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U. R. S. I.

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OBITUARY

Ernest Herbays

As already announced in the *Information Bulletin* No. 164 Ingénieur Ernest HERBAYS, died in Brussels on 26th October 1967 after a short illness. This sad event terminated an association with URSI, which had lasted for some forty years. It was at the fourth General Assembly in Brussels in 1928 that I first met Captain Herbays — as he then was — as a member of the Belgian delegation, and as an assistant to Dr. R. B. Goldschmidt, who was the Secretary-General of the Union. Captain Herbays had served in the Belgian army during the first World War and later he became a professional engineer and was associated as an instructor and consultant with the technical high-school in Brussels.

Ernest Henri Herbays was born at Ixelles, Belgium, on 15 June 1893. His general education was followed by entry in 1913 to the Ecole d'Application, a Belgian military high school, leading to service in the Belgian army during the first world war. After being wounded, he spent some time in hospital and convalescence in England. At the end of the war and on completing the course at the above military high school, Captain Herbays proceeded to the Ecole Supérieure d'Electricité de Paris, where he graduated in 1925. On return to Belgium he joined the signals branch of the army, from which he retired in 1945 with the rank of major; and he was later promoted to honorary lieutenant-colonel (engineers). In recognition of this service, Colonel Herbays was decorated in Belgium as an Officer of the Order of Leopold, and as a Commander of the Order of the Crown.

To return to his career with URSI, at the time of the General Assemblies in Copenhagen (1931) and London (1934), the secretariat of URSI comprised Dr. Goldschmidt, assisted later by Herbays and by Captain Dorsimont, another officer in the Belgian army. Following the suspension of URSI activities during the second World War, the now Major, Engineer E. Herbays was elected Secretary of URSI at the closing session of the General Assembly in Paris on 4th October 1946. From this time until his death, the whole of the administration of the affairs of URSI from the office in Brussels were conducted in a very efficient manner by its Secretary-General who became so well known throughout the world as Colonel — or Ingenieur — E. Herbays. During this period the number of national scientific bodies adhering to URSI grew from 16 in 1948 to 37 in 1966.

The meeting in Paris was the VIIth General Assembly; and from this time, Colonel Herbays was responsible for the administration of URSI, and particularly of its meeting and publications, up to and including the XVth General Assembly held in Munich in September 1966. During this period the successive Presidents of URSI were variously domiciled in England, France, Texas, Japan and California; but in spite of the resulting comparative rarity of personal contact, both the steering of policy and the everyday administration of the Union was managed efficiently from the secretariat in Brussels, with the aid of a single full-time assistant.

From this small office, the organisation and attendance at successive General Assemblies in Stockholm, Zurich, Sydney, The Hague, Boulder, London, Tokyo and Munich, was conducted by Colonel Herbays with conspicuous success.

Although naturally the main contributions at these meetings came from committees of the adhering national bodies and the scientific members representing them, the work of co-ordinating these and supervising their progress through to publication was carried out promptly and efficiently by Colonel Herbays himself. Under his guidance, the international scientific radio literature over the past quarter of a century has been organised, prepared and carried to the state of publication : although naturally with the increase in scope and specialisation of the subject, it had become necessary for individual scientific editors to deal with the detailed reports and papers coming before the separate Commissions.

Now URSI is one of the adhering Unions of the International Council of Scientific Unions (ICSU) which is effective in promoting close liaison with other unions concerned with astronomy, geophysics and, more recently, space science. Colonel Herbays served as a member of the bureau of ICSU from 1949 to 1955, and was its treasurer during the period 1955-1961. He was also vice-President of the Federation of Permanent Services for astronomy and geophysics (FAGS); and was the active Convenor of the special committee for the International Geophysical Year (CSAGI) during its early years (1952-53).

The success of URSI, as one of the oldest of the international scientific unions, is in no small measure due to the initiative, enterprise and energy shown by its Secretary General during the past forty years. An excellent review of the work of the Union, including its past objectives and future trends, was contributed by Colonel Herbays under the title « What is URSI ? » in the memorial volume to Robert Goldschmidt published in 1962.

In this essay, Colonel Herbays, after outlining the objectives and activities of URSI, foreshadowed the increasing need for the holding of specialist symposia between the General Assemblies, which for some time now have been held at three-year intervals. The reports of these symposia have been published in the form of the URSI monographs, in the production of which the late Secretary General played an important part. The last paragraph of his essay reads as follows :

> « This short discussion shows that the future of the Union is assured and that the founders have laid a solid groundwork. A half century has passed since a score of men sensed a necessity and a future for an organisation such as URSI; now hundreds of research scientists are taking part in its worldwide activities ».

In the following year (1963), URSI celebrated the Golden Jubilee of its formation; and in the volume commemorating this achievement, Colonel Herbays described the activities of the so-called « permanent services » of URSI, starting with the central and regional Ursigramme services, and leading up to those concerned with the International Geophysical Year (IGY) and the more recent International Years of the Quiet Sun (IQSY). While, naturally, these activities required the attention of specialist committees and associated expert secretariat, it remained for Colonel Herbays as the permanent officer of the parent organisation, to contribute the benefit of his many years experience in promoting effective international collaboration in this particular field of scientific radio.

As already mentioned, URSI is one of the adhering Unions of the International Council of Scientific Unions which is effective in promoting close liaison with the 16 or more other international scientific unions, and their associated activities in all parts of the world. The high prestige of URSI in the field of international science is in no small measure due to the initiative, energy and whole-hearted devotion of its former Secretary General. His passing is mourned by radio scientists throughout the world, and especially by those officers — past and present — who have had the privilege of working with him on the many scientific and other problems with which a successful international scientific body has to cope.

December 1967.

R. L. Smith-Rose.

COMITÉS NATIONAUX

Composition des Commissions

L'attention des Comités nationaux est attirée sur les listes, ci-dessous publiées, des Membres officiels des Commissions. Ils sont instamment priés de faire parvenir au Secrétariat général de l'URSI, toutes corrections ou additions au plus tard pour le 15 mars 1968.

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National Committees are kindly requested to verify the names and addresses of the official members of Commissions published below. All corrections or additions should be sent to the Secretariat of URSI so as to arrive not later than 15 March, 1968.

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USA

NAS COUNCIL RESOLUTION MEMORIALIZES L. V. BERKNER

(Reprint from *News Report*, Nov. 1967, XVII nº 9)

The Council of the NAS approved the following resolution on September 30 :

Whereas with the death of Lloyd Viel Berkner, member of this Academy, on June 4, 1967, the nation suffered the loss of a scientist and statesman of rare wisdom and vision; Whereas the many acts of his leadership in science, in the advancement of international cooperation and understanding, and in the initiation and development of new and effective institutions of science are monumental; and Whereas his leadership in the international community of science, education and public affairs was accompanied by an unusual dedication to the furtherance of society and man; Be it Therefore Resolved that the Council of the National Academy of Sciences declares its gratitude to Lloyd Berkner and its cherished regard for his memory.

USA

RADIO SCIENCE

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COMMISSIONS

Commission III — Ionosphère

INDICES FONDAMENTAUX DE LA PROPAGATION IONOSPHERIQUE

(Extrait du *Journal des Télécommunications*, Vol. 34, nº 11, novembre 1967)

Les tableaux ci-après, contenant les valeurs des indices fondamentaux de la propagation ionosphérique, ont été établis par le Secrétariat spécialisé du Comité consultatif international des radiocommunications (CCIR) conformément à la Résolution 4-1, à l'Avis 371 et au Rapport 246-1 de la XI[e] Assemblée plénière du CCIR (Oslo, juin-juillet 1966).

VALEURS OBSERVÉES :

● R_{12} (moyenne glissante sur douze mois du nombre de taches solaires) :

Mois / Année	1	2	3	4	5	6	7	8	9	10	11	12
1966	28	31	34	37	41	45	50	56	63	67	69	71
1967	73	76	79	82								

● I_{F2} (indice ionosphérique)* :

Mois (année 1966)

1	2	3	4	5	6	7	8	9	10	11	12
15	20	34	37	46	54	54	53	42	46	64	68

Mois (année 1967)

1	2	3	4	5	6	7	8	9	10	11	12
78	93	113	114	115	92	89	108	124	125		

(*) Pour plus de détails, voir le *Journal des Télécommunications* (avril 1964, page 119, et janvier 1966, pages 43-47).

● Φ (flux du bruit solaire moyen mensuel)** :

Année \ Mois	1	2	3	4	5	6	7	8	9	10	11	12
1966	88	84	90	97	98	96	107	106	111	109	113	125
1967	148	147	161	130	144	120	140	154	132	136		

(**) Renseignements obligeamment fournis par le « National Research Council », Ottawa.

PRÉVISIONS :

● R_{12}***

Année \ Mois	11	12	1968			
			1	2	3	4
1967	99	101	103	105	107	109

(***) Renseignements obligeamment fournis par le professeur Waldmeier, Observatoire fédéral de Zurich.

Estimation de l'erreur sur les prévisions, six mois d'avance, de R_{12} : $\pm$ 25.

ERREUR MOYENNE SUR LES PRÉVISIONS DE R_{12} BASÉE SUR LES 12 MOIS PRÉCÉDANT LE MOIS QUI SUIT CELUI POUR LEQUEL A ÉTÉ CALCULÉE LA DERNIÈRE VALEUR DE R_{12} :

Temps de prévision (mois)	0	1	2	3	4	5
Erreur moyenne	—6,8	—8,4	—9,8	—11,4	—12,8	—13,5
Ecart-type de l'erreur	±4,4	±3,1	±2,9	±2,5	±3,9	±5,4

● I_{F_2}****

Année \ Mois	10	11	12	1968			
				1	2	3	4
1967	124	119	122	125	128	130	(132)

(****) Renseignements obligeamment fournis par le « Department of Scientific and Industrial Research, Radio and Space Research Station », Slough.

La valeur prévue six mois à l'avance est donnée entre parenthèses.

ERREUR MOYENNE SUR LES PRÉVISIONS DE I_{F_2}, BASÉE SUR LES 12 MOIS PRÉCÉDENTS :

Temps de prévision (mois)	0	1	2	3	4	5	6
Erreur moyenne	—6,1	—7,4	—9,3	—9,7	—11,8	—14,2	— 16,8
Ecart-type de l'erreur	±11,7	±15,6	±17,3	±17,5	±16,3	±14,2	±12,6

● Φ*****

Mois / Année	11	12	1968							
			1	2	3	4	5	6	7	8
1967	(158)	(162)	(167)	(171)	(175)	(180)	(184)	(189)	(194)	(198)

(*****) Prévision selon une méthode d'extrapolation envisagée au Secrétariat du CCIR en application de la Résolution 30 de la XI^e Assemblée plénière du CCIR (Oslo, 1966). Pour les valeurs mises entre parenthèses, l'erreur dépasse probablement la valeur de ± 10 unités de Φ.

ERREUR MOYENNE SUR LES PRÉVISIONS DE Φ BASÉE SUR LES 12 MOIS PRÉCÉDENTS :

Temps de prévision (mois)	0	1	2	3	4	5	6	7	8	9
Erreur moyenne	+6,3	+7,2	+7,4	+7,8	+7,2	+5,4	+3,3	—0,1	—3,6	—6,9
Ecart-type de l'erreur	±18,9	±21,5	±23,5	±24,8	±25,9	±26,2	±26,4	±25,2	±24,3	±23,5

BASIC INDICES FOR IONOSPHERIC PROPAGATION

(Reprint from *Telecommunication Journal*, Vol. 34, nº 11, Novembre 1967)

The following tables, giving values of the basic indices for ionospheric propagation, have been prepared by the Specialized

Secretariat of the International Radio Consultative Committee (CCIR) in accordance with Resolution 4-1, Recommendation 371 and Report 246-1 of the XIth CCIR Plenary Assembly (Oslo, June-July 1966).

PARAMETERS :

● R_{12} (smoothed mean, over twelve months, of the number of sunspots observed) :

Month / Year	1	2	3	4	5	6	7	8	9	10	11	12
1966	28	31	34	37	41	45	50	56	63	67	69	71
1967	73	76	79	82								

● I_{F2} (ionospheric index)* :

Month (year 1966)

1	2	3	4	5	6	7	8	9	10	11	12
15	20	34	37	46	54	54	53	42	46	64	68

Month (year 1967)

1	2	3	4	5	6	7	8	9	10	11	12
78	93	113	114	115	92	89	108	124	125		

(*) For further details, see the *Telecommunication Journal*, April 1964, page 119, and January 1966, pages 43-47.

● Φ (monthly mean value of solar noise flux)** :

Month / Year	1	2	3	4	5	6	7	8	9	10	11	12
1966	88	84	90	97	98	96	107	106	111	109	113	125
1967	148	147	161	130	144	120	140	154	132	136		

(**) Data kindly supplied by the National Research Council, Ottawa.

FORECASTS :

● R_{12}***

Month / Year	11	12	1968: 1	2	3	4
1967	99	101	103	105	107	109

(***) Data kindly supplied by Professor Waldmeier, Federal Observatory, Zurich.

Estimated error in forecats of R_{12} six months in advance : ±25

MEAN ERROR ON R_{12} PREDICTIONS BASED ON THE 12 MONTHS PRECEDING THE MONTH FOLLOWING THAT FOR WHICH THE LAST R_{12} VALUE WAS CALCULATED :

Prediction time months	0	1	2	3	4	5
Mean error	—6.8	—8.4	—9.8	—11.4	—12.8	—13.5
Standard deviation	±4.4	±3.1	±2.9	±2.5	±3.9	±5.4

● I_{F_2}****

Month / Year	10	11	12	1968: 1	2	3	4
1967	124	119	122	125	128	130	(132)

(****) Data kindly supplied by the Department of Scientific and Industrial Research, Radio and Space Research Station, Slough.

The figure in brackets is the value forecast six months in advance.

MEAN ERROR IN I_{F_2} PREDICTIONS CALCULATED OVER THE 12 PRECEDING MONTHS :

Period of prediction (months)	0	1	2	3	4	5	6
Mean error	—6.1	—7.4	—9.3	—9.7	—11.8	—14.2	—16.8
Standard deviation of the error	±11.7	±15.6	±17.3	±17.5	±16.3	±14.2	±12.6

● Φ*****

Month / Year	11	12	1968: 1	2	3	4	5	6	7	8
1967	(158)	(162)	(167)	(171)	(175)	(180)	(184)	(189)	(194)	(198)

(*****) Prediction by a method of extrapolation devised by the CCIR Secretariat, pursuant to Resolution 30 of the XIth CCIR Plenary Assembly (Oslo, 1966). For the values in brackets, the error probably exceeds the value of ±10 units of Φ.

MEAN ERROR IN Φ PREDICTIONS CALCULATED OVER THE 12 PRECEDING MONTHS :

Period of prediction (months)	0	1	2	3	4	5	6	7	8	9
Mean error	+6.3	+7.2	+7.4	+7.8	+7.2	+5.4	+3.3	—0.1	—3.6	—6.9
Standard deviation of the error	±18.9	±21.5	±23.5	±24.8	±25.9	±26.2	±26.4	±25.2	±24.3	±23.5

Commission VI on Radio Waves and Circuits

SYMPOSIUM ON ELECTROMAGNETIC WAVES

The Stresa URSI Symposium on Electromagnetic Waves has been postponed and definitely fixed for the last week of June (Monday 24 to Saturday 29 June) 1968. Consequently the dead line for receiving the summaries of the papers proposed has been postponed to 29th February 1968.

Note : For more information see *Information Bulletin* n° 164, p. 37.

INTER-UNION COMMISSIONS

IUCSTP

The nucleus of the Inter-Union Commission on Solar-Terrestrial Physics was established at the General Assembly of ICSU in January 1966. In view of the increasing responsibilities of the Commission, particularly those relating to future international cooperative programmes, the membership has recently been enlarged by the inclusion of Discipline Representatives.

At meetings of the full Commission held in 1967 in London (July) and St Gallen (October), recommendations regarding future programmes in solar-terrestrial physics were discussed. Two documents resulting from these meetings were widely circulated in November 1967 and are reproduced below. These are (*a*) a letter from the President of IUCSTP asking for national collaboration in the execution of the proposed programmes (Doc STP 62(67)), (*b*) a summary of the main scientific projects proposed for the next few years, including the period of maximum solar activity (Doc STP 63(67)).

The terms of reference of IUCSTP include a number of activities other than the organisation of programmes of the type mentioned above and are listed in the following extract from the Provisional Constitution which was approved by the ICSU Executive Committee in October 1967.

« 3. *Terms of Reference.*

The principal tasks of the Commission are as follows :

(*a*) To coordinate all symposia which deal with some aspect of solar-terrestrial physics and which have been suggested by ICSU organizations. The Commission may recommend to ICSU or to the Unions that a Symposium should be held, but it shall not itself be responsible for the organization of any such symposia.

(*b*) To promote, organize and coordinate international research and cooperative projects in solar-terrestrial physics whenever inter-Union cooperation is desirable. The Commission itself shall not directly carry out research programmes implying its financial support.

(*c*) To determine the type of data to be exchanged through those of the WDCs which handle data relevant to the disciplines of solar-terrestrial physics.

(*d*) To provide such advisory services as may be required in connection with the activities of the above WDCs.

(*e*) To provide such advice as may be requested by other ICSU bodies concerned with solar-terrestrial physics.

(*f*) To implement the IQSY publications programme with the advice of, and under the supervision of, the IQSY Annals Editorial and Management Boards ».

* * *

STP 62(67)

To : ICSU National Correspondents

Dear Colleague,

At the Rome meeting of the Executive Committee of the International Council of Scientific Unions, 10 October 1967, the constitution of the Inter-Union Commission on Solar-Terrestrial Physics (IUCSTP) was formally approved. The terms of reference for the Commission authorize it « to promote, organize and coordinate international research and cooperative projects in solar-terrestrial physics » of the types that have characterized the IGY and IQSY programs.

It is only natural that man should take a close interest in his immediate environment and this interest has provided the driving force behind his explorations of the surfaces of the continents and the oceans of the world. At a later stage, his investigations led him to probe down into the earth's crust and the depths of the oceans as well as into the air above. Meteorology began with the quest for information about the characteristics of the lower atmosphere since these had an important influence on the weather. As techniques developed, new methods of probing the atmosphere and its ionized components up to greater and greater heights became possible; the space vehicles of today carry scientific instruments which can explore the vast reaches of interplanetary space and transmit their data back to the earth.

Probably the most important result to emerge from recent investigations of the upper atmosphere and interplanetary space is the growing understanding of the role that energetic solar radiation plays in determining the physical state of these regions; these radiations include ultraviolet light, X-rays and charged particles. Research on upper atmospheric phenomena is concerned with the nature of the interactions between these radiations and the earth's environment. In this connection, it is important to consider not only the interactions with the earth's atmosphere but also those with the geomagnetic field. In recent years, the concise term «solar-terrestrial physics» (hereafter abbreviated to STP) has been widely used to describe the whole complex of studies covered by research into the interactions between energetic solar radiations, the interplanetary medium and the near-earth environment.

There is no need to stress the fact that, in research relating to STP, it is essential for scientific workers in many disciplines to work in close collaboration; the many different contributions which they make must be regarded as complementary to each other in the search for a better understanding of the processes at work in the upper atmosphere and in interplanetary space. In addition, since STP can be studied successfully only if experimental data are available from all parts of the world, it is obviously essential for scientists from many parts of the world to share their results and often to plan their experiments in cooperation with each other so as to ensure that the maximum advantage can be gained from the resulting data. It is for this reason that STP is recognized as a science in which both international and interdisciplinary cooperation and planning must receive great attention if success is to be achieved.

Within ICSU, the many disciplines which form part of STP are spread over four of the Unions : IAU, IUGG, IUPAP, and URSI, all of which had already collaborated during the IGY (1957-1958) and the IQSY (1964-1965). Although the IQSY program concentrated almost exclusively on the acquisition of data relating to STP, the IGY program included other types of investigation which required international cooperation. Both the IGY and the IQSY programs were of limited duration and they concentrated mainly on the encouragement and coordination of synoptic-type observations; these provided essential basic data for global studies of many kinds, and background material for specialized experiments with more specific objectives.

Since the end of the IQSY, discussions have taken place from time to time on the desirability of continuing, in some modified form, the international interdisciplinary coordination which proved to be so successful during the IQSY and the IGY. In recognition of this need, the ICSU established the IUCSTP in 1966 and one of the principal objectives of this new Commission is to decide what form this coordination should take in the light of present-day needs.

The enclosed document describes, in brief form, the recommendations which have recently emerged from meetings of the IUCSTP in London (July 1967) and St. Gallen (October 1967) for a continuing program. Although it is recommended that certain programs of observation should be given special attention during the next few years, it must be emphasized that it is not the intention of IUCSTP to try to restrict the freedom of national organizations to pursue the lines of research and the experiments which they believe to be best suited to their available resources and capabilities.

It is my hope that you will bring the contents of the enclosed document to the attention of the appropriate organization in your country as soon as possible. After they have considered in what way they wish to collaborate in the programs outlined, it would be appreciated if their plans could be communicated to the Acting Secretary of IUCSTP (Dr. C. M. Minnis) in London. At a later stage, it is intended to provide more precise information about the actual intentions in each area and detailed arrangements for cooperation between active workers in each project. In the meantine, the outline provided will give a preliminary indication of the broad intentions of the IUCSTP and I look forward to your cooperation in helping to make a success of this new effort in international cooperation.

Sincerely yours,

16 November 1967.

H. FRIEDMAN.
President, IUCSTP

International Cooperation in Solar-Terrestrial Physics

Foreword

This document has been prepared jointly by the members of the Inter-Union Commission on Solar-Terrestrial Physics (IUCSTP) following meetings of the Commission held in the United Kingdom and Switzerland in July and October 1967. The information about the various projects described in the document should be regarded as preliminary only. Early in 1968, it is intended to circulate a second document in which more precise plans for the execution of the projects will be given. It is intended also to organize a General Meeting in Europe during 1968 at which ad hoc Working Groups will discuss the more detailed aspects of the different projects and make recommendations concerning their execution and the subsequent collection and analysis of the data.

The President of IUCSTP, Dr. H. Friedman, in his circular letter of 16 November 1967 has requested information on the desires of national organizations and scientists to participate in one or more of the projects. It would be appreciated if such information could be transmitted to the following address :

IUCSTP Secretariat, 6 Carlton House Terrace, London SW 1.

16 November 1967.

C. M. Minnis,
Acting Secretary, IUCSTP

International Cooperation in Solar-Terrestrial Physics

I. — Introduction

In recent months, the Inter-Union Commission on Solar-Terrestrial Physics (IUCSTP) has received many proposals, relating to the field of solar-terrestrial physics, for programmes of observations which could be achieved mainly by making use of existing resources during the next few years. After considering these proposals, the Commission decided to select a limited number of project areas and to submit this short list to national academies, research councils and similar bodies. In this way, it is hoped to direct the attention of the international scientific community to certain projects which seem to be important at the present time, and particularly for the period 1968-1970. In some cases, the project has been selected as being important for general reasons. In other cases, emphasis has been given to a project because it is particularly appropriate to the period of maximum solar activity which will coincide with the period 1968-1970 which is referred to as the International Years of the Active Sun (IASY).

In the list of projects contained in this document, each has been given a short title and this is followed by a brief explanatory statement of the main features or the objectives of the project. At a later date, further attention will be given to the more detailed aspects of each project, including not only the programme of observations but also plans for the subsequent study and analysis of the results, often on a cooperative basis.

II. — Distribution of information on programme plans

The success of all the proposed programmes in solar-terrestrial physics (STP) can be enhanced by the arrangements, provided through IUCSTP, for national bodies and institutions to share advance information about their plans for undertaking work in the various programmes. If such information is made available, it is more likely that useful complementary and supplementary work will be carried out by organizations in other countries.

It is especially important to coordinate complementary observations in the case of programmes involving satellites in order to take the maximum advantage of the relatively rare and expensive opportunities thus provided. The authorities responsible for satellite experiments are, therefore, invited to announce their plans, preferably as much as two years in advance, and to confirm or revise them at intervals of about six months. A responsible scientist should take the initiative to announce such information as :

(*a*) the approximate time interval within which the launch is expected to take place ;

(*b*) a brief statement listing the parameters to be measured and giving enough information to assist in the planning of related ground-based measurements, such as planned orbits, sensitivity of equipment, and rates of sampling;

(*c*) recommendations as to which types of related ground-based measurements are considered to be most useful.

Similar announcements by ground-based stations would assist the planners of rocket and satellite experiments, especially where the ground-based measurements refer to phenomena in the magnetosphere or interplanetary space, or where they involve special or non-permanent series of observations.

III. — Recommended projects for the period 1968-1970 including the years of the active sun

1. — *Monitoring of the Solar-Terrestrial Environment.*

Systematic monitoring of solar activity and the terrestrial environment is a necessity for further progress in understanding most of the problems in solar-terrestrial physics. The cooperation which was characteristic of the IGY and the IQSY should be continued between the existing ground-based networks in the disciplines of solar activity ionosphere, geomagnetism, aurora, airglow, and cosmic rays. Data interchange through World Data Centres (WDCs) and through the exchange of publications allows the results of the monitoring programme to be used in global and regional studies and in interdisciplinary researches. The detailed plans for the acquisition, processing and redistribution of data will be modified in the light of recent research experience and of plans for special experiments.

Solar X-ray, ultraviolet and particle radiations can be monitored directly only from space vehicles. The observations are of basic importance in studies of many ionospheric processes and atmospheric effects. Thus, solar monitoring from satellites, preferably at distances beyond the radiation belts, should be improved and made continuous as soon as possible, and the data should be made available to the scientific community for the many special projects which depend on knowing the changes of the solar flux with time.

It will be important also to organize, as soon as practicable, the monitoring, by means of satellites in suitable orbits, of the variations in space and time of the characteristics of the near and distant magnetosphere and the solar wind. It would be advantageous :

(*a*) to have a number of small, real-time telemetry satellites, operating simultaneously and carrying standard-package instruments;
(*b*) to include, in as many spacecraft as possible, standard packages of radiation detectors and magnetic field probes.

Monitor data from simultaneously operating spacecraft with similar or equivalent instrumentation should be made available to all experiments as promptly as feasible, for example, through Satellite Data Centres. This prompt supply of data would be aided considerably by making on-board data processing a standard procedure in spacecraft.

2. — *Proton Flares.*

Proton flares are one of the most powerful manifestations of solar activity; they inject into interplanetary space, streams of atomic particles with energies often ranging up to hundreds and even thousands of MeV. Such catastrophic outbursts constitute one of the most serious hazards to the survival of men in space and they may also be of concern to passengers in future high-flying supersonic aircraft.

For the Proton Flare Project, every available tool, both ground-based and space-borne, will be used in the study of all observational aspects of selected flares. Of particular interest are :
(*a*) the spatial structure of local solar magnetic fields at the flare source;
(*b*) the mechanisms by which particles are accelerated in and ejected from active regions;
(*c*) the energy spectra and composition of the relativistic particles produced by the flare;
(*d*) the interplanetary plasma clouds and shock waves that propagate from the flare source both in and outside the ecliptic plane.

The Project is intended partly to improve our understanding of this most energetic phenomenon originating in the solar atmosphere and partly to develop more successful methods for flare prediction. Routine observations should be accelerated and, in addition, more sophisticated measurements should be introduced. The choice of periods for such observations should be coordinated with the time schedules of related satellites, space probes, and rocket observations. Certain space projects such as the « Apollo

Telescope Mount », which is scheduled for the later portion of IASY, should be supported by the most comprehensive ground-based programme of observations that can be organised within that time interval.

3. — *Disturbances of the Interplanetary Magnetic Field Configuration.*

During quiet solar conditions, a continuous flow of plasma streams radially away from the sun. This solar wind carries « frozen-in » solar magnetic field lines which, in the ecliptic plane, attain a spiral form due to the sun's rotation, and which appear to be bunched in « sectors » with field vectors pointing either away from the sun or towards it. The basic configuration of the interplanetary magnetic field can be highly perturbed by enhanced plasma emissions from active regions of the sun, and by plasma clouds and shock waves emitted during solar flares. Several processes are of particular importance in relation to interplanetary magnetic field perturbations;

(*a*) galactic cosmic-ray modulation;
(*b*) solar energetic particle propagation and diffusion through interplanetary space;
(*c*) particle acceleration in the neutral regions between sectors or near shock fronts;
(*d*) the structure of the interplanetary medium outside the ecliptic plane, and
(*e*) the effects of interacting plasma clouds or shock waves.

Most important for the study of the interplanetary field are *in situ* measurements of the magnetic field and observations of the flux and anisotropy of solar energetic particles, together with precise directional measurements of cosmic-ray particles by ground-level monitors. These data should be correlated with solar observations throughout the entire electromagnetic frequency range, as well as with observations of magnetic and ionospheric storms and other related terrestrial effects. The network of super-neutron monitors is an essential element of the observational programme and should be appropriately enlarged.

4. — *Determination of Characteristics of the Magnetosphere.*

The earth's magnetosphere behaves like an elastic container of plasma and energetic particles enveloping the earth; it is stretched and squeezed by the solar wind, and is capable of transmitting perturbations in the form of waves from one point to another. It follows that many geophysical ground-based observations provide data which are related directly to the actual configuration of the magnetosphere and its temporal variations. For example, some geomagnetic pulsations are manifestations of the response of the magnetosphere to changing conditions in the solar wind; others are generated by plasma resonances due to an interaction between waves and particles. A better physical understanding of such correlations would make it possible to organize a service which could quickly provide much information about important characteristic parameters of the magnetosphere, such as the positions of the boundary, the limit of the closed field lines, the plasmapause and the maxima of the trapped particle fluxes. This project would afford valuable data to complement *in situ* observations made with rockets and space vehicles.

The immediate goal of the project would be to discover the detailed relationships that must exist between ground-based geophysical observations and the behaviour of the fields, plasmas and energetic particles in the magnetosphere and the interplanetary medium. On the basis of the results obtained and their physical interpretation, the types of surface observations that provide the most useful information about phenomena in space would be recognized and then organized into a continuous service which would be capable of supplying rapidly all available information on certain characteristic parameters of the magnetosphere.

The execution of this project would require

(*a*) the establishment of appropriate observatories to supplement those which are already in operation and to fill any gaps in the present observatory network, particularly in auroral and sub-auroral latitudes and on the polar caps;

(*b*) the simultaneous use of satellites to measure magnetic fields, electric field, magnetic pulsations, low-energy plasma and energetic particles along different orbits in space; and

(*c*) effective means of collecting and exchanging both ground-based and satellite data.

5. — *Conjugate-Point Experiments.*

The effects induced by many magnetospheric processes can be propagated in the form of particles or waves along a geomagnetic field line. If the field line forms a closed loop linking the northern and southern hemispheres, the effects can be detected on the ground almost simultaneously at the conjugate points at which the field line intersects the earth's surface.

A great variety of phenomena such as aurora, VLF emissions, micropulsations, and pre-dawn ionospheric heating, give rise to such conjugate-point effects, and they can provide important clues about the primary processes. Whistlers can be used as a means of studying the propagation mechanism along the field line, and the field-line geometry can be deduced from observation of the night-time opening of field lines, diurnal and seasonal variations of conjugacy, and the artificial injection of particles.

Conjugate-point experiments must be performed simultaneously in opposite hemispheres; in consequence, they require co-operation between two or more countries. In principle, they involve ground stations located as closely as possible to a pair of conjugate points; however, more sophisticated experiments require one station at one point and a *network* of stations in the conjugate area.

Of particular importance in the field of auroras and energetic particle precipitation are simultaneous high-altitude observations from aircraft flying along conjugate paths or from balloons launched in conjugate areas. Another extremely valuable arrangement would consist of simultaneous observations from a geostationary satellite and from ground stations at the conjugate points joined by the field line on which the satellite is located. Finally, observations of the effects produced at conjugate points by particles injected along a field line, by means of an accelerator flown on a rocket or satellite, can yield vital information on field-line geometry and electric fields.

6. — *Electric Fields in the Magnetosphere.*

The distribution of plasma and the energetic particle concentration in the magnetosphere are primarily controlled by the magnetic field. However, slowly varying electric fields, associated with co-rotation or convection of the plasma and with ionospheric currents, are also present; these fields also exert an important influence on the charged particle population.

Very little is known at present about these electric fields. However, their configuration is extremely important, in general, to particle acceleration and hydromagnetic processes in the magnetosphere. The experimental techniques for the direct measurement of these d.c. electric fields are rapidly improving and could, if applied in a coordinated programme, yield information of crucial importance.

A study project should include systematic electric field measurements carried out simultaneously with ion-cloud injections at pre-fixed locations and altitudes, and with satellite measurements of plasma convection possibly involving direct electric field probes. These investigations would be valuably complemented by ionospheric drift studies. During the initial stage of such a programme, combined experiments using two or more methods at the same time would be necessary to calibrate the different methods against each other. In addition, careful studies should be made of the effect of ion-cloud injections on the field to be measured.

7. — *Magnetic Storms and Polar Disturbances.*

Magnetic storms and polar disturbances are manifestations of violent perturbations caused by solar plasma clouds impinging on the earth's magnetosphere. These perturbations are morphologically complex; they involve the whole particle population of the magnetosphere, ranging from the cold plasma to the most energetic of the trapped particles.

In order to make further advances in our understanding of these phenomena, well-coordinated observations are necessary both on the ground and in space. The conduct of the proposed project would require:

(*a*) improvement of magnetic observations at ground stations;
(*b*) rapid transmission of microfilmed copies of records and digital data from the stations to the appropriate World Data Centres;
(*c*) establishment of new stations at locations likely to be the most useful for specific problems.

Activity indices intended to represent the physical processes involved should be recorded and made available to scientists working in other related disciplines. Simultaneous high-altitude balloon X-ray measurements, at high latitudes and along geomagnetic parallels and meridians, should be coordinated with auroral observations from the ground, aircraft and satellites. Regarding measurements in space, variations in the flux and energy spectrum of trapped particles should be studied, especially in the low-energy range; the behaviour of the plasma sheet in the geomagnetic tail should be carefully analyzed. The recently developed techniques of measuring electric fields in the ionosphere and in the magnetosphere by rockets and satellites should be utilised also so as to provide complementary data.

8. — *Low-Latitude Auroras.*

Tropical auroras in which the luminosity exhibits a structure have been observed by the naked eye at times of great geomagnetic storms, but reports of such events are rare. However, it is very likely that many barely subvisual auroras occur which could be detected with sensitive photoelectric photometers. During the last sunspot cycle, there were five geomagnetic storms of such great intensity that they must almost certainly have been accompanied by sub-visual forms at low latitudes. These great geomagnetic storms indicate a cross deformation of the magnetosphere, the nature of which can be revealed by the accompanying mid-latitude and tropical luminosity.

To accomplish the observations, tropical airglow observatories should be equipped with automatic scanning filter photometers. After being alerted by flare-warning systems and by networks of ground-based magnetometers, jet aircraft could fly photometers across wide spans of latitude so as to map the extent of the auroral luminosity. At the same time, rockets in standby readiness could be launched to traverse the disturbed regions. Modern image-orthicon cameras are capable of recording detailed pictures of sub-visual auroral structures as has already been demonstrated at mid-latitudes during a great storm in May 1967. Ionospheric sounders should be used to make observations of anomalous E-region ionization and these observations should be repeated at the highest practical rates under the alert conditions mentioned above.

9. — *Basic Structure of the Upper Atmosphere.*

The atmosphere « breathes » in and out as a result of the diurnal, seasonal and solar-cycle variations of the energy input from the sun. In order to clarify the global picture of atmospheric structure, a systematic worldwide survey of composition, temperature and density is needed.

The air drag on satellites can be measured with high sensitivity up to great altitudes and such measurements provide a simple and precise means of following density variations. At altitudes below 200 km, however, drag forces increase so rapidly that the lifetime of a typical satellite is severely curtailed. Satellites with high mass to cross-section ratios and with restartable rocket power to sustain their lives in low orbit are needed to explore the atmosphere below 200 km. Instrumentation should be included for composition, airglow and total-density measurements.

The 80-120 km region includes the transition from a mixed atmosphere to one in which eddy and molecular diffusion compete with one another before diffusive equilibrium is attained at still greater altitudes. Furthermore, the photochemical reactions that occur in the 80-120 km region exert a most important influence on the neutral atmosphere at all greater heights.

During IQSY, small rocket techniques were developed to probe the atmospheric structure from the high stratosphere up to the thermosphere. The methods employed included the use of explosive grenades, luminous vapour releases, falling spheres, mass spectrometers, observations of airglow at different heights and photometry of solar radiation fluxes at various wavelengths. The techniques have only recently attained a high degree of absolute accuracy and their employment thus far has been confined to the vicinities of just a few rocket ranges. For the future, therefore, it is important to apply small rocket methods more widely in conjunction with satellite surveys, so as to establish the large-scale global figure of the mesosphere and thermosphere under basic conditions and to distinguish the distortions caused by micro-, meso-, and macro-scale changes.

10. — *Atmospheric Dynamics.*

Atmospheric dynamics encompasses what is perhaps the most complex system of interacting processes that faces man in the study of his physical environment. These processes have origins that derive in part from the behaviour of the meteorological regions beneath, in part from interactions with the solar wind beyond, and in part from effects induced *in situ*. They have consequences that range from simple wind systems, through such diverse phenomena as compositional changes in the neutral gas, anomalous heating, and the modulation of energetic particle precipitation, to the formation of various types of ionization irregularity such as sporadic-E, spread-F, travelling disturbances and radio auroras.

Despite the complexity of the processes involved, recent advances indicate that a concerted effort at this time will lead to a greatly improved understanding of individual aspects of these phenomena and of the system as a whole. The project must involve an extension of normal meteorological measurements, improved networks of standard equipment for monitoring the ionosphere, and a judicious use of the more sophisticated (although more expensive) techniques now provided by ground-based meteor-scatter and Thomson-scatter radar systems and by high-altitude gun and rocket soundings.

11. — *Ion Chemistry of D and E Regions.*

It is generally agreed by ionospheric physicists that their most urgent need is a knowledge of the identity of the positive and negative ions in the D and E regions. Because of the importance of minor constituents in the neutral atmosphere and the complexity of the relevant ionic reactions, it is difficult to deduce the fundamental processes from measurements of electron density alone, except in the most general terms. Rocket and ground-based measurements must be used in combination and at times and places selected carefully so as to yield the maximum amount of scientific information. The experiments should include rocket measurements of the ionized and neutral constituents of the D and E regions, rocket and ground-based measurements of electron density, and measurements of the intensities of solar radiations and energetic particles in appropriate energy bands. Among the problems which may be solved by these measurements, if properly coordinated, are:

(*a*) the role of meteoritic ionization;

(*b*) sunrise effects;

(*c*) ion production by mid-latitude particle precipitation;

(*d*) sporadic-E ionization; and

(*e*) the relation between laboratory measurements of rate coefficients and those observed in the ionosphere.

12. — *Sudden Ionospheric Disturbances* (*SIDs*).

The coming solar maximum offers the first opportunity to apply several recently developed rocket and satellite experimental techniques to the study of solar flare ionization effects in the D region, commonly known as SID's. It is proposed to organize a project which will include the following sub-divisions :

(1) The recognition of the onset of a flare (within 15 sec) by means of real-time transmission, to a launch site, of information from a satellite which can monitor hard X-ray intensity (exceeding 10 keV);

(2) Monitoring throughout the flare, with a time resolution of 1 sec or better, of the solar spectrum in the range 0.05-20 A;

(3) Rocket (and perhaps gun) soundings of the electron and ion density profiles in the D and E regions between 50 and 150 km. These should start as soon as possible after the flare warning and should be repeated at intervals throughout the duration of the flare; in every case, a control sounding must be made after the end of the flare;

(4) Monitoring, with a time resolution of 1 sec or better, of the phase height given by VLF radio signals, and of the ionospheric absorption as measured by pulse, cw, and riometer methods.

This project should reveal the effects at various levels in the ionosphere of the variations with time in the hardness of the flare radiation and it should add greatly to an understanding of the ion chemistry of the lower D-region.

IMPORTANT NOTICE.

Dr. E. R. DYER, Jr. replaced Dr. C. M. MINNIS as Secretary of IUCSTP on 1 January 1968 and all correspondence should be sent to Dr. DYER at : National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington, D. C. 20418, USA.

International Symposium on the Physics of the Magnetosphere

WASHINGTON, D. C., SEPTEMBER 3-13, 1968

PRELIMINARY ANNOUNCEMENT

CO-SPONSORED BY :

Committee on Space Research (COSPAR).
International Astronomical Union (IAU).
International Association of Geomagnetism and Aeronomy (IUGG-IAGA).
International Union of Pure and Applied Physics (IUPAP).
International Scientific Radio Union (URSI).

HELD BY :

US National Academy of Sciences.
NASA Goddard Space Flight Center.

ORGANIZATION OF TOPICS :

1. Solar wind — magnetosphere interactions.
2. Magnetosphere models.
3. Geomagnetic tail.
4. Low-energy plasma in the magnetosphere.
5. Auroras and polar substorms.
6. Trapped radiation.
7. Wave-particle interactions.
8. Acceleration processes.
9. Laboratory experiments.

PROGRAM COMMITTEE :

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D. J. Williams, Secretary (USA).
I. A. Zhulin (USSR).

Attendance by invitation. For further information, contact any member of the Program Committee.

SERVICES PERMANENTS

FAGS Permanent Service Annual Reports for 1966

BUREAU INTERNATIONAL DE L'HEURE

Durant 1966, le BIH a continué à former et à comparer des échelles de temps en usage : le Temps Universel TU, le Temps Atomique TA et l'échelle de temps intermédiaire TUC. Il a, d'autre part, pris une part accrue à la coordination des émissions de signaux horaires. Les calculs ont été automatisés et accélérés.

TEMPS UNIVERSEL.

Les observatoires qui collaborent aux travaux du BIH envoient les résultats de leurs mesures de latitude. Le BIH en déduit les coordonnées du pôle et les corrections de longitudes qui permettent de passer des TUO individuels au TU1, commun à toute la Terre. Après lissage des valeurs observées, fait dans les observatoires, le BIH calcule par moyenne la valeur définitive de TU1, TU1 déf, et celle du TU régularisé par application d'une correction à période annuelle : TU2 déf.

Le calcul et l'édition des circulaires donnant les coordonnées du pôle et les corrections de longitudes ont été entièrement automatisés.

Cependant, pour gagner du temps, le BIH a décidé de calculer simultanément les coordonnées du pôle et TU1 déf en utilisant les mesures brutes de latitude et de TUO, sans lissage au niveau des stations participantes. Les essais conduits sur les années 1964 et 1965 ont été satisfaisants et cette nouvelle méthode a été appliquée pour l'année 1966. Une partie du retard de la publication de l'heure définitive a été comblée : le Bulletin Horaire de mars-avril 1965 a été envoyé le 9 juin 1966, celui de mars-avril 1966, le 14 février 1967 soit avec une avance de 4 mois.

Conjointement avec le service International du Mouvement Polaire, nous avons préparé et envoyé des formulaires pour la transmission sous une forme homogène des données d'observations.

Ces formulaires sont entrés officiellement en service le 1er janvier 1967, mais plusieurs observatoires les avaient utilisés plus tôt, à titre de contrôle.

Les nouvelles méthodes de calcul, possibles grâce à l'emploi de l'ordinateur de l'observatoire de Paris, permettent, par l'élimination des lissages, de suivre de plus près les caractéristiques de la rotation de la Terre et les valeurs publiées de TU1 déf et TU2 déf en sont améliorées. A la fin de 1966, les latitudes de 40 instruments et les TU de 43 instruments étaient transmis au BIH.

Temps atomique.

Nous avons modifié la définition de l'échelle moyenne de temps atomique A3 du BIH : A3 repose sur tous les étalons absolus et des poids ont été attribués pour tenir compte de leurs stabilités.

A3 est toujours une échelle intégrée reposant sur les comparaisons de fréquence. La méthode de comparaison par l'intermédiaire de fréquences-étalon a été utilisée plus complètement en traitant par la méthode des moindres carrés toutes les équations de liaison.

Les modifications ont donné à l'étalon moyen A3 une stabilité qui peut être estimée à 10^{-12} environ. A la fin de 1966 le nombre d'étalons suivis était de 8.

Coordination des émissions de temps.

On sait que les signaux horaires sont émis dans une échelle liée en temps atomique, mais qui comporte, par rapport à ce temps, un décalage croissant linéairement avec le temps et des sauts de rattrapage, afin de suivre approximativement TU. Cette échelle est appelée TUC. Le BIH a continué à maintenir l'échelle TUC. Le décalage choisi pour janvier 1966 a permis de suivre TU sans qu'aucun saut n'ait été nécessaire.

D'autres signaux suivent un système différent : sans décalage, mais avec sauts plus nombreux. Le BIH a favorisé la coordination de ces signaux entre eux et construit une autre échelle intermédiaire entre TA et TU : TAS (temps atomique à sauts). Le CCIR a chargé le BIH du maintien de l'échelle TAS.

De plus, le BIH doit maintenant aviser les autorités responsables lorsqu'un réajustement des signaux horaires à TUC (ou TAS) est nécessaire.

PUBLICATIONS PÉRIODIQUES DU BIH.

1. — *Bulletin Horaire* : Le Bulletin Horaire, distribué gratuitement sur demande, donne pour chaque période de deux mois les différences entre les diverses échelles de temps : A3, TU2 déf, TU1 déf, TUC, TAS. Il public, en outre, les écarts des temps d'émission nominaux des signaux horaires avec TUC.

Le fascicule contenant les résultats de janvier-février donne en outre des renseignements généraux et un tableau des principales émissions de signaux horaires. Les progrès de la coordination des signaux horaires permettent de réduire de plus en plus le volume de la publication. Le Bulletin Horaire est tiré à 550 exemplaires, 430 sont distribués.

2. — *Circulaire D* : La circulaire D est un résumé du Bulletin Horaire, envoyé par avion dès que les résultats sont obtenus. Elle comporte les comparaisons entre les échelles de temps : TU2 déf, TU1 déf, A3, TUC ainsi que les coordonnées du pôle, mais pas les écarts entre les signaux et TUC. Cette circulaire est suffisante quand une précision de 1 ms est demandée sur les temps d'émission des signaux. Pour limiter les frais postaux, la circulaire D n'est envoyée que sur demande justifiée : les usagers peu pressés, les bibliothèques, trouvent toutes les données de ces circulaires dans les Bulletins Horaires correspondants. 140 exemplaires sont envoyés.

3. — *Circulaire sur les corrections de longitude* : Cette circulaire mensuelle donne de 10 jours en 10 jours les coordonnées du pôle, interpolées et extrapolées, ainsi que les corrections de longitude correspondantes. Elle est envoyée par avion vers le 25 du mois, pour la période qui couvre le mois précédent. 140 exemplaires sont envoyés.

4. — *Circulaire A* : annuelles, donnent la différence TU2 — TU1 (140 exemplaires).

PERSONNEL — DIVERS.

En 1966, les travaux du BIH ont demandé la collaboration à plein temps de 3 calculateurs (Mlle A. M. Desprats, Mlle R. Barthalot, M. E. Eisop). Les travaux de recherche ont été menés par des astronomes de l'observatoire (Mlle M. Feissel, M. R. Forga) et par des stagiaires (Mlle M. Jorge-Silva, M. F. Razanamparany). M. R. Thomas, comptable et Mme C. Mulhauser, secrétaire, ont travaillé à temps partiel.

Les calculs ont été faits sur l'ordinateur de l'observatoire de Paris. Les publications ont été préparées par l'Imprimerie de l'observatoire. Ces services ont été rendus gratuitement.

Nous tenons à remercier ici tous les directeurs d'observatoires et de laboratoires pour leur collaboration et tout particulièrement le Directeur de l'Observatoire de Paris pour son aide matérielle considérable.

Le Directeur,
B. GUINOT.

LE SERVICE INTERNATIONAL DES URSIGRAMMES ET JOURS MONDIAUX

Le service International des Ursigrammes et Jours Mondiaux (IUWDS) est un service permanent de l'Union Radio Scientifique Internationale (URSI) en association avec l'Union Astronomique Internationale (UAI) et l'Union Internationale de Géodésie et Géophysique (UIGG). L'IUWDS adhère à la fédération des services d'Astronomie et de Géophysique (FAGS) : par son intermédiaire, il reçoit des subventions de l'UNESCO pour une partie de ses activités et de ses publications.

Le service s'attache à réaliser une coopération immédiate et permanente entre tous les scientifiques intéressés par l'activité solaire et ses conséquences géophysiques. Comme service permanent l'IUWDS apporte aussi son concours à l'UAI et au COSPAR pour des activités épisodiques.

La surveillance de l'activité solaire et géophysique ne peut se réaliser que par une coopération volontaire de tous les observatoires et instituts qui y sont intéressés. L'IUWDS organise cette coopération grâce à ses centres régionaux ou à ses centres associés : ceux-ci réunissent dans une région donnée, les informations obtenues et les diffusent soit directement, soit vers les autres centres régionaux en utilisant les moyens de communications les plus rapides. Grâce à cette organisation, la plupart des phénomènes observés sont connus dans le monde entier quelques heures après l'événement.

Cette difusion rapide a deux buts : d'une part l'information pure et simple, d'autre part l'établissement de prévisions de l'activité solaire ou géophysique à l'intention de tous ceux qui y sont intéressés.

Comme exemple particulièrement caractéristique et exceptionnel de cette diffusion de l'information, prenons celui du centre de Stockholm, en Suède. Les messages codés appelés URSI-GRAMMES sont diffusés tout d'abord aux instituts directement intéressés : Observatoires d'Astronomie d'Uppsala, de Stockholm (Saltsjöbaden) et station d'Anacapri (Italie), Observatoire Géophysique de Kiruna, Observatoires Ionosphériques de Lulea, de Lycksele et d'Uppsala, mais aussi à la Station Radio d'Enköping, aux Instituts de Technologie de Stockholm et de Göteborg, à l'Institut de Géodésie d'Uppsala, à différents organismes de la Défense Nationale et de la Marine, aux Chemins de Fer Suédois, à deux journaux et à l'Agence Centrale Suédoise d'Information.

Les prévisions concernent des disciplines variées et portent sur des périodes de temps très diverses.

La plupart des centres régionaux ont été établis au départ pour faciliter les transmissions par radio. De ce fait, il existe une tradition assez longue de prévision des conditions de propagation : prévision à long terme, c'est-à-dire plusieurs mois à l'avance, compte tenu de l'évolution probable de l'activité solaire complétée par une prévision à court terme, de l'ordre de la semaine et du jour, destinée à tenir compte de la situation réelle et surtout des perturbations occasionnelles liées aux événements solaires. Pour répondre à ce besoin un certain nombre de centres régionaux, notamment ceux de Fort Belvoir (USA), de Moscou (URSS) et de Kokubunji (Japon) travaillent 24 heures sur 24 et sont capables d'envoyer des alertes ou de fournir des prévisions partout sur une période très courte de 6 à 12 heures.

Cette prévision étant liée à la connaissance de l'activité solaire et de l'activité géomagnétique, on a été amené à faire de la prévision dans ce domaine. Depuis quelques années des progrès considérables ont été faits dans la connaissance des phénomènes solaires; ces progrès sont liés au développement de techniques nouvelles (radioastronomie, mesure des champs magnétiques solaires, etc...) et à l'augmentation du nombre d'observatoires, principalement dans les régions aurorales. Par ailleurs les expériences spatiales ont à la fois apporté des connaissances en ce domaine et posé des exigences : il n'est pas possible d'envoyer des hommes dans l'espace sans s'assurer que pendant le voyage ils ne risquent pas les véritables tempêtes cosmiques que constitue soit l'arrivée de protons très énergiques (plus de 100 Mev) soit le passage des nuages de plasma solaire lié aux perturbations géomagnétiques. On assiste donc sur le plan des observations à un effort gigantesque de certaines organisations pour assurer par elles-mêmes une surveillance et une prévision quasi permanente de l'activité solaire.

Dans le cadre de l'IUWDS, les scientifiques qui leur fournissent en fait les connaissances dont ils ont besoin, ont eux aussi perfectionné leurs méthodes. C'est ainsi que lors du Congrès de Belgrade (31 août 1966), le service a changé ses normes de prévisions de l'activité solaire, en se proposant d'alerter les organismes intéressés lorsqu'il identifie sur le disque solaire soit un centre d'activité particulièrement éruptif (moins de 10 % des centres observés fournissent les trois quarts des éruptions) soit un centre capable de donner une éruption à protons de grande énergie (ce sont des événements particulièrement rares et importants). Dans l'un et l'autre cas la position du centre suspect est donnée et la prévision est renouvelée toutes les 24 heures. Bien entendu les éruptions à protons, prévues ou imprévues, sont signalées aussitôt que possible, ainsi que les orages géomagnétiques qui rentrent aussi dans le cadre de cette prévision ; ces nouvelles normes sont appliquées depuis le 1er janvier 1967.

Dans la plupart des pays, cette activité solaire intéresse aussi les services de météorologie qui étudient son influence possible sur les phénomènes météorologiques de sorte qu'il existe une coopération très active avec ces services. En particulier l'IUWDS transmet aux périodes d'équinoxe des messages météorologiques spéciaux (STRATWARM) pour signaler les échauffements de la stratosphère qui se produisent dans les zones aurorales : ceux-ci sont en relation avec les changements de saison et le renversement du régime des vents. D'autre part la météo assure la transmission des Geoalerts de l'IUWDS et des informations concernant les satellites météorologiques.

L'année 1966 a permis la mise à l'épreuve des possibilités de l'organisation à propos d'un certain nombre d'expériences soit régionales, soit mondiales. Cette coopération a été un succès qui marque une évolution dans les possibilités du service et réalise pleinement ses ambitions.

A l'initiative du Dr. Svestka, Président de la Commission 10 de l'UAI, un projet d'étude des éruptions à protons (PFP) a débuté le 1er mai 1966, patronné par l'IQSY et encouragé par l'IUCSTP. Ce projet proposait d'une part une observation intensive des centres à protons et des éruptions à protons, d'autre part une publication concertée des observations obtenues. La première partie qui devait s'étendre jusqu'à la fin du mois de septembre 1966 nécessitait une prévision des éruptions à protons et sa diffusion immédiate à tous les observatoires coopérants, soit quatre vingt observatoires répartis dans le monde entier. L'IUWDS a permis la pleine réussite de cette partie du programme qui avait été confiée au secrétaire de l'IUWDS assisté d'un certain nombre d'experts qualifiés. Le centre de Meudon, bénéficiant du concours total de l'observatoire de Meudon et de ses experts et de celui de la plupart des observatoires solaires (en particulier de celui de Toyokawa), a pu prévoir les deux éruptions à protons les plus spectaculaires de cette période. Ce résultat est très encourageant pour un premier essai. Il a montré que les techniques utilisées étaient valables et que le réseau de l'IUWDS pouvait assurer les liaisons rapides nécessaires à ce genre d'expérience.

Sur un plan plus restreint, l'IUWDS a apporté au SPARMO l'appui de son organisation, lors des deux campagnes de lâchers de ballons pour l'étude du rayonnement cosmique. La première, pendant les deux premiers mois de 1966 se déroulait simultanément dans les zones aurorales arctiques et antarctiques soit à partir de bases fixes, soit à partir de bases mobiles. Malgré les difficultés des liaisons, les bulletins de prévisons sont arrivés en général dans l'heure qui suivent leur émission. La seconde, en Juillet-Août a permis l'observation complète de l'événement du 7 juillet dans les zones aurorales arctiques.

De façon organique, mais épisodique, le service permanent prête son concours au COSPAR et à l'UAI.

Le COSPAR a la responsabilité d'identifier tous les satellites et toutes les sondes spatiales et de fournir aux organismes intéressés les éléments de calcul des satellites et des renseignements sur le fonctionnement de ceux qui peuvent donner lieu à une observation internationale. En fait c'est le centre mondial de l'IUWDS à Fort Belvoir qui joue alors le rôle essentiel en centralisant les informations pour le compte du COSPAR et en les diffusant par télégramme ou par lettre circulaire (tous les quinze jours) selon l'intérêt des expériences.

L'UAI a un service, actuellement à la charge du Smithsonian Observatory de Cambridge (Massachusetts), pour annoncer les observations de comètes, de novae et en général de tout objet imprévu pouvant intéresser les astronomes. L'IUWDS est chargé de transmettre les informations : cette année une vingtaine de télégrammes ont été envoyés et l'année s'est terminée sur un événement totalement imprévu, la découverte d'un nouveau satellite de Saturne qui a pu être confirmée en quelques jours grâce aux Télégrammes Astronomiques.

Une charge plus routinière est celle de favoriser l'observation simultanée dans certains domaines ou de publier simultanément des observations relatives à des disciplines très différentes. Dans l'un et l'autre cas, il s'agit d'une coordination originale qui n'est assurée par aucun autre organisme.

Le premier but est atteint par la publication du Calendrier Géophysique International dans de nombreuses revues ou par sa diffusion à de nombreux observatoires. Il prévoit suivant le rythme des observations, un jour par semaine (RGD), trois jours par mois (RWD), deux semaines par saison (WGI) et quelques autres jours répartis dans l'année, tous particulièrement propres aux observations ionosphériques, au tir de fusées météorologiques et à toutes mesures locales qui peuvent bénéficier d'une simultanéité avec d'autres observations.

L'« Abbreviated Calendar Record » rassemble pour chaque jour les diverses observations solaires et géophysiques. C'est une compilation unique qui paraît après un délai de quelques mois dans les IQSY Notes. Pour les années 1960 à 1965, l'édition définitive paraîtra dans « Annales de l'IQSY ».

L'ensemble de l'organisation du service a été décrit en détail cette année dans le N° 19 des IQSY Notes sous le titre « 1966-1967 World Day Program ». Ce fascicule est disponible sans frais auprès du Secrétaire de l'IUWDS (Dr P. Simon, Observatoire, 92 — Meudon — France). Il décrit l'organisation des Jours Mondiaux, les programmes scientifiques recommandés pour ces jours ou périodes, l'organisation des divers centres, l'organisation des échanges de messages, d'alertes et de prévisions, les diverses activités du service et pour conclure donne des informations très complètes sur les centres mondiaux et régionaux, les représentants nationaux et la composition du comité de direction.

Favoriser cette coopération entre des disciplines parfois très diverses est une tâche ingrate mais cependant très passionnante ; ingrate car chacun s'intéresse principalement à ses propres problèmes et nul ne peut prétendre à une compétence dans tous les domaines ; passionnante car elle est indispensable en raison des problèmes que vont poser les voyages de l'homme dans l'espace, et surtout elle permet d'établir des relations exceptionnelles avec un grand nombre de personnes diverses qui apportent volontiers leur coopération active et aimable, ce qui est très réconfortant.

P. SIMON,
Secrétaire de l'IUWDS