
URSI

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XV^e ASSEMBLÉE GÉNÉRALE

MUNICH, SEPTEMBRE 1966

Bref rapport

Plus de 700 participants ont assisté à l'Assemblée Générale; ce nombre comprend les représentants des Comités Nationaux, les personnalités invitées et les observateurs.

ELECTIONS

Ont été élus ou réélus au Bureau de l'Union :

Président : Prof. S. SILVER (EUA).

Président sortant : Prof. I. KOGA (Japon).

Vice-Présidents : Prof. W. J. G. BEYNON (Royaume-Uni);
Prof. M. BOELLA (Italie);
Prof. W. DIEMINGER (Allemagne);
Prof. J. GROSZKOWSKI (Pologne).

Trésorier : Prof. Ch. MANNEBACK (Belgique).

Secrétaire Général : Ing. E. HERBAYS (Belgique).

En plus du D^r L. V. BERKNER, élu en 1963, les personnalités suivantes ont été élues comme Présidents d'Honneur :

M. B. DECAUX (France);

M. J. A. RATCLIFFE (Royaume Uni);

D^r R. L. SMITH-ROSE (Royaume Uni).

Ont été élus ou réélus Présidents et Vice-Présidents des Commissions :

COMMISSION I. — *Etalons et Mesures Radioélectriques.*

Président : D^r L. ESSEN (RU) — *Vice-Président* : Prof. M. E. ZHABOTINSKI (URSS).

COMMISSION II. — *Radio électricité et Milieux Non-ionisés.*

Président : D^r J. A. SAXTON (RU) — *Vice-Président* : Prof. W. E. GORDON (EUA).

COMMISSION III. — *Ionosphère.*

Président : D^r C. O. HINES (EUA) — *Vice-Président* : Prof. K. RAWER (Allemagne).

COMMISSION IV. — *Magnétosphère.*

Président : Prof. H. G. BOOKER (EUA) — *Vice-Président* : D^r J. W. DUNGEY (RU).

COMMISSION V. — *Radioastronomie.*

Président : D^r E. J. BLUM (France) — *Vice-Président* : D^r G. A. MULLER (Pays-Bas).

COMMISSION VI. — *Ondes et Circuits Radioélectriques.*

Président : D^r F. L. STUMPERS (Pays-Bas) — *Vice-Président* : Prof. H. M. BARLOW (RU).

COMMISSION VII. — *Radioélectronique.*

Président : Prof. P. GRIVET (France) — *Vice-Président* : Prof. M. CHODOROW (EUA).

NOUVEAUX COMITÉS NATIONAUX

Les Comités Nationaux établis au Brésil, en Hongrie, au Mexique et en Nigérie ont été reconnus officiellement.

NOUVELLE COMMISSION

Il a été décidé d'envisager la constitution d'une Commission VIII provisoire (Bruit Radioélectrique d'Origine Terrestre) qui succéderait à l'ancienne Sous-Commission IVa (voir p. 16).

TAUX DE L'UNITÉ DE COTISATION

Comme suggéré par le Comité des Finances, il a été décidé de porter l'unité de cotisation de \$ 150 à \$ 175 à partir de 1968.

PUBLICATIONS APRÈS L'ASSEMBLÉE GÉNÉRALE

Sur proposition du Comité des Publications, l'Assemblée Générale a marqué son accord :

- (i) pour que le Compte Rendu de la XV^e Assemblée Générale soit publié d'une façon semblable à celle utilisée pour la XIV^e Assemblée Générale;
- (ii) pour poursuivre la publication de « Progress in Radio Science » en utilisant un procédé permettant une publication plus rapide et un prix réduit.

MODIFICATIONS AUX STATUTS

Les principales modifications aux Statuts adoptées par l'Assemblée Générale concernent :

- (i) le choix et les prérogatives des Présidents d'Honneur;
- (ii) le mode d'élection des Présidents et Vice-Présidents des Commissions qui seront élus par l'Assemblée Générale, les Vice-Présidents succédant automatiquement aux Présidents après une période de trois ans.

MODIFICATIONS AU RÈGLEMENT INTÉRIEUR

La modification principale apportée au Règlement Intérieur est l'addition d'un article définissant le rôle du Comité de Coordination.

E. HERBAYS,
Secrétaire Général.

XVth GENERAL ASSEMBLY

MUNICH, SEPTEMBER 1966

Summary Report

The XVth General Assembly was attended by more than 700 participants including representatives of National Committees, invited guests and observers.

ELECTIONS

The following were elected or re-elected as Officers of the Board :

President : Prof. S. SILVER (USA).

Past President : Prof. I. KOGA (Japan).

Vice-Presidents : Prof. W. J. G. BEYNON (UK);
Prof. M. BOELLA (Italy);
Prof. W. DIEMINGER (Germany);
Prof. J. GROSZKOWSKI (Poland).

Treasurer : Prof. Ch. Manneback (Belgium).

Secretary General : Ing. E. HERBAYS (Belgium).

In addition to Dr. L. V. BERKNER, elected in 1963, the following were elected as Honorary Presidents :

Mr. B. DECAUX (France).

Mr. J. A. RATCLIFFE (UK).

Dr. R. L. SMITH-ROSE (UK).

Chairmen and Vice-Chairmen of Commissions were elected as follows :

COMMISSION I *on Radio Standards and Measurements.*

Chairman : Dr. L. ESSEN (UK) — *Vice-Chairman* : Prof. M. E. ZHABOTINSKI (USSR).

COMMISSION II *on Radio and Non-ionized Media.*

Chairman : Dr. J. A. SAXTON (UK) — *Vice-Chairman* : Prof. W. E. GORDON (USA).

COMMISSION III *on the Ionosphere.*

Chairman : Dr. C. O. HINES (USA) — *Vice-Chairman* : Prof. K. RAWER (Germany).

COMMISSION IV *on the Magnetosphere.*

Chairman : Prof. H. G. BOOKER (USA) — *Vice-Chairman* : Dr. J. W. DUNGEY (UK).

COMMISSION V *on Radioastronomy.*

Chairman : Dr. E. J. BLUM (France) — *Vice-Chairman* : Dr. C. A. MULLER (Netherlands).

COMMISSION VI *on Radio Waves and Circuits.*

Chairman : Dr. F. L. STUMPERS (Netherlands) — *Vice-Chairman* : Prof. H. M. BARLOW (UK).

COMMISSION VII *on Radioelectronics.*

Chairman : Prof. P. GRIVET (France) — *Vice-Chairman* : Prof. M. CHODOROW (USA).

NEW NATIONAL COMMITTEES

National Committees constituted in Brazil, Hungary, Mexico and Nigeria were formally recognized.

NEW COMMISSION

It was decided to consider the constitution of a provisional Commission VIII on Radio Noise of Terrestrial Origin to succeed to the previous Sub-Commission IVa (see p. 28).

RATE OF UNIT OF SUBSCRIPTION

As suggested by the Finance Committee, it was decided to raise the unit of subscription from \$ 150 to \$ 175 from 1968 onwards.

POST-ASSEMBLY PUBLICATIONS

On proposal of the Publications Committee, the General Assembly agreed :

- (i) to publish the Proceedings of the XVth Assembly in a way similar to the one used for the XIVth General Assembly;

- (ii) to continue the series of Progress in Radio Science, but to use a process enabling the series to be issued in a few months and at a lower price.

MODIFICATIONS TO STATUTES

The main modifications to the Statutes adopted by the General Assembly are concerned with :

- (i) a legal status for the choice and prerogatives of Honorary Presidents;
- (ii) the procedure of election of Chairman and Vice-Chairman of Commissions who will be elected by the General Assembly, the Vice-Chairman succeeding automatically the Chairman after a three year period.

MODIFICATIONS TO BYLAWS

The main modification to Bylaws is the inclusion of an article defining the role of the Co-ordinating Committee.

E. HERBAYS,
Secretary General.

Résolutions et recommandations de la XV^e Assemblée Générale

Résolutions de caractère général

Outre l'élection et la ré-élection des Membres du Bureau et des Présidents et Vice-Présidents des Commissions, le Comité Exécutif a proposé à la XV^e Assemblée Générale l'adoption des résolutions suivantes :

RÉSOLUTION I.

La XV^e Assemblée Générale *décide* de reconnaître officiellement les Comités Nationaux institués au Brésil, en Hongrie, au Mexique et au Nigéria, et de reconnaître provisoirement le Comité National d'Israël.

RÉSOLUTION II.

La XV^e Assemblée Générale,

approuve le Rapport du Comité des Finances et, considérant que l'URSI est appelée à accroître ses activités scientifiques et à encourager ses Commissions et Comités à organiser des réunions scientifiques dans l'intervalle entre deux Assemblées Générales,

décide de porter l'unité de cotisation de \$ 150 à \$ 175 à partir du 1^{er} janvier 1968.

RÉSOLUTION III.

La XV^e Assemblée Générale,

approuve le Rapport du Comité des Publications et

décide :

- 1) de poursuivre la publication et la distribution du Bulletin d'Information et des Comptes Rendus de l'Assemblée Générale selon les règles antérieurement en vigueur, et

- 2) d'adopter une nouvelle méthode pour l'édition de « Progress in Radio Science » en vue de rendre cette publication plus rapide et moins onéreuse.

RÉSOLUTION IV.

La XV^e Assemblée Générale,

considérant :

- (i) que le titre de Président d'Honneur doit être conféré à des scientifiques dont les activités et le dévouement ont apporté une contribution éminente à l'un des domaines couverts par l'URSI,
- (ii) qu'il est nécessaire d'assurer une meilleure continuité dans la présidence des Commissions ainsi qu'une collaboration plus étroite entre les Présidents et les Vice-Présidents des Commissions,

décide d'autoriser le Bureau à rédiger de nouveaux Statuts en tenant compte des points suivants :

- a) directives pour le choix et l'élection des Présidents d'Honneur,
- b) élection par l'Assemblée Générale des Présidents et des Vice-Présidents des Commissions, les Vice-Présidents succédant automatiquement aux Présidents après la période de trois ans.

RÉSOLUTION V.

La XV^e Assemblée Générale,

considérant :

- (i) la nécessité de donner un statut légal au Comité de Coordination,
- (ii) les modifications apportées aux Statuts,
- (iii) l'expérience acquise au cours des années écoulées, et
- (iv) l'accroissement des activités du Secrétariat Général,

décide d'autoriser le Bureau à rédiger un nouveau Règlement Intérieur en tenant compte :

- a) des modifications apportées aux Statuts,
- b) des suggestions formulées par le Comité Exécutif au sujet de l'administration de l'Union.

RÉSOLUTION VI.

La XV^e Assemblée Générale,

considérant :

- (i) les invitations reçues des Comités Nationaux du Canada et de Pologne pour l'organisation de la XVI^e Assemblée Générale en 1969,
- (ii) la coutume qui s'est installée de tenir les Assemblées Générales successivement dans un pays européen, puis dans un pays extra-européen,

décide :

- 1) d'exprimer sa gratitude et son appréciation aux deux Comités Nationaux,
- 2) d'accepter l'invitation du Comité National Canadien de tenir la XVI^e Assemblée Générale au Canada en 1969,
- 3) d'inviter le Comité National Polonais à examiner la possibilité d'organiser la XVII^e Assemblée Générale en Pologne en 1972.

RÉSOLUTION VII.

La XV^e Assemblée Générale *note* avec satisfaction l'invitation du Comité National Péruvien de tenir une Assemblée Générale de l'URSI au Pérou, et *exprime* à ce Comité ses remerciements et son appréciation.

RÉSOLUTION VIII.

La XV^e Assemblée Générale *exprime* à l'UNESCO sa gratitude pour ses activités éminentes et l'appui qu'elle a fourni à la Science au cours des vingt années écoulées, et exprime le vœu que ces activités se poursuivent pour le plus grand bien de l'humanité.

RÉSOLUTION IX.

La XV^e Assemblée Générale *exprime* au Comité National Allemand toute son appréciation pour l'excellence des arrangements et facilités fournis pour le déroulement de cette Assemblée.

La XV^e Assemblée Générale ne pourrait omettre d'exprimer également son appréciation profonde pour le programme très réussi du Comité des Dames dont la grâce et les prévenances ont rendu le séjour à Munich des plus agréables.

Résolutions et recommandations émanant des Commissions

COMMISSION I. — MESURES ET ETALONS RADIOÉLECTRIQUES

VOEU I.1.

L'URSI remercie l'UAI et le CCIR de leur coopération dans le domaine des émissions de fréquences étalon et de signaux horaires, et prend note des résolutions prises à Hambourg en 1963 et à Oslo en 1966. L'URSI enregistre aussi avec satisfaction l'adoption provisoire par le CIPM en 1964 d'une unité atomique de temps. L'URSI pense cependant que toutes les méthodes qui ont été proposées et qui sont en usage dans les services de fréquence étalon en fonctionnement provoqueront des difficultés croissantes au fur et à mesure de l'accroissement de ces services; elle pense que ces services doivent inévitablement s'orienter vers l'emploi d'un système de fréquence et de temps uniforme atomiques. Ceci nécessiterait la mise au point d'une certaine forme de correction pour les utilisateurs du temps astronomique.

VOEU I.2.

L'URSI apprécie l'heureuse décision de la 12^e Conférence Générale des Poids et Mesures qui a habilité le Comité International des Poids et Mesures à désigner une transition quantique pour être utilisée comme étalon pour les mesures de temps et de fréquence.

Ayant examiné l'exactitude obtenue dans la définition de la fréquence de transitions quantiques, l'URSI estime que les transitions hyperfines du césium, de l'hydrogène et du thallium donnent des résultats comparables. Bien que les travaux en cours pour réaliser de nouveaux progrès puissent être couronnés de succès, un certain nombre d'années devront s'écouler avant que ces progrès soient pleinement confirmés.

Considérant le fait que des étalons à césium de différente construction ont été employés et éprouvés d'une façon approfondie dans plusieurs laboratoires répartis dans le monde entier et qu'ils se sont montrés capables de fournir exactitude et sécurité dans des conditions variées, l'URSI est d'avis que la transition du césium est la plus convenable qui puisse être adoptée comme étalon pour la définition de la seconde.

RECOMMANDATION I.1.

Vu l'importance de la normalisation des unités de mesure, l'URSI *recommande* l'emploi des unités du Système International pour la mesure des grandeurs électriques et radioélectriques. Le Système International adopté par la Conférence des Poids et Mesures est publié dans le compte rendu des Séances de la 11^e Conférence Générale des Poids et Mesures (1961).

RECOMMANDATION I.2.

L'URSI, pleinement consciente du fait que les étalons de temps atomique n'ont pas encore atteint leur ultime précision, *recommande* que les travaux soient activement poursuivis dans ce domaine.

RECOMMANDATION I.3.

L'URSI recommande qu'une réunion des services responsables en Europe de la distribution des fréquences et du temps étalon soit conviée par le Président International de la Commission I, par l'intermédiaire des Comités Nationaux, dans le but d'examiner la méthode la plus appropriée pour assurer un service sûr dans cette zone.

RECOMMANDATION I.4.

L'URSI, vu

1. l'intérêt croissant des comparaisons internationales d'étalons radio-électriques,
2. les comparaisons déjà organisées soit par le BIPM, soit par elle-même, *recommande*
 - a) que l'activité du BIPM soit étendue particulièrement dans les domaines de mesure où les techniques sont bien établies,
 - b) que, dans la période transitoire et étant donné les mesures et techniques nouvelles, l'URSI continue de patronner les intercomparaisons à l'échelle nationale. Elle recommande en particulier des intercomparaisons pour les grandeurs suivantes : intensité de champ, affaiblissement, coefficient de réflexion, impédance, courant et tension sinusoïdale en ondes métriques et décimétriques, tension de crête des impulsions trapézoïdales pour les valeurs inférieures ou égales à 1000 V,
 - c) que le Président international de la Commission I soit informé de tout arrangement pris en vue de telles comparaisons, ainsi que des résultats qui en découlent,

- d) que, quand cela est nécessaire, le Président international de la Commission I favorise la mise au point de tels arrangements, se charge d'en diffuser les résultats aux Comités Nationaux et de tenir le BIPM au courant de toutes activités dans ce domaine placé sous les auspices de l'URSI,
- e) que le Président international de la Commission I soit autorisé à constituer un comité *ad hoc* en vue de la promotion de ces intercomparaisons.

RECOMMANDATION I.5.

Vu les progrès substantiels accomplis dans le domaine des connecteurs de précision pour lignes de transmission coaxiales rigides, la Commission I de l'URSI *recommande* :

1. que, pour les comparaisons internationales de grandeurs radio-électriques qui seront désormais parrainées par l'URSI, les laboratoires emploient de préférence, les normes ⁽¹⁾ de connecteurs adoptées par l'IEEE,
2. que la CEI envisage l'adoption des normes de l'IEEE pour les connecteurs coaxiaux de précision.

RÉSOLUTION I.1.

Etant donné l'intérêt commun du CIPM-BIPM et de l'URSI (notamment de sa Commission I) pour les questions scientifiques et métrologiques concernant les grandeurs électromagnétiques et les autres domaines de la physique, l'URSI décide que, pour le bien commun et dans un but de coopération mutuelle, le BIPM sera invité à désigner un représentant aux Assemblées Générales futures de l'URSI.

COMMISSION II. — RADIOÉLECTRICITÉ ET MILIEUX NON-IONISÉS

RÉSOLUTION II.1.

La XV^e Assemblée Générale de l'URSI *décide* de modifier comme suit le titre de la Commission II. — Radioélectricité et Troposphère : « Radioélectricité et Milieux non-ionisés ».

⁽¹⁾ IEEE Transactions on Instrumentation and Measurements, Vol. IM-13, n° 4, pp. 286-291, Dec. 1964.

RECOMMANDATION II.1.

L'URSI *recommande* que la Commission Inter-Unions de Radiométéorologie (URSI-UGGI) poursuive ses activités en s'attachant particulièrement à organiser des réunions de groupes restreints travaillant sur des sujets spécialisés.

RECOMMANDATION II.2.

L'URSI *recommande* que, dans les études spatiales, une attention soutenue soit apportée à la mesure des caractéristiques des surfaces et des atmosphères planétaires, y compris la Terre vue de l'espace. Des expériences en laboratoire et sur des modèles pourraient s'avérer utiles.

RECOMMANDATION II.3.

L'URSI *recommande* que les applications de la théorie de la radiométrie soient plus nombreuses, et que soit accru le nombre des données radiométriques obtenues à partir des énergies atmosphériques et terrestres rayonnées en ce qui concerne *a)* la structure atmosphérique et *b)* les systèmes de réception sensibles.

RECOMMANDATION II.4.

L'URSI *recommande* que l'attention soit attirée sur les ondes millimétriques, submillimétriques et optiques cohérentes en ce qui concerne : *a)* leur propagation à travers l'atmosphère, et *b)* leur utilisation en vue d'obtenir davantage de renseignements sur la structure atmosphérique, y compris les variations de l'indice de réfraction et l'intensité et la distribution des gouttes d'eau dans les précipitations.

RECOMMANDATION II.5.

L'URSI *recommande* que l'attention continue d'être consacrée à l'obtention de données nouvelles sur la propagation des ondes au-dessus et en-dessous de la surface de la Terre, en déterminant les caractéristiques du milieu et en mesurant leur effet sur le niveau du signal, l'angle d'arrivée, etc.

RECOMMANDATION II.6.

L'URSI *recommande* que les méthodes théoriques et expérimentales d'étude de la structure des irrégularités de l'indice de

réfraction soient mises à profit particulièrement en ce qui concerne : la théorie de la mécanique des fluides, les systèmes à grand pouvoir de résolution, les mesures radioélectriques simultanées à incidence verticale et oblique (y compris l'effet Doppler), et les mesures radioélectriques et météorologiques simultanées (y compris la coopération des différentes disciplines), et qu'un effort spécial soit entrepris pour trouver la limite ultime imposée par l'atmosphère à la précision des mesures de distance, l'angle d'arrivée et d'effet Doppler, ainsi qu'au spectre transmissible.

RECOMMANDATION II.7.

L'URSI *recommande* qu'un effort continu soit fourni en vue de l'amélioration des théories et des modèles de l'atmosphère expliquant de manière adéquate les phénomènes de propagation, en particulier la question du gain effectif de l'antenne en fonction de la distance, de la fréquence, etc.

COMMISSION IV. — MAGNÉTOSPHERE

RÉSOLUTION IV.1.

La XV^e Assemblée générale de l'URSI,

considérant les conclusions du Groupe de travail formé par le Comité exécutif pour examiner le statut de la Sous-Commission IVa. — Bruit radioélectrique d'origine terrestre,

décide :

- (i) de remplacer cette Sous-Commission par une commission provisoire, et
- (ii) d'inviter le Secrétaire général à faire les démarches nécessaires en vue de la constitution de la Commission provisoire, en consultation avec les Membres du Bureau.

RECOMMANDATION IV.1.

L'URSI,

considérant :

- a) que sa Commission IV estime qu'un Colloque inter-unions sur la physique de la magnétosphère devrait faire suite, en 1968, au Colloque inter-Unions sur la physique solaire-terrestre tenu récemment à Belgrade,

(b) que la « National Aeronautics and Space Administration » des Etats-Unis envisage l'organisation de ce colloque,

(c) que les sujets suivants sont proposés :

1. Zone de radiation interne,
2. Zone de radiation externe et magnétosphère supérieure,
3. Zone aurorale et calotte polaire,
4. Modèles de magnétosphère,
5. Traînée géomagnétique,
6. Magnétopause, onde de choc et zone de transition,

recommande :

1. que l'URSI prenne part au Colloque inter-unions sur la physique de la magnétosphère, projeté pour 1968, et qu'elle communique son désir de participation à la Commission inter-Unions de Physique solaire-terrestre (IUCSTP),
2. que le sujet suivant soit ajouté à la liste des sujets :
 7. Interaction entre les ondes et les particules.

RECOMMANDATION IV.2.

L'URSI,

notant l'avis de la Commission IV,

recommande que, parmi les disciplines figurant à son mandat, la nouvelle Commission inter-Unions de Physique solaire-terrestre reconnaisse de manière plus explicite celle de l'interaction entre les ondes et les particules, qui comprend :

- a) L'interaction entre le vent solaire et la magnétosphère, et plus particulièrement les instabilités, discontinuités et irrégularités dans la région d'interaction entre le vent solaire et la magnétosphère, ainsi que les ondes dans lesquelles peuvent être analysées ces instabilités, discontinuités et irrégularités;
- b) La relation entre les sifflements, le bruit aux très basses fréquences, les micropulsations et les particules énergétiques;
- c) L'interaction entre les particules thermalisées, les ondes acoustiques ioniques et électroniques, et les ondes radioélectriques, connue couramment sous l'appellation de diffusion incohérente.

RECOMMANDATION IV.3.

L'URSI,

notant l'avis donné à la Commission IV par sa sous-Commission des observations synoptiques de sifflements,

recommande :

- 1) que les observations des phénomènes de bruit aux fréquences extrêmement basses (EBF) et inférieures soient effectuées, dans la mesure du possible, en conformité avec les procédés définis par la sous-Commission et qui seront publiés au Bulletin d'Information de l'URSI;
- 2) que les chercheurs étudiant les sifflements et émissions aux fréquences très basses (TBF) et inférieures soient invités à publier, ou à rendre disponibles de toute autre manière, les détails des méthodes appliquées par eux pour l'enregistrement et l'interprétation des données. Dans le cas où ils ne seraient pas publiés, les renseignements appropriés seront communiqués aux centres mondiaux de données, par l'intermédiaire du président de la sous-Commission;
- 3) étant donné l'intérêt croissant que présentent les amplitudes relatives des sifflements et émissions enregistrés par différentes stations, que les chercheurs soient invités à faire connaître l'étalonnage en amplitude de leurs enregistrements, et à préciser l'amplitude du niveau de bruit inhérent à leur équipement, telle qu'elle apparaît sur les enregistrements.

RECOMMANDATION IV.4.

L'URSI,

notant l'avis de sa Commission IV,

recommande que la sous-Commission des observations synoptiques de sifflements de la Commission IV poursuive ses activités pendant une nouvelle période de trois ans, mais qu'elle devienne un groupe de travail, ou bien un sous-comité du Comité de l'URSI pour la physique solaire-terrestre, qui remplace le Comité de l'URSI pour la coopération internationale en géophysique.

COMMISSION V. — RADIOASTRONOMIE

RÉSOLUTION V.1.

La Commission V *décide* de dissoudre la sous-Commission Ve sur l'Attribution de Fréquences pour la Radioastronomie.

RÉSOLUTION V.2.

La Commission V *décide* d'établir un Groupe de travail sur l'étalonnage des densités du flux solaire, avec le Prof. H. Tanaka comme président.

RECOMMANDATION V.1.

L'URSI,

considérant :

- a) que l'Union a pour objectif de « développer, sur des bases internationales, les études scientifiques se rapportant à la radioélectricité »,
- b) que, dans le domaine de la radioastronomie, l'Assemblée Générale représente le moyen le plus efficace et le plus opportun pour les échanges de vues à l'échelle internationale, et
- c) que le développement des études est fortement influencé par les activités antérieures et en cours,

recommande :

que les séances organisées par la Commission V de l'URSI au cours des Assemblées Générales comprennent :

- (i) des séances où seront présentées les communications scientifiques ayant trait à des travaux originaux en radioastronomie (et radarastronomie);
- (ii) des séances où il sera fait état des techniques et équipements particuliers à la radioastronomie, ou bien susceptibles de contribuer à son développement,
- (iii) des séances où seront présentés les rapports de synthèse préparés par des chercheurs faisant autorité dans le domaine et où le temps nécessaire sera prévu pour la discussion, et
- (iv) des séances où seront examinées les questions administratives de la Commission.

RECOMMANDATION V.2. — *Attribution de fréquences pour la Radioastronomie.*

L'URSI,

notant que sa Commission V a) appuie et encourage les activités de l'IUCAF tendant à solliciter et à assurer une amélioration de

l'attribution des fréquences pour le service de radioastronomie et *b*) attire l'attention sur le fait :

- (i) que la série des bandes de fréquences pour l'observation du continuum des ondes radioélectriques cosmiques est très incomplète, aucune bande n'étant attribuée de façon définitive et à échelle mondiale entre les bandes allant de 37,75-38,25 MHz à 1420-1427 MHz, et
- (ii) que les observations effectuées récemment ont fait ressortir la nécessité d'améliorer la protection des fréquences naturelles du radical OH,

recommande que l'IUCAF :

1. poursuive ses efforts en vue d'obtenir une amélioration de la protection à l'échelle mondiale des bandes de fréquences pour l'observation du continuum des ondes radioélectriques cosmiques et, plus particulièrement, de la bande 322-329 MHz également nécessaire pour l'observation de la raie naturelle du Deutérium,
2. appuie la recommandation du CCIR (Oslo 1966) concernant la protection des fréquences pour les observations de la raie naturelle du radical OH, et
3. continue d'étudier la nécessité d'étendre la protection des bandes de fréquences pour l'observation de la raie naturelle du radical OH de façon à inclure les bandes appropriées à environ 1612,2 MHz et 1720,5 MHz.

* * *

REMARQUE : *Les recommandations de la Commission III (Ionosphère) seront publiées dans le prochain numéro du Bulletin d'Information.*

Resolutions and Recommendations of the XVth General Assembly

General Resolutions

Besides the election and re-election of Officers of the Board and of Chairmen and Vice-Chairmen of Commissions, the XVth General Assembly adopted the following resolutions on proposal of the Executive Committee.

RESOLUTION I.

The XVth General Assembly *resolves* to recognize officially National Committees constituted in Brazil, Hungary, Mexico and Nigeria, and to recognize provisionally the National Committee in Israel.

RESOLUTION II.

The XVth General Assembly,
endorses the Report of the Finance Committee and, considering that URSI should increase its scientific activities and encourage Commissions and Committees to organize scientific meetings in the period between two General Assemblies,

resolves to raise the subscription unit from \$ 150 to \$ 175 from January 1st, 1968 onwards.

RESOLUTION III.

The XVth General Assembly,
endorses the Report of the Publications Committee and
resolves :

- (1) to continue the publication and distribution of the Information Bulletin and of Proceedings of the General Assembly according to the rules previously in use, and,
- (2) to adopt a new method of publishing «Progress in Radio Science» in order to ensure prompt and less expensive publication.

RESOLUTION IV.

The XVth General Assembly,

considering that :

- (i) the title of Honorary President should be awarded to scientists whose activities and devotion have brought a valuable and outstanding contribution in one of the fields covered by URSI,
- (ii) there is a need to ensure better continuity in the chairmanship of Commissions and closer collaboration between Chairmen and Vice-Chairmen of Commissions,

resolves to authorize the Board of Officers to draft new Statutes, taking into account the following items :

- (a) instructions for the choice and election of Honorary Presidents,
- (b) election by the General Assembly of Chairmen and Vice-Chairmen of Commissions, Vice-Chairmen to succeed automatically to the Chairmen after a three year period.

RESOLUTION V.

The XVth General Assembly,

considering :

- (i) the need for a legal status for the Coordinating Committee,
- (ii) the modifications adopted for the Statutes,
- (iii) the experience gained in the past years, and
- (iv) the increase of duties of the General Secretariat,

resolves to authorize the Board of Officers to draft new Bylaws taking into account :

- (a) the modifications adopted for the Statutes,
- (b) the suggestions made by the Executive Committee concerning the administration of the Union.

RESOLUTION VI.

The XVth General Assembly,

considering :

- (i) invitations made by the National Committees in Canada and in Poland for organizing the XVIth General Assembly in 1969,

(ii) the custom to hold General Assemblies successively in the European area, and then in an extra-European country,

decides :

- (1) to express its thanks and appreciation to both Committees,
- (2) to accept the invitation of the Canadian National Committee to hold the XVIth General Assembly in Canada in 1969,
- (3) to ask the Polish National Committee to consider the possibility to organize the XVIIth General Assembly in Poland in 1972.

RESOLUTION VII.

The XVth General Assembly *notes* with satisfaction the invitation made by the Peruvian National Committee to hold a General Assembly of URSI in Peru, and expresses its thanks and appreciation to this Committee.

RESOLUTION VIII.

The XVth General Assembly *expresses* its gratitude to UNESCO for its outstanding activities and for the support given to Science during the past twenty years, and the wish that these activities be pursued for the benefit of mankind.

RESOLUTION IX.

The XVth General Assembly *commends* the German National Committee for the excellent arrangements and the facilities provided for the conduct of this Assembly.

The XVth General Assembly would be remiss were it not to acknowledge deep appreciation for the very successful programme of the Ladies Committee. Their graciousness and thoughtfulness have made the stay in Munich a very happy experience.

Resolutions and Recommendations of Commissions

COMMISSION I ON RADIO MEASUREMENTS AND STANDARDS

OPINION I.1.

The URSI acknowledges the cooperation of the IAU and of the CCIR in connection with standard frequency transmissions and

time signals, and notes the resolutions taken at Hamburg in 1964 and at Oslo in 1966. It notes also with satisfaction the interim adoption of an atomic unit of time by the CIPM in 1964. It is however the opinion of URSI that all the methods of operating standard frequency services which have been proposed contain defects which will cause increasing difficulties as the use of the services extends; and that these services must inevitably develop toward a system of uniform atomic time and constant frequency. This would necessitate the provision of some form of correction for those requiring astronomical time.

OPINION I.2.

The URSI welcomes the decision of the 12th General Conference of Weights and Measures empowering the International Committee of Weights and Measures to designate a quantum transition as a standard for the measurement of time and frequency.

Having considered the accuracies achieved in defining the frequencies of quantum transitions, the URSI finds that the hyperfine transitions of caesium hydrogen and thallium give comparable results. Although work in progress to effect further improvements may be successful, a number of years must elapse before this can be fully confirmed.

In view of the fact that caesium standards of different construction have been used and tested extensively in a number of laboratories throughout the world and found to be accurate and reliable in performance under a variety of conditions, it is the opinion of URSI that the caesium transition is the most suitable to adopt as a standard for a definition of the second.

RECOMMENDATION I.1.

Considering the importance of the international standardization of units, the URSI *recommends* that for the measurement of electrical, electronic and radio quantities, the International System (SI) adopted by the General Conference of Weights and Measures (CCPM), published in *Compte Rendu des Séances de la XI^e Conférence Générale des Poids et Mesures (1961)*, be used.

RECOMMENDATION I.2.

The URSI, recognising that the full potential accuracy of atomic standards of time has not yet been realised, *recommends* that work in this field should be actively pursued.

RECOMMENDATION I.3.

The URSI *recommends* that the International Chairman of Commission I should arrange through the appropriate National Committees a meeting of the agencies responsible for the operation of standard frequency and time services in the European area with the object of discussing the best way of providing a reliable service in this area.

RECOMMENDATION I.4.

The URSI considering :

- (a) the increasing interest in the international comparison of radio standards;
- (b) the comparisons already arranged by either the BIPM or the URSI;

recommends that

- (1) the work at the BIPM should be extended particularly in respect of measurements for which well established techniques exist;
- (2) that in the interim period and in respect of new measurements and techniques, the URSI should continue to sponsor inter-comparisons at a national level. It recommends in particular that inter-comparisons of the following quantities should be carried out : field strength, attenuation, reflection coefficient, impedance, current at VHF and UHF, sinusoidal voltage at VHF and UHF, and pulsed trapezoidal peak voltage up to 1000 volts;
- (3) that the international Chairman of Commission I should be informed of arrangements made for such comparisons and of the results obtained;
- (4) that the international Chairman of Commission I should, where appropriate, assist in effecting such arrangements and be responsible for circulating the results to National Committees and for keeping the BIPM informed of all activities in this field sponsored by URSI;
- (5) that the international Chairman of Commission I be empowered to establish an ad hoc committee to further these inter-comparisons.

RECOMMENDATION I.5.

Considering the substantial progress made in the field of precision connectors for rigid coaxial transmission lines, the URSI *recommends* :

- (1) That for the international comparisons of radio quantities now being sponsored by the URSI, the precision connector standard ⁽¹⁾ of the IEEE should preferably be used;
- (2) That the IEC consider the adoption of the precision coaxial connector standard of the IEEE as the IEC standards for precision measurements purposes.

RESOLUTION I.1.

Considering the common interests of the CIPM-BIPM and of the URSI (particularly of its Commission I) in the scientific and metrological aspects of various electromagnetic and other physical areas, the URSI hereby *resolves* to extend a standing invitation to the BIPM to appoint their representative to future General Assemblies of URSI for the purpose of mutual cooperation and benefit.

COMMISSION II ON RADIO AND NON-IONIZED MEDIA

RESOLUTION II.1.

The XVth General Assembly of URSI *resolves* to change the title of Commission II on Radio and Troposphere to « Radio and Non-Ionized Media ».

RECOMMENDATION II.1.

The URSI *recommends* that the Inter-Union (URSI-UGGI) Commission on Radio Meteorology be continued with particular emphasis on the organization of meetings involving small working groups dealing with special topics.

RECOMMENDATION II.2.

The URSI *recommends* that in space studies further attention be given to measuring characteristics of planetary atmospheres

⁽¹⁾ Described in IEEE Transactions on Instrumentation and Measurement, Vol. IM-13, n° 4, pp. 286-291, Dec. 1964.

and surfaces, including those of the earth as viewed from space; controlled laboratory and model experiments may be of assistance in this endeavour.

RECOMMENDATION II.3.

The URSI *recommends* that there be more application of the theory of radiometry, and that more radiometric data be collected on terrestrial and atmospheric radiative energy as regards the effect on (a) atmospheric structure, and (b) sensitive receiving systems.

RECOMMENDATION II.4.

The URSI *recommends* that attention be given to coherent millimetre, submillimetre and optical waves as regards (a) their propagation through the atmosphere and (b) their use in providing additional information on atmospheric structure, including variations both in refractive index and in the intensity and drop-size distribution of precipitation.

RECOMMENDATION II.5.

The URSI *recommends* that continued attention be given to collecting further data on surface and sub-surface wave propagation by determining the characteristics of the medium and measuring their effect on signal level, angle of arrival, etc.

RECOMMENDATION II.6.

The URSI *recommends* that experimental and theoretical methods of studying the structure of refractive index irregularities be exploited, with particular reference to fluid mechanical theory, higher resolution systems, simultaneous vertical and oblique radio measurements (including Doppler techniques), and to simultaneous radio and meteorological measurements (including inter-disciplinary cooperation); and also that stress be placed on finding the upper limit imposed by the atmosphere on the accuracy of measurements of range, angle and Doppler effects, and on the transmissible spectrum.

RECOMMENDATION II.7.

The URSI *recommends* that continued efforts be devoted to deriving improved theories and models of the atmosphere pro-

viding adequate explanation of propagation phenomena — in particular the question of effective antenna gain as a function of distance, frequency, etc.

COMMISSION IV ON THE MAGNETOSPHERE

RESOLUTION IV.1.

The XVth General Assembly of URSI,

taking account of the conclusions of the Working Group set up by the Executive Committee to consider the status of Sub-Commission IVa on Radio Noise of Terrestrial Origin,

resolves :

- (i) to replace this Sub-Commission by a Provisional Commission, and
- (ii) to instruct the Secretary General to take the necessary steps for the constitution of the Provisional Commission, in consultation with the Board of Officers.

RECOMMENDATION IV.1.

The URSI,

considering :

- (a) that its Commission IV believes that the recent Inter-Union Symposium on Solar-Terrestrial Physics in Belgrade should be followed by an Inter-Union Symposium on Magnetospheric Physics in 1968,
- (b) that such a symposium is understood to be under consideration by the National Aeronautics and Space Administration in the United States,
- (c) that the proposed topics are :
 1. Inner radiation zone,
 2. Outer radiation zone and outer magnetosphere,
 3. Auroral zone and polar cap,
 4. Magnetospheric models,
 5. Geomagnetic tail,
 6. Magnetopause, magnetosheath, and shock front,

recommends :

1. that URSI participate in the proposed Symposium on Magnetospheric Physics in 1968 and inform the Inter-Union Commission on Solar-Terrestrial Physics of URSI's desire to participate,
2. that the following item be added to the list of topics :
 7. Interaction between waves and particles.

RECOMMENDATION IV.2.

The URSI,

noting the advice of its Commission IV,

recommends that interaction between waves and particles be more explicitly recognized by the new Inter-Union Commission on Solar Terrestrial Physics as one of its organizational disciplines. This discipline includes :

- (a) The interaction between the solar wind and the magnetosphere, particularly instabilities, discontinuities and irregularities at the interface between the solar wind and the magnetosphere, and the waves into which the instabilities, discontinuities and irregularities may be analyzed;
- (b) The relation between whistlers, VLF noise, micropulsations and energetic particles;
- (c) The interaction between ambient particles, ion and electron acoustic waves, and radio waves, which is a topic usually known as incoherent scatter.

RECOMMENDATION IV.3.

The URSI,

noting the advice given to Commission IV, by its sub-commission on Synoptic Whistler Observations,

recommends :

- (1) That observations of noise phenomena at ELF and lower frequencies be carried out as far as possible in accordance with procedure which have been agreed by the sub-commission and which will be published in the URSI Bulletin;
- (2) That research workers studying whistlers and emissions at VLF and lower frequencies be urged to publish, or otherwise make readily available, the details of their techniques for

recording and interpreting their data. Relevant technical material which is not in published form should be submitted to the World Data Centres through the chairman of the sub-commission;

- (3) That, in view of increasing interest in the relative amplitude of whistlers and emissions at different stations, workers should be urged to make known the amplitude calibration of their records, and to state the amplitude of the inherent noise level of their equipment as it appears on the records.

RECOMMENDATION IV.4.

The URSI,

noting the advice of its Commission IV,

recommends that Sub-Commission on Synoptic Whistler Observations of Commission IV continue for a further period of three years, but become a working group, or Subcommittee of the URSI Solar Terrestrial Physics Committee that is replacing the URSI Committee for International Co-operation in Geophysics.

COMMISSION V ON RADIOASTRONOMY

RESOLUTION V.1.

Commission V *resolves* to dissolve its Sub-Commission Ve on Frequency Allocations for Radio Astronomy.

RESOLUTION V.2.

Commission V *resolves* to set up a Working Group on Calibration of Solar Flux Densities with Prof. H. Tanaka as convener.

RECOMMENDATION V.1.

The URSI,

considering :

- (a) That the objectives of the Union are to «develop on an international basis, scientific studies relating to radio », and
- (b) That in Radio Astronomy the most effective means for establishing an international exchange on a timely basis is at a General Assembly, and
- (c) That the development of studies is heavily influenced by prior and current activities,

recommends that :

- 1) Sessions of Commission V of URSI at a General Assembly shall consist of
 - (i) sessions in which scientific papers reporting original work in radio (including radar) astronomy are presented,
 - (ii) sessions in which techniques and equipment peculiar to or advancing the art of radio astronomy are reported,
 - (iii) sessions in which review papers prepared by authorities in the field are presented and in which adequate time for discussion is allowed, and
 - (iv) business sessions in which the administrative affairs of the Commission are discussed.

RECOMMENDATION V.2. — *Allocations of Frequencies for Radio Astronomy.*

The URSI,

noting that its Commission V *a)* supports and encourages the work of IUCAF in securing and seeking to improve the frequency allocations for the radio astronomy service, and *b)* draws attention to the facts that

- (i) the series of frequency bands for observations of the continuum of cosmic radio waves is seriously incomplete, no band being allocated on a secure and world-wide basis between the bands 37.75-38.25 MHz and 1420-1427 MHz and
- (ii) recent observations have emphasized the need for improved protection of the natural frequencies of the OH radical,

recommends that IUCAF should continue to :

1. press for improved and world-wide protection in the frequency bands for observation of the continuum of cosmic radiowaves, and in particular the band 322-329 MHz which is needed also for observation in the natural line radiation from Deuterium,
2. support the recommendation of CCIR (Oslo 1966) concerning the protection of frequencies for observations of the natural line radiation from the OH radical,

3. study the need for extending the protection of observations of the natural line radiation from the OH radical to include appropriate bands at approximately 1612.2 MHz and 1720.5 MHz.

* * *

NOTE : *Recommendations of Commission III on the Ionosphere will appear in the next issue of the Information Bulletin.*

**Report on the XVth General Assembly
of the
International Scientific Radio Union**

to the ICSU Executive Board Meeting

MONTE-CARLO, OCTOBER 7-8, 1966

by R. L. SMITH-ROSE

The XVth General Assembly of URSI was held in the Technische Hochschule, Munich, during the period 5 to 15 September 1966. This followed the Inter-Union Symposium on Solar-Terrestrial Physics in Belgrade, which many of the URSI delegates attended before proceeding to Munich.

The General Assembly, which was preceded by meetings of the Board of Officers and of the Co-ordinating Committee, was attended by some 500 delegates from 27 countries, together with about 120 observers invited by the German National Committee. In addition, observers invited by the President included representatives of other international scientific organisations, and of five national committees, whose application for membership of URSI was accepted during the Assembly.

SCIENTIFIC PROGRAMME

Following the opening meeting on Monday, 5th September, the seven commissions of the Union held scientific sessions during the periods 6-9th and 12-14 th September. These were organised

on the basis of one or more invited speakers presenting papers on previously selected subjects, following by general discussions on a formal or informal basis largely determined by the Chairmen of the sessions. It is intended that only the invited papers, together with a general account of the discussions, at each of the Commission meetings, shall be published in book form in two volumes with the title «Progress in Radio Science».

In addition to the meetings, a number of scientific tours were made to educational, government and industrial laboratories, to the broadcasting centre in Munich, to the Satellite Earth station at Raisting, and to the US Air Force Flying Ionospheric Laboratory at Riem airport.

SOCIAL PROGRAMME

A reception by the Lord Mayor of Munich on the first evening of the Assembly, was followed during the two weeks meeting by a Bavarian folklore evening, by a reception given by the academic organisations in Munich and by a concert given by the Bavarian broadcasting system. A number of ladies accompanying delegates participated in these and other visits.

CLOSING MEETING

At the general meeting held on Thursday 15th September, the President, Secretary-General and the Chairmen of Commissions presented an account of their activities for the period preceding and during the General Assembly. Among a number of resolutions adopted on this occasion, three may be mentioned here. First, it was decided that, on a proposal from the Executive Committee, both a chairman and a vice-chairman should be elected for each Commission for a three-year term; and on the understanding that the vice-chairman would succeed the chairman at the end of his period of office. Secondly, the status of the sub-commission IVa on «Atmospheric Noise» was discussed with the aid of a report from a working party appointed at the Assembly. It was decided that the future of this sub-commission should be decided during the next six months by reference to all the national Committees of URSI. Thirdly, it was recommended that Commission V, which had hitherto dealt mainly with techniques for radio astronomy should in future deal also with the results of research conducted in this field.

ELECTIONS

On the recommendation of the Executive Committee, the General Assembly elected the following officers to serve during the ensuing period 1966-69.

President : Professor S. SILVER (USA).

Vice-Presidents : Professor W. J. G. BEYNON (UK);
Professor M. BOELLA (Italy);
Professor Dr. W. DIEMINGER (Germany);
Professor J. GROSZKOWSKI (Poland).

Treasurer : Prof. Ch. MANNEBACK (Belgium),

Secretary General : Ing. E. HERBAYS (Belgium).

Honorary Presidents :

Furthermore, in addition to Dr. L. V. BERKNER (USA), who was elected at the Tokyo Assembly in 1963, the following Honorary Presidents were appointed at Munich :

M. B. DECAUX (France);
Mr. J. A. RATCLIFFE (UK);
Dr. R. L. SMITH-ROSE (UK).

NEXT GENERAL ASSEMBLY

Invitations had been received from the National Committees of Canada and Poland to hold the XVith General Assembly in one of these countries. After consideration and advice by the Executive Committee, it was decided to accept the first of these. The XVIth General Assembly of URSI will accordingly be held in Canada, probably in Montreal during the summer of 1969.

SIR EDWARD APPLETON'S TROMSÖ JOURNAL

All those interested in the past activities connected with the scientific fields covered by URSI will read with pleasure the following article published in *IQSY Notes* n° 16, April 1966.

In 1964, several distinguished geophysicists who had taken an active part in the Second Polar Year 1932-1933 contributed a short series of articles to *IQSY Notes*. Among the contributors was the late Sir Edward Appleton whose sudden death in April 1965 was such a great loss, not only to those who knew him, but to the people everywhere who were familiar with his long series of published papers on the ionosphere. Right up to the end of his life, he took a very active personal interest in ionospheric research, an interest which he had maintained practically without a break over a period of 40 years.

In these days of automatic ionosondes and topside sounders, it is easy to forget that ionograms were first constructed manually by plotting visual observations of the time delay of the reflected echoes from the ionosphere on a number of fixed frequencies. This was not an easy task in 1932 when, during the University summer vacation, Appleton went with the British Polar Year Expedition to Tromsö to establish an ionospheric station. Quite apart from the primitive character of their electronic equipment, the plotting and interpretation of the ionograms was complicated by unexpected and confusing phenomena which can now be recognized and more fully understood in the light of subsequent investigations. During the summer of 1932, Appleton recorded some of his experiences and also his thoughts about the new ionospheric observations being made at Tromsö, and their interpretation. These are contained in a notebook headed «A Wireless Visit To Tromsö» which he refers to as his Journal. Extracts from this Journal are reproduced in the following pages with the very kind permission of Lady Appleton who has made the Journal available to *IQSY Notes*.

The Journal includes references to « blot-out », which represent the first recorded polar black-out, and also to the realisation of the link between ionospheric behaviour, magnetic storms and auroral displays. It is clear from the Journal that Appleton placed much value on the informal discussions which he had with the Director of the Observatory at Tromsø, now Professor L. Harang, to whom we are greatly indebted for agreeing to write the short introduction to the extracts below.

Mention should also be made of the three other members of the British Expedition who accompanied Appleton and to whom the Journal refers. These included R. A. Naismith, a Scotsman, and W. C. Brown, a New Zealander, who in 1932 were members of the staff of the present Radio and Space Research Station at Slough. A third member was G. Builder from Australia who was one of Appleton's post-graduate research students at King's College on the University of London where Appleton occupied the Wheatstone Chair of Physics.

During the 34 years which have elapsed since the Journal was written, the techniques of geophysical observation have become very much more sophisticated and the costs of the equipment have increased enormously. Nevertheless, many of those who are now concerned with geophysical research will be interested in the glimpses of ionospheric history in the making which the Journal provides; there may even be some who recall with nostalgia an epoch when it was still possible for a small team to make significant advances in knowledge with comparatively simple apparatus.

IQSY Secretariat

C. M. MINNIS.

Sir Edward Appleton's Journal of his visit to Tromsø during the summer of 1932 relates to a period of pioneer activity in ionospheric research. Even the first weeks' work of the expedition presented in a most impressive way the possibilities and perspectives which the radio-echo method could yield in the field of cosmic geophysics.

The Auroral Observatory at Tromsø was opened in 1928 and the research programme planned to continue the observational work in geomagnetism and aurora which had been started at the beginning of the century by Kr. Birkeland. Through the radio-echo observations we were able, for the first time, to follow direc-

tly, on the oscillograph screen, the auroral and geomagnetic events which we had hitherto only been able to trace in a more indirect way through the classical recording method. It was apparent that a new avenue of research had been opened, a most impressive experience for every-one who witnessed this for the first time.

After the British expedition's pioneer work, it was obvious that radio-echo methods ought to be included in any programmes at observations which were to carry out upper atmosphere research.

The programme for the Second Polar Year 1932-1933 was modest compared with those for the more recent IGY and IQSY. The programme also included, however, recommendations for international collaboration, and the visit of the British Expedition to a high latitude observatory at Tromsø was a fine example of such collaboration. It was an inspiration for the future expansion of research in cosmic geophysics and led, in the following decades, to the building up of a Norwegian research group in ionospheric research.

University of Oslo

L. HARANG.

A wireless visit to Tromsø

(Editor's Note : Apart from a few changes in punctuation, the text of the Journal has been reproduced here in its original form. Omissions are indicated in the usual way... It should be noted that wave-lengths rather than frequencies are used almost everywhere and are indicated by λ followed by the wave-length in metres).

I am beginning this Journal just over a week (24.VII.1932) after landing at Tromsø for the intervening period has been taken up wholly with the practical details of unloading and assembling our apparatus. Tromsø was chosen for our observations because of the facilities which the Nordlysobservatoriet here provides... It was at the URSI meeting in Copenhagen that Dr. La Cour, of the Copenhagen Meteorological observatory, first suggested Tromsø. He pointed out that while there was very little difference between the latitudes of Tromsø and Hammerfest, the former had the advantage of observatory facilities. The British delegation to the URSI conference immediately decided to propose to the British National Committee that one of Great Britain's contributions to the work of the International Polar Year 1932-1933

should be the sending out of a party to Tromsö. Other countries appeared willing to cooperate by sending out similar expeditions and thus the whole of the wireless work during the Polar Year was started...

The work of Great Britain for the Polar Year was organized by the Polar Year Committee on which I served as the representative of the British National Committee...

After much discussion we decided to equip the party with the following types of apparatus :

- (1) Complete installation for ionospheric studies including pulse sender for Simavik and receiver and polarimeter for use at the observatory.
- (2) Short wave sender for communication purposes between Tromsö and Slough.
- (3) 10 metre pulse sender for use at Tromsö for special observational work at Slough.

My own interest is chiefly in connection with (1).

...

We arrived at Tromsö on Friday evening, July 15 and were met by Herr Tönsberg, the sub-director of the Observatory (Herr Harang, the Director, was away at Copenhagen, no doubt dealing with Polar Year matters) and also Herr Thrane who is soon to be Director of the Meteorological station here. The latter speaks very good English and so acted as interpreter. We saw all cases unloaded that night and left them in the customs place on the quay. Some of the cases contained valves and cathode-ray oscillographs so we had to be very careful with them.

Saturday, July 16 was spent unpacking the 16 cases at the Observatory... On the Monday, July 18 we all continued our unpacking and the erection of the receiver, but at 10 p.m. that evening Brown and Naismith (accompanied by Herr Tönsberg and Herr Thrane) with the Simavik cases, spars for masts and a few odds and ends, set off by steamer (s/s Lyngen) for Simavik.

Thursday, July 21 was a great day for on that day we erected out 40-foot masts and aerial... We were at first nonplussed by the very small support we should get by staying to pins driven into the ground. Cement bases for the loops, we were told, would need eight days. Finally we decided to bury big stones in the ground

and attach our stay-loops to them. This meant a lot of digging but the extra trouble was well worth-while. We feel fairly certain that the masts will be safe in winter. At any rate this is the opinion of the local people. We were very tired that night but the next morning we were eager to be back at the observatory to see if the signals were coming through. We came back via a steamer to Tromsø and on Friday, 22, 1750 had the satisfaction of receiving signals and echoes on λ 75 and on λ 150... I must add that the low ground wave intensity relative to the noise level on the former wave-length rather alarmed me but perhaps we shall be able to alter that in some way...

The first real test we had was on Saturday morning, July 23, when we ran through a series of wave-lengths. We found results according to the following table :

Aerial current	Time	λ	Results
m.a.			
15	1030	100	E_1
25	1100	85	E_1 and F_1
50	1130	75	F_1
60	1200	60	traces of F_1
18	1230	50	? echo of 9 m.s. (varying delay)
25	1300	45	? mixed echo in E and F positions and sign of long delay.
30	1330	40	_____

This showed fairly certainly that the stratification of the ionization must be very similar to that above S. E. England though on the whole I would say that the evidence points to the ionization's being less or slightly so. Splitting is very much in evidence and one feels that the conditions, even in summer here, are very similar to those in winter in England...

I have tried to get information from the people at the observatory about the incidence of the aurora. I am promised some aurorae before the end of August. Why are there not the magnetic accompaniments of aurora in summer? I get the impression from these people that they consider the aurora as existing only during the dark hours. But this can hardly be the case. Herr Harang

told me that the ion-clouds, which Krogness alludes to as being specially effective in absorbing radio-waves, are the aftermath of a brilliant aurora which may, for example, have stopped at 2300 or 2400 local time.

Because of its northerly situation, magnetic storms cause great effects at Tromsø and the earth-current variations here are abnormally high. In other words, all points to the abnormal magnetic-earth current-sunspot effects as being specially marked at the magnetic poles...

To-day (3.VIII.1932) is the beginning of the International Polar Year so far as we are concerned, for from 1700 today to 1700 tomorrow is a third-order day and thus a day for the 24-hour run on E region. Yesterday we tried out a run of the type we shall be doing and although we had some trouble with the camera, I think we shall be able to manage alright today and tomorrow. Builder is at Simavik to help Brown through the first run.

The first international-day test is over (6.VIII.1932) and it is possible for me now to give a fuller account of what it has meant. On August 2 we did two (P'f) runs. The first, about noon, seemed fairly regular and we got the jump at λ 109 to λ 100. (Here I would like to note that, when using the pulse method, one usually finds that although the penetration of E begins at a certain frequency, there is still a certain amount of reflection from higher frequencies from E. This is exactly what one would expect if reflection were determined by $\frac{\mu - 1}{\mu + 1}$ as the reflection coefficient.

We could look out on our μ^2 , N curves for the way in which this quantity falls off with frequency. In fact, it would not be a bad idea to plot out a theoretical P'f curve for both senses of rotation and follow it up with variation of reflection coefficient curve. Strictly speaking, I imagine that the critical frequency should be that which just shows some reflections from F region. But all this is by the way). In the afternoon of 2.VIII.1932 we did a run from 1710-1825 and found things very different. There was splitting of E with complexity, and very rapid intensity fading of components. It is possible that the rapid fading is due to local variations of μ due to local variations of the magnetic field actually in the medium. We were inclined to think that there was a magnetic storm on this day in the afternoon...

On the first 24-hour test, August 3 to 4 (1700 h to 1700 h local time), our study was to be E region. I took on from the start and worked at the receiver till 7.45 a.m. on Thursday, after which Naismith did the remaining 9 hours of the test. I was glad to have this opportunity of running the receiver alone for I found it admirable in performance... One could run very rapidly through a series of wave-lengths.

To begin with, things seemed reasonably normal for I got λ 83 as critical for E. Things remained about the same until, beginning at 2200, I got an absolute blot-out. No echoes except signs of a very low and very small E. Perhaps not much importance should be attached to the word «low», for I was unable to photograph and could only use eye-estimation.

At midnight and after, I began to get bigger echoes (e.g. E_1 up to G on λ 55 at 0015 a.m.) with the most violent fading at 0146. The echoes at this period were so complex as to make it difficult to decide between E and F. At 0430 I got a second blot-out with no echoes at all from λ 300 to λ 30. Thus, from 2 a.m. to 6 a.m. I got no sign of F, and E had been dense enough to give echoes on λ 50 but only very weak. At 8 a.m. Naismith took over and he got, about 9 a.m., some long delay echoes 6 to 14 ms. At about 1230 he got E and F again. By taking a P'f curve he thought that there was a gradual increase of height from λ 100 (150 km) to λ 75 (250 km).

All this seemed very mysterious but the solution became apparent when Herr Tönsberg announced that a most marked magnetic storm began suddenly at 2.20 (or thereabouts) on 3.VIII.1932. So this accounted for our «blot-out» of echoes. We followed this up by taking a P'f curve on 5.VIII.1932 at noon. The result was no echoes except a speck of E_1 on λ 55. In the evening of 5.VIII.1932 things seemed more like normal while today (6.VIII.1932) at noon we got a critical λ of 80 to 90 metres with fairly normal intensities. The latest run was characterized by a large amount of splitting both for E and F. In fact, I think in general we can say that E splitting is more marked here than in England.

I determined to have a talk with Director Harang about storms and got some very interesting data. The storms here tend to come on successive nights. For example, he said that after a fairly quiet period we got this storm at 2120 and that it should occur

at about the same time (or with regular shift) for a few nights. This is going to be very interesting for us, for it means that we can do a continuous run over these nights. Certainly this looks like a kind of «hosepipe» effect that reaches the earth on the dark side. Perhaps other polar stations get this same effect with a lag in time. I was also told that the magnetic field produced by a storm was always such as would be caused by a current flowing around the auroral zone. I take this to be a ring with the magnetic pole as its centre. Apparently Birkeland saw this clearly many years ago. Also it is found that August-September are the times for storms and February the quiet part of the year...

Somehow or other, we do not appear to have had multiple reflections here so frequently as in England. Can this mean that the reflection coefficient here is not so marked?

...

It is now (Sunday, August 7) becoming clear to me that the ionization can quite frequently be stronger in Region E than in Region F for quite frequently at King's College we have, during the Sunday tests, obtained this result; that when E is penetrated we get no signs of F.

By taking P'f curves at noon and doing continuous runs each night from 8 p.m. to midnight, we are gradually getting an insight into the ionospheric conditions here (Wednesday, August 10). There is no reason to revise the idea about the two regions, for our work seems amply to show that there is also this distinction here. So far as I can see, the height of E Region seems greater than in England. F Region seems sometimes to be less, and sometimes greater, than twice the height of E. There is most complicated splitting and the F_1 echo is sometimes very similar to those long delay signals described by Mögel, though of course the delay time is by no means so great.

Echoes from Region E seem to be subject to quite the same type of splitting as those from Region F. If this effect is magneto-electronic in origin, there must certainly be electrons in quantity in Region E. Simple splitting into a doublet has not been pronounced here; maybe because our squigg is a long one...

The storm which gave us such an interesting result on the first international test, August 3 to 4, showed itself for a few nights at about the same time. The effect got gradually weaker and by now it is practically gone. I am hoping that by these con-

tinuous runs from 8 p.m. to midnight we shall be catching another and so be able to get a closer correlation in time.

Director Harang gave us a most interesting and able talk on the auroral problem. He is fully aware of all the pitfalls in this subject and stuck to points which appeared to him to be adequately demonstrated by the facts. He has no use for speculation and going too much ahead of the facts. To me he is a most admirable type of worker and should do very well here with his unique facilities. I will deal with what I gleaned from his lecture perhaps tomorrow, for it has stimulated me into reading more on the subject.

The evening runs have continued, each taking a turn (Saturday, August 13). I had mine last night and had the interesting reduction of echo amplitude which I think means a magnetic storm. But we do not know yet, as the records are not yet developed. I hardly think that the case of our first test in E Region can have been fortuitous. Tonight Naismith is to observe and perhaps he may get an effect at the same time. It is very curious that here the storms occur usually during the night and usually before midnight...

I have been thinking a good deal about the meaning of the reduction of echo amplitude. As usual, it can either be absorption limitation or electron limitation. We use a very arbitrary scheme in the case of echoes from Region F. This can hardly be as satisfactory as the case of Region E. It seems to me that possibly our reflection persists a little even when μ^2 is appreciably different from 0. It would be a good thing to work out the reflection from a simple layer of a shape amenable to calculation.

(Sunday, August 14) Naismith reports that last night he had the same reduction of echo intensity to zero, the value of the amplitude of the reflected wave coming down to at least $1/50$ of its previous value. Director Harang, whom I saw this morning, reports that he himself developed the records of the last few nights and noted that storms had taken place. We must examine these more carefully tomorrow.

I have now examined the records and find that the correlation with the storms is by no means so marked (Wednesday, August 16). That is to say, that we obtained our blot-out of echoes actually before the main magnetic disturbance. The storms all had their maximum magnetic effect about midnight whereas we got our

absence of echoes as early as 2144. However it is fairly clear that the storms may cause the absence (of echoes before the appearance of magnetic effects). It is a pity that we did not go on further but of course we did not know what was happening in the world magnetic. This all points to our having continuous records during the night on a single wave-length as well as P'f curves as frequently as possible. For example, after a storm is found on a certain night, it is pretty certain to recur at about the same time (on following nights). This has proved the case in the last group. The evenings of 14/15 August and 15/16 August have proved fairly quiet.

It is however curious that we only get the blot-out on a night when there is, or is to be, a storm. This effect can hardly be fortuitous. But I am not yet an expert in reading the magnetic records properly.

We have now (Thursday, August 18) completed the 24-hour run for F Region and incidentally obtained a few readings for E Region. It is all very puzzling as for hours during the day we have obtained practically the same P'f curve; the E jump between λ 109- λ 100 and the F jump at λ 60- λ 55 metres. Perhaps we must regard the sun's altitude as not varying very much. It is, however, clear that there is a bigger variation for the E Region, as at midnight the value was λ 200- λ 150. For F it was about the same and we have to record that the ionization for F Region appeared to be at its maximum about 2000. Can this possibly mean that F Region here does not show the effects which rectilinear source of ionization would give?

There is much to be said about the P'f curves. Splitting is quite marked and today, when what I thought was the later delay component of F going out, it was a long mass of little echoes. This was on λ 65. But it will be possible to say better what this is when we have worked out a few of the photographs. I think I will take this first set of F run pictures back to England to try to unravel. Another interesting feature was, with high frequencies, complete separation of what may be magneto-ionic components of E_1 .

What worries me very much is the striking persistence of E echoes. If one goes up in frequency even when F has gone there still remains a spot of E in about the same place. Certainly there is no doubt about the existence of the KHL.

I have been thinking all day (22.VIII.1932) — it has been a miserable day in Trondheim, rain and wind — about the possibility of E-region reflection and F-region refraction. It would be a great simplification if we could revise the old theory I mentioned in my Royal Society paper on the subject. We should think of ultra-violet light as the principal ionizing agency which would give a maximum of ionisation at perhaps 150 km (in round figures) actual height. The reflection from E Region would be due to discontinuity caused by the variation of N and τ . The refraction from F Region would be more like the ordinary bending process. Electron limitation effects for F Region would take place while E Region would almost always be expected to reflect. This might account for its persistent reflection at high frequencies. When we get cases with reflection of 30 metres waves from E it usually means a very sharp boundary. I must see if I cannot think about some points of objection to this explanation.

(24.VIII.1932) There appears to be one difficulty in connection with the above and that is that, in the graph connecting P' and f , we get the fall in the curve after the jump. This Schafer and Goodall have also noticed and it seems to be just such a group retardation effect as one would get if there were two maxima of ionization. Another difficulty is that for vertical incidence one could hardly expect the two processes of reflection and refraction to differ. I cannot picture the physics of the two processes as I can in the case of oblique reflection and refraction (i.e. non-vertical incidence).

But to return to the theory itself, we might expect the jump to be associated with the effect $p = \frac{1}{\tau}$. This would fit in for as the ionization level rises at night, τ would increase and so p would decrease. E Region would be conductivity reflection, and F Region would be dielectric-refraction. E Region $\nu > p$; F Region $\nu < p$.

NATIONAL COMMITTEES

USA

Announcement of a Special Issue of *Radio Science* on the Propagation of Long Radio Waves

It is planned to have early in 1967 a special issue of *Radio Science* devoted to the subject of the Propagation of Long Radio Waves. Although emphasis will be placed on papers dealing with the terrestrial propagation of ELF, VLF, and LF radio waves, the influence of the ionosphere and earth, and VLF emissions, papers dealing with other relevant topics will be welcome.

Experimental and theoretical workers in these areas are invited to submit manuscripts for consideration to the Editor (D. D. Crombie, Radio Science, Environmental Science Services Administration, Boulder, Colorado 80302) as soon as possible, but before November 30, 1966. The manuscripts should be prepared in accordance with the Instructions to Authors in the current issue of *Radio Science*. To facilitate editorial planning it would be appreciated if prospective authors would submit a short abstract or summary of their paper to the Editor at their earliest convenience.

1966 Fall URSI Meeting

ANNOUNCEMENT AND CALL FOR PAPERS

December 7-9, 1966

Palo Alto, California

The Fall Meeting sponsored by the US National Committee of the International Scientific Radio Union will be held on December 7-9 in conjunction with the International Antenna and Propagation Symposium (December 5-7). A joint meeting on December 7 is to be held at the Cabaña Motor Hotel, 4290 El Camino Real, Palo Alto. The URSI sessions (arranged separa-

tely) will be held at Rickey's Hyatt House Hotel, 4219 El Camino Real, Palo Alto. Papers are solicited in all theoretical, experimental and developmental fields of interest to the following Commissions :

1. Radio Measurement Methods and Standards.
2. Radio Propagation in Non-Ionized Media.
3. Ionospheric Radio.
4. Magnetospheric Radio.
5. Radio and Radar Astronomy.
6. Radio Waves and Transmission of Information.
7. Radio Electronics.

ABSTRACT

Submit titles and 200-word abstracts before 1 *October* 1966 in duplicate to : Prof. R. A. HELLIWELL, Radioscience Laboratory, Stanford University, Stanford, California, 94305.

(Indicate the USNC-URSI Commission (or Commissions — with priority) for which you consider your paper most appropriate).

The meeting will be jointly sponsored by the following related IEEE Groups : Antennas and Propagation, Circuit Theory, Geoscience Electronics, Instrumentation and Measurement, Information Theory, and Microwave Theory and Techniques.

August 1966.

INTER-UNION COMMISSIONS

Inter-Union Commission on Solar and Terrestrial Relationships

Termination

Letter sent to Members of IUCSTR

Dear Colleague,

By decision of the International Council of Scientific Unions (Bombay, January 1966) the IUCSTR is to be terminated in 1966. The Commission's final meetings were held in Belgrade August 25-26, 1966 and will be reported in the Transactions of the IAU.

It is intended that essential functions of the Commission will be taken over by a newly formed Inter-Union Commission on Solar-Terrestrial Physics (IUCSTP, President, Dr. H. Friedman; Acting Secretary, Dr. C. M. Minnis; Secretariat, 6 Cornwall Terrace, London, N. W. 1, UK). This new Commission, in addition to promoting the science of solar-terrestrial physics, will coordinate international symposia in this field and also have charge of activities arising out of IQSY. The IUCSTR Roster of Active Workers, which contains your name, has been sent to the Secretariat of IUCSTP. It may be incorporated into a wider list for circulating IUCSTP affairs.

C. W. ALLEN,
President, IUCSTR.

September 1966.

Inter-Union Commission on Frequency Allocations for Radio Astronomy and Space Science (IUCAF)

Progress Report to ICSU Executive Board meeting

MONTE-CARLO, OCTOBER 7-8, 1966

by R. L. SMITH-ROSE
Secretary General

The last formal meeting of the Commission was held in Rome in December 1966, as reported to ICSU in Bombay.

This Inter-Union Commission has, however, been actively associated with (i) the Plenary Meeting of COSPAR held in Vienna in May 1966; (ii) the Plenary Assembly of the International Committee on Radio Communications (CCIR) in Oslo during June-July 1966; and (iii) the General Assembly of URSI in Munich in September 1966.

Meetings of the members of IUCAF present in Oslo and Munich respectively were held to discuss the steps to be taken to secure additional facilities and protection of frequencies for both radio astronomy and space research.

Special consideration was given to the possibility of using, on a shared basis, the side-bands of the standard frequency channels, as well as to the request for additional frequency allocations made by COSPAR to assist in the advancement of geodetic measurements by radio methods.

With regard to radio astronomy it was agreed that a case should be made for the allocation of a frequency band in the region of 320 Mc/s, in place of the present allocation at 404-410 Mc/s. This would have the advantage of being in approximately harmonic relationship with the bands at about 150, 600 Mc/s and above; and would also facilitate the attempts to locate and study the natural radiation of Deuterium in the band 322-329 Mc/s.

With the identification of several discrete bands of radiation from the OH molecule in space, it is considered that application should be made for an extension of the allocated bandwidth from 5 to 10 Mc/s in the region of the natural frequency band 1664-1668 Mc/s.

On more general grounds the Commission is of the opinion that it is very necessary for radio astronomers and space scientists to establish closer co-operation with their respective national administrations who, as members of the International Telecommunication Union (ITU), are responsible for the world-wide allocation of frequencies to the various radio services.

30th September 1966.

PERMANENT SERVICES

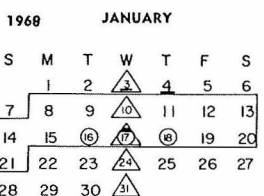
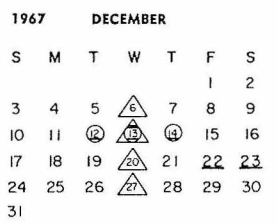
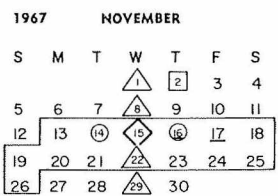
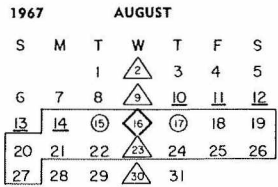
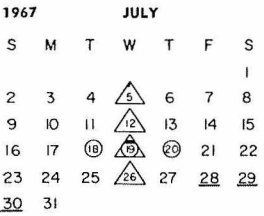
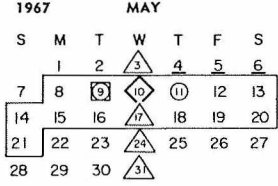
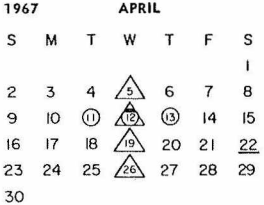
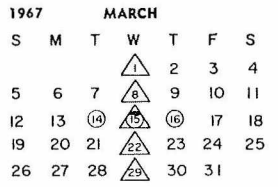
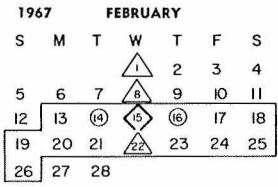
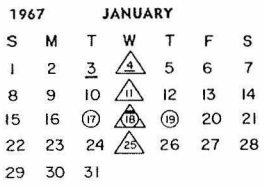
IUWDS International Geophysical Calendar for 1967

Explanations

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 worldwide 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. The Calendar is prepared by the International Ursigram and World Days Service (IUWDS) with the advice of the spokesmen for the various scientific disciplines, especially for the suggested scientific programs recommended to be carried out for the days or intervals marked on the Calendar (see paragraphs 11 to 16 below). In addition it is common practice 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.

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

3. REGULAR GEOPHYSICAL DAYS (RGD) are each Wednesday throughout the year. This weekly sampling schedule is particularly



- ⑰ Regular World Day (RWD)
- ⑨ Day of Solar Eclipse
- ③ Day with unusual meteor shower activity
- ⑬ ⑭ World Geophysical Interval (WGI)
- ⑮ Quarterly World Day (QWD) also a PRWD and RGD
- ⑱ Priority Regular World Day (PRWD)
- △ Regular Geophysical Day (RGD)

TABLE OF WORLD DAYS MARKED ON THE CALENDAR

1967	RWD	PRWD	QWD	RGD	WGI	ECL.	METEORS
Jan.	17, 18, 19	18	—	4, 11, 18, 25	—	—	3-4
Feb.	14, 15, 16	15	15	1, 8, 15, 22	13-26	—	—
Mar.	14, 15, 16	15	—	1, 8, 15, 22, 29	—	—	—
Apr.	11, 12, 13	12	—	5, 12, 19, 26	—	—	22
May	9, 10, 11	10	10	3, 10, 17, 24, 31	8-21	9	4-6
June	13, 14, 15	14	—	7, 14, 21, 28	—	—	6-10
July	18, 19, 20	19	—	5, 12, 19, 26	—	—	28-30
Aug.	15, 16, 17	16	16	2, 9, 16, 23, 30	14-27	—	10-14
Sep.	19, 20, 21	20	—	6, 13, 20, 27	—	—	—
Oct.	17, 18, 19	18	—	4, 11, 18, 25	—	—	20-21
Nov.	14, 15, 16	15	15	1, 8, 15, 22, 29	13-26	2	16-17
Dec.	12, 13, 14	13	—	6, 13, 20, 27	—	—	12-14

SEE OTHER SIDE

designed for the purposes of the meteorological program but has also been adopted for some other geophysical programs.

4. REGULAR WORLD DAYS (RWD) 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 (PRWD) are one day each month—the RWD which are also a RGD (Wednesday). They are for work which can or needs to be done only day one each month throughout the year.

6. QUARTERLY WORLD DAYS (QWD) are one day in each quarter of the year. They are the PRWD which fall within the World Geophysical Intervals (WGI) and are also a RGD (Wednesday). The QWD serve to coordinate seasonal high-altitude rocket experiments.

7. WORLD GEOPHYSICAL INTERVALS (WGI) during 1967 are fourteen consecutive days in each season, beginning on the second Monday of the selected months. They always include the three RWD of the month and the QWD for the season. The WGI are intended for intensified programs at the statistics of seasonal variations or the timing of seasonal changes. The schedule of WGI relative to the equinoxes and solstices is usually made different from year to year; however, the schedule for 1967 is similar to 1966 in order to include the solar eclipse of May 9 within a WGI.

8. SOLAR ECLIPSES are May 9 (partial) observable in North America, Greenland, Iceland, northern Scandinavia, and the north polar regions; and November 2 (total but not central) in a small area in the South Atlantic Ocean just north of Antarctica. Geophysical stations in the eclipse zones and their conjugate areas 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 any standard astronomical ephemeris or yearbook.

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), solar flare (SOFLARE), cosmic ray event (COSMIC EVENT), and sudden and unusual stratospheric warmings (STRATWARM). These Alerts are issued by the IUWDS World Warning Agency or under certain circumstances by one of the solar-geophysical Regional Warning Centers. The meteorological telecommunications network coordinated by WMO carries the worldwide Alerts once daily soon after 0400 UT. 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. Selections of RETROSPECTIVE WORLD INTERVALS, after a delay of a few 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 (USA); DEMPA TOKYO (JAPAN); NIZMIR MOSCOW (USSR); IONOSPHERE DARMSTADT (GFR) or CNETAGI MEUDON (FRANCE). Associate RWC operate in some other localities.

Recommended scientific programs Operational edition

(The following material was reviewed in 1966 by spokesmen for the various scientific disciplines and the 9th Meeting of COSPAR as suitable for coordinated geophysical programs in 1967).

11. METEOROLOGY. — Particular efforts should be made to carry out an intensified program on the RGD—each Wednesday, UT. A desirable goal would be the scheduling of meteorological rocket-sondes, ozone sondes and radiometer sondes on these

days, together with maximum-altitude rawinsonde ascents at both 0000 and 1200 UT.

During WGI and STRATWARM alert intervals, intensified programs are also desirable, preferably by the implementation of RGD-type programs (see above) on Mondays and Fridays, as well as on Wednesdays.

12. 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 will undertake the same program without regard to the 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 micropulsations (with fast chart speeds) are requested to make such records on every RGD—each Wednesday, UT—according to the following schedule : 1967 Jan. 4 from 1800 to 2200 UT; Jan. 11 from 1900 to 2300 UT; Jan. 18 from 2000 to 0000 UT; etc. The observatories are not obliged to send their recordings to the World Data Centers except by special request (see IQSY World Days Manual under Retrospective World Intervals on Micropulsations). (b) Stations which, in addition to other activities, are equipped for making magnetic observations, but which cannot carry out such observations and reductions on a continuous schedule are encouraged to carry out such work at least on RWD (and during times of MAGSTORM Alert).

13. IONOSPHERE. For the vertical incidence sounding program, the summary recommendations are : (a) soundings to be made at five minute intervals or less on RWDs for stations normally making observations every quarter hour or at more frequent intervals; all stations are recommended to make at least quarter hourly observations on RWDs; (b) f-plots are made for high latitude stations and representative stations at lower latitudes for all days (i.e., including RWDs and WGIs); (c) profile parameters h_c , q_c or recommended similar parameters to be determined and sent to WDCs for RWDs for all stations except those undertaking full profile programs or producing monthly median profiles; (d) copies of hourly ionograms with appropriate scales for PRWDs are to be sent to WDCs; (e) stations in the eclipse zone and its conjugate area should take continuous observations on solar eclipse days and special observations on adjacent days in accordance with

detailed recommendations in Ionosphere Manuals. Continuous records of ionospheric parameters are acceptable in place of f-plots at temperate and low latitude stations.

For the ionospheric drifts program, observations are made at least on all RWDs, on all WGIs, on every Wednesday (RGDs) and on every Thursday (day following each RGD). Hourly tabulations for all days mentioned are sent to the WDCs. It is essential that sufficient observations be made to provide representative values of the diurnal variations. Hourly tabulations for this purpose should also be sent to WDCs.

For the ionospheric absorption program, diurnal hourly observations are made at least on all RWDs and hourly tabulations sent to WDCs. Continuous observations on solar eclipse days, where possible, for stations in eclipse zone and its conjugate area. Special efforts should be made to obtain additional absorption measurements at temperate latitude stations during the period of Absorption Winter Anomaly, particularly on days of abnormally high or abnormally low absorption (approximately November-March, Northern Hemisphere; May-September, Southern Hemisphere).

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

For topside soundings experiments, it is recommended to send copies of records to WDCs for all RWDs at least.

For ELF noise measurements involving the earth-ionosphere cavity resonances any special effort should be concentrated during the WGI.

It is recommended that more intensive observations in all programs be considered on days of unusual meteor activity.

14. SOLAR ACTIVITY. — Observatories are invited to issue and send to the WDCs of all 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.

15. COSMIC RAYS, AERONOMY. — Experiments 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.

16. 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 endeavour to launch rockets on the QUARTERLY WORLD DAYS (QWD) since these are also days when there will be maximum support from ground observations.

THE INTERNATIONAL URSIGRAM AND WORLD DAYS SERVICE (IUWDS) is a permanent scientific service of the International Union of Radio Science (URSI), with the participation of the International Astronomical Union and the International Union of Geodesy and Geophysics. IUWDS adheres to the Federation of Astronomical and Geophysical Services of the International Council of Scientific Unions. The IUWDS 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.

This Calendar for 1967 has been drawn up by A. H. Shapley, Chairman, and J. V. Lincoln, Deputy Secretary, of the IUWDS Steering Committee, in close association with the CIG Committee and the Reporters and spokesmen for the various scientific disciplines and COSPAR. Similar Calendars have been issued annually with the IGY, 1957-58, and have been published in various widely available scientific publications.

Additional copies are available upon request to IUWDS, Secretary, Dr. P. Simon, Observatoire, 92 Meudon, France, or Deputy Secretary, Miss J. V. Lincoln, ITSA, Environmental Science Services Administration, Boulder, Colorado, 80302, USA.

Bureau International de l'Heure

Rapport sur les activités de 1966 présenté au Conseil de la FAGS en septembre 1966

Initialement, le rôle du Bureau International de l'Heure était de former la meilleure échelle de Temps Universel (TU) possible, afin d'assigner aux signaux horaires leur heure TU d'émission (heure définitive). L'apparition des étalons atomiques de fréquence

a permis la formation d'une échelle de temps atomique (TA) depuis juillet 1955. En outre, à la suite d'expériences réalisées par l'Observatoire de Greenwich et l'Observatoire Naval de Washington, les divers émetteurs de signaux horaires ont peu à peu adopté une échelle de temps commune en relation mathématique simple avec le Temps Atomique, qui a été appelée le Temps Coordonné (TUC). Le BIH forme ces deux dernières échelles et les compare avec TU.

TEMPS UNIVERSEL

Le Temps Universel publié est d'abord corrigé d'inégalités à courts termes dues au mouvement du pôle et à la variation saisonnière de la rotation de la Terre. D'après les données de 33 stations de latitude, le BIH calcule les coordonnées du pôle et les corrections de longitude et les diffuse sous forme de circulaires mensuelles. La variation saisonnière de TU est extrapolée et diffusée également. Ainsi le TU est régularisé d'une manière homogène par les 43 services horaires participant aux travaux du BIH. La moyenne générale des TU régularisés est le TU2 définitif (TU2 déf) publié par le Bulletin Horaire.

Les méthodes de calcul de TU2 déf reposent essentiellement sur la comparaison des temps de réception des signaux horaires donnés par l'observation astronomique dans les diverses stations. En 1965, la mécanisation des calculs a fait l'objet d'expériences, mais n'a pas été appliquée aux calculs courants.

TEMPS ATOMIQUE

La comparaison à distance des fréquences des étalons atomiques se fait par l'intermédiaire des fréquences-étalons radio-diffusées. Le BIH forme 2 échelles moyennes : A3 reposant sur les laboratoires suivants :

National Physical Laboratory;
Laboratoire Suisse de Recherches Horlogères;
National Bureau of Standards;

et AM, reposant sur tous les étalons dont les observations sont communiquées au BIH (10 étalons à la fin de 1965).

TEMPS COORDONNÉ

Le maintien de l'échelle de TUC a été confié au BIH par les décisions de l'UAI (1964) et du CCIR (1965). Il exige de déterminer au début de chaque année le facteur par lequel il faut décaler le Temps Atomique pour suivre approximativement TU2 puis de fixer les dates de sauts de TUC lorsqu'ils s'avèrent nécessaires. Ces décisions sont prises après consultation des services intéressés et largement diffusées. Le choix du facteur à adopter pour 1966 a été rendu difficile par un ralentissement accentué de la rotation terrestre et il a nécessité un grand échange de correspondance.

La plupart des signaux sont émis dans l'échelle TUC à moins d'une milliseconde près, de sorte que l'interpolation d'une table donnant TU2-TUC suffit généralement pour connaître l'heure TU2 des signaux.

PUBLICATION DU BULLETIN HORAIRE

Le Bulletin Horaire a été modifié en 1965 pour faire apparaître le plus clairement possible les différences entre les 3 échelles de temps mentionnées ci-dessus.

La notion de Temps Coordonné a été introduite au début de 1965 (à partir de l'heure définitive de janvier 1964) et l'on a publié les écarts entre les temps d'émission des signaux et le temps coordonné — écarts de plus en plus petits car peu à peu les services coordonnent plus parfaitement leurs émissions.

La périodicité du Bulletin Horaire et la rapidité de son impression permettent de diffuser des renseignements que les usagers des signaux horaires ont généralement de la peine à obtenir. En 1965 on a entrepris de publier chaque année le tableau des caractéristiques des principaux signaux horaires et tous les deux mois des correctifs à ce tableau. Le Bulletin Horaire récapitule aussi les décalages de fréquence et sauts qui affectent l'échelle de Temps Coordonné.

La régularité des signaux horaires et celle des diverses échelles de temps envisagées permettent de fournir la plupart des données de 5 jours en 5 jours et même de mois en mois pour certaines d'entre elles.

D'autre part, jusqu'en 1964, le BIH publiait en un fascicule séparé l'« heure demi-définitive » des signaux horaires qui résulte des observations astronomiques et des réceptions de signaux

horaires à Paris. Dans l'esprit des nouveaux statuts du BIH, qui sont en préparation, le service horaire de l'Observatoire de Paris ne doit pas jouer de rôle privilégié. Le fascicule de l'« heure demi-définitive » a été remplacé par un encart de 4 pages.

Bien que le Bulletin Horaire donne une information accrue, ces simplifications ont permis de réduire par un facteur 2 à 3 le nombre de pages publiées annuellement.

Le Bulletin Horaire est édité à 600 exemplaires dont 450 sont distribués gratuitement.

RÉORGANISATION DU BIH

Les statuts du BIH, établis en 1919, ne correspondent plus à la situation actuelle. De plus, ils ne répondent pas au statut-type de la Federation of Astronomical and Geophysical Services (FAGS), dont le BIH est un des services permanents. La révision des statuts est en cours. Les traits principaux des nouveaux statuts, dont on ne peut pas encore donner le détail, sont les suivants :

- le directeur du BIH ne sera plus ex-officio le directeur de l'Observatoire de Paris.
- la direction est assurée par le directeur et un conseil de direction.
- les tâches du BIH ont été redéfinies.

B. GUINOT,
Chef des Services.

J. F. DENISSE,
Directeur du BIH.

INTERNATIONAL ASTRONOMICAL UNION

Symposium n° 31 on Radio Astronomy and the Galactic System

ORGANIZED BY THE IAU IN COOPERATION WITH URSI, NOORDWIJK,
NETHERLANDS, 25 AUGUST-1 SEPTEMBER 1966

Report

The Symposium dealt with all aspects of the structure and dynamics of the Galaxy for which radio-astronomical methods have been of importance.

The diversity of these subjects has been shown by the programme previously drafted.

In addition there have been a number of interesting brief communications on quite recent results. Special mention should be made of extensive extra sessions in limited discussion groups on the still quite unsolved problems presented by the observations of OH and on 21-cm line results about the distribution and motion of gas in other galaxies.

The discussions were lively, in particular during the second half of the Symposium.

In my opinion the Symposium in Noordwijk has indicated once more how useful it is to have a limited group of experts discuss intensively during a week all different ways of approach to a given subject. The method chosen for this Symposium, viz. of having invited introductory reports as starting points for the discussions, has, I think, proved to be efficient.

The restricted number of invited participants (85, plus a score of young « observers » and a number of astronomers who attended a few sessions only) made it possible to have profitable discussions during the meetings. Fifteen countries were represented. The observers assisted at the same time with administrative and technical matters.

On the 2nd of September, immediately following the Symposium, a number of the participants went on an excursion to the Northern part of the Netherlands, where they visited the Radio Observatory at Dwingeloo, the site near Westerbork where the new large Synthesis Telescope is being constructed, and the new optical observatory of the University of Groningen at Roden.

The local organizers, in particular Dr. and Mrs. Raimond, have done a most excellent job. Everything has run extremely smoothly.

J. H. OORT.

September 8, 1966.

**INTERNATIONAL COUNCIL
OF SCIENTIFIC UNIONS**

**IV IQSY Assembly and IQSY/COSPAR Joint
Scientific Symposium**

(LONDON, 17-22 JULY 1967)

**VIII COSPAR International Space Science
Symposium**

(LONDON, 24-28 JULY 1967)

First information circular

GENERAL

Both the Special Committee for the International Years of the Quiet Sun (IQSY) and the Committee for Space Research (COSPAR) have accepted invitations from The Royal Society to hold their principal international meetings of 1967 in London. These Meetings are the IV IQSY Assembly and Scientific Symposium on the results of the IQSY, the X COSPAR Meeting, and the VIII International Space Science Symposium.

The Symposium on the IQSY will be an important occasion for reviewing recent investigations of the physics of solar-terrestrial relations, a field of research to which COSPAR has contributed much. In view of this, COSPAR has agreed to hold its 1967 Meetings in conjunction with the IQSY Meetings and also to be a joint sponsor for the Symposium on the IQSY results.

The week 17-22 July will be devoted mainly to the joint IQSY/COSPAR Symposium and to other matters relating to the IQSY. The following week will be devoted mainly to COSPAR Meetings of various kinds and sessions for the presentation of papers relating to topics which are of interest to COSPAR but which lie outside the field to be covered by the joint IQSY/COSPAR Sym-

posium. The X COSPAR Plenary Meeting connected with the VIII International Space, Science Symposium will also be held mainly during the period 22-28 July, but the details of its time schedule and organization will be given later in a COSPAR Information Circular.

LOCATION

All the IQSY and COSPAR meetings mentioned above will be held in the Department of Mechanical Engineering, Imperial College of Science and Technology, Exhibition Road, London, S. W. 7. The College is 3 km (about 10 minutes by the Underground Railway to South Kensington Station) from Piccadilly Circus, and about half this distance from the West London Air Terminal in Cromwell Road.

ACCOMMODATION

Living accommodation for delegates will be available either in the hotels of central London (in which rooms can be booked through the Cooks/Wagons Lits organization which has offices in most countries) or university halls of residence (hostels) which are conveniently situated in relation to the meeting place. The hostel accommodation contains single bedrooms only; the charge per night will be about 45 s. (\$ 6.50) including breakfast and lunch (mid-day), but not dinner (evening).

SCIENTIFIC PROGRAMME. — First week — 17-22 July

During the first week, the primary objective will be the review of scientific results obtained during the IQSY in those disciplines of geophysics in which solar control is an important factor. It is also intended to compare the new information obtained with earlier investigations made during the IGY when solar activity was last at its maximum. The programme of this joint IQSY/COSPAR Symposium is being arranged to permit the consecutive presentation of review papers in all the fields covered by the IQSY. During each 3-hour session, the main review papers will occupy approximately 2 hours; there will be a coffee break of 20 minutes and the remaining 40 minutes will be free for open discussion including the presentation of very brief summaries of recent results.

PROVISIONAL PROGRAMME — FIRST WEEK.

Sunday, 16 July 1967

14.00-20.00 h Registration of Participants

Monday, 17 July

09.00-10.30 h Registration of Participants

10.30-12.00 h Formal Opening Meeting : IV IQSY Assembly and IQSY/COSPAR Symposium

14.30-17.30 h Meteorology (upper atmosphere, ozone, dynamics)

Tuesday, 18 July

09.30-12.30 h The Sun and Its Radiations

14.30-17.30 h Production and Loss Processes in the Ionosphere

evening Public lecture on a scientific subject
Films relating to the IQSY

Wednesday, 19 July

09.30-12.30 h Ionospheric Structure and Synoptic Ionospheric Measurements

afternoon Excursion

Thursday, 20 July

09.30-12.30 h Geomagnetism (including World Magnetic Survey, conjugate point phenomena)
Aeronomy (atmospheric structure, and effects of solar radiation)

14.30-17.30 h Neutral Atmosphere (dynamics, oscillation, waves, etc.)
Airglow

Friday, 21 July

09.30-12.30 h Aurora
The Radiation Belts and the Magnetosphere

14.30-17.30 h Cosmic Radiation (spectra, modulation, anisotropy, etc.)
The Way Ahead in Solar Terrestrial Physics
(this will conclude the joint IQSY/COSPAR Symposium)

Saturday, 22 July

09.30- Meeting of Council for the IQSY

12.30 h Closing Plenary Meeting : IV IQSY Assembly

SCIENTIFIC PROGRAMME. — Second Week — 24-28 July

The COSPAR programme during the second week will be planned during the forthcoming IX COSPAR Plenary Meeting in Vienna; the following outline is therefore tentative and revised details will be circulated later by COSPAR.

The open sessions of the COSPAR Working Groups will be devoted to Latest Significant Results obtained by means of Space Vehicles, Life Sciences and Space Research, etc.

PROVISIONAL COSPAR PROGRAMME — SECOND WEEK

Saturday, 22 and Sunday, 23 July. COSPAR Business Meetings.

Opening session of the COSPAR Plenary Meeting

Monday, 24 July

Business Meetings of COSPAR Working Groups

Tuesday, 25 to Thursday, 27 July. VIII International Space

Science Symposium including Open Sessions of Working Groups.

Friday, 28 July

Other COSPAR activities and Final COSPAR Plenary Meeting.

PUBLICATION OF PROCEEDINGS

The review papers to be presented during the joint IQSY/COSPAR Symposium will be published in special volumes of the *Annals of the IQSY*; these particular volumes will be jointly sponsored by COSPAR and the IQSY Committee. In these volumes, it is intended to include also edited summaries of discussions on the review papers and of any very recent results presented during the Symposium. It must be emphasized that the full texts of such short papers presented by participants should be published in the normal way in the scientific press.

In addition to the above, COSPAR will arrange in the usual way for the publication of papers presented at the VIII International Space Science Symposium.

EXCURSION

Wednesday afternoon, 19 July 1967, has been provisionally reserved for an excursion, details of which will be given in a later information circular.

WEATHER IN LONDON

Typical maximum daytime temperatures in London during July are 20° to 26° C while the minimum night-time temperatures during the same month are 10° to 17° C. As some rain may be expected, it is advisable to bring a light rain coat.

REGISTRATION FORMS AND FEE

It would be of great assistance to the U. K. Organizing Committee, which has been established by the Royal Society, if those who hope to attend the meetings in London would kindly complete the attached preliminary registration form and return it, not later than 1 July 1966, addressed to « IQSY Secretariat (1967), 6 Cornwall Terrace, London, N. W. 1, U. K. ». A second registration form, to be circulated in 1967, will enable participants to confirm their attendance.

The COSPAR Secretariat will distribute, in September 1966, a circular giving further details of the programme during the second week and of other COSPAR activities. This circular will include a form to be completed by those who wish to present papers at the VIII International Space Science Symposium, which will be held after the joint IQSY/COSPAR Symposium.

The Registration Fee for all participants attending either, or both, weeks of the IQSY and COSPAR Meetings will be \$ 10.00 (70 s) payable on registration in London.

29 April 1966.

COSPAR

Information Bulletin

COSPAR has issued the *Information Bulletin* n° 33, October 1966 which contains a Summarized Report of the Ninth Meeting

of COSPAR, Vienna, May 1966, and a review of the symposium on « Interactions between the upper and lower layers of the atmosphere » held previously to the Ninth Meeting.

Committee on Data for Science and Technology

Board

At the first meeting of the Committee, Paris, June 1966, the following were elected :

Chairman : Prof. F. D. ROSSINI.

Vice-Chairmen : Prof. W. KLEMM;
Prof. B. VODAR.

Secretary-Treasurer : Sir Gordon SUTHERLAND.

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Commission III on the Ionosphere.

- « Rocket measurements of electron density profiles in the lower ionosphere by the VLF Doppler method », T. S. JØRGENSEN and E. UNGSTRUP, *Electron Density Profiles in Ionosphere and Exosphere*, Proc. NATO Advanced Study Inst., April 1965.
- « Electron density and collision frequency observations in the lower D-region during auroral absorption », M. JESPERSEN, O. PETERSEN, J. RYBNER, B. BJELLAND, O. HOLT and B. LANDMARK, *Ibid.*, April 1963.
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- « Mesure de l'intermodulation ionosphérique sur deux émetteurs de grande puissance en ondes longues », E. HABERKANT et K. VOLGT, *Revue de l'UER, Cahier A — Technique*, n° 98, août 1966.
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- « Measurement of Ionospheric electron density by a gyro-plasma probe. A rocket experiment by a new impedance probe », *Rep. of Ionosph. and Space Res. in Japan*, Vol. 20, No. 2, 1966.

Commission IV on the Magnetosphere.

- « Morphology of VLF hiss zones and their correlations with particle precipitation events », T. S. JØRGENSEN, *J. Geoph. Res.*, Vol. 71, No. 5, March 1966.
- « Observations of the VLF emission hiss at 8 kc/s in Greenland 1964 », T. S. JØRGENSEN, *Ionosph. Lab. Tech. Univ. Denmark, Lyngby*, Report No. 20, April 1966.
- « On the radio noise level at low and very low frequencies in Polar regions », T. S. JØRGENSEN, *Radio Science*, Vol. 69 D, No. 9, Sept. 1965.

Commission VI on Radio Waves and Circuits.

- « Non-linear Alfvén waves in Vlasov plasma », T. F. BELL, *The Physics of Fluids*, Vol. 8, No. 10, Oct. 1965.

International Geophysical Year.

- Annals : Volume XXXIII has been issued, and is devoted to « Results of Ionospheric drift observations obtained during IGY and IGC 1959 ». Those results have been compiled by K. Rawer.
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