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U.R.S.I.

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OBITUARY

DYFRIG JONES

1940-1989

Dyfrig Jones, Vice-Chairman of URSI Commission H and Head of the Space Plasma Physics Group at the British Antarctic Survey, died peacefully on the 6th August 1989 whilst on holiday in Wales. He will be sadly missed by his friends and colleagues.

Dyfrig was born on 16th August 1940 in the fishing village of Crwbin, Pembrokeshire, South Wales. He attended Cardigan Grammar School and went on to read Physics at the University College of Wales, Aberystwyth, where he obtained a II.1 (Hons). He stayed at Aberystwyth and completed a PhD in experimental physics in 1964 on the 'Interpretation of Ionospheric Drift Data'. The skills he learnt during his PhD work, which entailed the design of radio and signal processing equipment, and the development of new computer methods for signal correlation and spectral analysis, laid a firm foundation for his future career.

In 1965 Dyfrig moved to Cambridge to work at the Cavendish Laboratory with Dr. K.G. Budden F.R.S.. He constructed a low frequency radio receiver to study electron whistlers and investigated various dynamic spectrum analysis techniques. In parallel with the experimental work, he conducted a theoretical study of the conversion of electron whistlers to ion-whistlers in the ionosphere and magnetosphere, work for which he was awarded his second PhD from the University of Cambridge in 1970. It was while he was working at the Cavendish that Dyfrig became familiar with the process of energy conversion from one wave mode to another via the so-called radio window. He later applied this knowledge to work in the area for which he will best be remembered, namely the generation of planetary radio emissions.

Following his work at Cambridge, Dyfrig moved to The Netherlands and took up the post of Project and Research Scientist with the newly formed European Space Agency. He worked on the two highly successful GEOS satellites developing computer simulation software to investigate signal analysis techniques, and designing digital correlators for auto- and

cross-correlation. These correlators were flown on GEOS-1 and 2 (launched in 1977 and 1978); the first satellites to include on-board digital wave signal processing. This technique had the advantage of reducing the amount of data telemetered to the ground, and proved to be so successful that similar correlators were included on the InterKosmos, MAGIK and AMPTE UKS satellites.

It was while he was working for the European Space Agency that Dyfrig started work on the generation of non-thermal continuum radiation in the Earth's magnetosphere. The higher frequency component of this radiation has a wavelength of the order of 10^4m and escapes from the Earth's magnetosphere. Dyfrig called the radiation terrestrial myriametric radiation (TMR) where the prefix myria comes from the Greek 'murias' meaning 10^4. He proposed that the TMR is generated by a three stage process whereby electrostatic waves, propagating near the magnetic equator, are refracted by the large density gradient near the plasmapause into Z mode waves which are then mode converted at the radio window into the O mode to become the TMR.

This theory, which he later called the linear mode conversion window (LMCW) theory, predicted that the TMR should be emitted at a frequency equal to the source electron plasma frequency, and should be beamed away from the magnetic equator to northern and southern latitudes at a precise angle which depends on the electron plasma and gyro frequencies. Furthermore, he predicted that the polarization of the northern and southern beams should be predominantly right handed and left handed respectively. In 1987, data from the polar orbiting satellite Dynamics Explorer 1 was able to confirm the predicted beaming of TMR and, in the following year, to confirm the predicted polarization.

In 1979 Dyfrig joined the British Antarctic Survey where he became head of the Space Plasma Physics Group. In addition to his work on planetary radio emissions, which extended to include whistler mode waves and the generation of auroral kilometric radiation, he developed pattern recognition and signal compression techniques. He applied these techniques to Antarctic data and to reduce the amount of data sent, via satellite link, from Halley, Antarctica to Cambridge, England. However, the outer radio planets remained the focus of his research interest.

Dyfrig showed that the beaming of TMR, and analogous radiations at the other radio planets, could be used to determine the density gradient in the source region. He applied this 'remote sensing' technique to radiations emitted from Jupiter, Saturn and Uranus. For Jupiter, he predicted that broadband kilometric radiation was generated at the edge of the plasma torus formed by the moon Io, and predicted density gradients which were in remarkable agreement with in situ measurements made by Voyager 1. He also predicted that narrowband kilometric radiation is emitted from source regions on the northern and southern flanks of the Io torus. At Saturn, he used Saturnian kilometric radiation to predict a large density gradient at about 10 Saturnian radii from the planet. Again this prediction showed remarkable agreement with in situ observations. Later on, he also used the same technique to predict the existence of large density gradients at Uranus.

It was for his work on planetary radio emissions that Dyfrig was promoted from Grade 7 to Individual Merit Grade 6 in 1984, only the second scientist inside the British Antarctic Survey to achieve such distinction.

Despite his illness, which was first diagnosed in October 1984, Dyfrig continued his work on the radio planets until only a few months before his tragic death. He published more than 80 scientific papers, not including reports and general review articles, and in the summer of 1989 he was awarded the ScD degree by the University of Cambridge in recognition of his scientific achievements. He showed tremendous drive and enthusiasm in his work which he communicated to others. He also set and maintained very high standards since, as he himself once said, the higher the standard the better the scientist, and the better the reputation of the Institute for which that scientist works.

He held several offices during his career including Fellow St. John's College Cambridge, Chairman of the URSI Commission H Working Group on Wave Analysis, Member of Council for the Royal Astronomical Society, and associate editor for Annales Geophysicae. However, he never let the many honours he achieved separate him from ordinary folk. He was always willing to speak to students and scientists alike about their scientific work.

Throughout his illness, which included three operations for the removal of a brain tumour, he showed remarkable courage. He did not dwell on his illness but instead retained a cheerful

outlook on life; an outlook which was only briefly dampened when Wales lost at Rugby. He was Welsh and proud of it. In fact some of his most important results on planetary radio emissions were first given, in Welsh, to the community of Welsh scientists.

Dyfrig's enthusiasm and shear hard work was matched only by his devotion to his wife, Elenid, and four children. His inspiration and leadership will be sadly missed by those of us who had the privilege of working with him.

Richard HORNE

1989 International Geoscience and Remote Sensing Symposium (IGARSS'89)

Remote sensing is of interest to several URSI Commissions but was formally incorporated in the title of Commission F at the 1984 General Assembly. This activity has continued expanding within URSI, particularly through cosponsorship of the annual IGARSS meetings with the IEEE Geoscience and Remote Sensing (GRS) Society since 1985. This began through the US Member Committee for URSI at IGARSS meetings in the USA. Meetings held outside the USA are cosponsored by international URSI. Such was the 1989 meeting at the University of British Columbia in Vancouver. An additional cosponsor was the Canadian Remote Sensing Society (CRSS).

IGARSS'89 was the largest yet of these meetings with 922 registrants and 898 papers on the programme, of which 800 were presented. The five volume (GRS/CRSS) digest weighed approximately seven kilograms, but for a smaller registration fee one received a more manageable URSI digest containing about 200 one page abstracts. The authors came from 38 different countries, 43% from the USA, 30% from Canada, 17% from Europe and 10% from the rest of the world. Funds to offset travel expenses were provided in response to requests from 27 graduate students in the US and Canada and 12 scientists from abroad, mainly from developing countries.

The scientific programme consisted of thirteen parallel sessions on topics such as propagation, scattering signatures, synthetic aperture radar (SAR), ocean SAR, vegetation, atmosphere, oceans, ice, environmental processes, processing and instruments. Computer processing remains central to remote sensing but it is increasingly realized that electromagnetics is behind almost all of it. This is apparent in the growing use of scattering models and polarimetric techniques. The advantages of radio over optical remote sensing for polarimetric scatter and atmosphere and foliage penetration are appreciated. Remote sensing is becoming more scientific and so URSI's role is more important to it.

The theme of the meeting was: "Quantitative Remote Sensing; An Economic Tool for the '90s." This economic theme

was supported not only by papers related to forestry, agriculture and minerals but also by approximately 30 commercial exhibits by companies producing mainly hardware and software related to remote sensing. Attendance at this exhibition was ensured by serving the refreshments there and requiring that all oral presentations be followed by a poster display in the exhibit area. This double presentation was extra work for the authors and organizers but the result was very successful as it was possible to attend the poster presentation of oral papers missed. It is a solution to the problem of conferences with many parallel sessions.

From their beginning in 1981 the annual IGARSS meetings have been, appropriately, perhaps the most international of the IEEE Society meetings, alternating in venue between the USA and Western Europe or Canada. The next meeting is in Washington, May 20-24, 1990, followed by Espoo, Finland in 1991. These will be meetings important to URSI's role in the International Geosphere-Biosphere Programme. Radio scientists from all Commissions of URSI will find their participation welcome at these meetings and they will find challenging new applications for their skills.

E.V. JULL

REPORT OF THE IRI WORKSHOP

Abingdon (UK), 7-9 August 1989

In view of preparing a 1990 International Reference Ionosphere (IRI), more than twenty scientists from eleven countries met at Abingdon and exchanged their views. About twenty papers were presented; they will be published in *Adv. Space Res.* (Editors: W.R. Piggott and K. Rawer).

At the end of the meeting, the present situation of IRI and future needs for its improvement were openly discussed.

In order to improve the data base needed for further steps, different tasks were specified and attributed to responsible individuals. These shall report to another Workshop meeting expected to be held about one year after the forthcoming COSPAR Plenary Meeting.

The following brief report indicates the details of the proposed actions.

1. Mapping

URSI has recently carried out a remapping of the F2 peak electron density allowing for undersampled regions better. However, the new maps have not resulted in a substantial improvement.

URSI has endorsed the new set of coefficients resulting from this exercise but no national body has proposed they be accepted by CCIR nor is it clear which CCIR Working Group a recommendation would be directed to.

In this respect, new topside ionospheric measurements (Pulinets et al.) now give more details on the longitudinal difference in the ionosphere that can be used for testing mapping results and could prove a valuable input to update the mapping exercise.

Practical problems encountered using the CCIR coefficients description, both in the time spent computing peak electron densities and in the space used to store the coefficients, may be alleviated using some alternative representation. A potentially valuable method is the "empirical orthogonal functions" of Dvinskikh which allows the F2 maps to be stored in a significantly smaller space and used more quickly. This method,

and associated interpolation procedures are worth exploring further and should prove a valuable option for handling the F2 maps of peak electron density (Bossy, Singer).

The F2 peak height is currently calculated using an empirical conversion of M(3000)F2 maps. Confirmation of these maps validity from direct peak height measurements should be sought. Apart from incoherent scatter data, a possible data source worth exploring is data recorded with digital ionosondes applying automatic true height analysis (Reinisch).

2. Electron Density Profile

Topside

In order to obtain a more realistic topside distribution in the neighbourhood of the magnetic dip equator, Rawer proposed to describe the electron density decrease along magnetic fieldlines instead of along the vertical. This proposal was accepted in principle, but should be based on a larger data set.

As for altitudes high above the peak, Benkova et al.found that the IRI gives too small a gradient as compared with their topside profiles. Topside sounder results from USSR and USA satellites shall be collected and analyzed to clarify these problems (Bilitza, Radicella, Serafimov). Also incoherent scatter profiles (Millstone Hill) will be analyzed in this context (Buonsanto).

As for the transition to the plasmasphere (Rycroft and Jones model), an analytical transition after Rawer's recent proposal shall replace Rycroft's polynomial.

All profile changes to be introduced should not be in disagreement with total electron content data (see McNamara's earlier papers).

Middle Ionosphere

The "half-density point" will be included in future edition of IRI. It was shown that use of this parameter will considerably increase the bottomside thickness at low latitudes. This will also help to improve the agreement between total electron content measurements and IRI. During nighttime, the use of this parameter is to decrease the bottomside thickness, again in agreement with incoherent scatter measurements. Future

studies, however, are needed to describe the latitudinal and diurnal variations of the half-density height in more detail (Bilitza). Radicella proposed to introduce another characteristic point, namely the inflection point of the electron density profile below the F2 layer peak. This point might become helpful at the analytical representation of the density profile, that option shall appear as an option in the new IRI. The extra constraint so given should force the LAY formalism to better represent the actual profile.

Digisonde data, their comparison with incoherent scatter soundings, and also other data (French network, WDC-C1) will be used to investigate the variations of characteristic bottomside parameters including: the half-density height, the F1 height and another characteristic point as just proposed by Radicella. As for the F1-point, this latter intends to produce a straightforward relation that can easily be introduced into the code. This study is to be coordinated by Radicella (International Centre for Earth and Environmental Sciences, Trieste, Italy) in cooperation with Bradley, Reinisch and Sizun (deadline: 1991).

The determination of valley parameters is still an unresolved problem. URSI's Working Group G4 will further discuss this issue.

3. Plasma Temperatures

Brace presented global models of the electron temperature in the upper F region based on DE-2 measurements. These shall be used to further investigate the effect of solar activity on the electron temperature.

At lower heights, the plasma temperatures will be fitted to the new CIRA-86 at 100 km. The CIRA group will be asked to deliver a simplified description of the neutral temperature profile so that it could be easily incorporated into the IRI code (introducing the new CIRA/MSIS-86 code could almost double the present IRI software package).

In general, the latitudinal, altitudinal and diurnal variations of electron and ion temperatures are very well represented in IRI. The changes with solar activity are small and depend on latitude, season and local time.

4. Ion Composition

When comparing IRI with incoherent scatter data, Bilitza found serious differences above the F2-peak where 0+ is much more abundant than given in the IRI code. It is intended to concentrate on the transition levels for which data are easier to obtain. Instead of starting with the most abundant ion, it is safer to take the inverse way in the computation.

It is hoped that new data sources will be available, in particular from USSR rocket observations (Danilov). The preliminary description earlier published by this group shall, as an option, be made available in the IRI code.

5. Ionospheric Drifts

Kazimirovsky's, earlier, preliminary description of horizontal drifts at two levels has been replaced by a new code that is hoped to become available soon. It uses Fourier-analysis of mainly ground-based drift measurements. De Paula's recent analysis of Jicamarca observations might open a chance to inform about a third level above the F2-peak, in particular near the magnetic dip equator.

K. RAWER L. BOSSY

INTERNATIONAL SYMPOSIUM ON ELECTROMAGNETIC METROLOGY (ISEM'89)

1. Introduction

A Symposium on Electromagnetic Metrology, called ISEM'89, was held in Beijing, China from 19 to 22 August 1989. This is intended to be the first of a series the periodicity of which is still to be determined.

The Symposium was organized by the Chinese Society for Measurement, with the sponsorship of the International Union of Radio Science, of the Asia/Pacific Metrology Conference and of the Chinese Institute for Electronics.

In the two international Committees, Programme and Organizing, the past and present Chairmen of URSI Commission A were included.

The Symposium was attended by about 80 people (plus some officials of the organizing and sponsoring bodies), 16 of whom came from abroad. A total of 72 papers, 30 of which by non-Chinese researchers, were presented during the Symposium.

2. Topics Covered

In a plenary session, the following four introductory topics were covered: International aspects of EM metrology; Present status of EM metrology; Time domain versus frequency domain methods in EM metrology; Recent progress of EM metrology in China.

Six other sessions were held on: Radio frequency - Microwave (9 papers); Lasers (9 papers); Frequency standards - New types (8 papers); Electromagnetic metrology (7 papers); Time and frequency (7 papers); Electrical metrology (10 papers).

About 20% of the papers presented were the outcome of the activities of NIM (National Institute for Metrology of China).

3. Highlights

In the radio frequency-microwave domain, besides the usual topics, we note the widespread use of semiconfocal open cavities for measurements of dielectric constant and loss

angle on various materials (up to about 100 GHz). A paper reviewing the millimeter activity in China was also presented.

In laser research, not less than six papers were devoted to length standards using frequency stabilized lasers; an unusual fifth harmonic locking system is reported to give a reproducibility of 1*10-11 (with a gain of about one order of magnitude, with reference to the same laser, locked with the traditional third order loop) and a stability of 2*10-11 at 1 s.

During the Symposium a Russian team announced the successful lasing of a laser in which, by cooling at the liquid Nitrogen temperature a very large methane resonance cell (20 cm diameter, 200 cm length), the equivalent temperature of the gas was reduced to 4 mK, bringing the second order Doppler effect to a mere 0.006 Hz. With lasers of this type, it is possible to conceive an "optical clock" with a reproducibility of 1*10-15 or better.

The use of semiconductor lasers in length metrology (for microdisplacements) using the speckle technique was successfully investigated.

For frequency standards, out of the eight papers presented, two were considering improvements in the classical caesium beam standard, one with a selective atom selection along the beam, using two different pumping lines, the second investigating a new geometry of the beam, using magnetic state selection, but with the gradient in magnetic field obtained not with dipole magnets, but with concave and convex magnets.

Two other papers dealt with rubidium devices, one a series of three refined H masers in construction at Shanghai Observatory, and the remaining with lasers, fixed or tuneable, used in frequency metrology.

In electromagnetic metrology, at least two Chinese laboratories (BIRMM - Beijing Institute for Radio Metrology and Measurements, and NIM) are engaged in research on the Josephson effect and the Quantum-Hall effect. Moreover, at NIM work is performed towards the SI Ampere. The Chinese laboratories are well equipped, and ready for the introduction of the new definition of volt and ohm, which will come into effect worldwide starting on 1st January 1990.

As regards frequency and time, three papers discussed, from different points of view, the well-known Allan variance, the tool used for the last 25 years more widely in expressing

the frequency instability versus time of a device and the spectral properties of such instabilities. Two papers were considering the use of GPS for time comparison and dissemination and one paper dealt with humidity and temperature effects on commercial caesium standards.

In the field of electrical measurements, five papers were devoted to magnetic measurements, one to a measurement standard for superconductive magnetic fields, and four to measurements on magnetic materials. The problem of the transfer between AC and DC voltages and currents was also discussed.

4. Technical Visit

One afternoon was devoted to a very interesting visit to NIM, the National Institute for Metrology, situated in the Eastern part of Beijing. Some 1,800 people, about half of them with a technical degree, are employed by the Institute.

5. Proceedings

The Proceedings are available from Pergamon Press - International Academic Publishers (small IV format, 474 pages).

S. LESCHIUTTA

INTERNATIONAL TELECOMMUNICATION UNION

NEW SECRETARY-GENERAL

Dr. Pekka Tarjanne, of Finland, took office on 1 November 1989 as Secretary-General of ITU. He was elected to the post by the ITU Plenipotentiary Conference earlier this year.

Dr. Tarjanne succeeds Mr. R.E. Butler, of Australia, who served the Union for the last 21 years.

THE CCIR: 60 YEARS

The 60th Anniversary celebration of the Comité Consultatif International des Radiocommunications (CCIR) was held in the International Conference Centre in Geneva on 5 October 1989.

The opening address was given by Prof. Dr. M. Krivosheev, doyen of the CCIR Study Group Officers, who stressed the importance of the work of CCIR for the progressive evolution of communications. The Director of CCIR, Mr. R.C. Kirby, announced that, on the occasion of the 60th anniversary, a group of scientists, who had been associated with CCIR for a long time, would receive a "Diplôme d'Honneur" for distinguished contributions to the work of the Committee.

Together with Mr. Butler, Secretary-General of ITU, and Mr. Tarjanne, Secretary-General elect of ITU, Mr. Kirby presented the diplomas and congratulated the recipients or their representatives. Among the 65 persons so honoured, I mention especially those whom we know also for their contributions to URSI, and I apologize for possible omissions:

- Mr. Leslie W. Barclay (UK): major contribution to CCIR for many years, particularly on propagation subjects; Chairman of Study Group 6 since 1978.
- Dr. Gerhard Becker (FRG): Vice-Chairman of Study Group 7, 1970-1974 and Chairman 1974-1981.

- Mr. Lucien Boithias (France): technical contributions on propagation in the troposphere and propagation predictions; leadership of many groups of experts within Study Group 5.
- Prof. Claudio Egidi (Italy): technical contributions for over thirty years to CCIR studies related with Study Groups 2 and 7.
- Prof. Francesco Fedi (Italy): technical contributions to radio wave propagation studies over twenty years; Chairman of CCIR IWP 5/3 since 1977 and Vice-Chairman of Study Group on radio propagation in non-ionized media since 1986.
- Dr. Frederick Horner (UK): technical contributions over many years to CCIR studies on atmospheric radio noise, space research and radio astronomy; Chairman of CCIR Study Group 2 since 1980.
- Prof. Sigfrido Leschiutta (Italy): for contributions to CCIR studies of standard frequency and time from 1968 over more than twenty years, and distinguished Vice-chairmanship of CCIR Study Group 7 from 1982.
- Dr. Geneviève Pillet (France): technical contributions on propagation in the ionosphere and propagation predictions; Vice-Chairman of Study Group 6 since 1974.
- Mr. James McA. Steele (UK): for contributions to standard time and frequency studies from 1969 to present; Vice-Chairman Study Group 7 from 1974; Chairman from 1981 to present.
- Dr. William Utlaut (USA): technical contributions to and leadership of CCIR studies on spectrum utilization and monitoring and on ionospheric propagation.

As this year is also the centenary of the birth of Prof. Balth. van der Pol who had been elected 40 years ago as the first Director of CCIR, I had been asked to deliver a talk on "Van der Pol and CCIR". In the introduction, I referred to the scientific work of Balth. van der Pol from 1916 to 1959, to his work in URSI (Chairman of the Commission on Radio Waves and Circuits, Vice-President of the Union, and Honorary President), to his work in CISPR (Vice-President - Measurements) and in IRE (Vice-President 1934, Medal of Honour 1935). I drew attention to van der Pol's early work in CCIR, from 1929 onwards, and more especially to his work as Director (1949-1957) and to the three Plenary Assemblies he organized (Geneva 1951, London

1953, Warsaw 1956) during which years the attendance grew from 112 to over 400.

Dr. John Norbury, of Rutherford-Appleton Laboratory UK, presented the CCIR 60th Anniversary Lecture, "Radio Propagation and Bad Weather", a very interesting survey of variable conditions of propagation. Prof. Krivosheev thanked both speakers and expressed the hope that their lectures would be published. He closed the meeting, which was followed by an animated reception in the hall of the CICG building.

F.L.H.M. STUMPERS

INTERNATIONAL SYMPOSIUM ON SIGNALS, SYSTEMS AND ELECTRONICS

Erlangen, FRG, 18-20 September 1989

The three-day Symposium on Signals, Systems and Electronics was brought into being by Commissions C and D of URSI, with the intention that it should, if successful, inaugurate a new triennial series analogous to the well-established Electromagnetic Waves Symposia which have been running now for over thirty years. It was therefore very important for the organisers and for URSI that this new Symposium should be a success. In my opinion, it was a great success, and fully justified all the hard work put into it by the responsible Committees. These were the Scientific Committee, led by Prof. R. Saal and Prof. T. Okoshi, and the Steering Committee chaired by Prof. H.W. Schüssler.

In an Opening Session, chaired by Prof. Schüssler, those attending were welcomed to the Friedrich-Alexander University by its Vice-President, and to the city of Erlangen by the Deputy Mayor. The President of URSI expressed on behalf of the attendees sincere thanks for this very warm welcome, remarking that for URSI the occasion was an historic one.

Thirty-four countries were represented, the largest numbers coming (understandably) from the F.R.G., and France, but Japan, USA, and U.K. each had fifteen or more attending. It was good to see also substantial groups from Czechoslovakia, G.D.R., Hungary, and Poland. It was also particularly pleasing that fourteen attended under the Young Scientists Programme.

The meeting was genuinely international, and in this respect the Symposium got off to a flying start. The scientific programme was very well planned. On each of the three days there were two plenary sessions at the beginning of each morning and afternoon, with an invited lecture on a topical subject by an expert in the field. These were all of top quality. Then the programme split into parallel sessions, up to six sometimes running at the same time. Whilst this had the usual disadvantage of forcing choices that were often difficult to make, it is hard to see what alternative the organisers had when confronted with so many high-quality papers. Altogether, there were 197 papers and 6 plenary-session lectures. These

were shared amongst parallel sessions having the following titles: Signal and Information Theory, System Theory, Communications Systems, Electronic Devices and Applications, Optical Devices and Applications, and CAD for Devices and Circuits.

In private conversation opinion about the value of this new Symposium was uniformly positive, and the need for it to continue was quite firmly expressed. For the organisers there could have been only one disappointment; the two guided tours of Nürnberg and Bamberg had to be cancelled for lack of support. The organisers can perhaps draw comfort from the fact that the scientific programme was irresistible; few felt they could spare even half a day away from it!

All who attended had the opportunity to attend a most interesting banquet - a Franconian evening with traditional local food, local wine, and of course local beer. We were even presented with our own steins to provide a more permanent memory of the occasion. A final word of praise is due to those who organised the excellent volume of the papers presented; this was beautifully done, and provided at least a partial solution to the "parallel session problem".

The thanks of URSI are due to all who contributed to the highly successful debut of what must surely be just the first of many ISSSE's. May the succeeding ones be as interesting and enjoyable as the first.

A.L. CULLEN

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Copies of the Proceedings of ISSSE '89 are available from

Mrs U. Arnold
Lehrstuhl für Nachrichtentechnik
Universität Erlangen-Nürnberg
Cauerstrasse 7
D-8520 Erlangen, FRG

at the price of DM 120.

SOLAR-TERRESTRIAL PREDICTIONS WORKSHOP 1989

The Solar-Terrestrial Workshop, organised by the International Ursigram and World Days Service (IUWDS), was held in Sydney, Australia from 16 to 20 October 1989. It was attended by 103 participants coming from a wide area geographically although there was a lack of people from the Eastern European centres. On the other hand there was an increased support from Japan, China and India, for whom the Workshop was more accessible.

Scientifically, the Workshop produced a good balance of invited talks presented to the full group with detailed contributed papers to meetings of the three Working Groups. A pleasing feature of the Workshop was an increased awareness of the importance and value of the subject. The sun appeared to confirm this by producing a large solar flare and particle event late in the Workshop period. This was followed by a substantial geomagnetic storm on the closing day of the Workshop with aurorae reported from many parts of Australia!

There was substantial enthusiasm that the series of Workshops be continued with a decreased interval between Workshops. At a meeting after the Workshop, IUWDS decided to accept an offer from the Associate Regional Warning Centre in Ottawa, Canada to host a meeting there in 1992. This time should be an ideal opportunity to discuss the events of the next few years of what promises to be a very interesting solar cycle.

Papers from the Workshop are being edited into a "Proceedings" in the manner of the previous two Workshops. It is expected that this volume will be available in July of next year.

A fuller report of the Workshop will be included in the IUWDS annual report for 1989.

Richard THOMPSON
Chairman, IUWDS

BUREAU INTERNATIONAL DE L'HEURE
BUREAU INTERNATIONAL DES POIDS ET MESURES
(Time Section)

Report presented in preparation
of the 23rd General Assembly of URSI
(Prague 1990)

Introduction

On the 1st of January 1988, as a consequence of a reorganization of international services dealing with the Rotation of the Earth and Time, responsibility for the establishment of International Atomic Time (TAI) was officially transferred from the Bureau International de l'Heure (BIH) to the Bureau International des Poids et Mesures (BIPM). In fact, the BIPM had already housed the BIH Time Section since 1985: the transfer did not involve any scientific and technical discontinuity.

TAI and its sister time scale Coordinated Universal Time (UTC) are still made available by issuing corrections to add to the readings of the master clocks of national laboratories. These corrections are given for dates at 10-day intervals.

Establishment of TAI and UTC

(a) Clock data received at BIH/BIPM

The data are received from more than 50 laboratories, some of them being associated in national consortia. We note:

- a stability in the total number of participating clocks (about 170),
- an increasing input from hydrogen masers, the other clocks being cesium clocks (4 to 6 of them being laboratory "primary" clocks),
- an increasing participation of laboratories from the southern hemisphere,
- an insufficient input from primary frequency standards.

There are between 5 and 10 hydrogen masers participating effectively in TAI. Some of them have stabilities for two-

month samples which rival the stability of the best primary cæsium clocks (σ below 1 x 10^{-14}) and exhibit no significant frequency drift over several years.

The data of the primary frequency standards are used to maintain the accuracy of the TAI unitary interval through a long term frequency steering. These data are dominated by a single laboratory where the reported uncertainties are smaller by at least a factor five than in all other laboratories (1). This disparity, which is not new, remains one of the main concerns in the metrology of time.

(b) Time comparisons

Most of the time comparisons used for the establishment of TAI and UTC are obtained from simultaneous tracking of GPS satellites. The satellites of Block I are not subjected to the voluntary degradation for non-authorized users, known as "Selective Availability" (SA): six of them are regularly observed.

At BIPM, we have tried, in cooperation with national laboratories, to improve the accuracy of GPS time comparisons by:

(a) differential calibration of receiver delays (2);
(b) adjustment of geodetic coordinates of the antennas through analysis of the time comparisons themselves (3, 4, 5);
(c) construction, by a guest worker of CRL, of a codeless dual-frequency receiver measuring the ionospheric refraction and tests of application (6, 7);
(d) experimental use of precise ephemerides provided by the National Geodetic Survey for time comparisons between Europe and USA (8).

It appears that the total uncertainty of GPS time comparisons could be less than 5 ns, worldwide. But that would require an increased effort in equipment, coordination and data processing. Unfortunately, the implementation of the SA for satellites of Block II, which are now being launched, will degrade the quality of the GPS time comparisons to an extent which is not yet known and which might lead to operational problems.

These future difficulties with GPS reinforce the interest in two-way time transfers using telecommunication satellites, which are also potentially more accurate. The BIPM is now engaged in the coordination of time comparisons by the two-way

technique using the MITREX modem.

The stations where GPS receivers are not available are linked by the simultaneous reception of LORAN-C or television signals. These two methods provide good results over short distances. But a remaining problem is the rather poor link ($\pm$ 0,5 μs) with the USSR due to excessive distance of the nearest LORAN-C station.

(c) Algorithm for TAI

The BIH/BIPM algorithm ALGOS has been kept basically unchanged since it was devised in 1973, except for the system of assessment of weights attributed to clocks. ALGOS is described in (9).

In 1987/88, ALGOS was thoroughly re-examined in order to know if it was still well-adapted to the improved performances of clocks and time comparisons. The conclusion was that the ALGOS linear prediction based on two-month frequency samples was still optimum, but that the weighting system did not give full justice to the clocks having the best long-term stability. New weighting rules were adopted in 1988, according to which the maximum weight is reached for clocks having a stability characterized by

$$\sigma(6, \tau = 2 \text{ months}) \quad 3.7 \times 10^{-14}.$$

The six-sample variance is used, instead of the usual pair variance, in order to decrease the weights of clocks showing frequency drift and annual variation.

With this new weighting system, about 50% of the total weight is now carried by 15% of the best clocks, instead of 30% of the best clocks previously.

Other studies dealt with the comparison of the Kalmann technique with classical algorithms, the use of a double-weight system and the role of frequency prediction in time scale algorithms (10).

(d) Stability of TAI

During the period 1984 Feb.24 - 1989 June 22, it was not found necessary to steer the frequency of TAI in order to maintain it in agreement with the frequency of the best frequency standards. TAI is, therefore, practically independent of these standards; this offers the possibility of useful

comparisons.

With respect to the standard PTB-CS1, the mean relative drift was, over this interval,

$$\frac{d}{dt}\left[F(TAI) - F(PTB\text{-}CS1)\right] = -0.6 \times 10^{-14}.$$

The relative frequency stability of TAI and PTB-CS1, for one year samples is

$$\sigma(2, \tau = \text{year}) = 0.8 \times 10^{-14}.$$

We observe the persistence of an annual frequency variation between TAI and PTB-CS1, confirmed by PTB-CS2. However, while its phase is approximatively maintained, its peak amplitude decreased from about 5×10^{-14} in 1984 to 2×10^{-14} in 1988. This variation seems to be due mostly to humidity effects on industrial caesium clocks contributing data to TAI.

(e) Dissemination of TAI and UTC

The primary means of dissemination is the publication of corrections to the master clocks of national laboratories in the BIPM monthly Circular T (or in BIH Circular D before 1988).

However, we mention that the time scale for GPS is maintained close to UTC (plus an integral number of seconds). For instance, in 1989, the difference UTC-GPS time is of the order of 1 μs. For the users who need an accuracy of a few microseconds, GPS is an outstanding means of dissemination of TAI and UTC. The BIPM Circular T gives also UTC-GPS time and the residuals for individual satellites, once per day.

Other Research

TAI is established in near real time. For reasons that are evident, time scales established in retrospect can have a better accuracy and stability. It is especially important for pulsars studies to have the best time reference. Improved time scales have been computed at the BIPM under the designation TT(BIPMxx) where TT stands for Terrestrial Time and xx for the year of computation (11). These time scales are revised annually.

The relativistic definition of TAI and its role in celestial dynamics remain, to some extent, controversial. References (12 and 13) are contributions to these topics.

Among didactic papers, we mention a BIPM contribution to a comprehensive book on the Reference Systems in space and time (14).

Acronyms

BIH	Bureau International de l'Heure
BIPM	Bureau International des Poids et Mesures
CRL	Communications Research Laboratory
GPS	Global Positioning System (NAVSTAR)
PTB	Physikalisch-Technische Bundesanstalt
TAI	Temps Atomique International
UTC	Coordinated Universal Time.

References

(1) GUINOT, B. and AZOUBIB, J. Comparison of Primary Frequency Standards, Proc. 4th Symposium on Frequency Standards and Metrology, Ancona, 1989 (Springer-Verlag 1989), pp.37-42.

(2) LEWANDOWSKI, W., WEISS, M. and DAVIS, D. A calibration of GPS equipment of time and frequency standard laboratories in the USA and Europe, Metrologia, 24, 1987, pp.181-186.

(3) GUINOT, B., LEWANDOWSKI, W. Nanosecond time comparisons in Europe using the GPS, Proc. 2nd European Frequency and Time Forum, Neuchâtel, 1988, pp.187-193.

(4) GUINOT, B. and LEWANDOWSKI, W. Improvement of GPS time comparisons by simultaneous relative positioning of receiver antennas, Bull. Géodésique (in press).

(5) LEWANDOWSKI, W., DOUGLAS, R.J., KLEPCZYNSKI, W.J., STRANGE, W., SUTER, J. and WEISS, M. The positioning of GPS Antennae in Time-Keeping Laboratories of North America, Proc. 43rd Annual Symposium on Frequency Control, Denver, May-June 1989 (in press).

(6) IMAE, M., LEWANDOWSKI, W., THOMAS, C. and NIKI, C. A dual frequency GPS receiver measuring ionospheric effects without code demodulation and its application to time comparisons, Proc. 20th PTTI, Washington, D.C., Nov.-Dec. 1988, pp. 77-85.

(7) IMAE, M., MIRANIAN, M., LEWANDOWSKI, W. and THOMAS, C. A dual frequency codeless GPS receiver measuring ionospheric effects and its application to time comparisons between Europe and USA, Proc. 3rd European Forum on Time and Frequency, Besançon, France, 21-23 March 1989 (in press).

(8) LEWANDOWSKI, W. and WEISS, M.A. The use of precise ephemerides for GPS time transfer, 21st PTTI, 1989 (submitted).

(9) GUINOT, B. and THOMAS, C. Establishment of International Atomic Time. In Annual Report of BIPM Time Section, Vol.1, 1988 pp;D-3 to D-22.

(10) GUINOT, B. Some properties of algorithms for atomic time scales, Metrologia, 24, 1987, pp.195-198.

(11) GUINOT, B., Atomic time scales for pulsar studies and other demanding applications, Astron. Astrophys., 192, 1988, pp.370-373.

(12) GUINOT, B., Temps atomique et relativité, Bulletin du BNM, 75, 1989, pp.7-14.

(13) GUINOT, B. SEIDELMANN, P.K., Time scales - Their history, definition and interpretation, Astron. Astrophys., 194, 1988, pp.304-308.

(14) GUINOT, B. General principles of the measure of time: astronomical time, atomic time. In: Reference Frames, Kolaczek, J. Kovalevsky, I.I. Mueller (eds), 1989, Kluwer, pp.351-415.

INTERNATIONAL GEOPHYSICAL CALENDAR 1990

The International Ursigram and World Days Service (IUWDS) is a permanent service of the International Union of Radio Science, with the participation of the International Astronomical Union and the International Union of Geodesy and Geophysics. It adheres to the Federation of Astronomical and Geosphysical Data Analysis Services (FAGS) of ICSU. The IUWDS coordinates the international aspects of the world days programme and rapid data interchange. One of its tasks is the annual publication of the *International Geophysical Calendar*.

The Calendar reproduced on pp.32-33 continues the series begun for the IGY years 1957-58, and is issued annually to recommend dates for solar and geophysical observations which cannot be carried out continuously. Thus, the amount of observational data in existence tends to be larger on Calendar days. The recommendations on data reduction and especially the flow of data to World Data Centers (WDCs) in many instances emphasize Calendar days. The Calendar is prepared by the IUWDS with the advice of spokesmen for the various scientific disciplines. For some programmes, greater detail concerning recommendations appears from time to time published in the *IAGA News*, *IUGG Chronicle*, *URSI Information Bulletin* or other scientific journals or newsletters.

The definitions of the designated days remain as described on previous Calendars. Universal Time (UT) is the standard time for all world days. Regular Geophysical Days (RGD) are each Wednesday. Regular World Days (RWD) are three consecutive days each month (always Tuesday, Wednesday and Thursday near the middle of the month). Priority Regular World Days (PRWD) are the RWD which fall on Wednesdays. Quarterly World Days (QWD) are one day each quarter and are the PRWD which fall in the World Geophysical Intervals (WGI). The WGI are fourteen consecutive days in each season, beginning on Monday of the selected month, and normally shift from year to year. In 1990, the WGI will be January, April, July and October.

The Solar Eclipses are:

a) 26 January 1990 (annular) beginning in Antarctica and ending in South Atlantic. Partial phases visible on the South Island of New Zealand and much of South America.

b) 22 July 1990 (total) begins in Finland, then along northern coasts of Europe and Asia. Totality path 130 miles wide at maximum, duration 2 minutes 33 seconds; Sun at about 40° altitude. Totality crosses Alaska's Aleutian Islands. Partial phases in northeastern Europe, northwestern North America, northern Asia and Hawaiian Islands.

Meteor Showers (selected by P.M. Millman, Ottawa) include important visual showers and also unusual showers observable mainly by radio and radar techniques. The dates for Northern Hemisphere meteor showers are: Jan 3-4 ; Apr 22-23; May 4-5; Jun 8-12; Jul 28-29; Aug 10-14; Oct 21-22; Nov 2-3, 17-18; Dec 12-16, 22-23, 1990; and Jan 3-4, 1991. The dates for Southern Hemisphere meteor showers are: May 4-5; Jun 8-12; Jul 27-30; Oct 21-22; Nov 2-3, 17-18; and Dec 5-6, 12-16, 1990.

The occurrence of unusual solar or geophysical conditions is announced or forecast by the IUWDS through various types of geophysical ALERTS (which are widely distributed by telegram and radio broadcast on a current schedule). Stratospheric warmings (STRATWARM) are also designated. The meteorological telecommunications network coordinated by WMO carries these worldwide Alerts once daily soon after 0400 UT. For definitions of Alerts see IUWDS "Synoptic Codes for Solar and Geophysical Data, Third Revised Edition 1973" and its amendments. Retrospective World Intervals are selected and announced by MONSEE and elsewhere to provide additional analyzed data for particular events studied in the ICSU Scientific Committee on Solar-Terrestrial Physics (SCOSTEP) programmes.

RECOMMENDED SCIENTIFIC PROGRAMMES

OPERATIONAL EDITION

(The following material was reviewed in 1989 by spokesmen of IAGA, WMO and URSI as suitable for coordinated geophysical programmes in 1990).

Airglow and Aurora Phenomena. Airglow and auroral observatories operate with their full capacity around the New Moon periods. However, for progress in understanding the mechanism of many phenomena, such as low latitude aurora, the coordinated use of all available techniques, optical and radio, from the ground and in space is required. Thus, for the airglow and aurora 7-day periods on the Calendar, ionosonde, incoherent

scatter, special satellite or balloon observations, etc., are especially encouraged. Periods of approximately one week's duration centered on the New Moon are proposed for high resolution of ionospheric, auroral and magnetospheric observations at high latitudes during northern winter.

Atmospheric Electricity. Non-continuous measurements and data reduction for continuous measurements of atmospheric electric current density, field, conductivities, space charges, ion number densities, ionosphere potentials, condensation nuclei, etc.; both at ground as well as with radiosondes, aircraft, rockets; should be done with first priority on the RGD each Wednesday, beginning on 3 January 1990 at 0000 UT, 10 January at 0600 UT, 17 January at 1200 UT, 24 January at 1800 UT, etc. (beginning hour shifts six hours each week, but is always on Wednesday). Minimum programme is at the same time on PRWD beginning with 17 January at 1200 UT. Data reduction for continuous measurements should be extended, if possible, to cover at least the full RGD including, in addition, at least 6 hours prior to indicated beginning time. Measurements prohibited by bad weather should be done 24 hours later. Results on sferics and ELF are wanted with first priority for the same hours, short-period measurements centered around the minutes 35-50 of the hours indicated. Priority Weeks are the weeks which contain a PRWD; minimum priority weeks are the ones with a QWD. The World Data Centre for Atmospheric Electricity, 7 Karbysheva, Leningrad 194018, USSR, is the collection point for data and information on measurements.

Geomagnetic Phenomena. It has always been a leading principle for geomagnetic observatories that operations should be as continuous as possible and the great majority of stations undertake the same programme without regard to the Calendar.

Stations equipped for making magnetic observations, but which cannot carry out such observations and reductions on a continuous schedule are encouraged to carry out such work at least on RWD (and during times of MAGSTROM Alert).

Ionospheric Phenomena. Special attention is continuing on particular events which cannot be forecast in advance with reasonable certainty. These will be identified by Retrospective World Intervals. The importance of obtaining full observational coverage is therefore stressed even if it is possible to analyze the detailed data only for the chosen events. In the case of vertical incidence sounding, the need to obtain

quarter-hourly ionograms at as many stations as possible is particularly stressed and takes priority over recommendation (a) below when both are not practical.

For the vertical incidence (VI) sounding programme, the summary recommendations are: (a) All stations should make soundings on the hour and every quarter hour; (b) On RWDs, ionogram soundings should be made at least every quarter and preferably every five minutes or more frequently, particularly at high latitudes; (c) All stations are encouraged to make f-plots on RWDs; f-plots should be made for high latitude stations, and for so-called "representative" stations at lower latitudes for all days (i.e., including RWDs and WGIs) (Continuous records of ionospheric parameters are acceptable in place of f-plots at temperate and low latitude stations); (d) Copies of hourly ionograms with appropriate scales for QWDs 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. See also recommendations under Airglow and Auroral Phenomena.

For the incoherent scatter observation programme, every effort should be made to obtain measurements at least on the Incoherent Scatter Coordinated Observation Days, and intensive series should be attempted whenever possible on WGIs or the Airglow and Aurora Periods. The need for collateral VI observations with not more than quarter-hourly spacing at least during all observation periods is stressed. Special programmes: Dr. V. Wickwar, Utah State University, Center for Atmospheric and Space Sciences, Logan, UT 84322-4405, USA, URSI Working Group G/H.1. Phone: (801)750-3641.

For the ionospheric drift or wind measurement by the various radio techniques, observations are recommended to be concentrated on the weeks including RWDs.

For travelling ionosphere disturbances, propose special periods for coordinated measurements of gravity waves induced by magnetospheric activity, probably on selected PRWD and RWD.

For the ionospheric absorption programme half-hourly observations are made at least on all RWDs and half-hourly tabulations sent to WDCs. Observations should be continuous on solar eclipse days for stations in eclipse zone and in its conjugate area. Special efforts should be made to obtain daily absorption measurements at temperate latitude stations during the period of Absorption Winter Anomaly, particularly on days

of abnormally high or abnormally low absorption (approximately October-March, Northern Hemisphere; April-September, Southern Hemisphere).

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

For synoptic observations of mesospheric (D region) electron densities, several groups have agreed on using the RGD for the hours around noon.

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

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

Meteorology. Particular efforts should be made to carry out an intensified programme 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 programmes are also desirable, preferably by the implementation of RGD-type programmes (see above) on Mondays and Fridays, as well as on Wednesdays.

Solar Phenomena. Observatories making specialized studies of solar phenomena, particularly using new or complex techniques, such that continuous observation or reporting is impractical, are requested to make special efforts to provide the WDCs data for solar eclipse days, RWDs and during PROTON/FLARE ALERTS. The attention of those recording solar noise spectra, solar magnetic fields and doing specialized optical studies is particularly drawn to this recommendation.

Solar Interplanetary Variability Programme (SIV). Sponsored by SCOSTEP, focusses on observations of the transition phenomena from solar minimum to solar maximum (1988-1989). 1990 will emphasize analysis and interpretation of the observations. For details, contact Dr. E.J. Smith, JPL, Mail Stop 169/506, 4800 Oak Grove Dr., Pasadena, CA 91109, USA.

Transient Interplanetary Processes with emphasis on the solar connection (SOLTIP). Proposed programme within the SCOSTEP STEP (Solar-Terrestrial Energy Programme) project: 1990-1995. It will focus on remote and in situ observations and analyses of solar-generated phenomena and their propagation throughout the heliosphere. Desired goals include: (1) interplanetary scintillation observation of remote radio galaxies as well as telemetry signals to/from interplanetary spacecraft; (2) coordination of Earth-orbiting spacecraft such as IMP-8 in the solar wind and solar-orbiting spacecraft such as ICE, GIOTTO, SAKIGAKE, VOYAGER 1/2, PIONEER 10/11, ULYSSES, RELICT, WIND, and SOHO.

Space Research, Interplanetary Phenomena, Cosmic Rays, Aeronomy. Experimenters should take into account that observational effort in other disciplines tends to be intensified on the days marked on the Calendar, and schedule balloon and rocket experiments accordingly if there are no other geophysical reasons for choice. In particular it is desirable to make rocket measurements of ionospheric characteristics on the same day at as many locations as possible; where feasible, experimenters should endeavour to launch rockets to monitor at least normal conditions on the Quarterly World Days (QWD) or on RWDs, since these are also days when there will be maximum support from ground observations. Also, special efforts should be made to assure recording of telemetry on QWD and Airglow and Aurora Periods of experiments on satellites and of experiments on spacecraft in orbit around the Sun.

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This Calendar for 1990 has been drawn up by H.E. Coffey, of the IUWDS Steering Committee, in association with spokesmen for the various scientific disciplines in SCOSTEP, IAGA and URSI. Similar Calendars are issued annually beginning with the IGY, 1957-58, and are published in various widely available scientific publications.

Additional copies are available upon request to IUWDS Chairman, Dr. R. Thompson, IPS Radio and Space Services, P.O. Box 1548, Chatswood, NSW 2057, Australia, or IUWDS Secretary for World Days, Miss H.E. Coffey, WDC-A for Solar-Terrestrial Physics, NOAA E/GC2, 325 Broadway, Boulder, Colorado 80303, USA.

International Geophysical Calendar 1990

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

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

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

17	18	(19)	20*	21*	22	23
24	25+	26+	27+	28+	29+	30
S	M	T	W	T	F	S

16	17+	18*+	19*+	20	21	22	
23	24	25	26	27	28	29	
30	31	1	2	3	4	5	1991
6	7	8	9	10	11+	12+	JANUARY
13	14	(15)*	16*	(17)	18	19	
20	21	22	23	24	25	26	
27	28	29	30	31			
S	M	T	W	T	F	S	

(16) Regular World Day (RWD)

21 Priority Regular World Day (PRWD)

17 Quarterly World Day (QWD) also a PRWD and RWD

[3] Regular Geophysical Day (RGD)

[15 16] World Geophysical Interval (WGI)

28+ Incoherent Scatter Coordinated Observation Day

[26] Day of Solar Eclipse

[25 26] Airglow and Aurora Period

24* Dark Moon Geophysical Day (DMGD)

NOTES:

1. Days with unusual meteor shower activity are: Northern Hemisphere Jan 3,4; Apr 22-23; May 4-5; Jun 8-12; Jul 28-29; Aug 10-14; Oct 21-22; Nov 2-3, 17-18; Dec 12-16, 22-23, 1990; Jan 3-4, 1991. Southern Hemisphere May 4-5; Jun 8-12; Jul 26-30; Oct 21-22; Nov 2-3, 17-18; Dec 5-7, 12-16, 1990.

2. Solar Interplanetary Variability (SIV) Observing Program 1988 - 1989 concludes with in-depth data analysis in 1990.

3. Day intervals that IMP 8 satellite is in the solar wind (begin and end days are generally partial days): 29 Dec 1989-5 Jan 1990; 10-17 Jan; 23-30 Jan; 4-11 Feb; 17-24 Feb; 2-9 Mar; 15-22 Mar; 27 Mar-3 Apr; 9-16 Apr; 22-28 Apr; 4-11 May; 17-23 May; 30 May-5 Jun; 11-18 Jun; 24 Jun-1 Jul; 7-13 Jul; 19-26 Jul; 1-8 Aug; 13-20 Aug; 25 Aug-2 Sep; 7-15 Sep; 19-27 Sep; 2-10 Oct; 15-23 Oct; 28 Oct-4 Nov; 9-17 Nov; 22-29 Nov; 4-11 Dec; 16-24 Dec; 29 Dec-5 Jan 1991.

   There will not be total IMP 8 data monitoring coverage during these intervals. (Information kindly provided by the WDC-A for Rockets and Satellites, NASA GSFC, Greenbelt, MD 20771 U.S.A.).

4. + Incoherent Scatter programs start at 1600 UT on the first day of the intervals indicated, and end at 1600 UT on the last day of the intervals.

5. Incoherent Scatter world days: 24-25 Jan 1990; 12-17 Feb LTCS/WAGS; 21-23 Feb GISMOS; 20-21 Mar; 21-22 May; 25-29 Jun GITCAD/SUNDIAL/WAGS; 20-21 Sep; 13-15 Nov DELITE; 17-19 Dec DELITE; 11-12 Jan 1991.

where DELITE= Dynamics Explorer - Lower Ionosphere-Thermosphere Emissions;
GISMOS= Global Ionospheric Simultaneous Measurements of Substorms;
GITCAD= Global Ionosphere-Thermosphere Coupling and Dynamics;
LTCS= Lower Thermosphere Coupling Study;
SUNDIAL= Coordinated study of the ionosphere/magnetosphere;
WAGS= Worldwide Acoustics Gravity Wave Study.

OPERATIONAL EDITION, September 1989

INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

STATEMENT ON FREE CIRCULATION OF SCIENTISTS

The text reproduced below has been approved by the Executive Board and the General Committee of ICSU in Lisbon, October 1989.

The International Council of Scientific Unions (ICSU) is the oldest existing non-governmental body committed to international scientific cooperation for the benefit of humanity. Created in 1931, after its predecessor, the International Research Council, was dissolved because of discrimination against scientists in certain countries, ICSU has been vigorously pursuing a policy of non-discrimination ever since. ICSU maintains that discrimination hinders free communication and exchange of ideas and information among scientists and thereby blocks the progress of science, which depends on their collective efforts.

ICSU's Members are 20 International Scientific Unions and 75 national academies of science or research councils. Together these set up international mechanisms to carry out scientific programmes of an interdisciplinary nature. An important factor in the success of these activities, which are concerned with issues such as the protection of the environment, Antarctic regions or space research, is that they are carried out under the aegis of a respected independent and international body such as ICSU. Each Member adheres to the Council's Statutes when involved in activities carried out within ICSU's framework. One of the basic principles in these Statutes (see Statute 5) is that of non-discrimination, which affirms the right and freedom of scientists to associate in international scientific activity without regard to such factors as citizenship, religion, creed, political stance, ethnic origin, race, colour, language, age or sex. All of these rights are embodied in a variety of articles in the *International Bill of Human Rights*. ICSU seeks to protect, and promote awareness of, the rights and fundamental freedoms of scientists in their scientific pursuits. ICSU has a well-established non-political tradition which is central to its character and operations and it does not permit any of its activities to be disturbed by

statements or actions of a political nature.

As the intrinsic nature of science is universal, its success depends on cooperation, interaction and exchange, much of which goes beyond national boundaries. In order to achieve its objectives, scientists involved in ICSU activities must therefore be able to have free access to each other and to scientific data and information. It is only through such access that science can produce its fruits and international scientific cooperation can flourish. ICSU recognizes that scientists are not working in a world where such open access is always assured and it uses its best endeavours privately to resolve difficulties where they arise. In most cases it has been successful. Where such consultations have failed, ICSU has, however, had to publicize acts of discrimination against scientists and take steps to prevent their repetition, even to the extent of encouraging members of the ICSU family to decline invitations to hold meetings in the country concerned. On the basis of its firm and unwavering commitment to the principle of the free circulation of scientists ICSU continues to oppose any tendency to weaken or undermine this principle.

IONOSONDE NETWORK ADVISORY GROUP (INAG)

BULLETIN MAILING LIST

The INAG Bulletin mailing list is currently being revised. If you wish to remain on the mailing list, or if you wish to be placed on the mailing list, please advise

Dr. P.J. Wilkinson, Chairman INAG
IPS Radio and Space Services
P.O.Box 1548
Chatswood, NSW 2057
Australia

in writing. The new mailing list will come into effect after the URSI General Assembly in Prague, in 1990.

ANNOUNCEMENTS OF MEETINGS AND SYMPOSIA

INTERNATIONAL CONFERENCE ON RADAR POLARIMETRY

This Conference will take place from 20 to 22 March 1990 at IRESTE Nantes, France. The Conference organizer is Prof. J. Saillard.

In recent years engineers and researchers have noticed the development of a field of research which has a promising future: electromagnetic wave polarization. Indeed, its effects on various radar obstacles have only been partly researched and have therefore been little exploited. The International Conference on Radar Polarimetry, in which eminent specialists will take part, will address three major topics:

- Theory of polarimetry,
- Processing of polarimetric signals,
- Applications of polarimetry.

A wide spectrum of subjects will be covered, ranging from basic theory to the most advanced research and achievements.

Requests for further information should be addressed to:

JIPR - IRESTE
C.P. 3003
F-44087 Nantes Cedex 03
France.

Phone: (33) 40 68 30 64
Fax : (33) 40 68 30 66.

XV GENERAL ASSEMBLY OF THE EUROPEAN GEOPHYSICAL SOCIETY

The XV General Assembly of EGS will be held in Copenhagen, Denmark from 23 to 27 April 1990. The meeting is open to all scientists of all nations.

The scientific programme includes three sections: I.Solid Earth and Planets; II. Hydrospheres and Atmospheres; III. External Geophysics.

Requests for information should be addressed to:

EGS Office
Postfach 49
Max-Planck-Strasse 1
D-3411 Katlenburg-Lindau
FRG.

Phone: (49) 5556 1440
Fax : (49) 5556 4709.

5th INTERNATIONAL CONFERENCE ON

RADIO RECEIVERS AND ASSOCIATED SYSTEMS

The Conference is organised by the Electronics Division of the Institution of Electrical Engineers, and will be held at Churchill College, Cambridge, UK from 23 to 27 July 1990.

The objective of the Conference will be to provide a forum for the consideration of recent advances in the field of radio receivers and associated systems through the medium of original technical papers and discussion. The Conference will deal with all frequencies from ELF to millimetre-wave.Sessions will be devoted to receiver integrated circuits, receiver measurements and performance, radio systems, mobile radio, paging and cordless communications, antennas and propagation, receiver design, spread spectrum and digital receiver techniques.

The following list of headings provides a guide to the topics on which papers are particularly solicited, but is not meant to be exclusive:

RF Techniques, Signal Processing, Performance Optimisation, Receivers for Specific Fields of Operation, Receiver Components.

Those wishing to offer contributions for the programme are asked to submit a synopsis (approx. 300 words) by 8 January 1990.

For further information, apply to:

Conferences Services Department
IEE
Savoy Place
London WC2R 0BL
United Kingdom.

Phone: (44) 1-240 1871 Ext. 222
Telex: 261176 IEE LDN G
Fax : (44) 1-240 7735.

20th EUROPEAN MICROWAVE CONFERENCE

The Conference will take place in Budapest, Hungary from 10 to 13 September 1990, and a Microcoll Workshop will be held on 14 September 1990. The Conference is being organised in cooperation with the Hungarian Academy of Sciences, the Hungarian Scientific Society for Telecommunications, the Research Institute for Telecommunications, EUREL, IEE, IEEE Region 8 and URSI. The Chairman of the Technical Programme Committee is Prof. T. Berceli.

All areas of microwaves will be considered, and special emphasis will be placed on the following aspects:

1. Terrestrial and satellite communications (including DBS and cellular mobile radio)
2. Radar and remote sensing
3. Optical microwave interaction
4. Industrial, agricultural, environmental and medical applications
5. Semiconductor devices and circuits (hybrid and monolithic)
6. Gigabit logic
7. Millimetre techniques
8. Passive circuits
9. CAD and modelling
10. Antennas, phased arrays and propagation
11. Field theory
12. Measurements
13. Modern microwave education.

Summaries of papers describing new work in the areas listed above are invited for consideration by the Technical Programme Committee and should be received by 21 February 1990. They should be in English.

Authors are asked to submit 6 copies of their summaries which should be typed single-space and occupy no more than 3 A4 pages including graphs and diagrams. The summary should include an abstract and should also emphasise what is new and distinguish carefully between theoretical, simulated and practical results. The summary should include a brief conclusion.

The author's name, affiliation and full address should be given on the first page together with the topic reference number which seems most appropriate to the work. Please use number 14 for topics which are not listed.

Summaries should be sent to:

Dr. M. Kenderessy
Secretary, 1990 European Microwave Conference
Research Institute for Telecommunications
Gabor Aron u. 65
H-1026 Budapest, Hungary.

General information about the Conference is available from:

Microwave Exhibitions and Publishers Ltd
90 Caverley Road, Tunbridge Wells
Kent TN1 2UN, United Kingdom.

Phone: (44) 892- 544027
Telex: 95604
Fax : (44) 892-541023.

9th INTERNATIONAL ZURICH SYMPOSIUM AND TECHNICAL EXHIBITION ON ELECTROMAGNETIC COMPATIBILITY

The Symposium will be held in Zurich, Switzerland from 12 to 14 March 1991, and will again be hosted by the Federal Institute of Technology. The Symposium President is Prof. Dr. P. Leuthold, and the Vice-Presidents are Prof. Dr. F.L.Stumpers and Dr. J. Heyner. The Chairman of the Technical Programme is

Prof. Dr. R.M. Showers.

The general programme, with the tutorial lectures on Monday, followed from Tuesday to Thursday by three parallel daily sessions, the workshops, committee and URSI open meetings, the attractive social events and the technical excursions on Friday shall all take place as usual.

The scientific programme will include the following topics:

Social and economical impact of EMC - Electromagnetic pollution, control and enforcement - Spectrum economy and management - National and international cooperation in EMC - EMC management - Immunity of electronic systems - Electromagnetic compatibility of communications, electric power and automation - EMC hazards to ordnance and vital safety systems - Compatibility of medical electronics - Biological effects of RF energy - Interference propagation, source-to-receptor coupling - Nuclear and Lightning Electromagnetic Pulse (NEMP/LEMP) impact - Regulation, limits, standards and specifications - Measuring methods and instrumentation, production testing - Computers in EMC, prediction and analysis - Design of compatible equipment, suppression methods and devices - Special techniques: spread-spectrum, fibre optics - EMC education - Special case studies.

English abstracts and summaries of up to 5 pages in 11 copies must be received before 15 March 1990 by the Technical Programme Committee at the address given below.

Enquiries should be directed to:

Dr. G. Meyer
ETH Zentrum-IKT
CH-8092 Zurich, Switzerland.

Phone: (41) 1-256 2790
Fax : (41) 1-262 0943
Telex: 817 379 ethhg ch.

1990 ASIA-PACIFIC MICROWAVE CONFERENCE

The Third Asia-Pacific Microwave Conference (APMC'90) will be held in Tokyo, Japan from 18 to 21 September 1990. This Conference is organized and sponsored by the Institute of Electronics, Information and Communication Engineers (IEICE) of Japan, and is co-sponsored by IEEE MTT-S Tokyo Chapter, and is held in cooperation with IEEE MTT-S and URSI.

The main Conference topics are listed below:

Solid State Devices and Circuits - Passive Devices and Circuits - Microwave Superconductivity - Microwave and Millimetre Wave Monolithic Circuits - High Speed Digital Circuits - Computer-Aided Design - Low-Noise Devices and Techniques - High-Power Devices and Techniques - Ferrite Devices - Microwave Acoustics - Microwave and Millimetre Wave Systems - Millimetre Wave and Submillimetre Wave Techniques - Microwave Terrestrial, Satellite and Mobile Communication Systems - Microwave Industrial Applications - Microwave Medical/Biological Applications - Versatile Applications of GaAs FETs - HEMT, HBT and other Devices - Microwave and Millimetre Wave Packaging - Measurement Theory and Techniques - Microwave Measurement for Gigabit Devices - Electromagnetic Field Theory - Opto-Electronic Techniques - Phased and Active Array Techniques - Microstrip Antennas - Scattering and Propagation - Remote Sensing - EMC/EMI.

However, the above topics should not be considered as the total limits of the conference scope.

Original papers are solicited that have not been previously presented and which describe new contributions in the area suggested above. Authors are required to submit 6 copies of (1) a 500-1,000 word summary (typed, souble-spaced) with supporting illustrations, and (2) a 30-50 word abstract with telephone and/or Fax/Telex number, title, name of author(s), affiliation and a complete mailing address. The summary must clearly state: (1) the purpose of the work, (2) the manner and degree to which it advances the art, (3) specific results that have been obtained and their significance.

The paper summary must be received by 10 March 1990 by:

Prof. Yoshiyuki Naito
Chairperson Technical Programme Committee
c/o Business Centre for Academic Societies
3-23-1 Hongo, Bunkyo-ku
Tokyo 113
Japan.

Phone: (81) 3-817 5831
Fax : (81) 3-817 5836
Telex: 0 2722268 BCJSP J.

LIST OF FUTURE SYMPOSIA AND MEETINGS

Note: Events marked by an asterisk are sponsored or co-sponsored by URSI.

International Conference on Radar Polarimetry
IRESTE Nantes, France, 20-22 March 1990

Contact address: JIPR, IRESTE
C.P. 3003
F-44087 Nantes Cedex 03
France.

Tel: (33) 40 68 30 64
Fax: (33) 40 68 30 66

Symposium on Equatorial Aeronomy*
Tucuman, Argentina, March/April 1990

Contact address: Prof. S. Radicella
PRONARP
Julian Alvarez 1218
1414 Buenos Aires
Argentina.

Tx : 59134 ENTOP AR.

International Beacon Satellite Symposium*
Tucuman, Argentina, March/April 1990

Contact address: Prof. R. Leitinger
Karl-Franzens Universität Graz
Institut für Meteorologie und Geophysik
Halbärthgasse 1
A-8010 Graz
Austria.

4th International School for Space Simulations (ISSS-4)*
Kyoto, Japan, April 1990

Contact address: Prof. H. Matsumoto
Radio Atmospheric Science Centre
Kyoto University
Gokanosho, Uji
Kyoto 611, Japan.

Tel: (81) 774-332 532
Tx : 5453665 RASCKU J
Fax: (81) 774-318 463.

XV General Assembly of the European Geophysical Society
Copenhagen, Denmark, 23-27 April 1990

Contact address: EGS Office
Postfach 49
Max-Planck-Strasse 1
D-3411 Katlenburg-Lindau
Federal Republic of Germany.

Tel: (49) 5556 1440
Fax: (49) 5556 4709
Tx : 965 564 zil d.

Colloquium on Signature Problems in Microwave Remote Sensing of the Surface of the Earth*
Hyannis, Mass., USA, 16-18 May 1990

Contact address: Prof. C. Swift
University of Massachusetts
Amherst, MA 01003
USA.

International Geoscience and Remote Sensing Symposium (IGARSS'90)*
College Park, Maryland, USA, 20-27 May 1990

Contact address: IGARSS'90
Westover Consultants, Inc.
6303 Ivy Lane, Suite 416
Greenbelt, MD 20770, USA.

Tel: (1) 301-220 0685
Fax: (1) 301-345 2742.

XVIIth Plenary Assembly of the CCIR
Düsseldorf, FRG, 21 May - 1 June 1990

Contact address: CCIR
2 rue de Varembé
1211 Geneva 20
Switzerland.

Tel: (41) 22-730 5111.

Conference on Precision Electromagnetic Measurements(CPEM'90)*
Ottawa, Canada, 11-14 June 1990

Contact address: Dr. J. Vanier
Director, Laboratory for Basic Standards
Division of Physics
National Research Council of Canada
Ottawa, Canada K1A OR6.

Tel: (1) 613-993 9326
Fax: (1) 613-954 7708
Tx : 053-4322.

10th International Wrocław Symposium on Electromagnetic Compatibility*
Wrocław, Poland, 26-29 June 1990

Contact address: EMC Symposium
Box 2141
51 645 Wrocław 12
Poland.

XXVIII COSPAR Plenary Meeting and Associated Activities*
The Hague, Netherlands, 25 June - 6 July 1990

Contact address: LOC XXVIII COSPAR
Conference Secretariat
c/o Netherlands Congress Centre
P.O.Box 82000
2508 EA The Hague
The Netherlands.

Tel: (31) 70-351 2851
Fax: (31) 70-352 0407
Tx : 31700 NECON NL.

5th International Conference on Radio Receivers and Associated Systems
Cambridge, United Kingdom, 23-27 July 1990

Contact address: Conference Services Department
IEE
Savoy Place
London WC2R 0BL
United Kingdom.

Tel: (44) 1-240 1871 Ext.222
Fax: (44) 1-240 7735
Tx : 261176 IEE LDN G.

XXIII General Assembly of URSI*
Prague, Czechoslovakia, 28 August - 5 September 1990

Contact address: Prof. V. Zima
Institute of Radioengineering and Electronics
1 Lumumbova
CR-182 51 Praha 8
Czechoslovakia.

Tel: (42) 2-840 609
Tx : (66) 122646 urep c.

International Meeting on Mirror Antennae Constructions*
Jurmala-Riga, USSR, 6-8 September 1990

Contact address: Dr. E. Bervalds
Radiophysical Observatory
Latvian SSR Academy of Sciences
Turgeneva 19
226524 Riga
USSR, Latvia.

16th European Conference on Optical Communication (ECOC'90)*
Amsterdam, Netherlands, 16-20 September 1990

Contact address: Organizing Committee ECOC'90
W.P. Wapenaar
PTT Telecom, Long Lines and Radio Comm.
P.O.Box 3053
NL-3800 DB Amersfoort
The Netherlands.

20th European Microwave Conference*
Budapest, Hungary, 10-13 September 1990

Contact address: Microwave Exhibitions and Publishers Ltd
90 Calverley Road, Tunbridge Wells
Kent TN1 2UN
United Kingdom.

Tel: (44) 892-544 027
Fax: (44) 892-541 023
Tx : 95604.

9th Colloquium on Microwave Communication (MICROCOLL)*
Budapest, Hungary, September 1990.

Asia-Pacific Microwave Conference (AMPC'90)*
Tokyo, Japan, 18-21 September 1990

Contact address: Prof. T. Yoneyama
c/o Business Centre for Academic
Societies Japan
3-23-1 Hongo, Bunkyo-ku
Tokyo 113, Japan.

Tel: (81) 3-817 5831
Fax: (81) 3-817 5836
Tx : 0 2722268 BCJSP J.

International Conference on Automation, Robotics and Computer Vision (ICARCV'90)
Singapore, Rep. of Singapore, 18-21 September 1990

Contact address: Meeting Planners Pte Ltd
100 Beach Road No 33-01
Shaw Towers
Singapore 0718
Republic of Singapore.

Tel: (65) 2-972 822
Fax: (65) 2-962 670
Tx : RS 40125 MEPLAN.

Symposium on Digital Signal Processing*
Florence, Italy, Autumn 1990.

International Zurich Seminar on Digital Communication*
Zurich, Switzerland, Autumn 1990.

Symposium on Radio Interferometry - Theory, Techniques and Applications*
Socorro, New Mexico, USA, 8-12 October 1990

Contact address: Dr. W.M. Goss
National Radio Astronomy Observatory
P.O.B. 0
Socorro, New Mexico 87801-0387
USA.

Tel: (1) 505-772 4011
TWX: 910 888 1710.

International Conference on Signal Processing '90*
Beijing, China, 22-26 October 1990

Contact address: Prof. Yuan Baozong
Research Institute of Information Science
Northern Jiatong University
Beijing 100044
China.

International Symposium on Antennas (JINA'90)*
Nice, France, 13-15 November 1990

Contact address: Secrétariat JINA'90
CNET-PAB Centre de la Turbie
F-06320 La Turbie
France.

Tel: (33) 93-411 530
(33) 93-411 717
Fax: (33) 93-410 229
Tx : 470159 F.

Symposium on Large-scale Processes in the Ionosphere and Thermosphere*
Boulder, Colorado, USA, December 1990

Contact address: Dr. A.D. Richmond
National Centre for Atmospheric Research
P.O.Box 3000
Boulder, CO 80307, USA.

Tel: (1) 303-497 1570.

9th International Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility*
Zurich, Switzerland, 12-14 March 1991

Contact address: EMC Symposium and Exhibition
ETH Zentrum-IKT
CH-8092 Zurich
Switzerland.

Tel: (41) 1-256 2790
Fax: (41) 1-262 0943
Tx : 817-379 ethhg ch.

7th International Conference on Antennas and Propagation (ICAP'91)*
York, United Kingdom, 14-18 April 1991

Contact address: ICAP'91 Secretariat
Conference Services, IEE
Savoy Place
London WC2R 0BL
United Kingdom.

Tel: (44) 1-240 1871 Ext. 222
Tx : 26 1176 IEE LDN G.

International COMMSPHERE Symposium*
Tel Aviv, Israel, 23-25 April 1991

Contact address: Dr. J. Politch
Secretary, Israeli URSI Committee
Technion
P.O.B. 2250
Haifa 31021
Israel.

URSI Suzdal Symposium on Artificial Modification of the Ionosphere*
Suzdal, USSR, Autumn 1991

Contact address: Prof. V.V. Migulin
IZMIRAN
142092 Troitsk
Moscow Region
USSR.

European Conference on Optical Communication (ECOC'91)*
Paris, France, 9-12 September 1991

Contact address: Mme G. Bonami
SDSA
65 avenue Edouard Vaillant
F-92100 Boulogne Billancourt
France.

Tel: (33) 1-4608 5661
Fax: (33) 1-4608 2312
Tx : 633018 F.

12th IMEKO World Congress
Beijing, China, 5-10 September 1991

Contact address: Secretariat IMEKO XII
c/o Chinese Society for Measurement
P.O.Box 1413
Beijing 100013
China.

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Note: An alphabetical index of names, with addresses and page references, is given at the back of this Bulletin.

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