

# U. R. S. I.

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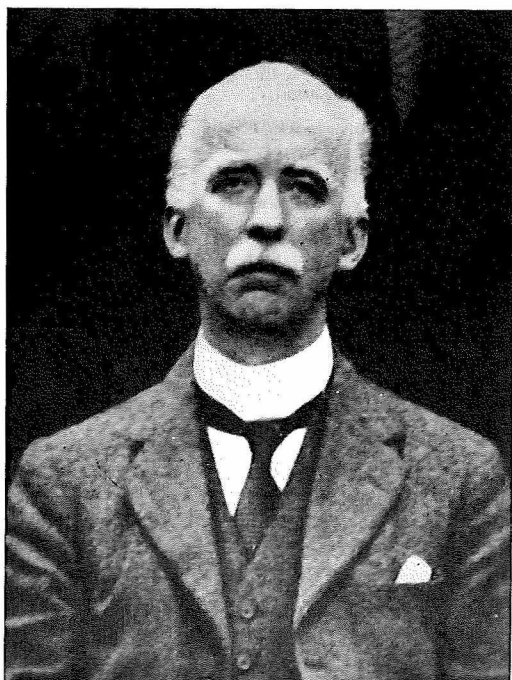
## OBITUARY

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### **Dr. E. H. Rayner**

Dr. Edwin Hartree Rayner, Honorary President, died peacefully at his home in Teddington, England, on 20th June, 1963, at the age of 88 years.

Dr. Rayner received his scientific and engineering education at the University of Cambridge, of which he held the M. A. and Sc. D.



degrees. After a short experience in industry, he joined the scientific staff of the National Physical Laboratory at Teddington in 1904 and remained there until his retirement in 1940. He was one of the pioneer scientists who built up what became the Electricity Division of the Laboratory, with its facilities for precision measurement and standardization over a wide range of frequencies, voltage and power. After his retirement from the British govern-

ment service, he returned for a few years to an industrial research laboratory.

Dr. Rayner's interest in radio matters dates from January 1913, when he was appointed as secretary to a committee of the British Postmaster General, to consider and report on the possibilities of existing systems of wireless telegraphy, both damped and continuous waves, for a world-wide scheme of continuous communication. He continued to be associated with radio research as the programme of the National Physical Laboratory developed after the first World War, during which he was also active in investigations in photometry and the detection of enemy aircraft.

At the third General Assembly of U.R.S.I. at Brussels in 1928, Dr. Rayner was one of the representatives of the United Kingdom. He there displayed his interest in obtaining assistance from radio amateurs in all parts of the world in making measurements, with simple apparatus, of long distance reception and the fading of radio signals. He also encouraged co-operation between radio scientists and astronomers in the study of correlation between solar and magnetic phenomena and radio transmission conditions. At the next General Assembly of U.R.S.I. at Copenhagen in 1931, Dr. Rayner was elected President of Commission IV with the responsibility of maintaining close liaison with amateur experimenters in the radio field. At this and later Assemblies, he also took a great interest in the two Commissions on Measurements and Standardization and on Radio Wave Propagation respectively, in which his colleagues from the National Physical Laboratory also participated.

At the fifth General Assembly held in London in September 1934, a major part of the organization of the programme, including the visits and social arrangements, was carried out under Dr. Rayner's personal supervision. In addition at this Assembly, he also presided over Commission I dealing with Measurements and Standardization; and he was re-elected to this position for the next General Assembly, which was held in Venice and Rome in 1938. Between the assemblies in London and Venice, Dr. Rayner accompanied the President of U.R.S.I., Sir Edward Appleton, to the meeting of the International Council of Scientific Unions held in London in 1937. The Council considered the international co-operation in radio matters to be so outstanding that they asked the president

to give a special lecture on the work of U.R.S.I., and this was supplemented by a report on the Union's activities by Dr. Rayner.

When U.R.S.I. resumed its activities after the second world war at its seventh General Assembly in Paris in 1946, Dr. Rayner presided over the main sessions of Commission I. At the closing meeting of this commission on 3rd October, however, he expressed his desire to resign in favour of a younger man. On the following day he was elected an Honorary President of the Union in recognition of his services to U.R.S.I. and radio research over a considerable proportion of his active life in science and electrical engineering. His interest in U.R.S.I. was continued by his attendance at the Stockholm General Assembly in 1948.

Many of the older participants in the activities of U.R.S.I. will remember him as a very agreeable and modest colleague, who was always ready and willing to give advice and encouragement to the younger scientists with whom he came in contact on either a national or international level.

R. L. SMITH-ROSE.

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## NÉCROLOGIE

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### Ernst Metzler

C'est avec émotion que nous avons appris le décès du D<sup>r</sup> Ernst Metzler, Directeur du C.C.I.R. survenu le 20 juin 1963.

Le D<sup>r</sup> Metzler avait été élu Directeur du C.C.I.R. en 1956 au cours de la VIII<sup>e</sup> Assemblée plénière du C.C.I.R. C'est sous sa



direction que le C.C.I.R. a inclus à son programme l'étude de problèmes nouveaux et, notamment, celle des télécommunications spatiales.

Le D<sup>r</sup> Metzler était un grand ami de l'U.R.S.I. et nous nous rappelons la part active qu'il prit au cours des Assemblées Générales de notre Union en 1957 et en 1960. Nous espérons le compter parmi nous, à Tokyo, mais la Providence en a décidé autrement.

Que sa famille et ses collaborateurs trouvent ici l'expression de la part prise par l'U.R.S.I. dans la perte qu'ils viennent de subir.

## COMITÉS NATIONAUX

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### Pologne

#### SOCIÉTÉ POLONAISE D'ÉLECTROTECHNIQUE THÉORIQUE ET APPLIQUÉE

En 1961 a été fondée en Pologne une société savante ayant pour but la vulgarisation et le développement des recherches scientifiques dans le domaine des sciences électriques, telles que : radiotechnique, télécommunication, énergétique, automatique, électronique.

C'est la société : « Polskie Towarzystwo Elektrotechniki Teoretycznej i Stosowanej » (Société Polonaise d'Électrotechnique Théorique et Appliquée). Son siège se trouve à Varsovie et les sections territoriales sont établies dans des villes importantes, à savoir : Varsovie, Gdańsk, Gliwice, Cracovie, Łódź, Poznań et Wrocław.

L'activité de la Société comprend entre autres l'organisation de sessions scientifiques, des conférences, en coopération avec d'autres sociétés savantes du pays et celles de l'étranger, et la vulgarisation des réalisations dans le domaine des sciences électrotechniques.

Les sessions scientifiques sont organisées régulièrement par les sections territoriales. Pour les détails concernant les thèmes de ces sessions, ainsi que les autres formes d'activité de la Société, on peut s'adresser directement à Polskie Towarzystwo Elektrotechniki Teoretycznej i Stosowanej (Société Polonaise d'Électrotechnique Théorique et Appliquée) Zarząd Główny, Warszawa 1, Pałac Kultury i Nauki, 23 p.

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## COMMISSIONS ET COMITÉS

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### Commission V on Radio Astronomy

#### BIBLIOGRAPHY

The N.B.S. has issued the Technical Note n° 171 entitled : *Bibliography on Atmospheric Aspects of Radio Astronomy* including selected reference to related fields.

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### Comité U.R.S.I.-C.I.G.

#### PROCÈS-VERBAL DE LA TROISIÈME RÉUNION

(See English text, *Inf. Bull. n° 137, p. 32*)

Le Comité U.R.S.I.-C.I.G. a tenu sa troisième réunion lors de la seconde Assemblée C.I.G.-I.Q.S.Y. qui a eu lieu à Rome du 18 au 22 mars 1963.

Les membres du Comité U.R.S.I.-C.I.G. constituaient le noyau du Groupe de Travail pour l'Ionosphère à cette Assemblée, et plusieurs réunions ont eu lieu au cours desquelles a été examinée la totalité du programme ionosphérique pour les A.I.S.C. Le rapport détaillé de ces réunions sera publié séparément dans le *Bulletin d'Information de l'U.R.S.I.* et dans les *IQSY Notes*.

En outre, le Comité U.R.S.I.-C.I.G. a tenu des réunions les 21 et 22 mars 1963, au cours desquelles ont été examinées des questions autres que celles concernant les A.I.S.C. Le présent procès-verbal rend compte seulement de ces deux réunions.

Étaient présents :

Prof. W. J. G. BEYNON (*Président*),

M. G. M. BROWN (*Secrétaire*).

Madame BENKOVA,

Prof. W. DIEMINGER,

D<sup>r</sup> C. O. HINES,  
D<sup>r</sup> C. G. LITTLE,  
M. W. R. PIGGOTT,  
D<sup>r</sup> K. RAWER,  
M. A. H. SHAPLEY,  
M. J. VOGÉ,

et Mlle Pillet représentait le Secrétaire Général de l'U.R.S.I.

#### 1. — PUBLICATIONS

a) Les Consultants pour les vents et l'absorption, le D<sup>r</sup> Rawer et M. Piggott respectivement, ont rendu compte de l'état d'avancement actuel de la publication dans les *Annals of the I.G.Y* des données de l'A.G.I. et de la C.G.I. Les manuscrits sont presque complets et on espère que la publication sera terminée dans six mois environ.

Il a été convenu que les données de vents et d'absorption seraient publiées dans le même volume.

b) M. Shapley signale que la monographie contenant les comptes-rendus du Symposium sur les Sondages Ionosphériques de l'A.G.I.-C.G.I., qui a eu lieu à Nice en décembre 1961, n'a pas encore été envoyée à l'imprimeur. On pense que la rédaction sera terminée très prochainement. Le Président insiste pour que l'on s'efforce de publier ce volume avant l'Assemblée Générale de l'U.R.S.I. en septembre prochain.

c) On a discuté de l'avenir du Manuel U.R.S.I. des Stations Ionosphériques. M. Brown signale qu'il a récemment obtenu tous les détails des corrections et compléments qui ont été rassemblés par M. Beagley et le Prof. Wright, et qui doivent être réunis dans un Supplément au Manuel. L'opinion de plusieurs membres est que le Manuel devrait être mis à jour pour comporter, autant que possible, des renseignements sur les stations des A.I.S.C., et il a été convenu que la décision serait laissée au Président et au Secrétaire, après consultation du Secrétaire Général de l'U.R.S.I.

d) La publication d'un Atlas d'Ionogrammes remis à jour, proposée antérieurement, a été approuvée. Il a été entendu que le D<sup>r</sup> J. W. Wright préparait l'Atlas et que le D<sup>r</sup> Little devait demander s'il pourrait être publié par le C.R.P.L., à Boulder.

e) Après discussion, il a été admis que les Comptes-rendus des divers symposiums spécialisés consacrés aux résultats de l'A.G.I. et de la C.G.I. qui ont déjà eu lieu ou qui sont en projet, constituent la meilleure discussion de l'interprétation de ces résultats. La préparation de « volumes d'interprétation » ne semble donc pas nécessaire.

## 2. — FONCTIONNEMENT DES CENTRES MONDIAUX DE DONNÉES

Le Dr Dieminger, Rapporteur du C.I.G. pour l'Ionosphère, rend brièvement compte des décisions prises par le Groupe de Travail pour l'Ionosphère en ce qui concerne le fonctionnement des Centres Mondiaux de Données. Les recommandations du Groupe de Travail ont été approuvées (pour les détails, on est prié de se référer au rapport complet de la réunion de Rome qui doit être publié dans le *Bulletin d'Information de l'U.R.S.I.*)

## 3. — AVENIR DU COMITÉ DES SONDAGES MONDIAUX

A la suite d'une discussion sur l'avenir de ce sous-Comité, recommandation suivante est acceptée par le Comité :

Etant donné que le Comité des Sondages Mondiaux a maintenant achevé les travaux dont il a été chargé à l'origine, il est décidé de revenir à une organisation moins officielle pour guider le programme des sondages verticaux. La responsabilité des décisions et des mesures à prendre, de nature principalement scientifique ou technique, est donnée à un « Consultant » pour les sondages verticaux, qui peut demander l'avis de qui lui semble approprié, y compris les membres et consultants de l'ancien Comité des Sondages Mondiaux. En ce qui concerne plus spécialement les enregistrements, les responsabilités, au titre de l'U.R.S.I., de la conduite du programme des sondages verticaux et des mesures prises en relation avec les recommandations C.I.G.-I.Q.S.Y. et C.I.G. concernant l'échange des données et les publications, sont données au Centre Mondial de Données A, agissant sous la direction d'un Consultant.

Le Comité des Sondages Mondiaux est dissout comme tel, mais les membres et consultants sont instamment priés de continuer leur participation à la nouvelle organisation moins officielle. Les



réalisations du Comité des Sondages Mondiaux depuis sa création, en 1955, ont été de première importance et il a mérité à juste titre la gratitude de l'U.R.S.I., de l'organisation de l'A.G.I. et de tous les participants et utilisateurs des résultats du programme des sondages verticaux.

Il a été décidé à l'unanimité que M. W. R. Piggott était désigné comme Consultant pour les sondages verticaux dans le cadre indiqué ci-dessus.

Il a été aussi décidé que les deux sous-comités du Comité des Sondages Mondiaux, pour les profils ( $Nh$ ) et pour les Ionosondes, seraient maintenus et deviendraient maintenant des sous-comités du Comité U.R.S.I.-C.I.G. et référeraient à ce dernier par l'intermédiaire du Consultant pour les sondages verticaux.

#### 4. — CONSULTANTS POUR LES SUBDIVISIONS DE LA DISCIPLINE

Il a été jugé nécessaire de remettre à jour la liste des Rapporteurs pour les subdivisions de la Discipline pour le Comité. La liste suivante est considérée comme devant entrer en vigueur à dater de cette réunion, sous réserve de l'accord des personnes concernées et du Comité Exécutif de l'U.R.S.I. :

Sondages verticaux : M. W. R. PIGGOTT.

Absorption A 1 et A 3 : D<sup>r</sup> K. RAWER.

Absorption A 2 : D<sup>r</sup> C. G. LITTLE.

Vents : Prof. R. W. H. WRIGHT.

Bruit Atmosphérique radioélectrique : M. F. HORNER.

Sifflements et Emissions TBF : Prof. R. A. HELLIWELL ; D<sup>r</sup> G. M.

ALLCOCK.

Fusées et Satellites : D<sup>r</sup> H. E. NEWELL.

#### 5. — MEMBRES DU COMITÉ

Il a été approuvé d'appuyer la résolution du Bureau du Comité U.R.S.I.-C.I.G., en date de décembre 1962, d'inviter l'U.R.S.I. à compléter le Comité U.R.S.I.-C.I.G. par les Membres suivants :

D<sup>r</sup> G. M. ALLCOCK (Nouvelle Zélande).

D<sup>r</sup> T. R. KAISER (Royaume-Uni).

Prof. E. LAUTER (République Démocratique d'Allemagne).

D<sup>r</sup> P. M. MILLMAN (Canada).

Prof. R. W. H. WRIGHT (Jamaïque).

En outre, il a été convenu que Madame Benkova remplacerait le D<sup>r</sup> Pushkov.

#### 6. — RÉUNIONS DU COMITÉ A TOKYO

Une ou deux réunions du Comité U.R.S.I.-C.I.G. ont été prévues au cours de la XIV<sup>e</sup> Assemblée Générale de l'U.R.S.I. qui doit se tenir à Tokyo en septembre 1963. Le D<sup>r</sup> Dieminger rappelle qu'il serait nécessaire, à ce moment, d'examiner les programmes envisagés pour les A.I.S.C. en ce qui concerne les sifflements et émissions TBF, et les observations en incidence oblique et en rétro-diffusion, puisqu'il n'a pas été possible de les discuter à la Seconde Assemblée C.I.G.-I.Q.S.Y.

Il a été convenu que toutes suggestions pour le programme de ces réunions seraient envoyées directement au Secrétaire.

Geoffrey M. BROWN.

Secrétaire.

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## Comité de l'U.R.S.I. pour les Travaux du C.C.I.R.

### RAPPORT DE LA DÉLÉGATION DE L'U.R.S.I.

#### A L'ASSEMBLÉE PLÉNIÈRE DU C.C.I.R.

GENÈVE, 1963

par B. DECAUX,

Président du Comité et de la délégation

Le Comité de l'U.R.S.I. pour les travaux du C.C.I.R. avait établi, à la suite de l'Assemblée Générale de Londres 1960, un rapport (publié dans le *Bulletin de l'U.R.S.I.*, n° 122) qui fut transmis au C.C.I.R. Il contenait un certain nombre de réponses aux problèmes soumis à l'U.R.S.I. par le C.C.I.R. à son Assemblée Plénière de Los Angeles, 1959. Diverses contributions furent également présentées par l'U.R.S.I. aux réunions intérimaires des Commissions d'Etudes du C.C.I.R. en 1962 ; un dernier document (n° 271) fut

soumis au C.C.I.R. à Genève même, sur la « directivité à grande distance des antennes en ondes décamétriques ».

La délégation de l'U.R.S.I. a tenu à Genève deux réunions, les 18 janvier et 12 février, en présence du Dr Smith-Rose, Président de l'U.R.S.I. Y assistaient, en plus des délégués de l'U.R.S.I. représentant les Comités Nationaux suivants : Australie, Canada, Danemark, Espagne, Etats-Unis, France, Italie, Japon, Pays-Bas, Pérou, Pologne, Royaume-Uni, Suède, Suisse, U. R. S. S., un certain nombre d'observateurs.

A la première séance furent évoqués divers points que le regretté Dr J. H. Dellinger avait déjà mis en lumière à Los Angeles (*C. R. Ass. Gles U.R.S.I.*, vol. XII, fasc. 8, 96-120). Ils furent ensuite longuement discutés au cours des deux séances. Le problème des réponses que l'U.R.S.I. devrait donner aux questions que pose le C.C.I.R. présente certaines difficultés. Tout d'abord ces questions ne sont pas toujours exprimées de façon assez claire et explicite pour que les Commissions de l'U.R.S.I. puissent les étudier à fond et leur apporter une réponse nette. La collaboration de l'U.R.S.I. est souvent sollicitée sans indication de la forme qu'elle devrait recevoir. D'autre part les préoccupations des deux organismes ne sont pas les mêmes et souvent il se glisse un certain malentendu dans leurs relations. L'U.R.S.I. envisage seulement l'aspect scientifique des problèmes, tandis que le C.C.I.R. doit considérer surtout leurs répercussions sur les règles d'exploitation. Enfin le travail cesse complètement entre les Assemblées Générales.

Il est donc souhaitable que les questions soient posées convenablement à l'U.R.S.I., qu'elles soient aiguillées vers les Commissions compétentes et que, dans celles-ci, les problèmes soient examinés avec soin, dans la perspective des applications aux cas concrets qu'étudie le C.C.I.R.

C'est pourquoi il a été suggéré de demander aux Présidents de Commission, tant à l'U.R.S.I. qu'au C.C.I.R., de désigner des « correspondants » susceptibles de veiller à la rédaction correcte des questions posées à l'U.R.S.I., d'orienter vers les Commissions compétentes les demandes et les réponses, et de préparer leur étude. En cas de besoin, les Commissions de l'U.R.S.I. pourraient constituer de petits groupes de travail spécialisés, travaillant entre les Assemblées Générales, et chargés d'établir les réponses ; celles-ci seraient transmises au C.C.I.R. en temps utile pour les réunions

intérimaires de ses Commissions d'Etudes. Les groupes de travail pourraient établir des rapports qui seraient publiés dans les Volumes du C.C.I.R. Une Commission d'Etudes du C.C.I.R. a même souhaité l'organisation de réunions mixtes U.R.S.I.-C.C.I.R. à l'occasion des réunions intérimaires des Commissions d'Etudes du C.C.I.R. La centralisation et la coordination de toutes ces opérations seraient assurées par le Comité U.R.S.I. pour les travaux du C.C.I.R. De plus la désignation des « correspondants » s'effectuerait par l'intermédiaire des Secrétariats des deux organismes. L'intérêt d'une telle organisation a été jugé suffisant pour que l'ensemble de ces problèmes soit porté à l'ordre du jour du Comité Exécutif de l'U.R.S.I. à Tokyo.

A la deuxième réunion de la délégation furent examinés un certain nombre de documents qui venaient d'être adoptés par le C.C.I.R. et concernant d'une façon ou d'une autre l'U.R.S.I. Après classement et numérotation définitive, les titres de ces textes sont joints au présent rapport, classés en trois catégories et suivis de brefs commentaires.

- I. documents demandant explicitement la collaboration de l'U.R.S.I. ; les plus importants seront communiqués aux Présidents des Commissions intéressées ;
- II. documents intéressant l'U.R.S.I. mais ne la citant pas ;
- III. documents faisant seulement référence à des publications de l'U.R.S.I.

Pour conclure, il y a lieu de remarquer combien la collaboration entre les deux organismes internationaux se développe et prend de l'importance. A maintes reprises il a été souligné que l'U.R.S.I. peut apporter au C.C.I.R. une aide efficace en lui fournissant des arguments scientifiques pour ses études et l'élaboration de ses recommandations. En retour l'U.R.S.I. peut signaler au C.C.I.R. l'intérêt de certaines dispositions intéressantes pour la recherche scientifique, dont la protection des fréquences pour la radioastronomie n'est qu'un seul exemple. Le Comité de l'U.R.S.I. pour les travaux du C.C.I.R. (dont chacun des membres participe d'ailleurs aux deux organismes) s'efforcera d'améliorer progressivement cette collaboration et de la rendre encore plus féconde.

**Documents adoptés par l'Assemblée Plénière du C.C.I.R.  
à Genève, 1963**

**I. — DOCUMENTS DEMANDANT EXPLICITEMENT LA COLLABORATION  
DE L'U.R.S.I.**

(Les documents marqués d'un astérisque \* seront communiqués  
aux Présidents des Commissions intéressées)

Commissions d'Etudes du C.C.I.R.		Commissions de l'U.R.S.I. intéressées
III	<p>PROGRAMME D'ETUDES n° 133 A (Doc. 2140) <i>Théorie des Communications</i></p> <p>Etude à conduire en liaison avec l'U.R.S.I. sur les méthodes de la théorie des communications les plus susceptibles d'applications pratiques, en particulier recherche de codes permettant une économie de largeur de bande ou de durée de transmission.</p>	VI
III	<p>RÉSOLUTION n° 1 (Doc. 2301) <i>Utilisation optimale du spectre radioélectrique</i></p> <p>Il s'agit d'étudier les rapports de protection et les intensités de champ nécessaires pour divers types de service. Cette Résolution est portée à la connaissance de l'U.R.S.I.</p>	VI
IV	<p>*QUESTION n° 239 (Doc. 2168) <i>Influence du plasma dans les liaisons avec des engins spatiaux</i></p> <p>Portée à la connaissance de l'U.R.S.I., cette Question soulève le problème de la formation du plasma autour d'un engin et ses influences sur le fonctionnement des télécommunications, surtout au moment de la rentrée dans l'atmosphère. Le choix des fréquences est également en cause.</p>	II, V, VI, SRR

Commissions d'Etudes du C.C.I.R.		Commissions de l'U.R.S.I. intéressées
IV	<p>RAPPORT n° 222 (Doc. 2169)</p> <p><i>Facteurs dont dépend le choix des fréquences à employer pour communiquer avec les engins spatiaux pendant leur rentrée dans l'atmosphère terrestre.</i></p> <p>Le rapport envisage, parmi ceux de la Question précédente, le problème particulier du choix des fréquences et donne quelques conclusions.</p> <p>Il est signalé à l'attention de l'U.R.S.I.</p>	II, V, VI, SRR
V	<p>*PROGRAMME D'ETUDES n° 192 (Doc. 2012)</p> <p><i>Influence des régions non-ionisées de l'atmosphère sur la propagation des ondes.</i></p> <p>Les études doivent porter sur les variations fines de l'indice de réfraction de l'air et leur corrélation avec divers paramètres. Il est demandé à l'U.R.S.I. de poursuivre de toute urgence cette étude sur les plans théorique et expérimental. Une formule donnant l'indice de réfraction est suggérée.</p>	I, II
V	<p>*RAPPORT n° 232 (Doc. 2021)</p> <p><i>Constantes de l'équation donnant l'indice de réfraction radioélectrique.</i></p> <p>Il est suggéré que la formule indiquée dans le document précédent soit adoptée par l'U.R.S.I. à la place de celle que l'U.R.S.I. a recommandée en 1960.</p> <p>Ce rapport sollicite les observations de l'U.R.S.I.</p>	I, II
VI	<p>VŒU n° 10 (Doc. 2026).</p> <p><i>Evanouissements de signaux se propageant par l'ionosphère.</i></p> <p>La question est posée à l'U.R.S.I. de définir les phénomènes fondamentaux qui provo-</p>	III

Commissions d'Etudes du C.C.I.R.		Commissions de l'U.R.S.I. intéressées
VI	<p>quent les évanouissements, et les méthodes expérimentales permettant de distinguer les diverses catégories d'évanouissements.</p> <p>*RAPPORT n° 266 (Doc. 2104) <i>Etude des évanouissements des signaux se propageant par l'ionosphère.</i></p> <p>Ce volumineux rapport explicite les différents termes du Vœu précédent et en renvoie l'étude à l'U.R.S.I. Il comporte une abondante bibliographie.</p>	III
VI	<p>*QUESTION n° 248 (Doc. 2386) <i>Problèmes particuliers aux radiocommunications en ondes décamétriques, liés à l'ionosphère équatoriale.</i></p> <p>Considérant les phénomènes particuliers à la propagation au voisinage de l'équateur magnétique et leurs effets dans diverses conditions, ce document attire particulièrement l'attention de l'U.R.S.I. sur l'étude des processus physiques mis en jeu.</p>	III
VI	<p>VŒU n° 6 (rappel Rés. 45) <i>Identification des signes précurseurs de variation à court terme dans les conditions de propagation ionosphérique.</i></p> <p>La question est posée à l'U.R.S.I. de définir les phénomènes permettant de prévoir les variations à court terme, plus particulièrement les tempêtes ionosphériques.</p>	III
IV, VI	<p>VŒU n° 9 (rappel Rés. 47) <i>Effets de l'ionosphère sur les ondes radio-électriques utilisées pour les télécommunications avec ou entre les véhicules spatiaux évoluant au-delà de la basse atmosphère.</i></p> <p>Question posée à l'U.R.S.I. Divers effets de l'ionosphère. Choix des fréquences émises par les satellites pour étudier l'ionosphère.</p>	III, VI, SRR

Commissions d'Études du C.C.I.R.		Commissions de l'U.R.S.I. intéressées
VII	<p>RÉSOLUTION n° 14 (Doc. 2187).</p> <p><i>Emissions de fréquences étalon et de signaux horaires.</i></p> <p>La collaboration de l'U.R.S.I. est demandée pour l'amélioration de ces services.</p>	I
VII	<p>RAPPORT n° 267 (Doc. 2264).</p> <p><i>Fréquences étalon et signaux horaires.</i></p> <p>Rapport d'ensemble exposant les progrès obtenus en particulier dans la précision, et la réduction des brouillages. Ces travaux sont liés à ceux de l'U.R.S.I. et il est suggéré d'organiser des discussions en commun entre représentants du C.C.I.R. et représentants de l'U.R.S.I. (voir Avis n° 374).</p>	I

II. — DOCUMENTS INTÉRESSANT L'U.R.S.I.

SANS QUE SA COLLABORATION SOIT EXPLICITEMENT SOLLICITÉE

Commissions d'Études du C.C.I.R.		Commissions de l'U.R.S.I. intéressées
I, III	<p>RAPPORT n° 178 (Doc. 2069).</p> <p><i>Possibilités de réduction des brouillages et de mesure des spectres en trafic réel.</i></p> <p>Exposé des méthodes de mesure. Réduction de la largeur du spectre; meilleure adaptation des émetteurs et des récepteurs.</p>	VI
III	<p>RAPPORT n° 196 (Doc. 2142).</p> <p><i>Quelques aspects de l'application de la théorie des communications.</i></p> <p>Exposé de théories et de résultats dans l'étude de « la relation entre le retard accep-</p>	VI



Commissions d'Études du C.C.I.R		Commissions de l'U.R.S.I. inréréssées
V	<p>table et l'incertitude résiduelle, et mesure dans laquelle cette relation dépend de l'utilisation de la largeur de bande ».</p> <p>PROGRAMME D'ETUDES n° 246 B (Doc. 2011). <i>Propagation de l'onde de sol sur terrain non homogène.</i></p> <p>Il s'agit de méthodes de mesure et des variations de la constante diélectrique et de la conductibilité équivalentes.</p>	II
VI	<p>RÉSOLUTION n° 5 (Doc. 2027). <i>Amélioration du réseau des stations de sondage ionosphérique.</i></p> <p>On souhaite le développement des réseaux existants et l'échange de données.</p>	III, CIG
VII	<p>RAPPORT n° 270 (Doc. 2096). <i>Economie du spectre de fréquences pour les signaux horaires de haute précision.</i></p> <p>Diverses méthodes ont été étudiées, par exemple le LORAN C et les impulsions en sinus carré.</p>	I
VII	<p>Avis n° 374 (Doc. 2188). <i>Emissions de fréquences étalon et de signaux horaires.</i></p> <p>Cet Avis recommande diverses caractéristiques que doivent remplir les émissions, et leur précision.</p>	I

III. — DOCUMENTS DANS LESQUELS IL EST FAIT RÉFÉRENCE  
A DES PUBLICATIONS DE L'U.R.S.I.

Commissions d'Etudes du C.C.I.R.	
IV	<p>RAPPORT n° 215 (Doc. 2345). Possibilité de faire des émissions de radiodiffusion sonore ou visuelle directes à partir de satellites.</p>

Commissions d'Etudes du C.C.I.R.	
VI	AVIS n° 373 (Doc. 2023). Signification du terme « MUF ».
VI	VŒU n° 8 (Doc. 2031). Propagation guidée des ondes décamétriques au-dessus de la couche F2.
VI	RAPPORT n° 259 (Doc. 2044). Propagation à grande distance par les régions ionisées E et F des ondes de fréquence comprise entre 30 MHz et 300 MHz.
VI	RAPPORT n° 248 (Doc. 2045). Disponibilité et échange de données de base pour les prévisions concernant la propagation.
VI	RAPPORT n° 260 (Doc. 2083). Propagation par diffusion ionosphérique.
VI	RAPPORT n° 262 (Doc. 2105). Propagation par le mode des sifflements.
VI	RAPPORT n° 247 (Doc. 2192). Identification des signes précurseurs de variations à court terme et évaluation de la fiabilité des prévisions à court terme des conditions de propagation ionosphériques.
VI	RAPPORT n° 265 (Doc. 2339). Propagation à grande distance de l'onde d'espace aux fréquences inférieures à 150 kHz.
VI	RAPPORT n° 264 (Doc. 2368). Prévisions de l'intensité de champ de l'onde d'espace ou de l'affaiblissement de transmission pour les fréquences comprises entre 150 et 1500 kHz.

PROGRAMME D'ETUDES 192 (V) <sup>(1)</sup>

**Influence des régions non-ionisées de l'atmosphère  
sur la propagation des ondes**

(Genève, 1951 — Londres, 1953 — Varsovie, 1956 —  
Los Angeles, 1959 — Genève, 1963)

Le C.C.I.R.,

*Considérant*

- a) qu'il est bien connu que la propagation des ondes radioélectriques est fonction des conditions thermodynamiques qui règnent dans l'atmosphère et que de nombreuses études ont été faites à ce sujet ;
- b) que la structure fine du champ dans le temps et dans l'espace n'est pas encore assez connue et que le manque de mesures appropriées ne permet pas d'expliquer dans le détail les caractéristiques de la propagation des ondes radioélectriques sur la base des théories actuelles ;
- c) que les études de propagation nécessaires à l'établissement d'une liaison radioélectrique de longueur quelconque nécessitent une connaissance statistique du milieu de propagation, c'est-à-dire de l'atmosphère ;
- d) que les progrès accomplis dans l'étude de cette propagation ont déjà conduit aux Avis 369 et 370 ;

*décide à l'unanimité* qu'il y a lieu d'effectuer les études suivantes :

1. variations fines de l'indice de réfraction de l'air dans l'espace et le temps ;
2. élaboration de méthodes améliorées pour l'étude des irrégularités des propriétés thermodynamiques de l'atmosphère, en mettant l'accent plus particulièrement sur des appareils tels que les réfractomètres, les thermomètres, les hygromètres et les radars (voir le par. 1 de l'Annexe) ;

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<sup>(1)</sup> Ce Programme d'études, qui remplace le Programme d'études 138, ne dérive d'aucune Question actuellement à l'étude.

3. répartition statistique et géographique de la vapeur d'eau, de l'oxygène, des nuages, de la pluie, de la neige, des brouillards et du sable, dans l'atmosphère ;
4. soumission, par les services de télécommunication nationaux, de données complémentaires sur  $N_s$ ,  $N_o$  et  $\Delta N$ , afin de compléter les travaux relatifs à la climatologie mondiale sur la base de l'indice de réfraction, travaux décrits dans le Rapport 233 (voir l'Annexe) ;
5. application à la propagation des ondes radioélectriques, de paramètres radiométéorologiques autres que ceux énumérés ci-dessus ;
6. corrélation entre, d'une part, les différents paramètres radiométéorologiques applicables à diverses conditions climatologiques et, d'autre part, les caractéristiques de l'affaiblissement de transmission, exprimées par leur valeur médiane, leur gamme de variation, leur vitesse de variation et la distorsion subie par les signaux ;
7. vérification, par les administrations et les exploitations privées, au moyen de mesures nombreuses, fines et précises, des différentes théories avancées pour expliquer la propagation.

*Note 1.* — Il y a lieu d'inciter les administrations nationales, l'U.R.S.I. et les autres organisations internationales, à poursuivre de toute urgence l'étude théorique et expérimentale de la propagation des ondes dans l'atmosphère.

*Note 2.* — Ce Programme d'Etudes, qui tient compte des Recommandations 4 et 5 de la Commission d'aérodologie de l'O.M.M., devra être porté par le Directeur du C.C.I.R. à la connaissance de l'O.M.M., l'attention de l'O.M.M. étant plus spécialement attirée sur les § 1, 2 et 3.

#### ANNEXE

1. — Les mesures thermodynamiques devant conduire au calcul de l'indice de réfraction de l'air et de son gradient devraient, si possible, être effectuées en des points espacés au maximum de 10 m et être obtenues avec une précision au moins égale aux valeurs suivantes :

température :  $\pm 0,2^\circ \text{C}$ ,

humidité (mesurée en rapport de mélange) :  $\pm 0,1$  g/kg.

Il serait d'ailleurs souhaitable de disposer d'appareils à mesures continues.

2. — Le paramètre  $N = (n - 1) \cdot 10^6$  est donné par la formule :

$$N = \frac{77,6}{T} \left( p + 4810 \frac{e}{T} \right);$$

$n$  = indice de réfraction de l'air ;

$T$  = température absolue ( $^{\circ}\text{K}$ ) ;

$e$  = tension de vapeur d'eau (mb) ;

$p$  = pression atmosphérique totale (mb).

Les renseignements fournis devront, si possible, porter sur une période de cinq années au moins.

On admettra que les saisons pourront être représentées par les mois de février, mai, août, et novembre, et les heures de mesures seront, si possible, les heures paires, en heures du méridien local. Comme la détermination de  $\Delta N$  dépend des données fournies par les ascensions de radiosondes, les heures correspondantes seront nécessairement utilisées, bien que l'on doive faire tous ses efforts pour rendre ces mesures aussi nombreuses que possible.

3. —  $N_s$  est la valeur de  $N$  à la surface de la terre. La formule donnant  $N_0$  est indiquée dans le Rapport ... (Annexe 5/23).  $\Delta N$  est la différence entre la valeur de  $N$  à la hauteur de 1 km au-dessus de la surface terrestre d'une part, et  $N_s$  d'autre part.

#### QUESTION 239 (IV) (1)

##### **Influences du plasma dans les liaisons avec des engins spatiaux**

(Genève, 1963)

Le C.C.I.R.,

*considérant*

- a) que l'on a observé que le plasma ionosphérique a une influence considérable sur le fonctionnement des antennes d'émission et de réception à bord de fusées et d'engins spatiaux ;

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(1) Cette Question conjointement avec le Programme d'études 205 (VI) remplace la Question 212 et le Programme d'études 173.

*Note.* — La Question ci-dessus devrait être portée à l'attention de l'U.R.S.I. par le Directeur du C.C.I.R.

- b) que le plasma produit par onde de choc, lors de la rentrée d'un engin spatial dans l'atmosphère terrestre, peut avoir une influence analogue ;

*décide à l'unanimité* qu'il y a lieu d'étudier la question suivante :

1. quelles sont les influences du plasma environnant sur le fonctionnement des émetteurs et récepteurs de bord, et en particulier des antennes, compte tenu des expériences de laboratoire et des mesures directes ;
2. quels sont les facteurs qui déterminent la formation du plasma induit et sa structure autour d'un engin spatial ;
3. quels sont les problèmes de télécommunications (propagation des ondes et bruit) qui se posent par l'effet du plasma (en particulier lors de la rentrée dans l'atmosphère terrestre) ;
4. quelle est l'influence de ces éléments sur le choix des fréquences utilisables, en particulier lors de la rentrée d'un engin spatial dans l'atmosphère terrestre ?

#### RÉSOLUTION 1 <sup>(1)</sup>

##### **Utilisation optimum du spectre radioélectrique**

(Genève, 1963)

Le C.C.I.R. :

*considérant*

- a) que les renseignements dont on dispose sur les rapports de protection signal désiré/signal non désiré et sur la sensibilité de fonctionnement des systèmes de réception ont encore besoin d'être précisés pour chacun des services, afin de permettre une planification des plus efficaces de l'utilisation du spectre radio-électrique ;
- b) que, dans l'avenir, il sera nécessaire de prévoir l'utilisation simultanée du spectre par un plus grand nombre d'utilisateurs ;

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<sup>(1)</sup> Cette Résolution répond aux Recommandations 2 et 3 de la Conférence administrative des radiocommunications (Genève, 1959).

c) que, pour desservir ces usagers additionnels sans qu'il en résulte une dégradation importante des services actuels, il sera nécessaire de bien tenir compte de tous les facteurs techniques qui entrent en jeu dans l'utilisation simultanée de systèmes susceptibles de causer des brouillages ;

*décide à l'unanimité*

1. qu'un groupe international d'experts du C.C.I.R. <sup>(1)</sup>, qui serait représentatif des Commissions d'études intéressées à ce problème, devrait être créé, avec mission d'établir un rapport sur les définitions et les méthodes dont la mise à disposition des diverses Commissions d'études du C.C.I.R. devrait conduire à l'obtention de renseignements plus précis sur :

- les rapports de protection signal/brouillage requis ;
- les intensités de champ minima nécessaires pour divers types de services ;

ce qui permettra une utilisation optimum du spectre radio-électrique par le plus grand nombre d'usagers agissant simultanément ;

2. que les travaux de ce groupe soient coordonnés par la Commission d'études III ;

3. que les travaux de ce groupe se fassent autant que possible par correspondance.

*Note.* — Le Directeur du C.C.I.R. est prié de porter cette Résolution à la connaissance de l'U.R.S.I.

#### QUESTION 248 (VI)

##### **Problèmes particuliers aux radiocommunications en ondes décimétriques liés à l'ionosphère équatoriale**

Le C.C.I.R.,

*considérant*

que l'on sait que les radiocommunications en ondes décimétriques, sur des trajets qui traversent l'équateur magnétique ou qui le suivent de près, sont sujettes à certaines difficultés liées à l'ionosphère équatoriale ;

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<sup>(1)</sup> Les Administrations suivantes à l'I.F.R.B. ont déjà fait savoir qu'elles étaient prêtes à participer au groupe de travail : Etats-Unis (Président), France, Japon, Pays-Bas, R. F. d'Allemagne, Royaume-Uni, U. R. S. S.

*décide à l'unanimité* de mettre à l'étude la question suivante :

1. quels sont les phénomènes particuliers à la propagation ionosphérique à l'équateur magnétique ou en son voisinage ;
2. quels sont les effets de ces phénomènes sur les radiocommunications, considérées en fonction :
  - de la classe d'émission,
  - des caractéristiques des antennes,
  - de la fréquence,
  - de l'emplacement géographique, de l'orientation et de la longueur du trajet de propagation,
  - du moment de la journée, du mois et de l'activité solaire ;
3. quels sont les processus physiques mis en jeu ? <sup>(1)</sup>

VŒU 10

**Evanouissements de signaux se propageant par l'ionosphère**  
(Genève, 1963)

Le C.C.I.R.,  
*considérant*

- a) qu'un Groupe de travail international spécial a été constitué en application du Vœu 49 <sup>(2)</sup> pour étudier les aspects des phénomènes d'évanouissements qui présentent de l'intérêt pour le C.C.I.R. ;
- b) que la connaissance des phénomènes de base qui interviennent dans les évanouissements facilitera grandement la spécification des mesures à prendre pour contrebattre les effets de ces évanouissements ;

*émet à l'unanimité le vœu* que la question suivante soit posée à l'U.R.S.I. :

1. quels sont les phénomènes fondamentaux qui provoquent les évanouissements des signaux radioélectriques se propageant par l'ionosphère, y compris :
  - les variations de l'absorption,

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<sup>(1)</sup> Le Directeur du C.C.I.R. est prié de bien vouloir transmettre cette question à l'U.R.S.I. pour avis, en attirant particulièrement l'attention de cet organisme sur le § 3.

<sup>(2)</sup> Ce Vœu a été supprimé.



- les phénomènes de focalisation et de défocalisation,
  - les changements de polarisation,
  - la propagation par trajets multiples ;
2. quelle est l'importance relative de chacun de ces facteurs dans le mécanisme des évanouissements et quelles sont les caractéristiques distinctives des évanouissements associés à chacun de ces facteurs ;
3. quelles méthodes expérimentales peut-on employer pour faire la distinction entre les diverses catégories d'évanouissements, à savoir :
- les évanouissements dus à l'absorption,
  - les évanouissements dus à la focalisation,
  - les évanouissements dus à la polarisation,
  - les évanouissements dus à la propagation par trajets multiples ?

RAPPORT 232 (1)

**Constantes de l'équation donnant l'indice  
de réfraction radioélectrique**

(Genève, 1963)

Dans l'Annexe au Programme d'études 192 (V), le C.C.I.R. indique pour le paramètre  $N = (n - 1) \cdot 10^6$  la formule suivante :

$$N = (77,6/T) (p + 4810 e/T) ;$$

$n$  = indice de réfraction de l'air ;

$T$  = température absolue (°K) ;

$e$  = tension de vapeur d'eau (mb) ;

$p$  = pression atmosphérique totale.

Cette formule a déjà été largement utilisée par le C.C.I.R., notamment en liaison avec le Rapport 233.

Au cours des Assemblées générales de l'U.I.G.G. (Helsinki, 1960) et de l'U.R.S.I. (Londres, 1960) on a recommandé des formules

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(1) Ce Rapport a été adopté à l'unanimité.

légèrement différentes utilisant d'autres unités. Une étude [1] indique que le C.C.I.R. doit continuer à utiliser la formule qu'il a établie avec les unités indiquées ci-dessus. Elle semble être un peu plus exacte que la formule de l'U.R.S.I. et de l'U.I.G.G. ; de toute façon, elle convient parfaitement aux besoins du C.C.I.R. dans la détermination de l'indice de réfraction radioélectrique de l'atmosphère, étant donné les erreurs commises dans les mesures de la température, de la pression atmosphérique et de la tension de vapeur d'eau.

Il semble souhaitable que toutes les organisations adoptent une formule unique avec des unités identiques et homogènes.

*Note.* — Ce Rapport devrait être porté, par le Directeur du C.C.I.R. à la connaissance de l'U.I.G.G. et de l'U.R.S.I., pour observations.

#### BIBLIOGRAPHIE

1. BEAN, B. R. — The refractive index of air. *Proc. I. R. E.*, Vol. 50, 3, 260-273 (mars 1962).

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**U.R.S.I. Committee for C.C.I.R. Work**

**REPORT OF THE U.R.S.I. DELEGATION  
TO THE PLENARY ASSEMBLY OF THE C.C.I.R.  
GENEVA, 1963**

by B. DECAUX,

Chairman of the Committee and of the Delegation

(*Translation*)

The U.R.S.I. Committee for C.C.I.R. Work had drafted, after the London General Assembly, 1960, a report (published in the *U.R.S.I. Information Bulletin*, n° 122) which was sent to the C.C.I.R. This report gave some answers to findings of the C.C.I.R. Plenary Assembly of Los Angeles, 1959. Various papers were also submitted by U.R.S.I. to the interim meetings held in 1962 by C.C.I.R.

Study Groups ; a last document (n° 271) was submitted in Geneva on « great distance directivity of decametric waves ».

The U.R.S.I. delegation held two meetings in Geneva, on January 18 and February 12. Dr R. L. Smith-Rose, President of U.R.S.I., was present and also representatives of the following U.R.S.I. National Committees : Australia, Canada, Denmark, France, Italy, Japan, Netherlands, Peru, Poland, Spain, Sweden, Switzerland, U. K., U. S. A. and U. S. S. R. ; some observers attended also the meetings.

At the first session some items were mentioned which had been raised at Los Angeles by the late Dr J. H. Dellinger (Proceedings of the U.R.S.I. General Assemblies, Vol. XII, p. 8, 90-112, 1960). Those items were discussed during both sessions. The problem of replies that U.R.S.I. should give to C.C.I.R. questions meets with some difficulties. At first the questions are not always expressed in a sufficiently clear and explicit way in order to allow U.R.S.I. Commissions to thoroughly investigate them and to give a clear answer. U.R.S.I. collaboration is often asked for without indication on the form it should be given. On the other hand, the aims of the two organizations are not the same and often misunderstanding might arise. U.R.S.I. considers only the scientific aspect of the problems, while C.C.I.R. has to consider mainly their influence on the working rules. And then the work stops completely inbetween General Assemblies.

It is most desirable that the questions should be put to U.R.S.I. in a suitable way, that they should be forwarded to the qualified Commissions and that, in those Commissions, the problems be carefully considered in view of their application to the specific cases investigated by C.C.I.R.

For the above mentioned reasons it is suggested to ask U.R.S.I. Commission and C.C.I.R. Study Group Chairmen to appoint « consultants » able to take care of the precise drafting of questions asked to U.R.S.I., to forward to the qualified Commissions the questions and answers, and to prepare their study. When needed U.R.S.I. Commissions should appoint small specialized working groups, active inbetween General Assemblies and entrusted with the drafting of answers ; these should be forwarded to C.C.I.R. in due time for the interim meetings of the Study Groups. The

working groups should draft reports to be published in the C.C.I.R. Volumes. It should be noted that a C.C.I.R. Study Group expressed the desirability of joint U.R.S.I.-C.C.I.R. meetings using the opportunity of interim meetings of C.C.I.R. Study Groups. Centralisation and co-ordination of all the actions should be done by the U.R.S.I. Committee for C.C.I.R. Work. Moreover the appointment of « consultants » should be carried out through the secretariats of the two agencies. The interest of such organization is felt as important enough to ask that the whole problem be added to the Agenda of the meeting of the U.R.S.I. Executive Committee in Tokyo.

During the second session, the delegation considered a certain number of documents which had been adopted by the C.C.I.R. concerning U.R.S.I. in one way or the other. After classification and final numbering the titles of such texts are appended to the present report under three categories and each of them is followed by short comments :

- I. documents asking explicitly for U.R.S.I. collaboration ; the most important will be distributed to the Chairmen of the interested Commissions ;
- II. documents interesting U.R.S.I. but not explicitly for its collaboration ;
- III. documents referring to U.R.S.I. publications.

Concluding, it should be noted that the collaboration between the two international organizations is developing and taking importance. On several occasions it has been underlined that U.R.S.I. can bring an efficient help to C.C.I.R. providing scientific opinions for its investigations and for the drafting of its recommendations. On the other hand, U.R.S.I. is able to inform the C.C.I.R. of the interest of some scientific provisions interesting scientific research, one single example is the protection of frequencies for radio astronomy. The U.R.S.I. Committee for C.C.I.R. Work (of which each member is participating to both organizations) will try to improve step by step this collaboration and to make it more fruitful.

Documents adopted by the C.C.I.R. Plenary Assembly,  
Geneva, 1963

I. — DOCUMENTS ASKING EXPLICITLY  
FOR U.R.S.I. COLLABORATION

Documents marked by \* will be sent to the Chairmen  
of the interested Commissions

C.C.I.R. Study Groups		Interested U.R.S.I. Commissions
III	<p>STUDY PROGRAMME n° 133 A (Doc. 2140). <i>Communication Theory</i></p> <p>Study to be carried in connection with U.R.S.I., on the methods of the communication theory which are the most suitable for practical applications, particularly investigations allowing a bandwidth or a transmission time economy.</p>	VI
III	<p>*RESOLUTION n° 1 (Doc. 2301). <i>Optimum use of the radio frequency spectrum</i></p> <p>Study of the protection rates and of the field strengths needed for the various service systems. Attention of U.R.S.I. is drawn to this Resolution.</p>	VI
IV	<p>*QUESTION n° 239 (Doc. 2168). <i>Effects of plasma on communications with spacecraft.</i></p> <p>This question, which is forwarded to U.R.S.I., raises the problem of plasma originating in the vicinity of a craft and of its effects on telecommunications particularly when the craft re-enters the atmosphere. The choice of frequencies is also involved.</p>	II, V, VI, SRR

C.C.I.R. Study Groups		Interested U.R.S.I. Commissions
IV	<p>REPORT n° 222 (Doc. 2169).</p> <p><i>Factors affecting the selection of frequencies for telecommunications with spacecraft re-entering the earth's atmosphere.</i></p> <p>The report considers, among the problems of the preceding Question, the particular problem of the choice of frequencies and gives some conclusions.</p> <p>Attention of U.R.S.I. is called to this Report.</p>	II, V, VI, SRR
V	<p>*STUDY PROGRAMME n° 192 (Doc. 2012).</p> <p><i>Influence of non-ionized regions of the atmosphere on wave propagation.</i></p> <p>Investigations should deal with the fine variations of the atmosphere refractive index and with their correlation with various parameters. U.R.S.I. is asked to pursue, as soon as possible, this study on theoretical and experimental levels. A formula giving the refractive index is suggested.</p>	I, II
V	<p>*REPORT n° 232 (Doc. 2021).</p> <p><i>Constants in the equation for the radio refractive index.</i></p> <p>It is suggested that U.R.S.I. adopt the formula of the preceding document instead of the formula recommended by U.R.S.I. in 1960.</p> <p>The report is asking for the comments of U.R.S.I.</p>	I, II
VI	<p>*OPINION n° 10 (Doc. 2026).</p> <p><i>Fading of signal propagated by the ionosphere.</i></p> <p>U.R.S.I. is asked to define the fundamental phenomena giving to fading, and the experimental methods allowing to distinguish the various categories of fading.</p>	III

C.C.I.R. Study Groups		Interested U.R.S.I. Commissions
VI	<p>REPORT n° 266 (Doc. 2104). <i>Fading of signals propagated by the ionosphere.</i> This extensive report explains the various terms of the preceding Opinion and refers the study to U.R.S.I. It contains an important bibliography.</p>	III
VI	<p>*QUESTION n° 248 (Doc. 2386). <i>Special problems of HF radiocommunication associated with the equatorial ionosphere.</i> Considering the problems particular to propagation in the vicinity of the magnetic equator and their effects under various conditions, this document draws particularly the attention of U.R.S.I. to the investigation of the physical processes involved.</p>	III
VI	<p>OPINION n° 6 (recalls Res. 45). <i>Identification of precursors indicative of short-term variations of ionospheric propagation conditions.</i> U.R.S.I. is asked to define phenomena suitable to predict short-term variations, and more particularly ionospheric storms.</p>	III
IV, VI	<p>OPINION n° 9 (recalls Res. 47). <i>Effects of the ionosphere on radio waves used for telecommunication with and between spacecraft beyond the lower atmosphere.</i> Question asked to U.R.S.I. Various effects of the ionosphere. Choice of frequencies transmitted by spacecrafts to investigate the ionosphere.</p>	III, VI, SRR
VII	<p>RESOLUTION n° 14 (Doc. 2187). <i>Standard-frequency and time signal emissions.</i> The collaboration of U.R.S.I. is asked to improve those services.</p>	I

C.C.I.R. Study Groups		Interested U.R.S.I. Commissions
VII	<p>REPORT n° 267 (Doc. 2264). <i>Standard frequencies and time signals.</i></p> <p>Review of progress reached particularly in accuracy and in reducing interference. Such works are connected to those of U.R.S.I. and it is suggested to organize joint discussions between C.C.I.R. and U.R.S.I. representatives (See Recommendation n° 374).</p>	I

II. — DOCUMENTS INTERESTING U.R.S.I.

BUT NOT ASKING EXPLICITLY FOR ITS COLLABORATION

C.C.I.R. Study Groups		Interested U.R.S.I. Commissions
I, III	<p>REPORT n° 178 (Doc. 2069). <i>Possibilities of reducing interference and of measuring actual traffic spectra.</i></p> <p>Review of measuring methods. Reduction of width of the spectrum ; better adaptation of transmitters and receivers.</p>	VI
III	<p>REPORT n° 196 (Doc. 2142). <i>Some aspects of the application of communication theory.</i></p> <p>Review of theories and results of the « relation between acceptable delay and residual incertitude, and measure in which such relation depends on the use of the bandwidth ».</p>	VI
V	<p>STUDY PROGRAMME n° 246 B (Doc. 2011). <i>Ground-wave propagation over inhomogeneous earth.</i></p> <p>Measurement methods and variation of the equivalent dielectric constant and conductivity.</p>	II



C.C.I.R. Study Groups		Interested U.R.S.I. Commissions
VI	<p>RESOLUTION n° 5 (Doc. 2027). <i>Improvement in the network of ionospheric sounding stations.</i></p> <p>The resolution expresses the desirability of the extension of the network and of data interchange.</p>	III, CIG
VII	<p>REPORT n° 270 (Doc. 2096). <i>Frequency spectrum conservation for high precision time signals.</i></p> <p>Various methods have been investigated, e. g. LORAN C and square sine pulses.</p>	I
VII	<p>RECOMMENDATION n° 374 (Doc. 2188). <i>Standard-frequency and time signal emissions.</i></p> <p>This document recommends various characteristics which the emissions should fulfil, and also their precision.</p>	I

III. — DOCUMENTS REFERRING TO U.R.S.I. PUBLICATIONS

C.C.I.R. Study Groups	
IV	<p>REPORT n° 215 (Doc. 2345). Feasibility of direct sound and television broadcasting from satellites.</p>
VI	<p>RECOMMENDATION n° 373 (Doc. 2023). Meaning of MUF.</p>
VI	<p>OPINION n° 8 (Doc. 2031). High-frequency propagation by ducting above the F<sub>2</sub>-region peak.</p>

C.C.I.R. Study Groups	
VI	REPORT n° 259 (Doc. 2044). Long-distance propagation of waves of 30 to 300 Mc/s by way of ionization by the E and F regions of the ionosphere.
VI	REPORT n° 248 (Doc. 2045). Availability and exchange of basic data for radio propagation forecasts.
VI	REPORT n° 260 (Doc. 2083). Ionospheric scatter propagation.
VI	REPORT n° 262 (Doc. 2105). Whistler mode of propagation.
VI	REPORT n° 247 (Doc. 2192). Identification of precursors indicative of short-term variations and evaluation of reliability of short-term forecasts of ionospheric propagation conditions.
VI	REPORT n° 265 (Doc. 2339). Long-distance sky-wave propagation at frequencies below 150 kc/s. (2339).
VI	REPORT n° 264 (Doc. 2368). Predictions of ionospheric field strength or propagation loss for the frequency range between 150 and 1500 kc/s.

STUDY PROGRAMME 192 (V) <sup>(1)</sup>

**Influence of the Non-Ionized Regions of the Atmosphere  
on Wave Propagation**

(Geneva, 1951 — London, 1953 — Warsaw, 1956 —  
Los Angeles, 1959 — Geneva, 1963)

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

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

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<sup>(1)</sup> This Study Programme, which replaces Study Programme 138, does not arise from any Question under study.

- (b) that the detailed structure of the field in time and space is still insufficiently known and the lack of appropriate measurements makes it impossible to explain the details of radio wave propagation characteristics on the basis of existing theories ;
- (c) that the propagation studies required for the establishment of a radio circuit of any length necessitate a statistical knowledge of the propagation medium, that is, of the atmosphere ;
- (d) that the progress in the investigation of such propagation has already led to Recommendations 369 and 370.

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

1. the detailed variations of the refractive index of air with space and time ;
2. the development of improved methods for investigating the irregularities in the thermodynamic properties of the atmosphere, with special reference to such instruments as refractometers, hygrometers and radar (see Annex, § 1) ;
3. the statistical and geographical distributions of water vapour, oxygen, cloud, rain, snow, fog, sand, etc. in the atmosphere ;
4. the provision by national telecommunications services of additional information concerning  $N_s$ ,  $N_o$  and  $\Delta N$ , to complete the work on world-wide refractive index climatology of Report 233 (see Annex) ;
5. the application to radio propagation of radio meteorological parameters other than those listed above ;
6. the correlation between the different radio meteorological parameters in various climatological situations and the characteristics of the transmission loss in terms of their median value, their range and rate of variation and the signal distortion encountered ;
7. verifications by administrations and private operating agencies, by means of a large number of detailed and accurate measurements, of the various theories put forward in explanation of propagation.

*Note 1.* — National administrations, the U.R.S.I. and other international organizations, should be encouraged to pursue the

theoretical and experimental study of the propagation of radio waves through the atmosphere.

*Note 2.* — The above Study Programme has taken into account Recommendations 4 and 5 of the Aerological Commission of the W.M.O. and should be brought to the attention of the W.M.O. by the Director, C.C.I.R., with particular reference to §§ 1, 2 and 3.

#### ANNEX

1. — The thermodynamic measurements intended for the calculation of the refractive index of the air and its gradient should, if possible, be determined at distances not more than 10 m apart and with an accuracy no less than :

Temperature :  $\pm 0.2^\circ \text{C}$ ,

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

Continuous measurement equipment should preferably be used.

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

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

$n$  = refractive index of the air,

$T$  = absolute temperature ( $^\circ\text{K}$ ),

$e$  = water-vapour pressure (mb),

$p$  = atmospheric pressure (mb).

The information provided should, if possible, cover a period of at least five years.

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

3. —  $N_s$  is the value of  $N$  at the surface of the earth. The formula for determining  $N_0$  is given in Report ... (Annex 5/23).  $\Delta N$  is the difference between the value of  $N$  at the height of 1 km above the surface of the earth and  $N_s$ .

QUESTION 239 (IV) (1)

**Effects of Plasma on Communications with Spacecraft**

(Geneva, 1963)

The C.C.I.R.,

*considering*

- (a) that ionospheric plasma has been observed to have a considerable effect upon the operation of transmitting and receiving antennae mounted on rockets and spacecraft ;
- (b) that the plasma produced by the shock wave resulting from the re-entry of a spacecraft into the terrestrial atmosphere, may have analogous effects ;

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

1. what are the effects of the surrounding plasma on the operation of the transmitters and receivers, and in particular the antennae on board spacecraft, taking into account laboratory experiments and direct measurements ;
2. what factors determine the formation and structure of the induced plasma surrounding a spacecraft ;
3. what communication problems (wave propagation and noise) are represented (in particular during re-entry into the terrestrial atmosphere) as a result of the plasma ;
4. what influence do these effects exert on the choice of usable frequencies especially during re-entry of a spacecraft into the terrestrial atmosphere ?

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(1) This Question replaces Question 212, and together with Study Programme 205 (V1) replaces Study Programme 173.

*Note.* — The above Question should be brought to the attention of the U.R.S.I. by the Director, C.C.I.R.

RESOLUTION 1 <sup>(1)</sup>

**Optimum use of the Radio Frequency Spectrum**

(Geneva, 1963)

The C.C.I.R.,

*considering*

- (a) that the available information on the wanted-to-unwanted signal protection ratios and the operating sensitivities of receiving systems needs further refinement for each of the services, to permit the most efficient planning of the use of the radio-frequency spectrum ;
- (b) that a larger number of simultaneous users of the spectrum must be accommodated in the future ;
- (c) that the accommodation of these additional users, without serious deterioration of those services in use at present, will require careful consideration of all potentially interfering systems ;

*unanimously decides*

- 1. that an International Group of Experts of the C.C.I.R. <sup>(2)</sup> which would be representative of the Study Groups interested in this problem shall be established, to prepare a report on definitions and procedures which would, when made available to the various Study Groups of the C.C.I.R., be expected to lead to improved information on :
  - the required signal-to-interference protection ratios ;
  - the minimum field strengths required for various types of service ;which would permit the optimum use of the radio-frequency spectrum by the maximum number of simultaneous users ;
- 2. that the co-ordination of the work of the Group should be undertaken by Study Group III ;

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<sup>(1)</sup> This Resolution relates to Recommendations 2 and 3 of the Administrative Radio Conference, Geneva, 1959.

<sup>(2)</sup> The following Administrations and the I.F.R.B. have already indicated their willingness to form part of this Group : U. S. A. (Chairman), France, Japan, Netherlands, F. R. of Germany, United Kingdom and the U. S. S. R.

3. that as far as possible, the work of the Group should be conducted by correspondence.

*Note.* — The Director C.C.I.R. is invited to bring this Resolution to the attention of the U.R.S.I.

#### QUESTION 248 (VI)

### Special Problems of HF Radio Communication Associated with the Equatorial Ionosphere

The C.C.I.R.,

*considering*

that HF radio communications for paths which cross or follow close to the magnetic equator are known to experience certain difficulties associated with the equatorial ionosphere ;

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

1. what are the phenomena peculiar to ionospheric propagation at or near the magnetic equator ?
2. what are the effects of these phenomena on radio communication as a function of :
  - class of emission,
  - antenna characteristics,
  - frequency,
  - geographical location, orientation and length of propagation path,
  - time of day, month and phase of solar cycle,
3. what are the physical mechanisms involved ? <sup>(1)</sup>

#### OPINION 10

### Fading of Signals Propagated by the Ionosphere

(Geneva, 1963)

The C.C.I.R.,

*considering*

- (a) that a special International Working Party was set up under Resolution 49 <sup>(2)</sup> to consider those aspects of the phenomena of fading which are of interest to the C.C.I.R. ;

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<sup>(1)</sup> The Director of the C.C.I.R. is requested to transmit this text to the U.R.S.I. for comment drawing particular attention to § 3.

<sup>(2)</sup> This Resolution has been deleted.

(b) that the understanding of the basic processes involved in fading will greatly assist in the formulation of measures to counteract its effects ;

*is unanimously of the opinion* that U.R.S.I. be asked the following question :

1. what are the basic phenomena which give rise to fading of radio signals propagated through the ionosphere, including :
  - changes in absorption,
  - focusing and de-focusing,
  - changes in polarization,
  - multipath propagation ;
2. what is the relative importance of each of these factors in the fading process ; and what are the distinctive features of the fading associated with each of these factors ;
3. what experimental techniques can be employed to distinguish between the different types of fading, including :
  - absorption fading,
  - focusing fading,
  - polarization fading,
  - multipath fading ?

REPORT 232 (1)

**Constants in the Equation  
for the Radio Refractive Index**

(Geneva, 1963)

In the Annex to Study Programme 192 (V), the C.C.I.R. gives the formula for the parameter  $N = (n - 1) \times 10^6$  as follows :

$$N = (77.6/T) (p + 4810 e/T),$$

$n$  = refractive index of the air,

$T$  = absolute temperature ( $^{\circ}$ K),

$e$  = water-vapour pressure (mb),

$p$  = atmospheric pressure (mb).

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(1) This Report was adopted unanimously.



This formula has been used extensively by the C.C.I.R. particularly in connection with Report 233 .

During the General Assemblies of the I.G.G.U. (Helsinki, 1960) and the U.R.S.I. (London, 1960), a slightly different formula using other units was recommended. A study [1] indicates that the C.C.I.R. formula, with units as above, should continue to be used by the C.C.I.R. It appears that it might be slightly more accurate than the U.R.S.I.-I.G.G.U. formula, and in any case is entirely adequate to meet the C.C.I.R. requirements for determining the radio refractive-index of the atmosphere considering the inaccuracies of measurements of atmospheric temperature, pressure and water-vapour pressure.

It appears desirable that a single formula using identical and homogeneous units be adopted by all organizations.

*Note.* — This Report should be drawn to the attention of the I.G.G.U. and the U.R.S.I. by the Director, C.C.I.R. for their comments.

#### BIBLIOGRAPHY

1. BEAN, B. R., The refractive index of air. *Proc. I. R. E.*, Vol. 50, **3**, 260-273 (March 1962).
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## INTER-UNION COMMITTEES

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### I.U.C.A.F.

INTER-UNION COMMITTEE  
ON FREQUENCY ALLOCATIONS  
FOR RADIO ASTRONOMY AND SPACE SCIENCE  
(U.R.S.I.-I.A.U.-C.O.S.P.A.R.)

Report of the Fourth Meeting of the Committee  
held at the Bureau des Longitudes  
Palais de l'Institut, Paris  
on Tuesday and Wednesday, 28th and 29th May, 1963

*Present* : Dr. J. F. DENISSE (*Chairman*),  
Mr. A. H. CATA,  
Dr. R. EMBERSON,  
Colonel E. HERBAYS,  
Dr. E. Metzler,  
Dr. A. P. MITRA,  
Professor J. H. OORT,  
Dr. H. STERKY,  
Professor Dr. A. UNSÖLD,  
Professor H. C. VAN DE HULST,  
Dr. R. L. SMITH-ROSE (*Secretary-General*),  
and Mme I. CHAPUISAT of the I.T.U. Secretariat.

1. — The Secretary reported apologies he had received from Dr. Hagen, Mr. Ratcliffe, Dr. van der Toorn and Dr. Vitkevitch.

2. — The Chairman and Committee complimented the Secretary General on the success achieved at the Plenary Assembly of the C.C.I.R., as a result of which the Administrative Council of the International Telecommunication Union (I.T.U.) agreed that Radio Astronomy would be included in the agenda of the forthcoming

Extraordinary Administrative Radio Conference (E.A.R.C.), which will start in Geneva on 7th October, 1963.

3. — The Report of the *third meeting of the Committee held in Geneva in November 1962*, and distributed as *Doc. I.U.C.A.F./44*, was approved. It was noted that, in accordance with the Committee's recommendation in paragraph 9 of this document, Dr. Smith-Rose had distributed more than 130 sets of the eight I.T.U. Circulars giving the detailed characteristics of observatories in the Radioastronomy service. Further copies of these were available in the English, French and Spanish languages.

Dr. Sterky reported that at the recent African VHF/UHF broadcasting conference, it was agreed that Channel 38 (606-614 Mc/s), should not be used for television broadcasting in Africa; and two recommendations, which were agreed unanimously by the 34 administrations present, are reproduced in Appendix I. These are similar in wording and intention to the corresponding Recommendations Nos. 2 and 3 adopted at the European VHF/UHF Broadcasting Conference at Stockholm, 1961.

Dr. Emberson referred to the efforts being made by Dr. Seitz, President of the U. S. National Academy of Sciences to persuade the F. C. C. to keep the same channel (n° 37 in U. S. A.) clear for radioastronomy. In subsequent correspondence with Dr. Smith-Rose, Dr. Seitz stated that while the difficulties in the United States are considerable, every effort would be made to work closely with the I.U.C.A.F. in securing the protection sought by the radio astronomers.

#### 4. — *Future Membership of the Committee.*

As certain representatives on the Committee had not found it possible to attend any of the four meetings, it was decided to ask the general secretaries of the I.A.U., U.R.S.I. and C.O.S.P.A.R. to consider finding replacement members in some cases. It was appreciated that this would involve awaiting the next General Assemblies of these three constituent bodies.

#### 5. — *Xth Plenary Assembly of C.C.I.R., 1963.*

Dr. Smith-Rose introduced his report on the above Plenary Assembly, which had been distributed as Document I.U.C.A.F./46. Dr. Metzler and Mr. Cata confirmed that the definitions referred to

therein, relating to radio astronomy and space science, would be added to the existing C.C.I.R. definitions. In reply to Professor van de Hulst, Dr. Metzler confirmed that reports on Questions and Study Programmes should be ready for submission to the appropriate Study Groups of C.C.I.R. within two years, so that specific proposals may be ready in good time before the next Plenary Assembly in 1966.

It was agreed that by the co-ordination of the views of U.R.S.I I.A.U. and C.O.S.P.A.R., the Inter-Union Committee (I.U.C.A.F.) was in a strong position, and could submit its proposals and reports direct to a meeting of the Study Group IV of C.C.I.R., which will be held before the XIth Plenary Assembly of C.C.I.R. being planned for 1966.

6. — *Submission of Document to the E.A.R.C. (October 1963).*

The Committee noted the text of the Resolution (reproduced as Appendix II), which accompanied the letter of the 6th April, 1963, from the Secretary-General of the I.T.U. convening the Extraordinary Administrative Radio Conference in Geneva on 7th October, 1963.

It was agreed that the Committee should express its views on the need for adequate protection of the frequency bands used for radio astronomy and for space science in general on a world-wide basis, so that research in these subjects could be pursued free from harmful interference in these bands. The Committee considered in detail all the frequency bands in which protection is to be sought for research in the fields of Radio Astronomy and Space Science; and the results are embodied in a report already distributed as Document I.U.C.A.F./49. Since the International Frequency Registration Board (I.F.R.B.) is charged with the technical preparation for the E.A.R.C., this Inter-Union Committee should send its report to the chairman of I.F.R.B., in addition to the copy to be transmitted to the Secretary General of I.T.U.

7. — *NOTE of action after the meeting in Paris.*

Document I.U.C.A.F./49, comprising a review of the frequencies desired for Radio Astronomy and Space Science was forwarded to the I.T.U. and the I.F.R.B. on 24th June; and confirmed with two very minor alterations on 18th July, 1963. Draft Recommen-

dations relating to Frequencies for the Radio Astronomy and Space Research Services respectively, have also been forwarded through members of the Committee to a number of individuals who may be in a position to obtain the support of their national administrations for these recommendations.

8. — *Participation in the E.A.R.C. - Geneva - October/November 1963.*

Dr. Metzler and Mr. Cata emphasized the importance of the Inter-Union Committee (I.U.C.A.F) being represented by at least one member during the whole period of the Conference. It was agreed that Drs. Denisse and Smith-Rose should be the formal delegates, in addition Dr. Sterky, Dr. van der Toorn, Professor van de Hulst, and Dr. Hagen or Dr. Emberson would participate in the Conference on a part-time basis. Every effort would be made to keep in touch with official delegates of national administrations, and to inform them of the basic research activities of the radio astronomers and space scientists, and of their need to be considered in the allocation of parts of the radio frequency spectrum. Members of the committee undertook to share in such publicity as was possible by way of talks and of articles in the appropriate journals, with a view to ensuring that the national delegates, many of whom would not have technical experts available to them, were appraised of the need of the radio scientists for protection from harmful interference in the various frequency bands assigned to them.

Reference was made to articles on radio astronomy in recent issues of *Fortune* and the *Scientific American*; and the secretary was asked to try and arrange for reprints of these to be distributed to members of the E.A.R.C.

9. — *Frequencies for Oceanographic Research.*

Dr. Emberson draw the attention of the Committee to I.F.R.B. Circular-Letter n° 60, dated 16th November, 1962, concerning radiocommunication facilities formulated by the Inter-Governmental Oceanographic Commission. He also tabled a draft recommendation, reproduced as Appendix III, which he suggested I.U.C.A.F. might forward to I.T.U.

In discussion of these documents, some members stated that this is a matter for the Scientific International Committee on Oceanographic Research (S.C.O.R.), which is not represented on I.U.C.A.F.

It was agreed that the Committee should take note of the document, and might support the request if it was made to I.T.U., although the subject thereof is outside the terms of reference of I.U.C.A.F.

10. — *Finance.*

Colonel Herbays presented a statement of accounts for the year 1962. These showed that the balance in hand at 31st December, 1962 was \$17,880 as compared with the sum of \$9,903 brought forward at 1st January, 1962. It was pointed out however, that the expenses during 1963 were likely to be appreciably greater than for 1962 due first to the attendance of the Chairman and Secretary-General at the Plenary Assembly of C.C.I.R. in Geneva during January/February 1963 ; secondly, to the need for members of the committee to participate in the E.A.R.C. meeting in Geneva in October/November 1963 ; and thirdly, to the fact that Drs. Emberson and Hagen had now found it necessary to claim their expenses for attending meetings of the Committee, all of which so far had been held in Europe.

The Committee expressed their thanks to Colonel Herbays for his services as Treasurer and presentation of the accounts, which were approved.

11. — *Acknowledgment of accomodation facilities.*

On the proposal of Dr. Emberson, the Committee expressed their gratitude to Dr. Denisse and the Bureau des Longitudes for the use of the meeting room and the facilities provided in the Palais de l'Institut.

12. — *Next meeting.*

It was noted that Drs. Denisse and Smith-Rose might find it convenient to meet with any other members of the Committee who would be attending the General Assembly of U.R.S.I. in Tokyo during September 1963, to discuss any matters relating to the forthcoming E.A.R.C.

It was agreed that the next full meeting of the Committee should be held after the I.T.U. report on the E.A.R.C. is published. The meeting could either be in New York in spring, if it proved convenient for it to coincide with other meetings there : alternatively Professor Unsöld invited the Committee to meet in Bonn in about May, 1964.

APPENDICES

- I. Recommendations concerning Radio Astronomy adopted by the African VHF/UHF Broadcasting Conference, Geneva, May 1963.
- II. Resolution concerning the Extraordinary Administrative Radio Conference to be convened in Geneva, 7th October, 1963.
- III. Draft Recommendation, I.U.C.A.F. to I.T.U. concerning the Inter-Governmental Oceanographic Commission.

APPENDIX I

**Recommendations concerning Radio Astronomy  
adopted by the African VHF/UHF Broadcasting Conference  
Geneva — May 1963**

RECOMMENDATION N° 3

*Radio Astronomy Observations in the Frequency Band 606-614 Mc/s*  
The African VHF/UHF Broadcasting Conference (Geneva, 1963),  
*considering*

- (a) that radio astronomy is now a recognized service in the Radio Regulations ;
- (b) that the frequency band 606-614 Mc/s is already in use at some radio astronomy observatories and is planned for several others ;
- (c) that the receiving equipment at these observatories has an extremely high sensitivity ; and
- (d) that it is most important that these observatories should be able to conduct their scientific work at all times and seasons ;

*recommends*

that Administrations should avoid, as far as possible, the use of Channel n° 38 (606-614 Mc/s) in the development of their UHF broadcasting services.

RECOMMENDATION N° 4

*Radio Astronomy Observations in the Frequency Band 1400-1427 Mc/s*  
The African VHF/UHF Broadcasting Conference, Geneva, 1963,  
*considering*

- (a) that radio astronomy is now a service recognized in the Radio Regulations ;

- (b) that this service has been allotted the band of frequencies 1400-1427 Mc/s exclusively for observations on the natural radiation from hydrogen gas ;
- (c) that the receiving equipment used at radio astronomy observatories has an extremely high sensitivity ; and
- (d) that it is most important that these observatories should be able to conduct their scientific work at all times and seasons,

*recommends*

that Administrations operating broadcasting stations in channels 21 (470-478 Mc/s), 50 (702-710 Mc/s) and 51 (710-718 Mc/s) should take all practicable precautions to ensure that harmonic radiations from these stations do not interfere with radio astronomy observations in the frequency band 1400-1427 Mc/s.

## APPENDIX II

### Resolution

Nº

*Extraordinary administrative radio conference to allocate frequency bands for space radiocommunication purposes.*

(cf. PV CA 18/ Doc. /CA 18 — March/April 1963).

The Administrative Council,

*in view of*

- (a) Recommendation nº 36 of the Administrative Radio Conference, Geneva, 1959,
- (b) Paragraph 3 of Resolution nº 495,

*having considered*

the Secretary-General's report and the replies from Administrations to the Secretary-General's letter 3607/61/R of 29 June 1962 pursuant to Resolution nº 496,

*considering*

that a majority of the Members of the Union have approved its proposals contained in Circular Telegram nº 17-29 of 29 March 1963,



*resolves*

1. that the agenda for the Extraordinary Administrative Radio Conference to be convened in Geneva, on 7 October 1963, shall be as follows :
  - (i) to examine the technical progress in the use of radio-communications in the space, earth-space and radio astronomy service and to examine the results of the technical studies made by the C.C.I.R. and other organizations and the proposals of Administrations concerning these services ;
  - (ii) in the light of this examination :
    - (a) to decide on the allocation of frequency bands essential for the various categories of space radiocommunications and for radio astronomy ;
    - (b) to consider whether there is a continuing need for the allocation of each of the bands designated for space research and take appropriate action in this regard ;
  - (iii) in accordance with nos 61 and 249 of the International Telecommunication Convention, Geneva, 1959, to revise only such provisions of the Radio Regulations, Geneva, 1959, as are essential for the effective implementation of the decisions of the Conference relating to the allocation, notification, recording and use of frequencies for space, earth-space and radio astronomy services ;
  - (iv) in accordance with nos 61 and 249 of the International Telecommunication Convention, Geneva, 1959, to adopt such provisions additional to those contained in the Radio Regulations, Geneva, 1959, as are essential for the effective implementation of the decisions of the Conference concerning the technical characteristics of the space, earth-space and radio astronomy services ;
  - (v) to make such recommendations and to adopt such resolutions related to the foregoing as may be necessary ;

2. that the duration of the conference shall not exceed five weeks.

*considering furthermore*

that the decisions of the Conference will have an important influence not only on the future development of space radiocommunications, but also on some existing services,

*urges all Administrations*

to participate in the Conference so that its important decisions may be taken with the participation of the greatest possible number of Members of the Union,

*invites Administrations*

1. to send their proposals for the work of the Conference to the Secretary-General at the earliest possible moment, preferably before 7 June 1963 ;
2. to send to the Secretary-General as soon as possible, and in any event before 7 September 1963, reports on the progress which may have been made in their countries in the development of space systems, and in particular of space telecommunication systems, in so far as they may, in the near future, extend terrestrial telecommunication facilities, since such reports would not only be of interest to all Members of the Union by providing them with background information, but also to the Administrative Council when considering any future action to be taken.

APPENDIX III

**Draft Recommendation, I.U.C.A.F. to I.T.U. <sup>(1)</sup>**

*Whereas* the Inter-Governmental Oceanographic Commission (I.O.C.) has recognized the vital role of oceanographic research and has developed a plan for meeting the oceanographic research requirements ;

*Whereas* the International Frequency Registration Board, in Circular-Letter n° 60, has invited Administrations to review and comment on the stated requirements and proposed plan and ;

*Whereas* the I.T.U., through its several agencies, and National Administrations, will be called upon to provide the necessary frequency allocation and assignments to permit implementation of the plan ; therefore

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<sup>(1)</sup> This was not adopted by I.U.C.A.F. at its meeting in Paris, 28th/29th May, 1963.

The I.U.C.A.F., by unanimous action, hereby

*Endorses* the importance of the oceanographic research programs, and

*Recommends* that prompt action be taken to provide the necessary 3.5 kc/s channels in the six exclusive mobile marine frequency bands ; and further

*Recommends* that due consideration be given by the I.T.U. and Administrations to anticipated oceanographic radio communication requirements in the VHF and UHF parts of the spectrum and in such frequencies as may be available for research via low altitude satellite.

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# INTERNATIONAL YEARS OF THE QUIET SUN

Issued by the International Ursigram and World Days Service  
under the auspices of U.R.S.I.

## International Geophysical Calendar 1964

1964 JANUARY

S	M	T	W	T	F	S
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1964 FEBRUARY

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1964 MARCH

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1964 APRIL

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1964 MAY

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1964 JUNE

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1964 JULY

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1964 AUGUST

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1964 SEPTEMBER

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1964 OCTOBER

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1964 NOVEMBER

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1964 DECEMBER

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⑰ Regular World Day (RWD)

⑮ Day of Solar Eclipse

7 Day with unusual meteor shower activity

16 17 World Geophysical Interval (WGI)

⑳ Quarterly World Day (QWD),  
also a PRWD and RGD

⑱ Priority Regular World Day (PRWD)

⑮ Regular Geophysical Day (RGD)

+ Priority WGI, particularly Southern Hemisphere

## International Geophysical Calendar 1965

1965 **JANUARY**

S	M	T	W	T	F	S
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1965 **FEBRUARY**

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1965 **MARCH**

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1965 **APRIL**

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1965 **MAY**

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1965 **JUNE**

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1965 **JULY**

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1965 **AUGUST**

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1965 **SEPTEMBER**

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1965 **OCTOBER**

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1965 **NOVEMBER**

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1965 **DECEMBER**

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1966 **JANUARY**

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24	25	26	27	28	29
31					

- ⑰ Regular World Day (RWD)
- ⑳ Day of Solar Eclipse
- ㉑ Day with unusual meteor shower activity
- ㉒ World Geophysical Interval (WGI)
- ㉓ Quarterly World Day (QWD), also a PRWD and RGD
- ㉔ Priority Regular World Day (PRWD)
- ㉕ Regular Geophysical Day (RGD)
- + Priority WGI, particularly Northern Hemisphere

**CALENDRIER GÉOPHYSIQUE INTERNATIONAL  
POUR LES ANNÉES INTERNATIONALES  
DU SOLEIL CALME 1964 ET 1965**

1. BUT. — Le Calendrier Géophysique International indique les journées et intervalles choisis, pendant lesquels une attention particulière est à consacrer aux observations et expériences géophysiques, à l'échange de données ou aux analyses. Il fournit de ce fait un cadre de coordination à l'échelle mondiale et inter-disciplines pour les programmes où il ne serait ni pratique ni valable de procéder au même travail au jour le jour. Il porte principalement sur les domaines de la géophysique relatifs à l'atmosphère terrestre. L'un de ses buts principaux est la coordination de l'étude des nombreux phénomènes qui accusent des variations importantes dans le courant de l'année. Le Comité pour les Années Internationales du Soleil Calme 1964-65 (I.Q.S.Y.) a formulé, pour certains programmes géophysiques, des recommandations sur le travail à effectuer pendant les Journées et Intervalles indiqués au Calendrier (voir les paragraphes 12 à 17 ci-dessous). Il est souhaitable que des stations géophysiques ou des groupes de stations adaptent leurs plans d'observations au Calendrier. Les géophysiciens peuvent donc espérer que leurs collègues dans d'autres pays, d'autres laboratoires et d'autres disciplines géophysiques s'efforceront, aux jours et intervalles figurant au Calendrier, de procéder à des expériences. De ce fait, le nombre des données géophysiques, aussi bien aux Centres Mondiaux qu'ailleurs, sera plus élevé pour les journées figurant au Calendrier.

Cette brève explication du Calendrier Géophysique International est inspirée de celle contenue dans le « I.Q.S.Y. Manual » n° 1, Programme des Journées Mondiales, publié en 1963 par le Secrétariat de l'I.Q.S.Y., 6 Cornwall Terrace, Londres NW1, Grande Bretagne. Il convient de consulter le Manuel pour tous les détails concernant le Calendrier et les Journées Mondiales de l'I.Q.S.Y. tels que les Alertes géophysiques et solaires et les Intervalles Mondiaux Rétrospectifs.

2. TEMPS UNIVERSEL (T.U.). — Le temps universel est le temps standard pour toutes les Journées Mondiales indiquées au Calendrier ; elles commencent donc toutes à 0000 T.U. et finissent à 2400 T.U.

3. JOURNÉES GÉOPHYSIQUES RÉGULIÈRES (Regular Geophysical Days — R.G.D.). — Elles se situent tous les mercredis pour toute la période 1964-65. Cet horaire hebdomadaire a été établi en tenant spécialement compte du programme météorologique de l'I.Q.S.Y. mais a également été adopté pour certains autres programmes géophysiques.

4. JOURNÉES MONDIALES RÉGULIÈRES (Regular World Days — R.W.D.). — Il s'agit de trois journées consécutives, chaque mois, et cela toujours les mardis, mercredis et jeudis vers le milieu du mois. Elles sont destinées aux observations, ou bien aux expériences ou analyses qui ne peuvent être effectuées que pendant 10 % des journées et doivent être réparties sur toute l'année, par groupes de trois jours.

5. JOURNÉES MONDIALES RÉGULIÈRES DE PRIORITÉ (Priority Regular World Days — P.R.W.D.). — Il s'agit d'une journée par mois, la Journée Mondiale Régulière qui est également une Journée Géophysique Régulière. Ces journées sont destinées au travail qui doit ou ne peut être effectué que pendant une journée par mois dans le courant de toute l'année.

6. JOURNÉES MONDIALES TRIMESTRIELLES (Quarterly World Days — Q.W.D.). — Tombant une fois dans chaque trimestre de l'année, elles sont en fait des Journées Mondiales Régulières de Priorité qui sont comprises dans les Intervalles Géophysiques Mondiaux (W.G.I.) et sont également des Journées Géophysiques Régulières (mercredi). Elles servent à coordonner les expériences saisonnières de fusées de haute altitude.

7. INTERVALLES GÉOPHYSIQUES MONDIAUX (World Geophysical Intervals — W.G.I.). — Pendant l'I.Q.S.Y., ce seront 14 journées consécutives pendant chaque saison et commençant le deuxième lundi du mois fixé. Ils incluent toujours les trois Journées Mondiales Régulières du mois ainsi que la Journée Mondiale Trimestrielle de la saison. Certains Intervalles sont considérés, dans certains programmes, de plus grande importance que d'autres ; ils sont destinés à intensifier les programmes axés sur la statistique des variations saisonnières ou sur la distribution dans le temps des changements saisonniers. Le programme des Intervalles Géophysiques Mondiaux relatif aux équinoxes et aux solstices varie d'année en année de

sorte qu'un Intervalle puisse coïncider avec le moment d'un changement saisonnier pour chacun des différents phénomènes géophysiques.

8. ECLIPSES SOLAIRES. — Elles sont indiquées au Calendrier, qu'elles soient totales, annulaires ou partielles. Les stations géophysiques dans les zones d'éclipse considèrent ces journées comme des journées mondiales et procèdent à des programmes spéciaux pour étudier les effets de l'éclipse sur l'atmosphère terrestre. Pour les cartes des zones d'éclipse ou autres détails, il convient de consulter le Manuel de l'I.Q.S.Y. pour le Programme des Journées Mondiales ou bien tout autre annuaire d'astronomie.

9. ESSAIS MÉTÉORIQUES. — Les essais qui présentent un intérêt spécial sont également indiqués au Calendrier, y compris certains des essais visibles importants et des essais inhabituels observables au moyen principalement de la radio et du radar. L'attention est attirée sur ces journées (choisies par P. Millman, Ottawa), dans le cas où l'ionisation produite par les météores pourrait expliquer des effets inaccoutumés dans d'autres expériences géophysiques.

10. « JOURNÉES MONDIALES » NE FIGURANT PAS AU CALENDRIER. — L'occurrence de conditions géophysiques ou solaires inhabituelles est annoncée ou prédite à l'aide des différents types « d'alertes » géophysiques, diffusées largement par télégramme ou par radio. Les types d'alertes sont les suivants : orages magnétiques (MAG-STORM dans les télégrammes), calme magnétique (MAGCALME), éruption solaire (SOFLARE), activité solaire (SOLACTIVITY), calme solaire (SOLCALME), rayons cosmiques (COSMIC EVENT), et échauffements stratosphériques soudains et inhabituels (STRAT-WARM). Ces Alertes sont déclarées par l'Agence Mondiale d'Alertes I.Q.S.Y.-I.U.W.D.S. ou bien, dans certaines circonstances, par l'un des Centres Régionaux d'Alertes. Le réseau de télécommunications météorologique, qui est coordonné par l'O.M.M., transmet ces informations une fois par jour quelque peu après 04,00 T.U. (à partir d'octobre 1963). Nombreuses sont les stations géophysiques qui intensifient leurs programmes dans les différentes disciplines ou bien procèdent à des expériences spéciales pour mettre à profit les conditions géophysiques ou solaires spéciales pendant la durée de l'Alerte. Le Manuel de l'I.Q.S.Y. pour le Programme des Journées



Mondiales renferme tous les détails, y compris les programmes scientifiques recommandés. Le choix des Intervalles Mondiaux Rétrospectifs, après un délai de quelques semaines ou mois, est également annoncé par l'Agence Mondiale d'Alertes. Un service supplémentaire fonctionnant auprès des Centres Régionaux d'Alertes est chargé de communiquer dans de brefs délais aux stations géophysiques et solaires (par Ursigrammes) des détails des observations géophysiques d'importance immédiate et des phénomènes solaires à effets géophysiques importants et, parfois, de longue durée. Les adresses télégraphiques des Centres Régionaux d'Alertes sont les suivantes : AGIWARN WASHINGTON (E. U. A.), DEMPA KOKUBUNJI (Japon), NIZMIR MOSCOW (U. R. S. S.), IONOSPHERE DARMSTADT (République Fédérale Allemande) ou CNETAGI BAGNEUX (France) ou AGI NEDERHORST-DENBERG (Pays-Bas).

11. LE SERVICE INTERNATIONAL DES URSIGRAMMES ET DES JOURNÉES MONDIALES (I.U.W.D.S.) est un service permanent de l'Union Radio Scientifique Internationale (U.R.S.I.) auquel participent l'Union Astronomique Internationale et l'Union Internationale de Géodésie et de Géophysique. Il est affilié à la Fédération des Services d'Astronomie et de Géophysique du Conseil International des Unions Scientifiques. L'I.U.W.D.S. coordonne les aspects internationaux du programme des Journées Mondiales et l'échange rapide des données ; il publie également annuellement un calendrier à posteriori des indices et phénomènes géophysiques et solaires.

### SUGGESTIONS RELATIVES

#### AUX PROGRAMMES SCIENTIFIQUES

#### A EXÉCUTER PENDANT LES JOURNÉES MONDIALES ET LES INTERVALLES FIGURANT AU CALENDRIER

(Le texte suivant a été rédigé à partir des recommandations du Comité C.I.G./I.Q.S.Y., II<sup>e</sup> Assemblée, Rome, mars 1963 (voir *I.Q.S.Y. Notes*, n° 3, 1963, publiées par le Secrétariat de l'I.Q.S.Y.), des Rapporteurs ou porte-paroles pour les différentes disciplines scientifiques. Toutes les recommandations supplémentaires seront publiées dans les prochains numéros des *I.Q.S.Y. Notes*).

12. MÉTÉOROLOGIE. — Des efforts particuliers sont à déployer afin d'obtenir le maximum de données sur les Journées Géophysiques Régulières (R.G.D.) — chaque mercredi T.U. Des lancements de fusées, de sondes à ozone et de sondes à radiation seront effectués à cette occasion. Les lancements de ballons aux altitudes maximales se feront à 0000 et 1200 T.U.

Les observations suivantes seront effectuées à toutes les stations intéressées au cours des Intervalles Géophysiques Mondiaux (W.G.I.) : *a*) chaque jour : deux sondages par ballons d'altitude maximum ; *b*) les lundis et vendredis : deux sondages par ballons d'altitude maximum, un sondage à ozone, un sondage à radiation et un sondage par fusée ; *c*) les mercredis : au moins deux, et de préférence quatre, sondages par ballons d'altitude maximum, un sondage à radiation, un sondage à ozone et, au moins un, de préférence deux, sondages par fusées.

*Remarque* : là où les Services et Instituts Météorologiques rencontrent des difficultés pour exécuter les programmes recommandés pendant tous les Intervalles Géophysiques Mondiaux, la priorité est à accorder aux Intervalles d'octobre 1964 et de mars 1965. Si elles sont situées dans l'Hémisphère Sud, les stations ne pouvant exécuter le programme recommandé que pendant un seul Intervalle Géophysique Mondial, devraient choisir octobre 1964 ; si elles sont situées dans l'Hémisphère Nord, elles choisiront mars 1965.

13. GÉOMAGNÉTISME. — La continuité des opérations a toujours été un des principes directeurs pour les observatoires géomagnétiques. En conséquence, la grande majorité des stations prenant part au programme géomagnétique de l'I.Q.S.Y. entreprendra le même programme sans égard au Calendrier des Années Internationales du Soleil Calme. Les journées indiquées au Calendrier seront particulièrement intéressantes pour les deux types suivants de stations géomagnétiques : *a*) les stations enregistrant les micro-pulsations à fréquence rapide (à grande vitesse d'enregistrement) sont invitées à effectuer ces enregistrements pendant chaque Journée Géophysique Régulière — chaque mercredi T.U. — selon l'horaire suivant : 1<sup>er</sup> janvier 1964 de 0000 à 0400 T.U., 8 janvier de 0100 à 0500 T.U., 15 janvier de 0200 à 0600 T.U., etc. Les observatoires ne sont pas obligés d'envoyer leurs enregistrements

aux Centres Mondiaux de Données, sauf sur demande spéciale (voir le Manuel de l'I.Q.S.Y. sur les Journées Mondiales à la rubrique : Intervalles Mondiaux Rétrospectifs pour les micro-pulsations); *b*) les stations qui, en plus des autres activités de l'I.Q.S.Y., sont équipées pour effectuer des observations magnétiques, mais qui ne peuvent poursuivre ces observations et la réduction des données selon un horaire continu, sont encouragées à exécuter ce travail au moins pendant les Journées Mondiales Régulières (et pendant les Alertes MAGSTORM).

L'attention est attirée sur l'occasion que les conditions calmes des I.Q.S.Y. sont susceptibles de fournir pour procéder à une étude utile de l'effet géomagnétique des éclipses solaires, indiquées au Calendrier.

14. IONOSPHERE. — Voici le résumé des recommandations pour le programme des sondages à incidence verticale : *a*) sondages à des intervalles de 5 minutes ou moins pendant les Journées Mondiales Régulières ; *b*) les stations de haute altitude et les stations sélectionnées aux latitudes inférieures effectueront des « *f*-plots » tous les jours (y compris les Journées Mondiales Régulières et les Intervalles Géophysiques Mondiaux) ; *c*) les paramètres des profils *hc* et *gc* seront déterminés et envoyés aux Centres Mondiaux de Données pour les Journées Mondiales Régulières par toutes les stations à l'exception de celles qui entreprennent les programmes complets de profils ou qui produisent les profils médians mensuels ; *d*) les copies des ionogrammes pour les Journées Mondiales Régulières de priorité seront envoyées aux Centres Mondiaux de Données ; *e*) les stations dans la zone d'éclipse feront des observations continues pendant les journées d'éclipse solaire et des observations spéciales pendant les journées voisines suivant le détail des recommandations données dans les Manuels des Y.Q.S.Y. pour les Journées Mondiales ou l'Ionosphère.

En ce qui concerne le programme des vents ionosphériques, les observations seront effectuées pendant toutes les Journées Mondiales Régulières et tous les Intervalles Géophysiques Mondiaux, tous les mercredis (Journées Géophysiques Régulières) et tous les jeudis (journée suivant la Journée Géophysique Régulière). Les tableaux horaires pour toutes les journées mentionnées seront envoyés aux Centres Mondiaux de Données.

Pour ce qui est du programme d'absorption ionosphérique, les observations horaires diurnes seront effectuées pendant toutes les Journées Mondiales Régulières et les tableaux horaires seront envoyés aux Centres Mondiaux de Données. Si possible, les stations dans la zone d'éclipse procéderont à des observations continues pendant les jours d'éclipse solaire.

Pour les programmes de diffusion par arrière et de diffusion par avant des observations seront effectuées au moins pendant toutes les Journées Mondiales Régulières.

Tous les programmes tiendront compte des journées d'activité inhabituelle des essaims météoriques dans le cas où des phénomènes ionosphériques inaccoutumés seraient enregistrés.

15. ACTIVITÉ SOLAIRE. — Les observatoires sont invités à publier et à envoyer aux Centres Mondiaux de Données de toutes les disciplines de l'I.Q.S.Y. des rapports spéciaux de leurs observations régulières ou spéciales effectuées pendant les journées d'éclipse solaire pour aider à l'interprétation des observations géophysiques faites dans les zones d'éclipse.

L'éclipse solaire totale du 30 mai 1965 se caractérisera par une longue durée (4 minutes environ) sur la ligne centrale. Il est recommandé de procéder à des observations solaires de cette éclipse, à la fois optiques et radio.

16. RAYONS COSMIQUES, AÉRONOMIE. — Les expérimentateurs doivent tenir compte que l'effort observationnel dans les autres disciplines tend à être intensifié pendant les jours marqués au Calendrier, de même que les programmes d'expériences par ballons et fusées s'il n'y a pas d'autres raisons de nature géophysique pour faire un autre choix.

17. RECHERCHE SPATIALE. — Etant donné la variabilité des régions D et E de l'ionosphère, il est souhaitable d'effectuer des mesures par fusées de leurs caractéristiques un même jour et au plus grand nombre de lieux possible. Là où faisable, les expérimentateurs lanceront des fusées pendant les Journées Régulières Trimestrielles étant donné que ce sont là en même temps des journées où ils seront appuyés au maximum par les observations au sol.

TABLEAU DES JOURNÉES MONDIALES  
INDIQUÉES AU CALENDRIER

1964

1964	RWD	PRWD	QWD	RGD	WGI	ECL.	Meteors
Jan.	14, 15, 16	15	15	1, 8, 15, 22, 29	13-26	14	3-4
Feb.	18, 19, 20	19	—	5, 12, 19, 26	—	—	—
Mar.	17, 18, 19	18	—	4, 11, 18, 25	—	—	—
Apr.	14, 15, 16	15	15	1, 8, 15, 22, 29	13-26	—	21-22
May	19, 20, 21	20	—	6, 13, 20, 27	—	—	4-5
June	16, 17, 18	17	—	3, 10, 17, 24	—	10	4-8
July	14, 15, 16	15	15	1, 8, 15, 22, 29	13-26	9	28-30
Aug.	18, 19, 20	19	—	5, 12, 19, 26	—	—	9-13
Sep.	22, 23, 24	23	—	2, 9, 16, 23, 30	—	—	—
Oct.	20, 21, 22	21	21	7, 14, 21, 28	12-25 <sup>1</sup>	—	19-21
Nov.	17, 18, 19	18	—	4, 11, 18, 25	—	—	15-17
Dec.	15, 16, 17	16	—	2, 9, 16, 23, 30	—	3-4	12-14, 22

(1) Priority WGI, particularly Southern Hemisphere.

1965

1965	RWD	PRWD	QWD	RGD	WGI	ECL.	Meteors
Jan.	12, 13, 14	13	13	6, 13, 20, 27	11-24	—	3
Feb.	16, 17, 18	17	—	3, 10, 17, 24	—	—	—
Mar.	16, 17, 18	17	17	3, 10, 17, 24, 31	8-21 <sup>2</sup>	—	—
Apr.	20, 21, 22	21	—	7, 14, 21, 28	—	—	21-22
May	18, 19, 20	19	—	5, 12, 19, 26	—	30	4-5
June	15, 16, 17	16	16	2, 9, 16, 23, 30	14-27	—	4-8
July	20, 21, 22	21	—	7, 14, 21, 28	—	—	28-30
Aug.	17, 18, 19	18	—	4, 11, 18, 25	—	—	10-14
Sep.	14, 15, 16	15	15	1, 8, 15, 22, 29	13-26	—	—
Oct.	19, 20, 21	20	—	6, 13, 20, 27	—	—	19-21
Nov.	16, 17, 18	17	—	3, 10, 17, 24	—	23	15-17
Dec.	14, 15, 16	15	15	1, 8, 15, 22, 29	13-26	—	12-14, 22-23

(2) Priority WGI, particularly Northern Hemisphere.

Le Calendrier pour 1964 et 1965 a été établi par A. H. Shapley, Président, et J. V. Lincoln, Secrétaire par intérim, du Comité Directeur du Service International des Ursigrammes et des Journées Mondiales, en étroite collaboration avec le Comité C.I.G.-I.Q.S.Y. et ses Rapporteurs pour les différentes disciplines. Des calendriers semblables ont été publiés chaque année depuis le début de l'A.G.I., 1957-58, et reproduits par différentes publications scientifiques de large diffusion.

\* \* \*

Des exemplaires du Calendrier peuvent être obtenus sur demande aux adresses suivantes : I.U.W.D.S., c/o Secrétaire Général de l'U.R.S.I., 7, place Emile Danco, Bruxelles 18 ; ou bien I.Q.S.Y. Secrétariat, 6 Cornwall Terrace, Londres NW1.

**INTERNATIONAL GEOPHYSICAL CALENDAR  
FOR THE INTERNATIONAL YEARS  
OF THE QUIET SUN, 1964 AND 1965**

1. PURPOSE. — The International Geophysical Calendar designates days and intervals selected for special attention for geophysical observations, experiments, data interchange or analyses. It is thus a framework for world-wide and interdisciplinary coordination in those programs where it is not practical or meaningful to carry out the same work for each and every day. The Calendar serves mainly the branches of geophysics dealing with the earth's atmosphere. A principal use is for the coordination of the sampling of the many phenomena which vary significantly during the course of a year. For many geophysical programs, the Committee for the International Years of the Quiet Sun 1964-65 (I.Q.S.Y.) has made recommendations on work to be carried out for the days or intervals marked on the Calendar (see paragraphs 12 to 17 below). It is also common for individual geophysical stations or groups of stations to arrange some of their plans of observations according to the Calendar. Thus geophysicists can expect that their colleagues in other countries, in other laboratories and in other geophysical disciplines will tend to be making increased efforts for the days and intervals marked on the Calendar ; the

amount of geophysical data in existence, at the World Data Centers and elsewhere, will accordingly be greater for Calendar days.

This abbreviated explanation of the International Geophysical Calendar is adapted from I.Q.S.Y. Manual n° 1, World Days Program, issued 1963 by the I.Q.S.Y. Secretariat, 6 Cornwall Terrace, London NW1, Great Britain. The Manual should be consulted for full details on the Calendar and other I.Q.S.Y. world days such as solar and geophysical Alerts and the Retrospective World Intervals.

2. UNIVERSAL TIME (U.T.) is the standard of time for all world days on the Calendar, i.e., each begins at 0000 U.T. and ends at 2400 U.T.

3. REGULAR GEOPHYSICAL DAYS (R.G.D.) are each Wednesday throughout the I.Q.S.Y. 1964-1965. This weekly sampling schedule is particularly designed for the purposes of the meteorological program of I.Q.S.Y. but has also been adopted for some other geophysical programs.

4. REGULAR WORLD DAYS (R.W.D.) are three consecutive days each month, always Tuesday, Wednesday, Thursday near the middle of the month. They are intended for observations, experiments or analyses which can or need be made for about 10 % of days and which should be spaced (in groups of three days) throughout the year.

5. PRIORITY REGULAR WORLD DAYS (P.R.W.D.) are one day each month — the R.W.D. which are also a R.G.D. (Wednesday). They are for work which can or needs to be done only one day each month throughout the year.

6. QUARTERLY WORLD DAYS (Q.W.D.) are one day in each quarter of the year. They are the P.R.W.D. which fall within the World Geophysical Intervals (W.G.I.) and are also a R.G.D. (Wednesday). The Q.W.D. serve to coordinate seasonal high-altitude rocket experiments.

7. WORLD GEOPHYSICAL INTERVALS (W.G.I.) during I.Q.S.Y. are 14 consecutive days in each season, beginning on the second Monday of the selected months. They always include the three R.W.D. of the month and the Q.W.D. for the season. Some of

the W.G.I. are considered of higher priority than others in certain programs. The W.G.I. are intended for intensified programs aimed at the statistics of seasonal variations of the timing of seasonal changes. The schedule of W.G.I. relative to the equinoxes and solstices is deliberately made different from year to year so that in due course a W.G.I. will cover the time of seasonal change of each of various geophysical phenomena.

8. SOLAR ECLIPSES, whether total, annular or partial, are marked on the Calendar. Geophysical stations in the eclipse zones treat these days as world days and undertake special programs to study eclipse effects on the earth's atmosphere. For maps of the eclipse zones and pertinent details, see I.Q.S.Y. Manual for the World Days Program or any standard astronomical ephemeris or year-book.

9. METEOR SHOWERS of special interest are also marked on the Calendar, including some of the important visual showers and also unusual showers observable mainly by radio and radar techniques. Attention is called to these days (selected by P. Millman (Ottawa)) in case ionization produced by meteors may account for unusual effects in other geophysical experiments.

10. « WORLD DAYS » NOT APPEARING ON CALENDAR. — The occurrence of unusual solar or geophysical conditions are announced or forecast through various types of geophysical « Alerts » which are widely distributed by telegram and radio broadcast on a current schedule. The types of alerts are : magnetic storm (in telegrams MAGSTORM), magnetic calm (MAGCALME), solar flare (SOFLARE), solar activity (SOLACTIVITY), solar calm SOLCALME), cosmic ray event (COSMIC EVENT), and sudden and unusual stratospheric warmings (STRATWARM). These Alerts are issued by the I.Q.S.Y.-I.U.W.D.S. World Warning Agency or under certain circumstances by one of the solar-geophysical Regional Warning Centers. The meteorological tele-communications network coordinated to W.M.O. carries the world-wide Alerts once daily soon after 0400 U.T. (as from Oct. 1963). Many geophysical stations in the various disciplines increase their programs or carry on special experiments to take advantage of the special solar or geophysical conditions during the period of Alert.



The I.Q.S.Y. Manual for the World Days Program contains full details, including recommended scientific programs. Selections of Retrospective World Intervals, after a delay of a few weeks or months, are also announced by the World Warning Agency. An additional service of the Regional Warning Centers is to notify geophysical and solar stations promptly (Ursigrams) with summary details of immediately significant geophysical observations and of major solar events which have important and sometimes long-lasting geophysical effects. The telegraphic addresses of the Regional Warning Centers are as follows : AGIWARN WASHINGTON (U. S. A.); DEMPA KOKUBUNJI (Japan); NIZMIR MOSCOW (U. S. S. R.); IONOSPHERE DARMSTADT (G. F. R.) or CNETAGI BAGNEUX (France) or AGI NEDERHORSTDENBERG (Netherlands).

11. THE INTERNATIONAL URSIGRAM AND WORLD DAYS SERVICE (I.U.W.D.S.) is a permanent scientific service of the International Union of Radio Science (U.R.S.I.), with the participation of the International Astronomical Union and the International Union Geodesy and Geophysics. The I.U.W.D.S. adheres to the Federation of Astronomical and Geophysical Services of the International Council of Scientific Unions. The I.U.W.D.S. coordinates the international aspects of the world days program and rapid data interchange, and also publishes subsequently an annual Calendar Record of solar and geophysical indices and events.

### **SUGGESTED SCIENTIFIC PROGRAMS FOR WORLD DAYS AND INTERVALS ON THE CALENDAR**

(The following material is adapted from recommendations of the C.I.G.-I.Q.S.Y. Committee, IInd Assembly, Rome, March 1963 (see *I.Q.S.Y. Notes*, n° 3, 1963, issued by I.Q.S.Y. Secretariat) or its Reporters or spokesmen for the various scientific disciplines. Any supplementary recommendations will appear in future issues of *I.Q.S.Y. Notes*).

12. METEOROLOGY. — Particular efforts should be made to obtain the maximum quantity of data on the R.G.D. — each Wednesday, U.T. Rocket ascents and ozone- and radiation-sonde

ascents should be made on these days. Maximum altitude balloon ascents should be made at 0000 and 1200 U.T.

During W.G.I. the following observations should be made at all appropriate stations : (a) on all days : two maximum altitude balloon soundings ; (b) on Mondays and Fridays : two maximum altitude balloon soundings, one ozone sounding, one radiation sounding, one rocket sounding ; (c) on Wednesdays : at least two and preferably four maximum altitude balloon soundings, one radiation sounding, one ozone sounding, at least one and preferably two rocket soundings.

*Note.* — Where Meteorological Services and Institutes have difficulty in carrying out the recommended programs during all W.G.Is, priority should be given to the W.G.I. in October 1964 and March 1965. Stations which are able to carry out the recommended program during only one W.G.I. should choose October 1964 if in the Southern Hemisphere and March 1965 if in the Northern Hemisphere.

13. GEOMAGNETISM. — It has always been a leading principle for geomagnetic observatories that operations should be as continuous as possible. Thus the great majority of stations taking part in the geomagnetic program of the I.Q.S.Y. will undertake the same program without regard to the I.Q.S.Y. Calendar. The days marked on the Calendar will be of interest mainly to the following two types of geomagnetic stations : (a) stations recording quick-run micro-pulsations (with fast chart speeds) are requested to make such records on every R.D.G. — each Wednesday, U.T. — according to the following schedule : 1964 Jan. 1, from 0000 to 0400 U.T. ; Jan. 8, from 0100 to 0500 U.T. ; Jan. 15, from 0200 to 0600 U.T. ; etc. The observatories are not obliged to send their recordings to the World Data Centers except by special request (see I.Q.S.Y. World Days Manual under Retrospective World Intervals on Micropulsations). (b) Stations which, in addition to other I.Q.S.Y. activities, are equipped for making magnetic observations, but which can not carry out such observations and reductions on a continuous schedule are encouraged to carry out such work at least on R.W.D. (and during times of MAGSTORM Alert).

Attention is called to the opportunity which the expected quiet conditions of the I.Q.S.Y. period may provide for a profitable

study of the geomagnetic effect of solar eclipses, marked on the Calendar.

14. IONOSPHERE. — For the vertical incidence sounding program, the summary recommendations are (a) soundings to be made at 5-minute intervals or less on R.W.D.s; (b) *f*-plots are made for high latitude stations and representative stations at lower latitudes for all days (i.e. including R.W.Ds and W.G.Is), (c) profile parameters *h<sub>c</sub>*, *q<sub>c</sub>* to be determined and sent to W.D.Cs for R.W.Ds for all stations except those undertaking full profile programs or producing monthly median profiles; (d) copies of ionograms for P.R.W.Ds are to be sent to W.D.Cs; (e) stations in the eclipse zone should take continuous observations on solar eclipse days and special observations on adjacent days in accordance with detailed recommendations in the I.Q.S.Y. World Days or Ionosphere Manuals.

For the ionospheric drifts program, observations are made on all R.W.Ds, on all W.G.Is, on every Wednesday (R.G.Ds) and on every Thursday (day following each R.G.D.). Hourly tabulations for all days mentioned are sent to the W.D.Cs.

For the ionospheric absorption program, diurnal hourly observations are made on all R.W.Ds and hourly tabulations sent to W.D.Cs. Continuous observations on solar eclipse days, where possible, for stations in eclipse zone.

For back-scatter and forward-scatter programs, observations should be made on all R.W.Ds at least.

For topside sounding experiments, it is recommended to send copies of records to W.D.Cs for all R.W.Ds at least.

All programs should take notice of the days of unusual meteor shower activity in case unusual ionospheric phenomena are noted.

15. SOLAR ACTIVITY. — Observatories are invited to issue and send to the W.D.Cs of all I.Q.S.Y. disciplines special reports of their regular and any special observations on all solar eclipse days to assist in the interpretation of geophysical observations made in the eclipse zones.

The total solar eclipse of May 30, 1965 will be characterized by long duration (about 4 minutes) on the central line. It is

recommended that comprehensive solar observations be made of this eclipse, both optical and radio.

16. COSMIC RAYS, AERONOMY. — Experimenters should take into account that observational effort in other disciplines tends to be intensified on the days marked on the Calendar, and schedule balloon and rocket experiments accordingly if there are no other geophysical reasons for choice.

17. SPACE RESEARCH. — In view of the variability of the D and E regions of the ionosphere, it is desirable to make rocket measurements of their characteristics on the same day at as many locations as possible. Where feasible, experimenters should endeavor to launch rockets on the Quarterly World Days (Q.W.D.) since these are also days when there will be maximum support from ground observations.

TABLE OF WORLD DAYS MARKED  
ON THE CALENDAR

1964

1964	RWD	PRWD	QWD	RGD	WGI	ECL.	Meteors
Jan.	14, 15, 16	15	15	1, 8, 15, 22, 29	13-26	14	3-4
Feb.	18, 19, 20	19	—	5, 12, 19, 26	—	—	—
Mar.	17, 18, 19	18	—	4, 11, 18, 25	—	—	—
Apr.	14, 15, 16	15	15	1, 8, 15, 22, 29	13-26	—	21-22
May	19, 20, 21	20	—	6, 13, 20, 27	—	—	4-5
June	16, 17, 18	17	—	3, 10, 17, 24	—	10	4-8
July	14, 15, 16	15	15	1, 8, 15, 22, 29	13-26	9	28-30
Aug.	18, 19, 20	19	—	5, 12, 19, 26	—	—	9-13
Sep.	22, 23, 24	23	—	2, 9, 16, 23, 30	—	—	—
Oct.	20, 21, 22	21	21	7, 14, 21, 28	12-25 <sup>1</sup>	—	19-21
Nov.	17, 18, 19	18	—	4, 11, 18, 25	—	—	15-17
Dec.	15, 16, 17	16	—	2, 9, 16, 23, 30	—	3-4	12-14, 22

(<sup>1</sup>) Priority WGI, particularly Southern Hemisphere.

1965

1965	RWD	PRWD	QWD	RGD	WGI	ECL.	Meteors
Jan.	12, 13, 14	13	13	6, 13, 20, 27	11-24	—	3
Feb.	16, 17, 18	17	—	3, 10, 17, 24	—	—	—
Mar.	16, 17, 18	17	17	3, 10, 17, 24, 31	8-21 <sup>1</sup>	—	—
Apr.	20, 21, 22	21	—	7, 14, 21, 28	—	—	21-22
May	18, 19, 20	19	—	5, 12, 19, 26	—	30	4-5
June	15, 16, 17	16	16	2, 9, 16, 23, 30	14-27	—	4-8
July	20, 21, 22	21	—	7, 14, 21, 28	—	—	28-30
Aug.	17, 18, 19	18	—	4, 11, 18, 25	—	—	10-14
Sep.	14, 15, 16	15	15	1, 8, 15, 22, 29	13-26	—	—
Oct.	19, 20, 21	20	—	6, 13, 20, 27	—	—	19-21
Nov.	16, 17, 18	17	—	3, 10, 17, 24	—	23	15-17
Dec.	14, 15, 16	15	15	1, 8, 15, 22, 29	13-26	—	12-14, 22-23

(1) Priority WGI, particularly Northern Hemisphere.

This Calendar for 1964 and 1965 has been drawn up by A. H. Shapley, Chairman, and J. V. Lincoln, Deputy Secretary, of the I.U.W.D.S. Steering Committee, in close association with the C.I.G.-I.Q.S.Y. Committee and its Reporters and spokesmen for the various scientific disciplines. Similar Calendars have been issued annually beginning with the I.G.Y., 1957-58, and have been published in various widely available scientific publications.

Additional copies are available upon request to I.U.W.D.S., c/o Secretary General of U.R.S.I., 7, Place Danco, Brussels 18; or to I.Q.S.Y. Secretariat, 6 Cornwall Terrace, London NW1.

## National Programmes

### IONOSPHERE — RADIO ASTRONOMY — WORLD DAYS

We quote from « *I.Q.S.Y. Notes* », n° 1 and 2, April and May 1963, the following national programmes :

#### IONOSPHERE

##### Argentine.

1. VERTICAL INCIDENCE.

Ionospheric soundings at Tucumán, Buenos Aires, Trelew, Ushuaia, Decepcion, Base General Belgrano and from the surveying vessel « Capitán Cánepa ».

2. IONOSPHERIC ABSORPTION MEASUREMENTS.

*Pulse method* : Buenos Aires and Ushuaia.

*Extra-terrestrial noise* : Base General Belgrano.

3. DRIFT MEASUREMENTS.

*Drift* : La Plata.

4. NOISE, WHISTLER AND V.L.F.

*Atmospheric noise* : La Plata and Ushuaia.

*Whistler and V.L.F.* : Tucumán, Ushuaia and Base General Belgrano.

5. ELECTRON DENSITY AND TEMPERATURE.

Measurements by Sounding Rockets up to 200 km at Chamental.

*Daily radioprotol on 86.5 Mc/s, at Pereyra.*

##### Australia.

1. Vertical Soundings will be made continuously at Port Moresby, Townsville, Brisbane, Canberra, Hobart, Mundaring, Cocos Island, Norfolk Island, Mawson and Wilkes ; hourly at Woomera and quarter hourly at Salisbury.

2. ABSORPTION AND SCATTERING.

H. F. forward scatter propagation studies will be carried out between Wilkes (transmitter) and Mawson.

Riometers operating at 27 Mc/s and 77 Mc/s will be used at Mawson.

At Wilkes and Macquarie Island, Riometers will be operated at 27 Mc/s.

At Armidale studies will be made of some or all of the following ; wave interaction D and E region ; lower ionospheric structure (back scatter) ; incoherent back scattering from F region at about 70 Mc/s ; total electron content using lunar echoes ; sun echoes at 40 Mc/s and absorption A-2 (Extra terrestrial noise).

At Brisbane measurements will be made of some or all of the following backscatter at fixed and varying frequencies ; forward scatter ; fading of signals from Beacon satellites.

At Camden backscatter soundings 12, 18, and 30 Mc/s will be measured.

### 3. ATMOSPHERIC RADIO NOISE.

Monitoring experiments of anomalous VHF 50 Mc/s signals from transequatorial sources will be made at Townsville.

VLF Radio Noise (Intensity measurement) will be made at Camden, Albany, Hobart, Adelaide, Mawson and Brisbane.

Some dispersion measurements will probably be made at Brisbane on Whistlers.

### 4. DRIFTS.

Occasional observations on Drifts (D-1) will be made at Brisbane with possibly some 24-hour runs on occasions — similar measurements may be made at Armidale.

### **Austria.**

*Institut für Meteorologie und Geophysik, Universität Graz.*

Hourly vertical incidence soundings.

Quarter-hourly vertical incidence soundings on International World Days.

Evaluation and publication of monthly mean values for  $f_oE$ ,  $f_oE_s$ ,  $f_oF_1$ ,  $f_oF_2$ ,  $h'E$   $h'F$ , and  $h'F_2$  as well as hourly values of  $f_oE_2$ .

Construction of  $f$ -plots and transmittal to the Slough Data Centre for all World Days.

Calculation of  $N(h)$ -profiles, at least for World Days.

Hourly measurements of ionospheric absorption by method A-1 (pulse at vertical incidence).

Whistler observations, if possible at Sonnblick Observatory (3100 m).

Satellite observations, in collaboration with the Geodetic Institute, Technische Hochschule, Graz.

### **Belgique.**

Le Centre de Physique du Globe établi à Dourbes par l'I.R.M. effectuera les observations suivantes :

Sondages à incidence verticale par balayage de 1 à 20 MHz en 180 secondes toutes les 15 minutes.

L'extension de la gamme de fréquence vers 250 KHz est envisagée. Mesure d'absorption (mesures par impulsions) dans les fréquences de 2, 3, 4 et 6 MHz, au voisinage de midi, au voisinage de minuit et dans certaines occasions pendant la journée.

Un programme sera établi pour l'observation des Whistler sur 10 KHz en collaboration avec la station qui est magnétiquement jumelée avec Dourbes.

Enregistrement continu des paramètres ionosphériques :  $h'$ ,  $fE$ , MUF, en vue d'une étude régionale.

### **Bulgarie.**

1. Vertical incidence sounding at ionospheric station Sofia (42°39' N, 23°21' E).
2. Absorption :
  - (a) Type A-2 (cosmic noise at  $f$  20 Mc/s approximately),
  - (b) Type A-3 (field strength measurements of CW transmitter on short, medium and long waves). Ionospheric observatory Sofia (42°41' N, 23°21' E).
3. Ionospheric drift : Type D-1 (pulse fading method) at Ionospheric Station Sofia.
4. Atmospheric noise :
  - (a) Method IZMIRAN, Moscow.
  - (b) Measurement of the effective value by continuous recording on frequency 27 kc/s.



**Canada.**

The following represents the programme on ionosphere measurements that is going at present and that we expect can be maintained throughout the I.Q.S.Y. :

1. HF SWEPT FREQUENCY IONOSONDES.

The following standard automatic ionosondes are operated by the Department of Transport. Sweeps are of 15 seconds duration in the range 1.0 to 16 Mc/s, at 00, 01, 15, 30, 45 and 59 minutes, each hour.

Station	Geog.		Type of Sounder	
	Lat.	Long.		
Resolute Bay, N. W. T. . .	74.7° N	94.9° W	LG	17
Churchill, Manitoba . . . . .	58.8° N	94.2° W	LG	17
Winnipeg, Manitoba . . . . .	49.9° N	97.2° W	S 1	I
St. John's, Nfld . . . . .	47.5° N	52.8° W	S 1	I
Ottawa, Ontario . . . . .	45.4° N	75.8° W	LG	17

Responsibility for the data collected by these sounders is in process of transfer from Defence Research Board, (Defence Research Telecommunications Establishment) to Department of Transport. Details are still being worked out, but it is expected that existing procedures, on the whole, will continue from now through I.Q.S.Y. At present, data are recorded on 35 mm film, scaled, tabulated, and published for world-wide distribution.

2. HF FIXED FREQUENCY IONOSONDES.

These are experimental high power pulse transmitters, operated by Defence Research Board (Defence Research Telecommunications Establishment). Two fixed frequencies (about 2.5 and 6 Mc/s) and two propagation modes are used to examine partial reflections from irregularities in the D region. Installations at Ottawa are now operating, and plans are being made for installation at Resolute Bay and Churchill during the I.Q.S.Y. period. Operation is for selected periods only. The work to date has been largely concen-

trated on noon-time electron density profiles during quiet and disturbed periods.

### 3. RIOMETERS.

There is an extensive riometer programme in Northern Canada, mainly operated by or on behalf of the Defence Research Telecommunications Establishment. There is no doubt that changes that cannot now be forecast in detail will occur before and during the I.Q.S.Y. However, the overall size of the riometer programme is not expected to change significantly. Continuous pen recordings are normally made on paper strips at a speed of 3 inches per hour. The records are retained at the Defence Research Telecommunications Establishment, Ottawa.

Station	Geog.		Frequency
	Lat.	Long.	
Ottawa .....	45.4° N	75.8° W	30 Mc/s 60 15 30 30 30
Mont Joli .....	48.6° N	68.2° W	30
Val d'Or .....	48.0° N	77.8° W	30
Cape Jones .....	54.5° N	79.5° W	30 30 30

*Note.* — A magnetic conjugate point experiment between the Great Whale-Cape Jones region and Byrd, Antarctica, is underway and will probably continue through I.Q.S.Y.

Participating laboratories include : Stanford University ; CRPL, Boulder ; DRB (Pacific Naval Laboratory) ; DRB (DRTE) ; Dominion Observatory. Because of the conjugate point experiment, the number of riometers at Cape Jones was recently increased from one to three, and duplicate recordings are being made. One copy is retained at DRB (DRTE), Ottawa, the second copy by CRPL, Boulder.

Station	Geog.		Frequency
	Lat.	Long.	
Churchill .....	58.8° N	94.2° W	30 Mc/s 60 30

*Note.* — The Defence Research Northern Laboratory operates one riometer as a service to users of the Rocket Range.

Coral Harbour .....	64.2° N	83.4° W	30 Mc/s
Resolute Bay .....	74.7° N	94.9° W	30
Prince Albert .....	53.2° N	105.7° W	30

#### 4. LF/VLF FIXED FREQUENCY RECEIVERS.

The VLF receivers, and a transmitter at Ottawa, are operated by DRTE. Continuous pen-recordings are retained at DRTE.

*Note.* — Operation of most of these circuits is dependent on the continuing operation of the listed transmitters.

Receiver	Transmitter	Frequency
Ottawa .....	Comfort Cove, N. S.	70.4 kc/s
	Goose Bay, Labrador	82.0
	Boulder, Colorado	20.0
	Boulder, Colorado	60.0
Churchill .....	Ottawa, Ontario	80.0
	Thule, Greenland	77.0
St. Stephen, N. B. ....	Cutler, Maine	14.7
Royal Roads, B. C. ....	Jim Creek, Wash.	18.6

5. HF OBLIQUE SOUNDERS.

The oblique sounders sweep from 1-25 Mc/s. The data are recorded on 35 mm film and distributed to participating agencies.

(a) *Trans-Atlantic Circuit.*

From Ottawa (DRTE) to The Hague, Holland (PTT). Now operating but decision as to duration of this experiment has not been made.

(b) *Auroral Circuit.*

From Ottawa (DRTE) to Resolute Bay (DOT). Now operating and will probably continue through I.Q.S.Y.

6. TOPSIDE SOUNDER (ALOUETTE).

The sounder sweeps from about 0.5 to 12 Mc/s. The data are recorded on 35 mm film and are sent to World Data Centers within one year or less after recording. There is a reasonable probability that Alouette will continue to operate into the I.Q.S.Y. Further details are given in Section XI on Space Research and in Item 7 below.

7. VLF RECEIVER (ALOUETTE).

Naturally occurring electromagnetic waves in the 0.4-10.0 Kc band are received in the Alouette satellite and the complete band width is telemetered to ground stations. These recordings allow detailed studies of variation with latitude, not previously possible. Comparison with existing ground-based equipment operated by DRTE, Stanford University and Dartmouth University, are producing valuable information pertaining to the theories of generation and propagation of whistlers and VLF emissions.

**China (Republic of)**

1. VERTICAL SOUNDING. The equipment to be used is NBS (U. S. A.) Model C-2 Recording Schedule :

(a) Ordinary days : 6 times an hour, i.e. 00, 01, 15, 30, 45 and 59 mins.

(b) Special days, including SWI, RWD, etc. : 14 times an hour, i.e. every five minutes and 01,59 minutes.

2. ABSORPTION MEASUREMENT using pulse reflection method.

### **Czechoslovakia.**

(Reporter P. Beckman, Institute of Radiotechnics and Electronics of C.A.S., Prague.)

1. Vertical ionospheric soundings at 1-18 Mc/s every 30 minutes.
2. Permanent measurement of the absorption (recording of the field intensity) at 2,61 Mc/s and 2,78 Mc/s.
3. Permanent measurement of atmospherics at 5 kc/s and 27 kc/s.
4. Study by means of a riometer at 30 Mc/s (later at 27,5 Mc/s).
5. Study and classification of SID (SWF, SPA, SEA, SCNA).
6. Study of the appearance of whistlers.

### **Denmark.**

In addition to the routine observations which will be continued at the permanent ionospheric stations at Godhavn and Narssarsuaq, both in West Greenland, present plans call for the following special investigations to be carried out during the I.Q.S.Y. :

1. Detailed investigations of Slant Es and F-region drift.
2. Recording of the total absorption of the ionospheric layers by means of riometers set up at Godhavn and Narssarsuaq.
3. Supplementary VLF observations at Nord, North-eastern Greenland, where tape recording of VLF phenomena and of photometric aurora measurements are contemplated, and at Thule Village, where disturbances of the chorus type will be the principal object of observation. Direction finding of whistler signals will be included in the programme of the Godhavn station.

The ionospheric investigations will be carried out by the Ionosphere Laboratory of the Technical University of Denmark under the auspices of the Danish National Committee for U.R.S.I.

### **East Africa.**

- (a) VERTICAL SOUNDING. — It is expected that a vertical incidence sounder will be operating at the Royal College, Nairobi, under the direction of Professor A. N. Hunter.

- (b) ABSORPTION. — A riometer may be installed at Nairobi.
- (c) ATMOSPHERIC RADIO NOISE. — Observations are planned at Nairobi.
- (d) DRIFTS. — Horizontal drifts in the Ionosphere will be studied at Nairobi.

In addition the Nairobi station hopes to be able to undertake observations of Faraday rotation and scintillation of radio transmissions from satellites, and of photo-fading of long distance radio transmissions.

### **Finland.**

#### *Sodankylä Observatory : Ionospheric Station.*

1. Vertical soundings in the frequency band 1-16 Mc/s. Pulse peak power approximately 8 kW, 50 pulses/sec, duration of the frequency sweep 480 secs.
2. Oblique soundings between Sodankylä and Kemi using the same transmitter as above and a similar receiver at Kemi.
3. Oblique soundings in the frequency band 4-45 Mc/s in both directions between Sodankylä and Lindau (Germany) in cooperation with Max-Planck-Institut für Aeronomie. Pulse peak power approximately 20 kW, duration of the frequency sweep 420 secs.
4. Back-scatter soundings, on occasions, using the same equipment as in 3.
5. Absorption measurements between Kemi and Sodankylä. Transmitter at Kemi with the frequency of 2.1 Mc/s and the CW power of 500 W ; receiver at Sodankylä.
6. Absorption measurements between Sodankylä and Lindau (Germany). Transmitter at Sodankylä, frequency 8.1 Mc/s, CW power 1 kW, receiver at Lindau.

#### *Nurmijärvi Observatory : Ionospheric Station.*

Ordinary vertical soundings following international I.Q.S.Y. instructions. Soundings once per minute during special world intervals.

## France.

### 1. SONDAGES A INCIDENCE VERTICALE.

Objectif : Etude continue de l'ionosphère inférieure aux diverses latitudes.

#### a) Stations du groupe de recherches ionosphériques.

Responsable : A. Lebeau.

Nature : Sondeurs verticaux type panoramique 35/16 mm à gamme de fréquence étendue vers le bas ( $<1$  MHz).

Dates : Sondages quadri-horaires. Lieux : Garchy, Tamarrasset, Bangui, Port-aux-Français.

#### b) Stations de la Division des Prévisions Ionosphériques.

Responsable : C. Halley.

Nature : Sondeurs verticaux à gamme de fréquences 1,2 à 20 MHz.

Dates : Sondages quadri-horaires, Lieux : Saclay, Dakar-Cambérène, Djibouti-l'Arta, Tananarive-Ivato, Tahiti-Taravao.

#### c) Station de Poitiers.

Responsable : R. Rivault.

Nature : Sondeur vertical à gamme de fréquences 1,2 à 20 MHz.

Dates : Sondages quadri-horaires ? Lieu : Poitiers.

### 2. ABSORPTION IONOSPHERIQUE.

Objectif : Etude de la basse ionosphère.

#### a) Sondeur d'absorption.

Responsable : A. Lebeau.

Nature : Sondeurs d'absorption à 4 fréquences ; enregistrement magnétique.

Dates : Régulières durant les A.I.S.C. Lieux : Port-aux-Français, Bangui.

#### b) Riomètres.

Responsables : 1. A. Lebeau,  
2. C. Halley.

Nature : 1. Riomètres à 4 fréquences du Groupe de Recherches Ionosphériques.

2. Riomètre à 1 fréquence de la Division des Prévisions Ionosphériques.

Dates : Permanent durant les A.I.S.C.

Lieux : 1. Garchy, Bangui, Port-aux-Français.

2. Dakar-Cambérène, Djibouti-l'Arta, Tahiti-Taravao.

c) *Mesures de champ d'émetteurs.*

Responsable : C. Halley.

Nature : Mesure de l'affaiblissement du champ propagé de nuit par réflexion sur une ionosphère calme, en fonction de la distance et de la situation géographique.

Dates : Enregistrements de nuit durant les A.I.S.C. Lieux : Saclay, Dakar-Cambérène, Djibouti-l'Arta, Tananarive-Ivato, Tahiti-Taravao, Port-de-France, Nouméa (éventuellement).

3. VENTS IONOSPHERIQUES.

a) *Etude des vents ionosphériques au niveau de la couche E.*

Responsable : A. Haubert.

Nature : Réception à antennes multiples par la méthode des fluctuations, adaptée à la couche E.

Dates : Régulières durant les A.I.S.C. Lieu : Garchy.

b) *Etude des perturbations itinérantes par diffusion arrière.*

Responsable : J. Delloue.

Nature : Etude de la diffusion arrière ionosphérique entre 8 et 26 MHz et mesure de la vitesse de propagation des échos.

Dates : Régulières durant les A.I.S.C. Lieu : Valensole.

c) *Etude des traînées météoriques.*

Responsable : A. Spizzichino.

Nature : Observations des échos météoriques par goniométrie en réflexion avant et arrière ; détermination des mouvements en vitesse et direction.

Dates : Permanent. Lieux : La Haye, La Crau, Garchy.



4. PHÉNOMÈNES A TRÈS BASSE FRÉQUENCE.

Objectif : Etude des bruits d'origine naturelle et de leurs conditions de propagation exosphérique.

a) *Enregistrement permanent des sifflements naturels.*

Responsable : R. Rivault.

Nature : Enregistrement conforme aux recommandations de l'I.Q.S.Y.

Dates : Permanent. Lieu : Poitiers.

b) *Etude de la structure électromagnétique des sifflements.*

Responsable : J. Delloue.

Nature : Analyse du front d'onde des sifflements par détermination en plusieurs points de la direction d'arrivée ; détermination de la région d'émergence de l'énergie hors de l'ionosphère ; effet des couches ionosphériques sur la propagation ; mesure de la polarisation et interprétation en fonction des paramètres exosphériques et ionosphériques. Utilisation d'un équipement permettant la mesure du temps de transit entre stations d'observation distantes soit de quelques dizaines de kilomètres, soit de quelques centaines de mètres.

Dates : Essais réguliers en 1964-1965. Lieux : Régions de Paris, Orléans, Chartres.

c) *Enregistrement d'émissions radioélectriques à très basse fréquence.*

Responsable : B. Decaux.

Nature : Enregistrement en amplitude et en phase du champ d'émetteurs lointains à très basse fréquence.

Dates : Permanent. Lieux : Bagneux, Port-aux-Français.

d) *Enregistrement des phénomènes à extrêmement basse fréquence.*

(cf. Géomagnétisme, 1 (c) et 2 (b).)

Responsable : A. Lebeau.

Nature : Spectromètre magnétique permettant l'enregistrement et l'analyse spectrale des phénomènes naturels dans les bandes 1-30 Hz ou 10-300 Hz.

Etude des résonances de la cavité terre-ionosphère et des bruits naturels. E.B.F.

Dates : Régulières à Chambon-la-Forêt ; campagne de durée limitée en 1964 à Port-aux-Français, Lieux : Chambon-la-Forêt, Port-aux-Français.

5. BRUITS ATMOSPHÉRIQUES.

Objectif : Etude du bruit atmosphérique et de ses variations.

a) *Enregistrement du niveau moyen des atmosphériques.*

Responsable : F. Carbenay.

Nature : Equipement d'enregistrement étalonné du niveau moyen des atmosphériques et de leur cadence de succession. Application particulière à l'observation des P.I.D.B.

Dates : Permanent durant les A.I..S.C. Lieux : Bagneux, Bangui, Tananarive-Ivato, Tahiti-Taravao, Port-aux-Français.

b) *Enregistrement du bruit atmosphérique sur 27 kHz.*

Responsable : C. Halley.

Nature : Observation du bruit radio atmosphérique à 27 kHz en l'absence de perturbations.

Dates : Permanent durant les A.I.S.C. Lieux : Saclay, Tananarive-Ivato, Tahiti-Taravao.

6. OBSERVATION DES EFFETS IONOSPHERIQUES D'UNE ÉCLIPSE DE SOLEIL.

Objectif : Influence d'une éclipse de soleil sur l'ionosphère.

Responsable : C. Halley.

Nature : Sondages ionosphériques verticaux accélérés et enregistrement de phase en H.F.

Etude des coefficients de recombinaison dans l'ionosphère.

Date : 30 mai 1965. Lieux : Tahiti-Taravao (et Iles Sous-le-Vent éventuellement).

7. EXPÉRIENCES ENTRE POINTS CONJUGUÉS.

Objectif : Expériences mettant à profit la conjugaison magnétique de la France et de l'Afrique du Sud.

Responsable : 1. F. du Castel pour 1 et l'ensemble.

2. J. Delloue.

3. R. Gendrin.

4. R. Schlich.

5. P. Vila.

Nature : 1. Guidage géomagnétique en H.F. Réception en hémisphère sud, avec synchronisation, d'un émetteur modulé en impulsions longues, autour de 10 MHz. Essai de mise en évidence d'une propagation guidée le long du champ magnétique terrestre.

2. Guidage géomagnétique en T.B.F. Réception en hémisphère sud d'un émetteur à 16 kHz (F.U.B.). Mise en évidence d'une propagation guidée le long du champ magnétique terrestre, et comparaison avec la propagation des sifflements naturels.

3. Phénomènes naturels en E.B.F. (cf. Géomagnétisme, 1 (c) et 2 (b)). Enregistrements simultanés en hémisphère nord et sud des phénomènes naturels dans la gamme des fréquences de résonance de la cavité terre-ionosphère (1-30 Hz) et des phénomènes E.B.F. (10-300 Hz). Analyse spectrale des enregistrements.

4. Perturbations magnétiques (cf. Géomagnétisme, 4). Enregistrements simultanés en hémisphères nord et sud des perturbations magnétiques rapides (micropulsations), à partir des barres-fluxmètres et lignes telluriques.

5. Sondages ionosphériques verticaux. Sondages verticaux simultanés en hémisphère nord et sud, à cadence rapide. Etude des perturbations itinérantes.

Dates : Campagne préliminaire en 1963 ; campagne de longue durée en 1964-1965.

Lieux : 1. La Turbie et Grahamstown.

2. Sainte-Assise et Grahamstown.

3. Saint-Michel et Prince-Albert (probablement).

4. Chambon-la-Forêt et Hermanus (probablement).

5. Poitiers et Capetown.

## 8. ÉTUDE DE L'IONOSPHERE PAR DIFFUSION ÉLECTRONIQUE INCOHÉRENTE.

Objectif : Etude des spectres des signaux diffusés par l'ionosphère jusque vers 1000 km, et détermination de l'ionisation, de la composition ionique et de la température.

Responsable : F. du Castel.

Nature : Réalisation d'un sondeur bistatique à diffusion électronique incohérente fonctionnant en onde entretenue sur 950 MHz.

Dates : A partir de fin 1964. Lieux : Saint-Santin-des-Maurs, Nançay.

9. MESURE DE LA DENSITÉ IONOSPHERIQUE.

a) *Mesure directe par fusées.*

Objectif : Etude des couches E sporadiques en régions tempérées.

Responsable : M. Thué.

Nature : Mesures simultanées de la densité électronique, par méthode radioélectrique (Méthode Jackson-Seddon sur 8 et 48 MHz) et par sondes de densité, et des mouvements au niveau de la couche E.

Dates : Non fixées. Lieu : Hammaghir.

b) *Mesure par observations de satellites.*

Objectif : Détermination du profil total de densité électronique.

Responsable : E. Vassy.

Nature : Mesure de l'effet Doppler-Fizeau et de l'effet Faraday sur des signaux émis par des satellites.

Dates : Régulières pendant les A.I.S.C. Lieu : Val-Joyeux.

10. ETUDE PAR SATELLITE DES IRRÉGULARITÉS D'IONISATION EXOSPHERIQUE.

Objectif : Etude des irrégularités d'ionisation dans l'exosphère à partir de la propagation d'ondes T.B.F.

Responsable : O. Storey.

Nature : Satellite lancé par la NASA (U. S. A.) mesurant le champ magnétique et le champ électrique en amplitude et en phase d'émetteurs terriens T.B.F.

Date : fin 1964.

## Germany (Democratic Republic)

### A. — Major Synoptic Programme

Type of observation	Station	Programme
1) VI. Vertical incidence sounding (0.5 ... 20 Mc/s in 30 sec.) (since 1957)	HHI, Juliusruh	Synopt. Progr. «B» (Hourly values and $f$ -plots) and partly «c» ( $N(h)$ -profiles)
2) A1. (A4). Absorption (frequencies 2.05, 3.18 and 3.86 Mc/s) (since 1956)	HHI, Juliusruh	A-scope «snapshots» all the day
3) A2. Cosmic Noise Absorption (a) 25 Mc/s Zenith (since 1959) (b) 25 Mc/s Polar Star (planned) (c) 25 Mc/s Polar Star (since 1962) (d) 27 Mc/s Polar Star (planned for 1963) (e) 30 Mc/s Polar Star	HHI, Neustrelitz    OIF, Kühlungsborn	Continuous recordings   Continuous recordings Continuous recordings
4) A3. CW-Absorption (a) 245 kc/s (since 1951) (b) 185 kc/s (since 1962) (c) HF-oblique-incidence (planned)	OIF, Kühlungsborn  HHI, Neustrelitz	Conversion-coefficient  Day and night-time Continuous recordings

Type of observation	Station	Programme
5) Ionospheric Drifts (CW, oblique incidence) (a) 245 kc/s (since 1957) (b) 185 kc/s (since 1962) (c) 185 kc/s (planned) (d) 272 kc/s (since 1958)	OIF, Kühlungsborn Geophys. Observat. Collm	Night-time only hourly mean values, full analysis for some RWD and SWI Periods Continuous night-time recordings with automatic recorder (Phillips-System)
6) Atmospheric Noise Statistics (a) 27 Kc/s integrated Level (since 1960) (b) 40 Kc/s integrated Level (since 1961) (c) 27 Kc/s counting rate (since 1952) (d) 30-500 Kc/s Envelope-Probability-Distributions (planned) (e) 27 Kc/s Atmoradiograph	OIF, Kühlungsborn  Geophys. Observat. Collm	Continuous recordings (bandwidth 500 c/s)
7) W. Whistler and VLF Emissions (a) Occurrence of whistlers and VLF-Noise (since 1957) (b) Dispersion-Analysis of special periods (planned)	OIF, Kühlungsborn  OIF, Kühlungsborn	Continuous recordings (bandwidth 1 Kc/s)  Recommended magnetic tape recording (300 c/s... 20 Kc/s)

Type of observation	Station	Programme
8) URSIGRAM-SERVICE USIDA-messages (since I.G.Y./I.G.C.)	OIF, Kühlungsborn (Station indicator 15) HHI, Juliusruh (Station indicator 93)	Cooperation with recommended network
9) BI. Backscatter, fixed frequency 33 Mc/s, PPI-Recording (since 1958) with special programme for  (a) Radio Aurora (b) E <sub>s</sub> Backscatter (c) Meteor-Showers	OIF, Kühlungsborn	WSI-Programme Synoptic programme with intervals of 1 1/2 hours  Special programmes during Radio-Aurora-Events and increased meteor activity
10) Forward scatter 3 Forward scatter-Propagation Paths in the 50 Mc/s-Band (since 1960)	OIF, Kühlungsborn	Continuous recordings
11) Vertical incidence sounding closely spaced network (planned)	HHI, Juliusruh HHI, Gross Lindau	Special programme for selected periods
12) Recordings CW-LF-Transmissions (a) night-time Conversion Coefficients at low frequencies 128, 185, 245, 355 Kc/s 245, 272 Kc/s	OIF, Kühlungsborn Geophys. Observat. Collm	Continuous recordings

Type of observation	Station	Programme
<p>(b) Fieldstrength recordings for phase-height analysis of low ionosphere 16, 54, 155, 164 Kc/s 155, 164 Kc/s</p>	<p>OIF, Kühlungsborn FRZ, Kolberg</p>	
<p>(c) Fieldstrength recordings for statistical analysis (150-1500 Kc/s)</p>	<p>FRZ, Kolberg</p>	
<p>13) Atmospheric Noise</p> <p>(a) Measurements of integrated Level at various frequencies on board of ship (Europe-China, Europe-South American Route)</p> <p>(b) Studies of frequency dependence of radiated power from flashes</p> <p>(c) Narrow-sector-recorder</p> <p>(d) Wave-form recording</p>	<p>OIF, Kühlungsborn</p> <p>Inst. f. exp. Physik. Halle Potsdam, Kühlungsborn Potsdam</p>	<p>Continuous recordings On workdays at 6 and 12 hours. GMT ; during WGI'S at closer intervals.</p>
<p>14) Satellite-Observations</p> <p>(a) Faraday fading Observations (since 1958)</p> <p>(b) Radio tracking of Satellites (planned)</p>	<p>OIF, Kühlungsborn</p> <p>OIF, Kühlungsborn</p>	<p>Analysis for total electron content and medium electron density profiles as in I.G.Y./I.G.C. period Doppler-Dispersion Measurements</p>



**Germany (Federal Republic).**

A. Contributions to ionospheric Research are planned at the following places :

- (a) (LI) Max-Planck-Institute for Aeronomy, Institute for Ionospheric Physics, Lindau/Harz (LI).
- (b) (TU) Ionospheric Station Tsumeb (TU); South West Africa. This station is operated by (a).
- (c) (SO) Geophysical Observatory Sodankylä (SO), Northern Finland in cooperation between (a) and the Finnish Academy of Science.
- (d) (BR) Ionospheric Institute Breisach/Rhein (BR).
- (e) (TO) Ionospheric Station in Northern Togo (TO), Central Africa. This station is operated by (d).
- (f) (BE) Heinrich-Hertz-Institute for Schwingungsforschung, West-Berlin (BE).
- (g) (CO) Institute for Geophysics and Meteorology of the University of Cologne (CO).
- (h) (RS) By LI on board a Research Ship (RS) around the crossing point of geographic and geomagnetic equator in the Atlantic Ocean during the second half of 1965.

B. The following observations are planned in detail (the places of observation are given by the abbreviations of A) :

1. VERTICAL SOUNDINGS.

- (1) Vertical incidence sweep frequency soundings (1-16 Mc/s) in 15 min. intervals and during RWD and SWI in 5 or 3 min. intervals at LI, TU, RS, BR and TO.
- (2) Vertical incidence sweep frequency soundings (0.35-5.6 Mc/s) according to a special programme at TU.
- (3) Direct recordings of ionospheric characteristics, e.g. MUF3000,  $h_{min}$ ,  $fEs$ , etc. at BR and TO.

2. OBLIQUE INCIDENCE HF-PROPAGATION AND BACKSCATTER.

- (1) Oblique incidence sweep frequency two way pulse transmissions (4-45 Mc/s) between LI and TU and between LI and SO.

- (2) Sweep frequency backscatter observations (4-45 Mc/s) at LI to different directions and at TU in direction towards the equator.
- (3) Field-strength recordings in the HF range on a long distance transequatorial path from LI to TU on three fixed frequencies.

### 3. IONOSPHERIC DRIFT MEASUREMENTS.

- (a) according to the fading method at BR, CO and TO.
- (b) according to the meteor method at BR.

### 4. ABSORPTION MEASUREMENTS.

- (a) Absorption measurements with vertical incidence pulse transmissions (A1) on several different fixed frequencies during noon time, during RWD and SWI the whole daytime hours, at LI and BR. At TU in the range 0.35-1.6 Mc/s.
- (b) Absorption measurements with vertical incidence pulse transmission on 2.2 Mc/s by observing of only one pulse selected by a gate (A 1a).
- (c) Absorption measurements by Riometers on a fixed frequency (A 2) at LI, TU, BR and SO.
- (d) Absorption measurements by field-strength recordings of a HF-transmitter about 300 km away (A 3) at LI and TU.

### 5. VLF — OBSERVATIONS.

- (a) VLF — recordings (amplitude and phase variations) of a transmitter over a transpolar path at LI (a contribution to polar cap absorption research).
- (b) VLF — recordings (amplitude and phase variations) and sferics-recordings at BR (a contribution to VLF-propagation research).

### 6. ROCKETS AND SATELLITES.

- (a) Observations of satellites with the Faraday rotation and Doppler method to compute the electron distribution above the F2 layer maximum. These observations which are planned at LI and BR are only possible so far as special satellites for this purpose are available during I.Q.S.Y.

(b) Rocket measurements of electron density and solar ultra-violet radiation in the ionosphere are planned by BR.

### Greece.

1. *Ionospheric Institute, National Observatory of Athens and special Research Groups sponsored by USAF Cambridge Research Center and NATO Scientific Affairs Division.*

Synoptic observations : vertical incidence sounding (continuous, 1 Mc/s to 20 Mc/s peak power kW. Absorption by riometer (in 6 different frequencies and pulse technique). Ionospheric drifts. Whistlers and VLF on 27.6 kc/s. Oblique incidence : 50 kW peak power panoramic sounder logarithmic receivers collaborating with Breisach and later with Boston, in sweep frequency. Oblique incidence on fixed frequencies (Breisach-Athens) on 11 and 13 Mc/s.

Special projects : Cross-modulation to determine electron profiles. Sporadic E (special project measurements by 5 special receivers spaced in locations 200 km around Athens).

### Hungary.

1. **SYNOPTIC OBSERVATIONS.**

(a) *Vertical incidence soundings.* — This programme will be the same as that carried out in Budapest during the I.G.Y. The ionospheric equipment was transferred to the meteorological station at Békéscsaba (46°41' N, 21°10' E, 87 m a.s.l.) in December 1962.

The measured values of the following ionospheric characteristics will be reported in a new series of publications beginning with July 1963.

$f_{min}$ ;  $f_oE$ ,  $f_oF1$ ,  $f_oF2$ ,  $fEs$ ;  $h'E$ ,  $h'F$ ,  $h'F2$ ,  $h'Es$ ; type Es. Type of ionospheric equipment : IRX. The recorder has a sweep of 35 sec. The frequency range is 1.0 to 20.0 Mc/s.

Beginning with 1st January 1964, it is planned to measure the values of the ionospheric absorption using the pulse reflection method as well as by measuring the field strength of skywave signals at oblique incidence.

(b) *ELF noise observations.* — In connection with the complex investigation of the electromagnetic field of the Earth, ELF noise

will be studied during the I.Q.S.Y. in the Geophysical Observatory near Nagycenk. The amplitude of the noise in the range 0-15 cps, and at two other higher frequencies, will be recorded with a speed of 20 mm/hour. Furthermore, on regular and irregular world days, the noise will be analysed hourly.

## 2. SPECIAL PROJECT.

Atmospheric noise. The wave form of atmospherics will be measured at the Aerological Observatory of the National Institute of Meteorology (Budapest ; 47°26' N, 19°11' E, 140 m a.s.l.).

### **Iceland.**

The Post and Telegraph Administration has for some years been carrying out vertical incidence soundings under an NBS contract. There is, however, an urgent need for new equipment, and when the contract expires later this year, the signing of a new contract should be accompanied by the removal of the ionospheric station to a new site. At the same time, the operation of the station should preferably be transferred to the University of Iceland, if the appropriate arrangements can be made. Additional types of equipment would be needed for the detection of whistlers, together with riometers for recording cosmic noise.

### **India.**

1. Maintenance of the existing eight ionospheric vertical sounding stations with increase in the ratio of automatic recording stations : working out of true height profiles on selected days from the records.

All India Radio — Delhi, Bombay, Madras, Tiruchirapalli,  
Trivandrum.

India Meteorological Department — Kodaikanal.

Physical Research Laboratory — Ahmedabad.

National Physical Laboratory — Delhi.

Institute of Radio-Physics and Electronics — Calcutta.

2. Ionospheric drift measurements (Ahmedabad, Trivandrum, Waltair, Delhi).
3. Ionospheric absorption Measurements ( $A_1$ ,  $A_2$ , and  $A_3$ ) (Ahmedabad, Delhi, Calcutta, Kodaikanal).

4. Faraday rotation, scintillations and perhaps also Doppler shifts, from beacon satellite transmissions (Delhi, Ahmedabad).
5. Meteor Echo Studies (Waltair).

### **Ireland.**

Recording of sudden ionospheric disturbances (SID) at Dunsink Observatory, which observatory will act as WDC for records of these phenomena.

### **Italy.**

Ionospheric ground observations will be made by means of vertical soundings from two stations :

S. Alessio (Rome) of the Ist. Naz. di Geofisica and Genova-Monte-Capellino.

Characteristic ionospheric parameter measurements will be repeated at very short intervals during periods internationally established or during special events.

Back-scatter experiments and riometers recordings on 30 and 60 Mc/s are planned at the station of Torrechiaruccia of the Centro Radioelettrico G. Marconi of the Istituto Superiore delle Telecomunicazioni.

The use of a special technique recently realized will enable observations of ionospheric irregularities and of their movements to be made.

Observations with riometers will be made by Ist. Elettronica Politecnico (Torino) and by Ist. Microonde (Firenze).

The possibilities of experimental studies of the lower edge of the ionosphere and alternatively of the upper part by means of special sounding techniques have been studied at the Ist. Elettronica Politecnico (Torino), but it is scarcely probable the project could be in operation for the I.Q.S.Y.

### **Japan.**

The plan of I.Q.S.Y. observations in the ionosphere discipline will be the same as during I.G.Y. and I.G.C., adding the special measurements of atmospheric radio noise in ELF band as well as

measurements of the polarization, bearing and angle of arrival of whistlers and VLF emissions.

The activity of WDC C2 for the ionosphere will be continued even during the I.Q.S.Y. on the same scale as during I.G.Y. and I.G.C.

Stations and items of observation are shown in the following list.

Station	Items
Wakkanai	Vertical incidence soundings.
Akita	Vertical incidence soundings.
Hiraiso	Measurement of field intensity of pulse transmission wave. Back scatter B-1 fixed frequency.
Kakioka	VLF emissions.
Kokubunji	Vertical incidence soundings. Absorption A-1 (pulse at vertical incidence). Radio observation of satellites.
Ohira	Forward scatter. Atmospheric noise in HF band.
Kyoto	Absorption (riometer), whistlers, ELF and VLF emissions.
Toyokawa	Atmospheric noise in ELF, VLF and LF bands, whistlers and VLF emissions.
Yamagawa	Vertical incidence soundings. Drift D-1 (pulse fading). Forward scatter.
Moshiri	Atmospheric noise in VLF and LF bands, whistlers and VLF emissions.

### Netherlands.

Routine measurements will be continued at the stations in the Netherlands and in Paramaribo. In addition drift measurements will be made on a co-operative basis at Paramaribo by means of the Mitra-method by the Meteorological Institute and the Postal, Telegraph and Telecommunication Service (P.T.T.).

### New Zealand.

(a) Vertical incidence sounding will be carried out at Rarotonga (Cook Islands), Godley Head, Campbell Island, Hallett Station

(Antarctica), and Scott Base (Antarctica) with the following equipment :

Rarotonga	NZ	P2 ionosonde
Godley Head	NZ	P2 ionosonde
Campbell Island	US	C4 ionosonde
Hallett Station	US	C4 ionosonde
Scott Base	NZ	P2 ionosonde

(b) Effect of ionosphere on long distance HF radio propagation. Studies will be made of the angle of arrival of HF signals from near antipodal transmitters at Seagrove and Invercargill.

(c) Study of fading and diversity effects. At Seagrove and Invercargill.

(d) Electron density determination using satellites. Observations of total electron content and irregularities will be made at Ardmore, Invercargill, Lower Hutt and Campbell Island.

(e) Antipodal reception of satellite signals. An interferometer will be used at Ardmore to obtain bearing and elevation angles. This will enable the size and position of the effective antipodal area to be determined.

(f) Radar meteor equipment will be operated near Christchurch.

(g) Scintillation due to ionospheric irregularities using satellites. Observations will be made at Ardmore, Invercargill, Lower Hutt and Campbell Island.

(h) Observations of Whistlers and VLF emissions according to the internationally agreed minimum synoptic programme will be continued at Wellington, Lauder, Hallett Station (Antarctica), and Scott Base (Antarctica).

(i) Operation of a low frequency ionosonde near Christchurch to study E region echoes below 1 Mc/s, which is the low frequency limit of the Godley Head panoramic ionosonde.

(j) Effects of atmospheric turbulence and mixing on recombination processes in the F region. A portable ionosonde will be operated near a meteorological station, such as Invercargill, which undertakes regular observations of high altitude winds.

## **Nigeria.**

### VERTICAL INCIDENCE.

The Union Ionosonde at Ibadan will continue operation through I.Q.S.Y. It is hoped that another Union Ionosonde MK. II promised by the Director of Radio Research Station, Slough will be in operation at Zaria before the end of 1963.

### ABSORPTION.

Absorption measurements of type A1 will be made at Ibadan.

### DRIFTS.

Ionospheric drift observations of type D1 will be made at Ibadan.

### ATMOSPHERIC NOISE.

Instruments are available but extra hands will be needed to cover noise measurements during the I.Q.S.Y.

### SPECIAL PROJECTS.

(a) It is proposed to install a vertical sounder (Ionosonde) on the magnetic zero dip equator in Nigeria during the I.Q.S.Y. Because of the difficulties anticipated, this can only run at short intervals unless our resources prove to be better than expected.

(b) Measurement of the total electron content of the ionosphere by the Faraday Rotation Method which has been going on at Albadan will be continued. Efforts will be made to start similar observations at Zaria.

## **Poland**

1. Vertical incidence sounding at ionospheric station Miedzeszyn 52° N, 21° E on the frequency band 1-18 Mc/s every 15 min.
2. Absorption. Permanent measurement of the absorption (recording of the field intensity) at 127 Mc/s (Piwnice-Torun).

## **Portugal.**

### MACAU.

Ionospheric soundings with a Cossor sounder.



### South Africa.

(a) VERTICAL INCIDENCE SOUNDINGS. — Existing stations will continue to operate at Johannesburg and Cape Town (National Institute for Telecommunications Research) and at SANAE Base in the Antarctic (Rhodes University).

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

It is recognized 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 than SANAE Base. If suitable equipment becomes available, consideration will be given to establishing stations at one or more of these points.

It should be noted that a station will be established at Tsumeb by the Max-Planck-Institut für Aeronomie.

(b) IONOSPHERIC ABSORPTION. — Ionospheric absorption measurements will be undertaken at Johannesburg (N.I.T.R.) using both the pulse-echo method and the CW Field Strength method.

(c) IONOSPHERIC DRIFTS. — No observations of ionospheric drifts are proposed.

(d) ATMOSPHERIC NOISE STATISTICS. — Observations of atmospheric noise as part of the world-wide network supervised by the National Bureau of Standards of the U. S. A. will continue in Pretoria (N.I.T.R.).

(e) 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.

Continuous recordings of whistler atmospherics at Durban, the establishment of a whistler station in the Antarctic, continuation of conjugate point experiments between Durban and Italy, and a special analysis of atmospheric wave forms with a view to expanding our knowledge of the type of atmospheric which produces whistlers, will be undertaken by the University of Natal.

(f) SPECIAL EXPERIMENTS.

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

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

Oblique incidence HF pulse transmission experiments will be continued between Grahamstown and Alice (Rhodes University).

3. *Atmospheric Radio Noise.* — No special experiments are being planned.

4. *Conjugate Point Experiments.* — Cooperation with overseas organizations in conjugate point experiments is being arranged with the Magnetic Observatory at Hermanus, the University of Natal, and the National Institute for Telecommunications Research.

This will include cooperation with the French National Centre for Telecommunications Studies in simultaneous ionospheric soundings at conjugate points, with the Institut de Physique du Globe in simultaneous recordings of magnetic variations at conjugate 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 (FUB) near Paris.

5. *Satellite Experiments.* — No special experiments are being planned.

6. *Rocket Experiments.* — No special experiments at this stage. However, some consideration may be given to this aspect.

### **United Kingdom.**

A comprehensive programme has been planned for I.Q.S.Y. using the synoptic network of ground stations between longitudes 0° and 110° E, and experiments borne in vertical sounding rockets and earth satellites.

*Vertical incidence soundings.* — The network of stations operating during the I.Q.S.Y. will be Aberystwyth, Slough and Sidmouth in the U. K., Singapore in equatorial latitudes, and Port Stanley, Argentine Islands and Halley Bay in high southern latitudes. At most of these stations, soundings will continue using similar ionosondes to those used during the I.G.Y. though it is hoped to install

improved ionosondes at some stations. At Halley Bay, tests will be conducted to investigate the obliquity of echoes in the sounding of the ionosphere.

*Absorption.* — The study of absorption by the pulse-reflexion method (A1) will be made at Aberystwyth, Singapore and Halley Bay. At Halley Bay and at Edinburgh, the absorption will be studied by measuring the cosmic radio noise (A2) with, respectively, a variable frequency (10-50 Mc/s) and a fixed frequency (20 Mc/s) riometer.

*Drifts.* — Regular measurements of ionospheric drifts by the three — receiver, short base, fading method (D1) will be made at Aberystwyth, Singapore and Halley Bay giving data complementary to those obtained during the I.G.Y. Radio-echo measurements of the magnitude distributions and incident fluxes of meteors by the dual wavelength method will be made at Sheffield.

*Special Experiments at ground stations.* — Scatter soundings of the ionosphere will be made from sites in the U. K. At Sidmouth, particular attention will be devoted to the study of the D and E regions. Back scatter measurements (B1) will be carried out at Edinburgh and incoherent scatter observations will be made at Malvern. A forward scatter link will be established between St. Lawrence (IOW) and Gozo, near Malta. Radio echo observations of ionospheric disturbances and or aurorae will be made at Sheffield on 17 Mc/s and similar equipment to study radio-echoes from aurora will be used at Halley Bay. The propagation of VLF and LF radio waves will be studied at Lerwick and Slough. In London, the propagation of VLF (3 kc/s to 16 kc/s) and ELF (1 c/s to 3 kc/s) radio waves and the structure of the lower D and E regions of the ionosphere will be investigated by utilizing the radiated energy from lightning discharges.

*Electron density and top side soundings.* — The electron density of the ionosphere will be studied by recording whistlers at Argentine Islands. By an analysis of radar echoes reflected from the lunar surface (on two frequencies) it is intended to study at Jodrell Bank the total electron content and the gross shape of the ionosphere, the diurnal, seasonal and storm-time magnetic variations of the content and shape and the dependence of these variations on solar

activity. By cooperating with other observers, to obtain a long base line, it is intended to study the variation of electron content with latitude and longitude and the structure of the large irregularities. Polarization fluctuations caused by irregularities of ionospheric origin will also be investigated using this moon-radar technique with the 250 ft. radio telescope.

The ground stations at Aberystwyth, Slough, Sidmouth, Singapore and Port Stanley will be equipped to receive signals propagated from above the ionosphere by transmitters in earth satellites.

*Rocket and satellite experiments.* — Plasma probes will be launched either in rockets (from Woomera) or satellites to obtain information on the concentration, temperature and mass of ions throughout the ionosphere. The data obtained will be used to study the correlation of ionospheric and solar behaviour, sporadic E ionization and its relation with wind structure, and the role of negative ions in the D region. The propagation of radio waves by rockets making vertical traverses of the ionosphere will be studied to give information on the electron density of the ionosphere.

It is hoped to study the electron profile through the D, E and F layers using rocket-borne high sensitivity r.f. electron density probes. It is possible that a standby unit of the mass spectrometer probe flown in the Ariel I satellite will be incorporated in a U. S. top-side sounding satellite to be flown during the I.Q.S.Y.

## RADIOASTRONOMY

### **Argentine.**

Daily radiopatrol on 86.5 Mc/s, at Pereyra.

### **Australia.**

A Solar Flare Patrol will probably operate near Sydney. The current series of measurements on Solar Emission will continue at Dapto and near Sydney.

### **Belgique.**

#### I. DOMAINE RADIOASTRONOMIQUE.

Observations radio-électriques du soleil calme sur les fréquences de 153 MHz, 408 MHz, 600 MHz et 900 MHz. Ces observations concernent :

- a) la mesure absolue du flux solaire global sur les différentes fréquences afin d'établir la courbe énergie-longueur d'onde du Soleil calme ;
- b) la mesure des distributions de brillance sur 408 MHz et 900 MHz.

La mesure sur 408 MHz doit, en principe, être effectuée à l'aide de l'interféromètre à 48 paraboloïdes (pouvoir résolvant 3') à la station de Humain.

La mesure sur 900 MHz doit être effectuée à l'aide de l'interféromètre à deux antennes, à balayage de lobes et à base variable, dont la réalisation sera terminée pour cette époque.

### Canada.

#### SOLAR RADIO EMISSION.

- (a) *National Research Council — Algonquin Radio Observatory (Latitude 46.0° N ; Longitude 78.0° W).*

Continuous observations are now being made daily from sunrise to sunset of the total solar flux at a frequency of 2800 Mc/s, and these will be continued during I.Q.S.Y. Data are communicated daily to the Regional Warning Service, Ft. Belvoir, and a quarterly summary of daily flux values and burst events is sent to World Data Centers for Solar Activity.

The solar radio spectrum is now being sampled in the frequency range of 20-120 Mc/s with a multi-channel receiver at the rate of 100 times per second. This high time resolution system will remain in operation throughout I.Q.S.Y.

The polarization of solar bursts is being measured at a frequency of 74 Mc/s with a sampling rate of 100 times per second. This instrument will also remain in operation during I.Q.S.Y.

- (b) *National Research Council — Goth Hill Observatory, South Gloucester, Ontario (Latitude 45.4° N ; Longitude 75.6° W).*

Strip scans of 2800 Mc/s emission from the solar disc will be made intermittently at local noon (approximately 1700 UT) with a fan shaped beam 1 minute of arc E-W by 2 degrees of arc N-S. Records for selected days will be made available upon request.

(c) *National Research Council — Dominion Radio Astrophysical Observatory, Penticton, B. C. (Latitude 49.3° N; Longitude 119.6° W).*

The Radio and Electrical Engineering Division of the National Research Council is constructing a radio telescope and radiometer for use at 2700 Mc/s similar to the 2800 Mc/s instrument now in operation at the Algonquin Radio Observatory. When completed this instrument will be installed near Penticton, D.C. at the site of the Dominion Radio Astrophysical Observatory of the Department of Mines and Technical Surveys. The D.R.A.O. has agreed to operate and maintain the instrument on the same daily patrol basis already established by the National Research Council.

The new telescope will help to bridge the time gap in the decimetre wavelength patrol observations between Eastern Canada and Japan. Information on daily flux and burst events will be communicated through the same channels currently used by the National Research Council. It is expected that installation will take place towards the end of 1963.

#### **Czechoslovakia.**

Permanent recording of the radio noise of the Sun at wavelengths of 115, 56, and 37 cm with absolute calibration and recording at 3.2 cm on chosen days (Ondrejov).

#### **Finland.**

Decametric solar radio spectroscopy measurements will be made at Keimola (60°21' N, 24°46' E).

#### **France.**

*Contrôle radio-astronomique de l'activité solaire.*

Objectif : Etude de la couronne du soleil calme.

Responsable : J. F. Denisse.

Nature : Observations interférométriques solaires sur 169 et 9300 MHz.

#### **Germany (Democratic Republic).**

Programme of solar radio observations during I.Q.S.Y., submitted by the Astronomical Observatory Potsdam (Radioastronomical Department).

*Measurements* (daily 07 h — 15 h UT).

A. Flux measurements on the following frequencies :

510 Mc/s (0.59 m); 362 Mc/s (0.83 m); 287 Mc/s (1.05 m);  
234 Mc/s (1.28 m); 111 Mc/s (2.7 m); only for the time when  
the flux exceeds  $20 \cdot 10^{-22}$  W/m<sup>2</sup> Hz (about fivefold the normal  
flux).

64 Mc/s (4.7 m) and 38 Mc/s (7.9 m) only during enhanced  
radiation.

B. Distinctive events; Time and flux tabulated on standards as  
used for the frequencies : 510 Mc/s, 234 Mc/s, 111 Mc/s, 23 Mc/s  
(13 m).

C. Spectrum observation :

Since the single frequency observations are made over a wide  
range of frequencies, (510 Mc/s; 362 Mc/s; 287 Mc/s; 239 Mc/s  
(1.25 m); 234 Mc/s; 111 Mc/s; 64 Mc/s; 38 Mc/s; 23 Mc/s;  
15 Mc/s (20 m); 10 Mc/s (30 m) it is in most cases possible  
to determine the spectral type of distinctive events.

D. Polarization :

Measurements of polarization of distinctive events are made  
now on 23 Mc/s. We intend to extend the observations on  
38 Mc/s and 30 Mc/s during the I.Q.S.Y.

*Publication of data.*

We intend to supply the data for international publication in  
the following manner :

*Daily* on key as used for the I.G.Y. : Flux and distinctive events  
on the frequencies : 510 Mc/s; 234 Mc/s; Distinctive events  
on 23 Mc/s.

*Monthly* on standard data forms as used for the Quarterly Bulletin  
on Solar Activity :

510 Mc/s (flux and distinctive events),  
234 Mc/s (flux and distinctive events),  
111 Mc/s (flux and distinctive events),  
23 Mc/s (distinctive events).

*Quarterly* publication (Mitteilungen des Astrophysikalischen Obser-  
vatoriums Potsdam).

Particular tabulation of all measurements (A-D).

(3) Programme of solar radio observations made by the Heinrich-Hertz Institute at Berlin-Adlershof (A) and at Neustrelitz (N).

Hours of observation :

May-September : 06 h — 18 h UT,

October-April : 07 h UT — sunset.

Daily total flux measurements :

at :  $f = 9400$  Mc/s (A, N)

$f = 2000$  Mc/s (N)

$f = 1500$  Mc/s (A, N)

planned :  $f = 3000$  Mc/s (A) (Start : 1963)

$f = 770$  Mc/s (N) (Start : 1965)

$f = 580$  Mc/s (N) (Start : 1965).

Communication of observations :

1. Daily communication of 1500 Mc/s flux densities and — burst data to the world centers by teletype (code RADIA).
2. Monthly publication of
  - (a) hourly and daily means of flux density at  $f = 9400$  and 1500 Mc/s ;
  - (b) burst data at  $f = 9400$ , 2000 and 1500 Mc/s ;
  - (c) records of selected bursts,in the bulletin « *Beobachtungsergebnisse des Heinrich-Hertz-Institutes* ».
3. Additional publication of burst data  $f = 9400$ , 2000 and 1500 Mc/s in the monthly bulletin « *Solnechnye Dannye* » of the Pulkovo Observatory (SU).

A yearly communication of solar 2000 Mc-flux densities can be found in the « *Information Bulletin of Solar Radio Observatories* » (Utrecht) and a publication of all burst data and figures of selected bursts obtained during the I.G.Y. at the HHI will come out next time.

### Germany (Federal Republic)

The Astronomical Institute Tübingen hopes to organise a current watch of the sun with a radio spectrograph in the wave length 46



to 548 (or perhaps 1000) cycles per second during universal time 08 to 15. These observations shall be supplemented and standardized by records of intensity and polarization in the wave length (9500), 3750, 1200, 610, 300, 151 and perhaps 80 cycles/sec.

### **Greece.**

*Ionospheric Institute, National Observatory of Athens and special Research Groups sponsored by U.S.A.F. Cambridge Research Center and N.A.T.O. Scientific Affairs Division.*

Synoptic observations : Solar patrol by the solar noise radio telescope working on 3000 Mc/s.

Special projects : Solar flares and prominences. Solar radio events (SCNA, SCA, etc).

Solar eclipses. Use of riometers in VHF and satellites tracking devices.

### **India.**

SOLAR RADIO NOISE STUDIES.

Kodaikanal (Solar Patrol at radio frequencies : 60, 100, 200 and 3000 Mc/s), Ahmedabad (Solar radio patrol and solar radio noise spectra on favourable occasions), Calcutta and Delhi (AIR and NPL — with riometer and 27 Kcs signal strength).

### **Italy.**

*Radio-Astronomic Programme* : Continuous recording of solar flux at 327 — 225 — 1420 — 9320 MHz frequencies.

Observations of solar corona during the eclipses which will happen during I.Q.S.Y. period.

### **Japan.**

Radio Observation.

Intensity and polarization observations at the frequencies of 9500, 9400, 3750, 3000, 2000, 1000 and 200 Mc/s, intensity observations at 100 and 60 Mc/s, position determination at 9400, 4000 and 200 Mc/s will be made as were done during the I.G.Y. It is planned to increase the resolving power of the interferometer at 9400 and 4000 Mc/s up to  $0.7 \times 3'1$ .

Station List (1) Optical Solar Observation

Observing Station	Type of observation	Equipment	Mounting
Ikomasan Obs.	K2-3	SG	CT
	H <sub>2</sub>	SG	CT
	Spots	PG	CT
Mitaka Tokyo	K2-3	SG	CT
	H <sub>2</sub>	SC	CT
	H <sub>2</sub> 0.7	LF	EQ
	Spots	PG	EQ
Mt. Norikura	Spectra	PG	CT
	5303	CO	EQ
	K-corona	CO	EQ

Notes. — SG : Spectroheliograph      PG : Photographic  
 SC : Spectrohelioscope      LF : Lyot-filter  
 CO : Coronagraph      CT : Coelostat  
 EQ : Equatorial.

(2) Radio Solar Observation

Observing Station	Frequency Mc/s	Type of observation	Type of Aerials
Mitaka Tokyo	60	RI	3 Twin Yagis
	100	RI	3 Twin Yagis
	200	RP	10 m dish
	200	I	3.4 × 10 arrays
	300-800	S	7 m dish
	3000	R	2 m dish
	9500	RP	1.5 m dish
Toyokawa	1000	RP	3 m dish
	2000	RP	2.2 m dish
	3750	RP	1.5 m dish
	4000	I	1.5 m dish × 8
	9400	RP	1.2 m dish
Hiraiso	9400	I	1.2 m dish × 17
	200	R	4 × 6 arrays
	200	I	2.8 × 8 arrays
	500	R	5 m dish

Notes. — R : Radiometer      I : Interferometer  
 P : Polarimeter      S : Spectrograph.

### **Netherlands.**

#### RADIO ASTRONOMY.

- (a) A spectrograph for the frequency 160-320 Mc/s will be used to study the radio radiation from the sun (NERA). In a small wavelength region around 274 Mc/s spectra with a high time resolution will be made at the NERA observatory.
- (b) The 25 m telescope at Dwingelo will be used for absolute measurements of the flux at 610 Mc/s and/or 408 Mc/s.
- (c) The same will be done at NERA for frequencies of 200 and 3000 Mc/s by comparing relative fluxes.
- (d) Interferometric detection of weak sources of enhanced radiation on frequencies of 136, 200 and 254 Mc/s.

### **Poland.**

Radio Observations at the N. Copernicus University, Torun :

- (a) Interferometric observations of weak sources of enhanced solar radiation at 127 Mc/s.
- (b) Precision monitoring of the solar flux at 127 and 327 Mc/s with emphasis on observations during solar eclipses in any part of the World,
- (c) The investigation of the outer solar corona during the occultations of radio sources including coronal scattering dependence on the phase of sunspot cycle, coronal extent and magnetic field, influence of solar activity on interplanetary space, search for the intensification of the radio waves at and beyond the normal extent of coronal scattering.

Permanent recording of the radio radiation of the Sun at 810 Mc/s at the Cracow University.

### **Portugal.**

Solar radio noise observations, at Macau.

### **United Kingdom.**

By observations of faint radio sources with the radio telescope at Cambridge, the extension of the corona into interplanetary

space on a non-equatorial plane and beyond the orbit of Mercury will be investigated. A search will also be made for large scale irregularities in the structure of interplanetary medium. As an index of solar activity, a systematic study will be made at Jodrell Bank of the decimetre wavelength emission of radio waves from Jupiter to discover the degree of polarization, the angular extent and the time variation of this energy, which may be synchrotron radiation from electrons trapped in Jovian « Van Allen » belts.

## URSIGRAMS AND WORLD DAYS

### **Belgique.**

Le Centre belge de réception et de diffusion des messages d'Alertes et des Intervalles Mondiaux Spéciaux établi au Service du Rayonnement de l'Institut Royal Météorologique participera au programme général.

### **Czechoslovakia.**

Regular exchange of solar, ionospheric and geomagnetic data by means of URSIGRAMS or similar form of information with the stations IZMIRAN MOSKVA (Regional Centre), FTZ Darmstadt, NERA Netherlands and CNET Bagneux, France.

### **East Africa.**

The East African Meteorological Department Headquarters (P.O. Box 30259, Nairobi) will be responsible for receiving and passing on information about alerts and special intervals. Mr. J. P. Henderson, Director of the East African Meteorological Department, and Dr. H. W. Sansom, Regional Representative of the Meteorological Department in Kenya, will be responsible for this service.

### **France.**

SERVICE DES URSIGRAMMES ET JOURS MONDIAUX.

Objectifs :

1. Collecte quotidienne de résultats d'observations des phénomènes solaires et géophysiques provenant des stations françaises et de quelques stations étrangères.

2. Transmission des données fournies par les observateurs aux autres centres régionaux similaires, affiliés au Service International des Ursigrammes et Jours Mondiaux.
3. Diffusion par télétype, téléphone, lettre ou radiodiffusion d'informations solaires et géophysiques aux laboratoires de recherche en fonction de leurs demandes.
4. Prévision à court terme des phénomènes contrôlés par l'activité solaire.

5. Relations Soleil-Terre.

Responsable : R. Michard.

Nature :

1, 2, 3. Voir ci-dessus.

4. Dépouillement des informations reçues tendant à en contrôler la qualité et la régularité.

5. Dépouillement et statistique pour les programmes de recherches sur les relations Soleil-Terre.

Dates : permanent. Lieu : Bagneux.

**Greece.**

The National Meteorological Service of Greece in Athens will act as the centre for World Days and Communications in Greece during the I.Q.S.Y.

**Ireland.**

Ireland will participate in the collection and dissemination of information in accordance with the I.Q.S.Y. Calendar. The Meteorological Telecommunications Network will be used to receive warnings of Alerts, etc. Such warnings received at the Meteorological Offices at Dublin and Shannon Airports or the Central Analysis and Forecasting Office, Dublin, will be despatched by telephone or Telex to those interested.

**Italy.**

As all the countries, Italy will have in this field two tasks :

- (a) reception and distribution of daily messages of the Warning Agencies to all its Observatories.

(b) Rapid communications to the above Agencies of all data of special solar observations obtained in Italy.

This service will be secured by means of TELEX equipment which was already operating during the I.G.Y. period by the Consiglio Nazionale delle Ricerche.

#### **Japan.**

The Radio Research Laboratories, Ministry of Posts and Telecommunications, will act as the center of the World Days and Communications in Japan during I.Q.S.Y.

Radio Research Laboratories will accept the responsibility for the Regional Center of the Western Pacific Region as it has before, if necessary.

#### **New Zealand.**

New Zealand is not in a position to contribute significantly to the organization of World Days but, in cases where data from New Zealand stations is of vital importance, is prepared to give full cooperation.

#### **Poland.**

Poland will participate in the fulfilment of the I.Q.S.Y. Calendar Programme.

The National Communication Centre will be used to receive warnings of Alerts and hold the constant telephone and teletype connection with the Regional IZMIRAN Centre.

#### **United Kingdom.**

The DSIR Radio Research Station (Slough) will be responsible for receiving communications about alerts and special intervals from Boulder, Colorado, and for distributing this information to British observatories throughout the world. Arrangements will generally be in accordance with the preliminary programme drawn up by a Working Group at the Ist C.I.G.-I.Q.S.Y. meeting in Paris in March 1962.

Mr. J. A. Ratcliffe, Director, Radio Research Station, will be responsible for this service.

## **IInd C.I.G.-I.Q.S.Y. Assembly**

Rome, March 1963

The proceedings of the meeting have been published in *I.Q.S.Y. Notes*, n° 3, June 1963.

Working groups were formed as mentioned hereunder with their respective chairmen.

Meteorology	Dr. W. L. GODSON.
Geomagnetism	Mr. V. LAURSEN.
Aurora	Mr. J. PATON.
Airglow	Professor D. BARBIER.
Ionosphere	Professor W. DIEMINGER.
Solar Activity	Professor M. ELLISON.
Cosmic Rays	Professor H. ELLIOT (in the absence of Professor VERNOV).
Aeronomy	Professor M. NICOLET.
Space Research	Dr. H. Friedman.
Data Interchange	Dr. H. ODISHAW.
World Days Programme	Mr. A. H. SHAPLEY.
Publications	Dr. D. C. MARTIN.

These Working Groups were invited to prepare reports on their work for presentation at the Final Plenary Meeting. Some of these reports are published hereunder.

### **REPORT OF WORKING GROUP V ON IONOSPHERE**

(*Chairman* : W. DIEMINGER)

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- ANNEX IV. Interim Report from the Ionosonde Sub-Committee.
- ANNEX V. Interim Report from the N(*h*) Profile Sub-Committee.

## REPORT

### 1. — Introduction

As in the I.G.Y., the ionospheric programme for the I.Q.S.Y. has been divided into sub-disciplines. The U.R.S.I.-C.I.G. Committee has designated « consultants » (sub-reporters) for each of



these, as shown below. The work of each sub-discipline may be divided into two parts :

- (a) synoptic experiments,
- (b) special experiments.

Both categories are essential for the fulfilment of the I.Q.S.Y. objectives.

#### 1.1. — MAJOR SYNOPTIC EXPERIMENTS.

VI : Vertical Incidence Soundings (W. R. PIGGOTT).

A : Ionospheric Absorption.

A1 Pulse-echo method (K. RAWER).

A2 Cosmic Noise method (C. G. LITTLE).

A3 CW Field Strength (K. RAWER).

D : Ionospheric Drifts (R. W. WRIGHT).

D1 Pulse-echo fading.

D2 Radio meteor.

D3 Radio star scintillations.

N : Atmospheric Noise Statistics (F. HORNER).

W : Whistlers and VLF Emissions (R. A. HELLIWELL ; G. M. ALLCOCK).

#### 1.2. — SPECIAL EXPERIMENTS.

##### *Vertical Incidence Experiments.*

Special vertical soundings for regional studies.

Continuous recording of ionospheric characteristics.

Control for other ionospheric experiments, e.g. rockets <sup>(1)</sup>, absorption, drifts.

Incoherent scatter sounding.

Profile determinations ( $N(h)$ ,  $v(h)$ ) by partial reflection, cross modulation, and multi-frequency pulse or riometer techniques.

##### *Oblique Incidence Experiments.*

Backscatter, fixed frequency (B1) ; multi-frequency (B2).

Auroral radar.

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<sup>(1)</sup> The coordination of rocket and ground-based observations is very important. Workers involved are requested to consult R. W. Knecht, B. Hultqvist, or the Academy of Sciences of the U. S. S. R.

Forward scatter.

Oblique HF pulse transmissions.

Oblique CW, VLF and LF transmissions.

*Atmospheric Radio Noise.*

Spectral distribution of radiated energy.

Sources of atmospherics.

*Conjugate Point Experiments.*

*Satellite Experiments* (H. E. Newell).

Topside soundings.

LF and VLF reception.

Probes.

Beacon transmitters : Faraday rotation and Doppler shift.

Moon echoes : Faraday rotation.

*Rocket Experiments* (H. E. Newell).

Studies of ionospheric and exospheric dynamics.

Jackson-Seddon dispersion experiments.

Medium frequency wave field experiments.

Probe experiments : Langmuir, RF resonance, ion trap.

Mass spectrometer.

Photometers : X-ray, Lyman  $\alpha$ ,  $u - v$ .

Topside soundings.

The objectives, programme, and detailed recommendations for each of the sub-disciplines are given below.

## 2. — Vertical Incidence soundings (VI)

### 2.1. — OBJECTIVES

The main objectives of the I.Q.S.Y. vertical sounding programme are :

- (a) To study diurnal, seasonal, and geographic variations of the principal ionospheric parameters deduced from vertical sounding data.
- (b) To study the solar cycle variations of the principal ionospheric parameters by comparing results obtained for the I.G.Y. and I.Q.S.Y. periods.

(c) To compare vertical sounding observations with data obtained using rocket and satellite techniques.

An important feature of the I.Q.S.Y. observations will be an increased emphasis on the determination of electron density profiles on a regional and world-wide basis.

## 2.2. — OBSERVING PROGRAMME

### 2.2.1. — *Basic Programme.*

During the I.Q.S.Y. all stations should produce ionograms at quarter-hourly intervals or more frequently. Timing should be such that the frequency of 3.0 MHz is reached at precisely the full hour UT or at multiples of 15 min. later. High latitude stations should, in addition, provide one low gain and one high gain ionogram at each hour.

### 2.2.2. — *Programme for RWDs and Alerts.*

The designation of Regular World Days and Alerts is described in Annex I.

During Regular World Days and Alerts type COSMIC EVENT and MAGSTORM, ionograms should be obtained at least at 5 min. intervals.

### 2.2.3. — *Programme for Eclipse Days.*

Continuous recording should be made at stations in the eclipse zone on Eclipse Days over a period from 2 hours before first contact to 2 hours after last contact, and observations at 5 min intervals should be taken during the same hours over at least a period from 2 days before, to 2 days after, the Eclipse Day.

## 2.3. — IONOGRAM REDUCTION PROGRAMME

It is recommended that stations undertake reduction programmes A, B or D, depending on criteria such as latitude of station, the average accuracy of the ionograms, access to computing facilities, the programmes being undertaken at neighbouring stations, special regional plans, etc. It is recommended that stations notify the C.I.G. Reporter for Ionosphere of their tentative plans for reduction in order to achieve, by informal co-ordination, well-balanced reduction plans along the meridional chains of stations and within regions.

Attention is drawn to the new *f*-plot format (Annex III) recommended for use at stations with extended frequency ranges, and to the simplified method of calculating medians and quartiles brought into use since the I.G.C. (*U.R.S.I. Information Bulletin*, n° 120, pp. 81-82, 1960).

2.3.1. PROGRAMME A. — *For high latitude stations and representative stations at lower latitudes.*

- (a) Hourly values :  $f_oF2$ ,  $f_oF1$ ,  $f_oE$ ,  $f_oEs$ ,  $fbEs$ ,  $fmin$  ;  
 $h'F$ ,  $h'Es$  ;  $h'E$  where height accuracy allows ;  
 $M(3000) F2$  or  $MUF(3000) F2$  ;  
 $Es$  types.
- (b) Some profile parameters (e.g.  $h_e$ ,  $q_e$ ) hourly on Regular World Days, or hourly monthly median profiles.
- (c) *f*-plots for all days.

2.3.2. PROGRAMME B. — *For temperate and low latitude stations.*

- (a) Hourly values :  $f_oF2$ ,  $f_oF1$ ,  $f_oE$ ,  $f_oEs$ ,  $fbEs$ ,  $fmin$  ;  
 $h'F$ ,  $h'Es$  ;  $h'E$  where height accuracy allows ;  
 $M(3000) F2$  or  $MUF(3000) F2$  ;  
 $Es$  types.
- (b) Some profile parameters (e.g.  $h_e$ ,  $q_e$ ) hourly on Regular World Days or hourly monthly median profiles.
- (c) *f*-plots for Alerts type COSMIC EVENT and MAGSTORM, and for Retrospective World Intervals type IONOMAGSTORM and INTERPLANET and, where possible, QUIET SUN (see Annex I).

Stations at places which have particular geophysical interest should produce *f*-plots for all days. In particular, it is hoped that organizations which operate many stations will select at least one to do Programme A.

2.3.3. PROGRAMME D. — *Mainly profile programme.*

- (a) Hourly values :  $f_oF1$ ,  $f_oEs$ ,  $fbEs$ ,  $fmin$ , by direct scaling of ionograms ;  
 $f_oF2$ ,  $f_oE$ , indirectly computed from the profile data ;

M(3000) F2 or MUF(3000) F2 from direct scaling or computed data, as is most convenient ;  
Es types.

- (b) Hourly height profiles of electron density or plasma frequency ;  
or hourly tables of electron density (or plasma frequency) with height ;  
or hourly tables of height for constant electron densities (or plasma frequencies).

#### 2.4. — DATA FLOW TO W.D.Cs

Recommendations for the flow of data to W.D.Cs for the pre-I.Q.S.Y. period (1960-1963) are given in Annex II.

For the I.Q.S.Y. period, at least one copy of the following data should be sent from every station to at least one W.D.C. It is, however, understood that four copies of all duplicated material will be submitted. It is essential that W.D.Cs also receive all calibrations and scaling indications necessary for the use of the data.

- (a) Monthly tables of hourly values, medians, and quartiles of all the parameters listed in para. 2.3 above under the appropriate programme A, B or D, section (a).
- (b) Hourly tabulations of descriptive profile parameters, or hourly profiles, as listed in para 2.3 above under the appropriate programme A, B or D, section (b).
- (c)  $f$ -plots as listed in para. 2.3 above under the appropriate programme A or B, section (c).
- (d) Copies of ionograms for Priority Regular World Days and Retrospective World Intervals type IONOMAGSTORM, INTERPLANET, and QUIET SUN (see Annex I).
- (e) Lists of all other data which are not regularly interchanged parameter or type of observation, and period).
- (f) A statement, at least quarterly, indicating dates and times of significant changes in frequency, height or timing calibrations, or in the sensitivity of equipment (in particular, changes which could affect  $f_{min}$  or  $f_oE_s$ ).
- (g)  $h'$ -plots or E-plots, if produced.

Data obtained from top-side soundings which can be used for studies of latitude and longitude variations should be deposited at a W.D.C. within a reasonable time. Copies of ionograms from top-side soundings obtained on Regular World Days should be sent to W.D.C.s.

## 2.5. — NEW TECHNIQUES

Although new techniques will form an essential part of I.Q.S.Y. ionospheric measurements, one of the primary objectives of the I.Q.S.Y. is to obtain data during the solar minimum period which can be compared with those obtained during the solar maximum of the I.G.Y. The use of new techniques and methods of data reduction should be compatible with this objective.

The importance of improving the performance of ionosondes used for ionization profile analysis is stressed, for example, by improving height and frequency calibration and by extending the lower frequency limit at which echoes can be obtained.

Attention is drawn to the advantages of continuously recording ionospheric characteristics.

The importance is stressed of using top-side sounding satellites to obtain data on the spatial variations of the F-layer ionization during the I.Q.S.Y. As data storage facilities are not likely to be incorporated into the early satellites it is important to increase the small number of existing telemetry stations.

## 2.6. — DISTRIBUTION OF STATIONS

### 2.6.1. — *General.*

Since a main purpose of the I.Q.S.Y. is to provide complementary data to those for the I.G.Y., it is recommended that the overall world coverage be not less than that during the I.G.Y. It is particularly important that stations started since the last sunspot minimum operate during the I.Q.S.Y.

Responsible administrations are requested to inform the Consultant for vertical incidence (W. R. Piggott, Radio Research Station, Ditton Park, Slough, Bucks, U. K.) of any new stations set up for the I.Q.S.Y., so that a complete list of active stations can be prepared and standard identification numbers and letters be assigned. It is very important that consistent systems of station

identification and coding be used in the I.Q.S.Y. to facilitate the large amount of mechanical data handling.

Some preliminary details of operating stations will be published in *I.Q.S.Y. Notes* and supplemented as necessary. A final station gazetteer will be published at the end of the I.Q.S.Y. (see Resolution 14).

Having reviewed the prospective distribution of stations during the I.Q.S.Y., the Ionosphere Working Groups which met in Paris (1962) and Rome (1963) draw attention to the following considerations :

### 2.6.2. — *Meridional Chains.*

It is particularly important that the four meridional chains of stations, identified in the I.G.Y. programme, be as complete as possible during the I.Q.S.Y. Highest priority should be given to completing the meridional chains by ensuring that observations are made at the following locations :

#### (i) 70°-80° W *Chain (the Americas).*

Panama — N. Columbia area. Large F-region electron density gradients occur in this region and a station is needed to fill the gap of 15° in latitude between Bogota and Puerto Rico.

#### (ii) 10°-20° E *Chain (Europe, Africa).*

Tsumeb — an important station in the transition zone of the south equatorial chain.

Grahamstown — needed for East-West studies in an anomaly zone.

Marion Island — a station at this location would extend the chain to the south and also increase the coverage in the Antarctic region. This location is particularly important because it is conjugate to western Europe, where there is a high density of stations.

Tamanrasset — essential from both geographic and magnetic considerations.

Bangui — needed to define the equatorial trough in this zone.

Teneriffe — this proposed station would help to fill the big gap between Tamanrasset and Rabat, and is important to European-African communications.

Longyearbyen — extends the chain to the north and also provides important information about the secular movements of the auroral zone.

Leopoldville, Elisabethville, Bunia and Lwiro — the value of the chain would be very much reduced without these stations which are in an area important for the understanding of ionospheric behaviour around the southern maximum of  $f_oF_2$ .

Zaria — this location is important for regional studies in conjunction with Ibadan and for linking ionospheric and magnetic phenomena.

Togo — necessary to test the influence of dip in conjunction with data from Djibouti, Ibadan, and Zaria.

(iii) 70°-90° E Chain (*U. S. S. R., India*).

Dushanbe — an important station to complete this chain.

Ceylon — important for the study of longitude changes close to the magnetic equator.

(iv) 130°-150° E Chain (*Australia, Japan, U. S. S. R.*).

Hollandia (Kota Baru) — an important station south of the magnetic dip equator which gave valuable data in the I.G.Y.

Cebu — close to the magnetic dip equator in a region where the dip equator is furthest north of the geographic equator, and thus of special value in comparison with Huancayo.

Djakarta — full I.Q.S.Y. operation is most desirable since this location is close to the suspected position of one of the latitudinal peaks in ionization density.

North of Singapore — it would be most valuable if measurements were available from a station in latitude 10°-15° N in the longitude zone of Singapore for use jointly with Singapore data to define the transequatorial profile in this zone.

Khabarovsk — an important position in the gap between 45° and 62° N.

### 2.6.3. — *Antarctica.*

The I.Q.S.Y. represents the first opportunity for obtaining any appreciable information on the behaviour of the Antarctic ionosphere during a minimum sunspot period. Bearing in mind the extensive use already made of I.G.Y. data from this area, it is obviously very important that as many as possible of the stations that were operated during and since the I.G.Y. be continued during the I.Q.S.Y. Whenever possible, stations which operated during I.G.Y., but which are not now active should be re-established



for I.Q.S.Y. and, in addition, observations from some new sites would help solve scientific problems raised by I.G.Y. studies.

Syowa — data obtained during the I.Q.S.Y. from this site would complement previous valuable measurements made during the I.G.Y.

Vostok — it is extremely important to obtain the solar cycle dependence of ionospheric parameters near the geomagnetic pole.

South Ice (about 80° S, 30° W) — data from this location would throw light on the physical mechanisms operating in the important Weddell Sea anomaly.

Maudheim — ionospheric observations at this station would help to fix the eastern boundary of the Weddell Sea anomaly.

Roi Baudouin — an especially important location which contributed to the delineation of south polar ionospheric phenomena during the I.G.Y.

Sentinel Mts. — a station at this location would be valuable for *a*) sub-auroral conjugate point studies, *(b)* additional ionospheric information in a region of Antarctica where marked spatial variations exist.

Dumont d'Urville — the proximity of the dip pole makes this station extremely important. The difficulties met by the French scientists are viewed with great regret and it is firmly hoped that these will be overcome in the short time remaining before the I.Q.S.Y. commences.

In addition to their invaluable contribution to the scientific experiments, ionospheric data from Antarctic stations, as recommended above, will contribute to the safety and efficiency of station and expedition operations, since almost no data exist for solar minimum on which to base radio propagation predictions for practical communications within Antarctica and to the outside world.

#### 2.6.4. — *Floating Ice Stations.*

The floating Arctic ice stations which operated during the I.G.Y. seem to have been successful where the severe technical difficulties were overcome. Complementary data for the I.Q.S.Y. from the area of the interior of the Arctic basin would be most valuable for comparison with I.G.Y. data.

2.6.5. — *Magnetically Conjugate Pairs.*

The value of pairs of geophysical stations within 300 km of magnetically conjugate points is becoming increasingly apparent; they may be operated either as synoptic stations or for short-term experiments. Vertical soundings should be included in the programme for such conjugate pairs. It seems opportune to use existing stations as one station of each pair. A partial list of pairs that are certainly scientifically desirable and perhaps logistically practical includes :

Byrd/Great Whale River; Lauder/Unalaska; Kerguelen/Salekhard; Mirny/Murmansk; Capetown/South of France; Vostok/Thule; Eights (Antarctica)/Quebec; South Pole/Frobisher Bay; McMurdo Sound/Shepard Bay.

2.6.6. — *Other New Stations.*

Easter Island — this seems to be the only possible practical location for a station in the Southeast Pacific Ocean. Data from this region are very desirable for morphological studies.

East Africa, Uganda, Kenya; Addis Ababa; Leyte (Philippines) — existing equatorial regional studies would be greatly assisted by additional stations near the dip equator.

2.6.7. — *Special closely-spaced chains.*

The existence of active cooperation between groups interested in equatorial problems is noted with satisfaction. Special and coordinated closely-spaced chains of equatorial stations are recommended for operation during the I.Q.S.Y.

As a result of I.G.Y. experience, it is realized that it is important to locate stations in such a way that studies can be made of phenomena which occur along the magnetic equator as well as across it. For example, the study of temporal variations in the occurrence of equatorial spread-F would be greatly aided by a suitable triangular network of stations designed to resolve the directions of the equivalent drifts. Particularly suitable areas are in Peru, Ghana-Nigeria, Togo, and India-Ceylon.

2.6.8. — *Ocean Areas.*

In order to gain more information about the ionosphere over the large ocean areas, it is recommended that greater emphasis be

placed on the use of shipborne and airborne ionosondes which employ techniques which have matured during and since the I.G.Y. Soundings from research vessels at approximately fixed locations for extended periods (of at least one week's duration) would be most suitable. Observations from a moving ship or aircraft are also useful, for example for transequatorial F-region studies.

The possibility of using weather ships and other semi-stationary vessels as ocean ionosphere stations should be re-examined. It is not essential for the observations to be complete; for example valuable information would be given by a single ionosonde on a particular weather ship if data for about one-third of the total possible time could be obtained.

## 2.7. — RECOMMENDATIONS AND REPORTS

The recommendations of the Ionosphere Working Group concerning vertical soundings will be found in the last section of this Report.

A supplementary manual for vertical soundings is being prepared. This will include the programme of observations and reductions for the I.Q.S.Y., details of the new *f*-plot format for stations with extended frequency ranges, the simplified method of computing medians and quartiles, and a note on the logistics of computer calculations of medians and quartiles.

A two-letter code for ionospheric station identification has been prepared and will be published in the station list (para. 2.6.1).

Brief interim reports from the sub-committees on ionosondes and *N(h)* profiles are given in Annexes IV and V respectively.

## 3. — Absorption Observations (A)

### 3.1. — OBJECTIVES

The main objectives of the I.Q.S.Y. absorption programme are :

- (a) To study diurnal, seasonal, and solar cycle variations of absorption and their connections with local and worldwide magnetic activity.
- (b) To compare the absorption at different latitudes and longitudes and to determine the areas over which the absorption has the same characteristics.

- (c) To correlate the changes in absorption with frequency and time with the variations of the ionization causing the changes.

### 3.2. — METHODS

The methods of measuring ionospheric absorption fall into the following main groups :

- A 1 Measurement of the amplitudes of pulses reflected from the ionosphere.
- A 2 Measurement of the absorption of extra-terrestrial radio noise.
- A 3 Measurement of the field strength of sky-wave signals propagated over short distance at oblique incidence on frequencies suitable for obtaining absorption data.

In addition, relative changes in absorption can be measured semi-quantitatively using ionogram parameters, in particular  $f_{min}$ .

The three methods do not give comparable data ; A 2 mainly measures absorption below about 70 km, whereas A 1 and A 3 mainly measure absorption above this level. Similarly, A 3 is less influenced by deviative absorption in the reflecting layer than is A 1.

In those cases where the full A 1 method cannot be undertaken, a simplified A 1 method may be used in which the amplitude of a gated pulse is recorded continuously. A description of this method will be found in the supplementary absorption manual.

The use of method A 2 for synoptic observations is described in the supplementary absorption manual. In the application of the A 2 method it is advantageous to use several widely spaced frequencies. Attention is drawn (i) to the value of essentially simultaneous separate measurements of the ordinary and extraordinary wave attenuations at the lower frequencies ; and (ii) to the possibility of improving high latitude coverage by using several low-elevation angle antennae at selected stations.

A description of an A 3 method suitable for new stations will be found in the supplementary absorption manual. Little effort is needed to maintain a programme of A 3 measurements and the method should be more widely used where manpower limitations preclude the use of method A 1.

### 3.3. — OBSERVING PROGRAMME

#### 3.3.1. — *Method A 1.*

For A 1 measurements the programmes adopted during the I.G.Y. should be used in the I.Q.S.Y. These are listed below in order of priority.

(i) All stations should obtain noon absorption measurements for every day, observed on a minimum of two frequencies.

(ii) All stations should obtain night observations at least once per week using the same frequencies.

(iii) The diurnal variation of absorption should be determined for the interval from at least one hour before sunrise to two hours after sunset on Regular World Days, and when possible, during Alerts type COSMIC EVENT and MAGSTORM.

(iv) Stations in an eclipse zone should make continuous observations over a period from 2 hours before first contact to 2 hours after last contact on Eclipse Days. In addition, at least 3 days centred on the Eclipse Day should be treated as Regular World Days.

(v) Measurements at times of constant solar zenith angle should be made whenever such measurements are possible.

Whenever possible, the absorption should be determined on a frequency of  $2.2 \pm 0.2$  MHz. When only two frequencies are used, the second should be chosen according to the rules given in the Absorption Manuals. Where facilities are available, it is desirable to make measurements on a group of frequencies so as to allow a fuller analysis of the frequency variations. It is important that an adequate sample of the amplitudes be obtained for each frequency. Full details of the techniques will be found in the Absorption Manuals.

#### 3.3.2. — *Method A 2.*

Continuous recording should be maintained on several widely-spaced frequencies, especially frequencies below about 20 MHz, during the I.Q.S.Y.

It is important that the sensitivity of the antenna and equipment be maintained constant over at least one year so as to provide adequate calibration data.

### 3.3.3. — *Method A 3.*

Continuous recordings should be maintained for as many hours as possible during each day. For calibration purposes it is essential that recordings should be available for times when E-region reflections are dominant at night.

### 3.3.4. — *Special Programmes.*

The importance of using methods A 1 and A 2, or A 3 and A 2, at the same station is stressed. The combined sets of measurements give much more information about the structure and behaviour of the D region than either set taken alone.

It is recommended that special programmes be undertaken to study the structure of the D and lower E layer by combining absorption measurements on several frequencies preferably using A 1 and A 2, or A 3 and A 2 methods with :

- (a) partial reflection techniques.
- (b) cross modulation techniques.
- (c) VLF measurements.
- (d) rocket measurements.

Experiments to study the geomagnetic cut-off for the cosmic radiation that generates the normal ionization at low heights in the ionosphere are desirable during the I.Q.S.Y. (e.g. by using method A 2).

## 3.4. — REDUCTION PROGRAMME

### 3.4.1. — *Method A 1.*

(i) Monthly tables of noon observations should be prepared in one of the following forms :

- (a) *For one or two frequency programmes.* Tables of absorption loss  $L$  in dB for each frequency, sample count, and virtual height, together with monthly medians, median count and quartiles of  $L$  and the calibration constants for the month.
- (b) *For multi-frequency programmes.* Tables of absorption loss  $L$  in dB for all frequencies, plus corresponding tables of virtual heights, together with monthly medians, median count and quartiles of  $L$ , and the adopted calibration constants for the month.

(ii) Summary of calibration constants.

(iii) Tables of hourly values of absorption loss  $L$  in dB for each frequency for Regular World Days, and Alerts type COSMIC EVENT and MAGSTORM. Where the data are available (e.g. from continuous recording) the corresponding hourly values for Retrospective World Intervals type INTERPLANET, IONOMAGSTORM and QUIET SUN (see Annex I) should be included. The tables should also show the monthly medians, median count and quartiles of  $L$  for each hour based on all the days listed.

(iv) Where continuous observations are available on Eclipse Days the absorption loss  $L$  in dB, and ionogram parameters  $f_{min}$ ,  $f_{min2F}$ ,... should be tabulated at the shortest convenient intervals.

(v) Where observations are available at constant solar zenith angle, the values of absorption loss  $L$  in dB should be tabulated for each day, together with monthly medians, median counts and quartiles.

#### 3.4.2. — Method A 2.

Monthly tables of the mean absorption in dB for the first minute of every hour, together with monthly medians, median count and quartiles (I.G.Y. Scaling type I).

A clear distinction should be made between *provisional* values of absorption based on estimates of the sidereal variation of cosmic noise, and *final* values obtained after this variation has been determined from a year's observations. Provisional values should not be listed when final values are available.

#### 3.4.3. — Method A 3.

(i) Monthly tables for each frequency of hourly values of the absorption in dB for hours when E region reflections are dominant, together with monthly medians, median count and quartiles.

(ii) Similar tables of half hourly values for Retrospective World Intervals type INTERPLANET, IONOMAGSTORM and QUIET SUN.

### 3.5. — DATA FLOW TO W.D.Cs

Recommendations for the flow of absorption data to W.D.Cs for the pre-I.Q.S.Y. period (1960-1963) are given in Annex II.

For the I.Q.S.Y. period at least one copy of the following data should be sent from every station to at least one W.D.C. It is

understood, however, that four copies of all duplicated material will be submitted.

3.5.1. — *Method A 1.*

Tables as listed under para. 2.4.1, (i)-(v).

3.5.2. — *Method A 2.*

- (a) Tables as listed under para. 3.4.2, in provisional and final form.
- (b) Copies of records, together with the necessary calibration curves, for Retrospective World Intervals type INTERPLANET, IONOMAGSTORM and RIOMETER (see Annex I).

3.5.3. — *Method A 3.*

Tables as listed under para. 3.4.3, (i) and (ii).

3.6. — DISTRIBUTION OF STATIONS

It is important that the stations which operated during the I.G.Y. continue during the I.Q.S.Y.

(a) *Equatorial latitudes.* — Absorption data obtained during the I.G.Y. indicate that considerable changes of absorption with longitude occur between Malaya and Africa. It is important that similar data suitable for comparison be made in other longitude zones, such as in South America.

(b) *Temperate latitudes.* — The existing distribution of A 1 stations in Europe and Asia is adequate. The situation in North America and in the southern hemisphere is not satisfactory. Since less accurate methods of measuring absorption can be calibrated only against A 1 — type data, it is clear that some additional A 1 stations should operate during the I.Q.S.Y. In this connection it is relevant to note that I.G.Y. data have shown that, in the northern hemisphere between about 40° and 60° magnetic latitude, abnormally high winter absorption in Europe or Asia was associated with relatively low absorption in America. It would be valuable to know whether a similar phenomenon occurs in the southern hemisphere, and modest A 1 or A 3 measurements would be sufficient for this purpose.

(c) *Sub-auroral and high latitudes.* — Although the intense absorption sometimes present during disturbed periods is best



measured by the A 2 method, analysis of I.G.Y. data has shown that there are occasions when methods A 1 and A 3 detect changes in absorption to which method A 2 appears relatively insensitive. It is therefore desirable that methods A 1 and A 3 should be employed together at least at some stations and particularly in the Antarctic polar cap where no such observations have yet been made.

(d) It is strongly recommended that riometers (A 2) be used at magnetically conjugate points wherever this is possible (see para. 2.6.5).

#### 4. — Drift Observations (D)

##### 4.1. — OBJECTIVES

The main objectives of the I.Q.S.Y. drift programme are :

- (a) To study diurnal, seasonal, and solar cycle variations of drifts and their connections with local and worldwide magnetic activity.
- (b) To interpret drift data obtained by different methods in order to gain a clearer picture of the relevant atmospheric phenomena. Intercomparisons of different methods at the same location are urgently needed.

##### 4.2. — METHODS

###### 4.2.1. — *Standard Methods.*

Measurements may be made by the following methods, which are mainly applicable at different height ranges :

- 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 wavelengths apart.
- D 4 Observations of characteristic reflection features at widely spaced sites.

It is not yet clear which features of the fading pattern drift with the ionospheric plasma.

It is important to compare the results obtained by analysing the same samples of D 1 or D 3 records using the two main methods of record analysis : similar fades and correlation analysis.

For Method D 2 it is important that the sensitivity of the equipment should be high enough to permit a satisfactory statistical coverage. This has not always been the case in the past.

There are advantages in measuring the drift at predetermined heights. For methods D 1 and D 4, this can be done if the operating frequency can be changed easily and quickly.

#### 4.2.2. — *Intercomparison of Methods.*

There is a need for detailed intercomparisons of results obtained by the standard methods at the same locations. This can be achieved by using method D 1 on different frequencies chosen so that echoes are obtained from the D, E, or F regions.

Special efforts should be made to compare the movements of sodium and other artificial clouds in the ionosphere, as observed by optical techniques, with drifts obtained by methods D 1 or D 3 as appropriate.

Whenever possible, optical observations of drifting meteor trails should be compared with results obtained by method D 2.

### 4.3. — OBSERVING PROGRAMME

Evaluation of I.G.Y. drift observations has shown that, in order to obtain satisfactory statistical results, it is necessary to have a large number of observations spread out in time. It is therefore recommended that, during the I.Q.S.Y., drift observations should be made not less frequently than as follows :

(i) Observations on every Wednesday and Thursday on all Regular World Days, and during all World Geophysical Intervals.

(ii) Observations should be made at least once an hour using a recording time which is long enough to give a representative sample of the fading pattern (typically 5-15 min).

(iii) The height to which the drift corresponds should be determined as accurately as possible, and recorded with each observation.

(iv) Observations using method D 1 should be made so that, as far as possible, approximately equal numbers of drift results are obtained at each hour of the day for a given region.

(v) Where facilities allow, it is recommended that observations be made on both the E-region and the F-region.

#### 4.4. — REDUCTION PROGRAMME AND DATA FLOW TO W.D.Cs

(i) Hourly tabulations for all days listed in para. 4.3 of :  
drift speed in m/s,  
drift direction in degrees East of North,  
corresponding height (whenever available).

(ii) Hourly tabulations as in (i) for the Retrospective World Intervals INTERPLANET, IONOMAGSTORM and QUIET SUN (see Annex I) when recordings are available.

(iii) Where half-hourly drift data are available, they should also be sent to the W.D.C. in the same form.

(iv) Reduced drift data for any other days should also be tabulated and sent to the W.D.C.

(v) Monthly medians of the hourly values of the North-South and East-West components of drift and median count. When the median counts are small, three-hourly running medians should be substituted.

*Note.* — At least one copy of the above data should be sent from every station to at least one W.D.C. ; if the material has been duplicated, four copies should be submitted.

#### 4.5. — NOTE ON NOMENCLATURE

For methods D 1 and D 3, results obtained by the simple similar-fade analysis should be designated by  $v'$  (speed) and  $\vartheta'$  (direction). Results obtained by correlation analysis should be designated by  $v$  and  $\vartheta$ .

Further details will be found in the *Annals of the I.G.Y.*, vol. III, Part III, pp. 231-287, and in a supplementary drift manual which is being prepared.

#### 4.6. — DISTRIBUTION OF STATIONS

During the I.G.Y. no drift results were obtained from wide areas of the globe. Every effort should be made to establish drift stations in these areas before the I.Q.S.Y.

The geophysical distribution of stations proposed for the I.Q.S.Y. is such that mapping should become possible for D 1 — type stations

in Europe and Western Asia. To extend the coverage it is recommended that efforts be made to obtain drift data in Africa between the Mediterranean and the existing station at Ibadan.

It is recommended that drift observations be made at high latitudes in the Arctic and Antarctic, except in the zone of maximum auroral activity where observations are not practicable. A station near the magnetic dip pole, particularly in Antarctica, would contribute much towards an understanding of the drift mechanisms.

## 5. — Atmospheric Radio Noise (N)

### 5.1. — OBJECTIVES

The objectives of the work proposed for the I.Q.S.Y. are :

- (a) To explain the generation of noise and evaluate the energy radiated from lightning discharges at all frequencies ;
- (b) to describe quantitatively the distribution of the incidence of lightning discharges over the whole world, in statistical terms ;
- (c) to compare the noise intensities at a number of receiving locations with conditions found during the maximum of the solar cycle.

### 5.2. — TECHNIQUES

Particular attention should be given to the accurate calibration of apparatus used for measuring integrated noise levels. Allowance should be made for the directivity of the receiving antenna. A rapid interchange of data between stations making such measurements should be arranged so that a continual comparison and check on accuracy may be made.

### 5.3. — OBSERVING PROGRAMME

Details of the programme of observations will be found in the *Annals of the I.G.Y.*, vol. III, Part IV, pp. 295-314. Additional information will be published in the *I.Q.S.Y. Notes*.

It is recommended that efforts should be concentrated on observations designed to provide information on the following items in order to extend the work performed during the I.G.Y. :

- (a) The statistical distribution of the incidence of lightning discharges. The extensive use of simple lightning flash counters would probably be suitable for this purpose.
- (b) The spectral distribution of the radiated energy.
- (c) The integrated noise level as carried out during the I.G.Y.
- (d) The waveform of atmospherics.
- (e) Noise measurements might well be extended into the ELF range. The theory that noise at these frequencies, measured at any station, is a good index of the total noise generated over the whole world, should be checked at several stations.
- (f) The importance is stressed of making ground-based measurements to support rocket and satellite experiments.

#### 5.4. — REDUCTION PROGRAMME AND DATA FLOW TO W.D.Cs

(i) Monthly tables, for each frequency, of hourly values of the noise level in dB above 1  $\mu$ V/m, together with medians, median count and quartiles.

(ii) Noise data, film records, and lightning count measurements as described in the *Annals of the I.G.Y.*, vol. III, Part IV, pp. 313-314, with any future modifications as published in *I.Q.S.Y. Notes*.

#### 5.5. — DISTRIBUTION OF STATIONS

The cooperation of the WMO is invited for determining the statistical distribution of lightning flashes using lightning flash counters.

Work on the spectral distribution of the radiated energy should be extended to the tropics.

### 6. — Whistlers and VLF Ionospheric Noise (W)

The current recommendations and programmes, published in *C.I.G. News*, n° 6, pp. 217-218, 1962, and *U.R.S.I. Information Bulletin*, n° 134, pp. 82-85, 1962, will be reconsidered at the U.R.S.I. General Assembly at Tokyo in September 1963. Pending publication of the revisions, interested groups are requested to refer to the consultants :

Prof. R. A. HELLIWELL, Stanford Electronics Laboratories, Stanford, California, U. S. A.

Dr. G. M. ALLCOCK, Dominion Physical Laboratory, Private Bag,  
Lower Hutt, New Zealand.

### 7. — Incoherent Scatter Sounding

The possibility of the use of incoherent scatter sounding, developed since the I.G.Y., offers an important means of studying the ionosphere and exosphere.

Stations which will probably operate during the I.Q.S.Y. include :

- Arecibo, Puerto Rico (Cornell University, U. S. A.),
- Jicamarca, Peru (NBS, U. S. A.).
- Malvern, England (RRE, U. K.).
- Nançay, France (CNET, France).
- Stanford, California (Stanford University, U. S. A.),
- Westford, Massachusetts (MIT, U. S. A.).

All these stations will be able to measure electron density profiles and it is desirable that the measurements be compared with those obtained from conventional vertical soundings from below, and from other possible measurements of the upper ionosphere, especially topside soundings from satellites. It is also recommended that the times of measurements adhere to those adopted for conventional vertical soundings.

The spectrum of the scattered energy contains information on ionic temperature and mass, and on plasma inhomogeneities. It is recommended that these characteristics be measured systematically during the I.Q.S.Y., and the data compared with corresponding observations obtained by other methods.

### 8. — Auroral Radar (R)

The continued study of aurorae by the radar echo technique is recommended. The data should be compared with those obtained using other methods of studying aurorae : see Report of Working Group IV, Aurora and Airglow.

Instructions will be found in the *Annals of the I.G.Y.*, vol. III, Part IV, pp. 337-341.

The following auroral radar stations are expected to operate during the I.Q.S.Y. :

- Australia : Hobart, Tasmania.
- Germany : Kühlungsborn, Lindau.

New Zealand : Invercargill.

U. K. : Sheffield, Halley Bay (Antarctica).

U. S. A. : Barrow (Alaska), Cold Bay (Alaska), College (Alaska), Kenai (Alaska), Kodice (Alaska), Pullman (Washington).

U. S. S. R. Dixon Is, Murmansk, Tixie Bay, Mirny (Antarctica).

### 9. — Forward Scatter (F)

During the I.G.Y. the metre-wave links used at high latitudes provided important information on the occurrence and extent of abnormal absorption due to the incidence of corpuscles (PCA events).

At middle latitudes the same techniques provide information on the ionized trails produced by meteors, the occurrence of sporadic-E, and movements in the low ionosphere.

It is recommended :

- (i) that the efforts directed towards the scientific use of operational links and begun during the I.G.Y. be continued and extended during the I.Q.S.Y. ;
- (ii) that an international cooperative effort be made to establish a VHF network in the Antarctic primarily to furnish information complementary to that provided by riometers ;
- (iii) that where possible VHL forward scatter circuits be set up having mid-points which are approximately conjugate in the North and South hemispheres.

### 10. — Oblique Incidence and Back Scatter (OI)

The current recommendations, published in *C.I.G.News*, n° 6, p. 219, 1962, and *U.R.S.I. Information Bulletin*, n° 134, pp. 86-87, 1962, will be reconsidered at Lindau in May 1963. Revised recommendations will be published in the *I.Q.S.Y. Notes*. Pending publication of the revisions, interested groups are requested to refer to the Reporter for Ionosphere : Prof. W. Dieminger, Max-Planck-Institut für Aeronomie, 3411 Lindau, Germany.

## 11. — Recommendations

### WORLD DATA CENTRES

1. It is recommended that the existing World Data Centres A, B, C1 and C2 for ionosphere continue to operate during the I.Q.S.Y. The Ionosphere Working Group recommended that the following responsibilities be adopted for data interchange between W.D.Cs and countries not possessing a W.D.C. for the ionosphere. (a) Such countries may request from one of the W.D.Cs copies of all relevant data listed in the Guide, except those which are exchanged regularly through other channels. (b) Ionospheric data up to the equivalent of that given to the same W.D.C. by the requesting country may be claimed free of all charges. (c) If the request should exceed the equivalent, the actual cost of reproduction and postage for the excess material may be charged by the W.D.C.

2. It is recommended that, for both the pre-I.Q.S.Y. period (1960-1963) and the I.Q.S.Y. (1964-1965), data should be sent to W.D.Cs, according to the instructions given in this report and in the Guide to W.D.Cs.

3. It is recommended that there be sub-disciplinary special world centres for routine processing of data. These centres should work in close collaboration with the relevant sub-reporters (consultants). They should receive the data necessary for their work free of charge from the W.D.Cs. Their minimum duties should comprise the preparation of a summary publication of the observations and results obtained during the I.Q.S.Y. in a form which is comparable with that employed during the I.G.Y. Proposals to establish such special world centres should be made to the Reporter for Ionosphere. Decisions on the number and location of these special world centres will be made by the Reporter with the approval of the C.I.G.-I.Q.S.Y. Bureau.

### RETROSPECTIVE WORLD INTERVALS

4. It is recommended that Retrospective World Intervals be designated for the I.Q.S.Y. to include types INTERPLANET, IONOMAGSTORM, QUIET SUN, and RIOMETER, provided that the number of these per year applicable to each sub-discipline does not exceed about five.



5. It is recommended that responsible organizations take all possible steps to transmit to W.D.Cs all data listed in this report which are required for Retrospective World Intervals as soon as possible after the designation of these intervals.

#### INSTRUCTIONS AND PROGRAMME FOR THE I.Q.S.Y.

6. It is recommended that the analysis procedures to be used in the I.Q.S.Y. for vertical soundings shall be those given in the « U.R.S.I. Handbook of Ionogram Interpretation and Reduction », supplemented where necessary by the instructions given in the *Annals of the I.G.Y.*, vol. III, Part I. Where the two texts disagree, the former is to be used.

It is recommended that the programmes of observation, reduction, and data flow to W.D.Cs be as given in this report.

7. It is recommended that the instructions for absorption measurements of types A1, A2, and A3 to be used in the I.Q.S.Y. shall be those given in the *Annals of the I.G.Y.*, vol. III, Part II, together with the relevant sections in the Absorption Supplementary Manual.

It is recommended that the programmes of observation, reduction, and data flow to W.D.Cs be as given in this report.

8. It is recommended that the instructions for drift measurements to be used in the I.Q.S.Y. shall be those given in the *Annals of the I.G.Y.*, vol. III, Part III, together with the relevant section in the Drifts Supplementary Manual.

It is recommended that the programmes of observation, reduction, and data flow to W.D.Cs be as given in this report.

9. It is recommended that the instructions for atmospheric radio noise, whistlers and VLF emissions, back scatter, forward scatter, and radar aurora to be used in the I.Q.S.Y. shall be those given in the *Annals of the I.G.Y.*, vol. III, Part IV.

10. It is recommended that the I.Q.S.Y. programmes of observation, reduction and data flow to W.D.Cs be reproduced in the Ionosphere Supplementary Manuals, and that any subsequent instructions and recommendations be published in the *I.Q.S.Y. Notes*.

11. It is recommended that vertical incidence stations notify the Reporter for Ionosphere of their tentative plans for reduction of data so that these can be coordinated for the meridional chains.

12. It is recommended that stations with extended frequency ranges adopt the new  $f$ -plot format described in Annex III to this report.

#### ROCKET AND SATELLITE EXPERIMENTS

13. The importance of correlating rocket and satellite data with corresponding information obtained by ground-based methods is stressed, and it is recommended that every effort be made to obtain simultaneous ground-based observations to compare with rocket measurements of such parameters as ionization densities, temperatures, collision frequencies and drifts.

#### STATION LISTS

14. It is recommended that lists of operating stations be published in the *I.Q.S.Y. Notes* for each of the sub-disciplines. These should include : station name, geographic coordinates, geomagnetic coordinates, angle of dip, magnetic latitude, time meridian used, code letters and cross reference to the C.S.A.G.I. identification number and the standard 3-digit code number. Additions and corrections should also be published in the *I.Q.S.Y. Notes*.

Final lists should be prepared at the end of the I.Q.S.Y. which will give, in addition to the above information, the programme actually carried out, months for which data are available, a brief statement of additional data available at the station, and the addresses of the responsible organization.

#### DISTRIBUTION OF STATIONS

15. It is recommended that special efforts be made to establish vertical incidence, absorption, drifts, lightning counter and noise stations as set out in this report.

16. It is recommended that special efforts be made to set up stations near conjugate points, in particular for vertical incidence, absorption A 1 and A 2, and whistler and VLF emission experiments.

17. It is recommended that participating I.Q.S.Y. committees planning ionospheric experiments from ocean research vessels coordinate their plans through the Reporter for Ionosphere so that, as far as possible, the ocean measurements will be coordinated in time and location.

18. It is recommended that greater emphasis be placed on the use of shipborne and airborne ionosondes. Even part-time deployment would be valuable.

19. It is recommended that the authorities concerned be urged to set up a vertical incidence station in Ceylon.

20. It is recommended that special efforts be made to provide suitable staff for the operation of the equatorial African ionospheric stations, in particular Bunia and Elisabethville. The attention of U.N.E.S.C.O. is drawn to this matter.

21. It is recommended that the authorities concerned be urged to reopen the ionospheric station at Kota Baru (Hollandia) which provided valuable data for the I.G.Y. and is an important station in the 150° E longitude chain.

22. It is recommended that efforts be made to establish a drift station near the south magnetic dip pole for studies of the physical interpretation of drift mechanisms.

#### SPECIAL PROGRAMMES

23. It is recommended that the structure of the lower ionosphere be studied by combining absorption measurements on several frequencies with measurements by partial reflection, cross modulation, VLF and rocket techniques.

24. It is recommended that results obtained at the same locations by the standard drift methods be intercompared, and related to movements detected optically, for example, by using artificial clouds or meteor trails.

#### ANNEX I

##### World Days and Intervals

1. — The full definitions of the days specially marked on the International Geophysical Calendar, and of Alerts and Retrospective World Intervals will be found in the report of Working

Group on World Days. The following recommendations refer to ionospheric measurements.

1.1. — *Alerts.*

During the I.Q.S.Y. the extended programme of ionospheric observations formerly associated with S.W.Is should commence with the receipt of an Alert type COSMIC EVENT or MAGSTORM. This applies to the three classes of Alert « expected », « just started », and « exists ».

The programme should continue for 24 hours only after the receipt of each message Alert type COSMIC EVENT or MAGSTORM. The Alerts type MAGCALME, SOLARACTIVITY, SOFLARE, SOLCALME, and STRATWARM are of interest to individual stations, but are not to be regarded as alerts demanding the extended programme at all stations.

1.2. — *Retrospective World Intervals.*

The following types of Retrospective World Intervals are suitable for ionospheric studies : INTERPLANET (cosmic ray flux increases and associated phenomena), QUIET SUN (quiet solar and geophysical conditions), IONOMAGSTORM (ionospheric and magnetic storm), and RIOMETER (special A 2 intervals).

The selection of suitable periods will be made by a small panel of experts for each type of interval. The following names are suggested as ionospheric experts, subject to their agreement and availability :

INTERPLANET : C. G. LITTLE.

QUIET SUN : A. H. SHAPLEY.

IONOMAGSTORM : C. G. LITTLE ; W. R. PIGGOTT.

RIOMETER : C. G. LITTLE ; B. HULTQVIST ; DRIATSKY.

ANNEX II

**Data Flow to WDCs for the Pre-IQSY Period**

1. — It is recommended that for the pre-I.Q.S.Y. period (1960-1963) the following data should be sent to at least one W.D.C. :

1.1. — *Vertical soundings data.*

(a) Monthly tables of hourly values and medians for the following four characteristics  $f_oF_2$ ,  $M(3000)F_2$ ,  $f_oE_s$ ,  $f_bE_s$  (this concerns all stations).

- (b) *f*-plots and copies of ionograms for retrospective intervals of a few days which will be designated by the Reporter for Ionosphere (this concerns all stations).
- (c) Monthly tables of hourly values for all characteristics which are interchanged (this concerns only stations producing station booklets).

1.2. — *Absorption data.*

- (a) Data obtained with methods A 1 or A 3 according to the I.Q.S.Y. rules (see para. 3.3 of this report) wherever available.
- (b) Monthly tables of hourly values of attenuation (in dB) obtained with method A 2, wherever available.

1.3. — *Drift data.*

No exchange recommended.

1.4. — *Atmospheric Radio Noise data.*

Monthly tables, for each frequency, of hourly values of the noise level (in dB).

ANNEX III

**The Format of *f*-Plots**

1. — *Existing standards.*

The standard *f*-plot form used during the I.G.Y. provides a frequency and time grid suitable for plotting quarter-hourly or, in a few cases, ten minute observations. The frequency scale is linear from 0 to 10 MHz and logarithmic from 10 to 25 MHz. Some stations, where the top frequencies never reach these high values, use scales which stop at 15 or 20 MHz.

The standard form uses a scale of 15 mm per MHz from 0-10 MHz. At higher frequencies the ordinate *y* in cm is related to the frequency *f* in MHz by the equation :

$$y = 34.54 \log_{10} (f) - 19.54$$

This gives a continuous scale at 10 MHz. The standard time scales vary slightly ; most of them allow 8 or 9 mm per hour for quarter-hourly recording, or about 10 mm per hour for 10 minute recordings. Smaller spacing gives plots which cannot be effectively reproduced.

The frequency scale has heavy rulings at 1 MHz intervals and is sub-divided into 0.1 MHz steps below 15 MHz and 0.2 MHz steps above this frequency. The time scale has heavy rulings every hour and is sub-divided to give one line per observation, i.e. to give 4 lines per hour for quarter-hourly observations.

A small subsidiary scale is added, usually at the top or bottom of the  $f$ -plot, to show the incidence of Es types. This graph normally contains 5 to 8 horizontal lines spaced about 3 mm apart.

Experience shows that this format is very satisfactory provided care is taken to make any entries, particularly line entries, sufficiently thick to be distinguished from the grid when reproduced. This requirement has not been adequately observed at some stations.

2. — *Recommendation on format.*

It is recommended that no changes in this format be made at stations which are using equipment comparable with that in use during the I.G.Y. For stations with extended low frequency ranges, down to say 200 kHz, some modifications in the format and  $f$ -plot reduction rules may be desirable to obtain the full advantage from the extended frequency ranges. A suitable new standard is described below and may be adopted instead of the old standard where the quality of the low frequency ionograms and the amount of additional data justify a change. In doubtful cases, it is recommended to keep to the current practice at the station so as to simplify comparison with I.G.Y. data. The existing format is adequate for equipments starting near 0.7 MHz.

3. — *A new  $f$ -plot format for stations recording on frequencies below 1 MHz.*

It is desirable that the new  $f$ -plot sheets should be, if possible, the same size as the existing standard but that the scale below 1 MHz should be more open. Since data are not likely to be obtained, on the average, for more than half the time on frequencies below 1 MHz, it is possible to make a compromise between convenience of plotting and space required. It is important that the spacing in that part of the  $f$ -plot which is used the most (2.8 MHz) should not be appreciably smaller than that provided at present.

This suggests doubling the spacing near 1 MHz and using a geometrically progressing variation starting at a lower frequency than at present.

A suitable scale can be constructed starting at 0 MHz with an interval of 3 mm per 0.1 MHz, and decreasing geometrically to 1.5 mm per 0.1 MHz at 1.5 MHz. The common multiplier is 0.953. The remainder of the  $f$ -plot is identical with the standard I.G.Y. form except that the highest frequency is restricted to 23 MHz.

A simpler alternative, which has the disadvantage that the frequency scale is not continuous, is to use 3 mm per 0.1 MHz from 0 to 1 MHz and then the standard scale. If this scale is used a heavy line should be drawn across the chart at 1 MHz.

#### 4. — Additional rules for frequencies below the gyrofrequency.

4.1. — A heavy line should be marked on the  $f$ -plot at the mean gyrofrequency  $f_H$  calculated to the nearest 0.1 MHz for a height  $h = 110$  km from the standard equation :

$$f_H = (r_o / (r_o + h))^3 \cdot (eH_o / mc)$$

where  $H_o$  is the total field at ground level in gauss and  $r_o$  is the radius of the earth.

4.2 — The following conventions should be used in the frequency band below the gyrofrequency in place of the standard conventions :

- $f_{\min}$ , the lowest frequency at which any echoes are observed (no rejection rules) ;
- $f_{\min} F$ , the lowest frequency at which F-layer echoes are observed, except when it is equal to the critical frequency of a lower layer, when —○— must be used ;
- $o$  any ordinary mode critical frequency or cusp frequency ;
- $z$  any  $z$  — mode critical frequency ;
- $x$  any cusp which is attributable to a maximum or a minimum in the ionization profile below the reflecting layer and is not already denoted by  $o$  ;
- $f_oEs$ .

4.3. — The distinction between  $o$  and  $x$  depends on the presence or absence retardation in the trace of the lower layer. Thus if both lower and upper traces show retardation at the critical frequency, and if the upper layer is effectively blanketed by the lower near this frequency, use  $o$ . When it is clear from the sequence of events that the cusp is due to the formation of a ledge in the F layer, e.g. near sunrise and sunset, the symbol  $o$  is used and the critical frequency is tabulated with the values for the appropriate layer. Care is needed to distinguish between  $f_oF1$  and  $f_oE$  when the ledge first appears in the morning.

4.4. — When the magneto-ionic modes are closely coupled, additional retardation occurs in the  $x$  mode when the working frequency is equal to the plasma frequency. Thus a complex magneto-ionic wave often shows retardation at frequencies where the underlying ionization has a maximum or minimum. The symbol  $x$  is introduced to denote maxima due to this phenomenon.

#### ANNEX IV

### **Interim Report from the Ionosonde Sub-Committee**

(*Chairman* : Prof. K. RAWER)

#### 1. — *List of ionosondes.*

In response to a detailed questionnaire on ionosondes, a list giving the technical performance of all existing ionosondes has been widely circulated. Whilst similar views were expressed on most points, clearly different views were held in a few cases, notably with regard to receiver and recorder performance.

The present list of ionosonde performance details will be revised and published. Information on the type of ionosonde to be used at any station during the I.Q.S.Y., together with details of antenna, should be included in the I.Q.S.Y. list of ionospheric stations. It is planned to prepare detailed descriptions of the main sounding antennae now in use, so as to provide working instructions for antennae constructors.

#### 2. — *Design of Ionosondes.*

During the U.R.S.I. Symposium in Nice in December 1961, working groups were formed on antennae, general design problems



and modern receiving techniques. It was concluded that, although most current developments seem to be converging, there is no doubt that future development will probably be less conventional and will largely use semiconductors. For this reason, it seems unwise to consider *technical* standardization based on present techniques.

### 3. — *Standard Ionograms.*

On the other hand, the standardization of ionograms seems possible. This would have the great advantage that records from many different stations could be used for scientific work without changing projectors, scales, etc. It appears that at present at least half of the working time of research workers at W.D.Cs is spent in such changes. Thus the scientific work on ionograms would be greatly facilitated if recording scales could be standardized.

For routine records there appears to be general agreement, based on sound scientific reasons, in favour of :

- (a) a logarithmic frequency scale,
- (b) a linear height scale,
- (c) photographic recording on standard 35 mm film.

Discussions are continuing by correspondence, with a view to obtaining agreement before the I.Q.S.Y., on definite numerical laws for the frequency and height scales. These would not necessarily mean a standard format for all ionograms ; the different frequency ranges used at present could be continued. But if agreement is reached, many ionosondes with logarithmic frequency scales could be used with the same projectors and scales.

## ANNEX V

### **Interim Report from the N(h) Profile Sub-Committee**

(*Chairman* : Dr. J. W. WRIGHT)

The text of this report is not available at the date of going to press but will appear in a later issue.

**Preliminary Joint Report of**  
**COSPAR WORKING GROUP II FOR IQSY**  
(Chairman : H. FRIEDMAN)  
and  
**IQSY WORKING GROUP XV ON AERONOMY**  
(Chairman : M. NICOLET)  
(Abstracts)

1. — *Introduction.*

The purpose of the meeting was to discuss rocket and satellite experiments for the I.Q.S.Y. Particular attention was focused on small rocket aeronomy experiments which could be conducted with the participation of scientists from a number of countries. Plans for solar monitoring and ionospheric beacon experiments aboard satellites were also reviewed from the standpoint of the desirability of real-time telemetry. Discussions were devoted to an exchange of technical details and experience, with the expectation that firm plans for national projects contributing to the I.Q.S.Y. could be formulated for presentation at the June 1963 meeting of COSPAR in Warsaw, Poland.

Five types of rocket experiments were initially designated as typical of well developed techniques which might be conducted on a widespread basis. These included sodium vapor and grenade experiments, molecular oxygen and electron-density measurements, and meteorological measurements of temperature-density-pressure. Later the following additional experiments were added : mass spectrometry for neutral and ion composition, electric currents, temperatures between 120-200 km density by the falling sphere method, and an integrated study of the D and E regions of the ionosphere. Discussions were grouped under aeronomy, meteorological rockets, and satellites.

**REPORT OF WORKING GROUP ON WORLD DAYS**

(Chairman : A. H. SHAPLEY)

1. The formal Working Group consisted of the following representatives of the scientific working groups and the International Ursigram and World Days Service : A. H. Shapley (I.U.W.D.S.)

(Chairman), W. Kellogg (Meteorology), J. Veldkamp (Geomagnetism), T. Davis (Aurora), G. Brown (Ionosphere), J. V. Lincoln (Solar Activity and I.U.W.D.S.), L. de Feiter (Cosmic Rays and I.U.W.D.S.), S. Bowhill (Aeronomy and COSPAR WG 7), with the part-time assistance of S. Chapman and M. Nicolet. The I.Q.S.Y. Reporters and many other members of the scientific working groups have been contacted as appropriate. The collation of material and elaboration of details has been done by the I.U.W.D.S. representatives.

2. — On the basis of the needs of the programs of the scientific discipline, the draft plan for World Days given in the March 1963 draft Manual has been modified and extended in a number of details. The main changes are :

- (a) The names (but not the dates) of some of the days marked on the Calendar have been changed, such as Regular Geophysical Days instead of Regular Meteorological Days, and Quarterly World Days to designate the Regular World Day with highest priority which falls within each World Geophysical Interval.
- (b) The present plans for the world-wide Alerts regarding magnetic storms are considered to serve the same purpose as the « Special World Intervals » as designated during I.G.Y. and since the I.G.Y. ; Special World Intervals as such are therefore dropped from the plan for I.Q.S.Y., and the specific intensified observations in certain disciplines will instead be carried out in connection with magnetic storm Alerts.
- (c) The plans for Retrospective World Intervals have been considerably elaborated by the scientific disciplines concerned, separately and jointly. Such intervals will be selected in general after a delay of one to three months rather than a few weeks. They will be selected by a designated expert in consultation with designated advisors, with suggestions from the Regional Warning Centers as may be appropriate. Two new types of Retrospective Intervals have been added : MICRO-PULSATIONS and RIOMETER.
- (d) The time for the once-daily I.Q.S.Y. GEOALERT warning message will be changed from 1600 UT to 0400 UT, subject to completion of satisfactory communication arrangements

for distribution over the meteorological telecommunications network.

3. — The scientific discipline Working Groups have provided in their resolutions and reports or directly to the I.Q.S.Y. World Days Reporter a large number of recommendations or suggestions on the scientific programs for the various world days and intervals and in connection with Alerts. These will appear in the World Days Manual or supplementarily, in *I.Q.S.Y. Notes*.

4. — The scientific discipline Working Groups have provided in their reports or to the I.Q.S.Y. World Days Reporter their suggestions on the criteria for declaring Alerts and Retrospective Intervals of various types, on the policy, on the number and length of Alerts, and on mechanisms for taking decisions. This information will be collected in the World Days Manual.

5. — It was decided to revise the I.G.Y. plan to have National Warning Contact to make the I.Q.S.Y. rapid communications arrangements effective.

6. — It was recommended to the I.Q.S.Y. Assembly to start the I.Q.S.Y. plan for Alerts and Retrospective World Intervals as of October 1, 1963.

7. — The March 1963 draft World Days Manual will be revised in accordance with the actions at the Rome Assembly and distributed widely through the I.Q.S.Y. Secretariat and the I.U.W.D.S. The synoptic codes will be published by I.U.W.D.S. Any supplementary information will be distributed through *I.Q.S.Y. Notes*.

## RESOLUTIONS

1. — It is recommended to participating Committees and participating scientists to make use of the World Days program as collected and described in the final I.Q.S.Y. Manual for World Days and as may be supplemented by further information to be given in *I.Q.S.Y. Notes*.

2. — It is recommended that the I.Q.S.Y. plan for Alerts and Retrospective World Intervals be put into effect as of October 1, 1963, the months of October, November and December, 1963 being considered a full trial for those stations and experiments

already operating and for the communications arrangements, in anticipation of the formal start of I.Q.S.Y. on January 1, 1964.

3. — It is recommended that the W.M.O. be asked to arrange for distribution of the once-daily I.Q.S.Y. warning message described in the I.Q.S.Y. World Days Manual over the inter-regional, regional and national meteorological telecommunication channels, thus continuing the valuable assistance given to the corresponding effort during the I.G.Y.

4. — It is recommended that the time of issue of the once-daily I.Q.S.Y. warning message be changed from 1600 UT to 0400 UT as of October 1, 1963, subject to the assent of the W.M.O. authorities with regard to distribution at that time through the meteorological telecommunications network, inasmuch as a message distributed beginning at 0400 appears to be more effective from both a scientific and practical viewpoint for the majority of I.Q.S.Y. stations and Regional Warning Centres; the final decision on the time of issue, if different from the above, will be announced as soon as possible to National Warning Contacts and through publication in *I.Q.S.Y. Notes*.

5. — It is recommended that participating Committees as a matter of urgency designate at least provisionally their National Warning Contacts in accordance with the resolution of the I.Q.S.Y. Council and notify the C.I.G.-I.Q.S.Y. Secretariat accordingly, so that the detailed organization of the plans for the necessary rapid communications for the execution of the I.Q.S.Y. program can be completed before the beginning of the pre-I.Q.S.Y. trial period.

6. — *Resolution adopted by Council for I.Q.S.Y.*

The I.Q.S.Y. Council urges Participating Committees to give all possible assistance in arranging for the rapid communications to their I.Q.S.Y. stations which may be necessary for the execution of the I.Q.S.Y. scientific program and recommends that they designate an individual to act as National Warning Contact to coordinate these communications arrangements for their country in accordance with the plans given in the I.Q.S.Y. Manual for World Days.

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# INTERNATIONAL GEOPHYSICAL YEAR

## Symposium on Results of the I.G.Y.-IG.G.

12-16 August 1963,

at the University of California, Los Angeles

1. General Description of the Symposium.
2. Subjects and Speakers.

Symposium Program Committee of the National Academy of Sciences :

W. W. ATWOOD,  
V. V. BELOUSSOV,  
L. V. BERKNER,  
Sydney CHAPMAN,  
J. Coulomb,  
L. M. GOULD,  
J. W. JOYCE,  
Joseph KAPLAN,  
M. NICOLET,  
Hugh ODISHAW (*Secretary*),  
F. W. REICHELDERFER,  
A. H. SHAPLEY,  
A. F. SPILHAUS,  
M. A. TUVE (*Chairman*).

Local Arrangements Committee at the University of California,  
Los Angeles :

L. H. ADAMS,  
J. A. BJERKNES,  
G. J. FERGUSON (*Chairman*),  
D. T. GRIGGS,  
Joseph KAPLAN,  
Leon KNOPOFF,

W. F. LIBBY,  
G. J. F. MACDONALD,  
Walter MUNK,  
W. W. RUBEY,  
L. B. SLICHTER.

*Note.* — The Symposium has been planned and arranged by the National Academy of Sciences. The Symposium also has the co-sponsorship of the Comité International de Géophysique (C.I.G.).

### 1. — General Description of the Symposium

Plans for a symposium of review papers embracing the I.G.Y. disciplines evolved within U. S. National Academy of Sciences over a period of several years. Advice was solicited from a representative group of scientists from many countries and, in particular, from the Unions and Committees active in the I.G.Y.-I.G.C. and subsequent programs. Warm responses and valuable suggestions have come from the I.U.G.G., I.A.U., I.U.P.A.P., U.R.S.I., C.I.G., C.O.S.P.A.R., and S.C.A.R.

Several considerations entered into the proposal and the planning of the symposium. It appeared timely : much of the I.G.Y.-I.G.C. data has been analyzed, affording an opportunity for suitable critical reviews of results. Moreover, much of the I.G.Y. work has continued, affording an opportunity to review progress since 1957, and the invited review papers will survey research from about 1957 to the present. Such a review appeared in itself scientifically worthwhile, and it would also contribute to our thinking about future research efforts — for example, the I.Q.S.Y. and the Upper Mantle programs.

The holding of the I.U.G.G. General Assembly of 1963 in the United States appeared to afford a unique opportunity because many of the participants would be coming to the West Coast of the United States. Another event added to the timeliness : our Academy celebrates its Centennial in 1963, and this symposium seemed an appropriate way to mark this occasion.

Some forty review papers on major topics will be presented by leading scientists who have been nominated for the occasion by their international colleagues. There will be two simultaneous sessions : one on solid earth and interface topics (geodesy, gravity,

seismology, oceanography, glaciology, and meteorology), the other on the upper atmosphere, solar-terrestrial relations and near space (solar physics, geomagnetism, cosmic rays, ionospheric physics, aurora and airglow, aeronomy, and the interplanetary medium). Each of these sessions will meet for three hours each morning and afternoon. In general, each «meeting» will consist of only three papers so that each speaker may have ample time for his presentation and yet allow some time for discussion.

## 2. — Subjects and Speakers

### SESSION I : *Solid Earth and Interface Phenomena*

#### *Geodesy and Gravity.*

Longitude and Latitude : Wm. MARKOWITZ.

Earth Tides : P. MELCHIOR.

Gravity : G. P. WOOLARD.

#### *Glaciology.*

Structure and Ice Cover of Antarctica : C. R. BENTLEY.

Deep Ice Coring : Henri BADER.

Ice of the Earth and Its Present Changes : P. A. SHUMSKIY.

### SESSION II : *Upper Atmosphere, Sun, and Interplanetary Medium*

#### *The Sun.*

Solar Ultraviolet and X-Rays : C. DE JAGER.

Solar Flares : M. A. ELLISON.

Solar Radio Waves : S. F. Smerd.

Solar Magnetic Field : A. B. SEVERNY.

#### *Interplanetary Medium.*

High Energy Solar Particle Events : J. G. ROEDERER.

Solar Wind : E. N. PARKER.

Cosmic Rays : P. MEYER.

Trapped Radiation : S. N. VERNOV.

Phenomena of Magnetospheric Boundaries : L. A. FRANK, J. A. VAN ALLEN.

#### *Aeronomy.*

Structure of the Atmosphere : M. NICOLET.

Geocorona : J. W. CHAMBERLAIN.



Aurora : S. Chapman, S. I. AKASOFU.

Airglow : D. BARBIER.

*Geomagnetism.*

Magnetic Storms and Ionospheric Disturbances : N. V. PUSHKOV.

Rapid Variations : V. A. TROITSKAYA.

Magnetic Field at the Poles : T. NAGATA.

*The Ionosphere.*

Constitution and Solar Control : H. FRIEDMAN.

Movements and Irregularities : C. O. HINES.

Morphology of Storms : T. ODAYASHI.

Ionospheric Absorption : W. R. PIGGOTT.

Ionospheric Emissions : R. A. HELLIWELL.

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**India**

**PUBLICATION OF DATA**

The Research Department of All India Radio, New Delhi, participated in the programme of ionospheric observations for the International Geophysical Year and the International Geophysical Co-operation. Measurements made under this programme pertain to the following :

(i) Measurement of ionospheric characteristics on vertical incidence ionospheric soundings at Delhi, Bombay, Madras, Tiruchirappalli and Trivandrum stations of A.I.R.

(ii) Measurement of ionospheric drift by the spaced receiver technique at Delhi.

(iii) Measurement of ionospheric absorption on vertical incidence pulsed transmissions.

(iv) Observation of solar flares from sudden increase in longwave field intensity (S. I. L.).

(v) In addition, measurements have also been taken on atmospheric noise by a modified Thomas Method in the frequency range of 2.5 to 9.5 Mc/s at Delhi, Gauhati and Trivandrum.

Half-hourly measurements of ionospheric characteristics are being regularly published by this Department in its monthly bulletin called « The Ionospheric Data ». The intensive observations of the ionospheric characteristics taken during the I.G.Y. and the I.G.C. and other data referred to above have not yet been published although some of them have been sent to the World Data Centre through the National Committee of the I.G.Y.

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## C. C. I. R.

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### X<sup>e</sup> Assemblée plénière du C. C. I. R.

Genève, janvier-février 1963

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#### Extraits du rapport du D<sup>r</sup> Ernst Metzler

publié dans le *Journal des Télécommunications*,  
vol. 30, n<sup>o</sup> 6, juin 1963  
(see English text, p. 161)

#### Travaux des Commissions d'Etudes

COMMISSION D'ETUDES IV. — *Systèmes spatiaux et radioastronomie*  
(Rapporteur principal, Prof. I. RANZI (Italie), Vice-Rapporteur principal, M. W. KLEIN (Suisse)).

Les problèmes principaux traités par cette commission, dont la création date de la IX<sup>e</sup> Assemblée plénière de 1959, sont ceux qui intéressent la Conférence administrative extraordinaire des radio-communications (C.A.E.R.), chargée d'attribuer les bandes de fréquences pour les communications spatiales, qui s'ouvrira à Genève en octobre 1963. Il s'agit surtout d'Avis concernant le partage des fréquences des systèmes de communications spatiales avec des systèmes de faisceaux hertziens et d'autres systèmes. Les problèmes des valeurs maximales admissibles de brouillages causés par ce partage, ainsi que la distance de coordination définissant la probabilité de brouillages aux stations radio-électriques terrestres, peuvent être également cités comme faisant l'objet de certains Avis. Parmi les autres problèmes étudiés par cette commission, citons encore : les satellites de radionavigation et les satellites météorologiques.

COMMISSION D'ETUDES V. — *Propagation au-dessus de la Terre et dans les régions non-ionisées de l'atmosphère* (Rapporteur prin-

cipal Dr. R. L. SMITH-ROSE (Royaume-Uni), Vice-Rapporteur principal, Dr. A. KALENIN (U. R. S. S.).

Les courbes de propagation pour différentes bandes de fréquences sont contenues dans plusieurs Avis préparés par cette commission. Cette commission porte un intérêt particulier aux différents problèmes de la radiométéorologie. Les courbes de propagation pour la radiodiffusion sur ondes métriques et décimétriques sur le continent africain ont été présentées sous forme d'un Rapport constituant une contribution du C.C.I.R. à la Conférence africaine de radiodiffusion (Genève, avril 1963).

COMMISSION D'ETUDES VI. — *Propagation ionosphérique* (Rapporteur principal, Dr. D. K. BAILEY (E. U. A.), Vice-Rapporteur principal Dr. E. K. SMITH (E. U. A.)).

Cette commission s'est attachée à l'élaboration d'un Avis sur le choix des indices d'activité solaire pour la propagation ionosphérique. Un travail considérable a été fourni au sujet de l'amélioration du rapport concernant les données sur les bruits atmosphériques radio-électriques. Pour améliorer les prévisions à long terme de la propagation des ondes décamétriques, un groupe d'experts a été constitué, ayant pour mission de préparer un atlas provisoire du C.C.I.R. représentant les caractéristiques ionosphériques mondiales.

Parmi les problèmes nouveaux étudiés par cette commission, citons : l'utilisation des satellites en vue des ionosondages par le haut et l'étude de la propagation des ondes décamétriques le long des guides d'ionisation alignés suivant les lignes de force du champ magnétique terrestre, spécialement en période de haute activité solaire.

COMMISSION D'ETUDES VII. — *Fréquences étalon et signaux horaires* (Rapporteur principal M. B. DECAUX (France), Vice-Rapporteur principal, Prof. M. BOELLA (Italie)).

En plus des travaux devenus classiques de cette commission, on constate qu'elle se penche de plus en plus sur certains problèmes nouveaux tels que : l'utilisation des étalons de fréquence atomique, l'émission de fréquences stabilisées et les moyens de contrôle dans les bandes 4 et 5 et la distribution de signaux horaires codés au moyen d'émissions radio-électriques, à partir de stations terrestres ou de stations spatiales.

COMMISSION D'ETUDES XIV. — *Vocabulaire* (Rapporteur principal, M. R. VILLENEUVE (France), Vice-Rapporteur principal, M. A. FERRARI-TONIOLO (Italie)).

Hormis les problèmes habituels de cette commission, celle-ci a établi un rapport sur la définition des ondes électromagnétiques polarisées elliptiquement ou circulairement destrorsum ou sinistrorsum. Ce problème est devenu actuel par suite du développement des télécommunications spatiales.

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Un article détaillé sur les résultats techniques de l'Assemblée paraîtra prochainement. Il importe de relever ici que toutes les commissions d'études intéressées ont fait un effort particulier en vue d'élaborer des textes techniques pouvant servir de base aux discussions de la C.A.E.R. dont l'ouverture est prévue à Genève le 7 octobre 1963.

Conformément à une Résolution adoptée par l'Assemblée plénière, le directeur du C.C.I.R. a porté à la connaissance du secrétaire général les conclusions de cette Assemblée qui, à son avis, présentent un intérêt pour la conférence en question.

#### *Structure des commissions d'études.*

Aucun changement n'est intervenu pendant l'Assemblée plénière en ce qui concerne les rapporteurs principaux et les vice-rapporteurs principaux des commissions d'études du C.C.I.R. et de la C.M.T.T. de sorte que les titulaires ont été confirmés dans leurs fonctions.

#### *Mandats des Commissions d'Etudes.*

Sur proposition de la Commission d'organisation, certaines modifications ont été apportées aux mandats des Commissions d'études I, II, V, VIII, XIII et de la C.M.T.T., tels qu'ils avaient été approuvés à Los Angeles, ce, pour tenir compte du développement des radio-communications et des travaux accrus qui en sont résultés pour ces diverses commissions.

#### *Conclusion.*

Le volume de travail de la X<sup>e</sup> Assemblée plénière, y compris les travaux préparatoires, a de nouveau dépassé de beaucoup celui de l'Assemblée plénière précédente.

Il convient de souligner l'esprit de coopération qui s'est manifesté pendant toute la durée de l'Assemblée plénière, et dont le meilleur signe est peut-être le fait que chacun des 395 textes adoptés par l'Assemblée l'a été à l'unanimité, sans qu'aucune réserve ait été formulée.

Les plus vifs remerciements doivent être adressés aux autorités suisses ainsi qu'aux autres organismes de l'Union dont la coopération a permis d'assurer le succès complet de cette réunion.

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## C. C. I. R.

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### Xth Plenary Assembly of the C. C. I. R.

Geneva, January-February 1963

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#### **Abstracts of the report by Dr. Ernst Metzler**

published in *Telecommunication Journal*,  
Vol. 30, n° 6, June 1963

#### **Work of the Study Groups**

STUDY GROUP IV. — *Space systems and radio astronomy* (Chairman : Prof. I. RANZI (Italy), Vice-Chairman : M. W. KLEIN (Switzerland)).

The chief problems considered by this study group, which was set up at the IXth Plenary Assembly in 1959, are those which interest the Extraordinary Administrative Radio Conference (E.A.R.C.) to allocate frequency bands for space radiocommunications, due to open in Geneva in October, 1963. The Recommendations concern the sharing of frequencies by space communication systems and radio relay links or other systems. Other Recommendations dealt with maximum admissible interference caused by such sharing, and the co-ordination distance defining the probability of interference to terrestrial radio stations. Other problems examined by this study group include radio-navigation satellites and meteorological satellites.

STUDY GROUP V. — *Propagation over the surface of the earth and through the non-ionized regions of the atmosphere* (Chairman : Dr. R. L. SMITH-ROSE (U. K.), Vice-Chairman : Dr. A. KALININ (U. S. S. R.)).

The propagation curves for different frequency bands are contained in various Recommendations prepared by this study group,

which has a special interest in the various problems of radio-meteorology. The propagation curves for broadcasts on very high frequencies and ultra high frequencies on the African continent were presented in the form of a Report constituting a C.C.I.R. contribution to the African Broadcasting Conference (Geneva, April 1963).

STUDY GROUP VI — *Ionospheric propagation* (Chairman : Dr. D. K. BAILEY (U. S. A.), Vice-Chairman : Dr. E. K. SMITH (U. S. A.)).

This study group prepared Recommendations concerning the choice of sunspot indices for ionospheric propagation. A considerable amount of work was done to improve the report on data about radio atmospheric noise. To improve long-term predictions for HF propagation, a group of experts was set up with the task of preparing a provisional C.C.I.R. atlas showing world ionospheric characteristics.

Among the new problems studied by this study group, mention may be made of : the use of satellites for ionospheric probes from above and the study of the propagation of high frequencies along the ionisation guidelines aligned according to the earth's magnetic field, especially in periods of high sunspot activity.

STUDY GROUP VII. — *Standard frequencies and time signals* (Chairman : Mr. B. DECAUX (France), Vice-Chairman : Prof. M. BOELLA (Italy)).

In addition to the established work of this study group, it is dealing more and more with certain new problems such as the use of atomic frequency standards, the emission of stabilized frequencies and means of control in bands 4 and 5, and the distribution of coded time signals by radio emissions from terrestrial or space stations.

STUDY GROUP XIV. — *Vocabulary* (Chairman : Mr. R. VILLENEUVE (France), Vice-Chairman : Mr. A. FERRARI-TONIOLO (Italy)).

Apart from the normal problems dealt with by this study group, the latter also prepared a Report on the definition of electromagnetic waves polarized elliptically or circularly destrorsum or sinistrorsum. This problem has come to the fore because of the development of space telecommunications.

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A detailed article about the technical results of the Assembly will be published shortly. It should be stressed here that all the



study groups concerned made a special effort to prepare technical texts which could serve as a basis for the discussion of the E.A.R.C., which is due to open in Geneva on 7 October, 1963.

In accordance with a Resolution adopted by the Plenary Assembly, the Director of the C.C.I.R. has informed the Secretary General of those conclusions of the Assembly which in his opinion are of interest for the above-mentioned Conference.

*Structure of the Study Groups.*

No change was made during the Plenary Assembly to the Chairmen and Vice-Chairmen of C.C.I.R. Study groups and the C.M.T.T., so that the gentlemen were confirmed in office.

*Terms of reference of C.C.I.R. Study Groups.*

On a proposal by the Organization Committee, some changes were made to the terms of reference of Study Groups I, II, V, VIII, XIII and of the C.M.T.T. as approved at Los Angeles. This was to cater for the development of radiocommunications and the resulting work increase for these study groups.

*Conclusion.*

The volume of work of the Xth Plenary Assembly including the preparatory work, again greatly exceeded that of the previous Plenary Assembly.

Mention should be made of the spirit of co-operation which was manifest throughout the Plenary Assembly. Perhaps the best proof of this lies in the fact that every single one of the 395 texts adopted by the Assembly was carried unanimously, no amendments being formulated.

Warm thanks are due to the Swiss authorities and to the other organs of the Union whose co-operation has assured the complete success of this meeting.

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## I. C. S. U.

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### **Resolutions adopted at the Fourteenth Meeting of the Executive Board of I.C.S.U.**

(voir texte français p. 169)

#### RESOLUTION EB (XIV) 1

The Executive Board

*recognizing* the emergency created by the sudden death of Dr. Steacie, President of I.C.S.U.

*appreciated* the action taken by the Bureau in having one of the Vice-Presidents, Dr. Hörstadius, assume all the powers and responsibilities attached to the office of President as provided for in the Statutes, and

*recommended* that steps be taken to conduct the election of the President, if necessary, by vote by correspondence.

#### RESOLUTION EB (XIV) 2.

The Executive Board

*recommended* that no new project be endorsed without prior consideration of all the financial implications.

#### RESOLUTION EB (XIV) 3.

The Executive Board

*decided* that :

- (a) the I.C.S.U. Special Fund would be used to make gifts or donations to new scientific projects by the Executive Board ;
- (b) the Working Capital Fund would be used for the following purposes :
  - (i) to make advances to I.C.S.U. bodies pending the receipt of expected subventions, grants or subscriptions ;
  - (ii) to make loans to new scientific projects of the Council, such loans to be repaid over a period to be determined by the Bureau, following the advice of the Treasurer.

RESOLUTION EB (XIV) 4.

The Executive Board.

*decided* that for a trial period of two years, commencing in 1964, the U.N.E.S.C.O. subvention be distributed on a percentage basis, provided it is approved by U.N.E.S.C.O.

RESOLUTION EB (XIV) 7.

The Executive Board

*adopted* the proposed distribution of the U.N.E.S.C.O. subvention for 1963, as recommended by the Allocations Sub-Committee.

RESOLUTION EB (XIV) 13.

The Executive Board

*considered* that the creation of new Committees or Commissions should not be envisaged without a thorough preliminary study proving that no other satisfactory solution exists, and that the target is sufficiently important to the development of international and interdisciplinary scientific co-operation and to the progress of the scientific disciplines involved ;

*recommended* consequently that such a creation should first be accepted by the Executive Board after consultation with the Unions and National Members of I.C.S.U. and then approved by the General Assembly of I.C.S.U.

RESOLUTION EB (XIV) 14.

The Executive Board

*considered* that :

- (a) the possible formation of new organisms and the evolution of existing Committees or Commissions should be followed by I.C.S.U. and examined at each I.C.S.U. General Assembly ;
- (b) the Bureau of I.C.S.U. should be represented, with a consultative voice, by one of its members at any Plenary Assembly of every Committee or Commission of I.C.S.U. ;

*recommended* that the evolution of Committees and Commissions should tend to lighten the initial financial burden of I.C.S.U., and that, when the development of their tasks lead to routine procedures more relevant to adequately equipped national organisms than to an I.C.S.U. body, the transfer of these tasks

to an appropriate intergovernmental body be studied, prepared and carried out ;

*emphasized* that such an evolution, discharging I.C.S.U. of a financial burden which no longer concerns directly the promotion of science by international or interdisciplinary co-operation, should in no case be a cause for a rupture on the scientific level of the filiation links between I.C.S.U. and Committees or Commissions becoming financially independent.

RESOLUTION EB (XIV) 15.

The Executive Board

*recommended* that I.C.S.U. should favour the establishment of good relations between Special and Scientific Committees of I.C.S.U. and the intergovernmental organizations working in the same field, while maintaining a strict independence in regard to these organizations, as well as the exclusively scientific character of the activities of I.C.S.U. and its Committees and Commissions.

RESOLUTION EB (XIV) 16.

The Executive Board

*recommended* that the Committees and Commissions when preparing scientific meetings should fully exploit the co-operation of the Unions, since this co-operation is the aim pursued by an interdisciplinary scientific activity and since the representation of participating Unions is an easy and direct way of its implementation, and should thus avoid any duplication of efforts between Unions and Committees or Commissions.

RESOLUTION EB (XIV) 18.

The Executive Board

*having considered* the resolution 27 and 28 (EC XIV) of W.M.O. on research aspects and applications of meteorological satellites.  
on research aspects and applications of meteorological satellites ;

*noted* that, pending the possible establishment by the 4th Congress of W.M.O. next year of an Advisory Committee on Scientific Research in Meteorology with Artificial Satellites, the Executive Committee of W.M.O. decided to set up a Working

Group to fulfil temporarily some of the functions of the Advisory Committee ;

*noted* also that this Working Group will consist of 12 members : 7 representatives of W.M.O., 4 of I.C.S.U. and 1 of U.N.E.S.C.O. ;

*noted* with great satisfaction that the Executive Committee of W.M.O. has nominated members whose functions or activities in I.U.G.G. or C.O.S.P.A.R. enable to speak at the same time for I.C.S.U. and for W.M.O., that such a selection was possible shows that the members of the Working Group could have been chosen by consultation between the two organizations ;

*wished* that the 4th Congress of W.M.O. examine the resolution 27 (EC XIV) in the spirit of the working agreement between W.M.O. and I.C.S.U. and set up the Advisory Committee in close co-operation with I.C.S.U. ;

*would* particularly *appreciate* that the members of the Advisory Committee be selected by consultation between the two organizations ;

*hoped* that the members of the Committee would work not so much as representatives of either organization than as individuals, in their capacity of scientists ;

pending final decisions of the 4th Congress of W.M.O. and in a spirit of co-operation, after consultation with the International Associations of Meteorology and Atmospheric Physics and of Geomagnetism and Aeronomy of I.U.G.G., with U.R.S.I. and C.O.S.P.A.R.

*designated* the following members to represent I.C.S.U. on the temporary Working Group ;

Professor W. Dieminger, Dr. W. L. Godson, Professor L. Kondratiev, Professor Sv. Petterssen, Professor J. Van Mieghem ;

*thought* that only points a (i) to a (vi) of the appendix to the First Report of W.M.O. are within I.C.S.U.'s competence ; finally

*entrusted* the liaison between I.C.S.U. and the International Telecommunications Union to the Inter-Union Committee on Frequency Allocations.

RESOLUTION EB (XIV) 21.

The Executive Board

*noted* with satisfaction the action taken by C.I.G. in establishing a Committee and a Secretariat for I.Q.S.Y. ;

*decided* to encourage the work of the Committee by making a loan of \$ 5000 from the I.C.S.U. Special Fund towards its initial expenses and an annual contribution of \$ 5000 for five years to the I.Q.S.Y. funds ;

*appreciated* the suitability of the draft rules proposed for the I.Q.S.Y. Committee and

*recognized* that they are based on I.C.S.U. rules for Special Committees, but

*was not in favour* of the creation of an I.C.S.U. Special Committee for I.Q.S.Y. ;

*recognizing* the essential links of the I.Q.S.Y. Committee to the broader responsibilities of the C.I.G.,

*requested* the C.I.G. to continue to regard the I.Q.S.Y. programme as one of its principal activities and during the period of 5 years ending 1 August 1967 to take all appropriate steps to support its I.Q.S.Y. Committee so as to achieve the successful accomplishment of the I.Q.S.Y. programme.

RESOLUTION EB (XIV) 23.

The Executive Board

*confirmed* the recommendation made at the 9th General Assembly that the responsibility of the World Magnetic Survey and of the Upper Mantle Project should be transferred to the I.U.G.G.

RESOLUTION EB (XIV) 31.

The Executive Board

*resolved* that :

- 1) votes by correspondence should only be used when absolutely necessary ;
- 2) such votes should only be valid if the procedure is approved by 2/3 of the members of the Executive Board (at present 20) ;

- 3) the motion would be carried with a simple majority of the Executive Board (at present 16) ;
- 4) in cases when one of the Unions has not designated its representative on the Board, the voting circulars should be sent to the General Secretary.

RESOLUTION EB (XIV) 36.

The Executive Board

*noting* with considerable interest the following recommendation which was forwarded by the President of the National Academy of Sciences of the United States with the formal endorsement of the Governing body of the National Academy of Sciences, National Research Council :

« That the International Council of Scientific Unions be requested to establish a special committee on Atmospheric Sciences and Hydrology with the functions of :

- (1) studying and fostering programmes of international co-operative research, and
- (2) providing advice if requested to intergovernmental bodies having responsibilities for international action in these fields » ;

*refers* it to the Executive Committee of the I.U.G.G. for detailed study in consultation with other Unions and for further recommendation to I.C.S.U. ;

*invites* attention to its prior decision on the U.N. Resolution 1721 (XVI), and the International Hydrological Programme.

**Résolutions adoptées à la Quatorzième Réunion  
du Comité exécutif de l'I.C.S.U.**

(see English text, p. 164)

RÉSOLUTION EB (XIV) 1.

Le Comité exécutif

*reconnaisant* l'urgence créée par le décès du Dr. Steacie, Président de l'I.C.S.U.,

*enregistre* la décision prise par le Bureau de confier à un des Vice-Présidents, le Dr Hörstadius, l'autorité et les responsabilités conférées au Président selon les statuts, et

*recommande* que des démarches soient entreprises en vue de l'élection du Président, au besoin par vote par correspondance.

RÉSOLUTION EB (XIV) 2.

Le Comité exécutif

*recommande* qu'aucun nouveau projet ne soit adopté avant que toutes les implications financières n'en aient été considérées.

RÉSOLUTION EB (XIV) 3.

Le Comité exécutif

*décide* que :

- a) le Fonds Spécial de l'I.C.S.U. (I.C.S.U. Special Fund) sera utilisé aux fins de dons et subventions à de nouveaux projets scientifiques acceptés par le Comité exécutif ;
- b) le Fonds de Roulement (Working Capital Fund) sera utilisé aux fins suivantes :
  - (i) avances aux organismes de l'I.C.S.U. n'ayant pas encore perçu leurs subventions, allocations ou souscriptions ;
  - (ii) prêts aux nouveaux projets scientifiques du Conseil, ces prêts devant être remboursés dans des délais fixés par le Bureau sur avis du Trésorier.

RÉSOLUTION EB (XIV) 4.

Le Comité exécutif

*décide* que pour une période d'essai de deux ans, à partir de 1964, la subvention de l'U.N.E.S.C.O. sera distribuée d'après un pourcentage préétabli et sous réserve de l'accord de l'U.N.E.S.C.O.

RÉSOLUTION EB (XIV) 7.

Le Comité exécutif

*adopte* la distribution de la subvention U.N.E.S.C.O. telle qu'elle est proposée pour 1963 par le Sous-Comité des Allocations.

RÉSOLUTION EB (XIV) 13.

Le Comité exécutif

*considère* que la création de nouveaux Comités ou Commissions ne doit être envisagée qu'après une étude approfondie montrant



qu'aucune autre solution satisfaisante ne peut y suppléer et que l'objet en est d'importance suffisante eu égard au développement de la coopération scientifique internationale et interdisciplinaire, et pour le progrès des disciplines scientifiques en cause ;

*recommande* en conséquence qu'une telle création devrait être approuvée par une Assemblée Générale de l'I.C.S.U. après avoir été acceptée par le Comité exécutif à la suite d'une consultation des Unions et des Membres nationaux de l'I.C.S.U.

RÉSOLUTION EB (XIV) 14.

Le Comité exécutif

*considère* que :

- a) la formation éventuelle d'organismes nouveaux et l'évolution des Comités et Commissions existants devraient être suivies par l'I.C.S.U. et examinées lors de chaque Assemblée générale de l'I.C.S.U. ;
- b) le Bureau de l'I.C.S.U. devrait être représenté, avec voix consultative, par un de ses membres à toute Assemblée plénière de tout Comité ou de toute Commission de l'I.C.S.U. ;

*recommande* que le développement des Comités et Commissions tende à alléger les charges financières initiales de l'I.C.S.U. et que, lorsque leur activité devient un travail de routine qui relève davantage d'organismes nationaux disposant d'un équipement adéquat que d'un organisme de l'I.C.S.U., le transfert de ces tâches à un organisme inter-gouvernemental approprié soit étudié, préparé et effectué ;

*estime* hautement souhaitable qu'une pareille évolution, affranchissant l'I.C.S.U. de charges financières qui ne concernent plus directement l'encouragement à la recherche scientifique par la coopération internationale et interdisciplinaire, ne provoque en aucun cas la rupture sur le plan scientifique des liens de filiation entre l'I.C.S.U. et les Comités ou Commissions devenus financièrement indépendants.

RÉSOLUTION EB (XIV) 15.

Le Comité exécutif

*recommande* que l'I.C.S.U. favorise l'établissement de relations étroites entre les Comités spéciaux et scientifiques de l'I.C.S.U.

et les organisations à caractère inter-gouvernemental intervenant dans le même domaine, en maintenant toutefois une stricte indépendance à l'égard de ces organisations, en même temps que le caractère exclusivement scientifique de l'activité de l'I.C.S.U. et de ses Comités et Commissions.

RÉSOLUTION EB (XIV) 16.

Le Comité exécutif

*recommande* qu'afin d'éviter toute duplication d'efforts entre les Unions d'une part, les Comités ou Commissions d'autre part, les uns et les autres assurent soigneusement la coopération des Unions dans la préparation des réunions scientifiques que les Comités ou Commissions peuvent organiser, étant donné que cette coopération est le but recherché de toute activité scientifique interdisciplinaire et que la représentation des Unions participantes en fournit le moyen direct et aisé.

RÉSOLUTION EB (XIV) 18.

*ayant pris connaissance* des résolutions 27 et 28/EC-XIV de l'O.M.M. sur les recherches et les applications météorologiques rendues possibles par les satellites artificiels ;

*note* qu'en attendant l'établissement éventuel, l'an prochain, par le 4<sup>e</sup> Congrès de l'O.M.M., d'un comité consultatif à l'aide de satellites artificiels, le Comité exécutif de l'O.M.M. a décidé d'établir un groupe de travail chargé de remplir temporairement certaines fonctions du comité consultatif ;

*note* également que ce groupe de travail serait composé de douze membres : 7 représentants de l'O.M.M., 4 de l'I.C.S.U. et 1 de l'U.N.E.S.C.O. ;

*constate* avec une très vive satisfaction que le Comité exécutif de l'O.M.M. a désigné des membres qui par leurs fonctions ou par leurs activités à l'U.G.G.I. et au C.O.S.P.A.R. peuvent fort bien défendre à la fois les intérêts de l'I.C.S.U. et de l'O.M.M.

Le fait qu'un tel choix ait pu être fait prouve qu'il eût été possible de désigner les membres du groupe de travail d'un commun accord entre les deux organisations ;

*souhaite* que le 4<sup>e</sup> Congrès de l'O.M.M. examine la Résolution 27/EC-XIV dans l'esprit de l'accord de travail O.M.M.-I.C.S.U.

et établisse le comité consultatif en étroite coopération avec l'I.C.S.U.

En particulier, le Conseil serait heureux que le choix des membres de ce comité consultatif se fasse d'un commun accord entre les deux organisations. Dans cet ordre d'idée, il faut espérer que les membres de ce comité travailleront non pas tant comme représentant de l'une ou de l'autre des deux organisations, mais bien plus à titre individuel, en leur capacité d'homme de science ;

En attendant la décision finale du 4<sup>e</sup> Congrès de l'O.M.M. et dans un esprit de coopération, après consultation de l'Association internationale de Météorologie et de Physique de l'Atmosphère et de l'Association internationale de Géomagnétisme et d'Aéronomie de l'U.G.G.I., de l'U.R.S.I. et du C.O.S.P.A.R.

*désigne* les membres suivants pour représenter l'I.C.S.U. au sein du groupe de travail temporaire : MM. Dieminger, Godson, Kondratiev, Petterssen, Van Mieghem ;

*estime* que seuls les points *a* (i) à *a* (vi) de l'appendice du premier rapport de l'O.M.M. sont de la compétence de l'I.C.S.U. et enfin

*confie* la liaison I.C.S.U.-I.T.U. au Comité inter-Unions des Allocations de Fréquences.

#### RÉSOLUTION EB (XIV) 21.

Le Comité exécutif

*a pris note* avec satisfaction de l'action déjà entreprise par le C.I.G. en vue de créer un Comité et un Secrétariat pour l'I.Q.S.Y. ;

*désire* encourager le travail de ce Comité et est disposé à verser une subvention annuelle de \$ 5000 à l'I.Q.S.Y. et à consentir un prêt de \$ 5000, pour dépenses de premier établissement, à prélever sur le Fonds Spécial de l'I.C.S.U. ;

*apprécie* l'opportunité du projet de règlement proposé par le Comité de l'I.Q.S.Y. et

*reconnait* qu'il est conforme aux règles de l'I.C.S.U. concernant les Comités spéciaux, mais

*n'envisage pas favorablement* la création d'un Comité spécial de l'I.C.S.U. pour l'I.Q.S.Y. ;

*reconnaissant* les liens essentiels du Comité de l'I.Q.S.Y. avec les responsabilités plus larges du C.I.G. ;

*demande* au C.I.G. de continuer à considérer le programme de l'I.Q.S.Y. comme l'une de ses activités principales et au cours de la période de 5 ans prenant fin le 1<sup>er</sup> août 1967 de s'efforcer d'aider le Comité de l'I.Q.S.Y. à réaliser ce programme avec succès.

RÉSOLUTION EB (XIV) 23.

Le Comité exécutif

*confirme* la recommandation prise à la 9<sup>e</sup> Assemblée générale de transférer la responsabilité du Levé magnétique mondial et du Projet du Manteau supérieur à l'Union géodésique et géophysique internationale.

RÉSOLUTION EB (XIV) 31.

Le Comité exécutif

*décide* que :

- 1) le scrutin par correspondance ne doit être utilisé que lorsqu'il est absolument nécessaire ;
- 2) le vote ne sera valide que si la procédure est approuvée par 2/3 des Membres du Comité exécutif (soit actuellement 20 voix) ;
- 3) la motion ne sera adoptée que si elle a recueilli la majorité simple des Membres du Comité exécutif (soit à présent 16 voix) ;
- 4) au cas où une des Unions n'a pas désigné son représentant au Comité, les circulaires relatives au vote seront adressées au Secrétaire général.

RÉSOLUTION EB (XIV) 36.

Le Comité exécutif

*considérant* avec un vif intérêt la recommandation suivante, présentée par le Président de la National Academy of Sciences des Etats-Unis avec l'accord officiel de l'organisme directeur de la National Academy of Sciences, National Research Council ;

« L'I.C.S.U. sera prié d'établir un Comité spécial des Sciences de l'Atmosphère et de l'Hydrologie qui sera chargé de :

- 1) étudier et favoriser les programmes internationaux de recherches, et
- 2) formuler des avis, si la demande leur en est faite, aux organisations intergouvernementales ayant des responsabilités internationales dans ces domaines »;

*transmet* cette question au Comité exécutif de l'U.G.G.I. pour étude détaillée en consultation avec les autres Unions et pour présentation à l'I.C.S.U. ;

*rappelle* à ce sujet sa décision antérieure concernant la Résolution 1721 (XVI) des Nations Unies et sur le Programme hydrologique international.

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### **Relations avec les Pays en Voie de Développement**

(see English text p. 180)

Etant donné que les pays en voie de développement sont appelés à jouer un rôle de plus en plus important dans le monde scientifique, ainsi qu'il a été nettement mis en lumière par la Conférence sur « l'application de la science et de la technique en faveur des régions en voie de développement », tenue à Genève en février 1963, il est devenu nécessaire pour l'I.C.S.U. d'assumer le rôle de conseiller technique pour le développement des activités scientifiques de ces pays.

La lettre suivante a été envoyée aux Ministères de l'Education des pays énumérés en annexe.

« Monsieur le Ministre,

» Selon les propres paroles du Secrétaire général des Nations Unies, U Thant, la recherche scientifique est encore actuellement le privilège d'une minorité de pays et de nombreuses nations ne sont pas en mesure de s'y livrer et d'améliorer par là même leur potentiel intellectuel qui est une des conditions primordiales de leur accroissement économique.

» Toutefois, la vérité scientifique échappe au conflit des idéologies et la recherche, sous peine de se nuire à elle-même, appelle un effort concerté de pensée, d'organisation, de réalisation, et de diffusion enfin, qui ne peut être accompli que par les institutions internationales.

» C'est pourquoi j'ai l'honneur de porter à votre connaissance l'existence du Conseil international des Unions scientifiques (I.C.S.U.) qui a pour but de coordonner cette recherche scientifique sur le plan international.

» Le Conseil international des Unions scientifiques groupe cinquante-et-un Conseils nationaux de Recherche et Académies des Sciences du monde ainsi que quatorze Unions scientifiques internationales. Ces Unions internationales rassemblent des hommes de science d'une même discipline — astronomes, physiciens, biologistes — et comprennent des représentants de plus de quatre-vingts pays. Mais lorsque ces problèmes relèvent en même temps de plusieurs domaines scientifiques — c'est le cas pour l'océanographie, pour les recherches antarctiques ou les recherches spatiales — il devient nécessaire de grouper ces Unions avec les Académies des Sciences nationales en un organisme pouvant assurer leur collaboration efficace : c'est le but que remplit le Conseil.

» Il n'avait pas été possible de réaliser une telle organisation avant la première guerre mondiale mais un Conseil international de Recherche fut créé en 1918, qui devint en 1930 le Conseil international des Unions scientifiques, d'où toute discrimination politique est rigoureusement exclue. L'extension considérable de l'activité scientifique après la deuxième guerre mondiale a provoqué l'accroissement correspondant des activités du Conseil.

» Chaque gouvernement contribue à l'activité scientifique du Conseil par l'intermédiaire de son Académie des Sciences ou de son Conseil de Recherche.

» L'autorité du Conseil est détenue par l'Assemblée générale, composée des délégués de chaque pays membre et de chaque Union scientifique. Les réunions de cette Assemblée ont lieu tous les deux ou trois ans ; la dernière s'est tenue à la Royal Society de Londres en 1961, la prochaine sera l'hôte de l'Agence atomique de Vienne en 1963 ou de la Société helvétique des Sciences naturelles à Zürich en 1964. Dans l'intervalle, un Bureau et un Comité exécutif où

siègent des personnalités scientifiques éminentes de nombreux pays se réunissent tous les six mois ou tous les ans pour assurer la continuité des travaux du Conseil. Enfin, l'organisation et la mise en œuvre des entreprises scientifiques sont confiées à un Secrétariat permanent, situé à Rome depuis 1962 (son siège a été successivement à Paris, à Londres, puis à La Haye).

« Parmi les projets actuels du Conseil il convient de citer, outre les activités des Comités scientifiques permanents institués pour la Recherche antarctique (S.C.A.R.), la Recherche océanique (S.C.O.R.) et la Recherche spatiale (C.O.S.P.A.R.), cinq programmes importants en cours d'organisation :

- le levé magnétique mondial, au cours duquel des mesures du champ magnétique terrestre seront effectuées sur toute la surface du globe, dans les mers et dans la haute atmosphère ;
- l'étude du manteau supérieur de la croûte terrestre, jusqu'à 1000 km de profondeur, à l'aide d'observations sismiques et volcaniques et de forages profonds (moholes) ;
- le programme biologique international qui sera consacré à la recherche, sur les bases biologiques, de la productivité et du bien-être humain. Le but d'une telle recherche est de fournir les éléments d'information nécessaires, non seulement pour accroître la productivité, mais bien aussi pour assurer le maximum de chance au développement des régions naturelles. La partie du programme dédiée au bien-être humain se propose de rassembler des données concernant les possibilités d'adaptation de l'homme aux conditions environnantes actuellement en cours de modification ;
- les années internationales du soleil calme (I.Q.S.Y.) sont le pendant de l'Année géophysique internationale et la complètent. De nombreux observatoires qui ont participé à l'Année géophysique internationale, période d'activité solaire maximale, feront des observations semblables au cours de la prochaine période d'activité solaire minimale 1964-1965. Ces observations permettront de tirer le plus grand profit des efforts de l'Année géophysique internationale ;
- l'expédition de l'océan Indien, à laquelle prendront part, en 1963, pendant une période complète de mousson, une cinquan-

taine de navires océanographiques envoyés par une vingtaine de nations, afin de procéder à une étude physique, météorologique et biologique détaillée de cet océan mal connu, et afin d'examiner les possibilités d'utiliser directement les ressources de cette région océanographique à des fins alimentaires.

» Il convient de noter aussi la création en septembre 1961 à Paris d'une Commission océanographique intergouvernementale groupant quarante nations, qui se propose, en conjonction avec le S.C.O.R. et l'U.N.E.S.C.O., de développer les recherches océanographiques sur un plan international par action concertée des nations participantes.

» Le Conseil international des Unions scientifiques est différent de l'U.N.E.S.C.O. en ce sens qu'il poursuit la recherche scientifique pure et que ses membres sont uniquement des hommes de science, tandis que l'U.N.E.S.C.O. se préoccupe davantage des applications de la science à des fins économiques et sociales. Mais les rapports entre les deux organismes sont nécessairement très étroits, l'U.N.E.S.C.O. utilisant les ressources intellectuelles du Conseil tandis que celui-ci a besoin des moyens logistiques et financiers dont l'U.N.E.S.C.O. peut disposer.

» La mise en œuvre de ces grands programmes scientifiques internationaux amène le Conseil, outre ses rapports constants avec l'U.N.E.S.C.O., à collaborer étroitement avec les organisations internationales, et notamment :

le Conseil économique et social des Nations Unies (E.C.O.S.O.C.),  
l'Organisation pour l'Agriculture et l'Alimentation (F.A.O.),  
l'Organisation météorologique mondiale (O.M.M.),  
l'Agence internationale de l'Energie atomique (I.A.E.A.),  
l'Union internationale des Télécommunications (U.I.T.),  
l'Organisation mondiale de la Santé (O.M.S.).

» Une coopération efficace est ainsi assurée par l'intermédiaire du Conseil entre tous les organismes scientifiques mondiaux.

» Bien que votre pays ne participe pas encore aux entreprises scientifiques que patronne l'I.C.S.U., ni aux recherches communes entreprises par les différentes Unions scientifiques, l'activité scientifique autonome qui est en voie de développement dans votre pays vous donnera d'ici peu des possibilités de collaboration efficace sur



le plan international. C'est pourquoi l'I.C.S.U. aimerait vous faire bénéficier de tous avis, directives et conseils qui pourraient vous être utiles pour mener à bien l'organisation d'une activité scientifique nationale.

» Dans ce but notre Secrétariat consacre un département, sous la direction de notre Secrétaire exécutif, M. A. E. Decae, qui est à votre disposition pour toute demande que vous voudriez bien lui adresser ou toute action que vous désiriez lui voir entreprendre en votre faveur.

» J'ai donc l'honneur de vous inviter à faire appel aux bons offices de notre Secrétariat dans la mesure où vous l'estimeriez utile pour votre pays,

» et vous prie, Monsieur le Ministre, de vouloir bien accepter l'expression de ma plus haute considération ».

Professeur Dr J. VAN MIEGHEM,  
Secrétaire Général I.C.S.U.

ANNEXE

*Liste des pays destinataires*

Afghanistan	Jordanie
Albanie	Laos
Algérie	Libéria
Arabie Saoudite	Libye
Cambodge	Mali
Cameroun	Mauritanie
Chypre	Mongolie
Congo (Brazzaville)	Népal
Costa Rica	Nicaragua
Côte-d'Ivoire	Panama
Dahomey	Salvador
Equateur	Sierra-Leone
Fédération de la Malaisie	Somalie
Gabon	Tchad
Haute-Volta	Togo
Honduras	Trinidad et Tobago
Jamaïque	Uganda
	Yemen

## **Relations with Developing Countries**

(voir texte français p. 175)

In view of the increasing part that developing countries are bound to play in the scientific world, a part that has been particularly brought to light by the Conference on the Application of Science and Technology for the Benefit of the less developed Areas, held in Geneva in February 1963, it has become necessary for I.C.S.U. to assume the part of technical adviser in the development of the scientific activities of these countries.

The following letter has been sent to the Education Boards of the countries listed in Annex.

« Sir,

» According to the words of the Secretary-General of the United Nations, U. Thant, scientific research is still the privilege of a minority of countries, and many countries are not yet able to make use of it and thus to improve their intellectual potential, which is, in fact, one of the basic conditions for an increase in their economic standards.

» However, scientific truth is not subject to ideological limitations ; and research if it is not to be still-born demands a concerted effort of thought, organization, realization and finally diffusion, which can only be achieved through international institutions.

» This is why I have the honour of bringing to your knowledge the existence of the International Council of Scientific Unions (I.C.S.U.) whose aim is to co-ordinate international scientific research. The membership of I.C.S.U. is of 51 countries and 14 International Scientific Unions. These International Unions group together scientists with the same disciplinary interests — astronomers, physicists, biologists — and include representatives of more than 80 countries. When several scientific disciplines are involved in a particular domain, such as the oceans, antarctica or space, a special or scientific committee is formed in which two or more Unions collaborate with representatives of the National Academies or Research Councils so as to ensure adequate co-operation.

» Prior to the First World War there was no such organization but in 1918 an International Research Council was set up, which in 1931 became the International Council of Scientific Unions, in which all political discrimination is strictly excluded. The considerable extension of scientific activity after the Second World War lead to an important augmentation in the activities of the Council.

» Each Government contributes to the scientific activity of the Council through its Academy of Sciences or its Research Council. The supreme authority of the Council is the General Assembly consisting of delegates from each member country and each Scientific Union. The meetings of this Assembly are held once every two or three years; the last one being at the Royal Society of London in 1961; the next one will be at the International Atomic Energy Agency in Vienna in 1963, or, as the guest of the Helvetic Society of Natural Sciences in Zürich in 1964. In the periods between General Assemblies, a Bureau and an Executive Committee, composed of eminent scientific personalities from many countries, meet every six or twelve months to assure the continuity of the work of the Council. To ensure the organisation and the day-to-day administration of the scientific projects I.C.S.U. has a permanent Secretariat which has been located in Rome since 1962 (it was initially located in London, then in Paris and later in The Hague).

» In the present programme of the Council, in addition to the permanent scientific committees for Antarctic Research (S.C.A.R.) Oceanic Research (S.C.O.R.) and Space Research (C.O.S.P.A.R.) mention must also be made of five important projects in the process of formation; namely

- The World Magnetic Survey, during which measurements of the magnetic field of the Earth will be carried out over the whole of the surface of the Earth including the oceans and the high atmosphere.
- The Upper Mantle Project, which will include studies, to a depth of 1000 kilometers, of the upper layers of the Earth's crust with the help of seismic and volcanic observations and of deep drilling (moholes).

- The International Biological Programme (I.B.P.), which will be devoted to research on the biological basis of productivity and human welfare. Such research is intended to provide the information necessary not only to improve production but also to ensure that the development of natural regions can be carried out with a greater chance of success. The part of the programme devoted to human welfare is designed to make available data about the adaptability of man to the changing conditions around him.
- The International Years of the Quiet Sun (I.Q.S.Y.), as a direct outcome and supplement to the International Geophysical Year. Many of the observatories that participated in the I.G.Y., a period of maximum solar activity, will make similar observations during the next period of minimum solar activity (1964-1965). These observations will allow us to derive greater benefit from the results of the International Geophysical Year.
- The International Indian Ocean Expedition, for which in 1963, twenty or so nations have provided fifty oceanographic vessels to make studies during a period of a complete monsoon. This will form part of a detailed study from the physical, chemical, meteorological and biological points of view of this little-known Ocean and will provide basic information which will be of help in improving the supply of food from this oceanic region.

» It should be noted that an Inter-governmental Oceanographic Commission was created in Paris in September 1961, with forty member nations. This Commission, in conjunction with the S.C.O.R. and U.N.E.S.C.O., proposes to develop oceanographic research at an international level through the co-operation of the member governments.

» The I.C.S.U. differs from the United Nations Educational Scientific and Cultural Organization in that it is primarily concerned in pure research and its individual members are research scientists, whereas U.N.E.S.C.O. is largely concerned with the application of science, economically and socially, but the relationship between the two organizations is necessarily very close. U.N.E.S.C.O. makes use of the intellectual resources of the Council which receives some financial backing and logistic help from U.N.E.S.C.O.

» In the execution of large international scientific programmes, the Council, in addition to being in regular contact with U.N.E.S.C.O., collaborates closely with various international organizations, such as :

Economic and Social Council of the United Nations (E.C.O.S.O.C.),  
Food and Agriculture Organization (F.A.O.),  
World Meteorological Organization (W.M.O.),  
World Health Organization (W.H.O.),  
International Atomic Energy Agency (I.A.E.A.),  
International Union of Telecommunications (I.U.T.).

» Fruitful co-operation is thus ensured among all the scientific agencies of the world.

» Although your country does not yet collaborate in scientific projects sponsored by I.C.S.U. nor take part in the mutual research enterprises of the different Scientific Unions, an autonomous scientific activity is in the process of development in your nation which will lead, in some years' time, to the possibility of efficient collaboration on the international level. This is why I.C.S.U. would like to put at your disposal all information, directives and advice which could be of use to you in your organization of a national scientific activity.

» With this aim in view, a Department of our Secretariat, under the direction of the Executive Secretary, Mr. A. E. Decae, has been set up which is available to reply to your questions about the above or for any appropriate action which you may wish it to undertake on your behalf. It is thus my honour to invite you to call upon its services for any matter in which you consider it could be of assistance to your country.

Yours respectfully,  
Prof. Dr. J. VAN MIEGHEM,  
Secretary General I.C.S.U.

ANNEX

*List of countries to which this letter was sent*

Afghanistan	Jordan
Albania	Laos
Algeria	Liberia

Cambodia	Libya
Cameroons	Mali
Chad	Mauritania
Congo (Brazzaville)	Mongolia
Costa Rica	Nepal
Cyprus	Nicaragua
Dahomey	Panama
Ecuador	Saudi Arabia
El Salvador	Sierra Leone
Federation of Malaya	Somalia
Gaboons	Togo
Honduras	Trinidad and Tobago
Ivory Coast	Uganda
Jamaica	Upper Volta
	Yemen.

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## COSPAR

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### **Fifth International Space Science Symposium**

Florence (Italy), May 12-16, 1964

#### **Fifth International Space Science Symposium**

##### 1. — GENERAL DESCRIPTION

Each year since 1960, C.O.S.P.A.R. has convened an International Space Science Symposium where new results of space research have been presented and discussed by scientists in various disciplines and from many countries.

The Fifth International Space Science Symposium will be held next year in Florence, Italy *from 12 to 16 May 1964*. As in the past, this Symposium is intended to provide for space scientists, back-ground scientific information as well as information on the current status of space research work. The Symposium will also be an occasion for scientists in many disciplines to discuss the opportunities and the techniques of space research.

The 1964 Symposium of Florence will comprise three parts as follows :

- (i) one part devoted to a special topic in the Physical Sciences :  
« *Interaction of Energetic Particles with the Atmosphere* » ;
- (ii) a second part assigned to topics in the Life Sciences ;
- (iii) and a third part devoted to papers on latest results obtained in any field of science by means of rockets or satellites, or to theoretical papers relevant to such results.

##### 2. — INTERACTION OF ENERGETIC PARTICLES WITH THE ATMOSPHERE

The Fifth International Space Science Symposium will give special attention to the topic *Interaction of Energetic Particles with the Atmosphere*. This topic has been divided into eight sub-topics

which will each form the subject of a Review Paper by an invited scientist and of a brief discussion also by an invited speaker. These review papers will be presented in the morning sessions of 12 and 13 May, during which no parallel session will be scheduled.

Following is a list of the sub-topics for these review papers :

Sub-topic for Review Paper	Preliminary problem description	Relevant space experiments
1. X-ray emission from the atmosphere.	Hard X-rays are emitted about the 80-100 km altitude range by bremsstrahlung as a consequence of particle dumping or of direct solar particle flux. Similar emission occurs in aurorae.	X-rays < 80 keV measured from balloons ; X-rays measured by sounding rockets ; conjugate point measurements.
2. Maintenance of night-time ionosphere.	The mid-latitude ionosphere under the F-region maximum (100-300 km) may be sustained at night by a continuous particle flux dumped from the radiation belts. As long as reaction rates are uncertain one would hope to learn from direct observations of ionization and of particle fluxes. Assessment of present knowledge of reaction rates is desirable.	Satellite observations of energetic particle flux ; energy spectrum of trapped particles < 40 keV ; night-time electron density soundings.
3. Polar ionosphere and aurorae.	What sustains the polar ionosphere during the long polar night ? Can the total energy output in an auroral display be supplied from dumped particles or not ?	Sounding rocket observations of auroral UV spectra ; Balloon and rocket measurements of particle flux.
4. Field-Aligned irregularities.	Persistent field-aligned regions of enhanced electron density have been observed. The explanation is puzzling but probably involves corpuscular radiation.	Electron density studies by topside sounder and Ariel satellite.



Sub-topic for Review Paper	Preliminary problem description	Relevant space experiments
5. Difference between ion and electron temperatures.	Electron temperatures are found to be about twice as high as ion temperatures. This difference may arise from excess energy given to electrons upon ionization either by electromagnetic solar radiation or by dumped particles.	Langmuir probes in sounding rockets; scale height from topside sounder (to be compared with incoherent backscatter data).
6. Hydromagnetic energy transfer	One solution to the problem why solar particle fluxes can promptly influence atmospheric density at satellite altitudes is energy transfer by hydromagnetic waves from the magnetosphere down. Are these waves detectable by magnetometers ?	Satellite drag correlation with K-index; particle fluxes studied with high time resolution.
7. Particle-excited	Latitude distribution and time variation of the red airglow line suggest corpuscular excitation. The $N_2^+$ bands pose related problems.	Optical spectra from sounding rockets.
8. Origin of the Radiation Belts	Critical review of hypotheses concerning the origin of radiation belts.	

#### 4. — INDIVIDUAL CONTRIBUTIONS

##### (a) *General.*

Individual contributions are invited in the following two categories :

- (1) Papers on space research by means of rockets or satellites, *connected with one of the topics for Review Papers* outlined in Section 2.
- (2) Papers on *latest results* obtained by means of rockets or satellites. These papers may be in any field of Science. Papers dealing

with theoretical work may also be submitted if they are related to research performed with rocket or satellites.

In view of the occurrence of the I.A.U. Symposium n° 23 on *Astronomical Results derived from Observations from Space Vehicles* in August 1964, and since it would not be desirable to duplicate papers to be presented to this Symposium, contributions on astronomical results may not be accepted by C.O.S.P.A.R.

*(b) Time allocated to individual contributions.*

Individual contributions will be presented in the afternoon sessions of 12, 13, 14 and 15 May. If necessary, parallel sessions will be scheduled during these afternoons. Also certain of these sessions may be arranged as open-meetings of Working Groups.

Normally, 15 minutes will be allocated to the authors attending the Symposium, for the oral presentation of their paper. Papers given on behalf of absent authors should be summarized in 10 minutes or less. Authors are encouraged to bring to the Symposium pre-prints of their full papers (about 200 copies) for distribution to interested participants; if this is done the oral presentation can omit much of the specialized details, giving more time to discussions of the main points and the implications of the work.

*(c) Presentation of slides.*

It would be appreciated if in general the number of slides could be limited to a maximum of six in the case of a paper presented by the author and three in the case of a paper presented on behalf of an absent author.

Authors are urged to test their slides for legibility under average conditions of lantern-projection before coming to the meeting. For example, a table with more than ten lines is seldom readable from the back of the lecture hall, nor letters or numbers which are smaller than 3 % of the slide dimensions. Opaque illustrations will not be acceptable. Authors are encouraged to design slides specially for the oral presentation of their work rather than to copy illustrations designed for the printed page of their paper.

*(d) Submission of Papers.*

In accordance with the procedure followed previously in several countries, scientists should submit their papers to C.O.S.P.A.R.

*through their National Space Committee.* These National Committees are requested to select papers, taking into account the criteria for individual contributions given in item (a) above. Abstracts of the selected papers should be sent to the C.O.S.P.A.R. Secretariat in time to meet the deadline date mentioned below.

(e) *Deadline date for submission of abstracts.*

Abstracts of papers should reach the C.O.S.P.A.R. Secretariat *not later than 1 March 1964.* The abstracts should be brief (200 words or less) and must clearly underline the newness of the results and their relationship to space research by means of rockets or satellites.

(f) *Arrangement of contributions in areas of space research.*

Individual contributions in the Physical Sciences, presented at the last C.O.S.P.A.R. Symposium in Warsaw were finally arranged under the following topics :

Upper Atmosphere,  
Ionosphere,  
Magnetosphere,  
Solar Radiation,  
Interplanetary Medium,  
Planets,  
High Energy Particles.

It would be helpful to the Programme Committee if contributors of papers to the Florence Symposium, would indicate in which of the above areas they feel their paper should be considered. If a paper relates to more than one of the above topics or does not relate to any of them, this should also be indicated.

(g) *Late papers.*

Abstracts of papers submitted after 1 March 1964 will not be included in the regular programmes of the Symposium which will be established by the Programme Committee in the first week of March 1964.

However, a few post-deadline papers of outstanding importance submitted through the National Space Committees might be accepted. But, rather than to crowd the established programme,

these papers may be presented in an eventual session for late papers at the end of the Symposium or may have to be given in very shortened form (5 minutes).

(h) *Pre-prints of papers.*

It is hoped to make available to participants in the Symposium pre-prints of papers presented at each session. Contributors of papers are kindly requested to arrange to bring to Florence about 200 pre-prints of their paper.

5. — EVENING LECTURE

The city of Florence will celebrate in 1964 the Fourth Centenary of the birth of Galileo. C.O.S.P.A.R. plans to commemorate during its Symposium, the work of the famous astronomer by presenting an Evening Lecture open to the public on the modern subject of astronomy : *X-Ray and Gamma-Ray Astronomy*.

**Participation**

Scientists from all countries whether or not they are members of C.O.S.P.A.R. are welcome to attend the Symposium and to submit papers for consideration by the Programme Committee.

Forms for « advance registration » will be issued with the Second Circular.

*Financial Assistance.*

It is expected that limited funds will be available to assist scientists actively engaged in space research who cannot otherwise find sufficient support to pay travel expenses to attend the Symposium.

If such assistance is required, application should be sent as early as possible to the C.O.S.P.A.R. Secretariat *through the scientist's National Space Committee*, stating clearly an estimate of the amount needed and the amount of support expected from his own country or institution.

All applications should reach the C.O.S.P.A.R. Secretariat *before 1 March 1964*. Applications received after that date will be considered only if funds are still available.

*Further Information.*

For further information, please write to the Executive Secretary, C.O.S.P.A.R., 55, Boulevard Malesherbes, Paris 8<sup>e</sup>.

A second Circular will be issued as soon as more detailed information on the program and arrangements of the Symposium are available.

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## **Académie Internationale d'Astronautique**

### RÉUNION SUR LA PHYSIQUE DU MILIEU SPATIAL

Le Dr F. J. Malina, Président de l'Académie Internationale d'Astronautique, annonce les conférenciers qui présenteront les exposés d'ensemble à la réunion consacrés aux « Connaissances récentes sur le milieu spatial », qui aura lieu le 27 septembre 1963, au Palais de l'U.N.E.S.C.O., à Paris, au cours du XIV<sup>e</sup> Congrès International d'Astronautique.

Cette réunion, organisée conjointement par l'Académie et la Fédération Internationale d'Astronautique, est réalisée avec l'aide et la coopération de l'U.N.E.S.C.O. et la coopération scientifique du C.O.S.P.A.R.

Le programme comprend les exposés suivants :

*Nouvelles mesures du plasma interplanétaire et leur interprétation,*  
par le Prof. L. BIERMANN, Max-Planck-Institut für Physik und Astrophysik, Munich (République Fédérale Allemande).

*Corpuscules de la Haute atmosphère,*  
par le Prof. V. I. KRASSOVSKI, Institut de Physique atmosphérique de l'Académie des Sciences, Moscou (U. R. S. S.).

*Manifestation des poussières météoriques au voisinage de la Terre,*  
par le Prof. F. LINK, Institut d'Astronomie de l'Académie des Sciences, Prague (Tchécoslovaquie).

*La Structure de l'hétérosphère,*  
par le Prof. N. NICOLET, Centre National de Recherches de l'Espace, Bruxelles (Belgique).

*Le spectre UV et X des étoiles,*  
par le Prof. E. SCHATZMAN, Institut d'Astrophysique, Paris (France).

*La nature et l'origine des bandes de radiation autour de la Terre,*  
par le Dr S. F. SINGER, Centre national de Satellites de météorologie, Washington D.C. (U. S. A.).

Les conférenciers ont été désignés par un Comité sous la présidence du Professeur A. EHMERT, du Max-Planck Institut für Aeronomie (République Fédérale Allemande).

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## **International Academy of Astronautics**

### MEETING ON THE PHYSICS OF THE SPACE ENVIRONMENT

Dr. F. J. Malina, Director of the International Academy of Astronautics, announced the speakers selected for the one day meeting on « Recently Acquired Knowledge of the Space Environment », which will be held on 27 September 1963, at U.N.E.S.C.O. House in Paris, during the XIVth International Astronautical Congress.

This meeting is co-sponsored by the International Astronautical Federation, and is held with the support and cooperation of U.N.E.S.C.O., and the scientific cooperation of C.O.S.P.A.R.

The programme will be as follows :

*New measurements of the Interplanetary Plasma and Their Interpretation,*

Prof. L. BIERMANN, Max-Planck Institut für Physik und Astrophysik, Munich (German Federal Republic).

*Corpuscles of the Upper Atmosphere,*

Prof. V. I. KRASSOVSKY, Institute of Atmospheric Physics, Academy of Sciences, Moscow (U. S. S. R.).

*The Effects of Meteoric Dust in the Neighborhood of the Earth,*

Prof. F. LINK, Astronautical Institute of the Academy of Sciences, Prague (Czechoslovakia).

*The Structure of the Heterosphere,*

Prof. M. NICOLET, Centre National de Recherches de l'Espace, Brussels (Belgium).

*Ultra-violet and X-Ray Spectra of the Stars,*

Prof. E. SCHATZMAN, Institut d'Astrophysique, Paris (France).

*Nature and Origin of the Earth's Radiation Belt,*

Dr. S. F. SINGER, National Weather Satellite Center, Washington  
D.C. (U. S. A.).

The speakers have been chosen by a Committee under the chair-  
manship of Professor A. Ehmert, of the Max-Planck Institut für  
Aeronomie (German Federal Republic).

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## PUBLICATIONS DE L'U.R.S.I.

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Extrait du *Journal des Télécommunications*,  
vol. 30, n° 6, juin 1963  
(see English text p. 196)

*Radio-wave propagation in the troposphere.* — Proceedings of Commission II, XIIIth General Assembly of U.R.S.I., London September, 1960 (Propagation des ondes radio-électriques dans la troposphère — XIIIe Assemblée générale de l'U.R.S.I., Londres, septembre 1960), par J. A. SAXTON (1).

L'ouvrage donne le résultat des travaux de la Commission II sur la radio et la troposphère, lors de la XIII<sup>e</sup> Assemblée générale de l'Union radioscopique internationale (U.R.S.I.), Londres, septembre 1960, publiés par les soins de J. A. Saxton.

Les principaux problèmes traités sont les suivants : données expérimentales sur la propagation troposphérique, caractéristiques physiques de la troposphère, théories de la propagation troposphérique, radiométéorologie et climatologie. L'on y présente tout d'abord les rapports préparés, à la demande du président de la commission, par les experts du Canada, des Etats-Unis d'Amérique, de la France, de la République Fédérale d'Allemagne, du Royaume-Uni et de l'U. R. S. S. Suivent la bibliographie et les contributions principales à la discussion. La publication représente une formule nouvelle dans le domaine de la littérature technique, donnant, sous forme condensée, l'état actuel des connaissances dans le domaine traité sans toutefois souffrir des délais considérables qui sont inévitables lors de la publication des manuels préparés par différents auteurs.

La présentation du livre, et surtout des figures, est parfaite.

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(1) Un volume relié, VIII, 199 p., illustr., tabl., diagr., 23 × 15 cm. Publié par Elsevier Publishing Company, 110-112 Spuistraat, Amsterdam, 1962. Prix : 24 florins hollandais.



*Radio noise of terrestrial origin.* — Proceedings of Commission IV, XIIIth General Assembly of U.R.S.I., London, September, 1960 (Monographie sur les bruits radio-électriques d'origine terrestre — XIII<sup>e</sup> Assemblée générale de l'U.R.S.I., Londres, 1960), par F. HÖRNER <sup>(1)</sup>.

Cet ouvrage contient les articles présentés à la Commission IV (Bruit radio-électrique d'origine terrestre) de l'U.R.S.I., lors de sa XIII<sup>e</sup> Assemblée générale, laquelle s'est tenue à Londres, en septembre 1960.

Ces articles sont groupés en huit sections :

Sources des bruits dans l'éclair.

Propriétés des bruits naturels.

Données sur les siffleurs obtenues pendant l'Année géophysique internationale.

Emissions sur ondes myriamétriques et ondes hydromagnétiques.

Théorie des siffleurs.

Exosphère.

Bruits industriels.

Propagation des ondes myriamétriques.

L'ouvrage est divisé en deux parties. Dans la première, l'article est brièvement présenté et l'on donne ensuite un exposé abrégé des discussions y relatives. Cette méthode de présentation donne à l'ouvrage un aspect très vivant. Ajoutons d'ailleurs que ces opinions, émises par d'éminents spécialistes, aident le lecteur à mieux comprendre le sujet traité et surtout à réaliser l'état d'avancement des études ou des théories qui s'y rapportent.

La deuxième partie du livre est une reproduction des contributions proprement dites. Celles-ci sont éditées d'une façon homogène, malgré la diversité des auteurs, et un grand soin a été apporté à la présentation des graphiques et des formules.

Chaque article est suivi d'une bibliographie et ceci contribue encore plus à faire de ce livre un ouvrage de base sur nos connaissances actuelles en matière de bruits.

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(1) Un volume relié, VIII, 202 p., illustr., tabl., 23 × 15 cm. Publié par Elsevier Publishing Company, 110-112 Spuistraat, Amsterdam, 1962. Prix : 24 florins hollandais.

## U.R.S.I. PUBLICATIONS

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Reprint from *Telecommunication Journal*,

Vol. n° 6, June 1963

*Radio-wave propagation in the Troposphere.* — Proceedings of Commission II, XIIIth General Assembly of U.R.S.I., London, September, 1960, by J. A. SAXTON <sup>(1)</sup>.

This book embodies the outcome of the work done by International Scientific Radio Union (U.R.S.I.), Commission II (Radio and troposphere) at the XIIIth General Assembly of U.R.S.I. (London, September, 1960), and has been edited by J. A. Saxton.

The main problems discussed are : experimental data relating to tropospheric propagation, physical characteristics of the troposphere, the theory of tropospheric propagation, radio meteorology and climatology. First of all, we find reports submitted, at the request of the Chairman, by experts from Canada, the United States of America, France, the Federal Republic of Germany, the United Kingdom and the U. S. S. R. Then come the bibliography and the main contributions to the discussion. The work represents something new in technical literature, since it presents an outline of present knowledge in the field, and has not suffered from that delay in publication which inevitably afflicts handbooks made by different authors.

The lay-out, especially that of the diagrams is very good indeed. Possibly there are rather more printers' errors than is normal in books of this kind. But the speed of publication outweighs this shortcoming.

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<sup>(1)</sup> One bound volume ; pp. VIII + 199, illustrations, tables, diagrams, 23 × 15 cm. Published by Elsevier Publishing Company, 110-112 Spuistraat, Amsterdam, 1962. Price : 24 Dutch florins.

*Radio noise of terrestrial origin.* — Proceedings of Commission IV XIIIth General Assembly of U.R.S.I., London, September, 1960, edited by F. Horner <sup>(1)</sup>.

This book contains the papers submitted to Commission IV (Radio noise of terrestrial origin) of U.R.S.I. at the U.R.S.I. XIIIth General Assembly in London, September, 1963.

These papers are grouped into eight sections :

Sources of noise in lightning.

The properties of natural noise.

Information about whistling obtained during the International Geophysical Year.

Transmissions on myriametric and hydromagnetic waves.

The theory of whistling.

The exosphere.

Industrial noise.

The propagation of myriametric waves.

The work has two parts. In the first, the paper is briefly presented and thereafter comes a summary of the discussions to which it gave rise. The work gains in liveliness as a result. The opinions given, coming as they do from distinguished specialists, facilitate understanding of the matter discussed, and help the reader to acquire some idea of the progress made with the relevant studies and theories.

The second part reproduces the papers properly so called. These are uniformly edited, despite the diverse origins of the authors, and much care has been taken in the lay-out of graphs and formulae.

Each paper is followed by a bibliography. The book is, in fact, a useful standard work summarizing the present state of knowledge with regard to atmospheric noise.

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<sup>(1)</sup> One bound volume ; pp. VIII + 202, illustrations, tables. Published by Elsevier Publishing Company, 110-112 Spuistraat, Amsterdam, 1962. Price : 24 Dutch florins.

## PRELIMINARY INFORMATION

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### Monograph on Radio Waves and Circuits

Proceedings of Commission VI during the XIIIth General Assembly of U.R.S.I., London, 1960. Edited by Samuel Silver, Space Sciences Laboratory, Leuschner Observatory, Berkeley, California, U. S. A.  $6 \times 9''$ , viii + 380 pages, 101 illus., 4 tables, Price Dfl. 75.—, £ 7.10 s. Special price for orders sent to the Secretary General of U.R.S.I.

U.R.S.I. (Union Radio-Scientifique Internationale) was organized in 1919 under the International Research Council in order to develop scientific studies relating to radio on an international basis. Commission VI is an offshoot of the Commission on Radio-physics, due to the need of a unit to deal with the many new areas of research, and as a unit of co-ordination between engineers, physicists and mathematicians on problems not dealt with by other commissions.

Commission VI has been organized on the basis of three sub-commissions :

1. Information and Communication Theory.
2. Circuit Theory.
3. Antennas, Waveguides and Electromagnetic Theory.

This monograph is largely a number of full-length papers presented by invitation at the technical sessions, giving special attention to material in which the subcommissions have a common interest. Space communications and their development have underlined the essential unity of the commissions' various fields. Discussion reports are included.

#### CONTENTS :

General Introduction .  
Boundary Value and Scattering Problems.

Surface Waves.

Coding Problems.

Information Theory of Randomly Varying Channels.

Propagation of Electromagnetic Waves in Statistically Inhomogeneous Media.

Aerials and Data Processing.

Solid State Circuits.

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## BIBLIOGRAPHIE

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### *Commission Electrotechnique Internationale*

*Publication 117-3 : Première édition.* — Symboles graphiques recommandés, 3<sup>e</sup> partie : Contacts, appareillage, commandes mécaniques, démarreurs et éléments de relais électromécaniques.

*Publication 148 : Première édition.* — Symboles littéraux pour les dispositifs à semi-conducteurs.

Ces publications sont en vente au Bureau Central de la C.E.I., au prix de Fr. S. 12.— l'exemplaire pour la Publication 117-3 et Fr. S. 7,50 pour la Publication 148, plus frais de port.

### *Union Internationale des Télécommunications*

*Nomenclature des stations de navire, 3<sup>e</sup> édition 1962.*

L'U.I.T. vient de publier la 3<sup>e</sup> édition de la *Nomenclature des stations de navire*.

Cette Nomenclature qui, d'après les dispositions du Règlement des radiocommunications doit être en possession des stations à bord des navires obligatoirement pourvus d'une station radiotélégraphique, peut aussi être d'une grande utilité pour d'autres stations de navire ainsi que pour les armateurs, les entreprises de sauvetage, de transport, etc.

*Ce document contient :*

La préface. Les états signalétiques des stations de navire, rangées à l'ordre alphabétique du nom de la station, sans considération de nationalité. Les renseignements portent sur le nom du navire, l'indicatif d'appel, le pays dont relève la station. les fréquences utilisées, les classes d'émission, la nature du service, les heures d'ouverture, les taxes perçues pour l'échange de la correspondance, le liquidateur des comptes et, suivant le cas, le propriétaire du navire, le nombre d'embarcations de sauvetage équipées d'appareils radioélectriques, etc. A la fin du volume se trouvent les observations relatives aux stations de navire.

Les titres des couvertures et les textes explicatifs sont rédigés dans les langues française, anglaise et espagnole.

Le prix de vente d'un exemplaire de cette publication de 628 pages a été fixé à 5,20 *francs suisses* ; ce prix comprend l'emballage et les frais de port pour envoi par la poste ordinaire dans le monde entier.

*Nomenclature des Stations de Radiodiffusion.*

L'U.I.T. vient de publier la dernière édition de la « Nomenclature des Stations de Radiodiffusion fonctionnant dans les bandes au-dessus de 5950 kHz ». Cette liste éditée en français, anglais et espagnol a été établie par le Comité international d'enregistrement des fréquences (I.F.R.B.).

## BIBLIOGRAPHY

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### *International Electrotechnical Commission*

*Publication 117-3 : First edition.* — Recommended graphical symbols. Part 3 : Contacts, switchgear, mechanical controls, starters and elements of electromechanical relays.

*Publication 148 : First edition.* — Letter symbols for semiconductor devices.

These publications are on sale at the Central Office of the I.E.C. at the price of Sw. Fr. 12.— per copy for Publication 117-3 and Sw. Fr. 7,50 for Publication 148, plus postage and packing.

### *International Telecommunication Union*

*List of Ship Stations, 3rd edition 1962.*

The 3rd edition of the *List of Ship Stations* has just been published.

This List, which according to the Radio Regulations must be in the possession of stations on board ships that have to be fitted with a radiotelegraph station, can also be of great use to other ship stations and to ship-owners, life-saving bodies, transport companies, etc.

*This document contains :*

A preface. Particulars of ship station, in the alphabetical order of the names of stations regardless of their nationality. The data comprise the name of the ship, call sign, the country responsible for the station, frequencies used, classes of emission, type of service, working hours, charges levied for the exchange of correspondence, the accounting authorities, and, where appropriate, the owners of the ship, the number of lifeboats fitted with radio apparatus, etc. There are observations about ship stations at the end of the book.

English, French and Spanish are used for the covers and explanatory texts.

The List, which contains 628 pages, will cost 5.20 *Swiss francs*, including packing and carriage costs by ordinary mail to any address in the world.

*List of Broadcasting Stations.*

I.T.U. has issued the second edition of the « List of Broadcasting Stations operating in bands below 5950 kc/s ». This list issued in French, English and Spanish languages has been drawn up by the International Frequency Registration Board (I.F.R.B.).

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