Bulletin nº 144 Mai-Juin 1964

U. R. S. I.

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COMITÉ POUR LA RÉORGANISATION DE L'U. R. S. I.

Donnant suite à la résolution V de la XIV[e] Assemblée Générale de l'U.R.S.I., le Bureau a invité certaines personnalités à faire partie du Comité pour la Réorganisation de l'U.R.S.I. ; elles ont toutes marqué leur accord et le Comité est constitué comme indiqué ci-dessous :

Convener : D[r] R. L. SMITH-ROSE.

Membres : Prof. W. J. G. BEYNON,
M[r] B. DECAUX,
M[r] J. A. RATCLIFFE,
Prof. S. SILVER,
Prof. E. VASSY.

Membres consultatifs : D[r] L. V. BERKNER,
Prof. H. G. BOOKER,
Prof. W. N. CHRISTIANSEN,
D[r] L. ESSEN,
M[r] J. VOGE,
Prof. G. A. WOONTON.

Ce Comité peut nommer des membres consultatifs appartenant à d'autres organisations internationales si une telle mesure s'avère nécessaire.

Les travaux du Comité ont commencé par des consultations par correspondance et nous espérons pouvoir, dans un bref avenir, donner un aperçu de l'avancement des travaux.

COMMITTEE ON THE FUTURE ORGANIZATION OF U. R. S. I.

Accordingly to Resolution V adopted at the last General Assembly of U.R.S.I., the Board of Officers asked some personalities to serve on the Committee on the Future Organization of U.R.S.I. ; all of them agreed to do so and the membership of the Committee is as given below :

Convener : Dr. R. L. SMITH-ROSE.

Members : Prof. W. J. G. BEYNON,
Mr. B. DECAUX,
Mr. J. A. RATCLIFFE,
Prof. S. SILVER,
Prof. E. VASSY.

Consultants : Dr. L. V. BERKNER,
Prof. H. G. BOOKER,
Prof. W. N. CHRISTIANSEN,
Dr. L. ESSEN,
Mr. J. VOGE,
Prof. G. A. WOONTON.

The Committee has the right to appoint consultants from other international bodies if such action is felt necessary.

The work of the Committee has started by correspondence and we are hoping to be able, in the near future, to give a view of the present state of activity of the Committee.

XVth GENERAL ASSEMBLY

General Arrangements Committee

MEMBERSHIP

President : Prof. Dr. W. DIEMINGER, Lindau/Harz.

Secretary : Dr. H. FLEISCHER, Darmstadt.

Members : Prof. Dr. L. BIERMAN ;
Dr. C. FENGLER, Philips, Hamburg ;
Prof. Dr. K. FRÄNZ, Telefunken, Ulm ;
Dipl. Ing. W. HORMUTH, Siemens und Halske, München ;
Prof. Dr. H. H. MEINKE, T. H. München ;
Prof. Dr. H. MARKO, T. H. München

The Committee will be complemented by representatives of the following organizations :

Rohde und Schwarz, München.
Standard Elektrik Lorenz, Stuttgart.
Arbeitsgemeinschaft der deutschen Rundfunkanstalten.
Rundfunktechnisches Institut.
Bundesministerium für Post und Fernmeldewesen.
Oberpostdirektion München.
Präsidialbüro der Max-Planck-Gesellschaft.
Stadt München.

SYMPOSIUM GÉNÉRAL SUR LA PHYSIQUE DES PHÉNOMÈNES SOLAIRES-TERRESTRES DE 1966

Comité Organisateur

Suite à la décision de la dernière Assemblée Générale de l'U.R.S.I. de tenir en 1966 en Yougoslavie un Symposium Général sur la Physique des Phénomènes Solaires-Terrestres, le Bureau a désigné les personnalités suivantes au Comité Organisateur du Symposium :

Convener : Dr Dejan Bajić, Secrétaire du Comité National Yougoslave.

Membres : Dr H. G. Booker (Commission IV) ;
Prof. R. Coutrez (Commission V) ;
Dr W. Dieminger (Bureau et Comité National Allemand) ;
Dr A. Kimpara (Sous-Commission Permanente du Bruit Radioélectrique d'Origine Terrestre) ;
Mr J. A. Ratcliffe (Commission III — Suppléant : Prof. W. J. G. Beynon).

Le Comité est invité à co-opter des membres pour assurer la liaison avec les autres organisations internationales intéressées par les sujets qui seront inclus au programme du Symposium.

Toutes les suggestions concernant l'organisation du Symposium seront bienvenues et elle peuvent être adressées au Convener du Comité Organisateur : Dr Dejan Bajić, E.T.A.N./U.R.S.I., POB 356, Beograd, Yougoslavie, ou bien au Secrétaire Général de l'U.R.S.I.

1966 GENERAL SYMPOSIUM ON SOLAR-TERRESTRIAL PHYSICS

Organizing Committee

Following a decision reached by the last General Assembly of U.R.S.I. to hold in 1966 in Yugoslavia a General Symposium on Solar-Terrestrial Physics, the Board of Officers appointed the following Organizing Committee.

Convener : Dr. Dejan BAJIĆ, Secretary of the Yugoslav National Committee.

Members : Dr. H. G. BOOKER (Commission IV) ;
Prof. R. COUTREZ (Commission V) ;
Prof. W. DIEMINGER (Board of Officers and German National Committee) ;
Prof. A. KIMPARA (Permanent Sub-Commission on Radio Noise of Terrestrial Origin) ;
Mr. J. A. RATCLIFFE (Commission III — Prof. W. J. G. BEYNON as alternate).

The Committee is invited to co-opt members to ensure a liaison with other international bodies which might be interested in the topics to be included in the programme of the Symposium.

Any suggestions concerning the organization of the Symposium will be welcome. They may be sent to the Convener of the Organizing Committee : Dr. Dejan BAJIĆ, E.T.A.N./U.R.S.I., POB 356, Beograd, Yugoslavia or to the Secretary General of U.R.S.I.

NATIONAL COMMITTEES

Australia

RADIO AND ELECTRONICS ENGINEERING CONVENTION

The Institution of Radio and Electronics Engineers of Australia is organizing a Radio and Electronics Engineering Convention in Canberra, A.C.T. from March 22 to March 26, 1965.

Amongst others the following topics are on the programme of the meeting :

— *Basic Sciences and Techniques.* The mathematics, physical science and techniques underlying radio and electronics engineering. General principles and theory.

— *Communication.* Transmission of intelligence by wire, radio, or optical means and associated switching, control and spectrum problems.

— *Computers and data processing.* Analogue and digital computers and data handling devices and systems generally where the emphasis is on transformation of information rather than transmission.

More details are available at The General Secretary, The Institution of Radio and Electronics Engineers Australia, Box 3120 G.P.O., Sydney, N.S.W., Australia.

Canada

MEMBERSHIP

Dr. J. T. HENDERSON (*Chairman*), National Research Council, Sussex Street, Ottawa, Ontario.

Dr. J. H. CHAPMAN (*Secretary*), Defence Research Telecommuni-

cations Establishment, Defence Research Board, Ottawa 4, Ontario.

Dr. M. P. BACHYNSKI (*Chairman Commission VI*), R.C.A. Victor Company Ltd., 1001 Lenoir St., Montreal P.Q.

Dr. L. J. L. BOULET, Laval University, Quebec, P.Q.

Prof. R. E. BURGESS (*Chairman Commission VII*), University of British Columbia, Vancouver 8, B. C.

Mr. A. E. COVINGTON, National Research Council, Sussex Street, Ottawa, Ontario.

Dr. D. R. HAY (*Chairman Commission II*), University of Western Ontario, London, Ontario.

Dr. G. A. HARROWER (*Chairman Commission V*), Queen's University, Kingston, Ontario.

Dr. J. A. JACOBS (*Chairman Commission IV*), University of British Columbia, Vancouver 8, B. C.

Dr. A. KAVADAS, University of Saskatchewan, Saskatoon, Sask.

Dr. J. L. LOCKE, Dominion Observatory, Department of Mines and Technical Surveys, Ottawa, Ontario.

Dr. J. S. MARSHALL, McGill University, Montreal, P. Q.

Dr. A. G. McNAMARA, National Research Council, Sussex Street, Ottawa, Ontario.

Dr. J. H. MEEK (*Chairman Commission III*), Defence Research Telecommunications Establishment, Defence Research Board, Ottawa 4, Ontario.

Mr. C. F. PATTENSON (*Chairman Commission I*), National Research Council, Sussex Street, Ottawa, Ontario.

Dr. R. S. RETTIE, National Research Council, Sussex Street, Ottawa, Ontario.

Dr. G. SINCLAIR, University of Toronto, Toronto, Ontario.

Dr. K. F. TUPPER, National Research Council, Sussex Street, Ottawa, Ontario.

Mr. J. E. WILSON, Department of Transport, Ottawa, Ontario.

Suisse

MEMBRES OFFICIELS

Commission	Nom	Adresse
I	Prof. Dr H. KONIG	Gossetstrasse 22, Wabern-Bern
II	Dipl. Ing. W. KLEIN	Brunnenweg 6, Muri-Bern
III	Prof. Dr R. MERCIER	Chemin de Primerose 8, Lausanne
IV	Prof. Dr. J. LUGEON	Hofstrasse 114, Zürich 7/44
V	Prof. Dr M. WALDMEIER	Wirzenweid 15, Zürich 7/53
VI	Prof. Dr E. BALDINGER	Weidengasse 35, Basel
VII	Prof. Dr F. BORGNIS	Bergstrasse 99, Zürich 7/32

United Kingdom

FIFTY YEARS AGO

We felt that our English readers may be interested in the following abstract from the *Telecommunication Journal*, Vol. 31, n° 4, April 1964.

« The eclipse of the Sun on 21 August 1914 — Astronomers predict a total eclipse of the Sun on 21 August next, which will enable the influence of solar rays on electric wave propagation to be observed. A number of such observations have been made since the last eclipse on 17 April 1912, but as the tests were made without methodical collaboration on the part of the observers, they have not had the scientific result desired. In order to derive the maximum advantage from the next eclipse, the British Association for the Advancement of Science (Radiotelegraph Research Committee) has drawn up a programme of observations. The space available to us in *The Journal* does not enable us to reproduce the text of this programme ; those interested may, however, obtain all necessary information for carrying out the tests by applying to Dr. W. Eccles, University College, London W. C. Moreover the above-mentioned committee asks any persons who have the necessary facilities and are willing to make observations during the eclipse of the Sun to communicate with Dr. Eccles as soon as possible.

Journal Télégraphique, April 1914 »

U. S. A.

1964 FALL U.R.S.I. MEETING

Announcement and Call for Papers

Oct. 11-14, Urbana, Illinois at the University of Illinois

Commission 2. — Radio Propagation in Non-Ionized Media.
Commission 3. — Ionospheric Radio.
Commission 4. — Magnetospheric Radio.
Commission 5. — Radio and Radar Astronomy.
Commission 6. — Radio Waves and Transmission of Information.

Jointly Sponsored by I.E.E.E. Professional Technical Groups :

Antennas and Propagation	Microwave Theory and Techniques
Circuit Theory	Instrumentation
Information Theory	Geoscience Electronics

Abstracts

Up to approximately 200 words before *August* 1, 1964. Should be sent in duplicate to : Fall U.R.S.I. Arrangements Committee, Department of Electrical Engineering, University of Illinois, Urbana, Illinois 61803.

Authors should indicate to which commissions papers are tendered but they should not be sent to the commission chairmen. Attention of authors is called to the *Guide for the Preparation and Publication of Synopses*, (p. 86).

COMMISSIONS ET COMITÉS

Commission I. — Mesures et Etalons Radioélectriques

NORMALISATION DES QUANTITÉS ÉLECTRIQUES ET MESURES EN HAUTES FRÉQUENCES RADIOÉLECTRIQUES

Nous attirons l'attention sur le rapport de la Réunion du Groupe de Travail du Bureau International des Poids et Mesures pour la Normalisation Internationale des quantités électriques et des mesures aux hautes fréquences radioélectriques (Sèvres, 21 et 22 avril 1964) reproduit p. 68, et particulièrement sur les recommendations dont la traduction et donnée p. 66.

STANDARDIZATION OF ELECTRICAL QUANTITIES AND MEASUREMENTS AT HIGH RADIO FREQUENCIES

Attention is called on the report (p. 68) of the meeting of Study Group for the International standardization of electrical quantities and measurements at high frequencies of the International Bureau of Weights and Measurements (Sèvres, 21-22 April, 1964) and particularly to the recommendations adopted by the meeting (p. 70).

Commission II. —
Radio et Troposphère

NOTE POUR LES MEMBRES OFFICIELS DE LA COMMISSION II DE L'U.R.S.I.

Titre de la Commission II.

Cher Collègue,

J'ai reçu récemment du Professeur Waterman, membre officiel du Comité National des Etat-Unis pour notre Commission, une lettre qui propose de *changer le titre de la Commission II* pour le mettre en harmonie avec les nouvelles attributions de la Commission, adoptées à Tokyo [1].

Je reproduis ci-dessous un extrait de cette lettre :

« I understand from our national officers that the new terms of reference for Commission 2 were accepted by the Executive Committee and by the General Assembly of U.R.S.I. This result is very gratifying.

It is also my understanding that no action was taken with regard to a change in the title of Commission II. As a result, we now have an inconsistency between the terms of reference of our Commission and the title of our Commission. The terms of reference cover non-ionized atmospheres of other planets as well as the earth and, in addition, their solid or liquid surfaces. The title, except in the United States, is « Radio and Troposphere ».

In order to make the title consistent with the terms of reference, the United States would like to recommend that specific action be initiated, so that there may be general agreement on a specific new title well before the next General Assembly. (Ideally it would be well to change the title as soon as possible, i. e., *before*

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[1] La Commission a décidé :

« que le mandat de la Commission II soit étendu de façon à inclure les phénomènes de propagation radioélectrique associés à la matière solide et/ou liquide, de même qu'aux gaz non-ionisés dont sont constituées la terre, les autres planètes et la lune, ainsi que leurs atmosphères. »

the General Assembly. Is this feasible ?) We fear that if there is not agreement in advance of the General Assembly, there may be inconclusive discussion during the General Assembly, and another three year's delay.

As you recall (Minutes of Organization Meeting of Monday, September 9, 1963, item 7), the title « Radio and Non-ionized Media » received considerable support. The United States would be satisfied with it, or with possible variations of it, such as « Propagation in Non-ionized Media » (which was criticized by J. S. Marshall). If it is desired to follow the pattern set by the other commissions, a title such as « On Non-ionized Media », « On Natural Non-ionized Media », or « On Geophysical Non-ionized Media » would probably be acceptable. We think that action should be initiated soon, in order that agreement may be reached and a decision taken. »

Je serais heureux d'avoir votre opinion sur cette proposition, afin d'essayer de dégager un accord général, susceptible d'être accepté par notre Commission, lors de la prochaine Assemblée Générale de l'U.R.S.I., en 1966.

Je profite de cette lettre pour solliciter également votre avis sur le fonctionnement de notre Commission — et en attendant une lettre plus détaillée que je vous enverrai au début de l'année prochaine — afin de recueillir dès maintenant vos propositions concernant les sujets à retenir pour les réunions de notre Commission à la prochaine Assemblée Générale.

Veuillez agréer, cher Collègue, l'expression de mes sentiments les meilleurs.

Le Président de la Commission II de l'U.R.S.I.
J. Voge,

Centre National d'Etudes des Télécommunications
3. avenue de la République
Issy-les-Moulineaux (Seine) France
Téléphone : LECourbe 40-00 poste 806

P. S. — Je souhaiterais recevoir vos réponses avant le 1er octobre 1964.

Commission III. — Ionosphère

PUBLICATION DES INDICES D'ACTIVITÉ SOLAIRE POUR LA PROPAGATION IONOSPHÉRIQUE

Communication du Secrétariat Spécialisé du C.C.I.R.

(Extrait du *Journal des Télécommunications*,
Vol. 31, nº 4. avril 1964)

La Xe Assemblée Plénière du C.C.I.R. (Genève, 1963) a approuvé l'Avis 371 : Choix d'indices d'activité solaire pour la propagation ionosphérique, indiquant les conditions dans lesquelles la moyenne glissante du nombre de taches solaires sur 12 mois (R_{12}), l'indice ionosphérique I_{F_2} et la valeur moyenne mensuelle du flux du bruit radioélectrique Φ, sont à utiliser.

En outre, conformément à la Résolution 4 du C.C.I.R. (Genève, 1963), le directeur du C.C.I.R. a été prié de prendre les dispositions voulues pour :

1. obtenir les données les plus récentes sur le nombre de taches solaires et sur le flux solaire sur 10 cm de longueur d'ondes, qui lui sont nécessaires pour le calcul de R_{12} et de la moyenne mensuelle de Φ.
2. obtenir les valeurs moyennes mensuelles des paramètres ionosphériques dont la connaissance est nécessaire pour le calcul de I_{F_2} (voir Rapport 246 du C.C.I.R.),
3. calculer les valeurs mensuelles de R_{12}, Φ et I_{F_2}.

Les données de R_{12} publiées régulièrement dans le *Journal des Télécommunications* concernent les prévisions pour les mois à venir. Les valeurs observées de R_{12} seront publiées régulièrement aussitôt qu'elles seront disponibles. Les données de Φ obtenues jusqu'ici sont reproduites dans un tableau joint à cet article.

Les valeurs de I_{F_2} pour les années 1938-1962, ainsi que pour les six premiers mois de l'année 1963 sont publiées en Annexe I au Rapport 246 du C.C.I.R., Volume II (Genève, 1963), page 248.

Néanmoins, le secrétariat a jugé utile de répéter dans le *Journal des Télécommunications* toutes les données de I_{F_2} pour l'année 1963 :

Année \ Mois	1	2	3	4	5	6	7	8	9	10	11	12
1963	14	14	18	16	23	10(1)*	14(1)	18(1)	15(1)	6(1)	15(2)	2(2)

Le *Journal des Télécommunications* publiera à l'avenir toutes les données, même provisoires de I_{F_2} aussitôt que celles-ci seront disponibles. La valeur provisoire de I_{F_2} pour le mois de janvier est de —3(3) et de 5(7) pour le mois de février (*).

La prévision des valeurs de I_{F_2} pour les mois de mars à août 1964 est la suivante :

Année \ Mois	3	4	5	6	7	8
1964	3	2	1	0	—1	(—2)

La valeur prévue 6 mois à l'avance est indiquée entre parenthèses.

Les administrations qui, conformément à la Résolution 4, point 3, désireraient obtenir ces renseignements par des moyens plus rapides sont priés de s'adresser au Secrétariat du C.C.I.R., U.I.T., Place des Nations, Genève, Suisse, où elles pourront obtenir des renseignement plus détaillés.

PUBLICATION OF SOLAR INDICES FOR IONOSPHERIC PROPAGATION

Communication from the Specialized Secretariat of C.C.I.R.

(Abstracts from the *Telecommunication Journal*, Vol. 31, nº 4, April 1964)

The Xth Plenary Assembly of C.C.I.R. (Geneva, 1963) approved Recommendation 371 on the choice of solar indices for ionospheric propagation, indicating the conditions in which the smoothed

(*) Le nombre de valeurs manquant se trouve entre parenthèses. Le nombre total est égal à dix. A partir du mois de juin 1963, une des stations (Porto-Rico) a cessé de fonctionner.

sunspot numbers over twelve months (R_{12}), the ionospheric index I_{F_2} and the average monthly value of the radio noise-flux Φ are to be used.

C.C.I.R. Resolution 4 (Geneva, 1963), moreover, requested the Director of the C.C.I.R. to make arrangements :

1. to obtain the most recent data on sunspot numbers and solar noise-flux at 10 cm wavelength which are necessary for the calculation of R_{12} and the monthly-mean value of Φ ;
2. to obtain the monthly-median values of ionospheric data which are necessary for the calculation of I_{F_2} (see C.C.I.R. Report 246) ;
3. to calculate the monthly values of R_{12}, Φ and I_{F_2}.

The data on R_{12} published regularly in the *Telecommunication Journal* concern the predictions for the following months. The observed values of R_{12} are published as soon as they are available. This will also be the case for the values of Φ. The Φ data so far obtained are given in a table appended to the present communication.

I_{F_2} values for the years 1938-1962 and for the first six months of 1963 are published in Annex I to C.C.I.R. Report 246, Volume II (Geneva, 1963), page 248. Nevetheless, the Secretariat feels it advisable to reproduce all I_{F_2} data for 1963 in the *Telecommunication Journal* :

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
1963	14	14	18	16	23	10(1)*	14(1)	18(1)	15(1)	6(1)	15(2)	2(2)

The *Telecommunication Journal* will henceforth publish all I_{F_2} data, including provisional data, as soon as they are available. The provisional value of I_{F_2} for January, 1964, is —3(3) and 5(7)

(*) The number of missing figures appears in brackets. The total number is 10. As from June 1963, one of the stations (Puerto Rico) ceased to operate.

for February (*). The prediction of I_{F_2} values for March until August 1964 is :

Year \ Month	3	4	5	6	7	8
1964	3	2	1	0	—1	(—2)

The value predicted six months is advance appears in brackets.

Administrations wishing to obtain these figures by more rapid means, in accordance with paragraph 3 of Resolution 4, should write to the C.C.I.R. Secretariat, I.T.U., Place des Nations, Geneva, Switzerland, which will furnish more detailed information.

Commission V. — Radioastronomie

ELECTION D'UN VICE-PRÉSIDENT

A la suite du décès du Prof. T. HATANAKA, élu Vice-Président de la Commission V au cours de l'Assemblée Générale de Tokyo, il a été décidé de procéder à l'élection par correspondance d'un nouveau Vice-Président. C'est le Prof. R. Coutrez qui, à la majorité de voix, a été élu à ces fonctions.

PROJECT WEST FORD EXPERIMENT

Members of Commission V are informed that the Space Science Board of the U.S.A. Academy of Sciences has issued on February 7, 1964 a Report on the Optical and Radio Astronomical Effects of the Project West Ford Experiment.

The report has been circulated with the following letter :

« Dear Colleague :

It is now time to bring you up to date on the West Ford experiment, the communications experiment conducted by the Lincoln Laboratory of the Massachusetts Institute of Technology, in which fine wire dipoles were dispensed in a belt around the Earth to serve as a reflector for radio waves at a frequency near 9000 Mc/s.

Attached hereto is the Report of the ad hoc West Ford Committee of the Space Science Board : The Report is final only in the sense

that the duties of the ad hoc Committee have been taken over by the Committee on Potential Contamination and Interference from Space Experiments, recently established by the Space Science Board. As its name implies, this new committee will have responsibilites broader than, and including, West Ford. Members of the ad hoc West Ford Committee will continue to work with the new group.

The Report was prepared by the Committee in October 1963 on the basis of data available up to that time, including data on radio cross sections and orbital behavior provided by the Lincoln Laboratory in August and September 1963. It was approved by the Board in December 1963, and by mid-February 1964, some 200 copies of the Report had been distributed to various interested agencies, organizations, and committees.

Moreover, in October and November 1963, preliminary drafts were sent to the International Astronomical Union's West Ford Committee and the General Secretary of the Union. The last of those drafts was almost identical to sections 1-6 of the attached Report.

One further comment on lifetimes can now be made. The Report correctly states that the mean lifetime in orbit of the individual dipoles will be of the order of three years, and cites evidence that some of the material was dispenses in clusters. At the time (October), the clusters were thought to be following the same orbit as the individual dipoles and would therefore be expected to have the same lifetime. In the meantime, the Lincoln Laboratory has continued measurements of the belt, in part with radar, and has informed us at the end of February as follows : (1) that the orbital separation between the individual dipoles and the clusters has increased and can now be detected ; (2) that the area-to-mass ratio of the clusters may be smaller than that of the individual dipoles ; and (3) that the analysis of the data and the calculations of the probable lifetime of the clusters based on them is under way. We expect that this material will be published as soon as possible. This newly learned development does not affect the conclusions at the end of this Report.

March 24, 1964

Yours sincerely,
John W. FINDLAY,
Chairman,
ad hoc West Ford Committee

The following abstract from the Report gives a general view of its contents :

Background and Summary of Findings

Project West Ford is the designation of an experiment in communications, in which the Lincoln Laboratory of the Massachusetts Institute of Technology placed in orbit a belt of more than 4×10^8 copper wire dipoles, each 1.77 cm long $\times$ 18 microns thick, to serve as an efficient artificial reflector for directed radio-frequency radiation in the 8000-Mc/s band. The dipoles were dispensed in a nearly circular polar orbit 3640 km high on 10 May 1963, and gradually formed a belt during the following several weeks. Certain communications experiments were successfully conducted during the ensuing months between stations in Massachusetts and California.

The proposal to perform this experiment was first brought to the attention of the Space Science Board of the National Academy of Sciences in 1959 by the Lincoln Laboratory. The Board convened several *ad hoc* meetings of astronomers, physicists, and other specialists to study the possibility of interference with other scientific activities in near space. Reports of their findings were returned to the Board in June 1960. As a result of these preliminary studies, the Board arrived at a number of conclusions : (1) The first exploratory test belt proposed by the Lincoln Laboratory would probably not have an adverse effect on science or any other human activity. (2) The Board was still concerned with the larger amount of interference that an operational communications system (in contrast to the first exploratory test belt) might cause for optical and radio astronomical observations, and strongly recommended that any planning for such a system, or for any possible larger-scale repetitions of the experiment, should take into account the protection of the interests of astronomical research and of science in general. (3) Full information on the scientific and operational aspects of the initial experiment should be published as soon as possible, so that members of the world scientific community at large could come to their own conclusions about the experiment.

The Space Science Board at that same time also established a standing committee of six optical and radio astronomers, under the

chairmanship of John W. Findlay, to work closely with project scientists and engineers at the Lincoln Laboratory, to review developments as the experiment progressed, and as far as possible to share its information and findings with the interested members of the world scientific community.

This Report is the final report of the S.S.B. West Ford Committee. Their review and analysis of the experimental results of the first five months of the West Ford experiment, insofar as they affect optical and radio astronomy, and a comparison of these results with predictions made in 1961-2 are contained in Sections 1 through 5. The study was conducted by the West Ford Committee of the Space Science Board, and is based on data and information made available by the West Ford experimenters and on observations made by optical astronomers.

Section 6 contains the conclusions, summarized as follows :

(1) Optical observations of the surface brightness of sunlight scattered by the West Ford belt show that the surface brightness is in no case brighter than that predicted ahead of the event by various astronomers.

(2) The radio reflectivity of the belt was somewhat less than predicted for frequencies near resonance, but was somewhat greater than predicted for emissions in the ultrahigh-frequency region, at least during the first several months of the belt's existence. These facts may be explained by the surmise, supported by considerable additional evidence, that some of the dipoles (probably somewhat more than one-half of the total number) failed in the early stages of the experiment to separate into individual reflectors, but remained loosely tangled in small clusters or chains.

(3) The changes in the orbital elements and the rate of spreading of the dipole belt during the first few months of its existence agree well with predictions computed on the basis of theory that takes into account the resonant interaction of the Earth's nonspherical gravitational field and solar radiation pressure. The predicted lifetime is about three years.

(4) The agreement of observation and prediction in all events is good enough to engender confidence that astronomers can predict accurately enough for all practical purposes the astronomical

side-effects of experiments similar to the West Ford, should any such ever be proposed, given the characteristics of the experiment and those of the observing equipment, whether optical or radio.

(5) With the observing techniques available today, the present experiment has not so far been harmful to optical or radio astronomy.

Comité pour les Recherches Radioélectriques dans l'Espace

DOCUMENTATION

Nous attirons l'attention des lecteurs sur l'article intitulé « Comment calculer le plus utilement possible les positions apparentes des satellites de télécommunications » publié sous la signature de H. C. Freiesleben (Deutsches Hydrographisches Institut) dans le *Journal des Télécommunications*, Vol. 31, n° 5, mai 1964.

Space Radio Research Committee

BIBLIOGRAPHY

We draw the attention of our readers to the paper « How to compute the apparent positions of communication satellites in the most useful way » by H. C. Freiesleben (Deutsches Hydrographisches Institut), published in the *Telecommunication Journal*, Vol. 31, n° 5, May 1964.

C. O. S. P. A. R.

Report of the International Scientific Radio Union

to the C.O.S.P.A.R. Assembly, Florence, Italy, May 8, 1964

(prepared by S. SILVER, U.R.S.I. representative)

The International Scientific Radio Union is vitally interested in all areas of space research but its special province is, of course, those areas involving and pertaining to radio science. Each of its seven Commissions give special attention to the space radio problems of its particular area and two committees, the Committee on Space Radio Research and U.R.S.I.-C.I.G. Committee, concern themselves with integrating the U.R.S.I.'s activities in the field and the participation of the U.R.S.I. in inter-Union programmes. In addition to the part and interest that the U.R.S.I. takes in C.O.S.P.A.R. the Union participates in the Inter-Union Committee on the Ionosphere and the Inter-Union Committee on Solar-Terrestrial Relationships both of which are also concerned with space research on the ionosphere, the sun, and the interplanetary medium.

The U.R.S.I. held its XIVth General Assembly in Tokyo in September 1963. The programme of the Assembly reflected the interests of the Union and its activities in the continually developing field of space radio research. This report deals primarily with the work of the General Assembly. The proceedings of the General Assembly and a series of special monographs covering the programmes of the Commissions will appear in the near future. Because of the limitations of time I shall confine myself here to a few topics that are most directly related to the programme of C.O.S.P.A.R.

Satellite and rocket borne experiments for studying the ionosphere and the exosphere were discussed in a number of sessions.

There are perhaps three points to be noted : (1) The top-sounding experiments have yielded far reaching results on the structure of the ionosphere and solar terrestrial inter-actions ; however, this is only a beginning, many results are as yet to be considered to be tentative, and more data must be gathered over extended periods of the solar cycle. (2) The structure and dynamics of the D- and E-regions need considerably more study and the importance of synoptic rocket soundings during the I.Q.S.Y. was underscored. (3) Many instrumentation problems, such as the properties of an antenna in a plasma, require more study and research before the data obtained can be interpreted properly.

Planetary research from ground based observatories and space vehicles was another major topic at the Assembly. The results obtained by the Mariner flyby of Venus may be said to have whetted the appetite and showed the need for more extensive programs of planetary observations from space platforms and planetary exploration. I wish to call attention to one topic that was developed in the general session conducted by the Committee on Space Radio Research because it must be given serious consideration in planning future studies of the planets, namely, the information to be gained about the structure of the surface of a planet from the characteristics of the polarization of the infrared and millimeter wave radiation emitted by the planet. The theory was developed for some rather simple models and needs considerably more development ; however, it shows that unless proper attention is paid to polarization the interpretation of radiometric data can be considerably in error.

Space communications naturally occupies a prominent place in the interests of the U.R.S.I. In one direction lies the tremendously important technological developments of satellite communication systems and in another direction the equally important, but of lesser economic significance, problems of the communications link in the conduct of space experiments. The technological area of satellite communication systems encompasses a number of basic problems such as tracking, phase distortion over the communication path, channel capacities and rates of transmission of information that are also directly pertinent to and part of the communications link of space experiments. The problems of reliability occupied much of the attention of Commission VII

of the U.R.S.I. and the discussions made it clear that a large area of research on the properties and behavior of materials in the environment of space is yet to be explored. On the side of the communication link of space experiments a first sally was made into the subject of the design of instrumentation for space experiments from the standpoint of data processing. The discussion served at this point only to bring the nature of the problems into focus and plans were made for further work in this field. I shall speak more about this shortly. I should note that one of the monographs of the Assembly will be devoted to space radio research and cover the general session conducted by the Committee on Space Radio Research and the session on Satellite Communication Systems conducted by Commission VII. I am sure it will be found to be highly interesting by the members of C.O.S.P.A.R.

Turning to organizational and programming matters, I should mention first that Commissions III and IV were reorganized to deal with the ionosphere and the magnetosphere, respectively, thus strengthening the U.R.S.I.'s programmes in these areas. The work on the magnetosphere had been spread somewhat diffusely among several commissions. The special importance of and developments that have taken place in the field of solar-terrestrial relationships were the centre of the consideration of the larger question of the organization of U.R.S.I. and its relationship to other Unions such as the I.A.U. and the I.U.G.G. We are studying this matter very intensively this year and some definitive proposals will be forthcoming by the time C.O.S.P.A.R. holds its next meetings.

The Assembly passed a number of resolutions pertaining to the work of its own Commissions and to projects involving the Inter-Union Committees and other bodies. The resolutions dealing with space research are given as an appendix to this report. I wish to call your attention to the emphasis placed on rocket and satellite measurements in these resolutions.

The assembly considered proposals for various symposia to be held during the next triennium. In this connection I should first present to you a resolution passed by the Assembly regarding work on solar-terrestrial relations :

« (*a*) The General Assembly of U.R.S.I.

recognising the need to unify the international discussions of solar

and terrestrial physics, even before any organizational changes can take place in the structures of the Unions involved,

resolves that it will, in future, hold scientific symposia and discussions on this subject only in collaboration with one or more of the other international bodies concerned, and it

invites those other bodies to act in the same way.

(*b*) The General Assembly of U.R.S.I.

recognising that if recommendation (*a*) is adopted it will imply that the next General Assembly of U.R.S.I. should be associated with a Scientific Symposium on topics in solar and terrestrial physics, and that this Symposium should be conducted jointly by U.R.S.I. and one or more other international bodies,

intends that the next General Assembly should be associated with a scientific symposium on some aspect of solar-terrestrial physics, run in conjunction with other international bodies. »

The arrangements for the next General Assembly provide for a symposium on solar-terrestrial relationships to be held in Belgrade in August 1966, to be followed by the General Assembly proper in Munich. The U.R.S.I. hopes that C.O.S.P.A.R. will take an active part in the Belgrade symposium. The Coordinating Committee of U.R.S.I. considered also a symposium on *Radio Astronomy Techniques* in conjunction with the Belgrade symposium and a symposium on *Radio Studies of Planetary Surfaces* to be held in 1965. The latter is of interest to C.O.S.P.A.R. and should definitely be coordinated with the symposium on Venus and Mars in the list drawn up by C.O.S.P.A.R. at the Warsaw assembly.

The subject of *Optimum Design of Instrumentation for Space Experiments from the Standpoint of Data Processing* received the special attention of the Committee on Space Radio Research. I have mentioned already the introduction to the subject that was made at the Tokyo assembly. The Committee inaugurated a study project to be conducted during 1964 which should clarify the problems and the lines of investigation to be followed. It then proposes to hold a symposium on the subject in 1965. C.O.S.P.A.R.'s interest in the subject was expressed at the Warsaw meeting and you will recall that the topic of *Basic Relations Between*

Space Experiment Design and Telemetry and Data Reduction Requirements was on the list of proposed symposium. It is clear that the proposed symposium should be conducted jointly by the U.R.S.I. and C.O.S.P.A.R. and I hope we can make arrangements to do so at this Assembly.

The U.R.S.I. has a rather parental interest in the I.U.C.A.F. and takes an active part in its work. Dr. Smith-Rose who is secretary-general of this Inter-Union Committee will be reporting for that organization. I need only mention the action taken by the Executive Committee of the U.R.S.I. at its 1963 Assembly recommending that the terms of reference of the I.U.C.A.F. be broadened to include all areas of science in which radio-frequency allocations are involved.

In closing, I wish to express the thanks of the U.R.S.I. for the invitation to participate in the current symposium on Interaction of Energetic Particles with the Atmosphere. Both the cordial invitation extended by C.O.S.P.A.R. and the accommodation of the U.R.S.I. 's suggestions and interests in the program were greatly appreciated and we look forward with great pleasure to collaboration in more scientific activities in the future.

APPENDIX

Resolutions of the 14th General Assembly of the U.R.S.I. bearing on Space Research

I. — *Resolution for the Inter-Union Committee on the Ionosphere*

Recognizing the great value of measurements of solar X-ray and extreme ultraviolet ionizing radiation flux for understanding and interpreting the ionosphere, it is recommended that continuous recordings on certain wavelengths (1) be given high priority in

(1) The spectral regions concerned are specified in the following paragraphs: The behavior of the ionosphere is controlled by the flux of solar ultraviolet and X-radiation. In each ionospheric region, certain wavelengths are of primary importance. Under quiet conditions, Lyman-*a* (1216 A°) is the major source of D-region ionization. When the sun is active, ionization by X-ray from 1-10A° increases in proportion to solar activity. At E-region heights (100-150 km) ionization is produced by the broad band of X-ray from 10-100 A°; the ultraviolet Lyman-B (1025.7 A°) may shape the base of E-region and CIII (977 A°) and the Lyman continuum (910-800 A°) are important sources of ionization in higher portions of E-region. The major input to F-region is a band of ultraviolet from 175 A° to 400 A° including the resonance line of H_eII (304 A°).

artificial satellite instrumentation. Emphasis should be placed on a coordinated sequence of relatively simple measurements, and on the continuity. It is of especial importance to cover the period of the I.Q.S.Y.

A solar monitoring program should measure absolute fluxes of the major sources of ionization continuously. At the present time it is possible to prescribe absolute photometers for the wavelength intervals 1-10 A°, 44-60 A°, 175-400 A° and Lyman-*a*. The detectors may be photocells or ionization chambers combined with appropriate filters. With data shortage it should be possible to monitor continuously. The response times of photometers currently in use is about 500 milliseconds. If carried on a solar pointed platform, the monitors may approach continuity to the limit of response time. On a spin stabilized satellite continuity is limited by the spin period, usually about one second.

It is noted further that it is highly important to make these data available to the scientific community as rapidly as possible and Dr. H. Friedman and Mr. A. H. Shapley are requested to explore means of doing so, either through an existing organization such as the World Data Center or another to be specially created for the purpose.

II. — *Resolution of Commission II — Tropospheric Radio*

(1) That in future space studies attention be given to measuring characteristics of planetary atmospheres and surfaces, including those of the earth as viewed from space ; controlled laboratory and model experiments may be of assistance in this endeavor.

(2) That more data be taken on terrestrial and atmospheric radiative energy as regards (*a*) the effect on atmospheric structure, and (*b*) the effect on sensitive receiving systems.

III. — *Resolutions of Commission III — Ionospheric Radio*

ROCKET MEASUREMENTS OF THE S_q CURRENT SYSTEM DURING THE I.Q.S.Y.

Commission III, considering the importance of electrodynamic forces in the ionosphere and the present lack of knowledge of the

levels in the ionosphere at which the quiet day currents flow, taking note of the proposals contained in section 2.2.2 of the Preliminary Joint Report of C.O.S.P.A.R. working Group II for I.Q.S.Y. working Group XV on Aeronomy (*I.Q.S.Y. Notes*, N° 3, pp. 60-61) « Ionospheric Electric Current Measurements », views with concern the comparatively small number of rocket measurements of ionospheric electric currents planned at medium latitudes for the I.Q.S.Y., and strongly recommends that steps be taken to increase the number of such measurements at temperature latitudes in order to delineate the diurnal and seasonal behavior of quiet day current systems.

Commission III further urges that each rocket measurement of ionospheric currents be supported by at least the following measurements : (1) ground-based sweep-frequency vertical incidence ionospheric soundings ; (2) adequate ground-based recording of magnetic elements so as to establish the quiet day magnetic variation, and (3) rocket-borne measurements of the electron density of the relevant height range of the ionosphere (where feasible).

VLF AND LF MEASUREMENTS DURING I.Q.S.Y.

Commission III, considering the importance of long term synoptic observations of the D-region, and aware of recent developments that hold the promise of significantly increasing the usefulness of the VLF and LF measurements for D-region profile studies, recommends the continuation of an active world-wide program of continuous recording of VLF and LF transmissions by as many organizations as possible during the I.Q.S.Y. period.

IV. — *Resolutions of Commission IV — Noise of Terrestrial Origin (now the Commission of the Magnetosphere)*

Commission IV recommends the adoption of the Draft Program for whistlers and VLF Ionospheric Noise during the I.Q.S.Y. :

Sub-Commission in Synoptic Whistler Observations — Final Draft of I.Q.S.Y. Programme — for presentation of U.R.S.I.-C.I.G. Committee.

WHISTLERS AND VLF IONOSPHERIC NOISE (W).

1. — *Introduction.*

During the I.G.Y. tape recordings of whistlers and VLF ionospheric noise were collected from many stations in the northern and southern hemispheres. Aural data summaries were sent to the world data centres. In addition to providing useful statistical data on occurence of various phenomena, these summaries have served as a catalog of activity on the tapes. Spectral studies of whistlers selected from this catalog have led to important new results on the distribution and variation of electron density in the magnetosphere. Including diurnal, annual, solar cycle and magnetic storm effects. The connections between VLF ionospheric noise and whistlers have been better defined. New relations have been discovered between VLF ionospheric noise and other phenomena such as auroral and magnetic variations.

During I.Q.S.Y. synoptic observations similar to those taken during I.G.Y. are needed to define the effect of solar activity on the properties of whistlers and VLF ionospheric noise. In addition, new special programmes on frequency whistler-mode observation and satellite observations of whistlers and VLF ionospheric noise are recommended. Attention is also drawn to the usefulness, of obtaining accurate amplitude spectra of whistlers.

2. — *Synoptic Observations.*

A program of synoptic observations is recommended for stations at all latitudes. Special emphasis should be given to pairs of magnetically conjugate stations. It is recommended that the frequency range 15-20 kc/s be included so that VLF code transmissions will be available for accurate relative timing. It is further recommended that, if practicable, the frequency range be extended above 20 kc/s at middle and low latitudes, to give information on path latitude from the noise properties of whistlers.

The following minimum programme is recommended for as many stations as is practicable :

(*a*) Recordings on magnetic tape should be made between 50 and 52 minutes past each hour UT.

(*b*) Normally every third recording schedule should be aurally monitored, namely those schedules commencing at 0050, 0350, 0650, ... 1850, 2150 UT.

(*c*) In addition, every recording schedule should be aurally monitored on days designated retrospectively by the International Ursigram and World Days Service to be included in Retrospective World Intervals (RWI).

(*d*) Monthly aural data summaries should be compiled in the form used for reporting to World Data Centres during the I.G.Y.

3. — *Data.*

(*a*) Aural data : It is recommended that World Data Centres be informed regularly of the existence of aural data summaries, so that researchers may obtain copies of the data summaries by writing directly to the station concerned.

(*b*) Whistler dispersion data : It is recommended that the following stations obtain the numerical value of whistler dispersion for one typical whistler for each day, if possible obtained between the hours of 0150 and 0350 local time. When whistlers are not available from these hours, another hour should be selected and identified.

Argentine Islands	Poitiers
Moscow	Stanford
Moshiri	Wellington

It is further recommended that World Data Centres be informed regularly of the existence of these data, and that complete information on the method of data reduction be supplied to researchers requesting data.

(*c*) The World Data Centres will report the existence of the above data in their Catalogs of I.Q.S.Y. Data.

4. — *Continuous VLF noise Recording.*

To obtain a full picture of the time variation of VLF ionospheric noise it is recommended that continuous recordings be made in the range of the synoptic whistler observations (usually 300 to

30,000 cps). Of principal interest are stations at medium and high latitudes. Accurate amplitude should be provided.

5. — *Conjugate-Point Noise Observations.*

Special efforts should be made to determine the relation between noise observed at geomagnetically conjugate points. Of particular importance are locations in the vicinity of the auroral zone and on the polar caps.

6. — *Fixed-Frequency Whistler-Mode Propagation.*

Attention is drawn to the usefullness of observing man-made VLF transmissions for the study of attenuation and fading of signals propagated in the whistler mode. Nevertheless, at the present state of the art, such observations must be considered as supplementing rather than replacing observations of natural whistlers.

7. — *Rocket and Satellite Observations.*

It is recommended that whistler-mode propagation and the origin of VLF ionospheric noise be studied by means of rockets and satellites. In such experiments coordinated ground measurements should be undertaken over the range of geomagnetic latitudes covered by the rocket or satellite.

8. — *Related Disciplines.*

It is recommended that wherever possible whistlers and VLF ionospheric noise be recorded at locations where other ionospheric and magnetic measurements are made. Phenomena which are thought to be connected with whistlers and VLF ionospheric noise include auroral fluctuations, both visual and optical, geomagnetic micropulsations, magnetic storms, F-region electron density and ionsphere absorption. Measurement of all these phenomena will therefore be of interest at whistler stations.

Allocation of Frequencies for Radio Astronomy and Space Science

by R. L. SMITH-ROSE

Past President, U.R.S.I.
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SUMMARY

It was realised during 1960 that to make effective progress in the fields of radio astronomy and space science would require the unrestricted use of various bands of frequencies throughout the spectrum. With the view of meeting this objective an Inter-Union Commission on Frequency Allocations for Radio Astronomy and Space Science (I.U.C.A.F.) was formed under I.C.S.U., with representatives from U.R.S.I., I.A.U. and C.O.S.P.A.R., and other consultative members from the International Telecommunication Union (I.T.U.).

The Commission known as I.U.C.A.F. has (i) made a critical examination of the frequency requirements for effective research in radio astronomy and space science; (ii) obtained recognition by both C.C.I.R. and I.T.U. as an active observer at their conferences; and (iii) made direct contributions to the I.T.U. through some of the national member bodies of this Union.

At the Extraordinary Administrative Radio Conference of the I.T.U. held in Geneva in November 1963, the work of I.U.C.A.F. bore the first fruits of its successful activities. The need to provide all possible protection for radio astronomy was fully recognised : and some 13 specific bands of frequencies were allocated on an exclusive or shared basis. In addition, some 22 bands of frequencies were allocated to research in space science as distinct from communications and satellite tracking.

Finally, a Recommendation, which was adopted unanimously by the 74 National administrations participating in the Conference, provides for further consideration to be given to the provision of improved frequency allocations for radio astronomy.

The question of frequencies for space research will automatically be reviewed at the next Administrative Radio Conference.

Résumé

En 1960, il fut réalisé que si l'on voulait atteindre des progrès effectifs dans les domaines de la radioastronomie et de la science spatiale, il faudrait disposer en toute liberté de certaines bandes de fréquences s'étendant sur tout le spectre. A cette fin fut formée, sous les auspices du Conseil International des Unions Scientifiques, une Commission Inter-Unions pour l'Attribution des Fréquences pour la Radioastronomie et la Science Spatiale (I.U.C.A.F.), comportant des représentants de l'U.R.S.I., de l'U.A.I. et du C.O.S.P.A.R., ainsi que des membres consultatifs attachés à l'Union Internationale des Télécommunications (U.I.T.).

Cette Commission, connue sous le sigle I.U.C.A.F., a (i) procédé à l'examen critique des nécessités, sur le plan des fréquences, pour assurer des recherches efficaces en radioastronomie et en science spatiale, (ii) obtenu la reconnaissance par le C.C.I.R. et l'U.I.T. en tant qu'observateur actif aux conférences, (iii) apporté des contributions directes à l'U.I.T. par l'intermédiaire des membres nationaux de cette Union.

C'est à la Conférence Administrative Extraordinaire des Radiocommunications tenue par l'U.I.T. à Genève en novembre 1963 que le travail de l'I.U.C.A.F. a porté ses premiers fruits. La nécessité de fournir toute la protection désirée à la radioastronomie a été pleinement reconnue, et 13 bandes spécifiques de fréquences ont été attribuées sur une base exclusive ou partielle. De plus 22 bandes de fréquences ont été attribuées à la recherche spatiale, considérée comme un domaine séparé du repérage par satellites et des télécommunications.

Enfin une recommandation, adoptée à l'unanimité par les 74 Administrations nationales participant à la Conférence, recommande que soit encore considérée la question de l'amélioration des attributions de fréquences pour la radioastronomie.

La question des fréquences attribuées à la recherche spatiale sera automatiquement ré-examinée à la prochaine Conférence Administrative des Radiocommunications.

Introduction.

During the past few years the subjects of radio astronomy and space science have required serious consideration on the part of those, both national and international, organisations responsible for allocating the available spectrum of radio frequencies among the numerous services — including communications, navigation and broadcasting — using radio waves. The current Radio Regulations drawn up by the International Telecommunication Union in 1959 recognise that the Radio Astronomy service is unique in that it is based solely on the reception of radio waves of cosmic origin. It does not itself originate any radio waves and therefore causes no interference to any other service. It does, however, require to be protected from interference caused by the operation of transmitters in any of these other services.

On the other hand, for the conduct of space research with the aid of unmanned earth satellites, it is essential to have the use of a number of radio frequencies for transmission and reception. In the first place, once the satellite with its load of instruments has left the launching vehicle, any subsequent and not pre-determined changes to its orbit or flight path must depend on radio control from the ground station. Secondly, radio direction finding and tracking techniques are necessary to determine the position of the satellite throughout its flight. Thirdly, the information collected by the measuring instruments carried in the satellite is, in most cases transmitted by radio to the observer, either continuously or on command at intervals during the flight.

The frequencies selected for these purposes must be both suitable for transmission over the path from satellite to ground, and selected so as to cause the minimum disturbance to all other services using radiocommunication. Although general research into the generation and reception of radio waves has been steadily extending the spectrum of frequencies available for practical use, there has also been a corresponding increase in the demand for frequencies by all the other services throughout the world. To avoid what

might easily become a state of confusion — and even chaos — in the radio field, international conferences are organised at intervals to discuss, and resolve so far as possible, the technical and administrative problems involved. Since space scientists are among the latest applicants for the use of portions of the radio frequency spectrum, it will be useful to describe briefly the international organisations concerned with this subject and the manner in which they operate.

The International Telecommunication Union.

In the early years of the present century it became clear that the new and rapidly developing service of radio communication would need protection at both national and international levels, and rules drawn up to control its use. After various conferences held at intervals of a few years from 1906 onwards, the International Telecommunication Union (I.T.U.) was formed, and later became one of the specialised agencies of the United Nations. The Union has a permanent secretariat in Geneva, Switzerland, together with a specialised staff to deal with technical problems associated with line and radio communications respectively.

At the Atlantic City conference of the Union held in 1947, steps were taken to record all frequencies in use by radio stations throughout the world; and a frequency allocation table was drawn up to cover all services then in operation. This table was used as the basis of negotiation as developments took place in the radio field and the various new, as well as the existing, services were seeking frequencies for their use.

To assist the I.T.U. in its work, the International Radio Consultative Committee (C.C.I.R.) was established in 1927 for the purpose of studying technical questions of interest to international radio communications. These questions include the technical development of sending and receiving equipment, the propagation of radio waves of all frequencies and under all practical conditions of use, and the interference arising from both natural and man-made disturbances. The Committee also deals with the specification of conditions and tolerances appropriate to all applications of radio. The function of the C.C.I.R. is limited to advising the I.T.U. on the various technical problems associated with all the applications of radio, with the object of ensuring that the radio

frequency spectrum is divided among the users in the most economical and efficient manner possible ; and so facilitate the conduct of the individual services with the minimum of mutual interference.

In 1947, the portion of the radio spectrum in which frequencies were allocated was limited to the range 10 kc/s to 10 500 Mc/s (or 10.5 Gc/s). At the next full Administrative Radio Conference held at Geneva in 1959, the range of frequencies covered in the allocation table was 10 kc/s to 40 Gc/s (corresponding to wavelengths from 30 km to 7.5 mm). The increase was due to the major developments which had taken place in the intervening twelve years in such fields as communication by ionospheric and tropospheric scatter, navigation and surveying techniques, and for scientific research in radio astronomy and the exploration of space. For the first time, the Geneva (1959) conference recognised and defined the Radio Astronomy Service, and also envisaged and made provision for the possibility of radio waves being required for communication with, and control of, man-made vehicles travelling both within and outside the earth's atmosphere.

The International Council of Scientific Unions.

Concurrently with these developments in the field of practical radio communications, the International Council of Scientific Unions (I.C.S.U.) appreciated the need for advanced and co-operative scientific research in space to increase our general knowledge of the earth's environment and to provide a basis on which various future expeditions in space could be founded.

As a member body of I.C.S.U., the International Scientific Radio Union (U.R.S.I.) has since its formation in 1913, been actively engaged in organising and conducting scientific research in radio throughout the world : and it has encouraged the application of radio measuring techniques to the study of the earth and its atmosphere, and the influence of the sun's radiation on the latter. On the practical side, U.R.S.I. has collaborated very closely with C.C.I.R. on many problems of mutual interest and in recent years, these have included communication with, and location of, man-made vehicles in space.

But there are two other member bodies of I.C.S.U. greatly interested in the problems of the use of radio techniques in asso-

ciation with outer space. One of these — the International Astronomical Union (I.A.U.) — is among the oldest of the scientific unions ; and it is very much concerned nowadays with the use of radio, as well as light, waves for modern astronomy. Apart from the use of radio for rapid communication between observatories, astronomers have for many years been engaged in a study of the relationship between time derived from astronomical observations and that provided by physicists from the atomic frequency standards. The introduction and development of radio receiving techniques to an extremely high degree of sensitivity in radio astronomy has opened up new vistas in our universe which could not be explored by optical techniques alone.

The other, and youngest, member of I.C.S.U. is the International Committee on Space Research (C.O.S.P.A.R.), Its great and healthy activity is indicated by the fact that, since its formation some five years ago, it has already held four international symposia, the first being in January 1960. We are now — in May 1964 — at the beginning of the fifth. The scope of these symposia provides for discussion on a wide international basis of all scientific problems associated with the earth's atmosphere and outer space, and the radiations and other phenomena which determine the physical conditions associated with the solar system. It is for the direct assistance of all this research in space science that the allocation and protection from interference of a number of suitable bands of radio frequencies is of paramount importance.

Inter-Union Commission on Frequency Allocations for Radio Astronomy and Space Science (I.U.C.A.F.).

It was at the General Assembly of U.R.S.I. in London in September 1960 that the subject of frequency allocations for radio research was discussed by the interested commissions of the Union. Subsequently, at an informal meeting of representatives of U.R.S.I., I.A.U. and C.O.S.P.A.R., a proposal was formulated to constitute an Inter-Union Commission which should first co-ordinate the future requirements of frequency channels for radio astronomy and space science ; and then take appropriate action on behalf of the three constituent bodies to bring suitable proposals before the I.T.U. with the view of securing frequency allocations to meet

these requirements. These proposals were subsequently approved by the member bodies of the Commission and endorsed by the Executive Board of I.C.S.U. at its meeting in Lisbon in October 1960. The constitution and terms of reference of the Commission have been published elsewhere (1).

While a great deal of the work has been conducted by correspondence, four full meetings of the Commission have been held between October 1961 and May 1963. During this period the activities of the Commission were formally recognised by the I.T.U. and its representatives participated in both Study Group meetings and in the 1963 Plenary Assembly of the C.C.I.R., at which the technical issues involved in space science and communication were discussed on an international scale. It was following this assembly of C.C.I.R. supported by other representations, that the Administrative Council of the I.T.U. agreed to include Radio Astronomy within the terms of reference of the 1963 Extraordinary Administrative Radio Conference. As a consequence of this action the I.U.C.A.F., with its constituent member bodies, U.R.S.I., I.A.U. and C.O.S.P.A.R., was an active participant in the Conference and was able to press through National Administrations for a number of bands of frequencies to be allocated to both radio astronomy and space research, and for the improved protection of these bands from interference by other radio services.

The details of the allocations for Radio Astronomy are published elsewhere (2); but it may be noted here that the frequency tables now include some 18 allocations with a number of reservations and including, particularly the exclusive allocation of the hydrogen band at 1400-1427 Mc/s on a worldwide basis. A recommendation adopted at the 1963 Geneva conference also ensures that further consideration should be given at the next Ordinary Administrative Radio Conference to the provision of improved frequency allocations for radio astronomy.

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(1) R. L. Smith-Rose : The Allocation of Radio Frequencies for Scientific Research. *I.C.S.U. Review*, 1961, Vol. 3, pp. 61-66.

(2) Final Acts of the Extraordinary Administrative Radio Conference to allocate Frequency Bands for Space Radiocommunication Purposes, issued by I.T.U., Geneva, 1963.

Frequencies for Space Research.

The need of the space research scientist for protection of radio frequencies is somewhat different from that of the radio astronomer. While a number of satellites are already in use for direct application to the extension of world-wide radio communications, others are placed in orbit round the earth or further afield with the object of extending our knowledge of the upper atmosphere at increasingly greater heights, and of measuring various physical quantities in outer space. In some cases, the frequencies required are for the control of instruments in the satellite or for locating it during its orbit : and here, in some instances, the frequencies can be conveniently shared with the corresponding requirements of, say, communications satellites. But, bearing in mind the inaccessibility of the scientific equipment carried in the space vehicle, and the need to use the measuring apparatus for the maximum proportion of the available time, it is important to ensure that the results of the scientific measurements can be communicated to the ground controlling station or laboratory with the minimum of delay or interference. It is thus desirable that a number of bands of frequencies in appropriate parts of the spectrum should be allocated, without danger of interference, to the needs of scientific research being conducted with the aid of satellites in orbit.

At the meeting of C.O.S.P.A.R. in Warsaw, the following general resolution was adopted :

« Considering that the transmission of data from space vehicles to the ground is essential to the use of such vehicles in space research,

C.O.S.P.A.R. recommends that through I.U.C.A.F. every effort should be made to guarantee the continued allocation of suitable frequency bands for space research. »

It was with this support and encouragement that the members of the Inter-Union Commission (I.U.C.A.F.) participated in the E.A.R.C. at Geneva during October/November 1963 ; and assisted through the various national administrations to achieve the results described in the next section.

Space Research and the Extraordinary Administrative Radio Conference 1963.

The Extraordinary Administrative Radio Conference (E.A.R.C.) was held in Geneva from 7th October to 8th November 1963.

It was attended by over 350 representatives of 74 National Administrations and of other interested international organisations. While the main objective of the Conference was to allocate frequency bands for space radiocommunication purposes, it also dealt with frequencies for space research and radioastronomy (1).

In the Radio Regulations, Geneva 1959, four definitions referred to radio communication services between space stations or between earth stations and space stations. These are :

No. 70 *Space Service* : A radiocommunication service between space stations.

No. 71 *Earth-Space Service* : A radiocommunication service between earth stations and space stations.

No. 72 *Space Station* : A station in the earth-space service or the space service located on an object which is beyond, or intended to go beyond, the major portion of the earth's atmosphere and which is not intended for flight between points on the earth's service.

No. 73 *Earth Station* : A station in the earth-space service located either on the earth's surface or on an object which is limited to flight between points on the earth's surface.

At the E.A.R.C., Geneva 1963, some thirty new definitions were drawn up in relation to « Space Systems, Services and Stations » and « Space, Orbits and Types of Objects in Space. » From these may be quoted the following terms and definitions relating to space research.

No. 84 AM *Space Research Service* : A space service in which spacecraft or other objects in space are used for scientific or technological research purposes ;

No. 84 AN *Space Research Earth Station* : An earth station in the space research service ;

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(1) Final Acts of the Extraordinary Administrative Radio Conference to allocate Frequency Bands for Space Radiocommunication Purposes, issued by I. T. U., Geneva, 1963.

No. 84 AO *Space Research Space Station* : A space station in the space research service ;

No. 84 AW *Space Telemetering* : The use of telemetering for the transmission from a space station of results of measurements made in a spacecraft, including those relating to the functioning of the spacecraft ;

No. 84 AY *Space Telecommand* : The use of radiocommunication for the transmission of signals to a space station to initiate, modify or terminate functions of the equipment on a space object, including the space station ;

No. 84 AZ *Space Tracking* : Determination of the orbit, velocity or instantaneous position of an object in space by means of radiodetermination, excluding primary radar, for the purpose of following the movement of the object ;

No. 84 BA *Deep Space* : Space at distances from the earth equal to or greater than the distance between the Earth and the Moon ;

No. 84 BH *Spacecraft* : Any type of space vehicle, including an earth satellite or a deep-space probe, whether manned or unmanned.

It will be recalled that the main purpose of this E.A.R.C. was « to allocate frequency bands for space radiocommunication purposes. » During its deliberations, however, the Conference gave full consideration to the need for frequency allocation for space research in addition to those required for communications by means of satellites and for control, meteorological and navigational purposes. While it may not always be necessary to assign separate bands of frequencies for the tracking and reception of data from research satellites as distinct from those used for radio communications, the frequencies now assigned to space the research services are listed in the appended table.

In order to take account of the new conditions resulting from the development of space communications for both practical applica-

tions and research purposes, appropriate additional sections were drawn up at the 1963 Conference to Article 7 entitled « Special Rules relating to Particular Services » of the 1959 Radio Regulations. These additions include recommendations as to the choice of sites, frequencies and power limits for earth stations in the space service, and the use of appropriate devices for terminating radio emissions from space stations when necessary.

In conclusion, attention is drawn to the fact that the revised Radio Regulations of the I.T.U. will provide for the notification and recording of frequency assignments to stations in the Space and Radio Astronomy services for inclusion in the Master International Frequency Register. For both earth and space stations in the Space Research Service, the technical details required include the frequency, power, class of emission and identification signals used for the various purposes of Telemetering, Tracking, Telecommand and transmission of research and other information. Additional orbital information is sought in the case of an earth satellite ; and for a space probe a general indication of its trajectory should be provided. Specimen tables are given in the « Final Acts » of the 1963, Geneva conference indicating in detail the information it is desirable to provide. This Inter-Union Commission (I.U.C.A.F.) may wish to co-operate in the compilation of this information.

Frequencies allocated to Space Research.

The attached table gives details of the bands of frequencies allocated to Space Research, first in the existing Radio Regulations of the I.T.U., Geneva 1959 ; and secondly the revised allocations resulting from the Extraordinary Administrative Radio Conference, Geneva, 1963. For the purpose of such frequency allocations the world has been subdivided into three regions, which are defined in detail in the existing Radio Regulations, 1959. In very broad terms Region 1 incorporates Europe and Africa, but includes all of Turkey and the U. S. S. R. if outside these continents : Region 2 comprises the Americas and Greenland : while Region 3 covers the rest of the world, mainly Asia, Australia and New Zealand.

APPENDIX

Review of Frequencies allocated to Space Research in the
« Final Acts of the Extraordinary Administrative Radio Conference »
Geneva, 1963

No.	Frequency Band Mc/s	Allocations in I.T.U. Radio Regulations : Geneva, 1959		Revised Allocations, Geneva 1963, Region		
		Applicable to Regions	Rec. = Recommendation F = Footnote	1	2	3
1	10.003-10.005	1, 2 and 3	F 215	No change, except the modification of footnote 215, 221 and 235		
2	19.990-20.010	1, 2 and 3	F 221			
3	39.986-40.002	1, 2 and 3	F 235			
4	15.762-15.768	No allocation		Secondary allocation (Primary in some countries — see F 215A). Fixed Services as Primary		
5	18.030-18.036					
6	30.005-30.010	No allocation		Primary allocation, with Fixed, Mobile and Space (Satellite identification) also as Primary		
7	136-137	1, 2 and 3	Primary Service F 280	Primary (T & T),* with Fixed and Mobile also Primary : F 281A (and Recommendarion No. 7A)	Prieary (T & T) and exclusive subject to F'281B. F 281 (and Recommendation No. 7A)	Primary (T & T) with Fixed and Mobile also Primary : F 281A (and Recommendation No.

8	137-138	No allocation		* (T & T) Primary, with Meteorological Satellite, and Space also Primary : various footnotes relate to use of this band for other services in some countries. F 281F		
9	143.6-143.65	No allocation		Primary, (T & T), shared with other Primary Services		
10	183.1-184.1	1, 2 and 3	F 294	Secondary allocation in accordance with F 294 modified		
11	400.05-401	1, 2 and 3	Primary Service F 280	Primary (T & T) shared with Meteorological Aids and Meteorological Satellite (Maintenance telemetering) as Primaries		
12	900-960	No allocation		F 339A Specific portions of the band may be used on a secondary basis		
13	1427-1429	1, 2 and 3	Primary F 280	Assigned to Space (Telecommand), not Research		
14	1700-1710	1, 2 and 3	Secondary F 280	Primary (T & T) with Fixed (Primary) and Mobile (Secondary)	Primary (T & T), exclusive except in Cuba	Primary (T & T), with Fixed and Mobile also Primary
15	2110-2120	No allocation		F 356A may be used for telecommand in deep space research subject to international co-ordination		

APPENDIX

Review of Frequencies allocated to Space Research in the
« Final Acts of the Extraordinary Administrative Radio Conference »
Geneva, 1963

No.	Frequency Band Mc/s	Allocations in I.T.U. Radio Regulations : Geneva, 1959		Revised Allocations, Geneva 1963, Region		
		Applicable to Regions	Rec. = Recommendation F = Footnote	1	2	3
16	2290-2300	1,2 and 3	Secondary F 280	Primary (T & T in deep space) with Fixed (Primary) and Mobile (Secondary) F 356C	Primary (T & T in deep space), exclusive except in Cuba	Primary (T & T in deep space) with Fixed and Mobile also Primary
17	5250-5255	1, 2 and 3	Secondary F 280	Secondary service, shared with Radiolocation as Primary		
18	5670-5725	No allocation		Secondary service (Deep space research), with Radiolocation (Primary) and Amateur (Secondary). Primary in some countries (F 389A)		
19	8400-8500	1, 2 and 3	Secondary F 280	Primary, with Fixed and Mobile, also Primary, subject to F 394A and D	Primary, exclusive except in Cuba	Primary with Fixed and Mobile also Primary, subject to F 394A and D

	Gc/s					
20*a*	15.15-15.25	1, 2 and 3	Primary F 280	No allocation		
20*b*	15.25-15.35	No allocation		Primary, exclusive, with reservations in F 409A and B		
21	31.0-31.3	No allocation		Secondary (Primary in some countries, F 412H), with Fixed and Mobile as Primary		
22	31.5-31.8	1, 2 and 3	Primary F 280	Primary, with Fixed and Mobile as Secondary	Primary exclusive except in Cuba	Primary with Fixed and Mobile as Secondary
23	31.8-32.3	No allocation		Secondary (Primary in some countries, F 412B), with Radionavigation as Primary		
24	34.2-35.2	No allocation		Secondary (Primary in some countries, F 412C), with Radiolocation as Primary		

F = Footnote reference : the I.T.U. document should be consulted for interpretation of the various footnotes.
* T & T = Telemetering and Tracking.

World list of Satellites tracking stations

Cospar Information Bulletin, nº 18, April 1964, contains the Part II on Radio Stations of the C.O.S.P.A.R. world list of satellite tracking stations and the First addendum to Part I on Optical Stations (*C.O.S.P.A.R. Information Bulletin*, nº 10, August 1962).

The list of Radio Stations has been edited by Dr. B. G. Presley, Chairman.

I. Q. S. Y.

The I.Q.S.Y. Secretariat has published n° 7 of *I.Q.S.Y. Notes* (May 1964). For information we are reproducing the following abstracts of this issue.

Ionospheric observations

The I.Q.S.Y. Reporter for Ionosphere, Professor W. Dieminger is supported by the U.R.S.I.-C.I.G. Committee which acts as an advisory group on matters relating to ionospheric research during the I.Q.S.Y. Several members of the U.R.S.I.-C.I.G. Committee act as sub-reporters on particular aspects of ionospheric research ; two of these are :

Professor K. Rawer — A1 and A3 absorption.
Professor R. W. H. Wright — D1, 2, 3, 4 drift.

Both these reporters have recently sent circular letters to stations known to be active in absorption or drift observations. These letters are reproduced below and those who are interested and who have not already made contact with Professors Rawer or Wright are invited to do so.

* * *

Cables : Physics University.
Ref. : D/1.

Department of Physics, University of the West Indies, Mona, Kingston 7, Jamaica.

26th February, 1964.

Dear

I.Q.S.Y. Ionospheric Drifts

I have been asked to act as a sub-discipline consultant on the C.I.G. (Comité International de Géophysique), I.Q.S.Y. Committee on the subject of Ionospheric Drift Observations. I am at present

trying to communicate with all workers in this field so that a comprehensive catalogue of the work in progress and planned, can be drawn up. We can then exchange views on the methods and difficulties that are experienced, and where possible agree on standard methods of recording and reduction.

The normal methods for measurement of ionospheric drifts have been designated as follows :

D 1. Fading intercomparison at three or more antennae spaced a few wavelengths from each other.

D 2. Radio observations on drifting meteor trails.

D 3. Radio star scintillation with three or more antennae spaced many wave-lengths apart.

D 4. Observations of characteristic reflection features at widely separated sites.

I should be most grateful if you could inform me of the names and addresses of the persons who are engaged in Ionospheric Drift observations in your country. Any further detailed information at the same time, as to the methods used and the sites at which observations are being made would be welcome.

When the initial data of the names of the workers, in the field are collected, then a circular will be sent around asking for the more specific details of the equipment, method of recording and treatment of results.

If there is one coordinator in your country who is especially appointed to cover ionospheric drifts, I should be grateful to receive his address.

It would be extremely helpful if I could receive an early reply by air mail, to the following address :

Professor R. W. H. Wright, Department of Physics, University of the West Indies, Mona, Kingston 7, Jamaica.

With kindest regards,

Yours sincerely,

(*signed*) Raymond W. H. Wright.

Circular letter No. 1 to I.Q.S.Y. Observers of ionospheric Absorption by Methods A1 and A3

See *Information Bulletin*, nº 143, p. 67.

Instruction Manuals for the I.Q.S.Y.

The Chairman of the I.Q.S.Y. Publications Committee, Dr. D. C. Martin, has recently obtained, from the Discipline Reporters, information on the accuracy of the list of manuals reproduced in *I.Q.S.Y. Notes*, No. 4 (pp. 36-38). Since this list was prepared, all the available I.Q.S.Y. Instruction Manuals issued by the I.Q.S.Y. Committee have been distributed by the I.Q.S.Y. Secretariat, and details of some new instructional material have become available. The list that follows is as complete as possible but in a few cases the publications are not yet available.

« Annals of the I.G.Y. » are published by Pergamon Press Ltd., Headington Hill Hall, Oxford, England.

I. — World Days.

1. *I.Q.S.Y. Instruction Manual No.* 1. — World Days Programme.
   Source : I.Q.S.Y. Secretariat.

2. *Synoptic Codes for Solar and Geophysical Data.*
   Source : I.U.W.D.S. Secretariat, Sterrewacht, 13 Servaasbolwerk, Utrecht, Netherlands.

V. — Ionosphere.

1. *U.R.S.I. Handbook of Ionogram Interpretation and Reduction* (Ed. Piggott and Rawer).
   Source : Elsevier Publishing Company, Amsterdam (70/-*d.*).

2. « Annals of the I.G.Y. », III (parts I, II and III), 1-287 for vertical incidence soundings, absorption measurements and drift measurements.

3. *I.Q.S.Y. Instruction Manual No.* 4. — Ionosphere.
   Part I. — Vertical Incidence Soundings.
   Part II. — Absorption Measurements.
   Part III. — Drift Measurements.
   Source : I.Q.S.Y. Secretariat.

4. « Annals of the I.G.Y. », III (part IV), 291-381 for atmospheric radio noise, whistlers, radio-aurora, radio meteors, forward scatter and back scatter.

5. *C.O.S.P.A.R. Information Bullelin*, No. 17. Technique Manual on Electron Density and Temperature Measurements in the Ionosphere.

Source : C.O.S.P.A.R. Secretariat, 55, Boulevard Malesherbes, Paris 8e, France.

C.I.G. guide to international data exchange through the world data centres

(*for the period* 1960 *onwards*)

1. The above Guide has been prepared by the Comité International de Géophysique and has recently been widely circulated. In addition to the Sections which deal with the I.Q.S.Y. disciplines (reprinted as I.Q.S.Y. Manual, No. 6) the Guide also contains sections which deal with the « solid-earth » disciplines of C.I.G. :

Longitude and Latitude,	Tsunamis
Glaciology,	Gravimetry
Oceanography,	Physics and Chemistry of the
Seismology,	Earth's Interior.

2. I.Q.S.Y. Manual No. 6 has already been circulated to all I.Q.S.Y. Participating Committees. In some countries, however, these committees are also responsible for work in the solid earth disciplines, listed above, which do not form part of the I.Q.S.Y. programme. Secretaries of such committees who have not already received copies of the C.I.G. Guide are invited to apply to : I.Q.S.Y. Secretariat, 6 Cornwall Terrace, London, NW1, U. K. or to the convenor of the World Data Centre Sub-Committee of C.I.G. : Dr. H. Odishaw, Geophysics Research Board, National Academy of Sciences, 2101 Constitution Avenue, Washington, 25, D.C., U. S. A.

The second U.K. satellite : « AERIEL 2 »

News has been received from the Royal Society in London that the second U. K. satellite was successfully launched on 27th March 1964 and has been named « Aeriel 2 ». The experiments carried were devised and produced in the U. K. and the satellite was launched by N.A.S.A. from Wallops Island, Virginia, using a four stage Scout rocket.

The satellite will make observations of galactic radio noise at frequencies which are too low to permit ground observations, measurements of the vertical distribution of atmospheric ozone and counts of micro meteorites.

I.Q.S.Y. PROGRAMMES OF PARTICIPATING COUNTRIES

(Additions or/and modifications to programmes previously published)

Madagascar

V. — IONOSPHÈRE.

Station Ionosphérique d'Ivato (*Tananarive*), Service dépendant du C.N.E.T. français (Centre National d'Etudes de Télécommunications).

1. Décembre 1963 au 31 décembre 1965, sondage Semi-Horaires ;
2. Sur ordre de la Division des Prévisions Ionosphériques de Saclay, sondage Quadri-Horaires ;
3. Exceptionnellement sondages continus (toujours sur ordre de la D.P.I.).

Adresse : Roger Andriamirado, Comité National Malgache de Géodésie et Géophysique, Secrétariat de l'Académie Malgache, Parc de Tsimbazaza, Tananarive.

South Africa

V. — IONOSPHERE.

1. — *Vertical Incidence Soundings.*

Existing stations will continue to operate at Johannesburg and Cape Town (National Institute for Telecommunications

Research) and at S.A.N.A.E. Base in the Antarctic (Rhodes University).

A station will operate at Grahamstown (Rhodes University) at the site of the station operated during the I.G.Y.

It is recognised that, in addition to these stations, new stations are desirable at Bouvet Island and at Marion or Gough Islands, Bouvet Island being first priority and possibly of even greater importance that S.A.N.A.E. Base. If suitable equipment becomes available, consideration will be given to establishing stations at one or more of these points.

2. — *Ionospheric Absorption.*

Ionospheric absorption measurements will be undertaken at Johannesburg (N.I.T.R.)using both the pulse-echo method and the C. W. Field Strength method.

3. — *Riometer.*

Riometer operating on 30 Mc/s will be in operation during the I.Q.S.Y. at both Hermanus and S.A.N.A.E.

4. — *Atmospheric Noise Statistics.*

Observations of atmospheric noise as part of the world-wide network supervised by the National Bureau of Standards of the United States of America will continue in Pretoria (N.I.T.R.).

5. — *Whistlers and VLF Emissions.*

A VLF spectrograph, sweeping from 1 to 100 kc/s six times per second, will be operated at Rhodes University, Grahamstown. VLF noise observations will possibly be taken at S.A.N.A.E.

A synoptic programme of whistler recording will be carried out at Durban. Sampling of incoming atmospherics will be made for two minutes each hour throughout the day and night. The apparatus used and the schedule followed will be the same as for the I.G.Y. programme. An analysis of results will be made with a view to ascertaining any changes in the salient characteristics of whistlers recorded.

A whistler recording station will be established at the South African Antarctic Base where no whistler recordings were made during the I.G.Y. The establishment of such a station will be dependent on the availability of suitable personnel.

The Department of Physics, University of Natal, is currently participating in a cooperative conjugate point experiment with a group of French scientists stationed at Hermanus. 16.8 kc/s pulses are being transmitted nightly from a transmitter near Paris and these are being received in Durban and recorded on magnetic tape. The purpose of the experiment is to establish whether whistler mode transmissions of these signals take place. Initially this work is scheduled to last only a few months but there is a possibility that it may continue for some time during the I.Q.S.Y.

Work on the analysis of the wave forms of atmospherics is to be continued with a specific view to ascertaining the difference between the characteristics of atmospherics which do generate whistlers and those which do not.

It is believed that certain results which have come out of the analysis of whistler records may be explained in terms of the physical processes taking place within the thundercloud. To investigate this further, radar studies of thunderclouds will be initiated using a wavelength of approximately 2 metres.

6. — *Special Experiments.*

6.1 *Vertical Incidence Experiments.* — Partial reflection and cross-modulation (pulse) experiments will be conducted in Johannesburg (N.I.T.R.).

6.2. *Oblique Incidence Experiments.* — Oblique incidence HF pulse communication experiments will be continued between S.A.N.A.E. and Grahamstown (Rhodes University). It is expected that two-way pulse transmission times and intensities will be recorded at several frequencies.

6.3 *Ionospheric and VLF Noise Observations.* — Ionospheric and VLF noise observations will be taken on board the « R.S.A. » whenever possible.

6.4 *Conjugate Point Experiments.* — Cooperation with overseas organisations in conjugate point experiments has been arranged with the Magnetic Observatory at Hermanus and the University of Natal.

This included cooperation with the Institut de Physique du Globe in simultaneous recordings of magnetic variations at con-

jugate points, with the University of Poitiers in the routine recording of whistlers and VLF noise, and with the Ecole Normale Supérieure for the reception of artificial VLF transmissions on 16,8 kc/s from the French station, F.U.B., near Paris.

Stations : Johannesburg ; Cape Town, S.A.N.A.E. ; Grahamstown ; Tsumeb ; Durban.

Austria

V. — IONOSPHERE.

(*a*) It will not be possible to make whistler observations at Sonnblick Observatory as intended.

(*b*) *Delete* the last sentence under V Ionosphere in *I.Q.S.Y. Notes*, No. 2, p. 12 ; *insert* :

« Faraday rotation observations will be made using satellites S-66 and OGO-A ».

Address : Professor Dr. F. Steinhauser, Zentralanstalt für Meteorologie und Geodynamik, Hohe Warte 38, Vienna XIX.

Spain

V. — IONOSPHERE.

1. — *Vertical Incidence soundings.*

These will be continued at Tortosa during I.Q.S.Y.

2. — *Absorption measurements.*

The installation of a riometer at Madrid and Tortosa is envisaged.

3. — *Field intensity.*

Field intensity is observed at Madrid at very low frequencies (under 5 kc/s).

4. — *Atmospherics.*

Barajas (Madrid) will continue the observations of direction, intensity and frequency of atmospherics.

At La Coruña and probably Son Bono (Palma de Mallorca), observations of direction of arrival of atmospherics.

At Tortosa the mean level of atmospherics is observed.

VI. — Solar activity.

At Tortosa, observations of the radio-waves ($\lambda = 1$ m) are made.

Adress : Father A. Romaña, Observatorio del Ebro, Apartado 9, Tortosa.

Sweden

V. — Ionosphere.

Uppsala.

1. Vertical soundings of the ionosphere each hour ; during R.W.D. and S.W.I. every quarter hour. Frequency range 0.3-20 Mc/s.
2. Riometer recordings at 27.6 Mc/s.
3. Recording of the 16 kc/s transmitter of Rugby.
4. Geomagnetic H-intensity recording (Askania direct recorder).

Lycksele.

1. Vertical soundings of the ionosphere each hour ; during R.W.D. and S.W.I. every quarter hour. Frequency range 0.3-20 Mc/s.
2. Riometer recording at frequency 27.6 Mc/s.
3. Recording of the 16 kc/s transmitter of Rugby.
4. Geomagnetic H-intensity recording (Askania direct recorder), photographic recording of all three components.

Kiruna.

Ionospheric ionization.

1. Panoramic ionosonde, together with continuous soundings on two fixed frequencies.
2. Riometers.
3. Radio-astronomical swept frequency interferometer.

Radio-wave propagation.

1. VLF Transmission : Rugby to Kiruna.
2. Recordings of transmissions from satellites.
3. Communication, Stockholm — Kiruna, on 50 and 80 Mc/s via meteor ionization.

Lulea. Ionospheric vertical soundings.

Enköping.

1. Recordings of atmospheric noise.
2. VLF Transmission : Rugby 16 kc/s to Enköping.

Stockholm. Recordings of VLF Transmissions from :

GBR Rubgy 16 kc/s.
NPM Hawaii 19.8 kc/s.
NBA Panama (Canal Zone) 18 kc/s
NPG Seattle 24 kc/s
} alternatively.

General.

(*a*) The Radio Department of the Royal Board of Telecommunication is represented in the European Regional Ursigram and World Days Committee and has a geophysical communication centre in Stockholm which will serve as an Associate Regional Warning Centre in the world-wide warning system during I.Q.S.Y. From this Centre, Ursigrams and warnings are distributed to Swedish observatories and institutions, and to Finland. Data of observations (ionosphere, aurora, riometer, major solar events) are collected and forwarded in Ursigrams to the European centres.

(*b*) The new address of WDC-C1 for cosmic rays, to supersede the earlier address is : WDC-C1 for Cosmic Rays, c/o Dr. Stig Lindgren. Observatorieparken, Uppsala, Sweden.

United Kingdom

Geophysical programme during the I.Q.S.Y. (March 1964)

Since the proposed U. K. contribution to the I.Q.S.Y. was submitted to the IInd C.I.G.-I.Q.S.Y. Assembly in Rome in March 1963, several amendments have been made to the U. K. programme (*I.Q.S.Y. Notes.* No. 1, pages 36-40). As a result, the account of the programme has been completely recast and a booklet, giving full details of the U. K. contribution which is now firmly expected, has been issued recently by the Royal Society whose British National Committee for Cooperation in Geophysics is

responsible for coordination of the U. K. activities during the I.Q.S.Y.

There is given below a summary (A) of the chief alterations to the U. K. programme, and this is followed by a condensed account (B) by disciplines to obviate the need to consult the description given in *I.Q.S.Y. Notes.* No. 1.

A. — *Primary amendments*

II. — METEOROLOGY.

Addition : Investigations of atmospheric electricity at four stations in the U. K.

III. — GEOMAGNETISM.

Revision : La Cour variometers will be used throughout the I.Q.S.Y. at Halley Bay and Argentine Islands. Fluxgate variometers to be used at Halley Bay to record micropulsations in H, D and Z.

Addition : 1. Continuous recording of normal variations at Plaisance (Mauritius).

Deletion : HMSV « Owen » and RRS « Discovery » will not record magnetic variations in the Indian Ocean ; no ship will be available in the Pacific for Sq distribution determinations.

Addition : 2. HMS « Vidal » will record magnetic variations in North Atlantic in 1964.

3. Proton precession magnetometers will be flown in « Skylark » rounds from Woomera to determine geomagnetic field variations.

IV*a*. — AURORA.

Revision : The S.C.A.R. standard 35 mm all-sky camera will not operate at Halley Bay during 1964 ; auroral records in 1964 are to be made with a 16 mm all-sky camera.

Deletion : The standard S.C.A.R. auroral photometer will not operate in 1964 at Halley Bay.

Addition : 1. Parallactic photography in the Coats Land area.
2. All-sky cameras (16 mm) at Lerwick and Sheffield.

IV*b*. Airglow.

Deletion : No airglow photometer will be operated at Halley Bay.

Addition : An investigation of nightglow Hα emission at Saint Michel, France.

V. — Ionosphere [Amendments to the previous programme).

Deletion : 1. No vertical incidence soundings at Sidmouth.
2. No back-scatter measurements at Edinburgh.

Revision : Only occasional vertical incidence soundings at Aberystwyth.

Addition : 1. A new vertical incidence station at Akrotiri (Cyprus) at 34°35'N 32°57E.

2. A2 absorption measurements at Sheffield (18 Mc/s).

3. A3 absorption measurements at Leicester.

4. Observation of the drift of large-scale irregularities using Antarctic stations at Halley Bay, Ellsworth (U. S. A.) and a mobile ionosonde up to 300 km south of Halley Bay.

5. Forward scatter link (South Pole to Halley Bay) in Antarctica.

6. Sudden Frequency Disturbances by monitoring MSF at Leicester.

7. Phase path shifts by motoring MSF at Sidmouth.

8. Several rocket- and satellite-borne experiments to study ionospheric parameters.

V. — Ionospheric Physics (Condensed account of U. K. programmes).

1. — *Routine programmes.*

Vertical incidence soundings. — Six stations (one each in U. K., Cyprus, Singapore and three in or near Antarctica) are to contribute data to the I.Q.S.Y. synoptic network. The ionosonde

at Halley Bay has been modified to permit measurement of the low critical frequencies expected during the solar minimum period. At this station, the obliquity of the echo signals is to be investigated.

Absorption measurements. — The Al absorption method is being used at Aberystwyth, Singapore and Halley Bay at which station the transmitter has been modified to enable measurements to be made when foF2 falls below 1 Mc/s. The A2 method is being used at Edinburgh (30 Mc/s), Sheffield (18 and possibly, 10 Mc/s), and Halley Bay (10-50 Mc/s). At Leicester, absorption is to be measured by the A3 method.

Drift measurements. — At Aberystwyth, Singapore and Halley Bay, routine measurements are being made of horizontal drift measurements by method D1. Method D2 is being used to study the ionospheric drifts at Sheffield while, in Antarctica, plans have been made to investigate the drift of large-scale irregularities by a comparison of foF2 variations at Halley Bay, Ellsworth and an outstation equipped with a mobile ionosonde on the continental ice-cap some 150 to 300 km south of the Weddell Sea ice-front.

Whistlers. — The routine study of the electron density of the outer ionosphere by recording whistlers continues at Argentine Islands, in the Antarctic Peninsula.

2. — *Special programmes.*

Incoherent scatter. — Electron densities up to a height of 450 km are being measured with a 25 m radio telescope at Malvern ; the measurements are to be extended to give electron-density profiles between 150 to 1000 km by using a more powerful transmitter enabling densities of less than 10^4 cm^{-3} to be detected at the maximum height.

Back scatter and auroral radar. — A 17 Mc/s back scatter equipment is being used at Sheffield to investigate the detailed structure of meteor streams. At the same station, radio echo observations of the aurora and of ionospheric disturbances are to continue with a 17 Mc/s radar equipment. A 72 Mc/s radar is being used at Halley Bay to study the Aurora Australis.

Forward scatter. — A one-way forward scatter link (length 1612 km) is being established between the U. S. South Pole station and the U. K. Base at Halley Bay to monitor the incidence of cosmic-ray particles at the mid-point in the path and to provide data complementary to the riometer measurements at Halley Bay. A two-way forward scatter link (length 2032 km) has also been established between St. Lawrence (Isle of Wight) and Il Qortin (Gozo, off Malta).

Frequency and phase-path shifts. — MSF transmissions are to be monitored at Sidmouth (25 Mc/s.) and at Leicester (2.5 and 5.0 Mc/s) to detect changes of phase path and frequency (Sudden Frequency Deviations). From these two programmes, it is hoped to detect lunar effects on the lower ionosphere and the influence of solar ionising radiations, in particular of solar flares, for which the fast response « sonogram » method is to be used.

Electron density. — The total electron content of the ionosphere and its time variations are being studied at Jodrell Bank by measuring the total Faraday rotation of linearly polarized signals (at 70.75, 71.00 and 71.50 Mc/s) in the earth-moon-earth path using the 75 m radio telescope at Jodrell Bank.

Four widely separated ground stations have been equipped to receive signals from earth satellites ; differential Faraday and Doppler effects of the ionosphere are to be investigated at two of these stations.

Low frequency studies. — Apparatus for studying the lowest layer of the ionosphere during ionospheric disturbances is operating at Lerwick and Slough. An investigation of VLF and ELF atmospheric noise is being undertaken by a group in London and includes a study of earth-ionosphere cavity resonances and of the energy spectrum, noise level and wave form of atmospherics, for which a station is to be established in Jersey. The lower part of the ionosphere is also being studied utilizing radiation from lightning discharges.

Rocket-borne experiments. — As part of the U. K. space research activities, « Skylark » rounds are launched from the range at Woomera in Australia. Several of the rounds to be launched during

the I.Q.S.Y. contain experiments that are pertinent to the study of solar-terrestrial relations. Continuous wave (Doppler) and pulse experiments, r. f. electron probes, plasma probes, sporadic-E probes, Langmuir and electron temperature probes are scheduled to be flown in these rockets during the I.Q.S.Y. It is planned to use another vehicle with a greater altitude capability for a single experiment to determine the electron density profile above Woomera. In a cooperative experiment with the University of Illinois, a version of the r. f. probe (similar to that flown in the first U. S.-U. K. satellite « Ariel ») will be used to obtain typical vertical density profiles through the D and E regions on very quiet days.

Satellite-borne experiments. — It is hoped that versions of certain instruments such as the electron temperature probe, r. f. plasma probe and the ion mass spectrometer flown in « Ariel » will be flown in N.A.S.A. satellites that are expected to be launched during the I.Q.S.Y.

VI. — Solar Activity

2. — *Special programmes.*

Radio-astronomy. — The extension of the corona into interplanetary space beyond the orbit of Mercury (on a non-equatorial plane) is being investigated at Cambridge by observations of the occultation of faint radio sources ; a search is also being made for large-scale irregularities in the structure of the interplanetary medium.

A systematic study of the decimetric radiation from Jupiter (presumed to originate in Jovian « Van Allen » belts) is to be carried out after June 1964 at Jodrell Bank using two steerable radio telescope as an interferometer to obtain data on the degree of polarization, angular extent and time variations of this energy.

Address : Dr. D. C. Martin, The Royal Society, Burlington House, Piccadily, London, W.1.

XV. — Aeronomy.

Several experiments are planned to investigate the structure and properties.

Moreover we would like to mention the following papers published in *I.Q.S.Y. Note*, No. 7.

— World Days Programme.

— Broadcasts of I.Q.S.Y. Alerts by LOL (Information from the I.Q.S.Y. Group in Argentina).

— Broadcast of I.Q.S.Y. Geophysical Alert symbols by WWV and WWVH.

— Abbreviated Calendar Record (January-February 1963) — Summary chronological account of solar and geophysical activity and events.

— Geographical distribution of I. Q. S. Y. Stations.

I. G. Y.

Annals of the International Geophysical Year

The following volumes of the Annals have been published by Pergamon Press; they are edited by J. A. Simpson, C.S.A.G.I. Reporter for Cosmic Rays :

Vol. XXVI. — Tables of I.G.Y. Cosmic Ray Data — Part I — Cosmic Ray Monitor Data — Argentina, India.

Vol. XXVII. — Tables of I.G.Y. Cosmic Ray Data — Part II — Cosmic Ray Monitor Data — Israel, U. S. S. R.; Balloon, Aircraft and Rocket flights; World Data Centres.

Vol. XXVIII. — Tables of I.G.Y. Cosmic Ray Data — Part III — Cosmic Ray Monitor Data; Balloon, Aircraft, and Rocket Flights; World Data Centres.

* * *

Vol. XXXVI. — Catalogue of data in the World Data Centres for the period of the International Geophysical Year and the International Geophysical Cooperation 1959 (1 July 1957-31 December 1959).

— Section V devoted to Ionosphere contains the following items :
World Map
Introduction
Station List
References and Notes
Catalogue of Data (Vertical incidence soundings, ionosphere electron density, absorption, ionospheric drift, atmospheric radio noise, whistlers, miscellaneous, backscatter).

— Section VI devoted to Solar Activity contains information on radio emission.

— Section XI devoted to Rockets and Satellites contains a list of reports and reprints relevant to inter alia atmospheric physics, ionospheric physics, etc.

BUREAU INTERNATIONAL DES POIDS ET MESURES

Réunion du Groupe d'Etudes pour la Normalisation Internationale des quantités électriques et des mesures aux fréquences radioélectriques élevées

Ce Groupe d'Etudes s'est réuni à Sèvres les 21 et 22 avril 1964. Nous publions p. 68 le rapport établi par le Dr. L. Essen, Président de la Commission I de l'U.R.S.I., qui a assisté à cette réunion comme représentant de l'U.R.S.I.

Ci-après la traduction des recommandations adoptées par la réunion :

1) Etant donné le rôle important des mesures radioélectriques dans la science et les techniques actuelles et en vue d'uniformiser internationalement le domaine de ces mesures, et compte tenu de la recommandation formulée par l'U.R.S.I. à l'Assemblée Générale de Tokyo en 1963, le Groupe d'Etudes considère qu'il est raisonnable et nécessaire de recommander au Comité International des Poids et Mesures d'entreprendre l'organisation de la comparaison internationale des étalons radioélectriques de fréquence.

2) Le Groupe d'Etudes considère qu'il est rationnel de commencer la comparaison internationale des étalons radioélectriques de fréquence en faisant circuler d'un laboratoire à l'autre des étalons et des appareils de mesure. Le Groupe d'Etudes recommande que la responsabilité de l'organisation des comparaisons et de la publication des résultats soit confiée au B.I.P.M.

3) Le Groupe d'Etudes prend note de la liste des étalons et des mesures proposées par certains laboratoires. Cependant, en vue d'éviter des difficultés probables, le Groupe d'Etudes recommande

de limiter au début le programme à la mesure de quelques unes des quantités les plus importantes, parmi lesquelles on peut envisager :

a) la mesure des faibles puissances à une fréquence de 3000 MHz par un appareillage à ligne coaxiale et à 10.000 MHz par un appareillage à guide d'ondes.

b) la mesure des paramètres des diélectriques à la fréquence de 10.000 MHz. Les valeurs à mesurer, les méthodes et les conditions de mesure seront spécifiées après décision du Comité International des Poids et Mesures et lorsque seront connus les laboratoires nationaux qui désirent y participer.

4) Pour l'étude de tous les problèmes en relation avec les comparaisons internationales des étalons radioélectriques de fréquence, le Groupe d'Etudes recommande la création d'un sous-comité permanent du Comité Consultatif pour l'Electricité. Les institutions nationales et internationales qui prendront part aux intercomparaisons devront être représentées au sein de ce sous-comité. Le sous-comité préparera un programme technique détaillé pour l'échange des étalons radioélectriques de fréquence et fera des propositions concernant les conditions nécessaires à créer au B.I.P.M. pour assurer sa compétence dans ce domaine de mesures. Le programme ne peut pas être exécuté avec succès sans la présence au B.I.P.M. de spécialistes qualifiés.

Le Groupe d'Etudes reconnaît l'importance des travaux de l'U.R.S.I. dans ce domaine. Il recommande que les programmes des comparaisons internationales actuellement en cours soient activement poursuivis, et que le B.I.P.M. coopère pleinement avec l'U.R.S.I. dans l'établissement des programmes futurs.

THE INTERNATIONAL COMMITTEE OF WEIGHTS AND MEASURES

Meeting of Study Group for the International standardisation of electrical quantities and measurements at high radio frequencies

Held at Sevres 21-22 April 1964

Report by L. ESSEN, representing U.R.S.I.

Delegates present :

President : G. D. BOURDOUN (Moscow).

Secretary : A. V. ASTIN (Washington).

J. BLOUET, International Electrotechnical Commission and C.N.E.T. (Paris).

J. EGIDI, National Institute of Electrotechnics, Turin.

L. ESSEN, International Scientific Radio Union (U.R.S.I.) (Teddington, U. K.).

I. A. HARRIS, Ministry of Aviation (Harefield, U. K.).

J. HENDERSON, N. R. C., Ottawa.

G. K. IAGOLA, Mendeleev Institute of Metrology (Leningrad).

J. A. LANE, Radio Research Station (Slough, U. K.).

Y. NAKAJI, Electrotechnical Laboratory, Tokyo.

M. POULIQUEN, International Telecommunications Union (Geneva).

W. SCHAFFELD, P.T.B. (Braunschweig).

The President outlined the reasons for the formation of the Study Group. At the 9th (1951) meeting of the Consultive Committee on Electricity (C.C.E.) a proposal was made by the Electrotechnical Laboratory of Japan, and the International Committee instructed the C.C.E. to study the problem. At the 10th meeting of the C.C.E. in Teddington the N.B.S. (U. S. A.) representative

put forward definite proposals for the formation of a study group. At its General Assembly in Tokyo (1963) U.R.S.I. passed a recommendation supporting such a study. The formation of the group was approved at the 52nd meeting (October 1963) of the International Committee.

The President suggested that the group should consider the following four points :

1. Should B.I.P.M. extend its activities to radio frequency standards ?
2. If so, what is the best way of organising such comparisons ?
3. The maximum and minimum programme to be undertaken.
4. The drafting of a recommendation to the International Committee.

M. Terrien as Director of B.I.P.M. outlined the organisational relationship between the International Committee with its 18 members, the General Conference represented by 39 countries and the Bureau. Although in the past emphasis had been placed on basic standards he was prepared to extend the field to radio standards if it was felt that such a step would further the interests of international science. However with the limited resources (total staff 35, total budget 300 000 dollars) any work in this field would be necessarily on a small scale at present.

Dr. Astin as Director of the N.B.S. said that experience had revealed a clear need for the B.I.P.M. to organise intercomparisons of radio frequency standards and eventually to become technically competent in this field. The U.S.S.R. and Japanese delegates also had positive views on the subject and had submitted written proposals suggesting an initial programme. G. K. Iagola said that the technical difficulties arising from the different dimensions, connectors, and equipment used in different countries must not be overlooked, and in view of the limited resources of B.I.P.M. a start should be made by circulating a standard to the different national laboratories. The results should be collected, reviewed and published by the B.I.P.M. The delegates from the U. K., Germany, France and Italy stated that no decision had been taken in their countries on the advisability of B.I.P.M. extending its

activities and that they would be able to give only their personal views. The U. K. for example had taken part where possible in the intercomparisons organised through U.R.S.I. and it was unlikely that they could extend these activities in the near future. Professor Egidi stressed the part that U.R.S.I. had played in encouraging international comparisons and hoped that this work would continue. Dr. Essen reported that the intercomparison organised by U.R.S.I. had been successful and valuable but had been restricted to comparatively few countries. He was not sure whether the time had come for B.I.P.M. to assist in this work but if action taken by B.I.P.M. was likely to extend the scope of intercomparisons U.R.S.I. would be in favour of such action. It was important that existing programmes in U.R.S.I. should be completed. Dr. Henderson thought that although B.I.P.M. should act with caution the time had come for some action to be taken. M. Blouet and M. Pouliquen expressed doubt whether some of the intercomparisons suggested were appropriate to the B.I.P.M.

It was clear from the discussion that some delegates were convinced that it would be easier for countries to take part in international comparisons if they come under the auspices of B.I.P.M. which had legal status as an International authority. For this reason delegates reached the opinion that it would be valuable for B.I.P.M. to take part in this work although it represented an extension beyond what some felt was its main function.

In summing up the President considered that work on radio frequency standards was not in contradiction with the aims of B.I.P.M. The feeling of the meeting was that the International Committee should be recommended to initiate a circular comparison of perhaps three fundamental radio standards and to engage a phycisist for the purpose. The final recommendation, given below subject to editorial revision, was approved unanimously with reservations on the part of several delegates concerning the inclusion of dielectric measurements.

Recommendation :

1. In view of the important role of radio measurements in science and in present day techniques and in order to establish international uniformity in the field of such measurements, and in reco-

gnition of the recommendation formulated by U.R.S.I. at the General Assembly in Tokyo in 1963 the Study Group considers it to be reasonable and necessary to recommend to the International Committee of Weights and Measures to undertake the organisation of international comparisons of radio frequency standards.

2. The study Group considers it rational to begin the international comparison of radio frequency standards by means of the circulation of standards and measuring apparatus from one Laboratory to another. The Study Group recommends that the responsibility for directing the comparisons and publishing the results be placed on the B.I.P.M.

3. The Study Group takes note of the lists of standards, and proposed measurements put forward by some laboratories.

However in view of the probable difficulties the Study Group recommends that at first the programme should be limited to a few of the most important quantities. Among these might be considered :

(*a*) The measurement of low powers at a frequency of 3000 Mc/s by coaxial line equipment and at 10 000 Mc/s by wave guide equipment.

(*b*) The measurement of the parameters of dielectrics at a frequency of 10 000 Mc/s. The values to be measured, the methods and conditions of measurement must be specified after the decision of the International Committee of Weights and Measures, and when the National Laboratories wishing to participate are known.

4. For the examination of all the problems associated with the international comparisons of radio frequency standards the Study Group recommends the creation of a permanent subcommittee of the Consultative Committee on Electricity. The National and International institutions taking part in the intercomparisons are to be represented on this subcommittee. The subcommittee should prepare a detailed technical programme for the circulation of radio frequency standards and make proposals concerning the creation of the necessary conditions at the B.I.P.M. to ensure its competence in this field of measurements. The programme

cannot be succesfully carried out without the presence of the appropriate specialists at the B.I.P.M.

The Study Group recognises the importance of the work of U.R.S.I. in this field. It recommends that the programmes of international comparisons now in progress should be actively pursued ; and that the B.I.P.M. should cooperate fully with U.R.S.I. in the planning of future programmes.

* * *

In closing the meeting on the 22nd a day earlier than expected, the President expressed his appreciation of the spirit of friendly cooperation in which the work of the Study Group had been conducted. Dr. Astin on behalf of the Study Group thanked the President for the able manner in which he had conducted the meeting, and also the two interpreters for their assistance.

FEDERATION OF ASTRONOMICAL AND GEOPHYSICAL SERVICES

At a meeting of the Council of F.A.G.S. held at the International Atomic Energy Agency, Vienna on Thursday 28, November 1963.

Present : Professor P. TARDI (I.U.G.G.) ;
Professor J. VELDKAMP (I.U.G.G.) ;
Ing. Gen. G. LACLAVÈRE (Secretary General).

Mr. D. SADLER (I.A.U.), Dr. J.-C. PECKER (I.A.U.), Dr. R. L. SMITH-ROSE (U.R.S.I.), Professor J. TUZO WILSON (I.U.G.G.), Professor G. D. GARLAND (I.U.G.G.) and Dr. E. M. FOURNIER d'ALBE (U.N.E.S.C.O.) attended by invitation.

An apology for absence was received from Mr. L. D. de Feiter (I.U.W.D.S.). Dr. A. F. Moore (Scientific Secretary, F.A.G.S.) and Mr. M. Rao (I.C.S.U. Accountant) were in attendance.

Professor J. Tuzo Wilson was appointed Chairman for the meeting.

1. — *Report of the Secretary General.*

Mr. Laclavère recalled that the previous meeting of the Council of F.A.G.S. had been held in Paris on 31 January, 1962. Since then some of the Permanent Services had taken decisions which had led to an acceleration of their data handling procedures. The I.S.S., now being transferred to Edinburgh, is using an Atlas computer and the B.C.I.S., Strasbourg, uses a Bull Gamma — E.T. machine. The Permanent Service for Earth Tides uses an I.B.M. 650 and an electronic data plotter. The Permanent Service for Mean Sea Level has put all its data on punched cards and future publications will be printed direct from an I.B.M. 1401. Analysis of the M.S.L. data is being performed with an I.B.M. 1620. The Bureau Gravimétrique International plans to put much of its data on to punched cards. The International Polar Motion

Service uses an I.B.M. 650 and an I.B.M. 7090. High speed procedures do not yet appear applicable to the other services.

A full report on the recent activities of the Permanent Services had been prepared in August 1963 and sent to the Secretaries General of the I.U.G.G., U.R.S.I. and I.A.U. Two shorter reports had also been prepared for the I.C.S.U. General Assembly, Vienna, November 1963 and it was decided that a full report on all the Services as of 1 January 1964 should be offered to the I.U.G.G., I.A.U. and U.R.S.I. for printing in their Bulletins, if so desired.

F.A.G.S. was a great success and it had gradually increased its income. Applications were always welcome from prospective new members. Two services, the International Radiation Service and the International Ozone Service had been transferred to the W.M.O. some years ago.

F.A.G.S. was very grateful for the continuing financial support given by U.N.E.S.C.O. each year. Without the assistance received from U.N.E.S.C.O. it would be extremely difficult to maintain the present high standard of the services.

At the January 1962 meeting the Secretary-General had offered his resignation and had only been pursuaded to withdraw it on the understanding that a Scientific Secretary would be appointed to deal, part-time, with the many reports that were demanded, to investigate the problems of the services as they arose, and to undertake the preliminary negotiation for subventions and contracts. Dr. A. F. Moore had been released by the Royal Society in October 1962 to undertake this work and the Council confirmed Dr. Moore in this appointment.

3. — *The International Polar Motion Service.*

It was reported that the Internarional Latitude Service had ceased receiving data in Turin at the end of 1961. Consequent upon I.U.G.G. and I.A.U. resolutions the Central Bureau of the Service, now known as the International Polar Motion Service, had been transferred to the Mizusawa Observatory, Japan, in January 1962. Soon afterwards the Director, Dr. Hattori, had died and Dr. S. Yumi was appointed Acting Director until the I.A.U. General Assembly, 1964. The Scientific Council of the I.P.M.S. (Dr. Guinot, Dr. Markowitz, Dr. Melchior and Dr. Yumi, (Prof. Fedorov absent) had met in Berkeley in August 1963 and

afterwards Dr. Guinot had visited Mizusawa, F.A.G.S. contributing $ 500 to his travel expenses. It was likely that Dr. Yumi would be appointed as Director of the Central Bureau in 1964.

Provision had been made in the Statutes of the I.P.M.S. Scientific Council for a member representing F.A.G.S. As such representation was not usual, it was resolved (Sadler proposer, Garland seconder) to recommend that the I.P.M.S. Council be reconstituted without a F.A.G.S. representative.

It was stated that the $ 5,000 grant for 1962 had been paid to Prof. Cecchini of the International Latitude Service in Turin. On being requested to return the sum for transfer to Japan it was discovered that work was continuing in Turin in reducing in a definitive manner the observations for 1949,0 — 1962,0 prior to final publication. Previous Directors had, since 1900,0, taken 6 or more years after the transfer of the service to publish the definitive results. Prof. Cecchini thus expected to spend all the last grant of $ 5000 he had received in 1962 by the end of 1963 and had requested $ 500 for each of the years 1964, 1965 and 1966. Costs of publication were being borne by the Italian Geodetic Commission.

Members were surprised that work was continuing at Turin but agreed that it was essential to publish the definitive results. The F.A.G.S. Council agreed to refer the problem of financing the Turin work till 1966 and the question of the 1962 I.P.M.S. grant for Japan to the I.P.M.S. Council for advice. No further sums would be granted for the Turin work until this advice had been received.

It was reported that when Prof. Cecchini had taken over the I.L.S. Central Bureau from Prof. Carnera, the latter had been responsible for the publication of his definitive results but only Vol. I had so far appeared. It was understood that responsibility for completion of the task had now been assumed by the Italian Geodetic Commission.

4. — *International Ursigrams and World Days Service.*

The International World Days Service and the Service Central des Ursigrammes were amalgamated at a meeting held in Brussels in October 1962 which was made possible with a U.N.E.S.C.O. contract. The new service, the International Ursigram and

World Days Service, is administered by an I.U.W.D.S. Steering Committee consisting of representatives of the three participating Unions and the Regional Ursigram and World Days Committees. The Chairman of the Steering Committee is Mr. A. H. Shapley (U. S. A.), the Secretary is Mr. L. D. de Feiter (Utrecht) with Miss J. V. Lincoln (Boulder) as Deputy Secretary.

It was reported that the I.U.W.D.S. had objected to the I.U.W.D.S. section of a F.A.G.S. report presented to the I.U.G.G. General Assembly 1963 and had promised a revised one by 15 October 1963. As this had not arrived by 18 November it had been impossible to report on I.U.W.D.S. activities in the F.A.G.S. report to the I.C.S.U. General Assembly.

Copies of the I.U.W.D.S. Synoptic Codes for Solar and Geophysical Data were displayed at the meeting.

5. — *International Seismological Summary.*

The I.S.S. was re-organised at the I.U.G.G. General Assembly in August 1963. A new International Seismological Centre is being created in Edinburgh and the I.S.S. will gradually be transferred there from Kew. Dr. P. Willmore has been appointed Director in succession to Dr. R. Stoneley. The Edinburgh centre will have access to an Atlas computer and this facility combined with automatic printing of the Bulletins should do much to reduce the delays in publication.

The initial expenses of the new centre are being met from a grant from the National Science Foundation of $ 280,000 over 3 years and a British Treasury capital grant of £ 10 000 and an annual grant of £ 6500 p. a.

In submitting estimates the Director of the I.S.S. had requested $ 7000 in 1964 for the Summary, $ 9000 in 1964 for the handling of microfilm copies of seismograms and had raised the problem of finding $ 50,000, p. a. in 1965 and each year thereafter. The Treasurer of I.C.S.U. stated that $ 50,000 p. a. could not be raised from I.C.S.U. sources. Other members, whilst having been very impressed with the Edinburgh Centre, considered that F.A.G.S. should only be responsible for the compilation and the publication of the Summary itself, the remainder of the funds to come from other sources. It was reported that the I.U.G.G. Bureau were charged with ensuring the international character

of the centre. There would be an opportunity at the forthcoming Intergovernmental Seismological meeting, Paris, April 1964, to bring the existence of the Centre and its financial needs to the notice of all governments.

It was agreed that F.A.G.S. should seek the advice of the I.U.G.G. on these matters, particularly the importance of commencing the microfilm work at this stage. It would also be necessary to ask the I.U.G.G. about its own plans for increasing the income of the Edinburgh centre. For the present, F.A.G.S. could only support the production and publication of the Summary.

6. — *U.N.E.S.C.O. Subventions.*

It was reported that U.N.E.S.C.O. had granted subventions of $ 22,000 p. a. for each of the years 1962 and 1963 and hoped that it would be possible to grant similar sums in 1964 and 1965. The Council expressed its gratitude for this valuable support.

7. — *U.N.E.S.C.O. Contracts.*

It was reported that U.N.E.S.C.O. had made a contract for $ 3000 to hold a meeting in Paris, July 1962, to make recommendations concerning the site of the new International Seismological Centre. A contract had also been made for the I.U.W.D.S. meeting in Brussels in October 1962.

In 1963 a contract was being negotiated with F.A.G.S. for $ 2500 to assist with the expenses of Father Mayaud's visits to geomagnetic observatories to standardize the scaling of K indices. Another contract in 1963 had been for $ 1000 whereby the Permanent Service for Mean Sea Level had rendered assistance to the Intergovernmental Oceanographic Commission.

In 1964 it is hoped to arrange contracts for a pilot study of the data flow on the fluctuations of glaciers, and for the correlation of gravity anomalies revealed by the perturbation of satellite orbits with those obtained by surface measurements.

The Council expressed its gratitude for this valuable support.

8. — *F.A.G.S. Grants in* 1963.

It was reported that the F.A.G.S. income in 1963 totalled $ 50,000 from I.C.S.U. and U.N.E.S.C.O. sources. As the I.C.S.U. contribution would be reduced by $ 11,000 in 1964, it was decided

to distribute only $ 45 000 in 1963 and to transfer $ 5000 for distribution in 1964. The sums granted in 1963 and the final distribution agreed by the F.A.G.S. Council at the meeting are given in the table below, together with the 1962 figures for comparison.

	1962 Grant	1962 Balance	1963 Requested	1963 Already paid	1963 Remainder granted	1963 Total
B.I.H.	14 000	4 964	16 400	9 000	2 000	11 000
I.L.S.	5 000	1 418	—	—	—	—
I.P.M.S.	—	—	5 000	2 500	2 500	5 000
B.G.I.	3 000	—	3 640	2 500	500	3 000
Geomag. Indices	4 000	—	5 000	4 000	0	4 000
I.S.S.	7 000	—	7 000	7 000	0	7 000
B.C.I.S.	5 500	—	6 000	3 000	1 500	4 500
M.S.L.	1 500	2 135	—	—	0	0
Earth Tides	3 000	2	3 000	3 000	0	3 000
I.U.W.D.S.	—	4 458	—	—	0	0
Solar Activity	3 000	144	1 800	1 800	0	1 800
Administration	1 000	2 211	4 000	500	3 500	4 000
	47 000	15 332	51 840	33 300	10 000	43 300

In reply to comments concerning the large proportion of funds granted to the Bureau International de l'Heure, Mr. Sadler undertook to discuss with the Director of the Service the possibility of reducing his demand to about $ 8000 annually as it was prior to the I.G.Y.

Authority was granted to the officers to act on the recommendations of the I.P.M.S. Council (see para 3) and also to make further grants for 1963 from the $ 1700 balance.

9. — *Fluctuations of Glaciers.*

The I.U.G.G. General Assembly 1963 recommended to F.A.G.S. that it consider the formation of a permanent service on the fluctuation of glaciers. The Secretary of the I.U.G.G. International Association of Scientific Hydrology (I.A.S.H.) had since stated that a service collecting data on the thickness and length, i. e.

volume, of glaciers was envisaged. Variations in these quantities were linked with changes in climate and mean sea level variations in turn might be linked as well. Variations in the volume of glaciers were also important for hydrology and hydroelectric projects. The I.A.S.H. Snow and Ice Commission (President : Prof. H. Hoinkes, Innsbruck) is responsible for the detailed arrangements. $ 3000 p. a. were required for a part time assistant, and for postage and office expenses.

Professor Hoinkes had since stated that the site of the Service would either be at Lausanne (Prof. Renaud) or New York (American Geographical Society) and that a decision would soon be made. He asked for an early assurance that $ 3000 would be forthcoming in 1964 for a pilot study.

Professor Tuzo Wilson emphasized the importance of measuring changes in the volume of ice which sometimes occurred with the snout remaining fixed. Interpretation of aerial photographs would not be possible for the service on the proposed budget but collection of widely dispersed references to glacier fluctuations should be possible.

The F.A.G.S. Council welcomed the proposal for the new service and expressed the hope that U.N.E.S.C.O. would contract for the 1964 pilot study. F.A.G.S. looked forward to receiving the results of this study when it would consider the matter once again.

10. — *S.P.A.R.M.O.*

The Solar Particles and Radiations monitoring organisation (S.P.A.R.M.O.) (Secretary M. Le Grand, Meudon) had enquired about membership of F.A.G.S.

S.P.A.R.M.O. had the following programme :

(*a*) To launch balloons carrying standard radiation detectors, simultaneously in different latitudes, in order to intensify the study of solar and geophysical phenomena particularly particle emissions and X-rays.

(*b*) Institution of a network for the reception of telemetry signals for the longest possible periods.

(*c*) Creation of an alert system for giving warning of events connected with proton and X-ray emission.

(*d*) Circulation of information to all groups with experience in carrying out such experiments with balloons and rockets.

(*e*) Making arrangements, for several years to come, for frequent surveys of high altitude radiations from Kiruna.

(*f*) Publication and circulation of the results obtained.

This programme is now being put into operation and plans are being discussed for co-ordinating the work with cosmic ray groups making measurements in rockets and satellites. It is hoped to link up with other regional groups, so ensuring the international character of the organisation, for many of these phenomena vary with latitude.

As it was usual to channel applications for membership through a scientific union, it was agreed to ask S.P.A.R.M.O. to take up the matter with the I.A.U. The F.A.G.S. Council would favourably consider the advice of the I.A.U. on this matter and also on the possibility of a pilot study.

11. — *Permanent Service on Crustal Thicknesses.*

Professor Tuzo Wilson temporarily vacated the chair in favour of Professor Veldkamp to introduce this item. He reported that in the Geophysics Laboratory, Toronto, they had been collecting measurements of crustal thicknesses much of which was diffused through many journals. Much of the data resulted from explosion refraction studies. The collection of the data had the support of the I.A.S. and I.U.G.G. The first report already produced was based on the print out of a 1000 punched cards which had columns for latitude and longitude of the stations, the number of layers, their thickness and velocity, total thickness, the velocity at the base of the crust and the velocity at the top of the mantle. Other similar studies were confined to the continent and did not include ocean measurements. The report also displayed the data on 22 maps.

Seismologists had urged continuance of the work in Toronto and Prof. Wilson desired to have some international status to assist the work. Only published results would be utilized and they would first be processed in a standard fashion. One graduate and one research student were required for the work and the

service would need $ 2000 p. a. from F.A.G.S. Prof. Tuzo Wilson would be the Director. The F.A.G.S. Council welcomed the proposed new service and agreed to advise the I.C.S.U. Executive Committee that it be accepted.

12. — *F.A.G.S. Grants in* 1964.

There had been a gradual increase in the annual income of F.A.G.S. since 1957 but owing to the many demands on I.C.S.U. funds there would be a temporary decrease in 1964, for I.C.S.U. would only be able to grant $ 17 000 to augment the $ 22 000 from U.N.E.S.C.O. In addition there was $ 5000 transferred from 1963.

It was decided to make a first distribution of funds in 1964, as soon as the U.N.E.S.C.O. funds became available, as set out in the table below. When the balances held by the services on 31st December 1963 had been certified by the auditors in April 1964, a further meeting of the Council of F.A.G.S. would be held and a second distribution would be made. This first distribution totalling $ 24 150 was based in most cases, on half the sums granted in 1963 and leaves $ 20 000 (approx.) for the second distribution. The needs of the new Permanent Service on Crustal Thicknesses would be negotiated in the coming months.

	1964 Requested	1964 1st Instalment
B.I.H.	15 800	5 500
I.P.M.S.	6 000	2 500
I.L.S.	500	—
B.G.I.	3 000	1 500
Geomag. Ind.	5 000	2 000
I.S.S.	7 000	3 500
B.C.I.S.	6 000	2 250
M.S.L.	4 000	1 500
Earth Tides	3 000	1 500
I.U.W.D.S.	3 000	1 000
Solar activity	2 000	900
Administration	4 000	2 000
	59 300	24 150

The Secretary-General reported that one service was requesting an honorarium for its Director. He said that in his opinion it was unwise to grant this for up to now F.A.G.S. money had been used solely for the processing, publication and distribution of data and for the salaries of personnel employed in carrying out these tasks. In addition, I.C.S.U. had very recently resolved that no honoraria be paid. The Council agreed with this view and decided to approach the Academy of the host country concerned for their assistance.

It was stated that if Permanent Services wished to carry out pilot studies or to hold special meetings etc. in 1965 or 1966, they should submit their requests to F.A.G.S. before 1 July 1964.

13. — *U.N.E.S.C.O. Status B.*

It had recently been discovered that the U.N.E.S.C.O. directives, for granting subventions to non-governmental organisations revised in 1960, forbad the payment of a subvention direct to a daughter organisation when the parent one was already in receipt of a subvention. Such was the position vis à vis F.A.G.S. and I.C.S.U.

U.N.E.S.C.O. had expressed its desire to continue financing the permanent services with sums specially earmarked for the purpose rather than including it with all the other items in a single subvention to I.C.S.U. One way of arranging this would be for F.A.G.S. to apply to U.N.E.S.C.O. for Consultation and Information status (B). If the application, which would need previous approval by I.C.S.U., were successful, then U.N.E.S.C.O. could make contracts directly with F.A.G.S. (I.C.S.U. has status A with U.N.E.S.C.O.). It was left to the new officers to begin these negotiations.

14. *Officers 1964-1968.*

It was reported that Professor Danjon on completion of his four years term of office had resigned as likewise had the Vice-President Col. E. Herbays. The F.A.G.S. Council recorded its appreciation of the services of these two officers. During their period in office many difficulties had been solved and they left F.A.G.S. as a strong organisation.

The Secretary-General, Ing. Gen. G. Laclavère announced his resignation. The F.A.G.S. Council recorded its deep appreciation of the services of M. Laclavère who, since the inception of F.A.G.S. in 1956, had carried a great responsibility. It had involved him in an enormous amount of work and he had done a remarkably fine job.

The elections resulted in the following appointments :

President : Professor P. TARDI (I.U.G.G.).

Vice President : To be proposed later after consultation between the I.A.U. and U.R.S.I.

Secretary General : Professor G. D. GARLAND (I.U.G.G.).

In accordance with the statutes, M. Laclavère, as retiring Secretary General, remains a member of the Council. Col. E. Herbays has been appointed I.C.S.U. representative on the Council.

U. G. G. I.

Publications

Les monographies de l'U.G.G.I. ci-après peuvent être obtenues en s'adressant à : I.U.G.G. Publications Office, 140, rue de Grenelle, Paris, 7e.

Ce service demande de joindre, si possible, le paiement aux commandes.

The following I.U.G.G. monographs are available at the I.U.G.G. Publications Office, 140, rue de Grenelle, Paris, 7e.

Subscribers are invited to send, if possible, full payment of their orders.

— Symposium on Atmospheric Ozone, Oxford, 20-25 July 1959 ($ 0.40, 3/—, NF 2.00).

— Symposium on Radiation, Oxford, July 1959 ($ 0.40, 3/—, NF 2.00).

— Antarctic Symposium, Buenos Aires, November 1959 ($ 1.00, 7/6, NF 5.00).

— The July 1959 Events and Associated Phenomena ($ 2.50, 18/—, NF 12.50.

— Instruction Manual on World Magnetic Survey, by E. H. Vestine ($ 0.30, 2/6, NF 1.50).

— Manuel d'Operations pour le Levé Magnétique Mondial, par E. H. Vestine ($ 0.30, 2/6, NF 1.50).

— Symposium on Geophysical Aspects of Cosmic Rays, Helsinki, July 1960 ($ 3.00, 21/—, NF 15.00).

— International Conference on Cloud Physics, Australia, September 1961 ($ 1.00, 7/6, NF 5.00).

Association Internationale de Météorologie et de Physique de l'Atmosphère

Preliminary list of future symposia of I.A.M.A.P.

Leningrad, U. S. S. R., 10-15 August, 1964.

International Symposium on Atmospheric Radiation.
Organized by I.A.M.A.P. Commission on Atmospheric Radiation, with cosponsorship by W.M.O.

Boulder, U. S. A., 14-18 September, 1964.

International Symposium on Radiometeorology.
Organized by Inter-Union Committee on Radiometeorology with cosponsorship by U. S. National Bureau of Standards and American Meteorological Society.

, Summer 1965.

Specialist Colloquium on Tropospheric Structure in Relation to Radiowave Propagation.
Organized by Inter-Union Committee on Radiometeorology.

Japan, , 1964.

International Symposium on Cloud Physics.
Organized by Meteorological Society of Japan and cosponsered by I.A.M.A.P. *Ad hoc* Committee on Cloud Physics and Cloud Modification and by W.M.O.

Europe, summer 1965.

International Symposium on Large-scale Atmospheric Dynamics.
Organized by I.A.M.A.P. Commission on Dynamic Meteorology.

Japan (?), 1965 (?).

International Symposium on Turbulence and/or Boundary Layer Problems Probably sponsored or cosponsored by I.U.G.G. and I.U.T.A.M.

I. C. S. U.

I.C.S.U. Review of World Science

Elsevier Publishing Company has issued Vol. 6, No. 1 (January 1964) of the review.

CONTENTS

Guide for the preparation and publication of synopses

Attention of authors is called to the following Guide which has been adopted by the International Council of Scientific Unions.

1. « Synopsis » is a term adopted by the Royal Society of London (in fulfillment of a recommendation of the Scientific Information Conference sponsored by the Society in 1948) and by the U.N.E.S.C.O. International Conference on Science Abstracting, 1949, to describe an author's summary of a scientific paper which is published simultaneously with the paper itself after editorial scrutiny by the editor of the journal in which it is published.

2. The purpose of a synopsis is not only to convenience the readers of the journal in which it is published, but also to reduce the cost and to expedite the work of the abstracting journals, and thus to contribute to the general improvement of informational services in the scientific field.

3. The synopsis should comprise a brief and factual summary of the contents and conclusions of the paper, a pointer to any new information which it may contain, and an indication of its relevance. It should enable the busy reader to decide more surely than he can from the mere title of the paper whether it merits his reading.

4. The author of every paper is consequently requested to provide also a synopsis of it in accordance with the following suggestions.

STYLE OF WRITING.

5. Use complete sentences rather than a mere list of headings. Any references to the author of the article should be in the third person. Standard rather than proprietary terms should be used. Unnecessary contractions should be avoided. It should be presumed that the reader has some knowledge of the subject but has not read the paper. The synopsis should therefore be intelligible in itself without reference to the paper. For example, it should not cite sections or illustrations by their numerical references in the text.

CONTENT.

6. As the title of the paper is usually read as part of the synopsis, the opening sentence should be framed accordingly so as to avoid repetition of the title. If, however, the title is not sufficiently indicative, the opening sentence should indicate the subjects covered. Usually, the beginning of a synopsis should state the objects of the investigation.

7. It is sometimes valuable to indicate the treatment of the subject by words such as : brief, exhaustive, theoretical, etc, etc.

8. The synopsis should indicate newly observed facts, conclusions of an experiment or argument, and, if possible, the essential parts of any new theory, treatment, apparatus, technique, etc.

9. It should contain the names of any new compound, mineral species, etc., and any new numerical data, such as physical constants; if this is not possible, it should draw attention to them. It is important to refer to new items and observations, even though some may be incidental to the main purpose of the paper; such information may otherwise be hidden although in fact it may be very useful.

10. When giving experimental results the synopsis should indicate the methods used; for new methods the basic principle, range of operation and degree of accuracy should be given.

REFERENCES, CITATIONS.

11. If it is necessary to refer in the synopsis to earlier work, the reference should always be given in the same form as in the paper; otherwise, references should be omitted.

12. Citations to scientific journals should be made in conformity with the standard practice of the journal for which the papers is written. (The International Conference on Science Abstracting has recommended the standard proposed by the International Organization for Standardization, Technical Committee 46, names of journals being abbreviated as in the *World List of Scientific Periodicals*).

LENGTH.

13. The synopsis should be as concise as possible. It should only in exceptional cases exceed 200 words, so as — among other things — to permit it, when printed, to be cut out and mounted on a 3 × 5 inch card.

PUBLICATION — LANGUAGE AND FORMAT.

14. The International Conference on Science Abstracting has recommended that synopses be published in one of the more widely used languages, no matter what the original language of the paper, in order to facilitate its international usefulness.

15. The International Conference on Science Abstracting also commended the practice of certain journals in which all the synopses

appearing in a single issue are printed together either inside the cover or with advertisements on the back in such a way that they can be cut out and mounted on index cards for reference without mutilating the pages of the journal itself. For this purpose the synopses should not be more than 4 inches wide so as to be mounted on 3 × 5 inch cards.

Reprinted July 1960 for U. S. A. National Committee, U.R.S.I., from Document NS. 51. D. 10A/05. X1.51 United Nations Educational, Scientific, and Cultural Organization.

U. N. E. S. C. O.

Letter of the Secretary General of U.R.S.I.

to all Commission and Committee Chairmen, Chairmen of I.U.W.D.S. and I.U.C.A.F.

LOCATION OF MEETINGS

Dear Mr. Chairman,

I am enclosing copy of a letter from the Director of U.N.E.S.C.O. Department of Natural Sciences concerned with the choice of location for meetings.

U.R.S.I. will support any suggestions to hold Commission or Committee meetings in developing countries.

Yours sincerely,

(*sgd*) HERBAYS.
Secretary General.

COPY.

No. NS/410/11 8 May 1964

Dear Ingénieur Herbays,

The « United Nations Advisory Committee on the Application of Science and Technology to Development » held its first session in New York from 25 February to 6 March 1964. The Committee in reviewing the ways and means of accelerating this application, examined the possibilities of mobilizing the efforts of scientific and technological institutions of the developed countries for active co-operation with the developing countries. Among the

recommendations made by the Committee, one concerns the holding of scientific meetings and reads as follows :

« Learned societies could be requested as far as possible to hold their annual conferences in the developing countries. This would build up the scientific milieu in these countries, improve contacts, and make men of science conscious of the problems of development. »

I do not think it necessary to stress the importance of this proposal, as I know that the Unions federated in I.C.S.U. are already making serious efforts in this direction, confirmed by Resolution GA(X) 17 on this matter in Vienna. However, I very much hope that following the appeal of the United Nations Advisory Committee this effort will be still further augmented. It may be especially appropriate to keep in mind the possibility of organizing in developing areas, not only the general assemblies of your Union, but also some of the symposia or meetings of committees sponsored by your organization. This tendency could apply particularly to the meetings held with the financial support of U.N.E.S.C.O.

I am aware of the supplementary difficulties which may arise as a result of this course of action, and I am contacting national scientific bodies in the areas referred to suggesting that in all possible cases, they provide the maximum facilities for the organization of your meetings in the respective countries.

Thanking you in anticipation for the attention given to this proposal,

Yours sincerely,

(*sgd*) V. Kovda,

Director,
Department of Natural Sciences

Rapport du Directeur Général sur l'activité de l'Organisation en 1963

Nous extrayons de ce rapport de 167 pages les passages ci-après qui intéressent l'U.R.S.I.

Sciences exactes et naturelles

Une étroite collaboration a été maintenue entre l'U.N.E.S.C.O. et les organisations scientifiques internationales non gouvernementales. Des membres du Secrétariat ont assisté à un grand nombre de réunions et conférences tenues par ces organisations, et on a continué à solliciter leurs avis — et en particulier ceux du Conseil international des unions scientifiques (I.C.S.U.) — au sujet des activités d'une ampleur croissante que l'U.N.E.S.C.O. exerce dans les domaines de la science et de la technologie.

Coopération avec les Organisations Scientifiques non gouvernementales

Résolution 2.11.

Au début de 1963, des subventions ont été accordées aux cinq organisations non gouvernementales ci-après, dont l'activité concerne diverses sciences exactes et naturelles :

	$
Conseil international des unions scientifiques (I.C.S.U.)	175.000
Fédération des services astronomiques et géophysiques (F.A.G.S.)	22.000
Conseil des organisations internationales des sciences médicales (C.I.O.M.S.)	25.000
Union des associations techniques internationales (U.A.T.I.)	12.000
Union internationale pour la conservation de la nature et de ses ressources (U.I.C.N.)	6.000

Le Secrétariat a été représenté aux principaux congrès et réunions dus à l'initiative des organisations susmentionnées, et il s'est

tenu en liaison étroite avec elles ainsi qu'avec les autres organisations internationales non gouvernementales admises par l'U.N.E.S.C.O. au bénéfice d'arrangements consultatifs.

Comme les années précédentes, on s'est efforcé d'étendre les activités de ces organisations au plus grand nombre possible de régions dans le monde entier. A titre d'exemple du succès de ces efforts, il y a lieu de signaler que le Conseil international des unions scientifiques, lors de sa X[e] assemblée générale (Vienne, 22-29 novembre), a accepté l'adhésion de six nouveaux membres nationaux (Association scientifique de la Nigeria, Conseil national de la recherche de Thaïlande, Académie des sciences d'Afrique orientale, Conseil national de la recherche de la République du Viêt-nam, Comité des sciences de la République démocratique du Viêt-nam et Université de Téhéran (Iran)).

Report of the Director General on the activities of the organization in 1963

We quote from this 167 pages report the following excerpts which are of interest for U.R.S.I.

Natural Sciences

Close collaboration continued between UNESCO and the international non-governmental scientific organizations, at many of whose meetings and conferences members of the Secretariat were present. The advice of these organizations, and particularly of the International Council of Scientific Unions (ICSU), continued to be sought on the expanding programme in science and technology.

Co-operation with international non-governmental scientific bodies

Resolution 2.11.

At the beginning of 1963, subventions were granted to five inter-

national non-governmental organizations active in various fields of the natural sciences as follows :

	$
International Council of Scientific Unions (I.C.S.U.) ...	175 000
Federation of Astronomical and Geophysical Services (F.A.G.S.)	22 000
Council for International Organizations of Medical Sciences (C.I.O.M.)	25 000
Union of International Engineering Organizations (U.A.T.I.)	12 000
International Union for Conservation of Nature and Natural Resources (I.U.C.N.)	6 000

The Secretariat was represented at the principal congresses and meetings convened by the above-mentioned organizations and maintained close contacts with them and with other international non-governmental scientific organizations with which U.N.E.S.C.O. has consultative relations.

As in previous years, efforts were made to ensure that the activities of these organizations be extended to as many geographical regions of the world as possible. Examples of the success of these efforts are : the International Council of Scientific Unions at its Xth General Assembly (Vienna, 22-29 November) accepted for membership six new national members (The Science Association of Nigeria, the National Research Council of Thailand, the East African Academy of Sciences, the National Research Council of the Republic of Viet-Nam, the Sciences Committee of the Democratic Republic of Viet-Nam, and the University of Teheran (Iran)), and the Union of International Engineering Organizations particularly concerned with the technological evolution of the developing countries held two technical meetings in Africa.

La coopération scientifique internationale

(Extrait de la *Chronique de l'U.N.E.S.C.O.*, Vol. X, nº 3, mars 1964)

Lorsque l'U.N.E.S.C.O. fut créée, en 1946, la communauté scientifique internationale souffrait d'un cloisonnement artificiel dû aux événements de la seconde guerre mondiale. L'isolement relatif dans lequel vivaient les savants des divers pays n'avait sans doute jamais atteint une telle acuité. Aussi l'assemblée convoquée à Londres en 1945 dans le but de créer l'U.N.E.S.C.O. inscrit-elle dans l'Acte constitutif, parmi les objectifs de l'Organisation, l'« aide au maintien, à l'avancement et à la diffusion du savoir... en encourageant la coopération entre nations dans toutes les branches de l'activité intellectuelle... ». La science représente un des aspects les plus universels de cette activité.

Le Département des sciences exactes et naturelles devait faire porter son premier effort sur le regroupement de la communauté scientifique mondiale. Il s'attacha immédiatement au renforcement des structures et de l'action du Conseil international des unions scientifiques (I.C.S.U.), et créa, dans le même esprit, le Conseil des organisations internationales des sciences médicales (C.I.O.M.S.), ainsi que l'Union des associations techniques internationales (U.A.T.I.). Par là même se trouvait constitué un réseau cohérent qui réunit les savants et ingénieurs de tous les pays au sein d'organisations non gouvernementales spécialisées, elles-mêmes groupées en trois fédérations intimement associées à l'U.N.E.S.C.O. Simultanément furent créés des postes de coopération établis dans les régions les plus éloignées des grands centres d'activité scientifique — à savoir Montévideo, Le Caire, New Delhi, Djakarta, Rio de Janeiro, Nankin, Changaï et Manille. Cette décentralisation permit une action directe de l'U.N.E.S.C.O. dans les pays qui souffraient non seulement d'isolement scientifique, mais souvent aussi d'un retard considérable dans le domaine des sciences et de la technologie. Le succès même de cette entreprise conduisit l'U.N.E.S.C.O. à dépasser le plan de la communication scientifique pour s'engager résolument dans la voie de l'organisation de la recherche internationale et des services internationaux de la science.

La recherche internationale

Vers cette époque, le Conseil économique et social des Nations Unies, considérant qu'un certain nombre de recherches ne pou-

vaient être conduites d'une façon rationnelle que sur le plan international, lançait une vaste enquête concernant la création de laboratoires de recherche des Nations Unies. L'opinion mondiale était, quant au fond, favorable au principe de la recherche scientifique sur le plan international, mais les avis différaient quant aux méthodes d'organisation et aux fins spécifiques de ces laboratoires. Les Nations Unies firent appel à l'Unesco pour qu'elle étudie les propositions de recherche collective qui avaient été élaborées par un comité d'experts en 1948.

Certaines de ces propositions portaient sur les domaines scientifiques suivants : le calcul automatique, le fonctionnement du cerveau, l'astronomie, la chimie de la matière vivante, les problèmes relatifs aux zones arides et tropicales humides, l'océanographie, la physique des particules de haute énergie. Plusieurs options s'offraient dès lors au Département des sciences exactes et naturelles, non seulement pour le choix des activités de recherche sur lesquelles son effort devait porter en priorité, mais également pour la sélection des méthodes d'action dont l'expérience montra qu'elles devaient être adaptées à chaque cas particulier. Différents projets furent soumis à l'approbation des conférences générales de l'U.N.E.S.C.O. à partir de 1950 ; il apparut que les possibilités de coopération scientifique internationale et les suggestions des chercheurs dépassaient largement les moyens d'action que l'Organisation pouvait alors espérer mobiliser en leur faveur.

Les méthodes de coopération internationale.

Suivant la nature des recherches envisagées, l'U.N.E.S.C.O. procéda soit à la création d'une organisation scientifique intergouvernementale autonome, soit à la mise en œuvre d'un programme de recherches coopératives exécuté dans ses Etats membres, ou grâce à leur action concertée.

Parmi les organisations scientifiques intergouvernementales ainsi établies se trouve notamment l'Organisation européenne pour la recherche nucléaire — appelée en abrégé le C.E.R.N. — située à Genève et groupant 14 États européens ; le Centre international de calcul — créé an 1961 à Rome, et auquel participent 12 États — ainsi que le Centre latino-américain de physique, qui groupe 20 États d'Amérique latine et dont la convention d'installation a été signée à Rio de Janeiro en 1962.

En ce qui concerne les recherches coopératives internationales, les méthodes d'action de l'U.N.E.S.C.O. se sont affirmées progressivement et d'une manière empirique. Ainsi en a-t-il été pour les sciences de la vie, pour celles de la mer, de la terre et de l'espace.

Dès 1954, des résolutions relatives aux sciences de la mer sont apparues dans le programme de l'U.N.E.S.C.O. Les initiatives de l'Organisation dans ce domaine se sont multipliées jusqu'en 1960, date de la création de la Commission océanographique intergouvernementale, dont l'U.N.E.S.C.O. assure le secrétariat par l'intermédiaire de son Office d'océanographie. Cette commission a pour but de contribuer, grâce à des plans préparés en commun, à la poursuite des recherches en vue de mieux connaître la nature et les ressources des océans. On voit apparaître ainsi la notion d' « action concertée » restreinte aux États qui s'y joignent volontairement : modalité nouvelle de coopération scientifique internationale dont le succès témoigne de la valeur. L'U.N.E.S.C.O. se propose d'appliquer cette méthode d'action au vaste programme de recherches internationales en matière d'hydrologie scientifique dont l'exécution commencera en 1965 dans le cadre d'une décennie internationale. Ce programme serait placé sous l'égide d'un conseil de coordination intergouvernemental.

Les programmes de recherches fondamentales collectives s'organisent parfois sous l'égide d'associations scientifiques internationales non gouvernementales ayant des accords de coopération avec l'U.N.E.S.C.O., qui les soutient financièrement. Il en a été ainsi par exemple pour l'Année géophysique internationale (1957-1958). Ce projet, auquel les États membres ont consacré des centaines de millions de dollars, a été planifié par un comité spécial du Conseil international des unions scientifiques ; en quatre ans, l'Organisation a alloué environ 100 000 dollars à cette entreprise mondiale dont le succès fut retentissant. Des plans similaires sont établis en ce moment, également avec le concours de l'U.N.E.S.C.O., par le comité spécial de l'I.C.S.U. pour l'organisation des Années internationales du soleil tranquille (I.Q.S.Y.). Le Conseil international des unions scientifiques envisage aussi la mise en œuvre d'un programme biologique auquel le soutien de l'U.N.E.S.C.O. est en principe acquis.

Le choix des projets et leur mise en œuvre.

Depuis 1954, l'U.N.E.S.C.O. dispose d'un comité consultatif chargé de conseiller le Directeur général sur la nature et les modalités des projets de recherches dont il estime que le Département des sciences exactes et naturelles devrait commencer à établir les plans, compte tenu de l'évolution des besoins de la communauté scientifique internationale et des politiques adoptées par les Etats membres en matière de sciences et de techniques. Ses recommandations concernent aussi les méthodes à suivre pour mettre en œuvre le programme approuvé, ainsi que l'organisation de l'action future dans le domaine de la recherche.

Le comité se compose de dix-sept membres, dont quatorze, de nationalités différentes, sont des hommes de science représentant des institutions nationales responsables de la promotion et de la coordination des recherches. Les trois autres membres représentent le Conseil international des unions scientifiques, le Conseil des organisations internationales des sciences médicales et l'Union des associations techniques internationales. Ainsi l'U.N.E.S.C.O. assure-t-elle, au stade de la planification, la liaison, d'une part, avec les milieux scientifiques gouvernementaux et, d'autre part, avec les représentants qualifiés de la communauté scientifique internationale.

L'Organisation des Nations Unies, les institutions spécialisées et l'Agence internationale de l'énergie atomique sont invitées à se faire représenter à chaque session du comité, et d'autres organisations intergouvernementales peuvent y envoyer des observateurs. En outre, le Directeur général peut demander à des experts de prendre part à certains débats ; c'est ainsi que nombre de spécialistes éminents ont été consultés au cours des 9 seessions que le comité a tenues jusqu'à présent.

D'une manière générale, un projet passe par quatre stades : enquête et étude, stimulation, planification, exécution. Ces quatre périodes peuvent s'étendre sur un nombre d'années qui varie avec la nature du projet et les méthodes d'action choisies. Deux cas concrets peuvent être cités : *La création d'une organisation intergouvernementale de recherche nucléaire, le C.E.R.N. et les recherches océanographiques internationales concertées.*

LES SERVICES INTERNATIONAUX DE LA SCIENCE ET DE LA TECHNOLOGIE.

Sous le vocable « Services internationaux de la science » sont groupées les activités qui permettent à la recherche de progresser sur des bases valables, normalisées, largement diffusées et accessibles aux chercheurs du monde entier. On a coutume de classer sous cette rubrique les programmes d'information et de documentation scientifiques, les services internationaux de rassemblement, de collationnement et de normalisation de mesures, les matériaux expérimentaux normalisés, les enquêtes scientifiques internationales, etc.

L'information scientifique et technique.

L'information scientifique et technique constitue un domaine d'activité privilégié pour l'U.N.E.S.C.O., et son importance a été soulignée à chaque session de la Conférence générale.

Quant à l'information verbale (congrès, réunions, colloques), on a déjà signalé le soutien accordé aux associations scientifiques internationales. Les trois grandes fédérations d'unions scientifiques (I.C.S.U., C.I.O.M.S. et U.A.T.I.) ainsi que leurs unions membres, organisent chaque année, avec l'aide de l'U.N.E.S.C.O., une centaine de réunions qui rassemblent plus de dix mille hommes de science d'une cinquantaine de pays. En outre, quand le besoin s'en fait sentir, l'U.N.E.S.C.O. prend l'initiative de grandes conférences sur des sujets scientifiques d'actualité qui ne tombent dans le domaine particulier d'aucune union.

L'information écrite (ou « permanente ») — c'est-à-dire la documentation scientifique et technique — pose de graves problèmes dont l'U.N.E.S.C.O. a été saisie dès sa première Conférence générale. On peut estimer à 50.000 au moins le nombre de périodiques scientifiques édités dans le monde, et à quelque 2.500.000 la quantité d'articles scientifiques qui paraissent annuellement. L'objectif est clair : permettre à chaque chercheur ou ingénieur de trouver aussi aisément que possible ce que d'autres ont déjà publié dans le domaine qui l'intéresse, et de savoir si les résultats obtenus ont des incidences sur ses propres travaux.

L'importance de la documentation scientifique et technique a conduit le Comité consultatif international de bibliographie, de

documentation et de terminologie à créer un sous-comité spécialisé où sont notamment représentés le Conseil international des unions scientifiques, la Fédération internationale de documentation, l'Organisation internationale de normalisation et la Fédération internationale des associations de bibliothécaires.

Trois aspects principaux de la question préoccupent surtout l'Unesco :

1. Le repérage des articles, c'est-à-dire l'indexage, la classification et la codification, les résumés analytiques et la mécanisation permettant d'accélérer certaines parties de ces opérations. Une étude sur les résumés analytiques a été présentée à la Conférence de Genève sur l'application de la science et de la technique. Depuis lors, le Conseil économique et social a demandé à l'U.N.E.S.C.O. de poursuivre et d'intensifier son action dans ce domaine. Il a également appelé l'attention des États membres sur l'intérêt que présentent le développement de centres nationaux ou régionaux de documentation (y compris la formation du personnel et le recours à l'équipement moderne approprié) et la conclusion, lorsqu'elle est possible, d'accords groupant ces centres par régions.
2. Les publications scientifiques primaires, les problèmes auxquels sont confrontés les éditeurs de journaux scientifiques. Un « Code du bon usage en matière de publications scientifiques » a été établi, et des travaux de normalisation entrepris.
3. Les langues de publication scientifique et technique, les traductions et la terminologie. L'U.N.E.S.C.O. a publié des bibliographies de dictionnaires et des ouvrages de caractère plus général sur le problème des langues dans la diffusion des connaissances scientifiques. Un groupe de travail a été constitué pour l'étude approfondie de ces questions.

L'examen du problème posé par la centralisation et l'échange des renseignements sur les travaux de recherche en cours ou en projets a fait l'objet d'une des recommandations formulées à la suite de l' « Étude sur les tendances actuelles de la recherche scientifique », effectuée en 1959 et 1960. Le Conseil économique et social s'y est intéressé et a prié le Comité administratif de coordination de lui présenter en 1964 des observations détaillées à ce sujet.

Les données scientifiques de base

Les services internationaux de rassemblement, d'analyse, de synthèse et de diffusion des données scientifiques de base sont d'une importance croissante pour le progrès des sciences. Nombre de ces données sont d'ailleurs utilisées par les services techniques ayant, sur le plan gouvernemental, la responsabilité du fonctionnement et du progrès dans les branches particulières : aviation, marine, télécommunications, etc

L'U.N.E.S.C.O. accorde un intérêt considérable à ces services C'est avec son concours qu'a été créé, en 1957, un organisme du Conseil international des unions scientifiques qui groupe en une fédération les services permanents d'astronomie et de géophysique.

Il est parfois difficile de distinguer clairement les services qui réunissent les données scientifiques de base, de leurs informateurs, c'est-à-dire des observatoires de tous genres qui effectuent les mesures. Il appartient à l'U.N.E.S.C.O. de parfaire le réseau de ces observatoires, d'harmoniser et d'intégrer leurs travaux afin que les services internationaux puissent fonctionner d'une manière satisfaisante. Cette action intéresse notamment les observatoires astronomiques (spécialement dans l'hémisphère sud) et les stations séismologiques internationales ou régionales.

La normalisation scientifique et technique.

Les mesures effectuées par les observatoires dans les différentes régions du globe doivent être universellement comparables et utilisables. Il convient en conséquence de procéder à une normalisation évolutive des méthodes et unités de mesure, ainsi que de l'expression des résultats obtenus. C'est pourquoi l'U.N.E.S.C.O. maintient des contacts étroits avec le Bureau international des poids et mesures, ainsi qu'avec l'Organisation internationale de métrologie légale. En outre, certains des programmes de recherches lancés par l'U.N.E.S.C.O. comprennent la préparation et la normalisation de cartes scientifiques internationales de la terre, dont plusieurs ont déjà été publiées.

LES ÉTUDES ET ENQUÊTES SCIENTIFIQUES INTERNATIONALES

D'après son Acte constitutif, l'U.N.E.S.C.O. est chargée de conseiller les Nations Unies « sur les aspects éducatifs, scientifiques

et culturels des questions intéressant les Nations Unies, dans les conditions et suivant la procédure qui auront été adoptées par les autorités compétentes des deux organisations ».

Les tendances actuelles de la recherche.

Lorsqu'en 1958, l'Assemblée des Nations Unies demanda au Secrétaire général qu'une étude soit faite sur les tendances principales de la recherche scientifique, le Comité administratif de coordination convint (lors de sa 27e session, en octobre 1958) que l'U.N.E.S.C.O. servirait d'organe centralisateur pour la réalisation de ce travail. Un mois plus tard, la Conférence générale chargeait le Directeur général de prendre les mesures nécessaires pour l'accomplissement de cette tâche.

Dès décembre 1958, le professeur Pierre Auger (France), ancien directeur du Département des sciences exactes et naturelles, était nommé coordonnateur de l'étude. Un comité consultatif spécial était constitué, composé de représentants des Nations Unies, des institutions spécialisées intéressées et de l'Agence internationale de l'énergie atomique. Ce comité dressa le plan de l'étude, dégagea les critères de sélection des tendances « principales » de la recherche et détermina les matériaux à utiliser pour l'élaboration du document, ainsi que les méthodes de consultation à suivre.

Aussitôt terminée, l'étude fut soumise à l'examen d'un collège de savants éminents, puis au comité consultatif spécial — notamment pour la mise au point des recommandations sur les mesures que les organisations du système des Nations Unies pourraient prendre pour favoriser la concentration des efforts de recherche sur les problèmes les plus urgents, compte tenu des besoins des divers pays.

Conformément au vœu du Conseil économique et social, ce document devait être largement diffusé. Il a été publié en anglais, en français, en espagnol et en russe, sous le titre *Tendances actuelles de la recherche scientifique*. Des éditions en langues italienne et japonaise ont également paru ou sont en préparation. En outre, des extraits en ont été diffusés en langue allemande, hongroise et thaï, tandis que la France en a publié une version abrégée, suivie d'une mise au point par le professeur Auger. Les États-Unis s'apprêtent à en publier une édition à large tirage.

La Conférence générale approuva en 1960 les commentaires formulés par le Directeur général sur les recommandations issues de l'étude, ainsi que les orientations générales du plan d'action de l'Organisation pour les années 1960-1970 dans le domaine des sciences et de la technologie. Ce plan de dix ans comportait trois lignes de force, à savoir :

1. La coordination des activités scientifiques (tant nationales qu'internationales) en matière de communication des résultats des recherches, la coordination des recherches en cours et l'identification des objectifs futurs de la recherches. En particulier : l'amélioration de l'information scientifique ; la normalisation des unités de mesure dans les sciences de base ; l'échange d'informations concernant la politique scientifique nationale des États membres ; la formation scientifique de base des chercheurs, ingénieurs et techniciens.

2. L'exploration du globe terrestre, l'inventaire et l'utilisation des ressources naturelles. Principales activités comprises dans ce chapitre : l'exploration et les méthodes générales d'étude des milieux naturels ; les cartes scientifiques ; les problèmes posés par l'exploitation et la conservation des ressources naturelles ; le bilan hydrologique mondial ; l'océanographie ; l'encouragement des recherches géologiques, géophysiques et séismologiques ; la pollution des milieux naturels.

3. L'application des sciences et des techniques à l'industrialisation des pays en voie de développement. Points saillants de l'action de l'U.N.E.S.C.O. dans ce domaine : la formation des cadres scientifiques et techniques ; la technologie en tant que science des arts et métiers : enseignement et recherche ; l'étude des méthodes et des processus technologiques d'industrialisation accélérée dans les pays en voie de développement indépendant ; l'organisation d'une grande conférence internationale sur la méthodologie de l'industrialisation.

Les programmes scientifiques et techniques approuvés par la Conférence générale, en 1960 et 1962, ainsi que le programme qui sera présenté à sa treizième session, en 1964, ont été élaborés dans le cadre conceptuel de ce « plan de dix ans ».

Le Conseil économique et social, lors de sa 32e session, établit un groupe de travail spécial chargé d'examiner les recommandations découlant de l' « Étude sur les tendances actuelles de la recherche », ainsi que des observations faites à son sujet par les gouvernements, les institutions spécialisées et l'Agence internationale de l'énergie atomique. Il devait, par la suite, porter à l'attention de l'Assemblée générale des Nations Unies les commentaires formulés par ce groupe de travail et prier tout particulièrement le Directeur général de l'U.N.E.S.C.O. de bien vouloir envisager, dans une section spéciale de son rapport annuel aux Nations Unies, la suite qui pourrait être donnée à l'étude. Le Conseil économique et social demandait également à l'U.N.E.S.C.O. de proposer un ordre de priorité pour les questions relevant de sa compétence.

La coopération scientifique avec les Nations Unies

Indépendamment de telles enquêtes, l'U.N.E.S.C.O. a eu différentes occasions de jouer son rôle de conseiller scientifique de l'Organisation des Nations Unies et de ses institutions spécialisées. Qu'il s'agisse de la recherche ou de la formation des spécialistes, elle collabore également avec certains organes spécialisés des Nations Unies, tel que le Comité sur les utilisations pacifiques de l'espace extra-atmosphérique.

International scientific co-operation

(Excerpt from *U.N.E.S.C.O. Chronicle*, Vol. X., No. 3, March 1964)

When U.N.E.S.C.O. was set up in 1946, the international scientific community was artificially partitioned as a result of the events of the Second World War. Never, probably, had scientists in different countries been so relatively isolated. The conference convened in London in 1945 for the purpose of establishing U.N.E.S.C.O., therefore rightly provided in the Constitution, as one of the aims of the Organization, that it should « maintain, increase and diffuse knowledge... by encouraging co-operation among the nations in all branches of intellectual activity. » Science represents one of the most universal aspects of this activity.

The Department of Natural Sciences had first to concentrate on restoring the unity of the world scientific community. It immediately set about reinforcing the structure and intensifying the work of the International Council of Scientific Unions (I.C.S.U.), and, in the same spirit set up the Council for International Organizations of Medical Sciences (C.I.O.M.S.) and the Union of International Engineering Organizations. A coherent network was thereby constituted, establishing contacts between the scientists and engineers of all countries through specialized non-governmental organizations which were in turn grouped in three major federations intimately associated with U.N.E.S.C.O. At the same time, Science Co-operation Offices were established in the areas furthest removed from the major centres of scientific activity — at Montevideo, Cairo, New Delhi, Djakarta, Rio de Janeiro, Nankin, Shangai and Manila. This decentralization enabled U.N.E.S.C.O. to exercise a direct influence in countries which were not only scientifically isolated but also often considerably behindhand in science and technology. This undertaking proved so successful that U.N.E.S.C.O. was led to go further than merely establishing scientific relations, and to embark resolutely on the organization of international research and international scientific services.

International research

At about the same time, the Economic and Social Council of the United Nations, being of the opinion that the only way of rationally carrying out certain types of research was to have them done internationally, started a vast inquiry into the problem of setting up United Nations research laboratories. On the substance of the problem, world opinion was favourable to the idea of scientific research on an international scale, but views differed as regards the methods of organization and on the specific purposes the laboratories should serve. The United Nations requested U.N.E.S.C.O. to study proposals for joint research which had been drawn up by a committee of experts in 1948.

The following themes were among those included in the proposals : automatic computing, the functioning of the brain, astronomy, the chemistry of living matter, problems relating to arid and humid tropical zones, oceanography and the physics of high-

energy particles. Several choices were thus open to the Department of Natural Sciences, with regard not only to the research activities to which it was to accord priority but also to its methods of work, experience having shown that these must be adapted to each particular case. From 1950 onwards, various projects were submitted for approval to the General Conference of U.N.E.S.C.O., and it became clear that the possibilities for international scientific co-operation and the proposals of research workers largely exceeded the means which the Organization could hope to mobilize on their behalf at the time.

Methods of international co-operation.

Depending upon the nature of the research in view, U.N.E.S.C.O. either set up an autonomous intergovernmental scientific organization or arranged for a programme of co-operative research to be undertaken in Member States (or by their concerted action).

One of the intergovernmental scientific organizations thus set up (in 1952), is the European Organization for Nuclear Research (C.E.R.N.), which is located in Geneva, and has a membership of fourteen European States; the International Computation Centre, set up in 1961 in Rome, with a membership of twelve States, and a third is the Latin American Physics Centre, the constitution of which was signed in Rio de Janeiro in 1962, and which has a membership of twenty Latin American States.

As regards international co-operative research, U.N.E.S.C.O.'s methods of action have evolved gradually and empirically—as, for example, in the cases of the life sciences, the marine sciences, and the earth and space sciences.

Resolutions relating to the marine sciences appeared in U.N.E.S.C.O.'s programme from 1954 onwards. The activities of the Organization in this field developed regularly up to 1960, when the International Oceanographic Commission was established, with U.N.E.S.C.O., through its Office of Oceanography, providing its secretariat. The Commission's purpose is to promote scientific investigation, on the basis of plans worked out in common, with a view to learning more about the nature and ressources of the oceans. Thus appears the idea of « concerted action », limited to the Member States voluntarily taking part in it—a new form of international scientific co-operation whose success attests its

merits. U.N.E.S.C.O. proposes to employ this method in the great programme of international research in scientific hydrology which it is to start in 1965 as part of the International Hydrological Decade. This programme will probably be placed under the supervision of an intergovernmental co-ordinating council.

Joint basic research programmes are sometimes organized under the aegis of non-governmental international scientific organizations which have co-operative agreements with U.N.E.S.C.O. and receive financial help from it. This was the case, for example, with the International Geophysical Year (1957-58). This project, to which Member States devoted hundreds of millions of dollars, was planned by a special committee of the International Council of Scientific Unions ; over a period of four years approximately $ 100 000 was allocated by U.N.E.S.C.O. to this world undertaking, which scored a resounding success. Similar plans are now being made by the I.C.S.U. special committee for the organization of International Quiet Sun Years (I.Q.S.Y.), for which U.N.E.S.C.O. is also providing assistance. The Council is considering a biological programme which U.N.E.S.C.O. has, in principle, agreed to support.

Selection of projects and their execution.

Since 1954, U.N.E.S.C.O. has had an advisory committee whose function is to advise the Director-General on the fields and appropriate methods of future action which, in his opinion, the Department of Natural Sciences should start to plan for, in the light of the changing requirements of the world scientific community and of the scientific and technological policies of Member States. Its recommendations also concern the best methods of carrying out the approved programme and future action in the field of research.

The committee consists of seventeen members, of whom fourteen, of different nationalities, must be scientists representing national institutions responsible for the promotion and co-ordination of research. The other three members are representatives of the International Council of Scientific Unions, the Council for International Organizations of Medical Sciences and the Union of International Engineering Organizations. In this way, at the planning stage, U.N.E.S.C.O. maintains liaison both with governmental

scientific circles and with the qualified representatives of the international scientific community.

The United Nations, the Specialized Agencies and the International Atomic Energy Agency are invited to send representatives to each session of the committee, and other intergovernmental organizations may send observers. In addition, the Director-General may invite experts to take part in certain of the discussions ; and a number of eminent specialists have been consulted in this way during the nine sessions which the committee has held to date.

Generally speaking, a project passes through four stages—study, stimulation, planning and action. These four stages may extend over a varying number of years, depending on the nature of the project and the methods selected for carrying it out. Two examples may be mentioned the *Establishment of an intergovernmental nuclear research organization* : *C.E.R.N.* and the *Concerted international oceanographic research.*

International scientific and technological services

The phrase « international scientific services » covers those activities relating to science which facilitate the advance of scientific research on bases which are sound, uniform, made widely known and accessible to research workers throughout the world. This heading is usually taken to include scientific information and documentation programmes, international services for assembling, collating and standardizing measurements, standardized experimental material, international scientific surveys, and so on.

Scientific and technical information.

This is given special attention in U.N.E.S.C.O., and its importance has been emphasized at every session of the General Conference since U.N.E.S.C.O. was established.

On the subject of oral information (conferences, meetings, symposia), the moral and financial support given to the international scientific unions has been referred to above. The three major federations of international scientific unions, I.C.S.U., C.I.O.M.S., and U.I.E.O., together with their member unions, organize about a hundred meetings every year, bringing together more than 10 000 scientists from some fifty countries. When

necessary, U.N.E.S.C.O. also proposes the holding of major international conferences on current scientific topics which do not fall within the particular sphere of any of the scientific unions.

Written or « permanent » information, i.e. scientific and technical documentation, gives rise to serious problems, which were brought to the attention of the U.N.E.S.C.O. General Conference at its first session. It is estimated that at least 50 000 scientific periodicals are published throughout the world, and that some 2.5 million scientific articles appear annually. The aim must clearly be to enable every research worker and engineer to find as easily as possible what others have already published on the subject that interests him, and to know if their results affect his own work.

The volume of scientific and technical documentation has led the International Advisory Committee on Bibliography, Documentation and Terminology to set up a specialized sub-committee, the membership of which includes representatives of the International Council of Scientific Unions, the International Federation for Documentation, the International Organization for Standardization and the International Federation of Library Associations.

There are three major aspects of the problem which are of particular concern to U.N.E.S.C.O. :

1. The identification of articles, i.e. indexing, classification and coding, abstracting, and the speeding up of certain parts of these operations by mechanical means. A survey on abstracting services was submitted to the Geneva Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas (1963), since when the Economic and Social Council has requested U.N.E.S.C.O. to continue and intensify its work in this field, and has called the attention of Member States to the importance of developing national or regional documentation centres (to include the training of staff and use of the appropriate modern equipment) and of concluding, where possible, agreements grouping such centres by geographical areas.

2. Primary scientific publication, i.e. the problems confronting the publishers of scientific journals. A « code of good practice

for scientific publications » has been prepared, and work has been undertaken in connexion with standardization.

3. The languages in which scientific and technical material is published, translations and terminology. U.N.E.S.C.O. has published bibliographies of dictionaries and more general works on the question of languages in the spread of scientific knowledge. A working party has been set up to make a thorough study of these questions.

The examination of the problem of centralizing and exchanging information concerning current or projected research was the subject of one the recommendations formulated as a result of the Survey on Current Trends in Scientific Research carried out in 1959 and 1960. The Economic and Social Council took up the matter and requested the Administrative Committee on Co-ordination to present it with detailed observations on this problem in 1964.

Basic scientific data.

Of increasing importance for the progress of science are the international services which assemble, analyse, synthesize and publicize basic scientific data. Many of these data, incidentally, are used by the technical services responsible, on the governmental level, for operations and progress in particular branches : aviation, shipping, telecommunications, and so on.

U.N.E.S.C.O. takes considerable interest in these services and contributed, for example, to the establishment in 1957 of an agency of the International Council of Scientific Unions federating astronomical and geophysical permanent services.

It is sometimes difficult to distinguish clearly between the services which assemble basic scientific data and those which provide them with information, i.e. the observatories of all kinds which make measurements. It is one of U.N.E.S.C.O.'s obligations to perfect the network of observatories and to co-ordinate and integrate their work, so that the international services can operate satisfactorily. This action particularly concerns astronomical observatories (especially in the southern hemisphere) and international or regional seismological stations.

Scientific and technical standardization.

Measurements made by observatories in different parts of the world must be universally comparable and usable. It is desirable, therefore, that there should be progressive standardization of methods and units of measurement, and of the statement of results. With this end in view, U.N.E.S.C.O. maintains close contact with the international Bureau of Weights and Measures and with the International Organization of Legal Metrology. In addition, some of the international research programmes started by U.N.E.S.C.O. make provision for the preparation and standardization of international scientific maps of the earth, several of which have already been published.

International scientific studies and surveys

U.N.E.S.C.O. is responsible, under its Constitution, for « advising the United Nations Organization on the educational, scientific and cultural aspects of matters of concern to the latter, in accordance with the terms and procedure agreed upon between the appropriate authorities of the two Organizations ».

Current trends in scientific research.

When the United Nations General Assembly requested the Secretary-General, in 1958, to arrange for a survey to be made of the main trends in scientific research, the Administrative Committee on Co-ordination agreed (at its twenty-seventh session in October 1958) that U.N.E.S.C.O. should act as the centralizing agency for this undertaking. A month later, the General Conference instructed the Director-General to take the necessary measures to enable this task to be carried out.

In December 1958, Professor Pierre Auger (France), formerly director of the Department of Natural Sciences, was appointed co-ordinator for the survey. A special advisory committee was set up, composed of representatives of the United Nations, the Specialized Agencies concerned and the International Atomic Energy Agency, and drew up a plan for the survey, determined what criteria should be followed in choosing the « main » trends of research, and decided what material should be used in preparing the survey and what methods of consultation should be followed.

As soon as it was completed, the survey was submitted for consideration to a panel of eminent scientists and then to the special advisory committee, in order that, among other things, recommendations could be prepared regarding the measures which the United Nations Agencies could take to help concentrate research on the problems which were most urgent in terms of the needs of the various countries.

The Economic and Social Council expressed the desire that this document should be widely publicized. It has been published in English, French, Russian and Spanish, under the title *Current trends in scientific research.* Italian and Japanese editions have also appeared or are in preparation ; extracts have been published in German, Hungarian and Thai ; while France has brought out an abridged version, and a revision of the latter by Professor Auger. The United States is also preparing to bring out a « popular » edition.

In 1960, the General Conference approved the Director-General's comments on the recommendations emerging from the survey, and the general lines of U.N.E.S.C.O.'s programme in science and technology for the years 1960-70. This ten-year programme had the following three major objectives :

1. Co-ordination of scientific activities (at both the national and the international levels) in regard to the communication of the results of research, co-ordination of current research activities and determination of the future aims of research ; and in particular : improvement of scientific information ; standardization of units of measurement in the basic sciences ; exchange of information about the national science policies of Member States ; basic scientific training of scientists, engineers and technicians.
2. Exploration of the earth, inventory and rational exploitation of natural resources. The principal subjects receiving attention under this heading are : exploration and general methods for the study of natural environments ; specialized maps ; problems concerning the exploitation and conservation of natural resources ; world hydrological balance ; oceanography ; promotion of geological, geophysical and seismological research ; pollution of the elements.

3. Application of science and technology for the industrialization of developing countries. Here U.N.E.S.C.O. is concentrating on : the training of scientific and technical personnel ; technology as the science of the technical arts and crafts ; teaching and research ; study of the methods and processes of accelerated industrialization in independently developing countries ; organization of a major international conference on the methods of industrialization.

The scientific and technical programmes approved by the General Conference in 1960 and 1962 and the programme which will be submitted to it at the thirteenth session, in 1964, were drawn up in the context of this « ten-year programme ».

As its thirty-second session, the Economic and Social Council set up a special working group to examine the recommendations deriving from the survey on current trends in scientific research and observations made on it by governments, the Specialized Agencies and the International Atomic Energy Agency. In due course, it drew the attention of the United Nations General Assembly to the working party's comments, and particularly requested the Director-General of U.N.E.S.C.O. to make provision, in a special section of his annual report to the United Nations, for action to be taken as a result of the survey. The Council also requested U.N.E.S.C.O. to propose an order of priorities for matters within its competence.

Scientific co-operation with the United Nation

Apart from such surveys, U.N.E.S.C.O. has had various opportunities of discharging its functions as scientific adviser to the United Nations and the Specialized Agencies. U.N.E.S.C.O. is also collaborating with certain specialized organs of the United Nations, such as the Committee on the Peaceful Uses of Outer Space, both as regards research and as regards the training of specialists.

ORGANISATION METEOROLOGIQUE MONDIALE

Extraits de la liste provisoire des Réunions pour 1964-1965

Date et lieu	Nom et but de la réunion
5-12 août 1964 Léningrad	*Colloque U.G.G.I./O.M.M. sur le rayonnement atmosphérique.* Problèmes du rayonnement en relations avec la circulation atmosphérique ; spectroscopie infra-rouge de l'atmosphère ; théorie et transferts dans l'atmosphère planétaire ; climatologie du rayonnement ; instruments de surface et de réseaux.
13-14-août Léningrad	*Groupe de travail des instruments et des observations du rayonnement de type spécial de la C.I.M.O.* (se tiendra en même temps que le Colloque sur le rayonnement atmosphérique à Léningrad). Etalonnage des bilanmètres différentiels ; recommandations concernant la normalisation des équipements destinés à mesurer l'éclairement, le bilan radiatif, le rayonnement ultraviolet et le rayonnement infra-rouge ; recommandations sur la normalisation des observations et des données en vue de leur publication ; terminologie.
31 août-5 septembre Albuquerque (Etats-Unis)	*Colloque U.G.G.I./O.M.M. sur la recherche concernant l'ozone et ses applications à la physique de l'atmosphère.* Le programme du colloque portera notamment sur les questions suivantes : ozone total et ozone au voisinage du sol ; distribution verticale de l'ozone ; théorie photochimique et relations entre l'ozone et l'activité solaire ; variations de l'ozone en fonction des saisons et de la latitude ; l'ozone et la circulation générale de l'atmosphère.

WORLD METEOROLOGICAL ORGANIZATION

Excerpts from the provisional list of 1964-1965 meetings

Date and place	Name and purpose of meeting
5-12 August 1964 Leningrad	*I.U.G.G./W.M.O. Symposium on Atmospheric Radiation.* Radiation problems as related to atmospheric circulation ; infrared spectroscopy of the atmosphere ; theory and transfer in planetary atmosphere ; radiation climatology ; surface and network instrumentation.
13-14 August Leningrad	*C.I.M.O. Working Group on Special Radiation Instruments and Observations* (to be held in conjunction with the Symposium on Atmospheric Radiation in Leningrad). Calibration of radiation balance meters ; recommendations on standardization of materials on measurement of illumination, radiation balance, ultra-violet and infrared radiation, and on standardization of observations and data for publication ; terminology.
31 August-5 September Albuquerque (U. S. A.)	*I.U.G.G./W.M.O. Symposium on Ozone Research and its Applications to Atmospheric Physics.* The programe of the Symposium will include items such as : total ozone and ozone near ground, vertical distribution of ozone, photochemical theory and the relation between ozone and solar activity, seasonal and latitudinal variation of ozone and general circulation of the atmosphere.

BIBLIOGRAPHIE

Commission Electrotechnique Internationale

Publication 41 : *Deuxième édition.* — Code international concernant les essais de réception sur place des turbines hydrauliques.

Prix : Fr. s. 75, plus frais de port et d'emballage.

Publication 149-1 : *Première édition.* — Supports de tubes électroniques. Première partie : Règles générales et méthodes de mesure.

Prix : Frs. s. 15, plus frais de port et d'emballage.

Ces publications sont en vente au Bureau Central de la C.E.I.

BIBLIOGRAPHY

International Electrotechnical Commission

Publication 41 : *Second edition.* — International code for the field acceptance tests of hydraulic turbines.

Price : Sw. Fr. 75, per copy plus postage and packing.

Publication 149-1 : *First edition.* — Sockets for electronic tubes and valves. Part 1 : General requirements and methods of tests.

Price : Sw. Fr. 15, per copy plus postage and packing.

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