

# International Scientific Radio Union

## U. R. S. I.

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The final programme of this session will be published latter on.

Moreover the Board of Officers of U.R.S.I. on the proposal of the Coordinating Committee has decided to appoint two Committees :

- (i) The U.R.S.I./C.O.S.P.A.R. Committee under the chairmanship of Prof. Dr. Balth. van der Pol, Honorary President,
- (ii) an « ad hoc » Committee on Space Radio Relay.

Confirmation of both Committees will be asked at the forthcoming General Assembly.

##### 5. *Reports and Papers.*

Besides National Committee, Commission, Sub-Commission and Working Party reports, invited papers on topics mentioned in Appendix B will be duplicated and circulated at the General Assembly.

It should be recalled that the Board of Officers of U.R.S.I., at its meeting of March 1958, adopted « Rules for submission of reports and papers ». These rules, which were published in the *Information Bulletin* n° 111, have been slightly amended by the Coordinating Committee. The amendments are given in Appendix D.

\* \* \*

The Board of Officers and Commission Chairmen would appreciate your assistance in informing all those interested in the contents of the present letter.

\* \* \*

Attention of National Committees is drawn to the urgent need of sending to the Secretary General of U.R.S.I. a tentative list of their delegates to the forthcoming General Assembly.

Yours sincerely,  
(*sgd*) HERBAYS,  
Secretary General.

APPENDIX A

XIIIth General Assembly — Tentative Technical Programme

J X Y = Joint Session, the first Commission mentioned being entrusted with the organization of the session.

Int. X = Session of which topic is of interest to Commission X.

Date	Commission I	Commission II	Commission III	Commission IV	Commission V	Commission VI	Commission VII
Thurs. Sept. 1	MEETING OF THE BOARD OF OFFICERS OF U.R.S.I.						
Fri. Sept. 2	MEETING OF THE EXECUTIVE COMMITTEE						
Sat. Sept. 3 a. m.	MEETING OF THE COORDINATING COMMITTEE						
Mon. Sept. 5 a. m. p. m.	ORGANIZING SESSION FOR ALL COMMISSIONS OPENING PLENARY						
Tues. Sept. 6 a. m.		Experimental results from investigation of tropospheric propagation	Ionization — height profiles	Sources of atmospheric noise in lightning		Surface waves	Molecular and parametric amplifiers
p. m.	Frequency standards — Atomic standards	Idem	F region ionization (Int. IV) Morphology and theory		Discrete sources	Boundary values — Scattering problems — Coding	

Date	Commission I	Commission II	Commission III	Commission IV	Commission V	Commission VI	Commission VII
Wed. Sept. 7 a. m.	Time signals and frequency standards	Physical characteristics of troposphere	Sporadic E ionization — Morphology and theory	Properties of natural sources (a) Special Report on Atmospheric Noise (b) I.G.Y. results (c) Effects of noise on communication systems (Int. VI)	Galactic emission and its physical interpretation	Microwave properties of ferrites J. VII-VI	Microwave properties of ferrites J. VII-VI
Thurs. Sept. 8 a. m.		Idem	Rocket and satellite observation data for the ionosphere	I.G.Y. Whistlers data	Antennas and data processing J. VI-V	Antennas and data processing J. VI-V	
p. m.	Time signals and frequency standards		Hydromagnetic waves - Extra low frequency oscillations J. III-IV	Hydromagnetic waves - Extra low frequency oscillations J. III-IV	Sensitive receivers - Molecular and parametric amplifiers applications J. V-VII		Sensitive receivers - Molecular and parametric amplifiers applications J. V-VII

Fri.  
Sept. 9  
a. m.

PLENARY SCIENTIFIC SESSION ON SPACE RESEARCH : U.R.S.I./C.O.S.P.A.R. COMMITTEE REPORT — AD HOC COMMITTEE ON SPACE RADIO RELAY REPORT

Date	Commission I	Commission II	Commission III	Commission IV	Commission V	Commission VI	Commission VII
Mon. Sept. 12 a. m.	Radio measurement of power			Whistlers interpretation (Int. III)	Solar phenomena and their interpretation (Int. III)	Statistically inhomogeneous media	
p. m.		Tropospheric propagation theories	The exosphere (Int. V) J. III-IV	The exosphere (Int. V) J. III-IV			Energy conversion
Tues. Sept. 13 a. m.	Measurement of physical quantities by radio techniques	Radio meteorology and climatology	Aurora - Radar observations J. III-V		Aurora - Radar observations J. III-V	Circuit theory (solid state circuits) J. VI-VII	Circuit theory (solid state circuits) J. VI-VII
p. m.			Ionospheric scattering (Int. II)	Characteristics of man made radio noise (Int. V)		Space relay problems	Plasma phenomena
Wed. Sept. 14 a. m.			Ionospheric movements	VLF Propagation (Int. III)	Planets and meteors		
p. m.	EACH COMMISSION WILL HOLD A SESSION TO PLAN ITS ACTIVITIES FOR THE NEXT TRIENNium						

Date	Commission I	Commission II	Commission III	Commission IV	Commission V	Commission VI	Commission VII
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Thurs.  
 Sept. 15  
 a. m.      PLENARY CLOSING SESSION OF THE GENERAL ASSEMBLY  
 p. m.      MEETING OF THE COORDINATING COMMITTEE

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In principle and when suitable the underlined theme of the technical sessions will be the U.R.S.I./I.G.Y. results.

APPENDIX B

**Topics selected for Discussion**

COMMISSION I :

Frequency standards — Atomic standards.  
Time signals and frequency standards.  
Radio measurement of power.  
Measurement of physical quantities by radio techniques.

COMMISSION II :

Physical characteristics of the troposphere.  
Tropospheric propagation theories.  
Experimental results from investigations of tropospheric propagation.  
Radio meteorology and climatology.

COMMISSION III :

F region ionization — Morphology and theory.  
Sporadic E ionization — Morphology and theory.  
Ionospheric scattering.  
Ionization — Height profiles.  
Hydromagnetic waves — Extra low frequency oscillations.  
The aurora — Radar observations.  
Ionospheric movements.  
The exosphere.  
Rocket and satellite observation data for the ionosphere.

COMMISSION IV :

Sources of atmospheric noise in lightning.  
Properties of natural sources :  
    (a) Special Report on atmospheric noise ;  
    (b) I.G.Y. results ;  
    (c) Effects of noise on communication systems.  
I.G.Y. Whistlers data.  
Whistlers interpretation.  
Characteristics of man made radio noise.  
V.L.F. Propagation.



*Jointly with Commission III :*

Hydromagnetic waves — Extra low frequency oscillations.  
The exosphere.

COMMISSION V :

Highly sensitive receivers — Molecular and parametric amplifiers applications.  
Solar phenomena and their physical interpretation.  
Planets and meteors.  
Galactic emission and its physical interpretation.  
Discrete sources and their physical interpretation.

*Jointly with Commission III :*

The aurora — Radar observations.

*Jointly with Commission VI :*

Antennas and data processing.

COMMISSION VI :

Surface waves.  
Boundary values — Scattering problems — Coding.  
Antennas and data processing.  
Statistically inhomogeneous media.  
Circuit theory (solid state circuits).  
Space relay problems.

COMMISSION VII :

Molecular and parametric amplifiers.  
Energy conversion.  
Plasma phenomena.  
Microwave properties of ferrites.

*Jointly with Commission V :*

Highly sensitive receivers — Molecular and parametric amplifiers applications.

*Jointly with Commission VI :*

Circuit theory (solid state circuits).

*Jointly with Commission VII :*

Microwave properties of ferrites.

APPENDIX C  
Inter-Commission Joint Sessions

Dates	Topics	Participating Commissions	Organizing Commission
Wedn. Sept. 7, a. m.	Microwave properties of ferrites	VI-VII	VII
Thurs. Sept. 8, a. m.	Antennas and data processing	V-VI	VI
Thurs. Sept. 8, p. m.	Hydromagnetic waves — Extra low frequency oscillations	III-IV	III
	Sensitive receivers — Molecular and parametric amplifiers applications	V-VII	V
Mon. Sept. 12, p. m.	The Exosphere	III-IV	III
Tues. Sept. 13, a. m.	Aurora — Radar observations	III-V	III
	Circuit theory (Solid State Circuits)	VI-VII	VI

APPENDIX D

**Rules for Submission of Reports and Papers**

(*Information Bulletin*, n° 111)

AMENDMENTS MADE BY THE COORDINATING COMMITTEE

5.2. Second line : *after* « Secretary General » *add* « or the Chairman of the relevant Commission ».

5.3. First sentence reads as follows :

« Papers on specific subjects of current interest to their Commissions will be invited by the Commission Chairmen after consultation (by mail) with Official Members of their Commissions ».

## NATIONAL COMMITTEES

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### Czechoslovakia

#### MEMBERSHIP

*President* : Josef STRÁNSKÝ, Prof. Dr. Ing. corr. member of the Czechoslovak Academy of Sciences.

*Secretary* : Petr BECKMANN, Ing., Cand. Tech. Sc., Institute of Radio Engineering and Electronics, Czechoslovakian Academy of Sciences, Prague.

*Members* :

Jiří TOLMAN, Ing., Inst. of Radio Eng. and Electronics, Czechosl. Ac. Sc., Prague.

Eliška CHVOJKOVÁ, Dr. Tech. Sc., Astronomical Institute, Czechosl. Ac. Sc., Ondřejov.

Jiří MRÁZEK, Cand. Tech. Sc., Geophysical Institute, Czechosl. Ac. Sc., Prague.

Jaromír BUDEJICKÝ, Dr., Astronomical Institute, Czechosl. Ac. Sc., Ondřejov.

Bohumil KVASIL, Prof. Dr. Ing., Faculty of Atomic Physics, Prague.

Jan TAUC, Dr., Institute of Technical Physics, Czechosl. Ac. Sc., Prague.

Sergej DJADKOV, Institute of Radio Engineering and Electronics, Czechosl. Ac. Sc., Prague.

Miguel TUERO, Institute of Radio Engineering and Electronics, Czechosl. Ac. Sc., Prague.

Albert PEREZ, Institute of Information Theory and Automation, Czechosl. Ac. Sc., Prague.

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## Inde

### MEMBERSHIP

*President* : Dr. K. S. KRISHNAN, FRS., Director, National Physical Laboratory of India, Hillside Road, New Delhi.

*Secretary* : Dr. A. P. MITRA, Assistant Director, National Physical Laboratory of India, New Delhi.

*Members* :

Prof. K. SREENIVASAN, Head of the Department of Electrical Communication Engg., India Institute of Science, Bangalore.

Prof. S. K. MITRA, Emeritus Prof. of Physics, University of Calcutta, 92, Upper Circular Road, Calcutta.

Mr. A. C. RAMACHANDANI, Chief Engineer, All India Radio, New Delhi.

Dr. M. B. SARWATE, Wireless Adviser, Ministry of Communication, Wireless Planning and Coordination, New Delhi.

Dr. K. R. RAMANATHAN, Director, Physical Research Laboratory, Ahmedabad 9.

Prof. S. V. CHANDRASEKHAR AIYA, Principal College of Engineering, Poona 5.

Chairman, Joint Communication Electronics Committee, Cabinet Secretariat, Military Wing, D. H. Q., New Delhi 2.

Mr. B. V. BALIGA, Managing Director, Bharat Electronics, Bangalore.

Director, Central Electronics Engineering Research Institute, Pilani.

Mr. S. MYAGERI, c/o M/s Murphy Radio of India, Ltd., Dr SHIRODKER, Road of Hospital Avenue, Parel, Bombay 12.

Director, Indian Standards Institution, Manak Bhavan, Mathura Road, New Delhi.

Prof. S. P. CHAKRAVARTI, Principal, Government Engineering College, Jabalpur.

Dr. A. S. RAO, Atomic Energy Commission, 32, Appolo Pier Road, Bombay.

Director General, Scientific and Industrial Research, Old Mill Road, New Delhi.

Dr. B. N. SINGH (A.I.R.), Room n<sup>o</sup> 108, H Block, DHQ PO,  
New Delhi 11.

Dr. J. N. BHAR, Head of the Institute of Radiophysics and Elec-  
tronics, 92, Upper Circular Road, Calcutta 9.

Dr. J. S. CHATTERJEE, Professor of Physics and Communications,  
Jadavpur, Calcutta.

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## COMMISSIONS

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### Czechoslovakia

#### OFFICIAL MEMBERS

- Commission I : Ing. Jiří TOLMAN.  
Commission II : Ing. Petr BECKMANN.  
Commission III : Dr. Eliška CHVOJKOVÁ.  
Commission IV : C. Sc. Jiří MRÁZEK.  
Commission V : Dr. Jaromir BUDĚJICKÝ.  
Commission VI : Prof. Bohumil KVASIL.  
Commission VII : Dr. Jan TAUC.
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### Commission I

#### REPORT OF COMMISSION I OF THE JAPANESE NATIONAL COMMITTEE

by I. KOGA, Official Member

In accordance with Resolution n° 3 of Commission I made at the XIIth General Assembly at Boulder in 1957, Commission I of the Japanese National Committee has recently prepared three Bolometer (Barretter) Mounts as standards of microwave power measurement at 9 375 Mc/s, and sent one (J9-7) to Dr. R. L. Smith-Rose in the United Kingdom and another one (J9-6) to Mr. W. D. George in U. S. A. in April, 1959, in order to intercompare with the standards of their countries.

As we have reported at the XIIth General Assembly we delivered a bolometer at that time to Mr. George, and in December, 1957 we received his detailed report on the intercomparison with the U. S. standards.

The result was about 10 % different from us. After careful studies we found that there was a weak point in the mechanical construction which was not strong enough for the transportation. Therefore, this time we have improved this weak point and transported by parcel post between several places in our country and intercompared the measured results for several times between the associated institutions before and after the transportation. Thus we expect a very good coincidence of our result with those of the United Kingdom. As soon as we obtain the results of intercomparison, we will report to the Secretariat.

In closing this report, we would like to point out that this work has been carried out by the Committee for Microwave Power Measurement with the cooperation of the Institute of Electrical Communication Engineers of Japan, the Electrical Engineering Department of Tokyo University, the Electrotechnical Laboratory of the Ministry of International Trade and Industry, the Electrical Communication Laboratory of the Japanese Telephone and Telegraph Corporation, the Shimada Physical and Chemical Industrial Co., and the Anritsu Electric Co., under the careful and considerate management of Dr. Sogo Okamura at Tokyo University as the secretary.

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## Commission II

### LETTER TO ALL OFFICIAL MEMBERS AND OFFICERS

27th May, 1959.

*To all Official Members and Officers, Commission II.*

Dear Colleague,

*Programme of Meetings of Commission II*

In accordance with the recommendations made recently by the Board of Officers of U.R.S.I., I wish to propose that the sessions of Commission II at London should be devoted to the following topics :

1. Experimental results from investigations of tropospheric propagation.

2. Physical characteristics of the troposphere.
3. Propagation theories.
4. Radio meteorology <sup>(1)</sup> and climatology.

More than one session may be allocated to some of these items. The aim will be to present, under items 1 and 2, the *known facts* about propagation and the atmosphere. Item 3 is concerned with theories of propagation and their relation to the experimental facts, and it is hoped that, as far as is possible, discussions under this item will not be embarked upon at any length until a clear statement of the current position under items 1 and 2 has been obtained.

I would also like to suggest that a joint session might be held with Commission III, to discuss the application of the new techniques of space research to the investigation of the influence of the atmosphere as a whole on radio wave propagation.

A meeting of the Board is to be held shortly to consider the programme for the XIIIth General Assembly, and I should therefore be grateful if you could let me have your comments on the above proposals as soon as possible, and in any case not later than Friday, 19th June, 1959.

When the programme of the sessions is agreed I shall wish to make further proposals concerning the individuals to be invited to present an opening integrating paper on each item.

Yours sincerely,  
(sgd) R. L. SMITH-ROSE,  
President, Commission II.

### BIBLIOGRAPHY

Attention of our readers is drawn to the following publication of the National Bureau of Standards :

« Low- and very low-radio frequency tables of ground wave parameters for the spherical earth theory : The root of Riccati's differential equation » (*Technical*, note n° 7).

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<sup>(1)</sup> It is possible that the Joint Commission on Radio Meteorology may wish to arrange more extensive discussions on this subject during 1960 (See *U.R.S.I. Bulletin*, n° 112, p. 41).



### Commission III

#### RADIO WAVE PROPAGATION CONDITIONS FOR THE SUNSPOT-MINIMUM EPOCH

Department of Scientific and Industrial research  
Radio Research Station

(SLOUGH)

*Special Issues of Bulletin A* dealing with predictions of propagation conditions at the sunspot minimum epoch of 1954-1955 and at the sunspot maximum epoch of 1957-1958 have already been circulated. These bulletins presented the predictions in 3-zone form.

As a result of requests for similar data in our standard U.T. form the *Special Issue* n° 3 of *Bulletin A* has now been produced. It has been compiled in terms of measured values of ionospheric parameters obtained during the months of March, June and December at the last sunspot minimum in 1954.

#### BIBLIOGRAPHY

1. Ionospheric effects due to nuclear explosions.

We want to draw the attention of our readers to NBS Report 6050 : « Ionospheric effects due to nuclear Explosions » by W. F. Utlaut.

2. *Bolletino di Geofisica Teorica ed Applicata* :

We have the pleasure to inform our readers that the Experimental Geophysical Observatory of Trieste started the publication of a review entitled : *Bolletino di Geofisica Teorica ed Applicata* .

N° 1 of this review contains :

- L'osservatore Geofisico Sperimentale di Trieste, by C. Morelli.
- Sull' Anisotropie elettrogeosmotrica, by A. Belliugi (with summary in English language).
- Effetti di temperatura sul fattore di scala dei gravimetri Worden, by C. Gantar and C. Morelli (with summary in English language).
- Sulla base gravimetrica nazionale « Bologna-Ferrare » e sulla variazione nel tempo del fattore strumentale dei gravimetri Worden, by C. Gantar and C. Morelli (with summary in English language).

- Sull'analisi mediante combinazioni lineari di ordinate di particolari funzioni di due variabile composite da elementi periodici, by F. Mosetti (with summary in English language).
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## **Commission V**

### **SUN-GAZER**

(Reprint from *Journal U.I.T.*, n° 4, april 1959)

A special television system that will permit astronomers on the ground to aim and focus a telescope suspended from a balloon fifteen miles above the earth is being developed by scientists of the Radio Corporation of America (R.C.A.).

Dr. V. K. Zvorikyn, Honorary Vice President of R.C.A., said the system is being prepared at R.C.A.'s David Sarnoff Research Center in Princeton, New Jersey, for a Princeton University experiment sponsored by the National Science Foundation and the Office of Naval Research.

The television equipment, comprising a specially designed slow-scanning airborne camera and transmitter as well as ground monitoring system, is to be used in high-altitude solar observation next summer.

(Source : *R.C.S. News Letter.*)

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## **Commission VI**

### **LETTER TO OFFICIAL MEMBERS AND TO SUB-COMMISSION CHAIRMEN**

SUBJECT : *Plans for the General Assembly of 1960.*

Dear Colleagues,

As you know the Board of Officers of U.R.S.I. and the Chairmen of the Commissions are going to meet with the British Arrangements Committee to plan in some detail the technical as well as other phases of the program of the General Assembly. The

planning meeting will take place in Brussels on June 29-30. I shall appreciate your assistance in preparing for this meeting by sending me your ideas and suggestions for alternate procedures.

First, I should say something about certain problems and difficulties which I have encountered in setting up our programs at previous General Assemblies. They are in part reflections of the more fundamental problem of determining the proper functions of the Commission. This is a matter which faces also Commissions I and VII. The fields covered by Commission VI do not have the day by day international feeding grounds as do those of Commissions II-V. Research in Information Theory, Circuits and Network Theory, Antennas and Waveguides can well progress without intimate international collaboration. There is, to be sure, a need for an exchange of ideas and information on an international basis but the program of exchange is certainly not in the same class as that for experiments in ionosphere and troposphere propagation, meteorology, terrestrial noise, and radio astronomy. Thus the spirit and the objectives of meetings of Commission VI differ from those of the others in the very nature of the fields.

It has been suggested that Commission VI should regard its primary function in U.R.S.I. to be the service it can give to the other Commissions. That, I believe, would hardly justify to those who supply the financial support the expenditures required to attend a General Assembly and would hardly make the efforts of the members of the Commission worthwhile. In actual fact to be of service to the other Commissions we must participate in the research areas of those Commissions so that we can recognize just where their problems become those of Commission VI. That type of service activity can be developed and obtained most effectively by creation within Commissions II-V of ad hoc study groups to deal with the immediate problem. We have, in fact, tried to fulfill a service function by participating in joint sessions at the General Assembly and I believe that some of those joint sessions have been the most fruitful that we have had. If they were lacking in effectiveness, it is because of inadequate planning which can be rectified by advanced arrangements such as can be made this June.

A major difficulty with Commission VI is the wide range of subject matter which falls within its province and the somewhat

disconnected nature of the subject matter. It is too extensive for any one person to be intimately knowledgeable in all of it, both as to subject matter and the major contributors to the field. We have tried to meet the demands of the situation by creating three subcommissions on Information and Communication Theory, Circuits and Network Theory, and Electromagnetic Theory including antennas and waveguides, respectively, without effecting an actual splitting up into new commissions. While we have maintained the form of a single commission it has been difficult to maintain a cohesive group and to establish common grounds for the three subcommissions. At the 1957 General Assembly we tried to generate interrelated programs such as those on Information Theory and Microwave Optics and on Circuit Theory and Electromagnetic Theory but it became clear that there were no really significant contributions being made on such subjects.

The suggestion of holding symposia at the General Assembly is a recurrent one. Professor van der Pol and I have both tried to organize our programs on a symposium basis. However, our procedures were simply not effective because an effective symposium could not be organized under the then existing rules of the National Committee authority over the appointment of delegates and submission of papers. The procedures could have been more effective if the National Committees had acted as bodies of reviewers for papers being submitted and had made certain that only those papers which spoke to the topics announced for symposia were submitted. But our experience has been that we have received volumes of irrelevant papers and found ourselves trying to accord appropriate recognition to the delegates who happened to come along with their papers by finding a spot for them on the program.

I believe that the most important role that Commission VI can play is as a central body for organizing international symposia such as the ones on Electromagnetic Waves which have been direct outgrowths of Commission VI activities, and those on Information Theory and Circuit Theory to which Commission VI has given support in a less direct way so far. One look at those symposia makes the importance of this function of Commission VI strikingly clear, but also makes any-one realize that no one General Assembly can accommodate even one such symposium. We would simply swamp the General Assembly by the sheer weight of our own

program. And to hold three to cover all of Commission VI is to me completely unreasonable. It seems evident to me that the major symposia sponsored by Commission VI must be held at times other than the General Assembly.

There are a number of important things that the Commission can do at a General Assembly :

(1) Plan and make the first arrangements for organization of its symposia which are to be held during the period between General Assemblies. The Commission can entertain invitations from National Committees to hold symposia in their countries, plan the general scope of the symposia, and assist in extending invitations to participants.

(2) Review the status of the fields on the basis of the symposia and of the National Committee Reports. Such reviews issued in the form of published documents can be more effective in stimulating further research than our present procedures.

(3) Organize special study groups on topics and questions submitted by the C.C.I.R.

(4) Organize special study groups to work on problems in our fields that arise in the work of the other Commissions ; participate in joint meetings with other Commissions when such are needed.

My proposals for the program of Commission VI at the General Assembly are than as follows :

(1) Organization of symposium committees to plan and organize the major technical symposia to be held during the period 1960-1963. In the future these committees can well take the place of our three subcommissions. I hope that the National Committees will explore the interest in such symposia among members of their organizations and relay their finding through their representatives on Commission VI. The committees will also entertain invitations for holding symposia in various countries.

(2) Organization of special study groups to serve the C.C.I.R. and other Commissions. This phase of the program cannot be developed in detail until after the June planning meeting and C.C.I.R. questions and requests for studies are received.

(3) A series of panel discussions are to be held to evaluate the status of the fields of Commission VI. The discussions will be based on *National Committee Reports*, special reports prepared by the

Commission, and on available publications of symposia held between General Assemblies.

*It is to be understood that there will be no presentation of or reading of individual contributed papers.* Each National Committee may append to its report what it considers to be particularly significant contributions to the field but the inclusion of a paper as part of the National Committee Report does not imply a commitment by the Chairman to have it presented formally at the General Assembly.

Now for this to be effective the National Committee Reports should and must be critical documents and not merely bibliographies with superficial statements introducing a set of papers. I hope that the National Committee Reports will read more like the review papers, of say the *Reviews of Modern Physics*, from which one can deduce the lines of argument in the theory, the relevance and reliability of experimental data, and the remaining problems in the field. I have already enjoined upon the U. S. A. Commission VI to try to prepare its report along such lines. If we are successful in getting the right form of contribution, we can turn the Proceedings of Commission VI at the next General Assembly into a publication of major significance.

Several topics around which the panel discussions may be organized are :

1. *Surface Waves* (a special study group was set up at the 1957 General Assembly under Dr. J. Wait; the report will be ready for the 1960 meeting).
2. *Comparison between Large Arrays and Reflector Antennas.*
3. *Antennas and Data Processing; Limits on Resolution.*
4. *Scattering of Electromagnetic Waves*, with particular reference to statistically inhomogeneous media.
5. *Necessary and Sufficient Conditions in Network Theory and Realizability.*
6. *Coding Errors.*

These are suggestions. Please feel free to criticise and, above all, send me suggestions for other topics.

Three international symposia will be held this June, one in Toronto, Canada on Electromagnetic Wave Theory Theory, one in

Los Angeles on Circuit and Network Theory, and one in Paris on Information and Data Processing Techniques. All three are in the week June 15-21. I hope that the publications will be out by the time of the General Assembly and that we can use the material as a basis for some of our studies.

I wish to state again that I am submitting this document for your consideration. I shall look forward to early replies with comments and suggestions for either the implementation of my proposal or for different methods of procedure. I shall be leaving Berkeley on June 10 and, therefore, I urge you to reply by June 1 so that I can study your ideas and integrate them into a plan for presentation in Brussels.

Thank you very much for your help and cooperation.

With best regards, I am

Sincerely yours,

(sgd) Samuel SILVER,  
Chairman, Commission VI,  
U.R.S.I.

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## U.R.S.I.-A.G.I. COMMITTEE

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### World-Wide Soundings Committee

May 1, 1959.

#### To : All Ionospheric Vertical Soundings Organizations

The World-wide Soundings Committee of the International Scientific Radio Union is holding a meeting in late August in Brussels to consider and compile recommendations on Ionospheric Vertical Soundings work for the post-I.G.Y. era. I would like to invite a representative of your organization to attend the sessions on August 28-29 and communicate your views.

The W.W.S.C. will be reviewing the procedures recommended for the reduction of vertical soundings data during the I.G.Y., to see what changes should be made on the basis of I.G.Y. experience. We also will consider whether to recommend alternative, compatible procedures involving less detail. Another topic will be the relationship of the systematic reduction procedures to the rapidly growing  $N(h)$  — true height programs. It is likely that the optimum size of the post-I.G.Y. network will also be discussed.

These W.W.S.C. sessions are being held immediately prior to the open meetings of the U.R.S.I.-A.G.I. Committee to survey results of the I.G.Y., scheduled for September 1 to 3, also in Brussels. I am sure you have received word of this letter meeting from the secretary, Professor W. J. G. Beynon. These meetings were intentionally coordinated so that individuals could conveniently contribute to both.

I would appreciate hearing if you can send a representative to this W.W.S.C. meeting, or alternatively can send written comments. The meeting room and schedule will be sent later to those indicating intention of participating.

(sgd) A. H. SHAPLEY, Chairman.

World-wide Soundings Committee, U.R.S.I.



**CENTRAL COMMITTEE ON URSIGRAMS  
AND I. W. D. S.  
STEERING COMMITTEE**

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**Joint Meeting of the Steering Committee of the  
International World Days Service (I.W.D.S.) and  
of the Central Committee on Ursigrams (C.C.U.)**

Brussels, May 14-15, 1959

The following Resolutions were endorsed by the Board of Officers of U.R.S.I. on July 1st, 1959.

**Resolutions**

With common agreement of both Committees, it was agreed to hold joint sessions on both I.W.D.S. and C.C.U. items.

At this meeting, the following resolutions were reached :

A. — TERMS OF REFERENCE OF BOTH COMMITTEES  
LINKS BETWEEN URSIGRAM AND I.W.D. SERVICES,  
AND WITH OTHER ORGANIZATIONS MEMBERSHIP TO F.A.G.S.

*Resolution 1.*

*Considering :*

(a) the terms of reference given for I.W.D.S. by I.C.S.U. at its VIIIth General Assembly in Washington in Sept.-Oct. 1958,

(b) the terms of reference given for C.C.U. by U.R.S.I. at its XIIth General Assembly in Boulder in September 1957,

the Meeting agrees that these provide a workable arrangement for proceeding with the activities of both groups, and would foresee the possibility of combining the two groups when the two Committees will be definitively organized.

*Resolution 2.*

In view of the increased interest in World Days and Data Interchange during the I.G.Y. by Cosmic Ray groups, the Meeting urges U.R.S.I. to request I.C.S.U. to authorize the Steering Committee to enlarge its membership by a representative nominated by I.U.P.A.P.

*Resolution 3.*

The C.C.U. and the I.W.D.S. Steering Committee assure I.C.S.U. of their desire to collaborate with any organization constituted under I.C.S.U. concerned with international cooperation in Geophysics.

*Resolution 4.*

Noting that the Ursigram Service has been already accepted as a member of F.A.G.S., and that organization and objectives of I.W.D.S. meet the requirements for such a membership, the I.W.D.S. Steering Committee requests U.R.S.I. to take the necessary steps to arrange the affiliation of I.W.D.S. to this Federation.

*Resolution 5.*

The I.W.D.S. Steering Committee resolves to appoint Mr. A. H. Shapley as its representative in the C.S.A.G.I.-S.C.G.

*Resolution 6.*

The I.W.D.S. Steering Committee has decided to appoint Dr. R. Coutrez (General Secretariat of U.R.S.I., 7, place Emile Danco, Brussels 18) as its Secretary.

B. — ADVISORY COMMITTEE

*Resolution 7.*

Taking into account Resolution 1, the Meeting of C.C.U. and I.W.D.S. Steering Committees resolves to appoint one Advisory Committee for both Committees.

This should include :

A) spokesmen to be designated by the Unions for the following specialities :

(a) sunspots (I.A.U.), flares (I.A.U.), corona (I.A.U.) other solar optical phenomena (I.A.U.);

- (b) solar radio phenomena on meter wave lengths (I.A.U.), solar radio phenomena on short waves (I.A.U.), localization of solar radio sources (I.A.U.), spectra (I.A.U.), polarization (I.A.U.);
  - (c) sudden ionospheric disturbances (U.R.S.I.), ionospheric storms (U.R.S.I.), radio propagation forecasts (U.R.S.I.);
  - (d) whistlers (U.R.S.I.);
  - (e) meteors (U.R.S.I.);
  - (f) geomagnetic indices (I.U.G.G.), geomagnetic storms (I.U.G.G.);
  - (g) aurora optical (I.U.G.G.), aurora radio (I.U.G.G.), airglow (I.U.G.G.);
  - (h) cosmic ray patrols (I.U.P.A.P.), special experiments (I.U.P.A.P.);
  - (i) regular meteorological observations (I.U.G.G.), special meteorological researches (I.U.G.G.);
  - (j) rockets (C.O.S.P.A.R.), satellites (C.O.S.P.A.R.);
- B) a representative to be designated by W.M.O. ;
- C) a representative to be designated by C.C.I.R.

#### C. — PRESENT ACTIVITIES

##### *Resolution 8.*

The I.W.D.S. Committee wants to acknowledge the work carried out by C.S.A.G.I. in the field of World Days and Intervals. The Committee wishes to express its thanks to the many agencies and observatories participating in this activity, and particularly to the U. S. National Bureau of Standards.

The Meeting expresses the wish that this cooperation will continue in the future.

##### *Resolution 9.*

The Meeting wishes to express its thanks to the many agencies and observatories participating in the interchange of data by Ursigrams. In view of the importance of such interchange for practical applications and scientific research in the various fields concerned, the Meeting expresses the wish that this cooperation will continue in the future at the same level.

*Resolution 10.*

The I.W.D.S. Steering Committee decides that a Calendar Record for 1959 should be prepared along the same general lines as the I.G.Y. Calendar Record, and that steps should be taken for its prompt publication in a journal of general availability.

*Resolution 11.*

The I.W.D.S. Steering Committee decides that the Geophysical Calendar for 1960 should be along the same lines as that for 1959 and should be made final as long in advance as possible.

*Resolution 12.*

The I.W.D.S. Steering Committee decides that the plan for Alerts and S.W.I. for 1959 (described in the Circular letter WW-19, Nov. 12, 1958, by I.G.Y. Coordinator) should be continued for 1960, subject to modifications in detail which may be based on experience and suggestions received.

D. — URSIGRAM NETWORKS

*Resolution 13.*

The Meeting agrees with the principle that, for the time being, four regional networks for Ursigrams are established :

Eurasia	Western Hemisphere
Europe	Western Pacific

and decides that there is no difficulty if some countries are included in more than one regional network.

The Meeting resolves that the list of participants in each network be established by the regional member concerned.

*Resolution 14.*

The Committee resolves that the C.C.U. should prepare terms of reference for the functioning of regional groups and to define the relationships between the C.C.U. and the regional groups, and also among the regional groups.

The Secretary of the C.C.U. is requested to prepare a draft which will take account of the suggestions of members of the C.C.U.

*Resolution 15.*

The C.C.U. has reviewed the manuscript of the loose-leaf compilation of codes prepared after much labor by the U.R.S.I. General

Secretary and his staff. The Committee is agreed to proceed with publication essentially in this form. The Committee resolves that modifications will only be made after consultation of the members of this Committee. Further, the C.C.U. invites individuals for suggesting modifications.

*Resolution 16.*

The Committee notes that great progress has been made towards unification and simplification of codes, but nevertheless calls the attention of its members on the need of further effort to reduce the number of essentially duplicate codes.

The members of C.C.U. are requested to take the necessary action in their region.

*Resolution 17.*

The Committee notes with satisfaction the consultation undertaken by the European Regional Committee on Ursigrams on the contents of the Ursigram messages, and instructs its Secretary to inform the members of C.C.U. and the interested Unions of the results of this consultation, and invites the members representing other regions to proceed to a similar consultation.

*Resolution 18.*

In view of the continuing need to keep the interchange Ursigrams as inexpensive and effective as possible, the C.C.U. resolves that first priority be given to reports of major distinctive events which may be observable in one or two regions but not in the others, specifically :

UFLAR (importance greater or equal to 2),

URANP (except 2, 3, 4),

USIDA (importance greater or equal to 2),

UCORA (yellow line only).

Equal priority to the above should be given to notices of Advance Alerts. The next priority would seem to belong to URALO and UPATA.

Other types of data will, in general, be included by special arrangements between the regions concerned.

*Resolution 19.*

The C.C.U. takes note that the facilities of the Communications networks for Ursigrams have also been used extensively for transmitting satellite predictions and observations during the I.G.Y. The Committee feels that such use is appropriate but believes that organizations originating satellite messages should be responsible whenever extra expenses are involved.

*Resolution 20.*

The C.C.U. resolves that in case the interchange messages between any two regions have to be reduced in completeness below the minimum desired level because of economical reasons, the regional center should take steps to interchange the remaining data daily by special airmail reports.

E. NEXT MEETING OF C.C.U.

*Resolution 21.*

The C.C.U. instructs its Secretary to consult the members on the possibility of holding the next meeting in Brussels, at the beginning of September 1959, urging that every member should be present or represented in order that the C.C.U. work can progress.

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## COMMITTEE ON SPACE RADIO RELAY

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### **Satellites as relay stations presage new era for communications**

(Reprint from *Journal U.I.T.*, n° 4, April 1959)

A new era in communications with obvious implications for commercial long-distance voice and record traffic, has moved much closer to reality with the success in relaying a voice message from the Atlas missile successfully launched by the United States in December, 1958.

The missile accomplished its major purpose when it demonstrated its ability to serve as a communications relay centre in outer space. The first voice heard from the satellite was that of President Eisenhower as he sent a Christmas message on frequencies 132.45 and 132.905 megacycles.

In a statement regarding the communications test, it was said following the launching : « The implications of this experiment are extensive. The success achieved in demonstrating the principle and the capacity of transmitting voice and multiple telegraph signals by orbiting relay equipment is of historical importance.

« As the capabilities of satellites increase, the distances can be covered and the complexity of the electronics carried by the satellite can be increased to provide many circuits for telegraph and telephone communications and even television signals, so that intercontinental services may be greatly expanded. Indeed, communications with manned space vehicles of the future are assured by the success already achieved in this experiment. »

The communications payload in the missile consists primarily of transmitting, receiving, and recording equipment designed to receive, store or relay messages from ground stations. When in range of these stations, the orbiting relay can receive and transmit seven written messages and one voice message at the same time.

To obtain stored messages from the satellite, a ground station

triggers off a relay transmitter by electronic command. As long as the satellite courier is in range the ground station can also transmit its own messages for relay to another station. Messages can be relayed from one station to another without storage.

The communication project, conducted under the direction of the Advanced Research Project Agency, is known as « SCORE » meaning Signal Communications by Orbiting Relay Equipment.

(Source : *Wire and Radio Communications.*)

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## C. C. I. R.

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### **Report of U.R.S.I. Delegation at Los Angeles 1959 Plenary Assembly of C.C.I.R.**

by Dr. J. Howard ~~B~~ELLINGER, Chairman of Delegation

The Director of C.C.I.R. will officially transmit to the Secretariat General of U.R.S.I. the texts of the C.C.I.R. topics referred to U.R.S.I. by the Los Angeles meeting. The purpose of the present report is to give the C.C.I.R. background of these and closely related topics, as aid to the U.R.S.I. members who will deal with the preparation of responses. The various topics are listed and explained in Appendix 1.

The present report can only be tentative in some respects, the official version of the Los Angeles actions being not yet available. They will appear in the Documents of the IXth Plenary Assembly, Los Angeles 1959, C.C.I.R., Vol. I (Recommendations), Vol. II (Questions, Study Programmes, Resolutions), Vol. III (Reports). At the time of writing of the present report, the assigned numbers of some the Recommendations, Questions, etc., are not yet known. The Los Angeles Document numbers used herein will need to be replaced by those assigned numbers.

The U.R.S.I. Delegation at Los Angeles had two meetings, the first on April 2, the opening day of the Plenary Assembly; the second on April 21. The report of the April 2 meeting is attached hereto as Appendix 2. The April 21 meeting was devoted to a review of the U.R.S.I. implications of the work in progress and a preliminary listing of the topics on which C.C.I.R. was to request U.R.S.I. action.

In accordance with the discussion at the April 2 meeting, the members of the U.R.S.I. Delegation exerted their influence throughout the Plenary Assembly to bring about the use of as specific and purposeful language as possible in referring matters to U.R.S.I. As a result, many more of such references than in the past were

separate Resolutions asking U.R.S.I. for definitely indicated information. This was particularly well done by Study Group VI, Ionospheric Propagation.

The need for this improvement is vividly shown by the fact that the Warsaw 1956 Plenary Assembly of the C.C.I.R. referred 20 topics to U.R.S.I., and U.R.S.I. prepared contributions on only 6 of them. The small percentage of response was in part due to the lack of precision of indication by C.C.I.R. of what contribution was expected from U.R.S.I.

The 6 contributions submitted by U.R.S.I. at its Boulder 1957 General Assembly in response to the Warsaw 1956 requests of the C.C.I.R. are individually mentioned in connection with the respective topics in Appendix I. Another contribution was made by Commission I, a Note on the Standardization of Quantities Used in Radio : Ranges, Accuracies, Definitions, etc. (see discussion in the next paragraph). These 7 U.R.S.I. contributions are given identifying letters, for subsequent reference in the following list :

- A. Commission I. Note on the standardization of quantities used in radio : ranges, accuracies, definitions, etc. (Published in *U.R.S.I. Inform. Bull.*, n° 111, p. 58).
- B. Commission II. Ionospheric sounding stations after the I.G.Y. (Re C.C.I.R. Resolution 26 ; Study Group VI). (Published in 1957 General Assembly Proceedings, Part 3, p. 160).
- C. Commission III. Identification of precursors indicative of short-term variations of ionospheric propagation conditions. (Re C.C.I.R. Study Programme 93 ; Study Group VI).
- D. Commission IV. Characteristics of terrestrial radio noise determining radio interference. (Re C.C.I.R. Study Programme 96 ; Study Group VI). (Published in *U.R.S.I. Inform. Bull.*, n° 105, pp. 11, 13-18).
- E. Commission V. Frequency protection for radio astronomy. (Re C.C.I.R. Recommendation 173 ; Study Group VI). (Published in *U.R.S.I. Inform. Bull.*, n° 105, p. 20).
- F. Commission VI. Communication Theory. (Re C.C.I.R. Question 133, Study Programme 86, Report 38 ; Study Group III). (Published in 1957 General Assembly Proceedings, Part 6, p. 185).

G. Commission VI. Measurement of field strength in the neighborhood of obstacles. (Re C.C.I.R. Question 137; Study Group V).

The U.R.S.I. Contribution A from Commission I (Note on the standardization, etc.) led to considerable discussion in Study Group V, based on the definitions proposed by Commission I Resolution n° 4 of « radio field strength » and « radio field intensity ». Difficulty has developed in the use of these terms, particularly of the French equivalents. The two terms, in English and in French, are :

1. radio field strength = force du champ radioélectrique ;
2. radio field intensity = intensité du champ radioélectrique.

Number 1 was proposed for the field vector and number 2 for the power flux density. Discussion indicated that this proposal reverses the preponderance of actual practice. In France the second term (« intensité du champ radioélectrique ») is commonly used in sense number 1 ; in the U. S. A. likewise, until U.R.S.I. proposed this, the second term (« radio field intensity ») was commonly used in sense number 1 ; in England the term « radio field intensity » has been used very little in either sense. The solution adopted at this meeting was to use for sense number 2 : « power flux density (field intensity) ». In view of the conflicts of practice, and since the difficulties all arise over the terms in which the word « intensity » is included, future practice would be clarified if the word « intensity » be abandoned and the two terms be « radio field strength » and « power flux density ».

A special amount of attention was given to the subject of frequency protection for radio astronomy observations. The Geneva 1958 interim meeting of Study Group VI had proposed a slight revision of Warsaw 1956 Recommendation 173. There was extensive activity among radio astronomers in 1958 to secure further revision with a view to complete protection against radio interference in a number of frequency bands throughout most of the radio spectrum. This view was strongly pressed at Los Angeles and a special Working Group was set up to formulate a Recommendation which was (Document 437 revision and corrigendum) adopted ; see Appendix 3. It was agreed also that the Director of the C.C.I.R. would submit this Recommendation to the I.T.U. Administrative

Radio Conference to be held in Geneva in Aug.-Dec. 1959. This subject is not among those referred by C.C.I.R. to U.R.S.I. for further attention. It is possible that C.C.I.R. may not again be concerned with this subject.

The new subject of space telecommunication was dealt with at length, responding to two Questions, 168 and 169, in this field. In consonance with the scientific interest of this matter, the U.R.S.I. Delegation was active in promoting action. C.O.S.P.A.R., the Committee on Space Research of the International Council of Scientific Unions, had asked the assistance of U.R.S.I. in securing C.C.I.R. consideration. The outcome was the adoption of four papers in this field listed in Appendix 1 ; two of them are Resolutions asking U.R.S.I. for the answers to questions on the radio propagation problems involved. The Recommendation and Report are, like the Recommendation on radio astronomy, to be submitted by the Director of the C.C.I.R. to the I.T.U. Administrative Radio Conference to be held in Geneva in Aug.-Dec. 1959. The Los Angeles Plenary Assembly established a new C.C.I.R. Study Group, to deal with future problems of Space Systems. It is to be Study Group n° IV ; the old n° IV on Ground-wave Propagation was abolished, its functions being placed in n° V which will hereafter deal with the effects of both earth and troposphere.

The present report and especially Appendix 1 summarize the results of the Los Angeles C.C.I.R. Plenary Assembly which require the future attention of U.R.S.I. Very many others of the papers resulting from the meeting are of substantial interest to U.R.S.I. members. One example of pretty close interest is Document 381, « Study of sky-wave propagation on frequencies between approximately 1.5 and 40 Mc/s for the estimation of field strength ». This is a new Study Programme replacing Study Programme 99. It does not call for any action by U.R.S.I., but it is desirable that U.R.S.I. workers in this field take note of the C.C.I.R. activity indicated in this document and in the related documents : Resolution, Doc. 535 ; Recommendation, Doc. 534 ; Report, Doc. 706.

In conclusion, the results of the Los Angeles meeting and the experiences of the delegates have demonstrated anew the mutual value of continued cooperation of the C.C.I.R. and the U.R.S.I. The Director of the C.C.I.R. said repeatedly that the collaboration

by U.R.S.I. is of growing usefulness to the C.C.I.R. The U.R.S.I. participation in the present meeting had the cordial support of all delegations.

#### APPENDIX I

##### **Los Angeles topics on which U.R.S.I. Action is required**

(\*) Documents published pp. 55-74.

##### FOR COMMISSION I. — *Radio Measurement Methods and Standards*

From Study Group VII : Doc. 313, Recommendation n° 319, « Standard frequency transmission and time signals » (\*). Replaces Recommendation 179, which had requested U.R.S.I. cooperation with C.C.I.R. U.R.S.I. Commission I in 1957 resolved to study these matters but no U.R.S.I. material resulted. The request for U.R.S.I. cooperation is repeated in the new Recommendation. It is regrettable that the specific work desired of U.R.S.I. is not stated as clearly as desirable. Study of this topic may include also consideration of Doc. 548, Recommendation « Standard frequency transmissions and time signals in additional frequency bands ».

From Study Group VII : Doc. 446, Report, second last paragraph only, « The possibility of using different forms of time markers to indicate physical and astronomical time ». This is specifically referred to U.R.S.I.

##### FOR COMMISSION II. — *Tropospheric Radio Propagation*

From Study Group V : Doc. 530, Resolution n° 40, « Influence of the troposphere on frequencies used for telecommunication with and between space vehicles » (\*). This is a specific request to U.R.S.I. for scientific information. Its purport is closely related to the following : Doc. 531, Recommendation, « Selection of frequencies used in telecommunication with and between artificial earth satellites and other space vehicles » : Doc. 662, Report, « Factors affecting the selection of frequencies for telecommunication with and between space vehicles » : also Doc. 538, Resolution n° 47 (\*) (listed under Commission III below).

From Study Group V : Doc. 527, Study Programme n° 138 (V), « Tropospheric-wave propagation » (\*). Replaces Study Programme 90, which had requested U.R.S.I. and others to study this « as a matter of great urgency ». That request is repeated. It is regrettable that the specific work desired of U.R.S.I. is not stated as

clearly as desirable. Study of this topic may include also consideration of Doc. 503, Report, «Tropospheric wave propagation curves»; Doc. 526, Recommendation, «Tropospheric wave propagation curves»; Doc. 279, Report on experimental basis of curves.

FOR COMMISSION III. — *Ionospheric Radio Propagation*

From Study Group VI : Doc. 540, Resolution n° 44, «Choice of a basic index for ionospheric propagation» (\*). This is a specific request to U.R.S.I. for scientific information. While specific, and put forward as a separate Resolution instead of a Note as had been done at the end of Study Programme 92, it nevertheless duplicates the entire scope of new study Programme Doc. 542 (same title), which replaces Study Programme 92. Very similar scope is also given to a continuing working party of C.C.I.R. Study Group VI in Resolution n° 50, Doc. 536, «Organization of work on the choice and evaluation of ionospheric indices» (\*); that Resolution encourages that working party to coordinate its studies with those of a special group which U.R.S.I. is presumed to establish. The chairman of the C.C.I.R. working party is C. M. Minnis of England. Close collaboration of the two groups will be necessary. The study may include consideration also of Doc. 707, Report, «Choice of a basic index for ionospheric propagation».

From Study Group VI : Doc. 705, Report, «Ionospheric sounding stations after the I.G.Y.». This is based on Contribution B from U.R.S.I., submitted in response to request in Resolution 26. The Report mentions also the more detailed information in report of U.R.S.I.-I.G.Y. Committee meeting of July 1958, reported in *U.R.S.I. Inform. Bull.*, n° 111, p. 32-42, and also reproduced as Doc. 69 Annex of Geneva 1958 meetings of Study Group VI. The U.R.S.I. is not again asked to do anything, but will doubtless want to keep the C.C.I.R. interests in mind in its further planning of ionospheric sounding station locations.

From Study Group VI : Doc. 539, Resolution n° 45 : «Identification of precursors indicative of short-term variations of ionospheric propagation conditions» (\*). This is a specific request to U.R.S.I. for scientific information. It is closely related to Doc. 713, Report (same title), which includes a brief statement on ionospheric disturbances that U.R.S.I. had submitted (Contribution C) in response to request in Study Programme 93.

From Study Group VI : Doc. 532, Recommendation n° 313, « Exchange of information for the preparation of short-term forecasts and the transmission of ionospheric disturbance warnings » (\*). This replaces, and only slightly modifies, Recommendation 59, which had requested of U.R.S.I. the fullest possible standardization of codes. This request is repeated.

From Study Group VI : Doc. 537, Resolution n° 43, « Radio propagation at frequencies below 1500 kc/s » (\*). This is a specific request to U.R.S.I. for scientific information. A broader request along these lines had been included in Study Programme 63 ; such request is omitted from the new Study Programme, Doc. 382 (same title), which replaces Study Programme 63.

From Study Group VI : Doc. 538, Resolution n° 47, « Effects of the ionosphere on radio waves used for telecommunication with and between space vehicles beyond the lower atmosphere » (\*). This is a specific request to U.R.S.I. for scientific information. Its purport is closely related to Doc. 530, Resolution n° 40, listed under Commission II above, and also to Doc. 531 and 662 mentioned thereunder.

From Study Group VI : Doc. 536, Resolution n° 50, « Organization of work on the choice and evaluation of ionospheric indices » (\*) This resolution suggests the appointment of a Working Party to continue the studies of Study Programme 150 (VI) and to work in collaboration with U.R.S.I.

#### FOR COMMISSION IV. — *Radio Noise of Terrestrial Origin*

From Study Group VI : Doc. 291, Resolution n° 46, « Measurement of atmospheric radio noise » (\*). This is a specific request to U.R.S.I. for information on the relations of radio noise intensity to the effects and distribution of lightning flashes. Study Programme 96 had requested U.R.S.I. study of some other problems of atmospheric radio noise, resulting in U.R.S.I. Contribution D which was duly used in preparing a new Report, Doc. 289, (same title). A new Study Programme, Doc. 295 (same title), replacing Study Programme 96, mentions the new request that is being made to U.R.S.I. in this new Resolution.

From Study Group VI : Doc. 378, Resolution n° 42, « Whistler mode propagation » (\*). This is a specific request to U.R.S.I. for

information on how to calculate field strength for propagation via the whistler mode. Mention is made of this Resolution in Study Programme, Doc. 379, « Study of the whistler mode of propagation ».

FOR COMMISSION VI. — *Radio Waves and Circuits*

From Study Group I : Doc. 277, Report, « Possibilities of reducing interference and of measuring actual traffic spectra. ». This replaces Report 38. It responds to Question 1 (I) and Report 38 and in part to Question 133 (III) and Study Programme 86. Study Programme 86 had requested study by U.R.S.I., resulting in U.R.S.I. Contribution F. Study Group I has asked the Director of C.C.I.R. to send a letter to the Secretary General of U.R.S.I. asking U.R.S.I. to study this anew. The letter states : « The theoretical and practical possibilities of reduction of radio interference have very great importance for C.C.I.R., and the aid of U.R.S.I. is requested in this study. This aid could for example make it possible to correct and extend the considerations given in the Report on the basis of published works, and to promote new researches bearing on the unsolved problems some of which are mentioned at the end of the Report ».

From Study Group II : Doc. 669, Question n° 175 (II), « Usable sensitivity of radio receivers in the presence of quasi-impulsive interference » (\*). This replaces, and only slightly modifies, Question 125, which had requested U.R.S.I. to study and to report promptly. This request is repeated. It is regrettable that the specific work desired of U.R.S.I. is not stated as clearly as desirable. A Report, Doc. 507, on methods for calculating certain effects of radio noise on radio receivers, should be considered in this study.

WARSAW PLENARY ASSEMBLY TOPICS

Attention of the members of U.R.S.I. should also be drawn to two documents of the Warsaw 1956 Plenary Assembly of C.C.I.R. : Report 46 : « Temporal variations of ground wave field strength » (Attention of Commission II).

Recommendation 165 : « Communication Theory » (Attention of Commission VI).



APPENDIX 2

**First Meeting of U.R.S.I. Delegation**

April 2, 1959

(Report by Chairman of Delegation, Dr. J. H. DELLINGER)

1. *Membership.* — All persons interested in U.R.S.I. work present at the C.C.I.R. Plenary Assembly were invited to attend this meeting. Those not members of the U.R.S.I. delegation attended as observers. The delegation members are those whose names have been notified in advance by National Committees plus those present who are members of National Committees or International Commissions, viz. :

Austria : PANGRATZ (substituting for Dr. ANTON).

Belgium : VAN DE WALLE.

Denmark : HEEGAARD.

France : DAVID, DECAUX, LÉPÉCHINSKY, LOCHARD, VOGÉ.

Germany : BECKMANN, GROSSKOPF, HEILMANN.

India : SARWATE.

Japan : MIYA.

Netherlands : HOUTSMULLER, NEUBAUER, STUMPERS, VAN DUUREN,  
VORMER.

New Zealand : CLARKSON.

Portugal : VIERA.

South Africa : BIRRELL, MILLS, VOLLMER.

Sweden : ESPING, GEJER, AKERLIND.

Switzerland : GERBER.

U. K. : BOOTH, SAXTON, SMITH-ROSE.

U. S. A. : AGY, ALLEN, BAILEY, BEAN, CRICHLAW, CUMMING,  
DELLINGER, DICKSON, DINGER, FINE, GAUTIER, GEORGE,  
HERBSTREIT, KIRBY, NORTON, SLUTZ, E. K. SMITH, WATT,  
WILLIS

2. *Timing of U.R.S.I. Contributions to C.C.I.R.* — Discussion developed agreement that work by U.R.S.I. on topics referred to it by the present Plenary Assembly of C.C.I.R. would not be likely to be done soon enough to be usable by the Radio Administrative Conference to be held in Geneva, August to December of this

year. The U.R.S.I. should begin work on topics here referred to it, as soon as possible, with view to completing some of them by the September 1960 General Assembly of U.R.S.I. in London and completing all of them at least some months before the Xth Plenary Assembly of C.C.I.R. in 1962.

3. *Improvement of Mode of Referring C.C.I.R. Topics to U.R.S.I.* — There is great need of more specific and more purposeful language in referring matters to U.R.S.I. In the past, some matters have been merely drawn to the attention of U.R.S.I., and quite commonly there has been no clear indication of what U.R.S.I. was expected to do, as distinct from what C.C.I.R. itself would do. The inadequacy is somewhat indicated by the fact that Warsaw 1956 referred 20 topics to U.R.S.I. and U.R.S.I. furnished responses on only 7. The needed improvement can readily be brought about by the members of the U.R.S.I. delegation keeping in mind the need for clear and specific statement of what U.R.S.I. should do on each topic in the various Working Groups here in Los Angeles. One good way to bring this about is to use the Resolution form, thus, «The C.C.I.R., considering..., unanimously resolves : that the U.R.S.I. be asked the following question...». There may be cases where U.R.S.I. consideration is requested, in the text of other types of papers, but in every case the purpose of the reference to U.R.S.I. and the precise nature of U.R.S.I. aid desired should be clearly expressed.

4. *Some Particular Topics.* — The Director of C.C.I.R. circulated, by request of U.R.S.I. Commission I, copies of Resolutions of that Commission on the need for standardization of radio quantities, special definitions, constants, etc. That Commission of U.R.S.I. would like to be informed of any needs felt by the C.C.I.R. for standardization of measurements, range of values or other types of standardization as above mentioned. The members of the U.R.S.I. delegation here might keep in mind the willingness of U.R.S.I. to undertake work of this kind.

Radio astronomy has been handed back and forth between C.C.I.R. and U.R.S.I. several times, Study Group VI adopted a slight revision of Warsaw Recommendation 173, at its July 1958 Meeting in Geneva. An U.R.S.I. sub-commission has prepared some further recommendations : these will be presented next week.

Space telecommunication has recently been made the subject of two new questions (168 and 169). Several proposals have been submitted by administrations. A proposal has also been submitted by the Committee on Space Research (C.O.S.P.A.R.) of the International Council of Scientific Unions. It was agreed that this should be submitted for consideration here by the U.R.S.I. delegation.

5. *To be done here.* — Members of the U.R.S.I. delegation will keep notes of the matters referred, or likely to be referred, to U.R.S.I. and will inform the Chairman of the delegation of these from time to time. A meeting of the delegation will be held early in the week of April 19 or sooner if needed. Near the end of the conference, the delegation will consider relative urgency of prospective U.R.S.I. work on the C.C.I.R. topics.

### APPENDIX 3

#### RECOMMENDATION N° ... (1)

#### **Protection of Frequencies used for Radio Astronomical Measurements**

(C.C.I.R., Los Angeles 1959).

The C.C.I.R.,

*considering :*

(a) that the development of radio astronomy has already led to major technological advances, particularly in receiving techniques, and to improved knowledge of fundamental radio noise limitations of great importance to radio communication, and promises further important results ;

(b) that protection from interference on certain frequencies is absolutely essential to the advancement of radio astronomy and the associated measurements ;

(c) that, for the observation of known spectral lines, certain bands at specific frequencies are of particular importance ;

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(1) This Recommendation replaces Recommendation n° 173.

(d) that account should be taken of the Doppler shifts of the lines, resulting from the motion of the sources which are in general receding from the observer ;

(e) that for other types of radio astronomical observations a certain number of frequency bands are in use, the exact positions of which in the spectrum are not of critical importance ;

(f) that the sensitivity of radio astronomical receiving equipment, which is still steadily improving, greatly exceeds the sensitivity of communications and radar equipment ;

(g) that a considerable degree of protection can be achieved by appropriate frequency assignments on a national rather than an international basis ;

(h) that, nevertheless, it is impracticable to afford adequate protection without some international agreement ;

*recommends :*

1. that radio astronomers should be encouraged to choose sites as free as possible from interference ;

2. that Administrations should afford all practicable protection to the frequencies used by radio astronomers in their own and neighbouring countries ;

3. that particular care should be taken to give complete international protection from interference to observations of emissions known or thought to occur in the following bands :

Line	Line frequency (Mc/s)	Band to be protected (Mc/s)
Deuterium .....	327.4	322- 329
Hydrogen .....	1420.4	1400-1427
OH .....	1667	1645-1675

4. that the bands allocated for standard frequency and time signal emissions at 2.5, 5.0, 10.0 and 20.0 Mc/s should not include anything other than the standard frequency and time signal emissions, thus permitting their use for reception in radio astronomy ;

5. that consideration be given to securing adequate international protection of a number of narrow frequency bands throughout the spectrum above 30 Mc/s for the purposes of reception in radio astronomy (see Note);

6. that Administrations, in seeking to afford protection to particular radio astronomical observations, should take all practicable steps to reduce to the absolute minimum amplitude harmonic radiations falling within bands of frequencies to be protected for radio astronomy.

*Note.* — Radio astronomers in a number of countries have indicated their desire to use for this purpose one frequency band at each of the following approximate positions (not necessarily in harmonic relation).

Frequency (Mc/s)	Bandwidth (Mc/s)
40	± 0.75
80	± 1.0
160	± 2.0
640	± 2.5
2560	± 5.0
5120	±10.0
10240	±10.0

### IXth Plenary Assembly

#### List of C.C.I.R. Findings of interest to U.R.S.I.

In the following list are only mentioned those items which refer to a question submitted by the C.C.I.R. to U.R.S.I. In the second part of the list reference is made to items of interest to U.R.S.I. which originate from the VIIIth Plenary Assembly of the C.C.I.R. (Warsaw, 1956) and the texts of these can be found in *U.R.S.I. Information Bulletin*, n° 100 (Nov.-Dec. 1956).

(a) FINDINGS OF THE IXTH PLENARY ASSEMBLY  
(Los Angeles, April 1959)

Item	Subject	Pages
<i>Commission I</i>		
Recommendation 319	Standard Frequency Transmissions and Time Signals .....	57
<i>Commission II</i>		
Resolution 40	Influence of the Troposphere on Frequencies used for Telecommunication with and between Space Vehicles .....	60
Study Programme 138 (V)	Tropospheric Wave Propagation	61
<i>Commission III</i>		
Recommendation 313	Exchange of Information for the Preparation of Short-Term Forecasts and the Transmission of Ionospheric Disturbance Warnings .....	64
Resolution 43	Radio Propagation at Frequencies below 1500 kc/s.....	66
Resolution 44	Choice of a Basic Index for Ionospheric Propagation .....	67
Resolution 45	Identification of Precursors Indicative of Short-Time Variations of Ionospheric Propagation Conditions .....	68
Resolution 47	Effects of the Ionosphere on Radio Waves used for Telecommunication with and between Space Vehicles beyond the Lower Atmosphere .....	69
Resolution 50	Organisation of Work on the Choice and Evaluation of Ionospheric Indices .....	70
<i>Commission IV</i>		
Resolution 42	Whistler Mode Propagation....	71
Resolution 46	Measurement of Atmospheric Radio Noise .....	72

Item	Subject	Pages
	<i>Commission VI</i>	
Question 175 (II)	Usable Sensitivity of Radio Receivers in the presence of Quasi-Impulsive Interference . . . . .	72
(b) FINDINGS OF THE VIII <sup>TH</sup> PLENARY ASSEMBLY (Warsaw, 1956)		
	<i>Commission II</i>	
Report 46	Temporal Variations of Ground-Wave Field Strength	
Question 137 (V)	Measurement of Field-Strength in the Neighbourhood of Obstacles <sup>(1)</sup>	
	<i>Commission III</i>	
Study Programme 93 (VI)	Identification of Precursors Indicative of Short-Term Variations of Ionospheric Propagation Conditions <sup>(2)</sup>	
	<i>Commission VI</i>	
Recommendation 165	Communication Theory	
Study Programme 86 (III)	Communication Theory	

**C.C.I.R. FINDINGS ON WHICH U.R.S.I.  
COLLABORATION IS REQUESTED**

**Commission I**

Doc. 313.

RECOMMENDATION N<sup>o</sup> 319 <sup>(3)</sup>

*Standard frequency transmissions and time signals*

(Question n<sup>o</sup> 140, (VII))

(Geneva, 1951 ; London, 1953 ; Warsaw, 1956 ; Los Angeles, 1959)

The C.C.I.R.,  
*considering :*

(a) that the Administrative Radio Conference, Atlantic City, 1947, allocated the frequency bands  $2.5 \text{ Mc/s} \pm 5 \text{ kc/s}$  ( $2.5 \text{ Mc/s}$

<sup>(1)</sup> Were considered and answered by U.R.S.I. in 1957.

<sup>(2)</sup> Has been superseded for U.R.S.I. purposes by the new Resolution 45.

<sup>(3)</sup> This Recommendation replaces Recommendation n<sup>o</sup> 179.

$\pm 2$  kc/s in Region 1), 5 Mc/s  $\pm 5$  kc/s, 10 Mc/s  $\pm 5$  kc/s, 15 Mc/s  $\pm 10$  kc/s, 20 Mc/s  $\pm 10$  kc/s, and 25 Mc/s  $\pm 10$  kc/s, requesting the C.C.I.R. to study the question of establishing and operating a world-wide standard-frequency and time service ;

(b) that the operation of 15 standard-frequency and time signal stations, 5 of which were put into operation since the VIIIth Plenary Assembly (Warsaw, 1956), has allowed the collection of considerable data on their performance ;

(c) that atomic (and molecular) standards of frequency with improved accuracy have come into general use, and that the first determination of the characteristic frequency of caesium with respect to Ephemeris time has been made ;

*unanimously recommends :*

1. that a standard-frequency transmission on 5, 10 and 15 Mc/s should preferably comprise a standard carrier-frequency, modulated by time signals only ;

2. that if desired, transmissions on 2.5, 20 and 25 Mc/s may be modulated by one audio frequency at a time chosen preferably from 440, 600 or 1000 c/s ;

3. that the time signals should consist of impulses repeated at intervals of one second and maintained within 50 ms of Universal Time, UT<sup>2</sup> <sup>(1)</sup> ;

4. that the impulses should consist preferably of  $m$  cycles of 200  $m$  c/s tone, where  $m$  is an integral number limited by the bandwidths allotted for standard-frequency transmissions and time signals ;

5. that the first impulse of each minute be modified so as to be easily identified ;

6. that preferably the time signals should be transmitted without any other modulation for periods of 1 or several minutes totalling at least 10 minutes per hour ;

7. that the Chairman of Study Group n° VII, in cooperation with the Director of the C.C.I.R. and the administrations concerned shall study the problem of reducing mutual interference in the

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<sup>(1)</sup> Provisional Uniform Universal Time n° 2 as adopted by the I.A.U. (Dublin, 1955).



existing standard-frequency and time signals bands, e. g. by time sharing and frequency offsetting ;

8. that atomic standards should be used to maintain the transmitted frequency within the stated limits and to provide correction ;

9. that transmitted frequencies should :

- correspond approximately to UT2 and differ from Ephemeris time by as constant an amount as possible ;
- remain constant throughout any one year to  $\pm 5$  parts in  $10^9$  ;

10. that a transmitted time interval of  $n$  seconds duration should be given with a tolerance of  $\pm(n \cdot 5 \cdot 10^{-9} + 10^{-6})$  seconds ;

11. that each administration should promptly publish :

- the provisional measured values of frequencies and time signals for each day at a specific time or for each group of 5 days, at a specified time, beginning on a day whose Julian number is divisible by 5 ;
- the date, time and magnitude of adjustments of the time signal ;
- the date, time and magnitude of step adjustments to the frequency ;
- the assumed value of the atomic standard when used as a frequency reference, in cycles per second <sup>(1)</sup> ;

12. that each administration should send to the Director of the C.C.I.R. for collation and distribution the results specified in 11 for the period of each calendar year ;

13. that each administration should coordinate with the Chairman and Vice-Chairman of Study Group VII any new standard-frequency broadcasts or any changes in existing standard-frequency broadcasts ;

14. that each administration should send all pertinent new information on standard-frequency broadcasting stations to the Chairman and Vice-Chairman of Study Group VII for forwarding to the *Telecommunication Journal of the I.T.U.* for publication in that Journal ;

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<sup>(1)</sup> The second being the unit of time adopted in 1956, at Sèvres, by the International Committee of Weights and Measures.

15. that no new transmitting station, operating in the standard-frequency bands, shall be notified to the I.F.R.B. until experimental investigations and coordination have been completed in accordance with Recommendation n° 2 to the C.C.I.R. in the Radio Regulations ;

16. that any station operating within the framework of this Recommendation and found to be causing harmful interference within the service areas of other established standard frequency stations should eliminate such interference ;

17. that cooperation with the B.I.H. and the U.R.S.I. should continue.

## Commission II

Doc. 530.

### RESOLUTION N° 40

*Influence of the troposphere on frequencies used for telecommunication with and between space vehicles*

(Study Group n° IV)

(Los Angeles, 1959)

The C.C.I.R.,

*considering :*

(a) that communication between the earth and space vehicles is now a practical possibility ;

(b) that the troposphere influences the characteristics of the received signals and the apparent positions as observed by radio methods ;

*unanimously resolves :*

that U.R.S.I. be asked the following questions :

1. what effect does the troposphere have on the propagation through it of radio waves of all frequencies ? Particular attention should be paid to :

- the attenuation of the waves ;
- any variations in the direction of propagation ;

2. what frequencies of transmission from space vehicles will produce the most useful information on the troposphere as a supplement to that obtainable by other methods ?

STUDY PROGRAMME n° 138 (V) <sup>(1)</sup>

*Tropospheric-Wave propagation*

(Geneva, 1951 ; London, 1953 ; Warsaw, 1956 ; Los Angeles, 1959)

The C.C.I.R.,

*considering :*

(a) that widespread developments have taken place in the practical application of radio waves at frequencies above 30 Mc/s ;

(b) that the propagation of such waves is known to be a function of the thermodynamic conditions prevalent in the troposphere and that numerous relevant measurements have been made ;

(c) that, nevertheless, the detailed structure of the field in time and space is still insufficiently known ;

(d) that the propagation studies required for the establishment of a radio circuit necessitate a statistical knowledge of the propagation medium, that is, of the atmosphere ;

(e) that the lack of appropriate measurements makes it impossible as yet to verify the various theories put forward in explanation of radio-wave propagation ;

(f) that progress in the investigation of such propagation has already led to Recommendation n° 312 ;

*unanimously decides* that the following studies should be carried out :

1. efforts should be made to establish the correlation between the variations in the radio field strength and the thermodynamic parameters of the atmosphere ;

2. study of rapid variations in the radio field strength in time and space with a view to defining the different types of propagation ; the establishment of a correlation between these types of propagation and the different meteorological conditions. The presentation of the results obtained should be on the lines described in Recommendation n° 311 ;

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<sup>(1)</sup> This Study Programme which replaces Study Programme n° 90, does not refer to any Question under study.

3. the variations in the refractive index of air with space and time, whatever their cause, should be investigated in detail; in particular, to facilitate calculation of this index, accurate thermodynamic and radio measurements, the latter by means of a refractometer or a similar device, should be made whenever possible (see Annex, para. 1);

4. the improvements in the instruments for measuring the small and rapid variations of the refractive index of the atmosphere, with special reference to the refractometer and a sensitive hygrometer with a low time constant;

5. world-wide climatology should be studied and as a first step in this important work, the national telecommunications services, in agreement with the meteorological services concerned, should calculate for each season the monthly mean value of the parameter  $N$ , as defined in para. 2 of the Annex, for both day and night, at ground level and at a height of 1000 metres above the ground. They should also calculate the parameter ( $\Delta N$ ) determined by the difference between these two values of  $N$ , with a view to establishing world-wide charts of constant values of  $\Delta N$  and world-wide charts of constant values of  $N$  at the surface of the ground,  $N_s$ . Further, if  $N_o$  is taken as the value of  $N$  reduced to sea level, it may be found that  $N_o$  used as an intermediate step may lead to more accurate values of  $N_s$  being derived; the general validity of this procedure should be studied and the preparation of charts of constant values of  $N_o$  considered;

6. administrations and private operating agencies should be encouraged to verify, by means of a large number of accurate measurements, the various theories put forward in explanation of propagation beyond the radio horizon.

*Note 1.* — National Administrations, the U.R.S.I. and other international organisations should be encouraged to pursue as a matter of great urgency the theoretical and experimental study of the propagation of radio waves through the troposphere.

*Note 2.* — The above Study Programme should be brought to the attention of the W.M.O. by the Director of the C.C.I.R., with particular reference to paragraphs 4 and 5.

ANNEX

1. The thermodynamic measurements intended for the calculation of the refractive index of the air and its gradient should, if possible, be made with an accuracy of :

Distance between 2 consecutive points of measurement : 10 metres.

Temperature :  $\pm 0.2^\circ$  C.

Humidity (mixing ratio) :  $\pm 0.1$  g/kg.

Continuous measurement equipment should be used for preference.

2. The parameter  $N = (n - 1) \cdot 10^6$  is given by the formula :

$$N = \frac{77.6}{T} \left( p + 4810 \frac{e}{T} \right)$$

$n$  = refractive index of the air.

$T$  = absolute temperature in degrees Kelvin.

$e$  = water-vapour pressure in mb.

$p$  = atmospheric pressure in mb.

In all cases it is desirable that a description of the apparatus used should be provided. The calculations should, if possible, cover a period of at least 5 years, preferably covering the periods 1951-1955 and 1956 to 1960.

The numerous data furnished by the national meteorological services during the International Geophysical Year should be published separately in so far as they are likely to provide additional information as compared with those other years.

It should be assumed that the seasons can be represented by the months of February, May, August and November, and the hours of measurement will, whenever possible, be at the even hours, local meridian time. Since the determination of  $\Delta N$  is dependent upon data from radio-sonde ascents, the times at which these are made must necessarily be used, though every effort should be made to make these measurements as extensive as possible.

### Commission III

Doc. 532.

#### RECOMMENDATION N° 313 (1)

*Exchange of information for the preparation of short-term forecasts  
and the transmission of ionospheric disturbance warnings*

(Geneva, 1951 ; Los Angeles, 1959)

The C.C.I.R.,  
*considering :*

(a) that it is important to give Administrations and operating services (navigation and other services) using ionosphere-propagated waves the earliest possible warning of the onset of disturbances to ionospheric propagation conditions, so that they may arrange their traffic schedules accordingly ;

(b) that it is desirable to find an easier method of drawing up a plan for the rational use of frequencies in place of the system based on long-term mean values, when the latter is temporarily on account of ionospheric disturbances ;

(c) that it would therefore be advisable for all organizations publishing ionospheric forecasts to study the technique of forecasting disturbances ;

(d) that it is of great importance to take steps to secure the greatest possible accuracy of such forecasts and the maximum of speed in their dissemination ;

(e) that, for the exchange and dissemination of propagation information, there are three categories of users : those who make forecasts, those who make operational use of propagation information and those who require the information for scientific research or other purposes ; and that, to meet these different requirements, it is desirable to use the most appropriate methods of exchange in each case ;

(f) that effective collaboration has been arranged, particularly for the I.G.Y. programme, between some Administrations, operat-

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(1) This Recommendation replaces Recommendation n° 59.

ing services and the organizations studying the characteristics of the ionosphere, and deducing forecasts therefrom ;

(g) that provisional codes, prepared by the International Radio Scientific Union (U.R.S.I.) such as the code used in French Ursigrams, or due to organizations such as the Central Radio Propagation Laboratory (C.R.P.L.), the Arbeits-Gemeinschaft Ionosphäre, the Japanese Central Propagation Laboratory and others, have proved their usefulness in the dissemination of information for the preparation of short-term forecasts ;

*unanimously recommends :*

1. that each country participating in radio propagation research should designate an official agency for the reception, coordination and exchange of such data and for liaison with corresponding agencies in other countries ;

2. that the information required for the preparation of short-term forecasts should be centralised by the agencies mentioned in para. 1, as far as possible by the most direct means of telecommunication between the centralising agency and the various scientific institutes for solar, magnetic and other observations ;

3. that, of the data thus assembled, those which are of use for forecasting within 48 hours should be disseminated in accordance with the U.R.S.I. decisions by suitable available communication channels ;

4. that the other data, of use for the improvement of forecasting technique in general and for other purposes, should be disseminated by ordinary post or airmail ; if they deem it of use for the organization of regional forecasts or for scientific research, interested Administrations may organize alone or preferably collectively after centralization of information, the dissemination of detailed information by radio ;

5. that certain short but regular transmissions, giving short-term warnings of ionospheric disturbances, should be effected by long-range radio stations ;

6. that the attention of the U.R.S.I. should be drawn to the advantages of the fullest possible standardization of the codes to be used either for the short warnings mentioned in para. 5, or for the exchange of the limited information mentioned in para. 3 or the general information mentioned in para. 4 ;

7. that Administrations should be invited to conform to the resulting codes and to make them known to their operating services ;

8. that Administrations should invite these services, together with operating agencies, to study the accuracy of the forecasts, to submit records and to make any suggestions which might assist the studies undertaken to improve the methods used ;

9. that special attention should be paid to the comparison between the forecasts and the actual behaviour of radio circuits ; it is particularly desirable that Administrations should adopt identical methods of assessing the quality of the circuits by using a suitable classification ;

10. that it is also desirable that a common method should be adopted to describe ionospheric perturbations, taking account of such factors as the starting time, zone affected, duration and importance of the perturbation ;

11. that where Administrations have provided facilities for the rapid exchange of information for the preparation of short term forecasts of radio propagation, in connection with the I.G.Y. these facilities should be maintained, and if necessary extended in the future

Doc. 537

RESOLUTION N° 43

*Radio propagation at frequencies below 1500 kc/s*

(Study Programme n° 142, (VI))

(Los Angeles, 1959)

The C.C.I.R.,

*considering :*

the problems involved in Study Programme n° 142 (VI) requires the scientific cooperation of the U.R.S.I. ;

*unanimously resolves :*

that the U.R.S.I. be asked the following questions :

1. What physical conditions in the lower ionosphere are responsible for the reflection of Medium, Low and Very Low frequencies with particular reference to the possibility that more than one reflection height may be simultaneously effective ?



2. How do the diurnal and seasonal variations in sky wave field strength depend on :

- geographical location with particular attention to transpolar paths and antipodal regions ;
- path orientation including the influence of the earth's magnetic field ;
- solar and geomagnetic indices with particular reference to the amplitude and phase consequences of S.I.D.'s and polar blackouts ;
- orientation of the path with respect to the day-night line.

3. What mathematical treatment is applicable to the general conditions of long-distance propagation in which the ionization, the direction of the magnetic field, and ground conditions (including terrain), vary along the propagation path ? This question is of particular practical importance at the present time in relation to variations of phase and amplitude at Low and Very Low frequencies.

Doc. 540.

RESOLUTION N° 44

*Choice of a basic index for ionospheric propagation*

(Study Programme n° 150, (VI))

(Los Angeles, 1959)

The C.C.I.R.,

*considering :*

(a) that the sun is generally accepted as the primary cause of many geophysical phenomena and in particular of the formation of the ionosphere and of most of its variations ;

(b) that when suitable smoothed averages are used the Wolf sunspot numbers provide an index of solar activity which shows a fairly good correlation with similarly smoothed ionospheric propagation data, but that these numbers are nevertheless subjective and empirical since they are obtained from an arbitrary formula based on the number of spots and of groups of spots observed on the sun's disk ;

(c) that determination of the Wolf numbers depends, moreover, on visual observations of the sun which can therefore be made only under favourable meteorological conditions;

(d) that it has recently been shown that the intensity of solar radiation in the VHF (metric) and UHF (decimetric) ranges is closely correlated with visible solar phenomena;

*unanimously resolves :*

that U.R.S.I. be asked the following questions :

1. what relationships exist between solar phenomena, other than sunspots expressed in Wolf numbers, which can be observed objectively, and ionospheric propagation conditions;

2. what is the relationship between the intensity of solar radiation at radio frequencies and ionospheric propagation conditions;

3. what is the possibility of establishing an index of solar activity, based upon optical or radio observations, which can be usefully employed as a basic index for ionospheric propagation;

4. what is the possibility of utilising, perhaps temporarily, some observations of terrestrial phenomena, such as of a geomagnetic or of an ionospheric character, so as to provide a suitable index of solar influence on ionospheric phenomena, for use in connection with ionospheric propagation studies?

Doc. 539.

RESOLUTION N° 45

*Identification of precursors indicative of short-term variations  
of ionospheric propagation conditions*

(Study Programme n° 93, (VI))

(Los Angeles, 1959)

The C.C.I.R.,

*considering :*

(a) that increased efficiency in many practical uses of ionospheric radio propagation would result if reliable identification of precursors of variations in propagation conditions could be made;

(b) that such identification is most important for ionospheric storms;

(c) that solar phenomena appear to be an important source of precursors ;

*unanimously resolves :*

that the U.R.S.I. be asked the following question :

what solar events or other phenomena may be used for reliable prediction of short-term variations in ionospheric radio propagation conditions, particularly ionospheric storms ?

Doc. 538.

RESOLUTION N° 47

*Effects of the ionosphere on radio waves used for telecommunication with and between space-vehicles beyond the lower atmosphere*

(Study Group n<sup>os</sup> IV and VI)

(Los Angeles, 1959)

The C.C.I.R.,

*considering :*

(a) that communication between the earth and artificial earth satellites is now a practical reality ;

(b) that, while VHF and UHF emissions are likely to be used for many such communication purposes, the ionosphere nevertheless will have some influence on the character of the received signals and on apparent positions as observed by radio methods ;

(c) that the study of the effects of the ionosphere on such communications may be facilitated by comparison of HF signals with VHF and UHF signals since the ionospheric effects are larger on the lower frequencies ;

(d) that, in particular, the ionosphere above the F<sub>2</sub>-layer peak, which cannot normally be studied with radio waves of terrestrial origin, will have some influence on such communications ;

(e) that magneto-ionic double refraction in particular can cause changes in the state of polarisation ;

*unanimously resolves :*

that U.R.S.I. should be asked the following questions :

1. What effect does the ionosphere have on the transmission through it of radio waves of all frequencies ; particular attention should be paid to :

- the attenuation of the waves,
- any variations in the direction of transmission,
- changes in the state of polarisation ;

2. what frequencies of transmission from artificial earth satellites will provide the most useful information on the ionosphere as a supplement to that obtainable by ionospheric sounding from terrestrial observatories ?

Doc. 536.

RESOLUTION n° 50

*Organisation of work on the choice and evaluation  
of ionospheric indices*

(Study Programme n° 150, (VI))

(Los Angeles, 1959)

The C.C.I.R.,

*considering :*

that the objectives of Study Programme n° 150 (VI) have not been attained and are not likely to be attained in the near future unless special efforts are made ;

*unanimously resolves :*

1. that a small continuing working party be formed with the objective of reviewing the studies in pursuance of Study Programme n° 150 (VI), taking account of the practical aspects such as ease and accuracy of measurements, with the ultimate aim of making possible both long- and short-term predictions of the chosen index or indices for ionospheric propagation services, particularly :

- to make a thorough study of all indices relevant to ionospheric propagation, existing and potentially possible ;
- to make comparisons among these indices, with the view that a choice can be made as to which among them have the best correlation with ionospheric propagation phenomena.

2. that the following Administrations known or thought to have an interest in this study be invited to participate in this working party :

- Canada,
- United States of America,
- France,
- Japan,
- Netherlands,
- P. R. of Poland,
- Federal German Republic,
- United Kingdom
- Switzerland
- U. S. S. R.

3. that the Chairman of Study Group VI appoint a chairman from among the representatives participating in this work ;

4. that this working party be encouraged to coordinate its studies with those of the special group which has been established by the U.R.S.I. on this subject.

#### Commission IV

Doc. 378.

RESOLUTION N° 42

*Whistler mode propagation*

(Study Programme n° 141, (VI))

(Los Angeles, 1959)

The C.C.I.R.,

*considering :*

that the mode of propagation at very low frequencies, known as the whistler mode, has potentialities for radio communication and can cause interference ;

*unanimously resolves :*

that the U.R.S.I. be asked the following question :

How may the field strength be calculated for waves propagated via the whistler mode for the case of :

1. both transmitter and receiver on the earth's surface ;
2. one terminal on the surface and the other in or above the ionosphere ?

Doc. 291.

RESOLUTION N° 46

*Measurement of atmospheric radio noise*

(Study Programme n° 154, (VI))

(Los Angeles, 1959)

The C.C.I.R.,

*considering :*

(a) that information is required on the atmospheric radio noise received on the types of directional aerial in common use for radio communication ;

(b) that such information might be obtainable by consideration of the mean power and other properties of the noise radiated from thunderstorm areas ;

*unanimously resolves :*

that U.R.S.I. be asked the following questions :

1. How can the mean noise power radiated, at different frequencies in the range 10 kc/s to 30 Mc/s, from areas of thunderstorm activity be deduced from :

- the characteristics of the noise radiated by individual lightning flashes ;
- the geographical distribution and frequency of occurrence of lightning flashes in thunderstorm areas ?

2. What information on these two topics is currently available in a suitable form for the estimation of radiated noise power ?

*Note.* — The attention of the W.M.O. should be drawn to this Resolution.

**Commission VI**

Doc. 669.

QUESTION N° 175 (II) <sup>(1)</sup>

*Usable sensitivity of radio receiver in the presence of quasi-impulsive interference*

(London, 1953 ; Warsaw, 1956 ; Los Angeles, 1959)

The C.C.I.R.,

*considering :*

(a) that many types of interference — e. g. from atmospheric phenomena ignition systems and electrical equipment — cannot

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<sup>(1)</sup> This Question replaces Question n° 125.

be considered as either random noise or as simple isolated impulses, but may be regarded as « quasi-impulsive » and intermediate between those two cases ;

(b) that while the usable sensitivity of a receiver may be limited in some cases by the internal noise of the receiver (cf. noise-limited maximum usable sensitivity — Recommendation n° 234) in other cases and in most services it may be limited by external quasi-impulsive interference and that it is desirable to have a standard method of measurement for this sensitivity ;

(c) that methods are available for describing certain types of noise and for calculating their effects upon the receiver for the case of telegraphic reception (see Report n° 99) ;

(d) that it is possible to develop pulse generators representing the effects of some types of quasi-impulsive interference, e. g. for facilitating theoretical as well as practical studies of the response of receivers to such interference ;

(e) that representative values for the response of receivers to quasi-impulsive interference are necessary for system planning purposes, and that data on the values of quasi-impulsive interference permissible in normal operation are required ;

*unanimously decides* that the following question should be studied ;

1. is it possible for administrations to determine practically, and in a satisfactory manner, the characteristic values of the interference as they have been defined in Report n° . . . (Doc. 507), and to calculate the susceptibility of telegraphic receivers subjected to such interference ?

2. is it possible to extend these methods to other types of receivers, such as those used for telephony and television ?

3. is it satisfactory to substitute a pulse generator (e. g. generating pulses of identical shape at a controllable average rate and with a controllable amplitude distribution) at the input of the receiver, for a source of interference, and does this simulate with good approximation the effect of quasi-impulsive interference ?

4. what are the methods of measuring the most useful definitions of the response of receivers to quasi-impulsive interference, taking into account any non-linear effects that may occur in practice ?

5. what is the amount of quasi-impulsive interference permissible in normal operation for a given signal level ?
6. what are representative figures for the impulse-limited sensitivity of receivers ?

*Notes :*

1. The above question should again be brought to the attention of the U.R.S.I., and the C.I.S.P.R., by the Director of C.C.I.R., with a view to encouraging those organizations to expedite their work bearing on these studies, requesting these organizations to inform the C.C.I.R., of the results of this study.
  2. It is considered that the information obtained as an answer to paras. 1, 2, 5 and 6 should be communicated as soon as possible to the C.I.S.P.R.
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**FEDERATION OF ASTRONOMY AND  
GEOPHYSICS PERMANENT SERVICES  
(F. A. G. S.)**

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**Activity Report**

The Activity report of the Federation for 1958 submitted to Unesco by Mr. G. Laclavère, Secretary General of F.A.G.S., has been published. Copies are available at the U.R.S.I. General Secretariat.

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# WORLD METEOROLOGICAL ORGANIZATION W. M. O.

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## **Second Session of the Regional Association IV**

Washington, December 1958

Mr. W. S. Ament, who represented U.R.S.I. at the above mentioned meeting sent on June 8th the following letter :

Dear Colonel Herbays,

Having had the honor of representing the U.R.S.I. as observer at a meeting of Regional Association IV, of the World Meteorological Organization last December, I wish to report on the rather few things of interest to U.R.S.I. that transpired there. The Abridged Final Report, enclosed, will indicate the primary concerns of Region IV, W.M.O.

Considerable interest was shown in radar as a storm-indicating device for airport use, for hurricane tracking, and for flood predictions. There was a similar, lesser interest shown in spherics nets. The problem of coding such observations for meaningful telecommunications was regarded as unsettled.

During the opening session, it became apparent that observers representing various interested organizations were expected to make brief addresses expressing the interest of their organizations in the substantive matters of the sessions. Fortunately, my ad hoc remarks are not included in the Abridged Report, but a summary which appeared among the working papers of the meeting is enclosed for your information. Should other items of the agenda be of interest to you, I retain a complete file of the working papers summarized in the Abridged Report.

There was no indication that the recommendations of Commission II of U.R.S.I., made at the Twelfth General Assembly, were:

being taken into account. I gather that such recommendations are addressed to national meteorological authorities, owing to the still experimental status of most radio-meteorological correlations.

Sincerely yours,  
(sgd.) W. S. AMENT.

Wave Propagation Branch  
Electronics Division  
U. S. A. Naval Research Laboratory  
Washington 25, D. C.

### **Provisional Minutes of the opening Meeting**

*(Abstracts)*

#### *Representation :*

Members of the Association — British Caribbean Territories, Canada, Dominican Republic, El Salvador, France, Guatemala, Netherlands Antilles, United States of America.

Members of the Organization — Korea, Greece, U. S. S. R.

International Organizations — Caribbean Commission, F.A.O., I.C.A.O., I.A.T.A., U.R.S.I., I.U.G.G.

...  
Mr. Ament speaking on behalf of the International Scientific Radio Union stated that the U.R.S.I. is interested in understanding the effect of weather on radio wave propagation, and in the use of radio and radar for observing meteorological phenomena. Weather effects on propagation will become increasingly important as higher radio frequencies come into use. Much more research is needed before one can say what routinely collected meteorological observations will be useful. Better humidity measurements and a better definition of the vertical section of the atmosphere appear necessary at the moment.

Radar as a tool observing storms and estimating rainfall is an obvious contribution of radio to meteorology. There is an increasing recognition of radio meteorological research as contributing to both radio science and meteorology. Mr. Ament said, however, he was present as an observer and not recommending the merits of further efforts in this direction.

## INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS

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### Scientific Meetings Scheduled for 1960

1. *Geodesic and Geophysical Study of rockets and artificial satellites* (I.U.G.G.).

The meeting will be held at Helsinki on July 29th, 1960. Publication will be in charge of Mr. G. Laclavère, Secretary General of I.U.G.G.

2. *Atmospheric Chemistry and Radioactivity* (International Association of Meteorology and Atmospheric Physics).

The meeting will be held at Helsinki, at the time of the General Assembly of the I.U.G.G. The exact date has not yet been selected. Dr. R. C. Sutcliffe, Secretary, International Association of Meteorology, Air Ministry, Meteorological Office, Kingsway, London, is in charge of the organization of the meeting which will be a fully international symposium under the Presidency of Prof. W. Bleeker of the Netherlands. The Secretary of the meeting will be Dr. C. E. Junge, U. S. A. Some 16 papers will be invited and discussed. Opportunity will be provided for any delegate at the General Assembly to attend the Symposium and over 100 participants drawn from virtually every country in the World may confidently be expected. The communications and discussions will be published by the Secretary of the International Association of Meteorology and Atmospheric Physics.

3. *Dynamical processes in the atmosphere* (International Association of Meteorology and Atmospheric Physics).

The symposium will be held at Helsinki, at the time of the General Assembly of the I.U.G.G. Dr. R. C. Sutcliffe, Secretary, International Association of Meteorology, Air Ministry, Meteorological Office, Kingsway, London, is in charge of the organization of the symposium. The anticipated number of participants is of about 100. No provision has so far been made for publication of the report of the symposium and of the communications presented.

## BIBLIOGRAPHY

### *International Electrotechnical Commission*

*Publication n° 113, First edition.* — Classification and definition of diagrams and charts used in electrotechnology.

*Publication n° 106, First edition.* — Recommended methods of measurement of radiation from receivers for amplitude-modulation, frequency-modulation and television broadcast transmissions.

This Publication contains description of standardized methods of test for determining the radiation from broadcast radio and television receivers, so as to make possible comparison of the results of radiation measurements obtained by different observers. Limiting values of the various quantities for acceptable performance are not specified.

It is divided into sections, as follows :

Measurement of radiation at frequencies below 30 MHz (Mc/s).

— radiation from receivers for a.m. broadcast transmissions.

— radiation caused by television receiver time-base circuits.

Measurement of radiation at frequencies between 30 and 300 Mc/s (Mc/s).

*Publication n° 108, First edition.* — Recommendations for ceramic dielectric capacitors Type I.

*Publication n° 109, First edition.* — Recommendations for fixed non-wirewound resistors Type II.

*Publication n° 56-1-A, First edition.* — I.E.C. Specification for alternating current circuit-breakers, Supplement to Chapter I : Rules for short-circuit conditions (a) Recommendations for the unit testing by direct methods of circuit-breakers for making-capacity and breaking-capacity ; (b) Methods of determining inherent restriking-voltage waveforms.

*Publication n° 56-3, First edition.* — I.E.C. Specification for alternating current circuit-breakers, Chapter II : Rules for normal load conditions, Part 2 : Rules for operating conditions, Part 3 : Coordination of rated voltages, rated breaking capacities and rated normal currents ;

These publications are on sale at the Central Office of the I.E.C. at the price of :

Sw. Fr. 3.— per copy, plus postage for Publication n° 113,

Sw. Fr. 10.— per copy, plus postage for Publication n° 106,

Sw. Fr. 9.— per copy, plus postage for Publication n° 108,

Sw. Fr. 8.— per copy, plus postage for Publication n° 109,

Sw. Fr. 9.— per copy, plus postage for Publication n° 56-1-A, and

Sw. Fr. 8.— per copy, plus postage for Publication n° 56-3.

