technical Committee) | Rapporteurs | Committee 4 |
| I-86 | Proposal No. 9 concerning the basic concepts for the allotment of frequencies | Argentina | Committee 4 |
| I-87 | Summary Record of the fourth Meeting of Committee 5 (Operating Statistics) | Rapporteurs | Committee 5 |
| I-88 | Statement of expenditure of the Aeronautical Radio Conference as at 31 January, 1964 | Secretariat | Committee 3 |
| I-89 | Agenda for the first Meeting of Committee 3 (Budget Control) | Committee 3 | Committee 3 |
| I-90 | Agenda for the sixth Meeting of the Technical Committee | Committee 4 | Committee 4 |
| I-91 | Fourth Report of Committee 4 (Technical) | Committee 4 | Committee 5 |
| I-92 | Fifth Report of Committee 4 (Technical) | Committee 4 | Committee 4 |
| I-93 | Sixth Report of Committee 4 (Technical) | Committee 4 | Committee 4 |
| I-94 | Summary Record fifth Meeting of Committee 4 (Technical Committee) | Rapporteurs | Committee 4 |
| I-95 | Summary Record of the fifth Meeting of Committee 5 (Operating Statistics) | Rapporteurs | Committee 5 |
| I-96 | First Report of Working Group 4A to to Committee 4 | Working Group 4A | Committee 4 |
| I-97 | Summary Record of the first Meeting of Committee 2 (Credentials) | Rapporteurs | Committee 2 |
| I-98 | Summary Record of the sixth Meeting of Committee 5 (Operating Statistics) | Rapporteurs | Committee 5 |
| I-99 | Agenda for the seventh Meeting of the Operating Statistics Committee | Committee 5 | Committee 5 |
| I-100 | List of documents | Secretariat | Plenary Meeting |