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SOME FUNDAMENTAL CONSIDERATIONS CONCERNING ICSU AND THE UNIONS

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1. — Introduction

The organisation of URSI has been under discussion for several years and some of the other Unions, as well as ICSU itself, are also considering how their objectives and structure could be modified so as to make them more appropriate to present-day needs.

Those of us who are closely concerned with the reorganisation of a particular Union can not avoid being preoccupied with many questions of detail, sometimes of a superficial character. As a result insufficient attention is sometimes given to more fundamental considerations concerning the functions of ICSU and of the Unions in general.

Such considerations should be used to provide guidelines for action and the purpose of this article is to offer some personal opinions on them.

2. — Objectives of the Unions

The customary formulation of the objectives of a Union is the following :

(1) to promote the advancement of the scientific field;

(2) to promote international cooperation in research;

(3) to promote the exchange of ideas and information on an international scale.

Although this formulation is a laudatory one, it is insufficient as a justification for a Union or as a definition of its purpose. All these objectives can be served, in some sense, by professional societies in which membership is available on an individual, personal basis. The IEEE, for example, although it is based in the USA, is developing a strong and significant international membership. It is certainly as effective as any International Union, and possibly even more so, in fulfilling objectives (1) and (3) as stated above. The argument that the Unions are concerned with science while the IEEE is concerned with engineering is not only false but is based on an outmoded view of science which is no longer appropriate and is certainly not conducive to the fulfillment of our objectives.

There is another component of human affairs that gives the Unions a special justification for their existence. We frequently indulge in the idealistic cliché that science is apolitical and is not concerned with national identities and national interests. In an ultimate abstract sense this is perhaps true. But, as a human activity, the pursuit of science or any other branch of knowledge is strongly conditioned by national interests and political forces of tremendous dimensions. This has become particularly significant with the advent of large-scale national commitments to, and investments in, research and development in every field of science and technology. Scientists and engineers and the work they do have become national commodities in a very decisive way. We can not, purely on our own initiative, link up readily and easily with anyone anywhere in the world in order to carry out a collaborative project, or even to exchange information regarding our work. Collaboration becomes even more difficult when experiments require simultaneous participation by workers in a number of countries and when equipment must be standardised or be moved across national frontiers.

The International Unions, by virtue of the fact that their members are bodies designated by the national academies of science, or their equivalents, can serve as intermediaries between the interests of individual scientists and of political bodies. In addition, the Academies are not themselves governmental agencies and hence, in their relations with the Unions, they can maintain an apolitical posture. But also, by virtue of the fact that the Academies are bodies that have an accepted status in relation to their governments, their support of agreements and recommendations entered into by the Unions are accepted more readily by governments. Thus the Unions can deal more effectively than can the professional societies with the political constraints that arise in the course of international cooperation and collaboration in research. This is not to say that scientific affairs can not, or could not, be conducted differently; I am merely describing the situation as I see it.

The singular rôle of an International Union that I have just identified is understandable in fields such as geophysics, geography, communications, climatology and meteorology; in all these, there are important phenomena of such a scale of magnitude that it is necessary to cross national boundaries when investigating them. In the field of communications, there may also be the inverse problem of how to keep electromagnetic waves from crossing national boundaries and from interfering with the communication systems of neighboring countries.

What is less clear, or at least is not immediately evident, is the place of the Unions in fields such as mathematics, physics, chemistry, circuit theory, electronics, and so on. International congresses and meetings on such topics can certainly be organised, under many auspices, so as to serve objectives (1) and (3); in these fields, objective (2) is not particularly pertinent because, in the main, the work hardly demands international cooperation and collaboration. But here also, an International Union can serve a special purpose : by giving its support to an international symposium, it can help to lower the political barriers to the exchange of information and can often facilitate the attendance, at international meetings, of persons from the countries whose Academies adhere to it.

There is yet another service that a Union can render. As a general rule, neither international nor national meetings are designed to make a critical assessment of the "state of the art" in a given field. Meetings of professional societies are most commonly set up so that members of the societies can present their latest work. The character and structure of a meeting varies from one organisation to another and it is not possible to make an absolute characterisation of meetings of professional societies. But, whatever the subject, I think that there is a place and a need for critical appraisals and distillations of the vast number of developments made in a given field around the world, and for the identification of those lines of endeavor that are most interesting and promising. To accomplish this, we need an international forum which scientists of as many nationalities as possible will support and accept. This critical forum is what a Union can provide and its realisation ought to be, in my opinion, one of a Union's most important objectives and functions.

Of course there are many other aspects of a science or a technology whose proper consideration, under the auspices of an International Union, facilitates the exchange of ideas and the advancement of the field. Among them are terminology, systems of units, primary and secondary standards, and procedures for calibration; on all of these aspects, common understanding and international agreement are certainly desirable, if not absolutely essential. In these areas too, an International Union can and should function effectively.

Besides the Unions there are other international scientific and technical organisations, of a semi- or wholly-governmental nature, that deal with practical issues underlying international agreements regarding technological operations. Cases in point are the CCIR and the other components of the ITU. The CCIR directs itself to making engineering analyses of problems relating to radiocommunication systems and it submits these analyses and the consequent recommendations to the ITU which is the organisation in the framework of which intergovernmental agreements are made. These agreements relate to operational problems and issues such as the protection of specified frequency bands for scientific purposes, the allocation of frequencies among the various types of communication systems in different parts of the world, and the setting of limitations on the power and directivity of transmitters so as to avoid interference across national boundaries. Naturally such activities sometimes call for objective scientific studies, and supporting data, that are internationally acceptable and the Unions are often capable of providing advice and information of this kind. Some of us have made considerable efforts, on behalf of URSI, to provide such a service to CCIR and it is a fact that the Union has done a very much needed job and has given valuable assistance to the CCIR in fulfilling its particular responsibilities.

Lastly I suggest that a Union can and should perform an educational function in bringing science and technology to the notice of all the peoples of the earth. While this is explicitly the duty of UNESCO, the Unions should both participate in and give support to the programmes of UNESCO and should help to marshal the capabilities and abilities of those who can assist in these programmes. The URSI Young Scientists Scheme in connection with the XVI General Assembly in Ottawa was motivated largely, so far as I was concerned, by such considerations.

3. — The Rôle of the Individual Scientist

The membership of the ICSU family now includes not only the Unions and the Inter-Union Commissions, but also Scientific and Special Committees which are directly responsible to ICSU. From time to time there are differences of opinion between some of the members, but it is difficult to see just how these can arise in organisations that serve the objectives and perform the functions set out in the foregoing section.

The problem lies, of course, in the fact that the work must be done by individuals, no matter what the institutional or organisation framework may be. In the various ICSU organisations, the national academies exercise their rôle through their accredited members in these bodies. It is very easy for individuals who are preoccupied with their science and their personal interests to forget their rôle as representatives, and to assume that they hold personal membership in the organisations. This is particularly true after they have served in the organisation for many years and when their rôle as representatives was not made clear to them in the first place. Certainly in my own case, the understanding of my position and my responsibilities in URSI, both as a member of the US National Committee and as delegate to the General Assemblies, evolved over quite a number of years. On the other hand, the rôle of an elected officer in an international body is quite another matter and is separable, in principle certainly, from his rôle and responsibilities as a representative of his national academy.

Many of us have lost sight of this special feature of the Unions, etc. and have tended to treat them as professional societies. When service to an organisation comes to represent a significant segment of the professional life of a scientist, it is a natural step for him to give too much attention to particular personal interests at the expense of the broader objectives and functions of the organisation. In these circumstances, the competitive postures of individuals in several organisations can easily lead to a situation where it appears that the organisations themselves are in conflict with each other.

4. — The Interdependence of Scientific Disciplines

In addition to the peculiarities of human behavior from which none of us is free, there is a more fundamental problem which arises from the interdependence of virtually all the sciences. There is truly no way to define areas of scientific endeavor that are absolutely unrelated and are completely separable from each other. Even the often-made distinction between "pure" and "applied" science is a delusion because what one mind discovers in the spirit of pure research, another more versatile and imaginative mind puts to use for a technological development in another field of science. What determines whether a given topic is the primary concern of one organisation or of another is the vigor with which the topic is pursued by those associated with the different organisations.

The early development of ionospheric and magnetospheric research in URSI is attributable to the fact that radio scientists, in studying the propagation of electromagnetic waves, were forced to investigate the different media through which they passed. During the years when radio waves provided the only means of probing the upper atmosphere and the influence of the geomagnetic field on it, URSI was the principal forum for discussing the ionosphere and the magnetosphere. In these fields, and in radioastronomy also, radio wave propagation became transformed, from being the center of interest, into a special tool for research.

5. — The International Council of Scientific Unions

The fundamental difficulties associated with the partitioning of science were recognised many years ago when numerous international scientific bodies came together in an "umbrella" organisation which evolved into the present-day International Council of Scientific Unions.

During the period when I served as the URSI representative in ICSU, several aspects of the organisation puzzled me. Although ICSU's title refers only to the Unions, it has an extensive roll of national members. Since both the Unions and National Members have close links with the academies, there appears to be, in effect, a duplication of membership in many cases.

The Executive Committee of ICSU is made up of representatives of all the Unions and of about the same number of national academies. In consequence it is an unwieldy body and is less effective than it ought to be.

In effect, ICSU is another Union, but its subject area is less clearly defined than that which is characteristic of a Union. It seems unfortunate that, in ICSU, no substantive discussions have taken place in recent years on the interrelationships between the Unions and on the important questions of their scientific areas and their programmes of activity.

Recently the possible involvement of ICSU in the subject of the social effects of science has been under consideration. It is difficult here to define the fundamental issue and, in any case, ICSU itself is not in a position to take any effective action. ICSU could perform a service by organising a multi-disciplinary group which might be expected to make a meaningful contribution to this difficult area. Unfortunately the scientific disciplines covered by ICSU alone are not sufficiently representative to deal adequately with social problems involving human relationships. The study of the important question of the misuses of science and technology demands the collaboration of workers in the behavioral sciences, the physical and natural sciences, engineers, historians and philosophers.

6. — The ICSU Family

The shortcomings of ICSU are often replicated in its Committees and in the Inter-Union Commissions established by the Unions. An Inter-Union Commission should be what its name implies; it should not have a membership over and above that representing the participating Unions. In particular, it should not have a body of national members; in order to avoid conflicts of opinion, national influences on its activities should be exercised through the parent Unions which provide the normal channels.

If there are compelling reasons for having direct national membership, this should be achieved by establishing the appropriate type of ICSU Committee, and not under the auspices of the Unions.

I feel strongly that all the Committees set up by ICSU and also the Inter-Union Commissions should be terminated automatically after a period agreed upon in advance by the appropriate parent body. This rule need not completely preclude renewal and reconstitution but, if applied, it would at least insure a review and reconsideration of the scientific problems and needs, and of the purposes of the organisation.

I have advocated the same principle for the Commissions of URSI because, after a number of years, the Commissions increasingly assume the rôle of permanency and the Union tends to become a collection of independent scientific units rather than an integrated scientific body. How we identify the subdivisions of radio science will vary from time to time; when this ceases to be so, we shall indeed be working in a dead field.

7. — Conclusion

In our discussions on the various issues that have been raised in this article, I hope that we shall all try to bring to them the rational objective approach that we presumably use in our research.

WORLD ADMINISTRATIVE RADIO CONFERENCE 1971 DECISIONS AFFECTING RADIO ASTRONOMY

Editor's Note. — The following report has recently been circulated by the Inter-Union Commission for Frequency Allocations for Radio Astronomy and Space Science (Ref. IUCAF/180). It has been prepared by Dr. F. Horner, a member of IUCAF.

The World Administrative Radio Conference for Space Telecommunications, held in Geneva from 7 June to 17 July 1971, included a review of regulations affecting radio astronomy. Many proposals had been made for changes to radio astronomy frequency allocations, and many of these had been co-ordinated among several countries, partly through the activities of IUCAF. In the event, not all the proposals were accepted by the Conference, but significant improvements to radio astronomy allocations were obtained in a number of frequency bands. On the other hand, the increasing use of satellites for various purposes will result in transmissions from which no protection can be gained from inteference, if it occurs, by siting radio astronomy observatories in remote regions, apart possibly from the polar regions which cannot be irradiated by a geostationary satellite.

The revised allocations for radio astronomy are shown in Appendix 1, which should be read in conjunction with the footnotes in Appendix 2. The following notes give some additional background information.

Starting with the lowest frequencies, it will be noted that the permissive use of the standard frequency guard bands for radio astronomy has been discontinued by deletion of footnote 204. These bands have been found not to be free from transmissions, and furthermore are rather narrow for useful radio astronomy. However, a useful exclusive band near 22 MHz has been gained, and a Recommendation has been adopted (see Appendix 3) which it is hoped will pave the way for a possible allocation near 10 MHz in the future.

Proposals to up-grade part of the allocation 37.75-38.25 MHz to primary status were not accepted. There is now a primary allocation (shared) at 150.05-153 MHz in Region 1, but the practical effects of this will not differ greatly from those of the previous footnote.

The footnote allocation for observations of the deuterium band at 327 MHz was the subject of much argument. Proposals to permit transmissions from satellites in a wide band, extending from 235 MHz upwards through the deuterium band, endangered valuable radio astronomy observations at the bottom end of this band which have been found possible in some countries even though there is no allocation. They were also a threat to observations near 327 MHz, a band to which India has attached considerable importance, but which is not usable in many other countries. Suggestions to prohibit transmissions from satellites in both these bands were not well supported. A compromise was achieved by not allocating the band 235-240 MHz for satellite use, and by making the band 322-328.6 MHz a primary allocation in India. (New footnote 310A). It remains to be seen what the practical effect of these decisions will be. The allocation at 322-328.6 MHz is now considered most useful for continuum measurements; although the possibility of detecting the deuterium line cannot be ruled out, it is unlikely to be detected in circumstances which will involve Doppler shifts which would need a 7 MHz bandwidth. The reference to deuterium has therefore been deleted (see modified footnote 310).

No other important changes have been made in other allocations below 1 GHz, except that the allocations around 408 MHz have been strengthened and brought into line in the three Regions. There is now a shared primary allocation backed up by a footnote (233B). The availability of the band at 610 MHz in most areas now seems assured for several years to come.

The downward extension of the hydrogen band at 1,400 MHz, on a shared basis (new footnote 349A), has been made to cater for the large Doppler shifts in emissions from the more remote sources.

Protection for observations on OH lines has been improved considerably. Meteorological satellite allocations have been deleted in the band 1,660-1,670 MHz, and while it was not possible to remove another potential source of interference—transmissions from balloons in the meteorological aids service—a new footnote (353A) advocates the removal of these as soon as possible from the band 1,664.4-1,668.4 MHz. Protection for other OH lines at 1,612 and 1,720 MHz is advocated in a new footnote 352K.

It is apparent that substantial increases in the bands for continuum measurements in some frequency ranges can be obtained only by sharing with other services. On this basis, for example, footnote references to the need for wider bands at 2.7 and 5 GHz have been agreed (footnotes 364G, 364H, 382B) and a shared primary allocation has been made to widen the band at 10 GHz. The allocation of 2,670-2,690 MHz on a shared basis may be nullified by the inclusion of these frequencies in new allocations for the broadcasting satellite service. It is to be hoped that the frequencies will be used only for transmissions in the earth-to-space direction. Of even greater significance is the fact that out-of-band energy from satellite broadcasting transmissions in frequencies extending up to 2,690 MHz could cause interference in the band 2,690-2,700 MHz which is allocated exclusively to radio astronomy. It was clear that the broadcasting service was unable to guarantee that such interference could be kept within limits approaching those recommended by the CCIR, even if radio astronomy aerials are not pointed directly at the satellite, or to agree to a guard band of several MHz. In view of the great scientific importance of this band, and the consequent large investment in equipment being made by radio astronomers for observations therein, the consequences of the broadcasting allocation will need to be studied closely.

The radio astronomy band at 19 GHz has been relinquished to permit more efficient planning of this part of the spectrum for other services. In exchange, a wider band has been allocated at 24 GHz, and observations of the water vapour line at 22 GHz have received recognition.

Above 40 GHz, three bands have been allocated, shared with space research, but with no transmissions allowed.

The need for observations on emission and absorption lines has been appreciated. Although it is clearly impracticable to protect all the increasing number of lines which have been detected, the allocations now cover, either in footnotes or in continuum bands, the following lines above 4 GHz :

Formaldehyde	4.829 GHz	(Footnote 382A)
Excited hydrogen	5.763 GHz	(Footnote 391A)
Formaldehyde	14.489 GHz	(Footnote 408C)
Water vapour	22.235 GHz	(Footnote 410A)
Ammonia	23.7 GHz	
Excited hydrogen	36.466 GHz	(Footnote 391A)
Hydrogen cyanide ...	86.3 GHz and 88.6 GHz	
Carbon monoxide....	115.271 GHz	(Footnote 412K)

Many radio astronomers have expressed the hope that the usage of frequencies above the ionosphere and on the shielded area of the Moon shall be planned in such a way that radio astronomy can be carried out with wide bandwidths in these regions without risk of interference from transmissions. The designation of specific frequency bands for radio astronomy at this stage was not accepted, but it was considered that the CCIR should conduct technical studies of the frequency ranges which would be suitable. The relevant recommendation is reproduced in Appendix 4. The general Recommendation No. 11 relating to the protection of the radio astronomy service (Appendix 5) has been retained.

Appendix 1

Frequency Allocations for Radio Astronomy

21.85-21.87 MHz.

World-wide exclusive allocation, subject to the provisions of a new footnote 221C.

36.65-36.85 MHz.
41.15-41.35 MHz.
45.65-45.85 MHz.

Allocations have been made in Argentina and Uruguay, according to a new footnote 233A.

Comment.

These allocations are a consequence of a desire to prevent radio transmissions in these bands which could cause interference to television reception through the generation of beat frequencies with the sound and vision carriers.

37.75-38.25 MHz.

Secondary allocation. (No change).

73-74.6 MHz.

Exclusive allocation in Region 2, subject to footnotes 253A and 253B. (No change).

79.75-80.25 MHz.

Footnote allocation in Regions 1 and 3, except in certain countries. (Footnote 261).

150.05-153 MHz.

Shared primary allocation with fixed and mobile services in Region 1, except for the provisions of footnotes 285, 286 (modified) and 286A.

Comment.

The allocation in the table replaces the previous footnote provision.

170.55-170.95 MHz.

Allocations have been made in Argentina and Uruguay according to a new footnote 233A.

Comment.

For reasons, see under 36.65-36.85 MHz.

322-328.6 MHz.

Shared primary allocation in India. (Footnote 310A).
Elsewhere, footnote mention (310 modified).

Comment.

The modification to footnote 310 recognises the fact that there is more interest in this band for continuum measurements than for possible observations of the deuterium line.

406.1-410 MHz.

Primary allocation shared with fixed and mobile.

Comment.

Aeronautical mobile is excluded. The table allocation replaces footnote 317 which is suppressed. The band 406-406.1 has been allocated for low power radio-beacons for emergency position-finding.

602-614 MHz.

Parts of this band are allocated in different regions according to footnotes 330A, 325A, 329A and 332.

1,350-1,400 MHz.

The need for observations in this band of the Doppler-shifted hydrogen line is noted in a new footnote 349A.

1,400-1,427 MHz.

World-wide exclusive allocation. (No change).

1,611.5-1,612.5 MHz.

The need to protect observations of an OH line in this band is noted in a new footnote 352K.

1,660-1,670 MHz.

Primary allocation shared with meteorological aids, with a modified footnote 353A encouraging the removal of meteorological aids from the band 1,664.4-1,668.4 MHz.

Comment.

Certain countries use the band 1,660-1,690 MHz for radio astronomy according to footnote 354. Certain countries also use the band 1,660-1,670 MHz for fixed and mobile services according to footnotes 354A (modified) and 354B.

1,720-1,721 MHz.

The need to protect observations of an OH line in this band is noted in a new footnote 352K.

2,670-2,690 MHz.

The needs of the radio astronomy service in this band are noted in a new footnote 364G.

Comment.

The broadcasting satellite service may also use this band, by agreement, under a new footnote 361B. Transmissions from satellites will be incompatible with footnote 364G in the same regions of the world.

2,690-2,700 MHz.

World-wide exclusive allocation, subject to footnotes 363, 364A (modified) and 364B. (No significant change).

Comment.

Out-of-band energy from broadcast transmitters in satellites using frequencies just below 2,690 MHz are a potential source of interference in this exclusive band. The need to avoid such interference is noted in a new footnote 364H. The need to avoid interference from services sharing this band is noted in modified footnote 365.

3,165-3,195 MHz.
4,800-4,810 MHz.

The use of these bands for radio astronomy in certain countries is noted in footnote 354.

4,825-4,835 MHz.

The need to protect observations of a formaldehyde line in this band is noted in a new footnote 382A.

4,950-4,990 MHz.

The needs of radio astronomy in this band are noted in a new footnote 382B.

4990-

4,900-5,000 MHz.

Primary allocation, exclusive in Region 2 and shared with fixed and mobile in Regions 1 and 3. (No change).

5,750-5,770 MHz.

The need to protect radio astronomy in this band in some countries is stressed in a new footnote 391A.

Comment.
This band contains a line of excited hydrogen.

5,800-5,815 MHz.
8,680-8,700 MHz.

Tue use of these bands for radio astronomy in certain countries is noted in footnote 354.

10.60-10.68 GHz.

New primary allocation, shared with fixed and mobile, except in F.R. of Germany where radio astronomy is secondary. (New footnote 404A).

10.68-10.70 GHz.

World-wide exclusive allocation except in countries listed in footnote 405B.

Comment.
Footnote 405A is suppressed.

14.485-14.515 GHz.

The need to protect observations of a formaldehyde line in this band is noted in a new footnote 408C.

15.35-15.40 GHz.

World-wide exclusive allocation, except in certain countries when the band is shared (footnote 409C). (No change).

22.21-22.26 GHz.

Allocated to radio astronomy, shared with fixed and mobile, for observations on a water-vapour line (new footnote 410A).

23.6-24.0 GHz.

World-wide exclusive allocation, except in certain countries where it is shared with fixed and mobile (see modified footnote 407).

Comment.
This allocation replaces the previous allocation of 19.3-19.4 GHz which has been suppressed.

31.2-31.3 GHz.

The use of this band for radio astronomy in some countries is noted in a new footnote 412HA.

31.3-31.5 GHz.

World-wide exclusive allocation, except in certain countries where it is shared with fixed and mobile (see footnote 412A).

33.0-33.4 GHz.

Primary allocation in Region 1, shared with radio navigation. Also allocated on a shared basis in some countries in other Regions (see footnote 412F).

33.4-34.0 GHz.

Allocated to radio astronomy on a shared basis in certain countries listed in footnote 412G.

36.458-36.488 GHz.

The need to protect radio astronomy observations in this band in some countries is stressed in a new footnote 391A.

Comment.

This band contains a line of excited hydrogen.

36.5-37.5 GHz.

Allocated to radio astronomy on a shared basis in certain countries listed in footnote 412E.

86-92 GHz.

New primary allocation, shared with space research (passive).

Comment.

All transmissions are prohibited (see new footnote 412I). The band contains hydrogen cyanide lines.

115.16-115.38 GHz.

The need to protect observations of a carbon monoxide line in this band is noted in a new footnote 412J.

130-140 GHz.

New primary allocation, shared with space research (passive). See footnote 412I.

230-240 GHz.

New primary allocation, shared with space research (passive). See footnote 412I.

APPENDIX 2

FOOTNOTES RELATING TO THE RADIO ASTRONOMY SERVICE

204 *(Suppressed).* — The standard frequency guard-bands at 2.5 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz and 25 MHz may be used by the radio astronomy service. The radio astronomy service shall be protected from harmful interference from services operating in other bands in accordance with the provisions of these Regulations, only to the extent that these services are protected from each other.

221B *(New).* — In Bulgaria, Hungary, Poland, Roumania, Czechoslovakia and the USSR the band 21,850-21,870 kHz is also allocated to the aeronautical fixed and the aeronautical mobile (R) services. The administrations concerned will take all practicable steps to protect radio astronomy observations from harmful interference.

233A *(New).* — In Argentina and Uruguay the bands 36.65 to 36.85 MHz, 41.15 to 41.35 MHz and 45.65 to 45.85 MHz, and in Argentina, Brazil and Uruguay the band 170.55 to 170.95 MHz, are allocated to the radio astronomy service and no assignments shall be made to the fixed and mobile services in these bands.

233B *(New).* — In making assignments to stations of other services to which this band is allocated, administrations are urged to take all practicable steps to protect radio astronomy observations from harmful interference.

253A. — In Region 2, fixed, mobile and broadcasting service operations previously authorized in the band 73-74.6 MHz may continue to operate on a non-interference basis to the radio astronomy service.

253B. — In Cuba, the band 73-74.6 MHz is also allocated to the fixed, mobile and broadcasting services.

261. — The band 79.75-80.25 MHz is also allocated in Regions 1 and 3 (except Korea, India and Japan) to the radio astronomy service. In making assignments to stations of other services to which this band is allocated, administrations are urged to take all practicable steps to protect radio astronomy observations from harmful interference. The radio astronomy service shall be protected from harmful interference from services operating in other bands in accordance with the provisions of these Regulations, only to the extent that these services are protected from each other.

285. — In Rhodesia and Nyasaland, and the Rep. of South Africa and Territory of South-West Africa, the bands 146-149.9 MHz and 150.05-174 MHz are also allocated to the aeronautical mobile service.

286A. — In the United Kingdom, the band 150.05-151 MHz is allocated to the radio astronomy service, and the band 151-153 MHz is allocated to the radio astronomy service on a primary basis and to the meteorological aids service on a secondary basis; however, in this band the provisions of No. 274 apply.

310 *(Modified).* — Radio astronomy observations in the band 322-328.6 MHz are carried out in a number of countries under national arrangements. Administrations should bear in mind the needs of the radio astronomy service in using this band.

310A *(New).* — In India, the band 322-328.6 MHz is also allocated to the radio astronomy service.

329A *(New).* — In Argentina and Uruguay, the band 602-608 MHz is allocated to the radio astronomy service.

330B *(New).* — In India, the band 608-614 MHz is also allocated to the radio astronomy service.

330A. — In the African Broadcasting Area, the band 606-614 MHz is allocated to the radio astronomy service.

332. — In Region 1, except the African Broadcasting Area, the band 606-614 MHz, and in Region 3, the band 610-614 MHz may be used by the radio astronomy service. Administrations shall avoid using the band concerned for the broadcasting service as long as possible, and thereafter, as far as practicable, shall avoid the use of such effective radiated powers as will cause harmful interference to radio astronomy observations.

In Region 2, the band 608-614 MHz is reserved exclusively for the radio astronomy service until the first Administrative Radio Conference after 1 January, 1974 which is competent to review this provision; however, this provision does not apply to Cuba.

330.1. — For the purposes of this Regulation the term "African Broadcasting Area" means :

(*a*) African countries, parts of countries, territories and groups of territories situated between the parallels 40° South and 30° North.

(*b*) Islands in the Indian Ocean west of meridian 60° East, situated between the parallel 40° South and the great circle arc joining the points 45° East, 11°30' North and 60° East, 15° North.

(*c*) Islands in the Atlantic Ocean east of Line B defined in No. 131 of these Regulations, situated between the parallels 40° South and 30° North.

349A *(New)*. — Radio astronomical observations on the Hydrogen line displaced towards lower frequencies are carried out in a number of countries under national arrangements. Administrations should bear in mind the needs of the radio astronomy service in their future planning of the band 1,350-1,400 MHz.

352K *(New)*. — Radio astronomy observations on important spectral lines due to the hydroxyl radicle OH at frequencies 1,612.231 MHz and 1,720.530 MHz are carried out in a number of countries under national arrangements; the bands observed being 1,611.5-1,612.5 MHz and 1,720-1,721 MHz respectively. Administrations should bear in mind the needs of radio astronomy service in their future planning of the bands 1,558.5-1,636.5 MHz and 1,710-1,770 MHz.

353A *(Modified)*. — In view of the successful detection of two hydroxyl spectral lines in the regions of 1,665 MHz and 1,667 MHz by astronomers, administrations are urged to give all practicable protection in the band 1,660-1,670 MHz for future research in radio astronomy particularly by eliminating air-to-ground transmissions in the meteorological aids service in the band 1,664.4-1,668.4 MHz as soon as practicable.

354. — In Albania, Bulgaria, Hungary, Poland, Roumania, Czechoslovakia and the USSR, the bands 1,660-1,690 MHz, 3,165-3,195 MHz, 4,800-4,810 MHz, 5,800-5.815 MHz and 8,680-8,700 MHz are also used for radio astronomy observations.

354A *(Modified)*. — In Bulgaria, Cuba, Ethiopia, Hungary, Israel, Jordan, Kenya, Kuwait, Lebanon, Uganda, Pakistan, Poland, the United Arab Republic, Roumania, Syria, Tanzania, Czechoslovakia, the USSR, and Yugoslavia, the bands 1,600-1,670 MHz and 1,690-1,700 MHz are also allocated to the fixed service and the mobile, except aeronautical mobile, service.

354B. — In Australia, Cyprus, Spain, Ethiopia, Indonesia, Israel, New Zealand, Portugal, the Spanish Provinces in Africa, the United Kingdom, Sweden and Switzerland, the band 1,660-1,670 MHz is also allocated, on a secondary basis, to the fixed service, and the mobile, except aeronautical mobile, service.

361B *(New)*. — The use of the band 2,500-2,690 MHz by the broadcasting-satellite service is limited to domestic and regional systems for community reception and such use is subject to agreement among administrations concerned and those having services operating in accordance with the Table, which may be affected (see Resolutions Nos. Spa F and Spa G).

The power flux density at the surface of the earth shall not exceed those given in Nos. 470NH-470NK.

363. — In the F.R. of Germany, the band 2,550-2,690 MHz is allocated to the fixed service; and the band 2,690-2,700 MHz is also allocated to the fixed service.

364A *(Modified)*. — In Bulgaria, Cuba, Hungary, India, Israel, Kuwait, Lebanon, Morocco, Pakistan, the Philippines, Poland, the United Arab Republic, Roumania, Czechoslovakia, the USSR, and Yugoslavia, the band 2,690-2,700 MHz is also allocated to the fixed and mobile services.

364G *(New)*. — Radio astronomy observations are being carried out in the band 2,670-2,690 MHz in a number of countries under national arrangements. Administrations should bear in mind the needs of the radio astronomy service in their future planning of this band.

364H *(New)*. — In the design of systems in the broadcasting-satellite service, administrations are urged to take all necessary steps to protect the radio astronomy service in the band 2,690-2,700 MHz.

382A *(New)*. — Radio astronomy observations on the formaldehyde line (rest frequency 4,829.649 MHz) are being carried out in a number of countries under national arrangements. Administrations should bear in mind the needs of the radio astronomy service in their future planning of the band 4,825-4,835 MHz.

382B *(New)*. — Radio astronomy observations are being carried out in the band 4,950-4,990 MHz in a number of countries under national arrangements. Administrations should bear in mind the needs of the radio astronomy service in their future planning of this band.

391A *(New)*. — Radio astronomy observations are being carried out in the bands 5,750-5,770 MHz and 36.458-36.488 GHz in a number of countries under national arrangements. Administrations are urged to take all practicable steps to protect radio astronomy observations in these bands from harmful interference.

404A *(New)*. — In the F.R. of Germany, in the band 10.6-10.68 GHz, the Radio Astronomy Service is a secondary service.

405A *(Suppressed)*. — In Australia and the United Kingdom, the band 10.68-10.7 GHz is also allocated, on a secondary basis, to the radiolocation service.

405B. — In Algeria, Bulgaria, Cuba, Hungary, Japan, Kuwait, Lebanon, Pakistan, Poland, the United Arab Republic, Yugoslavia, Roumania, Czechoslovakia and the USSR, the band 10.68-10.7 GHz is also allocated to the fixed and mobile services.

407 *(Modified)*. — In Albania, Bulgaria, Hungary, Poland, Roumania, Czechoslovakia and the USSR, the bands 13.25-13.5 GHz, 14.175-14.3 GHz, 15.4-17.7 GHz, 23.6-24 GHz, 24.05-24.25 GHz and 33.4-36 GHz are also allocated to the fixed and mobile services.

408C *(New)*. — Radio astronomy observations on the formaldehyde line (rest frequency 14.489 GHz) are being carried out in a number of countries under national arrangements. In making assignments to stations in the fixed and mobile services, administrations are urged to take all practicable steps to protect radio astronomy observations from harmful interference in the band 14.485-14.515 GHz.

409C. — In Algeria, Bulgaria, Cuba, Hungary, Kuwait, Lebanon, Morocco, Pakistan, Poland, the United Arab Republic, Yugoslavia, Roumania, Czechoslovakia and the USSR, the band 15.35-15.4 GHz is also allocated to the fixed and mobile services.

410A *(New)*. — The band 22.21-22.26 GHz is also allocated to the radio astronomy service for observations of a spectral line due to water vapour (rest frequency 22.235 GHz). Administrations are urged to give all practicable protection in this band for future research in radio astronomy.

412A. — In Bulgaria, Cuba, Hungary, Poland, the United Arab Republic, Roumania, Czechoslovakia and the USSR, the band 31.3-31.5 GHz is also allocated to the fixed and mobile services.

412E. — In Bulgaria, Cuba, Hungary, Poland, Yugoslavia, Roumania, Czechoslovakia and the USSR, the band 36.5-37.5 GHz is also allocated to the radio astronomy service.

412F. — In Cuba and India, the band 33-33.4 GHz is also allocated to the radio astronomy service.

412G. — In Bulgaria, Cuba, Hungary, Poland, Yugoslavia, Roumania, Czechoslovakia and the USSR, the band 33.4-34 GHz is also allocated to the radio astronomy service.

412I *(New)*. — Radio astronomy observations in the band 31.2-31.3 GHz are carried out in a number of countries under national arrangements. Administrations are urged to take all practicable steps to protect radio astronomy observations from harmful interference.

412J *(New)*. — All emissions in this band are prohibited. The use of passive sensors by other services is also authorized.

412K *(New)*. — Radio astronomy observations on the carbon monoxide line at 115.271 GHz are carried out in a number of countries under national arrangements. In making assignments to other services in the Table, administrations should bear in mind the need to protect radio astronomy observations from harmful interference in the band 115.16-115.38 GHz.

APPENDIX 3

RECOMMENDATION No. SPA KK

Relating to the Future Provision of a Band near 10 MHz for the Radio Astronomy Service

The World Administrative Radio Conference for Space Telecommunications, Geneva, 1971,

considering

(a) the requirements of the radio astronomy service, as expressed by the Inter-Union Commission on Frequency Allocations for Radio Astronomy and Space Science (IUCAF), for a frequency allocation near 10 MHz;

(b) that the use of the standard frequency guard bands has not satisfied the needs of the radio astronomy service at a frequency near 10 MHz;

(c) that propagation conditions at a frequency near 10 MHz are such that a transmitter operating anywhere on the Earth might cause interference to the radio astronomy

service and as a consequence an exclusive world-wide allocation is necessary for long-term observations;

(*d*) that successful radio astronomical measurements have, at times, been made at frequencies near 10 MHz;

(*e*) that IUCAF is co-ordinating the needs of radio astronomers for frequency allocations;

recommends

1. that administrations keep under review the possibility of releasing a band of frequencies 50 kHz wide for the use of the radio astronomy service between 10 MHz and 15 MHz;

2. that administrations give close attention to any future recommendation of the IUCAF concerning the specific frequency band between 10 MHz and 15 MHz required by the radio astronomy service;

3. that a future World Administrative Radio Conference consider granting to the radio astronomy service an exclusive allocation in this region of the spectrum.

APPENDIX 4

RECOMMENDATION No. SPA JJ

Relating to the Protection of Radio Astronomy Observations on the Shielded Area of the Moon

The World Administrative Radio Conference for Space Telecommunications, Geneva, 1971,

considering

(*a*) that radio astronomy observations at frequencies below the ionospheric critical frequencies and above 100 GHz are hampered or prevented by absorption in the Earth's atmosphere;

(*b*) that successful radio astronomy observations require complete freedom from harmful interference;

(*c*) that the shielded area of the Moon offers unique opportunities for observations which are not affected by such absorption;

(*d*) that the shielded area of the Moon appears to be the potentially most useful area accessible to man which is completely free from interference from terrestrial transmissions;

(*e*) that the shielded area of the Moon refers to the area of the Moon which is more than 23.2° beyond the mean limb of the Moon as seen from the centre of the Earth;

(*f*) that the transmissions by radio of data from observation stations to collection points will be in the bands allocated for this purpose;

noting

the desirability of maintaining the shielded area of the Moon as an area of maximum value for observations by the radio astronomy service and by passive space research and consequently as free as possible from transmissions;

recommends

1. that the CCIR study the frequency bands most suitable for radio astronomy observations on the shielded area of the Moon and work out recommendations concerning these bands as well as criteria for their application and protection;

2. that in the meantime, administrations, in accordance with the intent of this Recommendation, take all practicable steps to ensure that there will be no interference to radio astronomy observations on the shielded area of the Moon; and

3. that administrations apply such Recommendations as may be provided on this matter by the CCIR pending the convening of the next World Administrative Radio Conference.

APPENDIX 5

RECOMMENDATION No. SPA 11

Relating to the Radio Astronomy Service

The Extraordinary Administrative Radio Conference, Geneva, 1963,

considering

(*a*) that by definitions 74, 75 and 75A in Article 1 of the Radio Regulations, 1959, Radio Astronomy is a service using reception only;

(*b*) that research in Radio Astronomy is conducted with the use of receiving equipment of the highest attainable sensitivity;

(*c*) that at the Extraordinary Administrative Radio Conference, Geneva, 1963, considerable recognition was given to the needs of the Radio Astronomy service;

(*d*) that in addition to the exclusive allocation of one band on a world-wide basis, some administrations have been able to provide exclusive frequency allocations for Radio Astronomy in some other bands;

(*e*) that the greatest practicable protection from interference is essential to the advancement of the science of Radio Astronomy;

recommends

1. that the next Ordinary Administrative Radio Conference should give further consideration to the provision of improved frequency allocations for Radio Astronomy;

2. that in the meantime, administrations should afford all practicable protection to the frequencies now allocated to Radio Astronomy on a shared basis with other radio services.

REGISTRATION OF FREQUENCIES FOR RADIO ASTRONOMY

The Inter-Union Commission on Frequency Allocations for Radio Astronomy and Space Science has recently prepared a list of frequencies in use at many of the radioastronomical observatories throughout the world (Ref. Doc. IUCAF/179). Most of these frequencies have been communicated by the respective national administrations to the International Frequency Registration Board in Geneva for formal registration.

Some of the frequencies registered are outside the bands allocated to radioastronomy and no protection can be given to them. IUCAF points out that registration of such frequencies should be contemplated only if there is some very compelling scientific reason for using them.

Frequencies used for radioastronomy, and reported to IUCAF up to 31 July 1971, have been received from the following countries : Australia, Brazil, Canada, France, German Democratic Republic, Federal Republic of Germany, India, Italy, Japan, Netherlands, Norway, Poland, Sweden, United Kingdom, USA. IUCAF is anxious to receive report from any other countries engaged in radioastronomy, including information on frequencies that are unsuitable for registration by IFRB.

IUCAF has drawn attention to the availability of the standard frequency guardbands for radioastronomical observations. These are 5 and 10 MHz (±5 kHz); 15, 20 and 25 MHz (±10 kHz). Reports of interference in these bands should be addressed to the appropriate national administration of the country in which the observatory is situated and also to the Secretary General of IUCAF :

Dr. R. L. Smith-Rose,
21 Tumblewood Road,
Banstead, Surrey,
United Kingdom.

Dr. Smith-Rose will welcome comments from radioastronomers on any matters concerning the use and protection of frequencies for scientific observations.

SYSTÈME TUC : MODIFICATIONS AU 1re JANVIER 1972

Note de la rédaction. — Voir *Bulletin d'Information de l'URSI*, N° 179, p. 17.

En accord avec la Recommandation 460 du CCIR (New Delhi, 1970), la Recommandation 1 de la Commission 31 de l'UAI (Brighton, 1970) et le Rapport 517 du CCIR (Genève, 1971), le Bureau International de l'Heure annonce que :

1. Le 1er janvier 1972, un saut de temps négatif de —0,1077577 s sera appliqué au système TUC, dans les conditions suivantes. Le saut de temps aura lieu quand la date sera :

   1971, Déc. 31, 23 h 59 m 60 s, 1077577, ancien TUC,

   de sorte qu'à cet instant la date deviendra

   1972, Jan. 1, 0 h 0 m 0 s (exactement) nouveau TUC.

2. Le décalage de fréquence du TUC actuellement en usage (-300×10^{-10}) sera supprimé à l'instant du saut de temps ci-dessus.

Commentaires et Notes

a) *Date des événements au voisinage du saut de temps et de fréquence.* — Les règles de l'Annexe I du Rapport 517 du CCIR s'appliquent.

b) *Termes du second ordre du décalage de fréquence.* — On en a tenu compte en supposant que dans la relation

$$\text{TA(BIH)} - \text{TUC} = 4{,}213170 \text{ s} + (\text{J.J.} - 2439126{,}5) \times 0{,}02592 \text{ s j}^{-1}$$

le numéro du jour julien est calculé en jours atomiques depuis 1958, Janvier 1, date à laquelle le temps atomique était approximativement en coïncidence avec TU. Si J.J. est exprimé en jours de TU, la différence est de 0,3 μs.

c) *L'approximation de TUC* conservée par les laboratoires et désignée par TUC(i) (Recommandation 457 du CCIR (New Delhi, 1970)) peut être mise en accord avec TUC par extrapolation des TUC-TUC(i) publiés dans les Circulaires D du BIH.

d) *La valeur de DTU 1* à utiliser à partir du 1er janvier 1972 sera communiquée en temps utile aux organisations dont la liste figure aux pages 78 et 79 du Rapport Annuel du BIH pour 1970.

e) *La date d'apparition d'une seconde intercalaire* sera donnée 8 semaines à l'avance aux mêmes organisations qu'en (*d*) et de plus à des organisations internationales (ICSU, CCIR, CIPM, UAI, UGGI, UIT, URSI), aux organismes nationaux adhérant à l'ICSU (ou correspondants nationaux de l'ICSU).

UTC SYSTEM : MODIFICATIONS 1 JANUARY 1972

Editor's Note. — See *URSI Information Bulletin*, No. 179, p. 17.

According to the CCIR Recommendation 460 (New Delhi, 1970), to the IAU Recommendation 1 of Commission 31 (Brighton, 1970) and to the CCIR Report 517 (Geneva, 1971), the Bureau International de l'Heure gives notice that :

1. On the 1st of January 1972, a negative time step of —0.1077577 s will be applied to UTC, under the following conditions. The time step will occur when the date will be :

   1971, Dec. 31, 23 h 59 m 60 s. 1077577, old UTC.

   so that at this instant the date will become

   1972, Jan. 1, 0 h 0 m 0 s (exactly), new UTC.

2. Frequency offset of the presently used UTC (-300×10^{-10}) will be eliminated at the instant of the above time-step.

Comments and Notes

(*a*) *Dating the events in the vicinity of the time step and frequency step.* — The rules of Annex I to CCIR Report 517 apply.

(*b*) *Second order terms of the frequency offset* were taken into account by assuming that in the relationship

$$AT(BIH) - UTC = 4{,}213170\ \text{s} + (\text{J.D.} - 2439126.5) \times 0{,}002592\ \text{s}\ \text{d}^{-1}$$

the julian day number is computed in atomic days since 1958, January 1st, when the atomic time was approximately in coincidence with UT. When J.D. is expressed in universal time days, the difference amounts to 0.3 μs.

(*c*) *The approximation of UTC* kept by the laboratories and designated by UTC(i) (CCIR Recommendation 457 (New Delhi, 1970)) might be put in agreement with UTC by the extrapolation of UTC-UTC(i) published in the BIH Circular D.

(*d*) *The value of DUT 1* to be used from the 1st of January 1972, will be sent in due time to the organizations listed on pages 78 and 79 of the BIH Annual Report for 1970.

(*e*) *The date of occurrence of a leap second* will be given 8 weeks in advance to the same organizations as in (*d*) and, in addition to some international organizations (IAU, ICSU, CCIR, CIPM, UGGI, UIT, URSI), to the National adhering Organizations and National Correspondents to ICSU.

ADOPTION OF THE NEW UTC DEFINITION

The following information on the adoption of the new definition of UTC is contained in BIH circular D 60 (3 November 1971).

(*a*) UTC(USNO) and UTC(NBS) (as well as time signals associated to these time scales) will be retarded by 107600 μs at the end of this calendar year in order to coordinate them more closely with the new UTC.

(*b*) The CHU time signals will indicate DUT 1, in accordance with the CCIR code, by splitting second markers.

(*c*) The time signals of USSR will follow the new UTC and the CCIR code for DUT 1. Furthermore they will give an additional information dUT 1 specifying more precisely the difference UT 1-UTC down to multiples of 0.02 s, the total value of the correction being DUT 1 + dUT 1. Positive values of dUT 1 will be transmitted by the marking of p second markers within the range between the 21st and 24th second so that dUT 1 $= +0.02\ \text{s} \times p$. Negative values of dUT 1 will be transmitted by the marking of q second markers within the range between the 31st and the 34th second, so that dUT 1 $= -0.02\ \text{s} \times q$.

International Geophysical Calendar for 1972

(See other side for information on the use of this Calendar)

JANUARY

S	M	T	W	T	F	S
						1
2	[3	[4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

FEBRUARY

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29				

MARCH

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12*	13*	14*	15*	16*	17*	18*
19	20	21	22	23	24	25
26	27	28	29	30	31	

APRIL

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	[21	[22
23	24	25	26	27	28	29
30						

MAY

S	M	T	W	T	F	S
	1	2	3	[4]	[5]	[6]
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

JUNE

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	[8]*	[9]*	[10]*
[11]*	[12]*	13*	14*	15	16	17
18	19	20	21	22	[23]	[24]
25	26	27	28	29	30	

JULY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26]	[27]	[28]	[29]
[30]	31]					

AUGUST

S	M	T	W	T	F	S
		1]	2	3	4	5
6	7	8	9	[10	[11	[12
[13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

SEPTEMBER

S	M	T	W	T	F	S
					1	2
3	4*	5*	6*	7*	8*	9*
10*	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

OCTOBER

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	[20]	[21]
22	23	24	25	26	27	28
29	30	31				

NOVEMBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	[16]	[17]	18
19	20	21	22	23	24	25
26	27	28	29	30		

DECEMBER

S	M	T	W	T	F	S
					1	2*
3*	4]*	5]*	6]*	7*	8*	9
10	11	[12]	[13]	[14]	15	16
17	18	19	20	21	[22	23
24	25	26	27	28	29	30
31						

1973 JANUARY

S	M	T	W	T	F	S
	1	2	[3]	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

(18) Regular World Day (RWD)

(16) Priority Regular World Day (PRWD)

◇19 Quarterly World Day (QWD) also a PRWD and RGD

6 Regular Geophysical Day (RGD)

10 Day of Solar Eclipse

* Micropulsation Interval Day

10 11 World Geophysical Interval (WGI)

[3 Day with unusual meteor shower activity, Northern Hemisphere

4] Day with unusual meteor shower activity, Southern Hemisphere

12 13 Airglow and Aurora Period

Notes: D-region Winter Anomaly Program planned Jan. 15 – Feb. 15, 1972.
Atmospheric Electricity Intensification Interval of Ten Year Program is Jan. 26 – Feb. 25, 1972.
Campaign for Integrated Observation of Solar Flares (CINOF) planned 5-10, 12-17 and 19-24 June 1972.
International Hydrological Decade Field Year continues through Sept. 30, 1972.

OPERATIONAL EDITION, SEPTEMBER 1971

SEE OTHER SIDE

INTERNATIONAL GEOPHYSICAL CALENDAR : 1972

The operational edition of the 1972 Calendar has been prepared by IUWDS and issued in September 1971. Copies have been widely distributed. Additional copies are obtainable from :

Dr. P. Simon, IUWDS Secretary, Ursigrammes Observatoire, 92 - Meudon, France.	or	Miss J. V. Lincoln, IUWDS Deputy Secretary, WDC-A Upper Atmosphere Geophysics NOAA, Boulder, Colorado 80302, USA.

The Calendar itself is reproduced in this Bulletin. On the back, there are explanations of the types of observational activity appropriate to the various days and intervals, and recommended scientific programmes of observation in different branches of geophysical and astronomical research. A general description of such observational programmes, by A. H. Shapley, was published in *URSI Inf. Bull.*, No. 177, pp. 13-17.

URSI-STP COMMITTEE
MINUTES OF THIRD MEETING : JULY 1971

The third meeting of the URSI-STP Committee was held at the URSI Secretariat, Brussels, on 27-28 July 1971, and was attended by the following members and observers :

Prof. W. J. G. Beynon (Chairman)
Dr. K. Bibl
Mr. G. M. Brown (Secretary)
Mr. W. R. Piggott
Prof. K. Rawer
Prof. R. Rivault
Mr. A. H. Shapley

Dr. E. Harnischmacher
Miss J. V. Lincoln
Dr. C. M. Minnis (URSI)
Dr. J. Oksman
Dr. G. Pillet
Dr. S. Taagholt
Dr. T. Turunen

The Chairman referred to the recent illness of Professor M. Karabin (Yugoslavia) and Professor R. W. H. Wright (Jamaica) and it was agreed that Dr. Minnis should send to both the best wishes of all present for a speedy recovery.

1. — Ionospheric Vertical Soundings

1.1 — *Ionospheric Network Advisory Group.*

Mr. W. R. Piggott reported on the activities of INAG since its inception in Ottawa (1969). No formal meeting of the whole group has been held, but much work has been done by correspondence and ad hoc meetings. It is hoped that all INAG members will be in Warsaw in 1972; to this end, the URSI-STP Committee urges member committees to include INAG members in their national delegations to the XVII General Assembly of URSI.

It was agreed that a USSR specialist in high-latitude studies be invited to replace Dr. G. A. M. King, who has resigned from the Group, and that the question of representation from the southern hemisphere, along with other modest changes of membership, should be agreed by Mr. Piggott in consultation with Prof. Beynon.

Eight numbers of the *INAG Bulletin* have been issued. Thanks were expressed to Mr. A. H. Shapley and the WDC-A organization for funding the production and distribution of the first six issues; beginning with Bulletin No. 4 the printing costs are supported by a grant from URSI. The Bulletins have been well received : the value of direct mailing to stations was emphasised. Although selective translations into French and Russian have been made available through the kindness of Drs Pillet and Mednikova respectively, the Committee draws attention to the continuing need for this service and to the desirability of a translation into Spanish.

It was agreed that problems related to sporadic-E ionization would be dealt with by INAG and that Mr. Piggott would make contact with Dr. E. K. Smith on this matter. In view of this, the suggested appointment of a separate Es consultant (item 8(*b*) of previous Minutes) was considered unnecessary. It was also agreed that the *INAG Bulletin* could be usefully used for the dissemination of information in associated fields (e.g. ionospheric absorption, drifts) at the discretion of the relevant consultant.

1.2. — *Vertical Soundings Network.*

At present about 140 stations contribute to the world ionosonde network, and intermittent ad hoc measurements (e.g. support for rocket experiments) are made at a further 10-15 stations. Thus, although there was an initial decline in the number of stations from the IQSY total of 155 ± 5, there has been a slow recovery. It is, however, anticipated that there will be a slow decrease in the number of active stations over the next few years. Measurements are restricted to F-region parameters and foEs at some 20 stations within the network.

Data flow continues to be rather irregular. Increasing numbers of stations are converting to computerisation of data presentation. It was noted that this change has tended to result in the cessation of publication of station booklets of data, a move which is to be deprecated since it will inevitably reduce the use made of data and will introduce selectivity of stations for many workers who use only the data they receive. The importance was stressed of maintaining reasonable data exchange in modern form when conventional station booklets are withdrawn. It was felt that perhaps a lead could be given in this matter by the USA and USSR through WDCs A and B respectively.

The morale at network stations has improved enormously over the last year, partly due to the visits of experts to stations in Africa and South America, and partly to the circulation of the *INAG Bulletin*. The main weakness at stations at present is in the training of operators and staff for analysis.

Prof. Beynon reported that, in response to an enquiry, it was evident that there was little enthusiasm for a second meeting of network operators, in 1970/71, along the lines of the previous meeting held in January 1969 (see item 3.1 of previous Minutes). It was agreed that a statement be inserted in the *INAG Bulletin* to enquire whether there is a need for such a meeting in association with the next URSI Assembly in Warsaw.

1.3. — *Visits to Stations.*

Following the previous recommendations of URSI and CCIR, visits of vertical incidence experts to two areas were sponsored by UNESCO. Dr. G. M. Pillet made contact with some 13 stations in Africa in January-February 1970, and subsequently Mr. W. R. Piggott visited or saw representatives of 15 stations in South America. Full reports of both these visits will be published soon by UNESCO; some points which emerged are summarized below.

Problems arise where stations are operated by non-scientists, or by persons not themselves interested in the data produced. In general, stations work well where they are manned by the organizations responsible for their operation. There is frequently no natural use of the data locally, partly through ignorance of what could be done. Many stations have no access even to standard journals, in addition to which there are serious language problems in some areas. It is imperative to stress, through literature citations, reference lists, etc., the overall importance and use made of the ionospheric data obtained. It was agreed that the need for maintaining the African network should be emphasised at the forthcoming Equatorial Aeronomy Conference.

In general, the standard of ionosonde maintenance was satisfactory. In some cases considerable ingenuity in electronic adaptation had maintained equipment in operation. Instruction in ionogram interpretation was, however, often lacking; a central training school where analysis staff could discuss their own records would be the best solution to this problem. In some cases, also, there were long delays in the manual handling of data. Data Centres are urged to help as much as they can to obtain missing data from stations; e.g. they could perhaps agree to accept the original data sheets direct. Ultimately, it may be necessary to consider central coordination of the activities of the network by an international organization.

1.4. — *High Latitude Problems.*

A very successful seminar on the interpretation and reduction of high-latitude ionograms was held in Leningrad in May 1970. INAG has also discussed the matter at a meeting immediately preceding this URSI-STP Committee in Brussels, and a further meeting to finalise the international rules will be held in Warsaw in 1972. It was agreed that any changes of the rules should be endorsed by Commission III at that time. It is proposed subsequently to issue a high-latitude supplement to the Handbook of Ionogram Interpretation.

1.5. — *IF2 Index.*

On the request of CCIR, the desirability of adding more stations to those employed in deriving this index was investigated by INAG. It has been agreed that as from 1 January 1971 three southern hemisphere stations (Johannesburg, Mundaring, Port Stanley) and one northern (Moscow) be added to the list of contributors.

1.6. — *Parameter fxI.*

A recent sample survey shows that this new Spread index is regularly measured at about one third of the stations, with nearly complete coverage at high and low latitudes. This response is considered very good. The attention of scientists is drawn to a growing need for an investigation of the interpretation of this parameter.

1.7. — *Electron Density Profiles.*

Systematic determination of electron density profiles is carried out at less than 10 % of stations, while 25 % of stations still measure the parameter hpF2. Very few stations measure hc and qc systematically. For CCIR purposes there is a need to devise a quick and simple procedure for the determination of an estimate of the height of the maximum density of the F2 layer. It was agreed that this matter be referred to INAG (see also Section 5.).

1.8. — *Monthly-Median Ionospheric Data.*

Mr. A. H. Shapley reported that a major effort had been made to reduce the delays of publication in the "Ionospheric Data" series of monthly-median vertical soundings data, and he invited comments on the present form of these booklets, e.g. content of data, method of presentation, usefulness of graphs, etc. Any views should be sent direct to Mr. Shapley.

2. — Reports from other Working Groups

2.1. — *Ionospheric Drifts.*

In view of the illness of Prof. R. W. H. Wright, no report was available on the activities of the Working Group. Following a discussion it was agreed that it would be desirable to hold a meeting on the methods of analysis employed in the spaced-antenna technique, with emphasis on the interpretation of data; the Chairman undertook to arrange this, possibly in association with the Warsaw Assembly. The possibility would be examined of a prior circulation of sample fading records to those participating, so that the results of different methods of analysis of the same records could be discussed at the meeting. It was suggested that the following should be approached, in addition to the members of the Drifts Working Group : K. Bibl, E. Harnischmacher, A. Haubert, A. D. Maude, R. G. Rastogi, J. W. Wright.

2.2. — *Whistler Observations of the Magnetosphere.*

Prof. R. Rivault presented an interim report on behalf of the Chairman of the Working Group. Synoptic and continuous recording programmes, lasting about one month, have been organised between stations or groups of stations at conjugate points, during periods coinciding with high VLF activity or with other types of observations (e.g. solar eclipse observations, balloon measurements of electric fields and X-rays, geomagnetic measurements, etc.). A programme involving a considerable number of stations is planned for July 1972. Reduction of records is a long process, and so far few results are available on a global scale. The coordinated programme of September 1968 has demonstrated considerable complexity in the location of the plasmapause. In addition to these studies, observations of the temporal variation of whistler dispersion can lead to estimates of electron-density profiles and magnetospheric convection.

2.3. — *Digital Data Pre-processing.*

The Working Group met in Leningrad in May 1970; the minutes of this meeting have been published in the *URSI Information Bulletin,* No. 178 (March 1971), pp. 51-62. Development of devices capable of producing on-line ionograms in real time for monitoring the ionosphere is proceeding. Dr. K. Bibl reported that his group had produced a "digi-ionosonde" having a performance comparable to that of conventional instruments; with attachments, it was also adaptable for work on drifts and on the computation of absorption. The average power is low. It was learned that Mr. J. W. Wright had developed an instrument known as a "dynasonde" along different lines, chiefly for use in special experiments.

Digitisation is not complete until, in addition to the production of ionograms, the data are processed and other parameters generated. The format of digital data has to be decided, but it is difficult to propose an international standard while different techniques are in use. It was agreed that Dr. Bibl should send a questionnaire to the members of the Working Group seeking information on specific points and details of the activity of any other workers in this field. It was also agreed that Dr. A. D. Maude (Aberystwyth) and Mr. J. W. Wright (Boulder) be invited to join the Working Group.

2.4. — *Radio Science Data Centres.*

This Working Group operates as part of IUCSTP W.G.1 concerned with the whole solar terrestrial physics field. The current Guide to Data Exchange has been published in STP Notes No. 6; it will be updated in a year's time. The amount of data automatically transferred to WDCs has been reduced, but information is collected on the availability of other data at individual institutions, and if necessary the WDC system can act as a supply channel for such data. Mr. A. H. Shapley invited comments on the Guide or on the operation of the WDC system; also on suggestions regarding other types of radio data (e.g. propagation data per se, radio meteorological data, etc.). WDC Catalogues are of great value to stations and, in particular, the producers of WDC-A Catalogue were thanked for a most informative document. The Special Reports of WDC-A have also been much appreciated by stations.

The flow of data to WDCs continues to be slow; it takes 2 to 3 years for 90 % of data to be received. This creates a problem, since most requests by users are for fairly recent data. The WDCs are being used by increasing numbers of workers.

3. — Publications

3.1. — *Atlas of Ionograms.*

The new Atlas of Ionograms, edited by A. H. Shapley, was published in May 1970 as UAG Report No. 10 issued under the auspices of WDC-A. In addition to the large number of ionograms illustrated for individual seasons and times, the Atlas includes station lists, details of ionosondes, and examples of ionogram sequences illustrating various special phenomena. The Committee wishes to place on record its thanks to Mr. Shapley and his colleagues for undertaking this work.

3.2. — *Revised Ionogram Handbook.*

Prof. Rawer and Mr. Piggott reported that the text of the revised Handbook was nearly complete, apart from some details. It will be published by WDC-A as a UAG Report (in the style of the Atlas) before the Warsaw Assembly. The need for speeding publication was stressed. The scaling of high-latitude ionograms will be discussed in a Supplement to be issued later.

It is essential to translate the Handbook into French, Spanish and Russian, and it was agreed to invite URSI to encourage the preparation of such translations. The Chairman was requested to take the necessary action. Mr. Shapley offered the services of WDC-A for the printing of any such translations, but it was appreciated that WDC-B would probably wish to undertake the production of the Russian version.

3.3. — *Absorption Manual.*

Prof. Rawer reported that this would be published before the Warsaw Assembly, again as a UAG Report issued by WDC-A. There have been a few changes in authorship since the original list of contributors, but all papers are now to hand. Dr. Minnis agreed to edit the English where necessary.

3.4. — *International Reference Ionosphere.*

Progress reports on the status of the IRI were published by Prof. Rawer in URSI Information Bulletin No. 179 (June 1971), pp. 18-28 and No. 180 (September 1971), p. 25. Good progress has been made with the assembling of bottom-side electron density data, although some problems remain to be decided, particularly for the lower ionosphere. For electron temperature data, it is necessary to rely almost entirely on incoherent scatter observations, which are not conclusive at heights above about 800 km. Ion composition is reliably determined by mass spectrometry for individual constituents, but difficulties arise in intercomparisons between ions. It is recognized that the first edition of the IRI will necessarily be tentative; it is hoped to publish preliminary tables giving data for three locations by the end of this year.

4. — IUCSTP Matters

Prof. Beynon reported briefly on the recent meeting of the IUCSTP Bureau at Seattle. It is understood that a meeting of the full Commission will be held in January 1972, probably in London, to review the 12 projets and consider future plans; this will be followed by a general meeting of IUCSTP with national representatives early in 1973. Unions will be invited to send representatives to the 1972 meeting, and the Secretary General of URSI will initiate correspondence with Commission Chairmen to urge their attendance.

Mr. Shapley outlined the new MONSEE programme (Monitoring of the Sun-Earth Environment) which was approved by the IUCSTP Bureau at its Leningrad meeting in May 1970 on the initiation of IUCSTP W.G.1. Information on this programme has been widely distributed, and some details are in STP Notes No. 8, pp. 31-35. It is intended to be a federation of existing programmes of monitoring, with IUCSTP W.G.1 taking a coordinating rôle, in continuation of the monitoring programme after the

IASY. Since publication of the programme, various problems and misunderstandings have arisen, some of which were outlined by the Secretary General. Mr. Shapley gave the assurance that MONSEE was not an organization but a programme, and that there was no intention of superseding any existing international coordinating activities (such as those of the URSI-STP Committee). It had recently been agreed to reconstitute the membership of IUCSTP W.G.1 to include all ICSU bodies likely to be interested in MONSEE. In this connection, Prof. Rawer as Chairman of Commission III had requested the URSI-STP Committee to nominate an URSI representative to IUCSTP W.G.1, and it was agreed that Mr. W. R. Piggott be appointed. URSI representatives from other Commissions might be appointed later if this seemed essential.

In parallel with the inauguration of MONSEE, the IUCSTP Bureau has engaged in exploratory discussions with the WMO and a Joint IUCSTP-WMO Exploratory Committee on Solar-Terrestrial Monitoring has been set up to examine the possibilities of cooperation in this field. Only part of the present monitoring programme is designed to meet purely scientific needs; the requirements of more practical applications are becoming increasingly important and it has been suggested that intergovernmental participation may be desirable in the future. Mr. Piggott thought that, in the long term, ionospheric sounding stations concerned with routine observations would welcome some governmental support.

Mr. Piggott reported on a decision made at the recent Upper Atmosphere Working Group of SCAR that, in future, advice on geophysical research programmes would be sought through approaches to the Unions. In the case of ionospheric work this would clearly be the concern of URSI. It was, however, felt that the overall coordination of research programmes in the solar-terrestrial physics area at all latitudes should be dealt with by IUCSTP.

5. — Commission III Resolutions

Two resolutions of Commission III at the Ottawa Assembly were referred specifically to the URSI-STP Committee.

Resolution III.9 recommends the encouragement and maintenance of cooperative studies of D-region phenomena. The implications of this resolution were not clear. It is known that cooperative studies of mesospheric electron densities are being made in Canada, and coordinated studies of the winter anomaly in ionospheric absorption and related phenomena are currently being pursued by various groups. IUCSTP W.G. 11 is actively surveying the ion chemistry of the D (and E) regions, and W.G. 12 is coordinating studies of SIDs. The Chairman of Commission III agreed that no further action on Resolution III.9 was necessary.

Resolution III.12 on long-distance propagation in the ionosphere recommends that the attention of the Committee be drawn to the importance of obtaining data about the height of both the bottom and the peak of the F layer. It was understood that this Resolution was designed to provide better information concerning the calculation of MUF factors for the F2 layer and that such information was required by CCIR in connection with the prediction of MUF (for example, Study Programme 9A/6 in CCIR XII Plenary Assembly 1970, Vol. II, Part 2, p. 251). It was suggested that the needs of CCIR would be covered more satisfactorily by the representative electron-density profiles which will be published in due course in the International Reference Ionosphere.

6. — Future of the Committee

In view of possible reorganization of URSI, some thought will have to be given to the future of the URSI-STP Committee. Some members made the point that continuity is very valuable, and the Working Groups of the Committee might not find it satisfactory to be attached to individual Commissions with their changing Chairmen and members. The Committee, through its various stages as URSI-IGY, URSI-CIG(IQSY), and URSI-STP has been very successful, and a model of the response of a Union to special efforts. The Chairman will assemble the views of members and the matter will be discussed at the Warsaw Assembly.

Geoffrey M. Brown,
Secretary.

SATELLITE RADIO BEACONS

General Information

The following information has been extracted from a circular letter dated 21 September distributed by Dr. K. Davies, NOAA, Boulder, Colorado 80302, USA.

1. The provisional date of launch of the beacon satellite ATS-F is May 1973. After about 12 months in the Western Hemisphere it will be relocated at longitude 34° E (*not* 15° E) in May 1974. It will be visible at an angle of elevation exceeding 30° over the African continent, southern Europe, the Black and Caspian Seas, Arabia, Iran, and most of India and Pakistan.

2. Anyone in this region who is interested in recording the radio signals is invited to make contact with Dr. G. Hartmann, Max-Planck-Institut für Aeronomie, 3411 Lindau/Harz, Federal Republic of Germany, who is organising an observational programme, at Lindau, covering the frequency band 40-360 MHz. He is also investigating (with NASA) the possibility of observations of signals in the 1-4 GHz using the transponders in ATS-F and would be glad to hear from those interested in receiving them.

3. NASA has approved a beacon for ATS-G, almost identical with that in ATS-F, which is due to be launched in 1975.

SYMPOSIUM 1972

A Symposium on the Future Application of Satellite Beacon Measurements will be held in Graz, Austria, from 22-26 May 1972. The dates have been selected so that participants can attend the Symposium and also the Annual COSPAR Meeting in Madrid (29 May - 2 June). The following topics, at least, will be discussed in Graz :

1. Study of ionospheric and tropospheric inhomogeneities; scintillations.
2. Measurements of exospheric electron content by combining measurements of group delay on ATS-F signals and dispersive Doppler data of NNSS signals at 150 MHz/400 MHz.
3. Travelling ionospheric disturbances and other dynamic phenomena.
4. Receiving equipment for existing and future satellite beacons.
5. Standardisation and interchange of data, experiments in data processing.

Further suggestions for topics and all enquiries concerning the Symposium should be sent to :

Dr. R. Leitinger,
Institut für Meteorologie und Geophysik,
Universität, A - 8010 Graz, Austria.

COSPAR Panel 1B has recently formed a Working Party on Satellite Beacon Activities with Dr. Leitinger as Convenor and as the representative of the participants at the Lindau 1970 Symposium on Beacon Satellites. Prof. P.F. Checcacci (Italy) represents the Joint Satellite Study Group and the USSR will designate a representative of the Intercosmos Group.

XVTH MEETING OF COSPAR

(including specialized Symposia)

Detailed information on the XVth Meeting of COSPAR is given in the First and Second COSPAR Circulars issued in November 1971.

(1) This Meeting will include :

(*a*) Meetings of the various COSPAR bodies-Plenary, Executive Council, Bureau, Working Groups and Panels-on business matters;

(*b*) Symposia on selected subjects;

(*c*) Open Meetings of Workings Groups.

(2) The XVth COSPAR Meeting will take place in Madrid, Spain, in the Palacio Nacional de Congresos y Exposiciones from 15-24 May 1972.

Three specialized symposia cosponsored by COSPAR will be held in the same location immediately prior to the COSPAR Meeting, 10-13 May 1972. Immediately after the COSPAR Meeting, the joint International Radiation Symposium, sponsored by IUGG, COSPAR, and WMO will be held in Sendai, Japan from 26 May - 2 June 1972.

(3) The Chairman of the Comision Nacional de Investigacion del Espacio (CONIE), L. de Azcarraga, also chairs the Spanish Organising Committee for the XVth COSPAR Meeting, and the Secretary General of the Local Organising Committee is L. Pueyo. The address of the Local Organising Committee is :

COSPAR,
Apartado de Correos 8454,
Madrid 8, Spain.
Telephone : 2479800
Telex : 22026 INTA-E.

(4) *The Open Meetings of Working Groups* and their Panels are organized by their respective Chairmen (or chosen organizers). The Chairmen of

Working Groups form the Programme Committee and are assisted by the Chairmen of the Panels. Open Meetings of Working Groups and their Panels will consist mainly of presentation of papers on latest significant results but may also include some invited papers. Topics chosen for Open Meetings are listed below :

Working Group 1

(*a*) Tracking, instrumentation and procedures;

(*b*) Satellite geodesy and geodynamics;

(*c*) Lunar laser ranging.

There will be no presentation of papers on "frequency allocation and radio transmission" since the radio beacon subjects will be treated by the Symposium on the "Future Application of Satellite Beacon Measurements" to be held in Graz, Austria, immediately after the 1972 COSPAR Meeting.

Working Group 2

(*a*) Space-related methods for measurement of magnetosphere plasmas and fields;

(*b*) Topics relating to the *Symposium on Critical Problems of Magnetosphere Physics* (see Part (5), section B, for list of topics).

Working Group 3

Panel 3.A. — Topics concerned with space-related measurements in the field of competence of the Panel : Galactic and extragalactic astronomical measurements other than the topics of the *Symposium on X- and Gamma-Ray Astronomy (Non-solar)* (see Part (5), section C, for list of topics).

Panel 3.B.

(*a*) Solar electron events, with the following topics :

— non-relativistic electrons in space,
— relativistic electrons in space,
— sources of electron events on the Sun;

(*b*) Last year's progress in flare forecasting.

Panel 3.C. — Four half-day sessions are planned including the following topics :

(*a*) Cosmic dust data from space vehicles;

(*b*) Erosion processes of lunar material with special reference to micrometeorites;

(*c*) Studies of cosmic dust in the upper atmosphere;

(*d*) Distribution and comparative studies of interplanetary, cometary and interstellar dust.

Working Group 4

Panel 4.A.

(*a*) Composition and density in the lower thermosphere;

(*b*) Latest significant results concerning the neutral properties of the other layers of the upper atmosphere.

Panel 4.B.

(*a*) Special Workshop Meeting on topics of interest which have emerged from the *Symposium on Dynamics of the Thermosphere and Ionosphere above 120 km* (Seattle, June 1971).

It is the understanding of the COSPAR Secretariat that this Workshop Meeting will center on discussion, without formal presentation of papers, and will include invited researchers only.

(*b*) Latest significant results from space measurements relating to interactions of the neutral and ionized atmosphere.

There will not be an Open Meeting on International Reference Ionosphere, this matter is to be treated at the URSI General Assembly in Warsaw, Poland, in August 1972.

Panel 4.C. — Topics relating to the *Symposium on Critical Problems of Magnetosphere Physics*, devoted to presentation of results from balloon, rocket and low-altitude satellite experiments, complementary to the presentation of results from investigations of more distant magnetospheric regions to be covered by Open Meeting of Working Group 2 (see Part (5), section B, for list of topics).

Working Group 5

(*a*) Biological implications of recent Mars findings, cosponsored also by the Panel on Planetary Quarantine and Working Group 7;

(*b*) Radiobiology of HEZ particles;

(*c*) Interstellar organic matter and its possible biological significance;

(*d*) New medical, physiological, and general biological results of space flights.

Contributed papers on topics other than those listed above, but within the field of competence of Working Group 5 and reporting on recent and important results of investigations, may also be considered for presentation.

Panel on Planetary Quarantine. — Recent advances in quarantine technology.

Working Group 6

(*a*) Latest results in space meteorology;

(*b*) Latest results in Earth surveys using remote sensing techniques, with the possibility of further presentation of reports on national activities in Earth surveys from countries not represented at the 1971 COSPAR Meeting.

Attention of prospective authors is drawn to the fact that papers on radiation topics which would normally be submitted to the Open Meetings of Working Group 6 should, in 1972, be submitted to the *International Radiation Symposium* to be held in Sendai, Japan, 26 May - 2 June 1972 (see Part (6) for details).

Working Group 7

(*a*) Latest results of lunar investigations;

(*b*) Latest results of Mars investigations.

In addition, contributed papers reporting latest results of investigations of other planets, obtained by space techniques, and/or giving their interpretation or their comparison with results obtained from ground-based measurements, and relating to the Programme of the *Symposium on Planetary Atmospheres and Surfaces* (see Part (5), section A, for list of topics) may also be considered for presentation.

Joint Annual Review Sessions of Working Groups.

Two Joint Annual Review Sessions are planned, during which invited reviews from Working Groups, reporting on annual progress, will be presented for all the COSPAR audience. No other parallel sessions will be organised during these presentations.

(5) *Symposia to be held in conjunction with the XVth COSPAR Meeting.*

A. — *Symposium on Planetary Atmospheres and Surfaces* (10-13 May 1972).

Sponsors : URSI, IAU, and COSPAR.

Chairman of the Programme Committee : Prof. G. H. Pettengill, Dept. of Earth and Planetary Sciences, MIT, Room 54-612, Cambridge, Mass. 02139, USA.

The Symposium will comprise invited papers only. A half-day session will be held for each of the following topics :

1. Venus and Mercury : remote sensing results;
2. Venus and Mercury : interpretation of data;
3. Mars : space probe results I;
4. Mars : space probe results II;
5. Mars : remote sensing results;
6. Mars : interpretation of data;
7. Giant planets : new observations and theory;
8. Reserved for possible overflow.

B. — *Symposium on Critical Problems of Magnetosphere Physics* (11-13 May 1972).

Sponsors : COSPAR, IAGA (IUGG), and URSI (organised in consultation with IUCSTP).

Chairman of the Programme Committee : Dr. N. F. Ness, Code 690, Goddard Space Flight Center, Greenbelt, Md. 20771, USA.

The Symposium will comprise invited reviews only and discussions on unsolved problems in the magnetosphere; with emphasis on differences in theoretical interpretation that might be resolved by specific experiments, as a prelude to second-stage planning for the "International Magnetosphere Study (1975-77)". The specific topics for this Symposium will be :

1. Configuration of the magnetosphere, polar cusp, and neutral sheet;
2. Boundaries of the magnetosphere, magnetopause, plasmapause, and neutral sheet;
3. Plasma convection and dynamics;
4. Ring current;
5. Energetic particles, trapped and quasi-trapped;
6. Plasma instabilities and magnetosphere eigenmodes;
7. Magnetosphere-ionosphere coupling;
8. Electric fields;

9. Substorm phenomena;
10. Auroral oval morphology.

C. — *Symposium on X- and Gamma-Ray Astronomy (Non-solar)* (11-13 May 1972).

Sponsors : IAU and COSPAR.

Chairman of the Programme Committee : Dr. R. Giacconi, American Science and Engineering Inc., 11 Carleton Street, Cambridge, Mass. 02142, USA.

The Symposium will comprise invited and contributed papers on the following topics :

1. Galactic sources;
2. Extragalactic sources;
3. Interstellar medium;
4. Intergalactic medium.

(6) *International Radiation Symposium*, Sendai, Japan (26 May-2 June 1972).

This Symposium is sponsored jointly by IUGG, COSPAR, and WMO, and organised on the initiative of the International Association of Meteorology and Atmospheric Physics (IAMAP) with the support of the Japan Meteorological Society.

The Programme Committee of the Symposium has issued the First Circular with description of topics. COSPAR scientists who normally submit their papers on radiation topics to the Open Meetings of COSPAR Working Group 6 are requested to direct their contributions in 1972 to the International Radiation Symposium. Further information may be obtained from the Secretary of the Radiation Commission of IAMAP : Dr. H.-J. Bolle, Meteorologisches Institut der Universität, 8 München 13, Barbarastr. 16, F. R. Germany.

* * *

The First and Second COSPAR Circulars were distributed very widely, but a number of copies are still available on request at the COSPAR Secretariat, 55 boulevard Malesherbes, 75 Paris 8^{e}, France.

EQUATORIAL AERONOMY

IV International Symposium

Ibadan, Nigeria, 4-11 September 1972

The IV International Symposium on Equatorial Aeronomy will be held in Ibadan, Nigeria from 4 to 11 September 1972. The official language used will be English. Intending participants are invited to write for further information to the Secretary of the Local Arrangements Committee :

Dr. J. O. Oyinloye,
Physics Department,
University of Ibadan,
Ibadan, Nigeria.

A report on the III Symposium (India) was published in *URSI Information Bulletin*, No. 171, pp. 31-38. The preceding Symposia were held in Peru and Brazil.

EDUCATION OF TEACHERS FOR INTEGRATED SCIENCE

An international conference on the above subject will be held at the University of Maryland, USA (close to Washington D.C.) from 3-13 April 1973. The Conference is being organised by the ICSU Committee on Teaching of Science (Chairman, Dr. M. Matyas) and has been commended by UNESCO. The Chairman of the Conference will be Dr. Albert V. Baez. The working languages will be English and French.

Scope and Purpose

The major concern of the Conference will be the education of teachers —both initial and in-service— to teach science in both *integrated* and *co-ordinated* ways.

It is obviously necessary, in order to avoid ambiguity, to distinguish clearly between :

(*a*) Complete integration, which consists of joining several subjects into a single course in which the concepts of science are presented through a unified approach;

(*b*) Co-ordination, which entails a carefully planned collaboration between the various disciplines and in the training of teachers for such an approach.

The Conference will follow up the work of the Varna Conference in 1968 where the central question was "Why integrate science teaching ?". Discussion of the aims, objectives and methods of integrated science teaching will continue. Special consideration will be given to the relevance of integrated science to the development of social responsibility.

New approaches to the university and college education of teachers of science for all levels of education will be explored in relation to their effectiveness in achieving appropriate integration or co-ordination in a given situation. Suitable curriculum materials for the education of science teachers will be of particular concern, notably the contributions of laboratory-based study, field studies, multi-media methods and group and individual learning approaches.

The rôle of Science Teachers' Associations, Teachers' Centres, Inspectors and Advisers will be considered along with the contribution colleges and universities need to make to the life-long education of the science teacher.

Plenary sessions, lectures, visits, demonstrations, working sessions and practice with materials will contribute to a Conference in which there will be a high degree of participation by all. The Conference is intended to lead to a set of guidelines or summary statements that will be of help to all those concerned with the education of science teachers.

Participation

Attendance will be limited to 200 participants and will be by invitation in order to ensure broad national representation. Persons interested in attending are requested to write before 31 January 1972 to Miss Maureen Dietz, Science Teaching Center, University of Maryland, College Park, Maryland 20742, USA giving the following information :

1. Name and address.
2. Institution.
3. Position held and interest in teaching of integrated science.
4. Chances of attending the Conference if invited (high or doubtful).

THEORY OF NETWORK TOLERANCES

In the design of electronic circuits, the nominal network function, determined by calculation, may differ from the actual function as found experimentally. The theory of network tolerances is concerned with the study of such differences which are of particular importance when the specification of a network is stringent and when, as in the case of man-produced integrated circuits, there is a statistical spread in the values of the circuit elements.

In the calculation of network tolerances, an important rôle is played by the "sensitivity" of a network characteristic : the partial derivative of the characteristic as a function of a network parameter. Sensitivites are relevant also to the analysis of networks having variable parameters, such as amplifiers and adjustable filters, and to the design of circuits by iterative synthesis.

A recently published book (1) by Professor K. Géher, of the Polytechnical University of Budapest, is designed to provide a survey of sensitivity methods in the design of circuits and also to illustrate the application of these methods to a number of practical problems. The chapters in the first half of the book deal with bilinear and biquadratic network functions, with the different sensitivities and their determination by direct and indirect methods, and with the basic principles of tolerance analysis and synthesis. In the second half, three chapters discuss design problems in relation to linear passive and active circuits and to logic circuits. The final chapter is concerned with the application of the sensitivity concept to the optimization step in the iterative synthesis procedure for the design of circuits.

Prof. Géher points out that although the significance of sensitivity in network theory was recognised by Bode as long ago as 1945, it was not widely used until about seven years ago, following the work of Tomovic and of Kokotovic and Rutman. The recent rapid development in the applications of sensitivity is reflected by the fact that 75 % of the 123 references quoted by Prof. Géher refer to publications which appeared during the period between 1964 and 1968, just before the completion of the text in January 1969.

(1) K. Géher, *Theory of Network Tolerances*, pp. 184 (Akadémia Kiado, Alkatinany utca 21, Budapest, Hungary, 1971). Price $6.60.

PROGRESS IN RADIO SCIENCE 1966-1969

The three volumes in *Progress in Radio Science 1966-1969* were published by URSI in 1971. These volumes contain over 130 papers, in English or French, representing most of the contributions made during the scientific sessions of the XVI General Assembly of URSI at Ottawa in August 1969.

The invited speakers came from Australia, Austria, Belgium, Canada, France, F.R. Germany, Israel, Italy, Japan, New Zealand, Poland, Sweden, UK, USA and USSR. The Chairmen of the URSI Commissions, for the period 1966-1969, who were responsible for arranging the scientific programme were E. J. Blum (France), H. G. Booker (USA), L. Essen (UK), P. Grivet (France), C. O. Hines (Canada), F. Horner (UK), J. A. Saxton (UK) and F. L. Stumpers (Netherlands).

Vol. 1. — Ionosphere, Magnetosphere, Radio Noise
Ed. G. M. Brown, N. D. Clarence, and M. J. Rycroft
pp. ix + 425.

Vol. 2. — Radio Propagation in Non-Ionized Media, Radioastronomy, Radio Measurements and Standards
Ed. J. A. Lane, J. W. Findlay, and C. E. White
pp. ix + 344.

Vol. 3. — Radio Waves and Circuits, Radio Electronics
Ed. W. V. Tilston, and M. Sauzade
pp. viii + 478.

The volumes are available separately at US $5.50 (or 250 Belgian francs) per copy, surface postage included. If all three volumes are ordered together, the price is US $13.00 (or 600 Belgian francs) for the three volumes, surface postage included. If required, copies can be sent by air mail, by prior arrangement, for an additional charge.

Payment can be made by cheque payable to Union Radio-Scientifique Internationale or by bank transfer to

Banque Degroof,
Compte No. 02024,
44, rue de l'Industrie,
B - 1040 Brussels, Belgium.

Orders should be sent to URSI, 7 Place Emile Danco, B — 1180 Brussels, Belgium.