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# U. R. S. I.

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## NÉCROLOGIE

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C'est avec le plus profond regret que nous annonçons le décès, survenu le 26 octobre 1967, du Lieutenant Colonel Ing. Ernest Herbays, Secrétaire général de l'URSI. Le Bureau de l'Union a été représenté aux funérailles, le 31 octobre à Bruxelles, par le Prof. Ch. Manneback (Trésorier) et le Dr C. M. Minnis (Secrétaire général adjoint). Un article retraçant les activités, et les longs efforts que le Colonel Herbays consacra à l'URSI paraîtra dans le prochain numéro du Bulletin.

\* \* \*

It is with very deep regret that we record the death of Lieutenant Colonel Ing. Ernest Herbays, Secretary General of URSI, on 26 October 1967. The Board of Officers was represented at the funeral in Brussels on 31 October by Prof. Ch. Manneback (Treasurer) and Dr. C. M. Minnis (Assistant Secretary General). An account of Col. Herbays' long association with URSI will appear in the next issue of the Bulletin.

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## NATIONAL COMMITTEES

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### Australia

#### CHANGES TO IONOSPHERIC PREDICTION SERVICE

There have recently been several significant changes affecting the Ionospheric Prediction Service. This circular is intended to explain these.

1. The Ionospheric Prediction Service has become a Division of the Bureau of Meteorology. This will not cause any reduction in the services provided and in fact the object of this rearrangement is to improve the capacity and efficiency of the Service.
2. The Ionospheric Prediction Service has become a new Division of the Central Office of the Bureau of Meteorology and the position of Director, Ionospheric Prediction Service, has been changed to Assistant Director, Ionospheric Prediction Service Division.
3. Dr. W. G. Baker who was until recently Director of the Ionospheric Prediction Service has retired.
4. Mr. C. G. McCue has been appointed to the position of Assistant Director, Ionospheric Prediction Service Division.
5. In future all correspondence should be addressed to the Assistant Director, Ionospheric Prediction Service Division. The Postal Address is : Ionospheric Prediction Service Division, Commonwealth Centre, Chifley Square, Sydney, NSW, 2000. — Telegrams : IPSO Sydney. — Telex : AA20663.

19 sept. 1967.

C. G. McCUE.  
Assistant Director.

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## **New Zealand**

### **MEMBERSHIP**

*Chairman* : Mr. W. H. WARD, 8 Rakau Road, Wellington, E. 2.

*Secretary* : Mr. G. J. BURTT, Department of Scientific and Industrial Research, Physics and Engineering Laboratory, Private Bag, Lower Hutt.

*Members* :

Mr. G. MCK. ALLCOCK, DSIR.

Commander G. M. BEERE, RNZN Defence Dept.

Mr. A. H. BROWNE, Civil Aviation Dept.

Prof. R. L. DOWDEN, Otago University.

Dr. G. A. M. KING, DSIR.

Mr. L. H. MARTIN, N. Z. Broadcasting Corporation.

Mr. J. MAWDSLEY, Victoria University of Wellington.

Dr. E. I. ROBERTSON, Royal Society of New Zealand.

Mr. D. C. ROSE, New Zealand Post Office.

Dr. J. R. STOREY, Auckland University.

Dr. H. A. WHALE, Auckland University.

*Official Members of Commissions* :

Commission I. — Mr. W. H. WARD.

Commission II. — Mr. D. C. ROSE.

Commission III. — Dr. G. A. M. KING.

Commission IV. — Mr. G. MCK. ALLCOCK.

Commission V. — Dr. H. A. WHALE.

Commission VI. — Mr. J. MAWDSLEY.

Commission VII. — Mr. G. J. BURTT.

Commission VIII. — Mr. G. MCK. ALLCOCK.

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## **USA**

### **NEWLY ELECTED OFFICERS**

*President* : Prof. Edward C. JORDAN, Department of Electrical Engineering, University of Illinois, Urbana, Illinois 61801.

*Vice-President* : Prof. Alan T. WATERMAN, Jr., Electronics Laboratories, Stanford University, Stanford, California 94305.

*Secretary* : Dr. Francis S. JOHNSON, Southwest Center for Advanced Studies, P. O. Box 30365, Dallas, Texas 75230.

## RADIO SCIENCE

### CONTENTS OF VOL. 2, N° 8, AUGUST 1967

- Preface to « Electromagnetic Wave Propagation in Anisotropic Media » papers. Leopold B. FELSEN.
- Radiation of an antenna in a compressible magnetoplasma. Georges A. DESCHAMPS and Oren B. KESLER.
- Ray optics for radiation problems in anisotropic regions with boundaries II. Line-source excitation. Leopold B. FELSEN and Shalom ROSENBAUM.
- Ray optics for radiation problems in anisotropic regions with boundaries. II. Point-source excitation. H. L. BERTONI and A. HESSEL.
- Transient radiation of an electrical dipole in a uniaxially anisotropic plasma. S. W. LEE and R. MITTRA.
- Diffraction by a cylinder in a locally uniaxial medium with azimuthal optic axis. Henry J. STALZER, Jr. and Jerry SHMOYS.
- Scaling for rotationally symmetric potential in uniaxial media, George EICHMANN.
- Aperture fields in an anisotropic medium. E. V. JULL.
- Electromagnetic plane wave scattering from a plasma-coated conducting cylinder. R. J. MAYHAN and F. V. SCHULTZ.
- Propagation of oblique electromagnetic waves through a warm plasma slab with normal magnetostatic field. B. R. CHAWLA, D. KALLURI and H. UNZ.
- Reflection of circularly polarized electromagnetic waves from an anisotropic plasma. M. P. BACHYNSKI, B. W. GIBBS and K. A. GRAF.
- Propagation in nonuniform slightly gyrotropic media. Stanley H. GROSS.
- Ionospheric wave theory using coupled vacuum modes. H. POEVERLEIN.
- Full wave solutions in terms of coupled vacuum modes. Edward J. WALSH.
- Biorthogonal expansions for the linearized anisotropic multifluid warm plasma equations. Maurice I. SANCER.
- Mode matching method for anisotropic guides. R. MITTRA and S. W. LEE.
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**URSS**

**CORRIGENDUM**

**A. S. Popov Gold Medal Contest**

*Information Bulletin*, n° 162, p. 15, Para. 4 to read :

« For the A. S. Popov's Gold Medal are to be submitted : Scientific publications (series of papers), discoveries or inventions in triplicate; a testimonial of the scientific value... ».

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## COMMISSIONS

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### Commission I on Radio Standards and Measurements

#### MEETING TO DISCUSS COORDINATION OF THE STANDARD FREQUENCY AND TIME SIGNAL BROADCASTS IN THE EUROPEAN AREA

BRUSSELS, 19TH-20TH SEPTEMBER 1967  
URSI OFFICES, 7 PLACE EMILE DANCO

#### MINUTES

Those present were :

Mr. L. ESSEN, International Chairman, Commission I (NPL).  
Mr. U. ADELSBERGER, PTB.  
Mr. G. BECKER, PTB.  
Mr. J. BONANOMI, Observatoire Cantonal, Neuchâtel.  
Mr. B. DECAUX, Honorary President, URSI.  
Mr. J. DE PRINS, Université Libre de Bruxelles.  
Mr. C. EGIDI, IENGF.  
Mr. P. HONTOY, Université Libre de Bruxelles.  
Mr. P. LA MAÏDA, CNET.  
Mr. S. LESCHIUTTA, IENGF.  
Mr. J. MILLOT, IFRB.  
Mr. J. MCA. STEELE, Secretary, Commission I (NPL).  
Mr. Ch. STETTLER, CCIR.

Apologies for absence were received from Mr. ÅBOM (Sweden) and Mr. TOLMAN (Czechoslovakia).

SESSION I : 19th September, 1967.

Dr. Essen welcomed the delegates to this informal meeting which had been convened in accord with a resolution at the last General Assembly. In addition to the representatives of countries operating standard frequency services he was pleased to have present Mr. Stettler (CCIR), Mr. Millot (IFRB), Mr. Hontoy



(ULB) and Mr. De Prins (ULB). Unhappily Col. Herbays was ill and not able to attend; the meeting agreed that an expression of good wishes should be conveyed to him.

Explaining the object of the meeting Dr. Essen referred to the early standard frequency services established in Europe in 1950 to supplement the signals provided by WWV. With the requirements for increased accuracy in frequency comparison the original HF emissions had become less important and several LF stations now provided a time and frequency reference in Western Europe. The possibility of a single station for the region had been discussed but even if this could not be realized it was important to treat Europe as a whole and to examine how best the existing stations might be coordinated to satisfy the needs of the majority of users. We should bear in mind, also, the recent recommendation of an atomic definition of the second and the acceptance by the IAU of this definition for all frequency measurements.

The Agenda having been approved Mr. Steele summarized a recent article giving tables of the present characteristics of standard frequency stations in the HF, LF and VLF bands. A number of additions and corrections to the tabulated data were noted and also to the tables appearing in the CCIR Vol. III (Oslo, 1966). Mr. De Prins then outlined a paper giving the results obtained in time measurements using the signals transmitted by stations WWVB and HBG. Using the optimum reference point of 80 % of the carrier amplitude and photographic integration of 60-300 pulses the precision of time reference was determined to be 30-40  $\mu$ s at distances up to 1000 km when receiving the (dominant) ground wave. The precision at VLF was about three times less (100-150  $\mu$ s). If envelope timing can be made sufficiently precise then it is possible to identify a cycle at a VLF carrier and extend the timing accuracy to the microsecond region.

Difficulties in the use of the LF signals under conditions of interfering ground and sky wave were reported but it seemed likely that anomalous results were confined to geographically small areas. Both HBG and MSF, for example, provide a very stable day-time carrier phase as received at Bagneux and similar results may be expected at other locations within the ground-wave range of those stations. At longer distances ( $> 1000$  km) seasonal variations may be expected.

The powerful emissions of RWM Moscow on 5, 10 and 15 MHz

caused wide-spread mutual interference with other stations although, fortunately, this was confined to only one frequency at any one time. The interference with time signal measurements would increase should RWM adhere to the UTC system. The operating schedule was given in CCIR Vol. III (Oslo, 1966) and also known to the BIH. No need was foreseen to make use of frequency staggering to reduce interference. MSF would continue to operate in alternate 5-minute periods pending discussions on the future schedules of HBN and IBF. At present there is no intention to resume the HBN transmissions, so long as HBG continues to operate.

There was some doubt on the relative usefulness of the HF emissions but it appeared that they will continue to play a useful, if diminishing role, in time signal dissemination for the next 5-10 years.

In Europe the stations HBG, MSF and OMA provide continuous time signal distribution in the LF band. Both HBG and MSF radiate pulses in the form of carrier interruptions and when new time signal generating equipment is installed at Rugby it will enable MSF to adopt the HBG system of marking minutes, hours and 12-hours by repetition of the seconds pulse. There was a CCIR Study Programme on the question of precision of time indication related to the available bandwidth but it would be useful also if URSI could state an opinion on this important topic, which had not received much consideration so far.

There was a conflict between users who might require the highest precision ( $< 0.1$  ms), operating with a relatively wide-band receiver in areas of low man-made noise and the majority of users who would be satisfied with a few milliseconds and who would usually find themselves in high noise environments. It would be expensive to provide a receiver to cover all possible conditions of accuracy and noise. Equally, it would be costly to produce a tunable receiver to operate on the above three stations and also DCF77. The best solution would appear to be a common basic design, similar to those already commercially available and suitably adapted by the manufacturers to meet the specific requirements of the user.

On the subject of offset and non-offset operation it was agreed that carrier frequencies should be adjusted to nominal in the atomic scale. The UTC system had worked well and had great

advantages. Nevertheless, in view of the adoption of an atomic basis for the second it seemed desirable to abandon the offset for time signal generation and transmit an atomic time scale. To maintain coordination this change should be made simultaneously world-wide but in default of general acceptance Europe might take the initial step and switch all the transmitters to AT operation. The consequences both legal and scientific of such a change would require careful consideration although the change itself from UTC to AT could be accomplished with little immediate difficulty and without attracting undue attention.

Several schemes for combining AT and UTC signals in the one emission had been proposed : all were inevitably complicated and in principle it was undesirable to radiate two time scales which could only serve to confuse the general user.

Concluding the discussion Dr. Essen considered it the general opinion that the needs of users in Europe would best be served by a small number of LF stations operating continuously and providing continuous time signals. The carrier frequencies should not be offset and the existing offset of the time pulses should be regarded as an interim measure. The logical outcome of the adoption of the atomic unit of time was the use of this unit for all measurements of time interval. It remained for the meeting to express these views as clearly and convincingly as possible in a document which should be distributed to the interested organizations.

#### SESSION II : 20th September, 1967.

Mr. Millot presented the results obtained in the last monitoring campaign organized by the IFRB in July 1967 in preparation for the Meeting. It was confined to the European area and, like previous exercises, was designed to establish the extend of harmful interference within the standard frequency bands from stations of services other than the standard frequency services. In respect of this problem the IFRB had received only one complaint in the past 4-5 years but this did not represent a true measure of the situation since many cases of external interference were dealt with directly between Administrations and only a few per cent of all cases were referred to the IFRB for action. In the July campaign, and unlike previous campaigns, the IFRB had requested

Administrations to monitor not only out-of-band transmissions operating in the standard frequency bands but also the standard frequency emissions themselves. Thus the monitoring data constitute a valuable record of the extent of mutual interference between the standard frequency signals received in the European area.

The results of the monitoring campaign are at present being analysed and the conclusions will be made available to the next Interim Meeting, Study Group VII, CCIR. Mr. Millot stressed the importance of establishing well-defined channels within each Administration for the transmission of reports on interference with the standard frequency services. This was essential if the clearance of the standard frequency bands already achieved was to be maintained.

The Agenda having been covered the Meeting then turned to consider in what form its conclusions should be expressed. A number of draft statements were discussed at length and the conclusions given in the Appendix were finally agreed, unanimously.

In his concluding remarks, Dr. Essen thanked the delegates for their attendance and the excellent results which had been achieved. They were also indebted to the Secretariat for the excellent arrangements which had greatly facilitated the work of the Meeting.

#### CONCLUSIONS

This Meeting, called by URSI to consider the coordination of standard frequency transmissions in the European Area, has reached the following unanimous conclusions :

1. — *Type of emission.*

The most suitable standard frequency and time service will be provided by transmitters operating continuously in the lower part of the LF band. The transmitters should operate on their nominal values of frequency, i.e. without offset. The timing pulses should consist of carrier interruptions of precise duration, preferably of 100 ms, the minutes, hours and twelve hours being indicated by a double, triple and quadruple interruptions, respectively.

The HF stations will continue to provide a satisfactory service of time signal dissemination to an accuracy of a few tenths of a millisecond.

The VLF stations provide an additional source of standard frequencies and time signals.

2. — *Number of LF stations.*

Existing experience has shown that the effective range of LF transmission for frequency and time measurements is about 800 km under normal conditions. The whole of the area could be served by several suitably situated medium power stations.

The stations at present in operation, namely OMA (50 kHz), MSF (60 kHz), HGB (75 kHz) and DCF 77 (77.5 kHz), provide an adequate coverage. Further measurements of phase and signal strength are needed to ascertain with more confidence the useful range under all conditions.

3. — *Preferred time scale.*

The UTC system now widely in use can only be regarded as an interim solution since it does not exploit fully the second defined by means of an atomic transition. The advantages of dispensing with frequency offsets and steps adjustments are overwhelming and there seems to be no scientific reason why this should not be done immediately. Delaying the transition to an atomic time scale will only increase the difficulties and cost of a change which is inevitable.

The CGDS (Comité Consultatif pour la Définition de la Seconde) of the CIPM (Comité International des Poids et Mesures) has recommended that a meeting of specialists should be called to consider the full implications of adopting the atomic unit based on the new definition of the second. It is hoped that this meeting will be convened in the very near future and that it will then be possible to decide on a definite date (e.g. January 1st, 1970) on which all stations, or at least all those represented here, would adopt atomic time with a common origin. Some of the advantages of using atomic time and constant frequency (without offset) are listed below :

- (a) Measurements of time interval and frequency can be made immediately without the need to apply subsequent corrections.
- (b) The possibility of confusion is avoided by the use of a single

unit. The simultaneous use of two different time units (AT and UTC), one of which may be changed in value, is bound to lead to confusion (a common mistake is to express frequency in terms of the UTC unit).

- (c) The coherence of the carrier and the time pulses is preserved.
- (d) Frequency and time transmissions without discontinuities make possible the automatic setting of clocks without undue complication and simplify and increase the reliability of all applications of atomic clocks (e.g. anti-collision navigation systems).
- (e) Corrections will be required only for variable quantities such as the time of rotation of the earth. The present system of changing the unit to agree with the variable period of the earth's rotation is no longer acceptable.

#### 4. — *Continuous cooperation.*

The continued cooperation of stations in the European Area is essential.

### 1968 CONFERENCE ON PRECISION ELECTROMAGNETIC MEASUREMENTS

Boulder, Colorado — Several new areas will be accented at the biennial Conference on Precision Electromagnetic Measurements which will be held June 25-28, 1968 at the National Bureau of Standards Laboratories in Boulder, Colorado.

The scope of the conference continues to cover basic precision measurements at frequencies ranging from DC through microwaves and lasers and the precise measurement of time and frequency.

For the first time, however, the conference will devote major attention to the rapidly developing field of automated precision measurements, required for example, in large scale electronic systems such as steerable arrays. Another new field to be considered will be precision techniques in pulse and waveform measurements. Also, a special session is planned on the present status of comparisons of standards in international round robins.

Original papers in both the new and traditional fields of precise electromagnetic measurement are being solicited for the conference.



●  $I_{F_2}$  (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				

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

●  $\Phi$  (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
1967	148	147	161	130	144	120	140	154				

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

PRÉVISIONS :

●  $R_{12}$  \*\*\* :

Année \ Mois	9	10	11	12	1968		
					1	2	3
1967	95	97	99	101	103	104	

(\*\*\*) 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  $R_{12}$  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	-8,2	-9,5	-10,7	-11,3	-11,9	-12,7
Ecart-type de l'erreur	+2,7	+1,7	+1,6	+2,5	+4,4	+5,9

●  $I_{F_2}$  \*\*\*\*

Année \ Mois	1968						
	8	9	10	11	12	1	2
1967	98	112	115	119	122	125	(128)

(\*\*\*\*) 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	-4,2	-4,7	-6,7	-9,1	-11,6	-14,1	-15,8
Ecart-type de l'erreur	±12,0	±15,6	±17,2	±17,2	±16,2	±14,2	±13,5

●  $\Phi$  \*\*\*\*\*

Année	Mois											
	9	10	11	12	1968							
					1	2	3	4	5	6		
1967	(161)	(167)	(172)	(178)	(183)	(189)	(195)	(201)	(208)	(214)		

(\*\*\*\*\*) Prévision selon une méthode d'extrapolation envisagée au Secrétariat du CCIR en application de la Résolution 30 de la XI<sup>e</sup> Assemblée plénière du CCIR (Oslo, 1966). Pour les valeurs mises entre parenthèses, l'erreur dépasse probablement la valeur de  $\pm 10$  unités de  $\Phi$ .

Erreur moyenne sur les prévisions de  $\Phi$  basée sur les 12 mois précédents :

Temps de prévision (mois)	0	1	2	3	4	5	6	7	8	9
	Erreur moyenne	+4,5	+6,8	+8,8	+9,3	+8,9	+6,3	+3,2	-0,1	-3,4
Ecart type de l'erreur	$\pm 16,6$	$\pm 19,2$	$\pm 22,2$	$\pm 21,8$	$\pm 20,4$	$\pm 17,6$	$\pm 17,1$	$\pm 18,3$	$\pm 24,8$	$\pm 29,6$

## BASIC INDICES FOR IONOSPHERIC PROPAGATION

(Reprint from *Telecommunication Journal*,

Vol. 34, n° 9, Sept. 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) :

Year	Month											
	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										

●  $I_{F_2}$  (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				

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

●  $\Phi$  (monthly mean value of solar noise flux) \*\* :

Year	Month											
	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				

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

FORECASTS :

●  $R_{12}$  \*\*\*

Year \ Month	1968						
	9	10	11	12	1	2	3
1967	95	97	99	101	103	104	

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

Estimated error in forecasts of  $R_{12}$  six months in advance :  $\pm 25$ .

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	-8.2	-9.5	-10.7	-11.3	-11.9	-12.7
Standard deviation	+2.7	+1.7	+1.6	+2.5	+4.4	+5.9

●  $I_{F_2}$  \*\*\*\*

Year \ Month	1968						
	8	9	10	11	12	1	2
1967	98	112	115	119	122	125	(128)

(\*\*\*\*) 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 :

Periods of prediction (months)	0	1	2	3	4	5	6
Mean error	-4.2	-4.7	-6.7	-9.1	-11.6	-14.1	-15.8
Standard deviation of the error	$\pm 12.0$	$\pm 15.6$	$\pm 17.2$	$\pm 17.2$	$\pm 16.2$	$\pm 14.2$	$\pm 13.5$

●  $\Phi$  \*\*\*\*\*

Year \ Month	1967				1968					
	9	10	11	12	1	2	3	4	5	6
1967	(161)	(167)	(172)	(178)	(183)	(189)	(195)	(201)	(208)	(214)

(\*\*\*\*\*) 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  $\pm 10$  units of  $\Phi$ .

Mean error in  $\Phi$  predictions calculated over the 12 preceding months :

Period of prediction (months)	0	1	2	3	4	5	6	7	8	9
Mean error	+4.5	+6.8	+8.8	+9.3	+8.9	+6.3	+3.2	-0.1	-3.4	-6.2
Standard deviation of the error	$\pm 16.6$	$\pm 19.2$	$\pm 22.2$	$\pm 21.8$	$\pm 20.4$	$\pm 17.6$	$\pm 17.1$	$\pm 18.3$	$\pm 24.8$	$\pm 29.6$

## **Commission VI on Radio Waves and Circuits**

### **INTERNATIONAL SYMPOSIUM ON INFORMATION THEORY**

**San Remo, Italia**

SEPTEMBER 11-15, 1967

This International Symposium was sponsored by The Institute of Electrical and Electronics Engineers (Professional Group on Information Theory) and by the International Scientific Radio Union and its Italian Committee. The USA Air Force Office of Scientific Research also gave its cooperation.

The Symposium would originally have taken place in Athens, Greece. Unfortunately it became clear in the beginning of August that the Greek Committee of URSI would no longer be in existence at the time of the Symposium. The matter was referred to the President of URSI, and he decided that under these circumstances URSI could no longer sponsor the Symposium in Athens. The IEEE in solidarity with URSI decided even at this late moment (August 8) to try to find another host for the Symposium. In view of the already arranged charter flights the logical alternative to Greece was Italy. Notwithstanding the vacations the Italian National Committee agreed at very short notice to act as host, and the Symposium was moved as a whole to San Remo at the original dates. It was then necessary to inform all participants of the change. The Greek organisation committee very kindly accepted to inform all those who had registered in Athens and to refund their money, if they had sent it. Many phone calls were made and letters sent. In the end we have heard of only one participant who had been on his way for more than a month and remarked the change only on arrival in Athens. Even he came in time to San Remo to give his lecture.

The Symposium was held in the Casino Municipale of San Remo. On Monday, September 11, 1967 the opening session was held. Professor Balakrishnan introduced the Mayor of San Remo, who gave the opening speech. Professor Boella welcomed the delegates on behalf of URSI Professor. Cappacaccio spoke on behalf of the Italian Research Council. More short welcoming

speeches were made by professor Carrassa (official member of Commission VI of URSI), Dr. Stumpers, professor Drenick and Mr. Elspas (the two last speakers representing IEEE and its Professional Group on Information Theory). After the opening session a «vermuth d'onore» was offered by the Azienda Autonoma di Soggiorno.

On Monday afternoon the Symposium started with three sessions in parallel. A thunderstorm leading to a local electricity breakdown and some initial difficulties with the projectors made the end of this session come somewhat later than expected, but all papers were given. In the next days no problems arose and the Symposium went on smoothly.

The programme of the Symposium consisted of eight long papers and about 140 short papers. For the long papers 30 minutes and for the short papers 15 minutes were available (discussion included). Many authors found it difficult to bring out the essential points of their contribution in so short a time, and perhaps the audience also got more easily tired, listening to 12 to 14 different subjects in one afternoon. Even the three minutes available for discussion were many times not used. Large numbers of papers were devoted to pattern recognition (29) and coding (49). Other major topics were : filtering and prediction, detection theory, communication systems and radar.

There were two special sessions. In the first one Mr. E. N. Leith (Univ. of Michigan) gave a review of «Modern holography», that was enjoyed by a full audience. The second special session had professor A. A. Kolmogorov as guest speaker. The announced title of his lecture was «The logical foundations of information theory». Professor Kolmogorov tried to show that it was not necessary to start from probability distributions and to invoke the law of large numbers, but that one could also start from simpler algorithms. This leads to certain changes in the formulae, the principle of which he discussed. He referred to analogous work by Loève. Professor Kolmogorov spoke in French. The lecture was translated in english directly by professor Mourier. There was a prolonged discussion, and we all were greatly impressed by the youthful enthusiasm with which the great mathematician still attacks his problems.

To the regret of the organisers another session of ten contri-

buted papers from the USSR could not be held, because of difficulties with visas.

The great majority of the lecturers came from the United States, nearly thirty came from Europe, and one from Japan. This probably is a direct reflection of the number of workers in the field (with the exception of the USSR). It is impossible to mention even all the prominent participants, but names like Slepian, Elias, Gallager, Berlekamp, Turin, Zadeh, Jacobs, Zetterberg, Abramson, Marko, Kailath, to mention only a few, show a first class representation of the workers in information theory. Many interesting discussions developed outside working hours.

Many people have helped to bring this Symposium to its realization. Professor Drenick who not only dealt with most of the correspondence and phone calls during the preparation, but also acted as secretary-treasurer during the Symposium itself, should be especially mentioned. The help of professor Carrassa and of his assistants on the spot was very valuable. That the city of San Remo which announced its pleasure with the Symposium in large banners over the streets and at the Casino, had put on its best late summer climate, also contributed to the enjoyment of the participants.

To review all 150 papers here is impossible. The long papers and the best short papers will be published in the Transactions on Information Theory of IEEE. Moreover abstracts of most papers can be found in the Symposium Programme.

On Monday the Italian National Committee of URSI gave a cocktail party. On Wednesday excursions were held in the mountains north of San Remo, and along the coast to Nice. The Thursday night banquet with floor show was highly successful.

Eindhoven, October 4, 1967

Dr. F. L. STUMPERS.

## **TO THE OFFICIAL MEMBERS OF COMMISSION VI**

The Coordinating Committee meeting for planning the programme of the next Plenary Assembly in Ottawa August 1969 has been fixed for the end of March, or the beginning of April 1968. If Official Members send me their remarks before March 15, 1969 I will take them into account.



You will have seen the President's letter to the Chairmen and Vice-Chairmen of Commissions in the May-June 1967 issue of the URSI Bulletin.

The Plenary Assembly will be held in Ottawa, Canada in the period 17-29 August 1969. It is now proposed that technical sessions be held in the mornings only and that there be no formal schedules in the afternoons, so that discussion groups and ad hoc working parties can be formed. I suppose, however, that if the normal schedule of our Commission should require one or two afternoon sessions, this will be possible. In the technical sessions we should accommodate the normal subjects of our commission : Circuit Theory, Electromagnetic Wave Theory and Information Theory. In Munich professor Zadeh has suggested that the use of computers in radio science is of such importance as to warrant also at least a half day discussion. (Our sister organisation UGGI recently held a Symposium on the use of computers for its purposes.) In the domain of our Commission we have computers in communication systems, computers for the solution of e.m. wave theory problems, computers in circuit theory problems. Computers are used in antenna synthesis for radio astronomy, and probably in the study of models of atmospheres.

Another question is whether the more general subject of «system theory » is to be preferred to the subjects we have now. (I doubt that it would make much difference.)

In information theory time-varying channels are important for radio communication; the choice of optimal coding systems in satellite communication and for space studies is still of great interest. In circuit theory active RC networks (including sensitivity studies) are of major interest. In electromagnetic wave theory it would be interesting to know whether there is now a better link between the models of e.m. wave propagation in random and inhomogeneous media and communication models than there was some years ago. It can be discussed whether members prefer different subjects in Ottawa or at least partially the same as in Stresa.

I propose to have two speakers give review papers in the technical sessions. With regard to special discussion groups, or forums, Professor Barlow has suggested another discussion on surface waves. (You will remember the discussion in Boulder.) If there are other subjects for an international discussion, please let me

hear from you. When thinking about subjects for technical sessions or groups please have in mind the possibility of Joint sessions. The Plenary Assembly is a unique opportunity to get people of many specialities together and we should use it. Some afternoons have to be kept open for technical excursions, but then the group discussions need not require the presence of all participants.

You all have received the first announcement of the Stresa Symposium, June 3 to 8, 1968. The deadline for summaries (800-1600 words) is January 31, 1968. The Secretary is Mr. G. P. Bava, Istituto di Elettronica e Telecomunicazione Politecnico, Corso Duca degli Abruzzi 24, Torino, Italia 10129.

The International Summer School on Circuit Theory, that is cosponsored by URSI, is to be held in Prague June 28-July 12, 1968. For announcements and registration cards please contact Dr. M. Novak, Chairman of the Summer School Committee, Institute of Radio Engineering and Electronics, Lumumbova 1, Praha 8, Czechoslovakia.

#### COLLABORATION WITH CCIR.

The collaboration of URSI Commission VI is asked (see URSI Bulletin May-June 1967) on the following subjects :

Improved efficiency in the use of the radiofrequency spectrum (Resolution 1-I, Report 414).

The Communication Theory (Question 5-III, Report 196-1).

Terms and definitions relating to space radiocommunication (Report 204-1).

A comparative study of possible methods of modulation for active communication satellite systems (Report 211-1).

Possibilities of reducing interference and of measuring actual traffic spectra (Report 178-1).

Please consult the CCIR books of Oslo 1966.

I hope that at least some official members (e.g. USA, USSR, UK, Japan, France, Germany) can each have these questions and reports studied by a small group in their country and that I can receive their remarks before March 1, 1968. The questions involved are not suitable for discussion by an ad hoc group at the Plenary Assembly, unless several people come well prepared

to discuss them. Moreover the fact that the Plenary Assemblies of CCIR and URSI are held in the same year makes this arrangement inefficient.

4-10-1967.

Dr. F. L. STUMPERS,  
Chairman URSI Commission VI  
Philips Research Laboratories  
Eindhoven  
The Netherlands

## INTERNATIONAL SYMPOSIUM ON NETWORK THEORY

SEPTEMBER 1968 — BELGRADE, YUGOSLAVIA

A Symposium on Network Theory will be held in Belgrade at the beginning of September 1968. The symposium is organized jointly by the Yugoslav Committee for Electronics and Automation (ETAN) and the University of Belgrade with the cooperation of the IEEE Group on Circuit Theory.

Topics including all aspects of Network Theory and its extension to System Theory may be dealt with at the Symposium, though the sessions will be finally classified in accordance with the papers accepted. We suggest the following list of topics :

- Models of physical devices and their characterization;
- Topological analysis and synthesis of linear networks;
- State-space analysis and synthesis of linear and nonlinear networks;
- Functional analysis approach to time-variable and nonlinear networks;
- Analysis and synthesis of deterministic and probabilistic communication nets;
- Optimization of networks;
- Computational aspects of network analysis and design;
- Analysis and synthesis of active networks, especially in integrated form.

We intend to form International Scientific Committee which will select the papers to be presented and will suggest topics and

speakers for invited papers. We would appreciate it very much if you would send your suggestions to the International Organizing Committee listed below :

1. Professor R. HORVAT, Electrical Engineering Faculty, Bulevar Revolucije 73, Belgrade, Yugoslavia.
2. Professor Mc E. Van VALKENBURG, School of Engineering and Applied Science, Princeton University, Princeton, N. J., USA.

Issued March 1967.

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## SERVICES PERMANENTS

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### IUWDS

Londres 24 juillet 1967

Deux réunions importantes de l'IUWDS se sont tenues à Londres pendant la réunion COSPAR/IQSY. Sans attendre la publication des minutes, nous devons les porter brièvement à la connaissance des Unions.

#### I. — RÉUNION DES REPRÉSENTANTS DES CENTRES RÉGIONAUX.

C'est la première fois qu'une telle réunion se tenait depuis la fondation de l'IUWDS. Les représentants étaient pour la plupart des personnes ayant des responsabilités immédiates de fonctionnement et d'organisation.

Les perspectives actuellement ouvertes dans les domaines solaires et géophysiques sont marquées par trois faits nouveaux :

(a) *Prévisions.* — De plus en plus d'expériences ne peuvent être tentées qu'à partir de bonnes prévisions. Les motifs sont divers (coût de l'expérience, du dépouillement des données, danger encouru par les expérimentateurs, difficulté de l'expérience elle-même, etc...). De plus on souhaite des prévisions de plus en plus précises.

(b) *Observations.* — Des moyens d'observation de plus en plus nombreux et mieux adaptés sont mis en œuvre (chaîne de riomètres, d'observatoires, etc...).

(c) *Science.* — Les progrès effectués dans la connaissance soit de l'activité solaire, soit de l'activité géophysique fournissent des bases scientifiques de plus en plus sérieuses à la prévision.

En face de cette évolution très rapide, qui pose principalement des problèmes pratiques, une telle réunion était indispensable. On y a étudié un certain nombre de problèmes immédiats comme par exemple l'envoi de messages solaires et géophysiques particulièrement étudiés pour répondre aux besoins des stations polaires

ou des groupes se trouvant à des bases isolées pendant une campagne d'observations, l'amélioration des messages d'alertes pour tenir compte des nouvelles techniques, l'étude de nouveaux codes fournissant une description aussi totale que possible des centres d'activité ou des événements solaires et cosmiques, etc... Des échanges de vue sur les conditions de travail, les centres d'intérêt et les problèmes propres aux différents centres ont été particulièrement utiles pour mieux se connaître : ceci facilitera le règlement ultérieur des problèmes futurs.

## II. — RÉUNION DU COMITÉ DE DIRECTION.

Elle s'est tenue à la suite de la précédente. Le principal problème traité a été celui du projet d'un *Service International Soleil Terre*, étudié par le Prof. Pushkov et Mr. Shapley. Cette perspective pose de sérieux problèmes à l'IUWDS dans la mesure où son champ d'activité se recouvre en grande partie avec celui prévu pour ce service. Il a été décidé, en partie dans cette perspective, mais principalement en raison des évolutions profondes déjà signalées de remettre à jour les *termes de référence de l'IUWDS*. Le secrétaire devra étudier ce sujet par correspondance avec le comité de direction de façon à pouvoir faire des propositions aux Unions.

## IUWDS INTERNATIONAL GEOPHYSICAL CALENDAR FOR 1968

### Explanations

1. PURPOSE. — The International Geophysical Calendar designates days and intervals selected for special attention for geophysical observations, experiments, data interchange or analyses. It is thus a framework for worldwide and interdisciplinary coordination in those programs where it is not practical or meaningful to carry out the same work for each and every day. The Calendar serves mainly the branches of geophysics dealing with the earth's atmosphere. A principal use is for the coordination of the sampling of the many phenomena which vary significantly during the course of a year. The Calendar is prepared by the International Ursigram and World Days Service (IUWDS) with the advice of the spokesmen for the various scientific disciplines,

# IUWDS International Geophysical Calendar for 1968

**1968 JANUARY**

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

**1968 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		

**1968 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						

**1968 APRIL**

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

**1968 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	

**1968 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						

**1968 JULY**

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

**1968 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

**1968 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				

**1968 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		

**1968 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

**1968 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			

**1969 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	

- Ⓜ Regular World Day (RWD)
- ☀ Day of Solar Eclipse
- ☁ Day with Unusual Meteor Shower Activity
- ☄ World Geophysical Interval (WGI)

- ◊ Quarterly World Day (QWD) also a PRWD and RGD
- Ⓜ Priority Regular World Day (PRWD)
- ◊ Regular Geophysical Day (RGD)

TABLE OF WORLD DAYS MARKED ON THE CALENDAR

1968	RWD	PRWD	QWD	RGD	WGI	ECL.	METEORS
Jan.	16, 17, 18	17	17	3, 10, 17, 24, 31	8-21	—	4
Feb.	13, 14, 15	14	—	7, 14, 21, 28	—	—	—
Mar.	12, 13, 14	13	—	6, 13, 20, 27	—	28-29	—
Apr.	16, 17, 18	17	17	3, 10, 17, 24	8-21	—	21-22
May	14, 15, 16	15	—	1, 8, 15, 22, 29	—	—	4-5
June	11, 12, 13	12	—	5, 12, 19, 26	—	—	6-10
July	16, 17, 18	17	17	3, 10, 17, 24, 31	8-21	—	28-30
Aug.	13, 14, 15	14	—	7, 14, 21, 28	—	—	10-13
Sep.	17, 18, 19	18	—	4, 11, 18, 25	—	22	—
Oct.	15, 16, 17	16	16	2, 9, 16, 23, 30	7-20	—	20
Nov.	12, 13, 14	13	—	6, 13, 20, 27	—	—	16
Dec.	17, 18, 19	18	—	4, 11, 18, 25	—	—	12-14
							22

SEE OTHER SIDE

especially for the suggested scientific programs recommended to be carried out for the days or intervals marked on the Calendar (see paragraphs 11 to 16 below). In addition it is common practice for individual geophysical stations or groups of stations to arrange some of their plans of observations according to the Calendar. Thus geophysicists can expect that their colleagues in other countries, in other laboratories and in other geophysical disciplines will tend to be making increased efforts for the days and intervals marked on the Calendar; the amount of geophysical data in existence, at the World Data Centers and elsewhere, will accordingly be greater for Calendar days.

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

3. REGULAR GEOPHYSICAL DAYS (RGD) are each Wednesday throughout the year. This weekly sampling schedule is particularly designed for the purposes of the meteorological program but has also been adopted for some other geophysical programs.

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

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

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

7. WORLD GEOPHYSICAL INTERVALS (WGI) during 1968 are fourteen consecutive days in each season, beginning on the second Monday of the selected months. They always include the three RWD of the month and the QWD for the season. The WGI are intended for intensified programs aimed at the statistics of seasonal variations or the timing of seasonal changes. The schedule of WGI relative to the equinoxes and solstices is usually made



different from year to year; thus the WGI have been shifted one month earlier than those of 1967.

8. SOLAR ECLIPSES are March 28-29 (partial) observable in parts of Antarctica, the South Pacific Ocean and the southern part of South America; and September 22 (total) in the Arctic and Central Asia. Geophysical stations in the eclipse zones and their conjugate areas treat these days as world days and undertake special programs to study eclipse effects on the earth's atmosphere. For maps of the eclipse zones and pertinent details see any standard astronomical ephemeris or yearbook.

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

10. «WORLD DAYS» NOT APPEARING ON CALENDAR. — The occurrence of unusual solar or geophysical conditions are announced or forecast through various types of geophysical «Alerts» which are widely distributed by telegram and radio broadcast on a current schedule. The types of Alerts are; magnetic storm (in telegrams MAGSTORM), solar activity (SOFLARE PROTON-FLARE or SOFLARE FLARES), and cosmic ray event (COSMIC EVENT). Sudden and unusual stratospheric warmings (STRAT-WARM) are also designated. These Alerts are issued by the IUWDS World Warning Agency or under certain circumstances by one of the solar-geophysical Regional Warning Centers. The meteorological telecommunications network coordinated by WMO carries these worldwide Alerts once daily soon after 0400 UT. Many geophysical stations in the various disciplines increase their programs or carry on special experiments to take advantage of the special solar or geophysical conditions during the period of Alert. Selections of RETROSPECTIVE WORLD INTERVALS, after a delay of a few months, are also announced in suitable publications. An additional service of the Regional Warning Centers is to notify geophysical and solar stations promptly (URSIGRAMS) with summary details of immediately significant geophysical observations and of major solar events which have important and sometimes long-lasting geophysical effects. The telegraphic addresses of the Regional Warning Centers are as follows :

AGIWARN WASHINGTON (USA); DEMPA TOKYO (JAPAN); IZMIRAN MOSCOW (USSR); IONOSPHERE DARMSTADT (GFR) or CNETAGI MEUDON (FRANCE). Associate RWC operate in some other localities.

### **Recommended scientific programs-Operational edition**

(The following material was reviewed in 1967 by spokesmen for the various scientific disciplines as suitable for coordinated geophysical programs in 1968 at the 4th IQSY Assembly and 10th Meeting of COSPAR.)

11. METEOROLOGY. — Particular efforts should be made to carry out an intensified program on the RGD—each Wednesday, UT. A desirable goal would be the scheduling of meteorological rocketsondes, ozone sondes and radiometer sondes on these days, together with maximum-altitude rawinsonde ascents at both 0000 and 1200 UT.

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

12. GEOMAGNETISM. — It has always been a leading principle for geomagnetic observatories that operations should be as continuous as possible. Thus the great majority of stations taking part in the geomagnetic program will undertake the same program without regard to the Calendar. The days marked on the Calendar will be of interest mainly to the following two types of geomagnetic stations : (a) Stations recording quick-run micropulsations (with fast chart speeds) are requested to make such records on every RGD—each Wednesday, UT—according to the following schedule : 1968 Jan. 3 from 0300 to 0700; Jan. 10 from 0400 to 0800; Jan. 17 from 0500 to 0900; etc. The observatories are not obliged to send their recordings to the World Data Centers except by special request (see IQSY World Days Manual under Retrospective World Intervals on Micropulsations). (b) Stations which, in addition to other activities, are equipped for making magnetic observations, but which can not carry out such observations and reductions on a continuous schedule are encouraged to carry out such work at least on RWD (and during times of MAGSTORM Alert).

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

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

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

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

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

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

14. SOLAR ACTIVITY. — Observatories are invited to issue and send to the WDCs of all disciplines special reports of their regular and any special observations on all solar eclipse days to assist in the interpretation of geophysical observations made in the eclipse zones.

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

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

THE INTERNATIONAL URSIGRAM AND WORLD DAYS SERVICE (IUWDS) is a permanent scientific service of the International Union of Radio Sciences (URSI), with the participation of the International Astronomical Union and the International Union of Geodesy and Geophysics. IUWDS adheres to the Federation of Astronomical and Geophysical Services of the International Council of Scientific Unions. The IUWDS coordinates the international aspects of the world days program and rapid data interchange, and also publishes subsequently ABBREVIATED CALENDAR RECORDS of solar and geophysical indices and events.

This Calendar for 1968 has been drawn up by A. H. Shapley, Chairman, and J. V. Lincoln, Deputy Secretary, of the IUWDS Steering Committee, in close association with the IUCSTP Commission and the REPORTERS and spokesmen for the various scientific disciplines and COSPAR. Similar Calendars have been issued annually beginning with the IGY, 1957-58, and have been published in various widely available scientific publications.

Additional copies are available upon request to IUWDS Secretary, Dr. P. Simon, Observatoire, 92 Meudon, France, or IUWDS Deputy Secretary, Miss J. V. Lincoln, WDC-A Upper Atmosphere Geophysics, ESSA, Boulder, Colorado, 80302, USA.

## BROADCASTS OF SOLAR AND GEOPHYSICAL INFORMATION ON WWV AND WWVH

(REVISED PLANS EFFECTIVE FROM 1 JANUARY 1968)

The following has been extracted from Circular Letters RWC-101 dated 13 September 1967 which has been distributed to all Regional Warning Centres (RWC) and National Warning Contacts (NWC). Those who are interested in obtaining details of the codes used in the different types of messages should apply to the nearest RWC or to their NWC.

Numerous experimenters use WWV and WWVH for standard time indications, especially when they are far from their usual laboratories (on polar expeditions, eclipse expeditions, etc.). Since the International Geophysical Year, the world-wide GEOALERT messages have been included in the broadcasts. The GEOALERT decisions are made at 0400 UT by the World Warning Agency (SOLTERWARN) <sup>(1)</sup>. These decisions are broadcast once each hour in slow Morse code, with the letters repeated several times. The time of broadcast is at 18 minutes past each hour on WWV <sup>(2)</sup>, and at 48 minutes past each hour on WWVH <sup>(3)</sup>. The first broadcast of a newly issued GEOALERT message is at 0418 UT on WWV and at 0448 UT on WWVH.

With the approach of the next maximum of solar activity predicted for 1968, and with the many advances in experimental methods used in solar-geophysical studies, a new interest has been manifested by scientists and others for prompt information either for predictions of solar and geophysical events or for observations of these events. This information aids the work of experimenters in two ways :

1. it permits them to interpret with greater certainty their own observations (riometers, ionosondes, geomagnetometers, etc.)
2. it gives them the opportunity of modifying in advance the cadence of their observations, or the calibrations of their apparatus in order to be able to observe under better conditions the phenomena which interest them.

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<sup>(1)</sup> Operated by the Space Disturbance Forecast Center, ESSA, Boulder, Colorado, USA, 80302.

<sup>(2)</sup> WWV frequencies : 2.5, 5, 10, 15, 20, 25 Mc/s from Fort Collins, Colorado.

<sup>(3)</sup> WWVH frequencies : 2.5, 5, 10, 15 Mc/s from Maui, Hawaii.

Actually the number of observatories cooperating in observation of either the sun or geophysical phenomena have greatly increased : certain of them have been supplied with new equipment, which permits a considerable increase in the promptness with which the observations can be interpreted and made available. Another new thing is the existence of permanent liaison in «real-time » between certain observatories and certain forecast centers. These two circumstances now provide these forecast centers practically immediately with scientific information which is almost complete on different events whether of solar activity or of geophysical activity.

Therefore, the knowledge of solar and geophysical phenomena has much improved since the IGY, and actually the forecasts are made not alone on the experience of the forecasters, but according to scientific criteria principally established during the decreasing phase of the last solar cycle (1959-1965). These criteria ought to be confirmed and improved by further experience, but at the present one can affirm that the majority of the most important phenomena (great proton flares, strong geomagnetic storms, etc.) can be effectively predicted 24 hours in advance. To tell the whole story, we should say that certain events are unpredictable, whether by their novel character, or by their position on the sun (east limb where the observations are difficult to interpret, or beyond the limb as the case for January 28, 1967), or because of an accumulation of unfortunate circumstances as can happen ; but most of the important events are predictable scientifically. In the last eighteen months six proton events with strong polar absorption have occurred, and only one was not predicted.

Therefore, a larger amount of information (prediction or observation) than before can be furnished by the forecast centers. This is why we propose to improve the information broadcast on WWV and WWVH within the limitations permitted by the broadcast time available : actually we can supply three types of information at each broadcast — each in the form of letters repeated twice in slow Morse code.

#### **CHANGES IN OPERATION OF WORLD WARNING AGENCY**

This circular letter will notify you of changes in arrangements for carrying out the functions of the IUWDS World Warning

Agency. These changes have been made by the US Environmental Science Services Administration (which includes the former CRPL), which has for many years undertaken the role of IUWDS World Warning Agency at the request of the IUWDS Steering Committee. The changes also involve the functions of the RWC for the Western Hemisphere.

ESSA now operates two full-time forecasting centers. The center at Ft. Belvoir, Virginia, now specializes in telecommunications, while the center at Boulder, Colorado, specializes in solar activity and solar-terrestrial science and applications. The two centers are connected by a permanent communication link twenty-four hours daily.

Until now the functions of IUWDS World Warning Agency have been carried out fully by the forecast center at Ft. Belvoir, under the code name AGIWARN, while the center at Boulder has served in an advisory capacity. Now, some of the functions are being transferred to the center at Boulder, which for these purposes will function under the code name SOLTERWARN. These changes were effective September 1, 1967.

1. The following are now handled by SOLTERWARN (Boulder) :

- (a) GEOALERT decision and formal issuance at 0400 UT daily.
- (b) GEOALERT distribution to WMO circuits, RWC and Western Hemisphere addresses (transfer to be completed during September 1967).
- (c) ADALERT and ADALERTPRESTO for Western Hemisphere addresses and the other RWC.

2. The following are shared by SOLTERWARN (Boulder) and AGIWARN (Ft. Belvoir); eventually SOLTERWARN will handle after individual arrangements have been made :

- (a) Messages to World Warning Agency from other RWC with advice on GEOALERT, including ADALERTS from other regions.
- (b) Observatory reports coming directly to Western Hemisphere RWC.
- (c) Data interchange messages to and from other RWC.

(d) Data distribution messages as Western Hemisphere RWG.

3. The following functions are continued by AGIWARN (Ft. Belvoir).

(a) SPACEWARN activities for COSPAR — satellite designations, launching announcements and all other SPACEWARN messages.

(b) ASTROGRAM activities for IAU — announcements of comets, novae, etc., as provided by Bureau for Astronomical Telegrams.

Addresses :

AGIWARN : Mail : ESSA, Box 178, Ft. Belvoir, Virginia, 22060,  
USA Commercial Telegram : AGIWARN WASHINGTON  
DC USA.

SOLTERWARN : Mail : ESSA, Boulder, Colorado, 80302, USA  
Commercial Telegram : SOLTERWARN BOULDER COLO  
USA.

(TWX, TELEX, etc., addresses available on request and will appear in future IUWDS program publications).

11 sept. 1967.

A. H. SHAPLEY,  
Chairman

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## COSPAR/IQSY

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### **Report to the URSI on the Assembly of the COSPAR and the IQSY-COSPAR Symposia, London, July 17-29**

#### **Part I. — GENERAL REPORT**

Prof. S. SILVER, URSI Representative on the Executive Council  
of the COSPAR.

The meetings of the COSPAR held in London over the period July 17-29 were marked by a number of scientific and administrative features of special interest to the URSI. The symposia on special topics, except for those in the life sciences, were held jointly with the IQSY which was holding its final assembly from July 17 to July 22. The symposia were, therefore, a treatment in considerable depth of work in solar-terrestrial physics. The second week (July 24-29) was devoted to the usual plenary sessions of the COSPAR and the meetings of the working groups. The second part of this report, prepared by Prof. Henry G. Booker, chairman of URSI Commission IV, deals with the scientific program.

The subject of the relations between COSPAR and the Unions, which has engaged much of our attention and effort for some time, finally appeared as a prepared item on the agenda of the meetings of the Executive Council. It had been agreed at the Vienna meetings in 1966 that a special session of the Council would be held in 1967 to discuss this topic. The relations between Special Committees of the International Council of Scientific Unions and the Unions comprise a complex of problems, some inherent in the structure and organization of the Special Committees, some inherent in the structure and organization of the Unions, and many arising from lack of communications and the differences in viewpoints and interpretation of purpose and responsibility among the people involved.

You will recall the resolutions passed by our General Assembly of 1966 on this subject. The basic position of those resolutions, namely to be fully cooperative and ready to collaborate with COSPAR, was reiterated by our Board of Officers at their meeting in February 1967. In accordance with this position, the Board readily agreed to a proposal made by Prof. Nicolet in the name of the Bureau of the COSPAR, namely to set aside any consideration of the charter of the COSPAR at the special session in July and to concentrate on the operational aspects of developing a fuller participation of the Unions in the work of COSPAR.

I am very pleased to report that our discussions were held in this spirit of trying to resolve our problems cooperatively. We dealt openly and explicitly with the various interpretations of the role of the Unions in COSPAR, the responsibilities and prerogatives of the Executive Council, and methods of effecting closer working relationships between the working groups of the COSPAR and the Unions. The URSI was represented by your president and by vice-president Prof. Beynon. We were also able to discuss the issues with other members of URSI who were present in London at the time and I feel that we spoke truly as representatives of the opinions and ideas of our Unions.

The Executive Council appointed a special ad hoc committee to summarize the discussions in the special session and to draft a set of proposals and recommendations for the course of action in the future. The committee was chaired by Dr. R. Porter. The complete statement of the committee follows as Appendix I to this section of our report. There are several points which bear repeating and emphasizing :

- (1) The representatives of the Unions must take their responsibilities as members of the Executive Council seriously and be more aggressive in discharging those responsibilities. They must attend the meetings of the Council and they must report to the Unions.
- (2) The «time constants» of the Unions in responding to calls from COSPAR must be shortened. The Unions must find mechanisms for acting more quickly and for dealing with problems readily in the period between their own General Assemblies.

- (3) Union representatives must take part in the programs of the working groups of COSPAR and keep the groups in their Union whose interests are related to those of COSPAR well informed about the work.

A very striking illustration of the «time constant» problem presented itself in connection with the subject of studying the structure and temperatures of the constituents of the ionosphere by way of the Thomson scattering process. The investigations of Thomson scattering are primarily ground-based and the subject lies most properly in the province of URSI. The proposal calling for international support of further work on Thomson scattering was brought into Working Group II of COSPAR for action by the COSPAR because the proponents of the proposal felt that URSI could not act until the 1969 General Assembly. The literal reading of our statutes does indeed imply that resolutions must be approved by the General Assembly, but we have already found this to be a rather intractable procedure.

We approached this problem in this case by calling a meeting of the URSI members present (i.e., members of the Board and chairmen of Commissions) and discussing the proposal and the action to be taken. The proposal was withdrawn from Working Group II by Prof. S. A. Bowhill and instead we transmitted to President Roy of COSPAR a resolution in the name of the Board of Officers of URSI with the request that COSPAR endorse this resolution. The resolution communicated to President Roy appears as Appendix II of this section of this report. This points up the need for developing a procedure for quick executive actions by URSI. I shall propose to the Board of Officers that they shall consider this matter at the next meeting in the spring of 1968 and draw up a modification to the statutes and a plan for action to submit to the Assembly in 1969.

A second example of some of the problems of slow action and lack of communications is the issue of developing a «Reference Ionosphere». This topic was also raised in the business sessions of Working Group II in accordance with actions taken by our Executive Committee in Munich and our instructions to Prof. Bowhill. Owing to a break in communications among ourselves, we were led to a misunderstanding regarding the proposal being submitted to COSPAR. Again, the problem was solved effectively by «on the spot» discussions among the members of URSI fol-

lowed by direct communication between your president and Prof. Bowhill after the COSPAR Assembly. The action taken on this subject comprised (a) enlargement of the study group under Prof. Bowhill's chairmanship to extend the global representation, and (b) instructions to Prof. Bowhill to have a report by his committee ready by the next meeting of the COSPAR in May, 1968, as a first stage in the program of this study.

The Executive Council of the COSPAR discussed at some length plans for the next meeting to be held in Japan in May, 1968. A call had gone out some time prior to the present meeting to the Unions for suggestions and also to consider a proposal for a symposium on «Solar Flares». This material was distributed to the officers and the chairmen of our Commissions and I received a number of replies well before the London meetings. We discussed these replies at one of our URSI meetings and our decision was to support the proposed Solar Flare symposium, to express our desire to participate in the program, and to recommend that no other special symposium in the field of solar-terrestrial physics be considered for the May meetings. The latter point was made with particular recognition of the fact that there is to be an international meeting on the Physics of the Magnetosphere in Washington, DC, in August 1968.

The Executive Council also approved a proposal for a symposium on Experiments with Small Rockets in recognition of the special contributions made by Japanese workers to this area of research. The details of the organization of the program were left to the Science Council of Japan.

Meetings of the Officers and the Commission Chairmen of URSI were specially convened in London on July 20th and 26th. The discussions at these meetings included the following topics :

- (a) The appointment of Dr. C. M. Minnis as Executive Secretary of URSI in view of the illness of Colonel Herbays.
- (b) Participation of URSI in future COSPAR Symposia and in COSPAR Working Groups.
- (c) The 1969 General Assembly and the Meeting of the Coordinating Committee in March 1968.
- (d) Proposed revision of URSI Statutes.
- (e) Improvements in co-operation between URSI and CCIR.

In closing, I should express my personal appreciation to the many members of the URSI present in London who responded most readily to my call on their time. I should express for the URSI our appreciation for the very considerate attitude of the Bureau of the COSPAR and our gratification with the results of the discussions of the Executive Council on COSPAR-Union relations. Finally, I must express special thanks both for myself and for all of the URSI to Dr. Minnis who, although his duties do not begin formally until January, 1968 and was already overburdened with his duties to the IQSY-COSPAR meetings, nonetheless responded readily to our needs and gave unstintingly of his energy and efforts in helping us with our critical problems.

### Appendix I

#### REPORT OF THE EXECUTIVE COUNCIL SPECIAL COMMITTEE

London, July 25, 1967

The following members of the Executive Council met on the afternoon of 25 July 1967 at the instruction of the Council to consider in detail the constructive suggestions which had been set forth by various Members at the Council meeting on 22 July 1967 :

Prof. Maurice ROY.	Prof. J. KAPLAN
Dr. R. W. PORTER	Prof. S. SILVER.
Acad. A. BLAGONRAVOV.	Prof. L. GRATTON.

After lengthy deliberation, these Members have agreed to submit to the Council for its further consideration and possible action the following statements :

1. In order to stimulate and encourage more active participation by all Union Members in COSPAR, and especially in the deliberations of its Executive Council, the Council instructs its President to send a personal letter to the representatives of all Union Members urging that they attend a session of the Executive Council during the XIth COSPAR Meeting to be held in Tokyo for the purpose of discussing possible future scientific programs

of COSPAR that might be especially interesting to those Unions that have not heretofore been very active in COSPAR, and offering financial assistance if needed. It is also recommended that the President send a personal note to the President of each Member Union expressing the importance of full Union participation in this session and asking him to encourage correspondence and discussion within his Union on the subject of how it might best participate in the future work of COSPAR and to make sure that some well-informed person will be designated to represent his Union at this session. A financial subvention should be sought from ICSU to help defray the additional travel expenses of representatives of Member Unions, whose expenses have not previously been paid by COSPAR.

The personal assistance of the President of ICSU should be sought in the form of unofficial encouragement to all Union Members of COSPAR to participate actively in its work and deliberations.

2. In order to make the deliberations of the Executive Council more effective, the Council recommends that its President prepare for each meeting an annotated agenda, with explanatory notes setting forth the background for discussion of each of the main points to be covered. In addition, the Council recommends that each of its Members give careful consideration, well in advance, to matters which, in its opinion, ought to be discussed at a Council Meeting and communicate the results of such consideration to the President and Secretary of COSPAR to assist them in preparing the agenda and, where appropriate, to the representatives of other Members in order that they may have time to consult their colleagues before the meeting.

3. In order to facilitate communications among the various Union Associations and/or Commissions and COSPAR Working Groups, the Executive Council suggests that the representatives of each Member Union, or some other person designated by the Union to assist and advise him, collect from all appropriate Commissions and adhering Associations, if any, of his Union information relating to the subject matter of scientific meeting or symposia planned more or less firmly for the three coming years, relating to research conducted by means of rockets or space vehicles, and that these representatives and advisors of Member Unions in closely related fields (such as IAU, IUGG, URSI, IUPAP, IUPAC,

IUTAM and IMU in physical sciences, and IUB, IUBS, IUPS and IUPAB in the life sciences, or any other combinations which may be more rational) should meet together informally with appropriate representatives of COSPAR Working Groups or Panels, prior to Executive Council meetings, to exchange information about planned scientific programs and formulate constructive suggestions for COSPAR activity.

It is further suggested that one Member Union representative serve as Convener for each meeting; for example, the IUGG representative for physical sciences and the IUBS representative for life sciences. No formal reports would be expected to result from these informal meetings, but rather a better background of information for their subsequent participation in the Executive Council.

4. In order to provide the Member Union with a more formal voice in the deliberations of the COSPAR Working Groups and Panels, as appears to be desired by some of the Member Unions, the following resolution is submitted to the COSPAR Plenary Assembly for consideration :

*Resolution* : on official Union Members in Working Groups and Panels.

COSPAR,

*noting* the increasing concern in many Unions over the activities of COSPAR Working Groups and Panels and their concern about the communication of these actions to Member Unions,

*invites* each Member Union to study the constituency of COSPAR Working Groups and Panels and, if it desires to do so, to designate an official representative to any COSPAR Working Group or Panel. These designated representatives may be persons who are already Members of the Working Groups or Panels concerned or they may be additional persons to be named by the Union. The additional responsibilities implied by such designation shall be defined by the designating Union.

5. Although recognizing certain difficulties in universal implementation, the Executive Council accepts as a general guide for its future actions the suggestion that, wherever possible, major scientific meetings arranged by COSPAR should be held at contiguous times and places with major Union assemblies or symposia

and that an attempt should be made to select common or complementary themes for such meetings.

## Appendix II

Professor M. Roy, President  
COSPAR.

Dear Professor Roy :

The Board of Officers of the URSI in extraordinary session on July 26, 1967 adopted the following resolution :

*Noting* the increasing importance of studies of the dynamics of the ionosphere and related motions of the neutral atmosphere to the interpretation of space experiments, and noting the recently demonstrated capability of the multistatic Thomson scatter technique for measuring mean motions of the ionosphere,

*we recommend*

(1) that existing Thomson scatter sounders should be converted where possible to multistatic operation;

(2) that new systems for studies of such scattering of electromagnetic waves should be designed with the measurement of ionospheric motions as one of the prime objectives;

(3) that the results of such measurements should be coordinated carefully and as fully as possible with results of related experiments.

The foregoing resolution was approved by the chairmen of Commissions I, II and IV who were also present at our meeting. This resolution is, we believe, also of special interest to W. G. II of the COSPAR and I am submitting it to you for consideration by the Executive Council and, I trust, the endorsement by the COSPAR.

Very truly yours.

Samuel SILVER.  
President.



## Part II. — SCIENTIFIC PROGRAM

*To* : The President of URSI.

*From* : Chairman, Commission IV.

*Subject* : The Tenth Plenary Meeting of COSPAR.

In accordance with the instructions of the General Assembly of URSI in Munich I attended the above meeting and wish to report as follows :

### SCIENTIFIC SESSIONS.

The Tenth Plenary Meeting of COSPAR was held from July 24 to July 29, 1967 in London, England. Well over six hundred people attended, of whom about a hundred were closely associated with URSI. Over 250 papers were presented, distributed approximately as follows :

Magnetosphere . . . . .	21
Polar substorms in their relation to the magnetosphere . .	21
Ionosphere . . . . .	28
Aeronomy . . . . .	25
Thermosphere and exosphere . . . . .	18
Mesosphere . . . . .	9
Troposphere and stratosphere . . . . .	16
Upper atmospheric structure and variations . . . . .	5
Radiations . . . . .	11
Flare forecasting . . . . .	22
Moon and planets . . . . .	15
Collection and detection of interplanetary dust . . . . .	28
Tracking, telemetry and dynamics of satellites . . . . .	13
Life sciences . . . . .	25

Some sessions consisted of about half a dozen invited papers combined with discussion. Other sessions consisted of a large number of contributed ten-minute papers each followed by one or two questions.

The scientific sessions were spread over a five day period and were preceded by two simultaneous symposia, one on sterilization techniques for instruments and materials as applied to space research, and the other on the results of the IQSY. The latter involved eight half-day sessions of review papers presented

during the period July 17 to July 21 and devoted to the following topics :

- Meteorology.
- The sun and its radiations.
- Production and loss processes in the ionosphere.
- Ionospheric measurements.
- Geomagnetism and aeronomy.
- Neutral atmosphere and airglow.
- Aurora and radiation belts.
- Cosmic rays.

Abstracts of most papers presented during both weeks were available at the time of registration.

There were some papers in the COSPAR meeting devoted exclusively to ground-based observations. For example, half a session was devoted to the results and interpretation of ionospheric and magnetospheric observations using the incoherent radio backscatter method. However, presentation of ground-based observations was very spotty. Even in the case of the incoherent backscatter technique, observations were presented from Millstone Hill and by the French workers, but there were no papers from Jicamarca or Arecibo, probably because workers at the latter two observatories did not regard a COSPAR meeting as appropriate for the presentation of ground-based observations.

There is a clear need to compare grounded-based observations of the ionosphere with observations made in situ. Using the two methods, radically different values for electron temperature in the E region were reported at the COSPAR meeting in the same session. Surprisingly, this drastic discrepancy did not lead to serious discussion. Indeed, the principal authors of the rocket papers had left the session before the incoherent scatter data were presented.

#### BUSINESS SESSIONS.

Business meetings of COSPAR Working Groups and their Panels were not, in general, open to non-members. However, arrangements are to be made in the future for Unions, including URSI, to have membership of appropriate Working Groups and Panels.

I did attend a meeting of the Panel on Interactions between the Neutral and Ionized Parts of the Atmosphere. This panel is-

co-chaired by S. A. Bowhill and E. A. Lauter, and has the following additional membership : W. I. Axford, J. E. Blamont, Yu. I. Galperin, J. B. Gregory, C. O. Hines, F. S. Johnson, J. W. King (acting secretary), V. I. Krassovsky, K. I. Maeda, A. P. Mitra, W. Pfister, K. Rawer, G. A. Skuridin, L. R. O. Storey, P. Triska and J. D. Whitehead. The name of F. du Castel was added to improve the representation of grounded-based radio observations.

The objectives of the Panel were formalised at the Vienna Meeting (May 1966) and are as follows :

«The work of the Panel shall consist principally in the planning of new combinations of experiments (ground-based, rocket and satellite), which will give critical tests of specific physical theories of ionosphere-neutral atmosphere interactions.

To accomplish this, the Panel shall study and discuss the following scientific phenomena :

- (a) chemical interactions (e.g. photoionization rates, changes in constituent concentrations, and the like; but excluding study of extraterrestrial sources themselves);
- (b) dynamical interactions (e.g. wind shears and sporadic-E; turbulence and irregularities; current systems, neutral winds and protonospheric convection; equatorial electrojet; apparent drifts of the ionization and their excitation by the neutral wind);
- (c) systematically observed phenomena of the ionization which appear to have a possible relation to the neutral atmosphere, though the exact nature of the interaction may not yet be understood; including seasonal and sporadic changes. »

Topics under discussion by the panel include :

1. The turbopause.
2. Ionospheric-stratospheric coupling effects; ground-based and rocket-borne experiments.
3. The neutral wind.
4. Neutral wind profiles.
5. Scheduling of trail experiments.
6. Scheduling of vapour-trail releases.
7. The study of global circulations.
8. The need for data from greater heights.
9. Stratospheric circulation data.

10. Measurements needed in conjunction with wind measurements
11. Measurements of turbulence.
12. Simultaneous wind and drift measurements.
13. Comparison of neutral winds and spaced radio receiver drifts
14. The data most needed by sporadic-E theorists.
15. The type of ground-based measurements of sporadic-E required.
16. Daytime sporadic-E studies.
17. An experiment to investigate sporadic-E.
18. Night-time sporadic-E.
19. An experiment to test the validity of the wind-shear theory
20. An experiment to elucidate the structure of the sporadic-E associated with the electrojet.
21. Neutral composition of the F region.
22. Electric fields in the F region.
23. Scattering of quasi-trapped photoelectrons by neutral particles.
24. Solar activity and the upper atmosphere.
25. Auroral models.
26. Global ionization and neutral transport.
27. Magnetospheric photoelectrons.
28. Applicability of new space measurement techniques to measurements in different ionospheric regions.
29. Simultaneous experimental investigations of sporadic-E, Sq currents, electrojet currents and neutral winds in the E layer.
30. Standardized ionospheric profiles.

#### NEXT MEETING.

The Eleventh Plenary Meeting of COSPAR will be held in Tokyo from approximately May 8 to May 24, 1968. In addition to the usual closed and open sessions, there will be three symposia, one of which will be devoted to the life sciences. A second dealing with the instrumentation of small rockets, will be organized by Japan. A third on the subject of solar flares is to be jointly sponsored by COSPAR, IAU, IUGG and URSI under the auspices of IUCSTP.

#### CONCLUSIONS.

The following conclusions are drawn :

1. The annual COSPAR meeting has become the principal meet-

ing for the presentation of data on ionospheric and magnetospheric physics. However, the annual COSPAR meeting handles ground-based observations and the integration of observations into comprehensive theories only imperfectly.

2. The COSPAR meetings are likely to continue as annual events for many years. The only practical way to keep discussion of solar terrestrial physics to not more than one meeting a year is for all concerned to rally round the annual COSPAR meetings. Many people, especially young people in ionospheric and magnetospheric physics, are already doing so. The USSR is sending to COSPAR meetings excellent ionospheric and magnetospheric physicists never seen at URSI Assemblies.
3. An advantage of annual meetings is that no review papers are necessary—only papers dealing with recent developments.
4. The compact programming and summer timing of the 1967 COSPAR meeting were very appropriate, especially for university participants, and constitute a desirable model for COSPAR meetings.
5. The combination of the 1967 COSPAR meeting with a meeting dealing more comprehensively with solar terrestrial physics was very appropriate. The IUCSTP should organize, in association with the annual COSPAR meeting, a more broadly based annual meeting on solar terrestrial physics. The IUCSTP part of the meeting could be arranged by assigning a session or two to each of the principal participating unions. In particular, URSI should organize a session or two dealing with ground based radio observations of the solar system.
6. If IUCSTP and COSPAR develop the habit of cooperating on an annual comprehensive meeting on solar terrestrial physics at a time convenient to university participants, then URSI Commissions III and IV could abandon extended discussions on the physics of the ionosphere and magnetosphere at URSI Assemblies and concentrate instead on the propagation of waves in the media.
7. If URSI Commissions III and IV cooperate with IUCSTP and COSPAR in an annual meeting on solar terrestrial physics, there should be business meetings of URSI Commissions III and IV at the same time. Moreover, the URSI Board of Officers should act on recommendations of Commissions III and IV at the end of the same annual meeting. Study groups appoin-

ted at one meeting would need to report at the following meeting one year later. If URSI does not achieve this quick reaction time, even URSI adherents will find it more expeditious to act through a panel of a COSPAR Working Group.

July 31, 1967.

Henry G. BOOKER.

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**Resolutions etc. adopted by COSPAR at the Meeting  
held in London, July 1967**

The following Resolutions and Recommendations have been extracted from COSPAR Document 67/897 dated 14 September 1967 and are of interest to URSI.

*RESOLUTION N° 1 on official Union Members in Working Groups  
and Panels.*

COSPAR,

*noting* the increasing concern in many Unions over the activities of COSPAR Working Groups and Panels and their concern about the communication of these actions to Member Unions,

*invites* each Member Union to study the constituency of COSPAR Working Groups and Panels and, if it desires to do so, to designate an official representative to any COSPAR Working Group or Panel. These designated representatives may be persons who are already Members of the Working Groups or Panels concerned or they may be additional persons to be named by the Union. The additional responsibilities implied by such designation shall be defined by the designating Union.

*RESOLUTION N° 4 on frequency allocations.*

COSPAR,

*noting* that IUCAF has taken steps to obtain allocation of frequencies requested by COSPAR for space research, and has reported on this subject at the present meeting; *Taking account* of the remarks made by the IUCAF representatives and of the report of its eighth meeting (June 1967) in particular,

*recommends* that the frequency band Nos 1), 2), 3 and 6) listed in the previous resolution 5 (Vienna Assembly, 1966) be amended as follows :

- (1) 2495-2498 and 2502-2505 kHz as secondary allocation;
- (2) 4995-4998 and 5002-5005 kHz as secondary allocation;
- (3) 14990-14998 and 15002-15010 kHz as secondary allocation;
- (6) 799.8-800.1 or 1199.7-1200.15 MHz as a new primary allocation for high accuracy radio/navigation satellites.

*Note 1.* — Frequencies of 2500, 5000 and 15000 kHz are reserved for standard frequency transmissions, and the guard bands provided by these amendments allow sufficient protection from interference due to Doppler shift or low audio frequency modulation.

*Note 2* (concerning band 6). — For geodetic beacons extreme accuracy is needed. It is accomplished by comparing the phases of two uhf frequencies or, better (in order to determine the ionospheric correction very accurately), two uhf and one vhf frequencies. The present allocation for radio navigation satellites being 149.9-150.05 and 399.9-400.05 MHz, one higher uhf frequency is required, preferably a simple multiple of 400 MHz.

RESOLUTION N° 5 *on interchange of solar and geophysical data.*  
COSPAR,

*recognizing :*

- (i) the increasing need for rapid exchange of solar and geophysical data in connection with space activities, including manned flight,
- (ii) that improvements in the present system depend largely on improved communications arrangements within regions and between region warning centers,
- (iii) the increasing need in a number of space programs for reliable forecast of solar flare activity and solar proton events,

*urges* IUWDS, its Regional Centers and cooperating scientific bodies to accelerate their efforts in the field of rapid interchange of solar and geophysical data, with emphasis on :

- (i) analyzing the needs for scientific purposes,
- (ii) exchange of forecasts among forecast centers, and

- (iii) prompt exchange of observational data on the occurrence of solar and geophysical events of major importance.

RECOMMENDATION N° 4 on *PCA Events*.

COSPAR W. G. II,

*having identified* the following activities as being extremely beneficial to the satisfactory conduct of PCA studies :

- (a) forecasting of solar proton events,
- (b) a programme of solar-geophysical monitoring,
- (c) making adequate use of the information provided by (a) and (b),

*recommends* that they be given serious consideration by IUCSTF and that for this purpose, an alert network should be established capable of providing warnings of the likely occurrence of a PCA event within 30 minutes of the occurrence of the flare responsible

RECOMMENDATION N° 5 on *PCA Results*.

COSPAR W. G. II,

*anticipating* that during coming year, important new results of PCA studies by means of rockets and satellites will become available,

*recommends* that a special session of the next COSPAR Symposium be devoted to new results of PCA studies.

*Note* : There may be the possibility of combining the PCA session with that on solar flares.

RECOMMENDATION N° 6 on *Conjugate Experiments*.

COSPAR W. G. II,

*having considered* what conjugate point experiments are required to make them a decisive factor for the study and understanding of the magnetosphere,

*recommends* consideration of the following guide-lines, (detailed amplification of which will be found in the report of the Panel on Conjugate Point Experiments) :

- (a) the production of a more refined model of the external geomagnetic field,



- (b) the establishment of a larger number of well equipped permanent geophysical stations, specifically for conjugate studies; ideally these should be distributed in nets (see report), and should be able to make simultaneous observations of a great variety of parameters,
- (c) carrying out of simultaneous satellite, ground based, and balloon measurements along a satellite's conjugate trace,
- (d) wider use of mobile stations, such as aircraft,
- (e) more systematic and frequent simultaneous balloon X-ray measurements in exactly conjugate regions, in or near the auroral oval,
- (f) artificial conjugate experiments (see reports).

RECOMMENDATION N° 7 on RTT.

COSPAR W. G. II,

*recognizing* that a large number of scientists need data which could best be obtained by real time transmission from monitoring satellites and, further, that several satellite projects at present planned might be able to provide some of these data if the needs of the scientific community are made known as quickly as possible,

*recommends* that IUCSTP determine, before the end of 1967 :

- (a) which solar and other monitoring requirements could be met by such satellites and
- (b) which type of satellite (e.g. orbit and type of telemetry, etc.) would provide the data best.

RECOMMENDATION N° 8 on the Use of RTT of Data.

COSPAR W. G. II,

*noting* that at the present time there are four distinct types of experiments which have been available to the international scientific community through the use of Real Time Transmission provided by the following satellites :

- (a) Automatic Picture Transmitting (APT) Satellites
- (b) Solar Radiation Monitoring Satellites
- (c) Ionospheric Beacon Satellites
- (d) Geodetic Beacon Satellites

and noting the interest expressed by the International Scientific

Community in the additional fields of

- (i) Magnetic Field and Particle Measurements
- (ii) Auroral Particle and Radiation Measurements
- (iii) Continuous Solar Monitoring from geostationary platforms in both X-ray and U-V spectral regions
- (iv) Topside ionospheric sounding
- (v) Tropospheric and Stratospheric Radiation Measurements

*recommends* that satellite sponsoring agencies consider the use of real time transmission of data to enable such measurements to be made by the International Scientific Community.

RECOMMENDATION N° 9 *on Beacons of Geostationary Satellites.*  
COSPAR W. G. II,

*referring* to Resolution 6 of the Vienna Assembly, and

*noting* the experiences since obtained with transmissions from geostationary satellites, and

*considering* that beacons operating in the lower frequency bands (such as the 20, 40 and 41 MHz combination) are likely to be of scientific interest and that in addition, continuous operation of beacons in the VHF band, even on only one frequency (e.g. in the 136-138 MHz tracking and telemetry band) would also be of value for ionospheric and propagation studies,

*strongly encourages* the provision of such beacons in geostationary satellites.

RECOMMENDATION N° 17 *on Data between 80 and 150 km.*  
COSPAR W. G. IV,

*noting* that the variations in the upper mesosphere and lower thermosphere are of fundamental importance for interpreting the variations in the upper thermosphere, and noting the scarcity of data on atmospheric parameters in the region between 80 and 150 km and their dependence on solar activity,

*recommends* that special efforts be made to obtain such data at frequent intervals in both time and space, with emphasis on the distribution of both major and minor neutral constituents.

RECOMMENDATION N° 18 on *Measurement of Winds in the Lower Thermosphere.*

COSPAR W. G. IV,

*noting* that advection plays an important role in the time-dependent behaviour of the lower thermosphere,

*recommends* that the number of measurements of winds in that region be increased as far as possible to obtain greater diurnal and global coverage.

RECOMMENDATION N° 19 on *Systematic Winds in the Thermosphere.*

COSPAR W. G. IV,

*noting* that the variation of the orbital inclination of satellites indicates the existence of very large systematic winds in the thermosphere, and noting that the large diurnal density variations at satellite heights imply the existence of large-scale circulation,

*recommends* that special efforts be made to obtain direct experimental evidence of the existence of these winds.

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