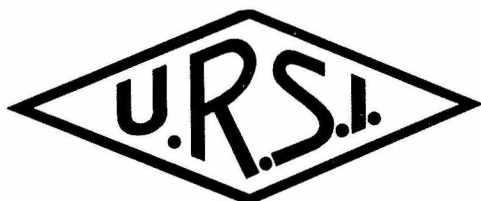


UNION RADIO-SCIENTIFIQUE INTERNATIONALE INTERNATIONAL UNION OF RADIO SCIENCE



**Comptes Rendus des Assemblées Générales de l'URSI
Proceedings of URSI General Assemblies**

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INTRODUCTION

ACKNOWLEDGEMENT

The XXI General Assembly of URSI was held at the Palazzo dei Congressi and the Centro Affari in Florence, Italy, from 28 August to 5 September 1984. In introducing this account of the proceedings, it is appropriate to offer the sincere thanks of the Union:

- to the URSI Member Committee in Italy, under the sponsorship of the Consiglio Nazionale delle Ricerche,
- to the Italian Organizing Committee which was responsible for the detailed planning of the excellent local arrangements in Florence,
- to the Chairmen and Vice-Chairmen of URSI Commissions and Inter-Commission Working Groups who successfully planned the programme for the scientific sessions, and to the session chairmen and the speakers,
- to the organizers of the Open Symposia which attracted many participants to the Assembly,
- to UNESCO, ICSU, COSTED, the Royal Society of London, the URSI Member Committee in Italy and the International Institute for Theoretical Physics in Trieste who provided funds in support of the URSI Young Scientists Programme,
- to the international scientific Unions and organizations which sent representatives to the Assembly.

OUTLINE OF THE ASSEMBLY

The representatives of the Member Committees of URSI, who form the URSI Council, met in Florence on five occasions between 26 August and 6 September 1984. The Resolutions and Recommendations adopted by the Council and by the URSI Commissions are reproduced at the end of this volume. Summary accounts of the business transacted by the Council and the Commissions are given elsewhere.

In addition to the scientific sessions arranged by the nine scientific Commissions of URSI, four Open Symposia were organized on the following topics:

- Interaction of Electromagnetic Fields with Biological Systems;
- Active Experiments in Space Plasmas;
- Radio Techniques in Planetary Exploration;
- Data, Signal and Image Processing.

Three General Lectures of common interest to all participants were given by outstanding scientists. The subjects were:

Very long-baseline interferometry (Dr. R.T. Schilizzi);
Twenty years of satellite communication (Dr. J.V. Evans);
Solitons in biology (Dr. A. Scott).

A special session was arranged on 3 Sept. during which the young scientists who attended the URSI General Assembly under the Young Scientists Programme were given the opportunity to describe their research work.

At the formal Closing Meeting on 5 September, the outgoing President expressed his thanks to all those who had contributed to the success of the XXI General Assembly. The Secretary General announced the names of the newly elected officers and summarised the main decisions of the Council. Finally, the incoming President, Dr. A.P. Mitra, expressed his appreciation of the honour which his election represented, and looked forward to the XXII General Assembly in Tel Aviv, Israel, in 1987.

LIST OF URSI OFFICERS AND OFFICERS OF MEMBER COMMITTEES

Following the elections at the XXI General Assembly in Florence, Italy, the Officers of the Union and the URSI representatives on other organizations are as given below.

The list of Presidents and Secretaries of URSI Member Committees is based on information available to the URSI Secretariat up to the time of going to press.

HONORARY OFFICERS

Honorary Presidents

Sir Granville Beynon (UK)
Prof. H.G. Booker (USA)
Prof. W.N. Christiansen (Australia)
Prof. W. Dieminger (FRG)
Mr. J.A. Ratcliffe (UK)

Secretary General Emeritus

Dr. C.M. Minnis (UK)

BOARD OF OFFICERS

President:	Dr. A.P. Mitra (India)
Past President:	Prof. W.E. Gordon (USA)
Vice-Presidents:	Dr. H.J. Albrecht (FRG)
	Prof. A.L. Cullen (UK)
	Prof. S. Okamura (Japan)
	Prof. V. Zima (Czechoslovakia)
Secretary General:	Prof. J. Van Bladel (Belgium)

OFFICERS OF COMMISSIONS AND COMMITTEES

Commission A - Electromagnetic Metrology

Chairman: Prof. S. Hahn (Poland)
Vice-Chairman: Prof. S. Leschiutta (Italy)

Commission B - Fields and Waves

Chairman: Prof. J. Bach Andersen (Denmark)
Vice-Chairman: Prof. T.B.A. Senior (USA)

Commission C - Signals and Systems

Chairman: Prof. K. Géher (Hungary)
Vice-Chairman: Prof. R. Saal (FRG)

Commission D - Electronic and Optical Devices and Applications

Chairman: Prof. W.A. Gambling (UK)
Vice-Chairman: Prof. T. Okoshi (Japan)

Commission E - Electromagnetic Noise and Interference

Chairman: Prof. F.L.H.M. Stumpers (Netherlands)
Vice-Chairman: Prof. R. Strużak (Poland)

Commission F - Wave Propagation and Remote Sensing

Chairman: Dr. F. Fedi (Italy)
Vice-Chairman: Prof. R.K. Crane (USA)

Commission G - Ionospheric Radio and Propagation

Chairman: Dr. J. Aarons (USA)
Vice-Chairman: Dr. H. Rishbeth (UK)

Commission H - Waves in Plasmas

Chairman: Prof. R.L. Dowden (New Zealand)
Vice-Chairman: Dr. H. Matsumoto (Japan)

Commission J - Radio Astronomy

Chairman: Dr. R. Wielebinski (FRG)
Vice-Chairman: Prof. R.H. Frater (Australia)

Inter-Commission Working Group on Time Domain Waveform Measurements

Chairman: Dr. S. Nahman (USA)

Inter-Commission Working Group on Coordination of URSI's Activities
for Communication, Sensing and Processing

Chairman: Prof. W.A. Gambling (UK)

Inter-Commission Coordinating Group on Remote Sensing

Chairman: Dr. J.F.R. Gower (Canada)
Vice-Chairman: Dr. D. Gjessing (Norway)

Steering Group for Coordination of URSI Scientific Programme

Chairman: Dr. P. Bauer (France)

Standing Finance Committee

Chairman: Dr. M. Petit (France)

Standing Committee on URSI Membership

Chairman: Prof. S. Okamura (Japan)

Standing Committee on URSI General Assemblies

Chairman: Prof. V. Zima (Czechoslovakia)

Standing Committee on Developing Countries

Chairman: Prof. S. Radicella (Argentina)

URSI-CCIR-CCITT Liaison Committee

Chairman: Mr. G. Hagn (USA)

URSI REPRESENTATIVES ON OTHER SCIENTIFIC ORGANIZATIONS

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

Dr. J.W. Findlay (USA) and Dr. B. Robinson (Australia)

ICSU (International Council of Scientific Unions):

Dr. A.P. Mitra (India)

FAGS (Federation of Astronomical and Geophysical Services):

Dr. J.C. Ribes (France) and Dr. R. Wielebinski (FRG)

BIH Directing Board (Bureau International de l'Heure):

Mr. J.McA. Steele (UK)

IUWDS Steering Committee (International Ursigram and World Days Service):

Dr. L. McNamara (Australia)

COSPAR (Committee on Space Research):

Prof. K. Rawer (FRG)

COSTED (Committee on Science and Technology in Developing Countries):

Dr. A.P. Mitra (India)

SCAR (Scientific Committee on Antarctic Research):

Dr. G. Pillet (France)

SCOR (Scientific Committee on Oceanic Research):

Dr. G. Valenzuela (USA)

SCOSTEP (Scientific Committee on Solar-Terrestrial Physics):

Dr. R. Woodman (Peru)

MONSEE (Monitoring the Sun-Earth Environment):

Dr. D. Cole (Australia)

CPEM (Conference on Precision Electromagnetic Measurements):

Prof. S. Hahn (Poland)

PRESIDENTS AND SECRETARIES OF URSI MEMBER COMMITTEES

ARGENTINA	President: Ing. A.M. Andreu Secretary: Prof. V.A. Padula-Pintos
AUSTRALIA	President: Prof. R.H. Frater
AUSTRIA	President: Prof. S.J. Bauer
BELGIUM	President: Prof. R. Gonze Secretary: Prof. P. Delogne
BRAZIL	President: Dr. Nelson de Jesus Parada Secretary: Prof. P. Kaufmann
BULGARIA	President: Prof. K. Serafimov Secretary: Dr. A. Spasov
CANADA	President: Dr. E.V. Jull Secretary: Dr. L.H. Doherty
CHINA	
CIE (Beijing)	President: Prof. Feng Shizhang Secretary: Dr. Zheng Wenhao
SRS (Taipei)	President: Mr. Yu-Kai Chen Secretary: Dr. Yinn-Nien Huang
CZECHOSLOVAKIA	President: Prof. V. Zima Secretary: Dr. L. Kratena
DENMARK	President: Dr. T. Stockflet Jørgensen
EGYPT	President: Prof. Abd El-Samie Mostafa Secretary: Dr. E.A.M. Salem
FINLAND	President: Prof. M. Tiuri Secretary: Dipl. Eng. M. Hallikainen
FRANCE	President: M. D. Lombard Secretary: Dr. G. Pillet
GERMAN D.R.	President: Prof. Dr.-Ing. H. Frühauf Secretary: Dr. A. Iwainsky
GERMANY, F.R.	President: Dr.-Ing. H.J. Albrecht Secretary: Dr. Th. Damboldt
GREECE	
HUNGARY	President: Dr. G. Bognar Secretary: Prof. K. Géher

INDIA	President: Dr. A.P. Mitra
IRAQ	President: Dr. Aziz R. Sadik
IRELAND	President: Prof. M.C. Sexton Secretary: Mr. T.J. Quinn
ISRAEL	President: Dr. J. Shapira Secretary: Dr. Z. Huminer
ITALY	President: Prof. C. Egidi Secretary: Prof. E. Nano
JAPAN	President: Prof. H. Tanaka Secretary: Prof. M. Morimoto
NETHERLANDS	President: Dr. J.B.H. Peek Secretary: Mr. H.C. Kahlman
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NIGERIA	President: Prof. J.O. Oyinloye Secretary: Dr. G.O. Ajayi
NORWAY	President: Dr. D. Gjessing Secretary: Ms E. Rødsrud
PERU	President: Dr. R. Woodman
POLAND	President: Prof. A. Smolinski Secretary: Dr. T. KosiŃo
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SWEDEN	President: Dr. T. Stockflet Jorgensen Secretary: Dr. B. Öhman
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USSR	President: Prof. V.V. Migulin Secretary: Dr. V.N. Gubankov
YUGOSLAVIA	President: Prof. R. Horvat Secretary: Prof. Dr. B. Popović

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Secretary General:	Prof. J. Van Bladel
Assistant Secretary General:	Prof. P. Delogne
Executive Secretary:	Mrs Y. Stevanovitch

OPENING MEETING

Tuesday 28 August 1984

The Opening Meeting was held at the Palazzo dei Congressi, in Florence, in the presence of about 1,000 participants and guests.

During the first part of the programme, the Chair was taken by Prof. V. Cappellini, Chairman of the Italian Organizing Committee, who introduced two speakers: Prof. C. Egidi, President of the URSI Member Committee in Italy, and Mr. R. Bausi, representing the Lord Mayor of Florence.

The President of URSI replied briefly to the welcoming remarks made by these speakers.

After a short interval, the President of the Union took the Chair and invited Prof. J. Van Bladel, Secretary General, to present his Report. Following a now well established tradition, the Director of CCIR, Mr. R.C. Kirby, was invited to address the URSI Assembly. Prof. W.E. Gordon concluded the second part of the meeting by delivering his presidential address.

The third part of the Opening Meeting was chaired by Prof. S. Okamura, Vice-President of URSI and Chairman of the Awards Advisory Panel. The URSI awards for distinguished work during the period 1981-1983 were handed over to the four laureates as follows:

Balth. van der Pol Gold Medal: Prof. W.G. Farnell (Canada)

J.H. Dellinger Gold Medal: Mrs I. de Pater (Netherlands)

Appleton Prize: Prof. K.D. Cole (Australia)

Issac Koga Gold Medal: Dr. M. Ohtsu (Japan).

WELCOME

by Prof. V. Cappellini
Chairman, Italian Organizing Committee

Mr. President, honorary and acting Officers of URSI, ladies and gentlemen,

As Chairman of the National Organizing Committee and of the Local Organizing Committee, I am very happy and honoured to welcome all of you at this XXI General Assembly of URSI in Florence.

While Prof. C. Egidi, President of the URSI Member Committee in Italy, will give you some historical details on the URSI activities in Italy, and also on our beautiful city of Florence, I shall spend the remaining few minutes of my talk to acknowledge the support and cooperation of the many Institutions and persons who contributed to

the organization of the Assembly, and to describe briefly the activities of the Istituto delle Ricerche sulle Onde Elettromagnetiche (IROE - CNR), of which I am Director and which was involved in all the organizational aspects of this Meeting. The Consiglio Nazionale delle Ricerche (CNR) provided the main financial support for the organization of this Assembly.

Therefore, I would like to express thanks to Prof. E. Quagliariello, President of the CNR, to Prof. S. Martellucci, President of the Committee for Physical Sciences of the Consiglio, to Prof. G. Biorci, President of the Committee for Engineering and Architecture Sciences of the Consiglio, and to all the Members of the National Organizing Committee, in particular to Prof. F. Carassa and to Prof. C. Egidi.

Further I wish to thank the Italian Institutions and persons, which are officially listed in the Assembly Programme, for their financial and organizational support.

Special thanks are due to the Italian Electrotechnical and Electronic Association (AEI), Department of Florence, which contributed strongly to the organization, in particular to its President, Prof. U. Scappini, and to its Secretary, Dr. A. Giorgi.

I am very glad to thank also Prof. J. Van Bladel, Secretary General of URSI, and Mrs Y. Stevanovitch, Executive Secretary for their very helpful cooperation. They have been in continuous contact with us regarding the main organizational steps.

However, all the contributions, support and cooperation mentioned above would not have proved truly efficient without the action of the staff of the IROE - CNR in Florence, which, since last year, provided a continuous, generous and extremely valuable cooperation and help on all the aspects of the organization. I will not mention all the persons involved - they are listed in the Local Organizing Committee -, but I must at least acknowledge the wonderful activity of Prof. A.M. Scheggi, Executive Secretary, and Mrs. V. Cammelli: a great part of the success of the organization is due to these two active ladies.

Speaking about IROE - CNR, I would like to say a few words on its history and activities. The Institute was founded in 1946 by the Consiglio Nazionale delle Ricerche, through the cooperative action of Prof. G. Colometti, President of CNR at that time, Prof. P. Lombardini, and especially Prof. N. Carrara, first Director of the Institute.

The Institute started its research activities on microwave theory and applications, in particular for radar systems, but quickly expanded them to space research, especially ionosphere investigations and quantum electronics - laser systems, thanks also to the efforts of Prof. P.F. Checcacci, who died unfortunately in 1980, and of Prof. G. Toraldo di Francia, the second Director of the Institute.

Now the IROE has about one hundred full-time research staff, developing advanced research in the domain of electromagnetic wave theory and applications, from space research and remote sensing to

laser systems, optical fibers, integrated optics, biomedicine and information science.

Thanking you for your attention, I now have the pleasure to invite Prof. G. Egidi, President of the URSI Member Committee in Italy, to take the floor.

ADDRESS

by Prof. G. Egidi
President, URSI Member Committee in
Italy

Mr. President, honorary and acting Officers of URSI, ladies and gentlemen,

As Chairman of the Italian Committee of URSI, I am privileged and honoured to welcome you at this XXI General Assembly of URSI.

Almost fifty years ago, Italy already played the part of host country to an URSI international meeting. "Meminisse iuvabit" - it is important to remember - is the suggestion of the old poet and could be the motto of a computer company. I think that it may be instructive to recollect facts and deeds of that old URSI convention. Old people like myself will rejuvenate their spirit in remembrance, and young people will know what a progress our Union has gone through in the past five decades.

At the end of the V General Assembly, held in London from 11 to 20 September 1934, the Italian Delegation invited URSI to convene the subsequent Assembly in this country. The Assembly was actually held in Venice from 4 to 9 September 1938, and the post-Assembly technical tour proceeded from Venice to Rome and Leghorn, and ended in Turin on 14 September of that year.

As a young engineer and graduate student at the National Electrotechnical Institute in Turin, I took part, as a member of the welcoming staff, in the visit that URSI participants paid to the Institute.

The organization was under the sponsorship of the Consiglio Nazionale delle Ricerche (CNR): later I heard (particularly from Col. A. Dorsimont, Secretary General of URSI at that time, and from Mrs Dorsimont) that the meetings had been very successful, thanks to the parallel efforts of Prof. Vallauri and Dr. Fubini in Turin, mainly for the scientific side involving our country, and of Senator G. Volpi and Comm. Marini in Venice, for the local arrangements and additional financial contribution to the Organizing Committee.

The VI General Assembly had been planned for an attendance of about 50 scientists, and was held in one of the most artistic buildings facing the Grand Canal, the Palazzo Vendramin-Calergi,

headquarters of the Volpi Centre for Electrology, but also well known because Richard Wagner lived his last years and passed away there.

At the Opening Session, Prof. E.V. Appleton, President of the Union, delivered the inaugural address, outlining the great contribution of studies and researches since 1934 and commemorating Guglielmo Marconi, deceased the year before. The purpose of URSI was to ensure strict interconnection between scientists and technicians, and to promote and coordinate those studies and researches most important for the radiocommunications. The work was divided among five Study Commissions, each of them being subdivided into "experts subcommissions".

Commission I on Methods of measurement and standardization (original French title: Méthodes de mesure et d'étalonnage), chaired by E.H. Rayner (UK), was concerned with precise frequency measurements. The Chairman supplied details on international frequency comparisons, carried out among European laboratories in 1935, using the 1000 Hz frequency standard, emitted by NPL. Moreover, directives were given for the measurement of the em field intensity, with particular consideration to short and ultra-short waves, and new subjects for future work were considered.

Commission II on Radio wave propagation was chaired by E.V. Appleton, in the absence of J.H. Dellinger (USA). Its concern were studies on propagation and ionosphere, and a service on the periodic observations, through the so-called "Ursigrams". Discussions took place on the nomenclature of anomalous phenomena, on the opportunity to investigate systematically highly delayed echoes and radio wave interaction (Luxembourg effect), on the organization of studies on rapid fading of signals and on the observations to be made during the expected solar eclipse of 1940.

In Commission III on Atmospheric perturbations, chaired by E.V. Appleton (UK), it was discussed how to organize systematic registration of atmospheric; it was remarked that specialized laboratories were only a few, and the hope was expressed that their number be increased. Special typical forms of interference, generally accompanied by strong magnetic storms, were examined for their interest both in geophysics and in radiocommunications.

Commission IV on Liaisons (in French: Liaisons avec les praticiens, amateurs, opérateurs et les sciences connexes), recently entrusted to G. Vallauri (I), considered the standardization of Ursigrams and the study of solar phenomena related to the ionosphere and radio wave propagation, in cooperation with other international bodies.

Commission V on Radiophysics, chaired by B. van der Pol (Netherlands), considered the physical phenomena of particular interest for radiocommunications. Special attention was devoted to nonlinear oscillations, of interest for relaxation oscillators, for synchronization of oscillators, for tubes operating as amplifiers and generators. On this subject, it is worth mentioning a paper by G. Giorgi, relating to the application of the impulsive function to the study of transients. Great interest was attracted by the problem of

spontaneous fluctuations in tubes and circuits, on which a valuable report was submitted by Bakker and van der Pol. A paper by Esau dealt with the newly developed techniques for the generation of very high frequencies. Two communications by Manneback and Eckersley, on the applications of geometric optics to the propagation of em waves, arose a great interest.

The participants were then received at the CNR Headquarters in Rome, and afterwards they visited the Italo Radio (now ITAL-CABLE) station at Torrenova, the Santa Palomba station of ETAR (now RAI), the Aeronautics Studies and Experiences Centre at Guidonia, the Navy RIEC at Leghorn and the Istituto Elettrotecnico Nazionale in Turin.

This sketch of the 1938 meeting in Venice, based upon a report that appeared in the magazine *Alta Frequenza*, should suffice to give an idea of the immense progress in the field of radio science that took place between the VI and the XXI General Assemblies. Now, after about half a century since Venice 1938, our country is again the host country for an URSI international meeting.

Our first idea was to repeat the experience of Venice, also on account of the well known facilities of the Cini Foundation on the Isola di San Giorgio Maggiore, that saw so many Congresses since the end of the war. However, we had to expect an attendance many times that of 1938, of the order of one thousand participants and, unfortunately, Venice is unable to accommodate such a crowd, particularly during the high season at the end of August. Therefore we turned our attention to another national treasure, the City of Florence, the cradle of the Renaissance, which is more roomy than Venice. Our Florentine colleagues accepted promptly and willingly (probably not completely aware at the beginning of the numerous difficulties subsequently encountered!): they have devoted and are devoting their best energies to the organization, as you have learnt just now by listening to our colleague, Prof. Cappellini, the Chairman of the Local Organizing Committee.

This City of Florence was born as the Roman Colony of "Florentia" around the beginning of Christian Era, was also for about seven years (1864-1871) the Capital of Italy, after Turin and before Rome, during the national "Risorgimento" for the unification of the country. It is the metropolitan city of Tuscany, a region well known all over the world for its glory in poetry, architecture, sculpture, painting and science. Not everybody knows, however, that - differently from any other place in Italy - there is no Tuscan dialect: the "Tuscan tongue" since the XII-XIII century is in fact the standard "Italian tongue".

But Florence and Tuscany have never ceased to operate for the progress of science. In Florence four major Institutes are operational: the Arcetri Astrophysical Observatory, for many years directed by our dear late colleague Prof. Guglielmo Righini, the National Institute of Optics, the Institute of Research on Electromagnetic Waves (IROE) about which Prof. Cappellini has just spoken, founded and directed for many years by our dear colleague Prof. Nello Carrara, the Institute of Quantum Electronics (IEQ). All these Institutes are well connected with the University of Florence.

I have read the final programme of this Assembly, and the titles of the communications; therefore I am sure that the results of this XXI General Assembly will testify once again the outstanding progress in the fields of scientific radiocommunications, electromagnetic metrology, electronics and any other allied fields considered by URSI. With these sentiments, on behalf of the Consiglio Nazionale delle Ricerche and of our colleagues of the Italian Radio Science Committee, I wish every success to the work of this General Assembly.

ADDRESS

by Mr. R. Bausi
representing the Lord Mayor of Florence

Mr. President, ladies and gentlemen,

I would like first of all to thank you very heartily, on behalf of the Lord Mayor of Florence and of the city of Florence, for having chosen our city to hold the General Assembly of the International Union of Radio Science. This is a great event indeed, and Florence is fully aware of its importance. Florence is a city which attracts people and groups from all over the world and where numerous international meetings are held. But there are certain events which it considers of particular significance, and your General Assembly belongs to this category. I must, and do, proclaim it on behalf of the city.

As Professor Egidi has recalled, Florence is a city with a great tradition. I know I am speaking to men of science who have a good knowledge of such things; but I must say that the general public very often has a distorted view of the role of this city. Let us leave aside the fact that it is considered (and this is perhaps the sad lot of the cities which have a long past, a long tradition, a great history) as a museum of past glory. There is also, to my mind, another misapprehension, on the part of the general public. I mean, when Florence is considered as a city which is merely the cradle of artistic history, the centre of artistic history and the cradle of the Renaissance. But within this first misapprehension we can discover a second one, namely that the Renaissance is thought to be a phenomenon which exclusively affected certain aspects of man and not human thought in its entirety, not the whole reflection of man about its destiny. On the contrary, Florence is also a city which has developed a great scientific tradition, in which, as has been recalled, it takes great pride. I hope that the choice you made of our city - and indeed I have already mentioned that some of the reasons of this choice, indeed the most important ones, had been these - after your meeting in Washington in 1981 had also been guided by such considerations.

Above all Florence does not want to act as the custodian of a great past, be it even a scientific past: it also wants to contribute

to the scientific progress of today. Florence is a city with a complex network of activities: art, of course, culture, of course, but also technology, science, industry and trade - it is a city which has a strong commercial vocation. And it is this network, which indeed affects the fundamental activities of man, that also gives the scientific activities and the scientific research in Florence their dynamism. These scientific activities are being developing because Florence feels that it must play a part - only a part, of course, but it does want to play one - in the concert of all nations.

I thank you, then, for having chosen our city to hold this meeting of yours. This Assembly will certainly yield significant results. Florence would be particularly proud if, in the history of your recurring General Assemblies it could be said: the meeting in Florence was one during which significant results were achieved. Yes, and this would also become part of the scientific traditions of our city.

I wish you an excellent stay in Florence. This is a city which, even in the rain, is pleasant. We have not succeeded today in holding this Opening Ceremony on a fine day, but I hope that you also appreciate our city in the rain, and above all I want to hope that tomorrow we shall have glorious sunshine so that you can really appreciate Florence. Florence will welcome you - many of you certainly already know it, for I know that scientists often come here in Florence - it welcomes you with all its heartiness, its spontaneity, its sincerity and its friendliness, and I say to you: goodbye, come back to Florence soon!

REPLY BY THE PRESIDENT OF URSI

Prof. W.E. Gordon

Thank you for your addresses of welcome. On behalf of URSI, let me express our gratitude for inviting us to hold the XXI General Assembly in Florence. We are grateful to you, Dr. Bausi and to the Lord Mayor, to you Prof. Cappellini and to you Prof. Egidi for the kind invitation and for the pleasant arrangements you have made.

Ladies and Gentlemen, URSI met in this great country in 1938 for the VI General Assembly only a year after the death of Guglielmo Marconi who was and is an inspiration to all of us. Marconi, who by ignoring the generally accepted ideas concerning radio waves in the atmosphere, boldly sent signals across the North Atlantic, confirmed the practicality of long-distance, wireless telegraphy and established himself as a giant in our field through his great adventure. And so now URSI happily assembles in Florence, the cradle of the Renaissance, to consider the field that Marconi opened, that has exploded with the advent of communication satellites and we meet at a time when both parking automobiles in urban areas is a major frustration and parking satellites in geo-synchronous orbit looms as a major international problem.

We look forward to the next ten days, not only for the science but for the opportunity of enriching our lives amid the cultural treasures in this city of Florence. A city that inspired such greats as Galileo, Leonardo da Vinci, Dante and Macchiavelli. We propose, distinguished hosts, to work arduously in our meetings so as to make time to enjoy the museums, the galleries, the cathedrals, the way of life of our colleagues in Italy and our hosts in Florence. We will carry away with us vivid memories of the greatness of Michelangelo, Donatello, Raphael and Titian of the Uffizi and the Pitti Palace, of the Medicis and of the Ghiberti doors.

We are very grateful to Prof. Anna Maria Scheggi for her support of Prof. Cappellini in organizing the meetings and to Sir Granville Beynon and the Commission Chairmen for the scientific sessions.

May I take a moment to introduce to you, our hosts, and to the audience the distinguished representatives of other scientific organizations and the Honorary Presidents of URSI who are with us:

Representing ICSU, Dr. A.P. Mitra, Member of the Executive Board;
From CCIR, Mr. Richard Kirby, Director;
From IAGA and IUGG, Dr. R. Gendrin, Vice-President of IAGA;
Representing IAU, Dr. R.T. Schilizzi;
From COSPAR, Prof. S.A. Bowhill, Chairman of COSPAR Commission C;
From SCOSTEP, Prof. C.H. Liu, Secretary;
From IUCAF, Dr. J.W. Findlay, Chairman;
From SCAR, Dr. J.R. Dudeney.

The Honorary Presidents of URSI: Sir Granville Beynon, Prof. Henry G. Booker and Prof. Walter Dieminger.

Thank you again, generous hosts. I declare the XXI General Assembly of URSI open and invite the Secretary General to deliver his report after a short break.

REPORT OF THE SECRETARY GENERAL

Prof. J. Van Bladel

It is my pleasant duty to give a brief report on the scientific activities, the finances, and the administrative situation of the Union. This Report is traditionally presented partly in English and partly in French, the two official languages of URSI.

The delegates who have attended previous General Assemblies will remember that the full-time Secretariat General was abolished, for financial reasons, in the mid-seventies, and that the members of the Board of Officers took up additional responsibilities to enable the Union to function with an honorary, part-time Secretary. This new structure puts a particularly heavy load on the Treasurer. In collaboration with the Finance Committee, chaired by Dr. Albrecht, and making good use of the advice given with unfailing courtesy by Dr. Minnis, Prof. Cullen prepared a budget for the 1981-1984 triennium which allowed us to function without any serious financial worries. In fact, our financial situation is quite healthy. This is quite a feat given the difficulty to make even medium-term predictions in the face of unknown inflation rates, and unpredictable fluctuations of the respective values of dollar and other currencies.

The scientific activities of the last triennium have continued at about the same level as in 1978-1981. This means that our Union has sponsored about twenty meetings a year, a few of these organized directly by URSI. We mention here the successful symposia of Commission B in Santiago de Compostella and of Commission F in Louvain-la-Neuve. On the whole, in 1982-4, Commissions G and H jointly sponsored seventeen meetings, Commission F thirteen, Commission C nine, Commission B seven, Commission E six, Commission J four, and Commissions A and D three each. Details on the procedure to be followed to obtain sponsorship of a meeting can be obtained from the Secretariat. The various URSI Committees have had local programmes, of which the annual meeting of the Committee in the United States is particularly well known. The scientific activities of the General Assembly play a major role in the life of our Organization. The elaboration of the programme has been put in the capable hands of Sir Granville Beynon, who took upon his shoulders to organize this programme into sessions, joint sessions, the contributions to which are invited, and general lectures, and gave the necessary impetus to the Open Symposia, where the contributions result from a Call for Papers. The logistic base for the Assembly has been provided by our Italian hosts, among whom Prof. Scheggi carried the main load with everlasting good spirits and optimism.

Avant de quitter le sujet de l'Assemblée générale, je voudrais dire quelques mots concernant les Jeunes Scientifiques. Ce programme a été revitalisé avec grand succès à Washington en 1981. Cette année il connaît une nouvelle ampleur grâce à l'aide financière considérable que nous ont apportée l'ICSU (Conseil International des Unions Scientifiques), l'UNESCO, le COSTED (Comité pour la Science et la Technologie dans les pays en développement), la Royal Society de Londres et le Comité organisateur italien. Nous avons pu inviter 50 jeunes scientifiques (en y comprenant le lauréat du Prix Koga et le Booker Fellow), répartis par moitié entre pays développés et pays en voie de développement. Dix de ces participants se rendront d'ici à Trieste, où se tient un cours international sur la troposphère, la stratosphère et la mésosphère. Un cocktail de l'amitié, auquel assisteront quelques officiels de l'URSI, sera offert demain à ces jeunes hommes de science, qui représentent la génération montante de nos disciplines dans leurs pays respectifs.

Par rapport à sa structure des années soixante, notre Union, je l'ai déjà dit, a perdu son Secrétaire général permanent, qui était traditionnellement sa tête pensante. Les tâches routinières sont restées constantes, et leur exécution a mis un poids supplémentaire important sur les épaules de la Secrétaire exécutive, Mme Stevanovitch, qui a tenu tête à cette situation avec ses compétence et bonne humeur bien connues. La structure n'est cependant pas saine, et une proposition sera faite au Conseil de l'élargir en créant la fonction de Secrétaire général adjoint. Cette aide supplémentaire permettra aux Secrétaires généraux futurs de porter plus d'attention aux grands problèmes, et de mieux guider notre Union dans la constante évolution qu'elle subit.

Let me conclude this Report with a request. The programme of the last two General Assemblies has been influenced by the answers to a questionnaire which was distributed to the delegates at the time of the Assembly. This "grass roots" consultation is invaluable, and I urge the participants to show civic sense by answering the questionnaire which they will find in their pigeon hole. The questionnaire may be dropped in the ballot boxes which have been installed in both the Palazzo dei Congressi and the Centro Affari.

ADDRESS

by Mr. R.C. Kirby
Director, CCIR

Mr. President, Distinguished Officers of URSI,
Mr. Secretary General, Ladies and Gentlemen,

I am very happy for the traditional invitation to the Director of CCIR to address greetings and reflections to the URSI General Assembly. The URSI/CCIR connection has been a long and fruitful one.

In the fleeting first century since Hertz's demonstration of electromagnetic waves, radio science has reached into many domains, giving birth to major new scientific branches of astronomy, geo-, solar- and space physics, biology and medicine. But the first impact of radio science was in telecommunications, and still today the greatest reach of radio science into human lives remains in telecommunications - electromagnetic waves in the acquisition, processing and transfer of information.

URSI's relationship to telecommunications has always been close to that of the CCIR. Prof. Balth. van der Pol was not only the great figure of URSI; in his remarkable breadth, he was also the first Director of CCIR. Here he stressed the need for a scientific approach, while obtaining elegant practical results which remain essential to radiocommunications planning today. Indeed, CCIR, as well as URSI, was a family affair for the van der Pol's. Mme Le Corbeiller maintained correspondence with CCIR until shortly before her death, recently contributing a portrait of Dr. van der Pol and a painting of the first CCIR headquarters, the lovely Villa Bartaloni along Lake Geneva.

Dr. John Howard Dellinger, under whose leadership I was privileged first to join the Central Radio Propagation Laboratory in 1948, was the other URSI personality who set the character of URSI/CCIR relationships for decades to come. His leadership in URSI and his scientific contributions in electrical measurements and radio physics are legend. His engineering research, especially his contributions to radio navigation for aircraft, and understanding of short-wave propagation, was also background for his CCIR work. He was Chairman of CCIR Study Group on Ionospheric Propagation for more than eight years. The tradition of close ties to URSI has been maintained by the CCIR Study Groups on Propagation and on Space Research and Radio Astronomy.

Today, the most important challenge for radio science in CCIR is the technical means to accommodate the growth of requirements for the shared use of the radio frequency spectrum, including the services using the geostationary satellite orbit. In the early 1960's, after thirty-five years of development of short-wave communication, ITU had to form a special international panel on means to reduce congestion

in the high frequency bands. Fortunately satellite communications arrived to alleviate that problem largely. Now, twenty years later, there is wide concern about spectrum congestion for satellite communications. Fibre optic communications will help, but not solve the problem. Today, the ITU is preparing for a world conference on the geostationary satellite orbit and the planning of the space services using it; the first session is to be held in 1985, and a second session in 1988. Given that we already know something of the limits of the useful range of frequencies for telecommunication, means to increase the communication capacity of the useful radio frequency spectrum is the most fundamental link between radio science and international telecommunications.

Important current problems in radio wave propagation include rainfall effects, especially the characterization of the spatial extent of rain for various climatic regions, seasons and percentages of time. This is needed for satellite communication planning at bands above 10 GHz. Atmospheric refractivity studies remain needed to assess the extent of propagation effects of superrefraction and ducting, especially in climatic regions giving rise to sustained periods of anomalous propagation, as in the Gulf region and West Africa. Studies of scintillation and multipath in the lower atmosphere, and their effects on coherence and bandwidth, are important to the ever-increasing capacity of digital microwave systems. Studies of millimetre and infrared propagation need to continue toward exploitation of ever higher frequencies for short range communication.

Such propagation studies are the traditional topics of the URSI/CCIR relationship. But today, the Signals and Systems studies of Commission C, and the Electromagnetic Noise and Interference studies of Commission E, hold the promise of the greater communication capacity of the frequency spectrum. All the aspects of optimization of signal coding, processing, transmission and detection, for terrestrial and satellite channels in the presence of interference, need to be encouraged not only toward reduction of power -- but more and more toward increasing the aggregate communication capacity of a number of users sharing a frequency band.

Mr. President, the programme of the XX1st URSI General Assembly is rich in the relation of radio to new scientific exploration, as in biology, and planetary and plasma physics. But it shows also a core of research in advanced communications which strengthens the future of URSI's importance to ITU and international telecommunications.

PRESIDENTIAL ADDRESS

by Prof. W.E. Gordon
President, URSI

Distinguished guests, colleagues, dear friends,
ladies and gentlemen,

It is a great pleasure to add my welcome to that already extended today by our generous hosts. These are exciting times for the field of radio science and for URSI. Before dealing with those, however, I have the sad duty to remind you of the passing during the past three years of distinguished colleagues and friends. May I ask you to pay tribute by rising while I read their names:

Mrs P. Le Corbeiller-Posthuma, dear friend and supporter of URSI, the widow of one of our most respected colleagues, Prof. Balth. van der Pol;

Issac Koga (Japan), former President, and Honorary President of URSI;

Janusz Groszkowski (Poland), former Vice-President of URSI;

F.E. Borgnis (Switzerland);

M. Ceccarelli (Italy);

S. Matsushita (USA);

N. Mednikova (USSR);

Antonio Romana (Spain);

J.S. Shirke (India);

Joseph Stransky (Czechoslovakia);

A.H. Waynick (USA).

Thank you.

Mr. J.A. Ratcliffe, Honorary President of URSI, sends his apologies for missing this Assembly: "All good wishes for a very successful meeting and greetings to my numerous friends. I shall be thinking of you".

Dr. C.M. Minnis, Secretary General Emeritus, is unable to attend.

With your permission, I shall send them greetings and warm wishes on your behalf.

The Young Scientists Programme has succeeded beyond anyone's expectations. Through the efforts of Dr. Mitra and Prof. Van Bladel, 48 young scientists from 38 countries have been invited to the Assembly as guests of URSI. The Henry George Booker Fellow of the US Academy of Sciences, Dr. Rahmat-Samii, and the laureate of the Issac Koga Gold Medal, Dr. Ohtsu, will also participate in the Assembly. I extend a special welcome to them.

The IEEE celebrates its 100th anniversary this year. At their big birthday party, Prof. Jack Wolf, Chairman of Commission C, represented URSI and received a Medal. The Council will extend greetings to the IEEE on your behalf.

Over the triennium, URSI activities have included participation in more than 50 symposia, meetings of a number of active Working Groups, the recognition at this ceremony of four radio scientists with major awards, the stimulation at this Assembly of 48 young scientists and the offering of three General Lectures by leaders in fields of broad interest.

In August 1985 representatives from most of the nations of the world will meet for five weeks in Geneva at one of the most important formal international telecommunication conferences of the decade, the World Administrative Radio Conference on the Use of the Geostationary Satellite Orbit and the Planning of Space Services Utilizing It (Space WARC). The International Telecommunications Union conducts Space WARC and is advised on technical matters by the CCIR, directed by Mr. R.C. Kirby. URSI's interactions with CCIR are fourfold; (1) our Commissions respond to formal Questions posed by CCIR; (2) our scientific symposia and meetings often describe new developments of practical interest to CCIR and are attended by representatives of CCIR; (3) perhaps most importantly, CCIR and URSI are populated by many hard working individuals wearing two hats and they constitute a pervasive network linking our organizations, and finally (4) the IUCAF, a joint Commission of URSI, IAU and COSPAR, works with CCIR to protect frequencies for scientific use in radio astronomy, a critical function.

The URSI Council during this Assembly will deal with a number of interesting and important issues. Three issues that will influence the future of URSI are: (1) the proposed merger of Commissions G and H, (2) URSI's role in the field of remote sensing and (3) the applications for membership of URSI from the Chinese Institute of Electronics, Beijing, People's Republic of China, and from the Post and Telegraph Department of Thailand.

The merger of Commissions G and H was agreed in principle at the XX General Assembly in Washington, with certain tests to be conducted during the triennium and a decision made at this Assembly. The proposal goes back more than 10 years and is part of the continuing evolution of the structure of the Commissions. The Council is charged by the Statutes with making the decision, but it will recognize the many expressions of the advantages and disadvantages already in writing and will provide opportunity through an ad hoc committee for the hearing of additional points.

Remote sensing generates a great interest both as a technique where radio plays a significant but not the only role, and as a data gathering resource applied to many fields of science and practice. Over at least the past six years the role of URSI in remote sensing has been actively discussed with proposals including a call for a new Commission, and URSI inter-Commission Working Group, and an inter-Union Commission with IUGG. Three years ago the title of Commission F was changed to include remote sensing. At this Assembly

the action is centered in a Working Group and those of you who have an interest will have an opportunity to be heard.

The Chinese Institute for Electronics and the Thailand Post and Telegraph Department have applied for membership in URSI and we are grateful to past President Christiansen, Secretary General Van Bladel and URSI Vice-President, Prof. Okamura, Chairman of our Committee on Membership, for their assistance in the matter.

A fourth issue, this time URSI cooperating with other scientific bodies, faces the Council. The ICSU has promoted a study of the environmental consequences of nuclear war for the purpose of producing a scientific, unemotional, authoritative statement on the consequences of a nuclear exchange. Since communications, an essential need of society, might be completely cut-off by a nuclear exchange disrupting normal and emergency services, URSI has a role. With the agreement of the Board of Officers, a Committee will draft here in Florence a contribution to that study. This is only one example of URSI's interaction with other sciences. We also participate in MAP, COSPAR, SCOSTEP, SCOR and SCAR and we join other Unions in sponsoring joint scientific symposia.

A Member Committee of URSI is free to select its Category of membership. During the past three years, three Member Committees, those in Japan, India, and South Africa have chosen to increase their level of participation and two Members have chosen to decrease the level. These actions on the part of the Members reflect changes in resources and emphasis in radio science as perceived by each Member.

The *Review of Radio Science* is a major undertaking of the Commission Chairmen ably organized and produced by Prof. S.A. Bowhill and his assistant, Ms Belva Edwards. This year for the first time the Review will be distributed to eight hundred research libraries by URSI as well as to the participants at this Assembly. This should become a regular tradition. We are especially grateful to Prof. Bowhill and Mrs Edwards.

Radio science and the communications revolution it spawned are products of the 20th century. It was Marconi, inspired by Hertz, who set the pace with his bold experiment that initiated wireless telegraphy across the ocean. Marconi believed, incidentally, that radio waves should be generated in the Universe and he tried without success to detect them, leaving to Jansky some thirty years later the observation of "a steady hiss from an extraterrestrial source".

The communications revolution is fueled by the needs for, and use of, information. It started subtly with Maxwell, Hertz and especially Marconi, but has exploded with satellites, fiber optics and computers. The demands on radio science are enormous. Radio explorations of the atmosphere, the Earth, the planets, the galaxy and beyond, the human body and its tissues have expanded our scientific horizons and our understanding of man and his role in the cosmos.

Innovations continue to pour forth in computing, telecommunications, electronic media and the use of satellites for navigation, weather, communications and remote sensing. The economic impact of these communication and information resources are significant, a

world market of \$300 billion is just ahead of us! Aside from the economic impact these innovations are revolutionizing such traditional industries as banking, printing, transportation, construction, petroleum and mail delivery among others.

Digital technology is being applied to radio transmissions, improving quality and decreasing costs. In this dynamic atmosphere innovations will accelerate the rate of global change, boost productivity and provide new opportunities.

Radio science provides an underpinning for this activity. URSI celebrates its 65th anniversary this year. I see signs of maturity in URSI, but not signs of slowing down. You, the participants and especially the Commission Chairmen provide the scientific leadership and the vitality to URSI. Your deliberations here, your plans for the next triennium, particularly for timely, well focused symposia and Working Groups dealing with relevant issues will do much to influence the direction of our field.

There is no way in the short time available to cover all of the significant events and contributions. Let me conclude with comments on the future ahead.

High frequency radio which many thought would become obsolete with the increased use of short waves and of satellites is still of great interest in communication, in over-the-horizon radars and in plasma studies. Vibrant activities are bearing fruit in all parts of the spectrum of radio science. The marriage of computers and communications into information systems challenges us for better, faster, cheaper information exchanges. Remote sensing by radio in its wide array of applications opens avenues for information gathering about resources on and in the Earth, conditions of atmospheres and oceans, and on diagnosing and treating human ailments.

Radio science provides fascinating problems for engineers and scientists, theoreticians and experimentalists. It is clear that the next decade will be exciting. URSI meetings should be alive with stories of new discoveries by theorists with the vision of a Maxwell and experimenters with the boldness of a Marconi.

PRESENTATION OF URSI AWARDS

Thanks to the generosity of the donors, four awards are presented on the occasion of each General Assembly of URSI:

- The Balthasar van der Pol Medal, sponsored by the late Mme P. Le Corbeiller-Posthuma, widow of Professor van der Pol;
- The John Howard Dellinger Gold Medal, sponsored by the URSI Member Committee in the United States of America;
- The Appleton Prize, sponsored by the Royal Society in London;
- The Issac Koga Gold Medal, sponsored by the URSI Member Committee in Japan.

During the last part of the Opening Meeting, chaired by Prof. S. Okamura, Chairman of the URSI Award Advisory Panel, the awards were handed over to the laureates.

The laureates in 1984 were as follows:

Balth. van der Pol Gold Medal:

Prof. W.G. Farnell (Canada) for his work in physical electronics, in particular on microwave lenses, spin phonon interactions in solids, microwave acoustics and acoustic microscopy.

John H. Dellinger Gold Medal:

Mrs I. de Pater (Netherlands/USA) for her work on noise of planetary origin, the magnetosphere of Jupiter, and shock waves in the magnetosphere of the Earth.

Appleton Prize:

Prof. K.D. Cole (Australia) for his contributions to the understanding of the basic processes taking place in the magnetosphere and the ionosphere.

Issac Koga Gold Medal:

Dr. M. Ohtsu (Japan) for his work on precise optical measurements, gas and semi-conductor lasers, including the frequency stabilization of these components.

CLOSING MEETING

The Closing Meeting of the General Assembly was held at the Palazzo dei Congressi in Florence on Wednesday 5 September 1984 in the late afternoon.

ANNOUNCEMENTS

At the request of the President, the Secretary General announced:

- (a) the results of the elections for the Board of Officers, Chairmen and Vice-Chairmen of Commissions for the period 1984-1987;
- (b) the decision of the Council to confer the title of Honorary President on Prof. W.N. Christiansen;
- (c) the decision of the Council to create the function of Assistant Secretary General, and the appointment, by the Board, of Prof. P. Delogne to this function;
- (d) the admission of two new Member Committees of URSI, to be formed by the Chinese Institute of Electronics, Beijing, PRC, and by the Post and Telegraph Department of Thailand;
- (e) the decision not to merge Commissions G and H for the time, but to recommend a strong and efficient collaboration between the two Commissions;
- (f) the decision to hold the XXII General Assembly in Tel Aviv, Israel, in 1987, at the invitation of the Israeli URSI Committee;
- (g) the success of the Young Scientists Programme at the XXI General Assembly, and the decision to continue such programme in the future.

CLOSING REMARKS BY THE PRESIDENT

Distinguished guests, generous hosts, ladies and gentlemen,

The XXI General Assembly has been a success in all of the ways that can be measured now as nearly as I can tell.

The scientific programme ably arranged by Sir Granville Beynon, the Commission Chairmen, and the open-symposium organizers has stimulated, provoked, and saturated us with new ideas, with old ideas revisited and given us scientific seeds that we may carry away, plant and cultivate.

The local arrangements have been handled smoothly and capably by Professors Cappellini and Egidi with the most generous and energetic support by Professor Anna Maria Scheggi, Mrs Vanna Cammelli and the staff members of the Institute (the IROE). We are grateful for the services offered and especially for the gracious manner in which they were offered.

The Young Scientists, including the Booker Fellow, Dr. Ramat-Samii, the Koga Medallist, Dr. Ohtsu, and the more than 40 young people from 38 countries have demonstrated their competence by the depth and the breadth of the work they have presented. It is our hope your presence here has initiated collaborations and friendships that will enhance your professional growth. We wish you a safe journey home and look forward to meeting you again at future URSI Symposia and Assemblies.

The Board of Officers, the Council of URSI and the Coordinating Committee have expended many hours of time in guaranteeing a continuing scientific vitality and a sound organizational structure. I am grateful to each member of the Board, the Council and the Coordinating Committee for the cooperation they have shown and the extra efforts they have expended. I would like to recognize Prof. Smolinski, Vice-President of URSI, who has served you well for many years and who retires from the Board after this Assembly.

Among the many actions of the Council reported by the Secretary General let me highlight one in adding a word of welcome to URSI to the new Member Committees: The Chinese Institute for Electronics in Beijing, represented by Prof. Feng, and the Post and Telegraph Department in Thailand, represented by Mr. Reowilaisuk.

A hard working Committee under the leadership of Mr. Lundbom and Mr. Wik have drafted a statement on the communications impact of a nuclear exchange. This statement will be incorporated into a broader study underway by the International Council of Scientific Unions using inputs from many Unions with the purpose of increasing the public understanding of the possible consequences of the nuclear arms race. The study is using the scientific competence that can be mobilized under ICSU to assess the biological, medical and physical effects of the use of nuclear weapons.

Much of the success of this Assembly can only be measured in the future when the plans, the exchanges produced here come to fruition. The rate of progress of radio science is the true measure and future meetings and symposia, some of them planned here, will determine that rate.

To the Organizing Committee and the local hosts, let me say that we shall carry away with us many vivid and lasting images. I would like to cite a few:

The organ music by the master composer Bach, the haunting melody of Bossi, the majestic music of Franck, as produced by Organist Vandelli on the superb instrument in the Basilica di Santa Croce was a thrilling experience rendered even more meaningful in the company of such greats as Galileo and Rossini.

The radar-eye view of the planet Venus observed from space-

craft Venera 15 and Venera 16 circling Venus was shown with about the resolution of the naked eye -- were it able to see through the clouds. Our USSR colleagues offered this view in a video projection.

We returned to our roots as radio scientists when we visited the Memorial to Marconi near Bologna, placed a wreath on his tomb and had a rewarding visit with his charming widow, the Marchese Christina Marconi and daughter Elettra Marconi.

The city of Florence exposed to us cultural treasures that lifted our spirits after long and absorbing scientific sessions. Clearly the city attracted participants to the Assembly for the attendance exceeded 1000 scientists and exceeded 200 accompanying persons.

Renewing old friendships and making new ones is always an important part of an Assembly and this one was particularly pleasant in that regard.

Finally, the real success of radio science and of URSI will be measured in part by how soon any human being in any part of this world may communicate with any other human being for their mutual benefit and surely for the betterment of mankind.

It is with a mixture of exhaustion and exhilaration that I complete my duties as President of this distinguished Union, and it is with great pleasure that I pass the symbolic gavel to your new President, Dr. A.P. Mitra, confident that URSI is in good hands.

ADDRESS OF THE INCOMING PRESIDENT

Friends,

In taking over the Presidency of the URSI, may I first convey my gratitude to the Member Committees for their trust on me and my colleagues on the Board. Since its first General Assembly in Brussels in 1922, URSI, over a period of more than sixty years, has gained an international standing for excellence, for global cooperation and for scientific innovation. To the recently emerging nations URSI holds a special attraction. To them we owe a special responsibility. URSI can and should provide the impetus and encouragement for the growth of radio science in these countries in many ways: by encouraging them to become members of URSI, through the organisation of symposia and workshops in these countries, through training programmes and the supply of tutorial materials, and perhaps even through the loan of instruments. To some extent this has been done in the past. Several institutions have now become members of URSI; in this Assembly we have accepted two new members: the Chinese Institute of Electronics at Beijing and the Post and Telegraph Department of Thailand. We should reach out to other institutions also. For countries which have difficulties in paying subscriptions, one might consider the ICSU approach

of introducing a new class of temporary membership, the "National Associates", who do not have to pay subscriptions, and have no voting rights. After all the objective is to reach out as far as possible.

We have also a responsibility of bringing in young scientists and encouraging them in all conceivable ways. The Young Scientists Programme introduced for the first time at the Ottawa Assembly in 1969 has now grown into a major activity. At this Assembly we have had a total of 47 young scientists, 41 directly under the URSI Young Scientists Programme. The young scientists came from 38 countries, both developed and developing. We expect to continue this programme in the future.

The new Board will share the administrative responsibilities of the URSI as done in the recent past. Dr. Albrecht has agreed to undertake the very difficult task of Treasurer; I would like to take this opportunity of thanking Professor Cullen for the tremendous effort he had put in as Treasurer in the last 3 years and for the healthy financial situation of the URSI. Professor Okamura will continue to act as Chairman of the URSI Committee on Membership and of the URSI Awards Advisory Panel. Professor Zima will look after the matter of the future General Assemblies of URSI. Professor Gordon has kindly agreed to be our advisor on the effects of Nuclear Explosions and will be our link with this Committee.

There are two aspects of URSI's activities that need to be specially recognised. The first concerns the applications of radio science. Our linkage with CCIR, ITU, WMO and other technical organisations have always been strong; we need to maintain these links and perhaps even enhance these. The role of the Commissions is critical in this respect. The other aspect is the role of URSI in new forms of interdisciplinary activities that are coming up. One of these which concerns the effects of nuclear warfare I have already referred to earlier. In this URSI is already making a contribution. ICSU has a Steering Group which is looking into this problem in broader technical perspectives. SCOPE's contribution is part of this broad picture. Another new activity that I believe is going to be a major international enterprise relates to the Biosphere-Geosphere Interactions. The role of URSI in this new approach is not immediately clear, but this must be looked into by a competent body. SCOSTEP has defined a number of long-range programmes relating to the Earth and its neighbouring systems; URSI can play an important role in these programmes.

Ladies and gentlemen, may I, on behalf of the Board, thank you again. We would like to promise you a scientifically useful triennium in the field of radio science and its many applications.

Thank you.

YOUNG SCIENTISTS PROGRAMME

The URSI Young Scientists Programme was introduced for the first time at the General Assembly in Ottawa, in 1969, at the suggestion of Professor Samuel Silver. It was again organized for the General Assembly in Warsaw in 1972 but, due to financial difficulties at the time, it could not be implemented at the Assemblies in 1975 and 1978. The Young Scientists Programme was restarted for the 1981 General Assembly and has grown now into a major activity.

Of the Young Scientists selected for participation in the XXI General Assembly, 19 from developing countries and 22 from developed countries (plus the H.C. Booker Fellow and the winner of the Issac Koga Gold Medal) did actually attend the Assembly. In addition 4 Young Scientists from India attended under India-COSTED arrangement. The Young Scientists came from 33 countries.

Several of the Young Scientists had formal presentations of their work in the appropriate Commissions. In addition a Special Young Scientists Session was organized on 3 September. In this session 18 presentations were made, covering almost the fields covered by all the URSI Commissions.

The names of the Young Scientists who attended the Assembly in Florence are given below:

Mr. E.R.T. Awunor-Renner (S.Leone)	Dr. M. Paes Leme (Brazil)
Dr. P. Banerjee (India)	Dr. T. Panteleev Dachev (Bulgaria)
Dr. D. Bilitza (FRG)	Dr. O.I. Pintado (Argentina)
Mr. M. Diallo (Mali)	Dr. S.A. Pulinets (USSR)
Dr. D. de Zutter (Belgium)	Dr. A. Rosenberg (Israel)
Dr. G. Dubner (Argentina)	Mr. W.O. Sagbohan (Benin)
Ms F.M. d'Ujanga (Uganda)	Dr. M.J.H. Salman (Iraq)
Mr. R. Ellialtöglu (Turkey)	Dr. J.L. Sebastian Franco (Spain)
Dr. A.H. Hartog (UK)	Dr. W.E. Senanayake (Sri Lanka)
Dr. P. Hasan (Czechoslovakia)	Mr. J.P. Solvay (Belgium)
Mr. J. Hjelmstad (Norway)	Mr. N. Subramaniam (Malaysia)
Dr. U.S. Inan (USA)	Mr. S. Sukumar (India)
Dr. V.C.K. Kakane (Ghana)	Mr. A. Svensson (Sweden)
Dr. L.B. Kolawole (Nigeria)	Mr. A.G. Tjhuis (Netherlands)
Dr. L.B. Lopes (UK)	Dr. I. Vajda (Hungary)
Dr. J. Machac (Czechoslovakia)	Mr. K.G. Vaughan (New Zealand)
Dr. A.J. Maliarovskij (USSR)	Dr. J.F. Vickrey (USA)
Mr. Mecklenburg (FRG)	Dr. V. Waszkis (Poland)
Prof. A. Meriono Castellanos (Mexico)	Dr. W. Wolde-Ghiorgis (Ethiopia)
Dr. K.P. Möllmann (GDR)	Mr. Zhou Xiaolin (China).
Mr. P.B.T. Nyirenda (Malawi)	

The implementation of the Young Scientists Programme has been made possible thanks to the generous support of the following organizations: UNESCO, ICSU, COSTED, the Italian URSI Committee, the Royal Society of London, and the International Institute for Theoretical Physics in Trieste.

REPORTS OF MEETINGS

URSI BOARD OF OFFICERS

I. Board of Officers 1981-1984

The Board met on two occasions, on 26 and on 30 August 1984. All members were present.

The main items discussed were as follows:

1) The preparation, during the XXI General Assembly, of a Factual Statement on Nuclear Electromagnetic Pulse and Associated Effects, in response to the request of the ICSU Scientific Committee on Problems of the Environment (SCOPE).

2) The possibility of creating a new category of membership of URSI for the countries which might find difficulties in paying dues to the Union.

3) The desirability of increasing the number of symposia originating within the Commissions of URSI.

4) The proposal to amend Art. 37 of the Statutes so as to make it possible for the Board to appoint an Assistant Secretary General.

5) The voting procedures in the URSI Council.

6) The problem of the protection of passive radio observations posed by IUCAF.

II. Board of Officers 1984-1987

The incoming Board of Officers met in Florence on 6 September. All members were present, with the exception of Prof. V. Zima.

1) Appointment of Treasurer

In accordance with Art. 36 of the Statutes, Dr. J.H. Albrecht was designated as Treasurer of URSI for the period 1984-1987.

2) Division of Responsibilities within the Board

The responsibilities were distributed among the individual members of the Board as follows:

- a) Young Scientists Programme: Prof. A.L. Cullen;
- b) Membership of URSI: Prof. S. Okamura;
- c) URSI Awards: Prof. S. Okamura;
- d) Future General Assemblies: Prof. V. Zima;
- e) International contacts: Dr. A.P. Mitra;
- f) Cooperation with ICSU in SCOPE-ENUWAR: Prof. W.E. Gordon.

3) Assistant Secretary General

The Board appointed Prof. P. Delogne (Belgium) as Assistant Secretary General up to the end of the 1987 General Assembly.

4) Steering Group for Coordination of URSI Scientific Programme

This was formed as follows:

Chairman: Dr. P. Bauer

Members: Prof. C.M. Butler, Prof. A.L. Cullen, Dr. V. Radhakrishnan

Secretary ex officio: Prof J. Van Bladel.

It was agreed that this Group should start its work before 1985, in close cooperation with the Chairmen of the Commissions.

5) New Guidelines for the Sponsorship of Symposia

The Board asked Dr. Albrecht, Prof. Cullen and Prof. Van Bladel to prepare a new set of guidelines for the sponsorship of meetings by URSI, in the light of the discussions in the Council. In particular, the financial aspects will be considered, as well as the possibility of making loans to certain meetings. Prof. Delogne will be given extensive duties in the area of meetings and their control. The list of URSI sponsored meetings will be sent regularly to the appropriate organizations.

6) Young Scientists Programme

The Board agreed that support should be sought for extending the Young Scientists Programme at the next General Assembly, and also for making it possible for Young Scientists to attend URSI sponsored symposia. It was decided that the *URSI Information Bulletin* should be sent to the Young Scientists who attended the Florence Assembly, and to open in the Bulletin a news column in which the Young Scientists could express their views.

7) Highlights of the XXI General Assembly

A short text summarizing the main achievements of the Florence General Assembly will be disseminated widely in the radio technical press. The best way to cover the international press is to send this text to the Member Committees for diffusion and possible translation.

SUMMARY REPORT ON MEETINGS OF THE URSI COUNCIL

The Resolutions and Recommendations adopted by the Council are reproduced at the end of this volume.

1. Membership of the URSI Council, August-September 1984

President: Prof. W.E. Gordon
Secretary: Prof. J. Van Bladel

Representatives of Member Committees:

Argentina: Prof. S. Radicella
Australia: Prof. R. H. Frater
Austria: Prof. S.J. Bauer
Belgium: Prof. P. Delogne
Brazil: Dr. E. Scalise
Bulgaria: Dr. A. Spasov
Canada: Prof. E.V. Jull
Czechoslovakia: Prof. V. Zima
Denmark: Prof. J. Bach Andersen
Finland: Prof. M. Tiuri (alternate Prof. R. Pirjola)
France: M. D. Lombard (alternate Dr. G. Pillet)
German Dem. Rep.: Dr. A. Iwainsky
Germany, Fed. Rep. of: Dr. H.J. Albrecht
Greece: Prof. I. Fikioris
Hungary: Prof. K. Géher
India: Dr. V. Radhakrishnan
Ireland: Prof. M.C. Sexton
Iraq: Dr. R.A. Sadik
Israel: Prof. J. Shapira
Italy: Prof. C. Egidi
Japan: Prof. H. Tanaka
Netherlands: Prof. F.L. Stumpers
New Zealand: Prof. R.L. Dowden
Nigeria: Prof. J.O. Oyinloye
Norway: Prof. A. Tonning
Poland: Prof. S. Hahn
South Africa: Mr. R.W. Vice
Spain: Prof. M. Rodriguez Vidal
Sweden: Prof. P. Weissglass
Switzerland: Prof. F. Gardiol
Taiwan: Prof. Mei-Hwa Wang
United Kingdom: Sir Granville Beynon
USA: Prof. T.B.A. Senior (alternate Prof. R.K. Crane)
USSR: Prof. M.E. Zhabotinskij (alternate Prof. V. Migulin)
Yugoslavia: Prof. B.D. Popović

Observers: Prof. Feng Shizhang (Chinese Institute of Electronics,
Beijing)
Dr. R. Reowilaisuk (Post and Telegraph Office of
Thailand)

The members of the Board, the Chairmen and Vice-Chairmen of Commissions attended in an advisory capacity.

2. Formation of Temporary Committees

Publications Committee:

Prof. T.B.A. Senior (Chairman)
Prof. R.L. Dowden
Prof. V. Kose
Dr. Ph. Waldteufel
Prof. P. Weissglass

Drafting Committee:

Prof. M.C. Sexton (Chairman)
Dr. P. Bauer
Prof. P. Delogne
Prof. J. James

Advisory Group on Proposed Merger of Commissions G and H

Dr. G. Little (Chairman)
Prof. R.H. Frater
Dr. E.V. Jull
Prof. M. Tiuri
Prof. V. Zima

Ad hoc Committee on Nuclear Electromagnetic Pulse (EMP)

Mr. Manuel Wik (Chairman)
Dr. W.R. Stone (Secretary)
Dr. D.T. Gjessing
Dr. F. Lefeuve
Mr. P.O. Lundbom
Prof. V. Migulin
Prof. S. Schwartz
Prof. F.L. Stumpers.

3. Election of Board of Officers

The results of the election were as follows:

President: Dr. A.P. Mitra (India)

Vice-Presidents: Dr. H.J. Albrecht (FRG)
Prof. A.L. Cullen (UK)
Prof. S. Okamura (Japan)
Prof. V. Zima (Czechoslovakia)

Secretary General: Prof. J. Van Bladel (Belgium)

Prof. W.E. Gordon remains a member of the Board as Past President. The Board later designated Dr. H.J. Albrecht as Treasurer.

4. Election of Chairmen and Vice-Chairmen of Commissions

The names of the candidates for election were submitted by the

respective Commissions and the elected Officers are listed on pages 3 and 4.

5. Honorary President

The Council decided unanimously to confer the title of Honorary President on Prof. W.N. Christiansen, President of URSI 1978-1981.

6. Admission of Member Committees

The Council agreed unanimously to accept the applications for membership received from the Chinese Institute of Electronics, Beijing (Category 3) and the Post and Telegraph Department of Thailand (Category 1).

7. Finances

The Treasurer expressed the thanks of the Union to the Member Committees for the regular payment of their annual contributions. He also expressed his appreciation of the advices and cooperation provided during the past triennium by the members of the Standing Finance Committee.

The Treasurer presented a detailed triennial report on the finances of the Union. This included the audited accounts for the years 1981, 1982 and 1983.

These documents were accepted by the Council on recommendation of the Standing Finance Committee. The Report and recommendations of this Committee are reproduced on pages 45-48.

8. Young Scientists Programme

The Council approved the actions taken by the Board of Officers regarding the implementation of the URSI Young Scientists Programme. A report on this appears on page 30.

9. Future General Assemblies

There were three invitations before the Council for the XXII General Assembly: from the Member Committees in India, in Israel and in New Zealand. As a result of the vote, the next General Assembly of URSI will be held in Tel Aviv, Israel, in August/September 1987.

Tentative invitations for the XXIII General Assembly had been received from the Member Committees in Sweden and in the United Kingdom.

10. Standing Committee on Developing Countries

The Report of the Standing Committee on Developing Countries, which was approved by the Council, is reproduced on page 59.

11. URSI/CCIR/CCITT Liaison Committee

The Council approved the Report of the URSI/CCIR/CCITT Liaison Committee. This Report is reproduced on page 61.

12. Publications Committee

The recommendations submitted by the Publications Committee were approved by the Council. The Report of this Committee is reproduced on page 56.

13. Merger of Commissions G and H

Dr. Little, Chairman of the Advisory Group, reported that, at the present time, there was no adequate international consensus for a merger of Commissions G and H, but that there was strong agreement on the need for the two Commissions to cooperate closely. The recommendations submitted by the Advisory Group were accepted by the Council which adopted Resolution U.5.

14. Ad hoc Committee on Nuclear Electromagnetic Pulse (EMP)

Mr. M. Wik, Chairman of the Committee, stated that the document prepared by his Committee for the SCOPE/ENUWAR unit represented a factual statement intended for people without technical knowledge. It was not a scientific report and dealt with problems of the consequences for society from high altitude bursts. Mr. Wik invited the members of the Council to submit editorial comments since the final text would be presented only in October 1984, for inclusion in the more general document on the environmental consequences of nuclear war which was being prepared by ICSU.

The Council approved unanimously the Statement in principle. The Statement, as submitted later to ICSU, appears as Annex 1 to this Summary Report.

15. Remote Sensing

The Council, having considered the Report submitted by Dr. Gower, Chairman of the Inter-Commission Coordinating Group on Remote Sensing, agreed that ways should be found to achieve better cooperation with bodies outside URSI (IUGG, COSPAR, etc.), and that the coordination of meetings in the field of remote sensing should be improved. It was decided to maintain the Inter-Commission Coordinating Group for the next three years.

16. Name of URSI

URSI Commission D on Electronic and Optical Devices and Applications had proposed a change in the name of URSI so as to include a reference to "electronics" and thereby reflect the interests of the Union more adequately. It was felt, however, that this question had to be considered seriously before any action was taken. The Council agreed to refer the question of a possible change of the name of URSI to the Board of Officers.

17. Creation of the post of Assistant Secretary General

In view of the fact that the work for which the Secretary General of the Union was responsible was too heavy for a scientist being able to devote only part of his time to the affairs of URSI, the Board proposed the creation of the post of Assistant Secretary General. The Council agreed to the addition, to Article 37 of the

Statutes, of a sentence authorizing the Board to designate an Assistant Secretary General, on nomination by the Secretary General.

ANNEX 1 - URSI FACTUAL STATEMENT ON NUCLEAR ELECTROMAGNETIC PULSE
(EMP) AND ASSOCIATED EFFECTS

Disclaimer

All material in this document is based on what is available in the open literature. Participation in the preparation of this document does not constitute more than an affirmation that the material in the document is consistent with what is in the open scientific literature. Such participation and the information in this document neither confirm nor deny the validity of such information.

Preface and Acknowledgments

This factual statement on nuclear EMP and associated effects was prepared by URSI during the URSI XXI General Assembly in Florence, August 1984. The statement was requested by SCOPE-ENUWAR (Scientific Committee on Problems of the Environment - Environmental Consequences of Nuclear War) within ICSU (International Council of Scientific Unions) and should be unemotional, non political, authoritative and readily understandable.

The statement was unanimously approved (in principle) by the URSI Council meeting on 6 September 1984.

Due to the limited time available during the URSI General Assembly, some editorial work including some remarks at the Council meeting was left to be done.

For better clarity, headings have been added and some paragraphs rearranged. In the conclusions the most important statements have been repeated. New paragraphs have been added concerning

- "Low altitude EMP" (in accordance with discussion at the Council meeting);
- "Transient radiation effects (TRE)" (which was referred to in the introduction);
- the Argus effect (under "Radio wave propagation and long-term radiation effects");
- the objectivity of assessments (under "Testing and assessments").

The nuclear EMP ad hoc Committee and the URSI Council delegates have not had time to comment on this editorial work. Such comments are encouraged.

The Committee is grateful to those URSI delegates who have taken active part in the preparation of this factual statement during the URSI General Assembly in Florence.

Allow me to add one personal reflection. The unanimous acceptance of the statement and the fear what would happen if communications were to be disrupted also shows that URSI delegates all around

the world are striving towards future better understanding among people.

Manuel W. Wik

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 - 2.4 Testing and assessments
 3. OTHER RELATED EFFECTS
 - 3.1 Low altitude EMP
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 - 3.3 Transient radiation effects (TRE)
 - 3.4 System generated EMP (SGEMP)
 4. CONCLUSIONS
- EXAMPLES OF REFERENCES

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1. INTRODUCTION

Communications, electronic control and electric power systems are fundamental to modern society. Without them there would be risk of widespread chaos if outages were to last for many hours or days. Nuclear explosions can create blast, ground shock, thermal and nuclear radiation and electromagnetic pulse (EMP) effects. In this document emphasis is given to widely distributed environmental consequences on electric and electronic systems due to EMP rather than to the more local effects. EMP from exoatmospheric or high altitude bursts and associated electromagnetic effects, transient radiation effects (TRE), and radio propagation changes are described. Further information and technical and scientific reports can be found in the open literature, and even more has been classified for military and other reasons.

2. HIGH ALTITUDE EMP

2.1 Phenomenology

Early Time EMP Environment

High altitude nuclear explosions can cause disruption of communications and electric power systems *even though other nuclear effects such as shock, heat, and radioactive fallout are not present at ground level.*

The electromagnetic pulse generated by a single high altitude

explosion could have a devastating effect on communications and power systems over the whole area of the earth, that can be viewed from the burst location, covering a country or a continent, and cause more or less widespread communication and/or power blackouts.

The explosion emits gamma rays with duration times of the order of nanoseconds. The gamma rays that travel downward will reach denser atmospheric layers at a height of 20-40 km and at this pancake-shaped zone, known as the deposition region, the gamma rays strip electrons from air molecules. This process is called the Compton effect. The free electrons initially move in an average radial direction (from the detonation point). In the presence of the earth's magnetic field these electrons are deflected to give a transverse component to the current, which in turn produces a radially directed (and therefore propagating toward the earth's surface) high-amplitude pulse of electromagnetic energy.

This EMP interacts with all sorts of metallic conductors which by design or by accident act as resonant antennas. The energy induced in conductors will find its way to connected objects where it is dissipated as heat, in some cases in combination with flashovers. The electric field-strength of the pulse can be billions of times greater than those normally used for radio communications, e.g. some 10^{11} times larger than radio fields that could be received by an FM radio receiver. The rise-time of the pulse is less than 10 nanoseconds and its duration is of the order of a few hundreds nanoseconds. The rise-time and duration of the EMP field differ significantly from those of lightning and power transients. Thus, protection against these effects will not necessarily protect against EMP.

In a widespread network, pulses might be able to destroy or interfere with connected devices almost simultaneously in a number of places. Lightning and power transient stress levels are thought to exceed those for EMP for many situations. However, the simultaneous appearance of EMP-induced pulses in most parts of complex networks is a completely new situation that under some circumstances can affect network stability and performance in a serious way. There may be additional, quite significant effects on synchronous (e.g. power) networks. Instability and accumulated stress could also be the result of several EMP's.

Late Time EMP Environment

A nuclear explosion also causes a disruption of the earth's magnetic field. This can result in a second type of damaging electromagnetic pulse of much lower magnitude but longer duration (hundreds of seconds). This is known as the magnetohydrodynamic EMP (MHD-EMP), in some way comparable to auroral geomagnetic storms. The MHD-EMP fields can disrupt very long landlines and submarine cables, including telephone cables and power distribution cables.

+

In English literature 1 billion $\sim 10^9$

2.2 Environmental Consequences

Society has entered the information age and is more dependent on electronic systems that work with components that are very susceptible to small but excessive electric currents and voltages. For example, telecommunication networks, high voltage power supply networks, railway networks, air traffic, water supplies and industrial processes are all controlled and regulated by equipment which usually contains semiconductor components susceptible to EMP effects.

High altitude nuclear explosions could thus "knock out" radio receivers and other communications, electronic and electric equipment temporarily, if not permanently, by overloading and damaging the front ends, various cable terminations and internal circuitry, both by coming through intentional antennas and other paths that are unintended. However, whether or not this occurs depends strongly on the design and configuration of the system.

EMP and associated effects will vary considerably due to a number of factors, including the following: burst location and observation points; type of weapon; yield; number of bursts; type of exposed system and its topology; direction and length of exposed conductors; susceptibility of sub-systems; and protective measures taken.

Several questions can be raised concerning the impact of high altitude EMP and associated effects on communications and power systems in case of nuclear exchange. Can people still use their radios? Do the nation-wide telecommunication networks still function so that information about the radioactive fallout situation and weather forecasts can be distributed? Do the communication systems needed to re-establish electric power, water and food supplies and other vital requirements work? Can electric power for light, heat, water, and gasoline pumps be obtained? Which transportation systems can be used? Do the hotlines between the political leaders still function, so that the conflicts can be solved politically and not militarily? Are the command, control and communication systems intact so that defence systems are under control?

It is clear that current landline and satellite communication systems and domestic power grids may be at a serious risk. As an example there have been various recent incidents in several countries where regional and national power networks have failed totally because a few elements of the system failed and a cascade effect resulted. Any practical assessment must anticipate massive failures of communication systems, power supplies and electronic equipment. The effects of this on the civilian population could cause chaos, and the possible disruption of communication networks could have major significance for the development of a nuclear exchange.

Electric power networks often use nation-wide overhead power lines that act as unintentional antennas and collect EMP energy. Many power stations are computer controlled and involve components that are very sensitive to electromagnetic transient overstress. However, the most serious situation are possible long time outages that could arise if damage occurs to any unique high voltage equipment, such as some larger, specially designed transformers. If there is not enough

redundancy and flexibility in the power system, this might result in a power outage until new equipment has been manufactured and installed.

2.3 Protection

Today EMP analysis, testing, and protective design is a discipline in which there is much scientific work done. Yet, additional research on many aspects of EMP is necessary. For decision-makers and for those responsible for civil defense, telecommunications, and electric power administrations awareness of these effects is a must if protective measures are to be taken in order to reduce system susceptibility.

Protection against EMP commonly includes shielding, filtering, transient protection using surge arresters and other more specialized techniques. However, the protection (usually termed "hardening") of a power or telephone network is vastly different from the hardening of a radio receiver. As an example, a rapid changeover to optical fibre cables is occurring in telecommunication networks. This provides a unique opportunity for planning exclusive EMP-protected communication channels superposed on the ordinary networks. Nevertheless, one must then also be prepared to invest the additional financial means for these less vulnerable communication networks.

It is unlikely that complex systems can be completely protected against EMP. However, just as a given level of reliability can be attained for a given effort and cost in design and engineering, so is the degree of hardening achievable dependent on the amount one is willing to spend on the hardening process.

It is vital to be aware that hardening can be accomplished much more economically in almost every case if it is brought in at the planning and design stages, rather than if an attempt is made to add it at some later time.

2.4 Testing and Assessments

The understanding of EMP simulation and system testing is important to achieving protection and to measuring the degree of protection achieved. The complexity of the phenomena and the inability to test them with actual EMPs make fully verified assessments impossible although sophisticated analysis and testing techniques exist and are widely used.

It is important to maintain a sound scientific basis for the assessments of the effects. This implies that there shall be a certain objectivity in any assessment. In particular, it is important that highly qualified scientists and engineers and their organisations which have nothing to gain by hiding deficiencies be selected for this task. As in any serious scientific discipline the results of such assessments must be subjected to peer review and must be fundamentally based on experimental data (testing), if one is to have confidence in the accuracy of the results.

3. OTHER RELATED EFFECTS

3.1 Low Altitude EMP

Low altitude nuclear explosions create blast, ground shock, thermal radiation, prompt nuclear radiation, fallout and electromagnetic pulse (EMP) effects. Electric power networks and communication networks are vulnerable to most of these effects. It is possible that in some cases because of EMP, failures will extend far outside the region where most objects are damaged by the usual blast and thermal effects. However, at least for public systems this EMP effect does not appear to be nearly as significant as the widespread effects of high altitude EMP effects.

3.2 Radio Wave Propagation and Long-Term Radiation Effects

Depending upon the scenario, nuclear bursts can also modify the atmosphere and ionosphere and affect radio wave propagation at all frequencies from a few Hertz through tens of Gigahertz.

They also create intense radio-frequency noise. The bursts increase the electron and ion densities, and there are large- and small-scale structural modifications, and long-term chemical changes. The actual propagation disruption patterns depend on many factors, and are very complicated. The propagation effects can cause black-outs for at least several hours, especially for short-wave communications. Questions also remain about whether satellite signals would be able to penetrate the ionospheric disruptions from high-altitude bursts.

An additional radiation effect that can disturb terrestrial radio wave propagation and communication satellite functioning is the Argus effect. By this phenomenon charged particles spiral around the paths of the earth's magnetic field.

The nuclear explosions can also produce artificial electron belts that can persist for months. The ionizing dose to electronic components in space installations can reduce their performance and lifetime. Other effects could result from different scenarios.

3.3 Transient Radiation Effects (TRE)

Transient radiation effects (TRE) are primarily caused by the prompt gamma, neutron and X-radiation. Transient and sometimes permanent changes in the performance of semiconductor components and other sensitive components and material can occur. These effects are of special concern in space for communication satellites where the atmosphere is not present to filter out the radiation environment.

3.4 System Generated EMP (SGEMP)

In outer space, communication satellites can be exposed to gamma and X-rays at considerable distances from a nuclear burst. The interaction of this radiation with the system also produces what is termed system generated EMP (SGEMP). This SGEMP can be a significant threat to many satellite systems.

4. CONCLUSIONS

Nuclear EMP is one of the effects of nuclear weapons. The awareness of the high altitude EMP threat in different scenarios and the protection problems should be widely spread and taken seriously. This brief document touches only on a small portion of the known effects of EMP and associated effects. It is intended to make workers outside this field aware of:

- 1) The existence of nuclear EMP phenomena.
- 2) The fact that high altitude EMP effects can occur even though other nuclear effects such as shock, heat, and radioactive fallout are not present at ground level.
- 3) The fact that these effects can cover the whole area of the earth, that can be viewed from the burst location, e.g. a country or even a continent.
- 4) The potentially serious nature of the effects of high altitude bursts to telecommunications and power systems.
- 5) That, in consequence, the possible disruption of communication networks could have a major significance for the development of a nuclear exchange.
- 6) That the possible disruption of power supply in large areas could cause chaos and lead to the collapse of the infrastructure of modern society if outages were to last for a longer time.
- 7) The various serious effects on satellite communications.
- 8) The techniques for protection against EMP and associated effects.
- 9) The necessity for valid testing and assessments of system performance in EMP environment.

It is hoped that the information presented in this statement and its scientific basis will emphasize the need to recognize the seriousness of nuclear EMP and associated effects.

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REPORT OF THE STANDING FINANCE COMMITTEE

1. Introductory Comment

By its Resolution U.4 (Washington, D.C., 1981), the Council decided to maintain the Standing Finance Committee; within its terms of reference, the Committee monitored the URSI-oriented financial situation during the period between the XXth and the XXIth General Assemblies. It submitted recommendations concerning the finances of the Union and generally assisted the Treasurer when so requested by him. In its advisory capacity and during the period mentioned, the Committee paid particular attention to the adequacy of the unit contribution as well as to the conservation of URSI assets. In three meetings during the XXIth General Assembly, the Committee considered:

- 1) the accounts for the period 1981 to 1983;
- 2) the conservation of URSI assets;
- 3) the budget for the period 1985 to 1988;
- 4) the budget for the 1987 General Assembly.

The Committee used the Treasurer's Report as basic input material. To evaluate expenditure requests concerning scientific and directly related activities, it took into account:

- a) the decision of the Council on the site of the forthcoming General Assembly;
- b) the recommendations made by the Coordinating Committee;
- c) the recommendations made by the Publications Committee.

2. Accounts for the Period 1981 to 1983

The Finance Committee has examined the accounts of URSI for the years 1981 to 1983 as audited by Bureau Rahier, Brussels, as presented to the Council with the Treasurer's Report on 27 August 1984. It is recommended that the accounts be published in the *Proceedings of the URSI General Assemblies*, Volume XX.

With reference to the balances and their trends for the years 1981 to 1983, as mentioned in the Treasurer's Report, and particularly regarding an unallocated balance, the Committee expressed full agreement with the re-establishment of a General Reserve Fund, with the objective of increasing it beyond the amount mentioned in the Report, which is a small fraction of the annual budget.

3. The Conservation of URSI Assets

Concerning the assets, the Committee confirmed its endorsement with regard to the investment in the Rorento fund as carried out by the Treasurer in 1982 after consultation with the Finance Committee and the Secretary General.

Regarding the response to future trend inversions in assets and their effects upon URSI finances, the Committee discussed various possible approaches including the suggestions offered by Dr. Minnis, as attached to the Treasurer's Report. As a result of detailed

considerations, the Committee is of the opinion that, as in the past, the assets situation should be monitored carefully and continuously, and the changes in investment should be initiated whenever considered necessary, with the ultimate objective of reducing eventual losses to a minimum.

For the time being and also for the immediate future, the present distribution of assets appears to yield optimum results. However, the use of several investment funds may be indicated but the relative distribution should not be limited, in order to permit the Treasurer to respond flexibly.

4. Limiting Conditions in Budget Planning

In some countries, the present economic conditions may display a trend towards recovery or, at least, stabilization in essential economic variables, such as growth rate of gross national product or its equivalent, exchange rate with respect to a reference currency, consumer prices as significant indicators of inflation rates, etc.; yet, the general situation does not permit an accurate forecast.

As far as URSI finances are concerned, the situation for the forthcoming triennium seems to allow the unit contribution to remain constant at US\$610. Although a budget adjustment by the Board or even an increase in unit contribution may be necessary under exceptional circumstances, such action should be avoided, particularly if occurring as an increase not contained in triennial budgets.

As an example, such a strategy is supported by the unfavourable effects of the unplanned increase in unit contribution for 1984 (from \$610 to 630) and the subsequent return to the original level of \$610 recommended by the Finance Committee.

Moreover, the Council may wish, in its discussion of Item 17 of the Agenda, to consider recommending upper limits for other cost items immediately effective upon participants in URSI activities, such as registration fees for symposia. In the view of the Committee a reasonable upper limit for the registration fee would be \$150 (1984 value).

5. Budget 1985 to 1988

In addition to the above mentioned general limiting conditions in budget planning, the need for continuing attempts at reducing expenditure is to be emphasized. As an example and with reference to the Report of the Finance Committee in 1981, it is suggested to continue to apply guidelines for the reimbursement of travel expenses, including the requirement of detailed cost estimates with information on the use of other resources; a supporting statement by the applicants' URSI Member Committees should be attached to such cost estimates.

As a result of these considerations and referring to the budget models contained in the Treasurer's Report, the Committee herewith recommends the adoption of a budget based in principle on Model B with enhancement of the allocation for scientific activities, to take into account the recommendations of the Coordinating Committee

and the Publications Committee.

Other modifications refer to the transition supplement concerning the planned personnel change in the Secretariat. In this connection, the Committee suggests to rename the fund presently entitled "Closure of Secretariat" to "Secretariat Personnel Reserve Fund" or "Personnel Reserve Fund".

The new model B is shown in Table 1.

Of the two possible budgets prepared by the Treasurer for the General Assembly 1987, Budget II appears to be the most appropriate one, modified as shown in Table II.

6. Recommendations

In addition to the above mentioned suggestions and summarizing the more important ones, the Finance Committee recommends a constant unit contribution of \$610 up to and including the year 1988. However, the lack of predictability of the economic situation and relevant variables should again require the appropriate factors to be monitored closely and eventually necessary budget corrections to be made annually by the Board. As an example, a statistically significant trend in the exchange rate of Belgian francs with respect to US dollars may call for appropriate action.

Attention is drawn to the need of keeping administrative expenditure at a reasonable level with respect to the entire budget. Travel expenses of any kind should be reduced and maintained at a minimum level.

The Finance Committee:

H.J. Albrecht (Chairman)
A.P. Mitra
M. Petit
S. Radicella
V. Zima

Assisted by:

A.L. Cullen (Treasurer)
J. Van Bladel (Secretary)

TABLE I					
Model B Modified					
	\$(000)				
	1985	1986	1987	1988	Total
<u>INCOME</u>					
Member Committees	140.3	140.3	140.3		420.9
ICSU/UNESCO	11.0	11.0	11.0		33.0
Sale of Publications	0.7	0.6	1.3		2.6
Interests and Dividends	10.0	10.0	10.0		30.0
Total Income	162.0	161.9	162.6		486.5
<u>EXPENDITURE</u>					
Scientific Activities:					
Normal	46.3	49.9	35.3		131.5
XXII Assembly	-	-	58.3		
Young Scientists	2.0	2.2	8.0		12.2
XXII Ass. Organization	-	-	33.0		33.0
ICSU Dues	3.5	3.5	3.5		10.5
Administration	57.7	63.4	69.6		190.7
Transition supplement	-	-	20.0		20.0
Loss on exchange	3.0	3.0	3.0		9.0
Total Expenditure	112.5	122.0	230.7		465.2
Surplus(+)/Deficit(-)	+49.5	+39.9	-68.1		+21.3

TABLE II		\$(000)
<u>INCOME</u>		
1. Registration fees, 1,000 at \$40		40.0
2. URSI operating budget		91.3
3. Young Scientists Programme		8.0
		<u>139.3</u>
<u>EXPENDITURE</u>		
1. Travel at excursion fares		48.0
2. Subsistence		
a) Board (less Sec.Gen.) (6 x 14 nights)		8.4
b) Chairmen and Vice-Chairmen (18 x 12 nights)		21.6
c) Secretary General (1 x 17 nights)		1.7
d) Secretarial assistants (2 x 17 nights)		3.4
e) Young Scientists Programme		8.0
3. Proceedings of General Assembly		9.3
4. Review of Radio Science		15.0
Contingency Fund		23.9
Total		<u>139.3</u>

URSI ACCOUNTS FOR THE YEARS 1981, 1982 and 1983

The Standing Finance Committee examined the audited Accounts of Income and Expenditure for the calendar years 1981, 1982 and 1983. It recommended the approval of these accounts to the Council and their publication in the *Proceedings of URSI General Assemblies*, Volume XX.

The URSI account books are kept in Belgian francs and US dollars, but the accounts are presented in US dollars using the United Nations rate of exchange in force at 31 December each year, as shown below:

Value of US\$1 on 31 December

<u>Year</u>	<u>Belgian Frs</u>
1981	37.5
1982	49.0
1983	55.0

INTERNATIONAL UNION OF RADIO SCIENCE
Income and Expenditure Accounts
for the years ended 31 December 1981, 1982, 1983

Year ended 31 December 1981

<u>INCOME</u>	\$	\$	\$
Subscriptions from Member Committees		114,144.20	
Interest and dividends,	12,587.92		
less interest attributable to			
Balth. van der Pol Gold Medal Fund	<u>568.03</u>		
		12,019.89	
Registration Fees XX General Ass.		19,520.00	
UNESCO/ICSU Subvention		9,600.00	
Sale of publications		<u>870.23</u>	
Total Income			<u>156,154.32</u>
 <u>EXPENDITURE</u>			
<i>Scientific Activities</i>			
Meetings and Symposia		7,463.64	
Grants			
IUCAF	1,250		
IUCRM	300		
FAGS	<u>1,000</u>		
		2,550.00	
Publications			
URSI Information Bulletin(216-219)	5,858.48		
INAG Bulletin	500.00		
URSI Brochure	<u>1,432.50</u>		
		7,790.98	
XX General Assembly			
Scientific Sessions and Open			
Symposia	24,509.67		
Organizational expenses	19,672.13		
Young Scientists Programme	<u>3,282.93</u>		
		<u>47,464.73</u>	
Total: Scientific Activities			65,269.35
 <i>Administration</i>			
Salaries (including Social			
Security		40,111.33	

(carried forward)

(brought forward)	\$	\$	\$
		40,111.33	65,269.35
Office and general expenses			
Rent	3,200.00		
Stationery, office supplies	795.65		
Office equipment	43.06		
Insurance	269.06		
Telephone	2,083.46		
Postage	825.12		
Entertainment	250.37		
Audit fee	1,666.80		
Administrative travel	1,727.30		
Bank charges	245.89		
Miscellaneous	<u>121.30</u>		
		<u>11,228.01</u>	
Total: Administration			51,339.34
ICSU Dues			2,853.60
Loss on exchange (net)			<u>1,851.14</u>
Total Expenditure			121,313.43
Excess of Income over Expenditure			<u>34,840.89</u>
			<u><u><u>156,154.32</u></u></u>

	\$
Balance in hand on 1 January 1981 (\$1=31 BF)	126,986.17
Plus adjustment Symposium Fund	<u>573.29</u>
	127,559.46
Less loss on depreciation of Belgian francs	<u>22,110.33</u>
Revised balance on 1 January 1981 (\$1=37.5 BF)	105,449.13
Surplus on Symposium	536.00
Excess of Income over Expenditure	<u>34,840.89</u>
Balance in hand on 31 December 1981	<u><u><u>140,826.02</u></u></u>

Year ended 31 December 1982

	\$	\$	\$
<u>INCOME</u>			
Subscriptions from Member Committees			109,221.51
UNESCO/ICSU Subvention			13,543.00
Sale of publications			647.04
Interest and dividends (net)			13,040.89
Appreciation in value of RORENTO units			<u>9,682.45</u>
Total Income			<u><u>\$146,134.89</u></u>

EXPENDITURE

Scientific Activities

Meetings and Symposia		7,193.82	
Grants			
FAGS	1,000.00		
IUCAF	<u>1,250</u>		
		2,250.00	
Publications			
<i>URSI Information Bulletin</i> (220-223)		5,634.20	
XX General Assembly		<u>1,135.50</u>	
Total: Scientific Activities			16,213.52

Administration

Salaries and pensions (including Social Security)		35,709.08	
Office and general expenses			
Rent	2,715.64		
Stationery, office supplies	528.56		
Office equipment	772.45		
Insurance	3,112.18		
Telephone	944.97		
Postage	622.78		
Entertainment	426.02		
Administrative travel	7,530.96		
Bank charges	459.26		
Miscellaneous	<u>3,426.83</u>		
		<u>20,539.65</u>	
Total: Administration			56,248.73
Loss on sale of Belgian State Loans	3,148.57		
Loss on exchange	<u>3,682.27</u>		
			<u>6,830.84</u>
Total Expenditure			<u>79,293.09</u>
Excess of Income over Expenditure			<u><u>66,841.80</u></u>
			<u><u>\$146,134.89</u></u>

	§
Balance in hand on 1 January 1982 (§1=37.5 BF)	140,826.02
<u>Less loss on depreciation of Belgian franc</u>	<u>-23,414.34</u>
Revised balance on 1 January 1982 (§1=49 BF)	117,411.68
Excess of Income over Expenditure	<u>66,841.80</u>
Balance in hand on 31 December 1982	<u><u>§184,253.48</u></u>

Year ended 31 December 1983

	\$	\$	\$
<u>INCOME</u>			
Subscriptions from Member Committees		118,667.20	
UNESCO/IGSU Subvention		14,879.00	
Sale of publications		527.29	
Interest and dividends (net)		7,055.47	
Miscellaneous income		<u>14.80</u>	
Total Income			<u>\$141,143.76</u>
<u>EXPENDITURE</u>			
<i>Scientific Activities</i>			
Meetings and Symposia		10,904.53	
Grants			
FAGS	1,500.00		
IUCAF	<u>1,250.00</u>		
		2,750.00	
Publications			
URSI Information Bulletin (224-225)	1,692.75		
INAG Bulletin (1982-83)	<u>1,050.00</u>		
		2,742.75	
Scientific travel		3,006.15	
Board of Officers		5,758.34	
Representation of URSI		<u>1,855.11</u>	
Total: Scientific Activities			27,016.88
<i>Administration</i>			
Salaries and pensions (including Social Security)		31,381.49	
Office and general expenses			
Rent	2,181.82		
Stationery, office supplies	381.69		
Office equipment	116.73		
Postage	1,136.44		
Telephone	1,147.49		
Bank charges	1,172.04		
Insurance	2,713.49		
Documentation	11.18		
Entertainment	481.24		
Social and accounting fees	3,729.94		
Audit fees	460.82		
Administrative travel	<u>2,739.24</u>		
		<u>16,272.12</u>	
Total: Administration			47,653.61

(carried forward)

	\$	\$	\$
(brought forward)			74,670.49
ICSU Dues			2,730.54
Loss on exchange			<u>3,209.61</u>
Total Expenditure			80,610.64
Excess of Income over Expenditure			<u>60,533.12</u>
			<u><u><u>141,143.76</u></u></u>

	\$
Balance in hand on 1 January 1983	184,253.48
Excess of Income over Expenditure to 31 December 1983	<u>60,533.12</u>
Balance in hand on 31 December 1983	<u><u><u>244,786.60</u></u></u>

Rates of exchange:

1 January 1983 : \$1 = 49.00 BF
 31 December 1983: \$1 = 55.00 BF

REPORT OF THE PUBLICATIONS COMMITTEE

The membership of the Committee was Prof. T.B.A. Senior (Chairman) and Profs. R.L. Dowden, P. Waldteufel and P. Weissglas. Mme Y. Stevanovitch (Executive Secretary) met with the Committee.

1. Proceedings of the 1984 General Assembly

The Proceedings constitute the only permanent and accessible record of the business transacted at the General Assembly, and their publication should be continued, with distribution to individuals, libraries, and Member Committees as in the past. The Committee feels that the format used for the XXth General Assembly, i.e. typed by the Secretariat rather than type-set, is quite satisfactory. It was noted that the activities of Inter-Commission Working Groups are not always adequately covered in the Proceedings, and it is recommended that the Chairmen of such Groups submit summaries of their activities for inclusion.

2. URSI Brochure and Statutes

Copies of these are distributed to all registrants at the Assembly. The present versions were printed in 1980, and though there have been some changes in the relevant information since that time, the Committee does not believe that the changes are sufficient to warrant the publication of revised versions until the available copies are exhausted.

3. URSI Information Bulletin

The Bulletin is an essential means of disseminating information and communication with Member Committees. Publication is quarterly (Belgian postal regulations make it uneconomical to reduce the frequency to three times per year), with distribution to selected individuals (by air mail), to designated representatives in Member Committees (in bulk), and to a few libraries and organizations. We believe that the present format is satisfactory, and that the costs involved are reasonable. However, the Committee would like to see more use made of the publication, and strongly encourages the inclusion of information about all URSI activities, URSI-related meetings, etc. This can only happen if the information is submitted to the Secretariat, and all Member Committees should regard it as their responsibility to do so. Advance notice of meetings even when dates are only tentative could also help to eliminate conflicts. The Committee understands that a lead-time of one month is sufficient for the preparation and publication of the Bulletin, and recommends that the Bulletin include a statement of the deadlines for the receipt of information.

4. Review of Radio Science

Under the able guidance of Prof. S.A. Bowhill, the Review has established itself as the major URSI publication. Individuals with

which we have discussed the Review have all expressed general satisfaction with the present format and composition, and we recommend that this be followed during the next triennium. Although the 1981-1983 Review was not available at the time of writing this Report, the delay was in no way the fault of the people involved, and the Committee expressed its thanks to Prof. Bowhill (the General Editor), and to the Commissions editors and contributors for their work.

The 1981-1983 Review is approximately 160 pages in length, and the cost (approximately \$13,000 US) of providing 2,500 copies was covered by registration fees at the present Assembly. To assure the wider availability of the Review, it is the intention to provide copies free to about 1,000 libraries, and these will be sent along with a cover letter from the URSI President. It had been hoped to sell at nominal cost the remaining 500 or so copies to individuals who request them, but there are difficulties in doing this through the URSI Secretariat because of its tax status. This is a matter which needs further exploration.

Prof. Bowhill has indicated that he does not wish to continue as General Editor or to be responsible for the printing, but would be pleased to assist in an informal capacity. In view of this, the Committee recommends that Dr. G. Hyde, of COMSAT Laboratories, Washington, D.C., who served as Chairman of the Organizing Committee for the XXth General Assembly, be appointed General Editor for the 1984-1987 Review. Recognizing the considerable increase in costs that would almost certainly result were a commercial organization employed to type-set and print the Review, the Committee also recommends that serious attention be given to the use of word processors, while adhering as closely as possible to the size, style and format of previous Reviews. Commission editors having access to word processors could then submit their contributions on disks. The feasibility of this approach will be explored in the next few months, but regardless of the approach, it is essential that Member Committees and Commission editors adhere strictly to the deadlines established by the General Editor for the submission of material.

5. General Lectures

Mme Stevanovitch raised the question of the publication of the three General Lectures presented at the Assembly. The Committee does not believe that these should be included in the Proceedings of the Assembly. In the case of the XXth General Assembly, the three lectures were published together in the journal *Radio Science*, with some of the page charges paid by the US Member Committee. The Committee supports this form of publication and recommends that, if the authors are agreeable, the texts of the General Lectures at the present Assembly be submitted as a group for publication in a similar technical journal.

6. INAG Bulletin

For many years URSI has contributed financially to the publication of the INAG Bulletin. The Committee believes that this is appropriate and supports its continuation. In view of the representations made to the Committee, we recommend an increase in the annual

support to \$750 US to WDC-A/STP of Boulder, CO, to assist with the printing and distribution of the Bulletin.

7. International Reference Ionosphere

The Committee recommends the continuation of URSI's nominal financial support of the IRI to assist with the publication and exchange of data.

REPORT OF THE COMMITTEE ON DEVELOPING COUNTRIES

1. The Committee on Developing Countries met on 31 August 1984. The following attended: A.P. Mitra (Chairman), J.O. Oyinloye, S.M. Radicella, A.R. Sadik and J. Voge.

2. The Chairman reviewed the activities of the Committee during the last three years. He emphasized the successful relations with the International Centre for Theoretical Physics of Trieste that allowed to carry out the Workshop on Radiopropagation in the Tropics, held in Trieste in 1982, and the Autumn College on Troposphere, Stratosphere and Mesosphere to be held in Trieste after the present URSI General Assembly. The active participation of lecturers and students from developing countries was stressed, and also the success of the URSI Young Scientists Programme.

M. Voge explained the scope and reach of the newly established UNESCO International Programme for the Development of Communications (IPDC), and suggested a close relationship between URSI and the Programme. The possibility of IPDC support to activities organized by the Committee was analyzed.

3. Future programmes of interest to Developing Countries were discussed and specific activities identified.

After discussion two specific areas were selected: radiocommunications and radio metrology.

Activities in radiocommunications decided upon were:

- (i) A biregional Latin American-African Workshop on Tropical and Subtropical Radiopropagation Research and Applications, including Spectrum Management, to be held in Buenos Aires, Argentina, during 1986. Conveners: Profs S.M. Radicella and J.O. Oyinloye.
- (ii) Middle East Regional Workshop on Radiocommunications, to be held in Baghdad, Iraq, in late 1985 or 1986. Conveners: Dr.A. Sadik and Dr. B.M. Reddy.
- (iii) Handbook on Radiopropagation for tropical and subtropical countries, based upon the existing documents and efforts in countries like Argentina, India and People's Republic of China. A working group composed of Profs S.M. Radicella, J.O. Oyinloye and Dr. B.M. Reddy will be responsible for the preparation of the Handbook that should be ready in 1986.

Activities in radio metrology agreed upon were:

- (i) Handbook on radio standards laboratories. Already prepared and under distribution.
- (ii) A Training Workshop on Radio Metrology for Developing Countries to be held in New Delhi, India during 1986.

4. Taking into account the difficulties encountered by several groups in developing countries regarding the availability of radio measurement and related instruments, that make it uneasy to pursue research and development work in radio science, the Committee agreed to proposing the establishment of an International Radio Measurement

Instruments Exchange System for developing countries based on the following general scheme:

- (i) Radio science research and development groups in developing countries will be asked to briefly describe their projects that would need equipments not available or buyable at or by their institutions.
- (ii) After an evaluation by the Committee of the information received a request will be made to the institutions of the developed countries.
- (iii) Adequate mechanisms for the loan and follow up of the projects will be studied by the Committee.

5. The following restructuring of the Committee was suggested:

Chairman: Prof. S.M. Radicella (Argentina)
Members: Prof. Feng Shizhang (CIE, Beijing)
 Prof. J. Oyinloye (Nigeria)
 Dr. B.M. Reddy (India)
 Dr. Aziz Sadik (Iraq)
 M. J. Voge (France).

REPORT OF THE URSI-CCIR-CCITT LIAISON COMMITTEE

A meeting of the Committee was held on 31 August 1984, with the attendance of the six members of the Committee, and of eleven interested observers.

1. Object of the Committee

According to Resolution U.8 (1981), the object of the Committee is "to develop further and to improve the cooperation between URSI and the Consultative Committees of the International Telecommunication Union".

2. Activities of the Committee

During the period 1978-1984:

- information was circulated to URSI Commissions on CCIR and CCITT Questions which could be the subject of URSI contributions;
- information was given to CCIR and CCITT Study Group Chairmen on the fields of activity of URSI Commissions and the kind of contributions which could be expected from URSI;
- discussions were held with some URSI experts to encourage them to participate in the work of the Consultative Committees of ITU.

3. Status of Cooperation

- For Commissions F and G (Propagation), cooperation is considered satisfactory; a number of experts attend both URSI Commission F and CCIR Study Group 5 (non-ionized media) or URSI Commission G and CCIR Study Group 6 (ionized media). Both Commissions nominate several "liaison members" to ensure a good cooperation in the different fields, including aspects of remote sensing (CCIR Study Group 2).
- Commission A (Measurements) has a good cooperation with CCIR Study Group 7 (Frequency standards and time signals) but could perhaps transfer to the CCIs some results in other fields of measurements (on optical fibers and devices, on voice or picture signals, etc.).
- Commission E (Noise and Compatibility) prepared for CCIR Study Group 1 reports on recent data relative to noise environment, but could perhaps expand its cooperation in other fields of electromagnetic compatibility. A good cooperation also exists with CCIR Study Groups 5 and 6 for noise questions. Cooperation could be initiated with CCITT Study Group V (Electromagnetic protection).
- Commission C (Signals and systems) is ready to cooperate with the CCIs in the field of systems; it is suggested that during the next period some priority could be given to satellite communication systems (CCIR Study Group 4) and optical fiber communication systems (CCITT Study Group XV).
- Commission B (Waves and fields) and Commission D (Devices) have no direct cooperation with the CCIs, because of their fields of

activity, for which results could be transferred to CCI Study Groups through another URSI Commission. Direct cooperation could be envisaged in the field of antennas.

- Subjects dealt with by Commission H (Waves in plasmas) do not concern directly CCI activities.

4. Proposed Actions

- URSI Commissions are invited to nominate one or several Liaison Members to ensure cooperation with the CCIs in the different fields of activity common to URSI and CCIR/CCITT.
- URSI Member Committees should be invited to encourage cooperation with the CCIs (in connection with their CCI national organizations if any) on the occasion of their national or regional scientific meetings, or of specialized symposia with which they are associated (e.g. EMC Symposium in Zurich, March 1985).
- Information needed should be identified and prioritized by the CCIs and then circulated among URSI Liaison Members and Member Committees concerning CCIR/CCITT specific questions for which URSI contributions should be particularly encouraged.

5. Proposed Membership and Chairmanship for the Period 1985-1987

Chairman	: G. Hagn (USA)		
Members	: M. Thué (France) Past Chairman		
	S. Leschiutta (Italy)	Commission A	
	P.J.B. Clarricoats (UK)	"	B
	J.G. Lucas (Australia)	"	C
	F.L. Stumpers (Netherlands)	"	E
	A.D. Spaulding (USA)	"	E
	F. Fedi (Italy)	"	F
	M. Hall (UK)	"	F
	A. Blomquist (Sweden)	"	F
	L. Boithias (France)	"	F
	C. Rush (USA)	"	G

a member to be designated by Commission J.

BUSINESS TRANSACTED BY COMMISSIONS

The following summaries of the activities of the URSI Commissions during the General Assembly have been prepared using the documents provided by the Officers of the Commissions, or by those who acted as reporters.

COMMISSION A - ELECTROMAGNETIC METROLOGY

Chairman: Prof. Dr. V. Kose (FRG)

Vice-Chairman: Prof. S. Hahn (Poland)

REPORT ON BUSINESS MEETINGS

Business Meetings were held on 29 and 31 August, 3 September 1984. The meetings were chaired by the Chairman of the Commission, Prof. V. Kose.

1. Commission Chairman and Vice-Chairman

Prof. S. Hahn (Poland) was introduced by Chairman Kose as the Chairman of Commission A for the next triennium.

The result of the vote for the Vice-Chairman was as follows, in order of preference:

- i. Prof. S. Leschiutta (Italy)
- ii. Prof. C. Audouin (France).

It was reported later that Prof. S. Leschiutta had been elected as the incoming Vice-Chairman of Commission A.

2. Cooperation between URSI Commission A and CPEM

Action taken at the CPEM '82 recommended that the Chairman of URSI Commission A be, ex officio, a member of the CPEM Executive Board. This action approved by the URSI Board of Officers, resulted in an arrangement whereby meetings of the CPEM '84 at Delft were contiguous, but not in conflict, with the sessions of URSI Commission A in Florence. R. Kaarls reported on the success of the Delft meeting: over 170 papers presented and 35 countries represented by the attendees. The next CPEM is scheduled for Gaithersburg, USA, in June 1986.

A joint meeting of the USA and Canadian Member Committees of URSI, with the co-sponsorship of the IEEE Antennas and Propagation Group, will be held in Vancouver, BC, 17-21 June 1985.

Some discussions developed on the significance of the membership in URSI and CPEM. H. Hellwig noted that Commission A members were the official representatives of their respective Member Committees and that CPEM membership was on a voluntary basis; that URSI invited specific papers and that CPEM papers were volunteered. S. Hahn spoke

of the close-to-the-public sessions formerly part of URSI tradition but now open to the public. G. Winkler pointed out that paper presentations at URSI meetings were not a major concern but that encouragement of measurement research was.

3. Time and Frequency

Discussions were centered upon BIPM and BIH. It was mentioned that intercomparison measurements received highest priority from BIPM. J. McA. Steele spoke of the BIH links with other organizations (IAU, CCIR, BIPM, etc.) and the continuity of its work. Three recommendations (A1, A2 and A3) were suggested, discussed, and submitted to the Council for acceptance.

4. Biological Effects

Prof. S. Rosenthal reported on the work of the Working Group on Interactions of Electromagnetic Waves with Biological Systems. Excellent support has been encountered at numerous meetings held. He pleaded for more financial support from the budget of the Union and suggested a recommendation (A4) to continue URSI support of the Working Group.

5. Time Domain Waveform Measurements

Dr. N.S. Nahman reported on the Time Domain Sessions, saying that papers were well received by the audience which varied from 50 to 80 attendees. There was a feeling that future sessions should be open-symposium presentations.

6. URSI Register of National Standards Laboratories

A. Bailey discussed the preparation, publication and distribution of the *URSI Register of National Standards Laboratories*. The National Physical Laboratory (UK) printed 40 copies for the Assembly. Mr. Bailey noted that the late arrival of data from a number of countries had prevented the inclusion of their up-dated material in this revised edition as distributed. Copies distributed at this meeting will be reviewed, pages revised as required, and the remaining 150 copies committed by the NPL will be published and distributed internationally following instructions from Commission A. The need for further copies is considered in Recommendation A5. Chairman Kose complimented and thanked the Working Group through its Chairman, Mr. A.E. Bailey.

7. Review of Radio Science

Prof. Leschiutta reported that all contributions had been well organized and in the approved format. He suggested that guidelines be re-established for future work, a need brought up by the report on biological system effects which mixed together medical and metrological data.

Chairman Kose suggested that consideration be given to making an Inter-Commission Working Group of the Working Group on Interactions of Electromagnetic Fields with Biological Systems. Although this was officially approved by a vote, in the absence of Prof.

Rosenthal, Chairman of the Working Group, no further constructive action could be taken.

8. International Organizations

Prof. S. Hahn expressed his feelings that URSI should approach IMEKO, to establish better relations. Mr. P.O. Lundbom seconded this idea. The opinion was expressed that the incoming Chairman had freedom of action if he so desired.

9. Editor of Review of Radio Science

Mr. R. Kaarls was nominated as the Commission A Editor for *Review of Radio Science 1984-1987*.

10. ENUWAR

Mr P.O. Lundbom informed the Commission about the activities of the ICSU Scientific Committee on the Effects of a nuclear war with resultant electromagnetic and other types of fall-out pollution. Workshops were held in Stockholm (15-17 Nov. 1983), New Delhi (9-11 Feb. 1984), Moscow (14-15 May), and are scheduled for Paris (22-23 Oct. 1984), Budapest (Feb. 1985), and at Essex University, Colchester, UK (June 1985). At this Assembly a meeting on this matter had taken place.

11. Future Aspects

Several suggestions were discussed with regard to the future tasks of URSI and its publication policy at General Assemblies.

TITLES OF SCIENTIFIC SESSIONS

- Time-transfer metrology
Organizer: C.C. Costain (Canada)
Chairman: J. McA. Steele (UK)
- Time-domain waveform metrology
Organizer: S.N. Nahman (USA)
Chairman: S.J. Halme (Finland)
- Microwave and mm wave metrology in guided systems
Organizer and Chairman: H. Bayer (FRG)
- Standards for free field and antenna gain
Organizer and Chairman: R.C. Baird (USA)
- Submillimeter and laser metrology
Organizer and Chairman: T. Nemoto (Japan)
- Tutorial lecture on Frequency Standards
Lecturer: C. Audouin (France)
- Tutorial Lecture on Automatic network analyzers and six-port systems
Lecturer: C.A. Hoer (USA).

COMMISSION B - FIELDS AND WAVES

Chairman: Prof. H.-G. Unger (FRG)

Vice-Chairman: Prof. J. Bach Andersen (Denmark)

REPORT ON BUSINESS MEETINGS

1. Chairman and Vice-Chairman 1984-1987

It was agreed unanimously that Prof. J. Bach Andersen (Denmark) should succeed as Chairman. The result of the vote for Vice-Chairman was in order of preference Prof. T.B.A. Senior (USA) and Prof. P.J.B. Clarricoats (UK).

2. Electromagnetic Theory Symposium

During the period a successful Symposium had taken place in Santiago de Compostella, Spain. For the venue of the 1986 Symposium invitations were received from Hungary and Israel. After a vote it was decided that the invitation from Hungary should be accepted. The Symposium will be held during the same week as MICROCOLL with one or two days overlapping. It was mentioned that it should be guaranteed in advance that scientists from all Member Committees of URSI may attend the Symposium.

3. Other Symposia and Conferences

The International Symposium on Antennas and Electromagnetic Theory in Beijing, China in August 1985 will be co-sponsored by URSI. It will be checked that there will be free access to the People's Republic of China for scientists from all Member Committees of URSI who wish to attend the Symposium.

Commission B recommends that URSI co-sponsor the following conferences:

- International Conference on Integrated Optics and Optical Communication, Venice (Italy), 1 - 4 October 1985;
- 8th Colloquium on Microwave Communication, Budapest (Hungary), 1986;
- European Microwave Conference, Paris, 1985;
- European Conference on Optical Communication, Spain, 1986.

4. Remote Sensing

Commission B has a sustained interest in Inverse Scattering and its applications, and recommends that the Inter-Commission Coordinating Group on Remote Sensing continue its activities.

5. Inverse Scattering

Commission B desires to give added focus and impetus to the work on Inverse Scattering within the Commission. It therefore resolves to establish a Working Group on Inverse Scattering within Commission B.

SUMMARY OF SCIENTIFIC SESSIONS

Commission B had organized a number of scientific sessions for Commission B alone. Furthermore there were Joint Scientific Sessions with one or the other or several of all the other Commissions. Commission B participated also in the Open Symposium on Interaction of Electromagnetic Fields with Biological Systems. Most of the Scientific Sessions are reported below.

Inverse Scattering (W. Tabbara)

At the XXth General Assembly of URSI, Inverse Scattering problems have been examined from a theoretical point of view: modelization, existence of a solution and its uniqueness... At the present General Assembly in Florence, we wanted to complete this overview by looking at the application side of these problems.

Since Inverse Problems are of interest in various domains, the session was organized on a pluridisciplinary basis. The following topics were discussed:

Microwave Imaging in Medicine	- A.P. Anderson
Inverse Methods in Non-Destructive Testing	- K.J. Langenberg
An Inverse Method in Geophysics	- A.Q. Howard
Inverse Methods in Environmental Surveillance	- D.T. Gjessing
Inverse Methods in Optics	- H.P. Bates
Inversion Techniques for Electromagnetic Imaging	- W.M. Boerner

The first five papers are technical surveys of the application of inverse methods in their respective fields. The last one summarizes the content of the papers presented at a NATO workshop devoted to Inverse Scattering and Electromagnetic Imaging which took place at Bad Windsheim, FRG, in September 1983. Since at this workshop Inverse Problems have been examined on a broader scale, it was interesting to communicate the latest developments in this field to the participants of this session.

In their presentations, the authors described real world problems, showing how various methods can be used to retrieve physical parameters or produce images of objects, from the knowledge of the field scattered by the investigated object. The usefulness, the domain of validity and the accuracy of the models used to describe the interaction between the incident wave and the object, have been underlined.

These papers have shown more particularly that:

- Different fields of application share similar techniques of inversion. This must encourage users in different fields to increase their collaboration.
- There is a need to enhance actual techniques (or develop new ones) in order to solve complex problems.

From a scientific point of view, the papers presented here have contributed to a better understanding:

- 1) of the possibilities of actual techniques in inverse scattering;
- 2) of the importance of the practical problems;
- 3) of the need for interdisciplinary work.

If a recommendation can be made for future sessions on Inverse Scattering, it will concern the duration of each talk. This must be increased in order to give the author enough time to conveniently review the work in his field and make it understandable to the widest audience.

Synthesis of the Patterns of Reflector Antennas (P.J.B. Clarricoats)

Rhamat-Samii reviewed current United States work in the field of antenna synthesis and analysis. He described in particular a variety of software packages suitable for the design of multiple reflectors of use in spot-beam and shaped-beam applications. To illustrate the techniques examples were chosen from both small earth-station antennas and large unfurlable antennas (55 m diameter) intended for future mobile satellite communication systems over the United States.

Westcott gave a review of the method of reflector synthesis developed by him and his colleagues at the University of Southampton. This is an exact synthesis procedure and is based on geometric-optics. The problem is transformed into one of differential geometry leading to a non-linear 2nd order partial differential equation of the Monge-Ampere kind. The equation can be solved by a linearisation process accompanied by finite-difference techniques.

Westcott, in the question period, commented on alternative methods of synthesis and concluded that there was no need for approximate methods when a rigorous solution was available. He noted that the paper by Kimber had caused some unnecessary controversy suggesting as it did that a general synthesis procedure was not possible. Westcott indicated that some existence theorems were available and there was hope for a definitive theorem for constant phase aperture problems. Clarricoats noted that at Queen Mary College some success had been achieved with an arbitrary synthesis method developed by Westcott.

Henning Bach's paper drew attention to the problem of feed modelling. He suggested that errors could occur if models were chosen which did not satisfy Maxwell's equations. In discussion, Rhamat-Samii felt that while Bach's paper was rigorously correct, in many dual-reflector applications there is little error in approximate feed models. The JPL dual-shaped reflector was cited as an example. However, Bach's paper serves to remind designers of the important need to examine the consequences of approximations.

Balling (formerly of Intelsat) reviewed the requirements for shaped-beam antennas with particular reference to the Intelsat series. He illustrated designs based on shaped-beam synthesis using array feeds.

This topic was taken up by Clarricoats in the final paper of the session. He showed how by using a 39-element feed and a single off-

set reflector, a fairly complex beam shape could be synthesised. Full account of mutual coupling effects showed that the cross-polarisation was limited and techniques for reducing cross-polarisation in array feeds remains a productive area for study. Next he examined results of synthesis methods based on the method of Westcott including results for elliptical apertures. The results of aperture integration were successfully compared with those obtained by physical-optics methods.

Reference was also made to a comparison of Westcott's method with that adopted by Peterson (Norwegian Telecommunication Authority) when it was noted that these two synthesis methods (the latter being approximate) produced almost identical results.

In a concluding discussion it was recognised that two broad techniques for shaped-beam synthesis exist. One utilises a simple conic section reflector and a complex array feed, and the other a simple feed and a specially shaped reflector. The former offers the flexibility of reconfigurability in space but suffers the disadvantage of a complex and heavy beam forming network. The alternative requires synthesis procedures which are still under development. It is probably the best solution when the contour pattern is fixed.

Scattering and Diffraction - Analytical Techniques (P.M. van den Berg)

Recent work in low-frequency scattering has been reviewed by Kleinman and Senior (USA). They have emphasised the analytical and numerical developments of the last few years. Included were some non-standard integral-equation formulations of scattering problems which lead to better conditioned matrices when the equations are discretized.

High-frequency methods have been reviewed by Felsen (USA). The deficiencies of simple ray-tracing and ray-summation techniques have been pointed out. Several techniques, such as spectral-smoothing, Gaussian beam simulation and hybrid ray-mode formulations to deal with some or all of these deficiencies have been discussed.

The general problems of low-frequency scattering by conducting strips and slots in screens have been reviewed by Butler (USA). Some exact solutions of approximate equations are presented. In the case of TM illumination, a simple solution can be obtained for the problem of a narrow strip which resides on the interface between two semi-infinite media.

The theory of relativity for solution of field problems involving moving media or sources has been reviewed by Van Bladel and De Zutter (Belgium). Starting from the Fourier spectra of the fields from a moving source, the existence of an inverse Doppler effect can be criticized. For field problems involving media with time- and/or space-dependent velocity, the quasi-stationary approach is inadequate, and the more correct instantaneous rest-frame theory should be used. Series expansions in the small velocity are incorrect for (highly) conducting media. The interaction between the moving media and the fields gives rise to forces and torques.

Radiation and Scattering - Numerical Techniques (R.F. Harrington)

The session consisted of 5 papers. The first paper, by D.R. Wilton et al., was on numerical analysis of inhomogeneous dielectric bodies. In three dimensions, tetrahedral cells were used. Questions centered on problems associated with electrical size, high conductivity, elongated cells, etc. The second paper, by P.M. van den Berg, was on iterative computational techniques. Discussion followed on error criteria and convergence. The third paper by K.K. Mei, was on time-domain solutions. There was discussion on comparison of the time-domain finite element method with the k-space method. The fourth paper, by B. Popović, was on the analysis of electrically thin structures. A discussion of the error involved using the equivalent radius concept took place. The final paper, by S. Ström, was on the null field approach. The topics of using other than spherical harmonics, stability problems, and low frequency results were discussed. At the end of the session a general discussion of numerical methods was held.

Optical Fibre Measurements (A.E. Karbowiak)

The purpose of the session was to bring together experts in Optical Fibre Measurements for discussion on matters relating to electromagnetic theory in relevance in optical fibre measurements, examine alternative methods of fibre parameter measurements and assess their relative significance. The parameters of interest covered among others, numerical aperture, spot size, bandwidth, OTDR, coherent techniques, etc.

There were six papers invited and presented. The papers by Midwinter and Todd was presented by Dr. White, BT, UK. On account of changes in the global programme, the original timing of the session was changed from 9 am-12.30 to 10 am to 1 pm. The restricted time had an adverse effect on the discussion periods which had to be cut proportionately. The attendance was 40 people at the start of the session which declined to about 20 people at the conclusion of the session at 1.05 pm. Compared with other sessions, the attendance was about average.

The feedback during subsequent discussions indicated that the topics were well received and that attention to a range of important aspects has been drawn. Those who participated felt on the whole that the subject matter was of relevance to URSI activity.

Propagating in Random Media (A. Ishimaru, F. Eklund)

The session was devoted to a review of recent progress in wave propagating and scattering in random media in three major areas: rough surface scattering, discrete scatterers, and random continuum. The first paper by Brown critically reviewed the recent work on rough surface scattering. Existing theoretical approaches were first divided into two categories - Classical Methods wherein the deterministic scattering problem is solved as far as is possible and then the result is averaged, and Modern Methods where averaging is introduced very early in the problem to achieve a degree of simplification. The theoretical approaches were then put into a common framework for

comparison using the concept of a generalized angular spectrum. Although it has just recently been applied to the rough surface scattering problem, the method of smoothing appears to have the capability of providing some new and very useful results. Among the outstanding problems discussed were (a) the lack of any rigorous technique for computing the probability density function of the scattered field, (b) the inadequacies of many rigorous techniques in the limit of small surface correlation length, and (c) the root cause of classical problems encountered at grazing incidence. The basic conclusion of this presentation was that some very significant progress has been made since the previous General Assembly.

The second paper by Delogne and the third paper by Ishimaru and Tsang discussed the scattering by random distribution of discrete scatterers. Important contributions have been made in recent years on the propagation characteristics of the coherent field and mixture formulas including the effects of pair correlations. The incoherent field has been studied in terms of the distorted Born approximation, but more work needs to be done. Radiative transfer theories are extended to the vector radiative transfer and two frequency radiative transfer theories, and diffusion approximations are investigated. The relationship between the wave theory and the radiative transfer theory are studied in terms of Wigner distribution.

The paper by Uscinski dealt with the fourth-order moment of the wave in random continuum and has successfully demonstrated the saturation effects of the intensity fluctuations. The paper by Besieris dealt with the waves in the focusing region. Our understanding of the effects of noise in the vicinity of (geometric) focal points (e.g., the asymmetric diffusion of radiation in the lit and shadow side of a caustic) has been enhanced significantly by recent studies of the mutual coherence function in random channels characterized by realistic deterministic profiles. These studies are based on ordinary and singular perturbational techniques and are restricted to physical situations where the forward scattering and pure Markov approximations are valid. The relative merits of the underlying mathematical techniques were discussed, with particular emphasis on their applicability of the computation of higher order single and multifrequency moments. Alternative, physically more encompassing techniques (e.g., radiation transport theory) were presented, and several open research areas were identified.

The paper by Booker, Ferguson, and Vats clarified the relationship between the extended-medium and the phase screen theories. The two papers by Consortini et al. discussed strong scintillation in the turbulence and the effects of the saturation of the apparatus and the angle-of-arrival correlation measurements.

Microwaveguides for Planar and Integrated Circuits (K. Schünemann)

Six papers have been presented dealing with various aspects of planar and other transmission lines. In the first contribution, an overview has been given concerning waveguides for MICs and MMICs. Besides the conventional transmission lines, alternatives like the H-guide, the groove guide, and the fence guide are described and discussed in detail. Based on these comments, the important E-plane

structures have been presented in the second paper. Not only an overview but also detailed insight into component realizations and numerical design methods have been given. Problems and methods for their solution are shown for a bandpass filter design as typical example.

A very promising modification of the H-guide, the non-radiative dielectric waveguide, has been presented by its inventor. This waveguide shows attractively low attenuation and is, moreover, characterized by a single-mode performance. It also leads to easily fabricable components, some of them having been described in the oral presentation. Quite a different "transmission medium" has been treated next: the rectangular waveguide operated in its cutoff regime. It is suited for realizing evanescent-mode resonators which represent lumped-elements in a certain respect. Many active and passive microwave components can thus be built showing superior performance with respect to bandwidth, losses, and simplicity.

In the fifth paper, a deep and comprehensive discussion of field-theoretical approaches in the CAD of MICs has been given with special attention to the two- and three-dimensional formulation of the spectral-domain method. Its potentials for the solution of complex (planar) boundary value problems have been illustrated by referring to various practical examples. The last paper, finally, was devoted to a special problem of high practical importance: the coupling of dielectric resonators to planar transmission lines. An efficient numerical technique has been developed and successfully compared to measurements. A further paper on planar waveguides on anisotropic substrates was not presented orally.

Transients and Identification (D.G. Dudley)

The transient identification problem is one of definitive current interest in the electromagnetic community. Briefly stated the problem consists of determining characteristics of a scattering object from input-output data. The session drew an attendance varying between 50 and 75 persons. There were many questions from the audience, some resulting in a lively debate immediately following the session.

There has been considerable confusion in the literature concerning the meromorphic nature of the scattering from a perfectly conducting object. By the Mittag-Leffler theorem, the scattering consists of an infinite summation over the natural resonances (poles) of the scatterer plus an entire function. Dr. Tjihuis presented results in scattering from lossy slabs that are indicative of shapes exhibiting strong resonance scattering. Profs Felsen and Dudley emphasized scattering where the entire function plays an important role. This is not a happy situation for those attempting to model the scattering by poles alone. Indeed, the entire function often dominates the scattered field. Prof. Langenberg demonstrated this graphically with data obtained in ultrasonic experiments. An open problem emerging from the session is resolution of the entire function into parameters that can be used to describe the local features of the scatterer.

Crucial to progress in electromagnetic transient identification

is the availability of algorithms for estimation of the parameters describing the scattering process. The session included a tutorial presentation on modern system identification by Prof. Lennart Ljung, who is one of the acknowledged leaders in his field. The session concluded with a presentation by Prof. Achenbach of how these same issues arise in mechanics, particularly in scattering from flaws in materials.

Scattering and Radiation by Objects near Media Interfaces
(Ch. M. Butler)

This session was sponsored jointly by Commissions B and F. Approximately sixty participants attended the session and the discussion following the papers was thoughtful and often lively.

The content of the papers represented a rather thorough coverage of current research on scattering and radiation by objects near media interfaces. Two of the papers presented a comprehensive review of techniques for computing scattering from objects buried in either a homogeneous or layered earth. A third paper addressed the problem of radiation and scattering by bodies which extend through the planar interface between two dissimilar half spaces. This paper covered all work done to date on the subject of radiation by partially buried antennas and of scattering by partially buried objects. The fourth paper presented results of recent research on radiation from loop antennas near media interfaces and described interesting applications to the important area of well logging. High frequency diffraction by a conducting half-plane residing on an interface between two media was reviewed in the fifth paper and new results were presented for diffraction by a half-plane at an interface of a layered-media space.

COMMISSION C - SIGNALS AND SYSTEMS

Chairman: Prof. J.K. Wolf (USA)

Vice-Chairman: Prof. K. Géher (Hungary)

REPORT ON BUSINESS MEETINGS

1. Chairman and Vice-Chairman for the Period 1984-1987

Prof. K. Géher was congratulated on his becoming Chairman of Commission C for the next triennium.

The result of the vote for the Vice-Chairman was as follows in order of preference:

- i. Dr. R. Saal (FRG)
- ii Dr. J. Ziv (Israel).

It was later reported that Dr. Saal had been elected as Vice-Chairman for the next triennium by the Council of URSI.

2. Possible Change of the Name of URSI

The Chairman mentioned the possibility of changing the name of URSI in order to reflect more specifically the interest of the Union in electronics and electronic devices. A discussion developed on the desirability of such a change, and on the particular role of URSI bearing in mind the activities of other organizations (for example, IEEE). Commission C recommended that the name of URSI should not be modified.

3. Meetings between General Assemblies

The Chairman discussed the desirability of organizing symposia on specific topics (for example, satellite communications) between Assemblies. The Commission was in favour of this.

3. Poster Sessions at the XXII General Assembly

Commission C recommended that poster sessions should be organized at the next General Assembly of URSI.

4. Remote Sensing

Prof. Carassa reported on the work of the Inter-Commission Coordinating Group on Remote Sensing. It was recommended that this Group should be continued until the next General Assembly in 1987 and that Prof. Carassa be the Commission C representative on the Inter-Commission Coordinating Group.

5. URSI-CCIR-CCITT Liaison Committee

After a discussion on the relations between URSI and the Consultative Committees of ITU, Dr. J.G. Lucas agreed to be the representative of Commission C on this Committee.

6. Working Group on Wave Analysis

A report on the Working Group on Wave Analysis was presented by Prof. Lacoume. The Commission agreed unanimously to recommend the continuation of this Working Group for the next triennium. The Group had organized open symposia at the General Assemblies in Lima, in Helsinki and in Florence. It was recommended that the next symposium be organized at the General Assembly in 1990.

7. Editor for the 1987 edition of *Review of Radio Science*

Prof. K. Géher will be the Commission C Editor for *Review of Radio Science 1984-1986*.

8. Sponsorship of Meetings

The Commission recommended the co-sponsorship by URSI of the following events:

- 1) Workshop on Information Theory, USSR (1984);
- 2) E.C.C.T.D., Prague, Czechoslovakia (1985);
- 3) 8th Colloquium on Microwave Communication (MICROCOLL), Budapest, Hungary (1986);
- 4) IEEE International Symposium on Information Theory, UK (1985);
- 5) Joint Swedish/USSR Workshop on Information Theory, Sweden (1985);
- 6) Benelux Symposium on Information Theory, Netherlands (1985);
- 7) Conference on Digital Signal Processing, Florence, Italy (1987).

SUMMARY OF SCIENTIFIC SESSIONS

Eight scientific sessions were sponsored solely by Commission C. In addition, Commission C cooperated in the sponsorship of a number of joint sessions. Each session was planned to consist of five or six one-half hour presentations. Although a few of the presentations were cancelled, the programme was a full one. The audience at each session averaged about 40 persons. Most papers were followed by a lively discussion period.

The following is a very brief summary of the content of the eight scientific sessions sponsored by Commission C. In all but one case, the summary was prepared by the session chairman.

Session C.1 - Coding

Organized and chaired by J.P.M. Schalkwijk

- 1) J.L. Massey, "Improvement of Viterbi's Orthogonal Convolutional Codes". The author talked about "partial unit-memory codes". These codes have fewer states and thus allow a simpler Viterbi decoder than do the ordinary unit memory codes.
- 2) S.W. Golomb, "Frequency Hop Patterns with Thumb-Tack Ambiguity Functions". The subject was time-frequency matrices with good autocorrelation functions. He described various combinational properties of these Latin Square related arrays.

- 3) M. Cedervall and R. Johannesson, "How to Find Good Convolutional Codes". The presentation was given by R. Johannesson who discussed an algorithm that makes use of the distance profile to find convolutional codes with large free distance.
- 4) W.J. van Gils, "Linear Block Codes for Unequal Error Protection". The author discussed linear codes that provide better error protection to the most significant message digits. He gave bounds that simplify to the well known Plotkin and Griesmer bounds if unequal error protection is not required.
- 5) J.P.M. Schalkwijk, "Coding Strategies for Two-Way Channels". Constructive coding strategies for several deterministic two-way channels were described. These strategies all beat the Shannon inner bound region. The scheme for the binary multiplying channel achieves capacity.

Session C.2 - Computer Networks

Organized and chaired by Martin Reiser

- 1) Phil Janson, "Local Area Communication Networks". Bus and Ring local area networks were discussed and their system behaviour characterized. It was shown that the LAN provides low-cost packet switching for the local domain. Standardization effects were summarized.
- 2) Hugo de Pedro, "On Adaptive HF Networks". Data networks composed of 18 nodes were described which are based on HF links. Methods for characterizing the links were given and different backbone networks were analyzed.
- 3) Paul J. Kuhn, "Voice and Data Communications in Public Switched Digital Networks". The state-of-the-art in digital switched networks was reviewed. It was shown, that a full 7-layer data network is needed for signalling. The evolving ISDN standards were put in perspective with these network architectures.
- 4) Jean-Louis Grangé, "Computer Applications Using Communication Satellites". A system based on 3-meter dishes was described. The characteristics of the satellite communication discussed were given. Pilot projects (NADIR) using satellite networks were discussed.

Session C.3 - Multi-Access Communications

Organized and chaired by James Massey

- 1) J.P.M. Schalkwijk, "Capacity Regions of Two-Way Channels". An explanation of the capacity region of a two-way binary multiplier channel was given. In particular it was shown how two computers connected by a wired-end circuit could exchange more than 1 bit per pulse even though both users were transmitting and receiving binary data.
- 2) E.N. Protonotarios, "Queueing Analysis of Random Multi-Access Protocols". This paper reviewed the various queueing analyses for random-access channels.

- 3) A. Ephremides, "Performance Analysis of Frequency Hopping Multi-User Systems that May or May not Tolerate Partially Overlapping Interference". This paper discussed a frequency hopping multi-user system where each user utilized a Reed Solomon code to fill in erasures. In particular it was concerned with increasing the duration of the pulses so that pulses that were partially interfered with by other signals could still be received without error.
- 4) I. Vajda, "More on Modelling and Performance Evaluation for Frequency-Coded Multiple-Access Channels". This paper was concerned with the modelling and performance of frequency coded signals for the multiple access channel.
- 5) G. Benelli, "Utilization of Random Access Techniques in Multibeam Satellite Systems". This paper discussed multibeam satellites and how one could use such a system in conjunction with random access protocols.

Session C.4 - Information Theory

Organized and chaired by Prof. E.C. van der Meulen

- 1) T. Ericson, "The Arbitrarily Varying Channel and the Jamming Problem". This paper discussed the arbitrarily varying channel which was introduced by Blackwell, Breiman, and Thomasian in 1960. Prof. Ericson gave a historical survey on this channel and explained the essential results for it. He distinguished between the deterministic capacity and the random capacity of this channel. Prof. Ericson introduced the concept of key rate for this channel, stated various coding theories, and formulated exponential error bounds. He illustrated his talk with several examples.
- 2) M.H.M. Costa, "Interference Channels". Dr. Costa gave a tutorial lecture on the interference channel, which is closely related to the two-day channel introduced by Shannon in 1961. Dr. Costa first surveyed the Gaussian interference channel and then discussed the discrete interference channel. He thereby discussed the important notion of typicality, originally due to Shannon, and further developed by the Stanford School of thought among others. Dr. Costa gave many interesting examples and gave for both types of interference channels the current state of affairs, thereby conjecturing some capacity regions.
- 3) H.M. Wallmeier, "Statistically Varying Games with Incomplete Information". Dr. Wallmeier presented new results on an entirely new line of research. He gave an information theoretic approach to a game-theoretic problem. In particular, he discussed the influence of incomplete information on the payoff to two players within a game-theoretical model. In this set-up it is assumed that the states of nature are only partially known when the controls are to be chosen. With information theoretic methods Dr. Wallmeier established the value of this game. Thereby a coding theorem and its converse are used and research from rate distortion theory are applied.

- 4) J.A. Seidler, "Hierarchical Communication Systems". In this investigation, the users of a communication system can share the capacities of the channel by a built in subsystem for identifying the state of the system. Such a subsystem, which is called a remote internal measurement system, is again a communication system, thus leading to a hierarchy of communication systems. Dr. Seidler presented the principles of designing and performance evaluation of the lower level communication systems. Moreover, he compared the effectiveness of state identification subsystems on the basis of trade-off relationships between indices characterizing the performance and cost of the higher level communication system.

Session C.5 - Bandwidths Efficient Modulation

Organized and chaired by C.E. Sundberg

- 1) G. Ungerboeck, "Trellis Coded Modulation for Data Modems". Trellis coded modulation for high speed modems for telephone lines were discussed.
- 2) A. Svensson, "Coded Continuous Phase Modulation Systems". Constant amplitude modulations were discussed. A review of recent work where phase modulation with low spectral sidelobes and convolutional codes are combined for better performance was given.
- 3) G. Ascheid, "Performance Analysis of a Decision Directed Carrier Synchronization System of CMP Signals". This paper discussed carrier recovery for CMP signals.
- 4) G. Foschini, "Contrasting Performance of Faster Binary Signalling with QAM". Faster binary signalling with maximum likelihood detection was shown to be slightly better than QAM.
- 5) I. Sasase, "Bandwidth Efficient Quadrature Overlapped Modulation Techniques". A review of recent work on quadrature overlapped raised cosine type modulations for satellite channels was presented.
- 6) P. Wittke, "On Error Rates and the Distribution of Phase Angles in Digital Frequency Modulation". This paper was concerned with the error rate evaluation of digital FM without click theory.

Session C.6 - Switched Capacitor and Digital Filters

Organized by G.S. Moschytz and chaired by K. Géher

- 1) H.W. Schussler, "Sampled Data and Digital Filtering: Introduction". Prof. Schussler gave an excellent 50 min. introduction to the theory and design of digital filters.
- 2) M. Bellanger, "Digital Filters for Communication Systems". Dr. Bellanger gave an overview of the most important applications of digital filters in telecommunications.
- 3) G.C. Temes, "Switched-Capacitor Filters for Communication Systems". Prof. Temes described the basic properties and some applications of switched capacitor filters.
- 4) R.E. Schreiber, "Switched-Capacitor versus Digital Filtering: A View from the Communications Industry". Dr. Schreiber gave a comparison of digital vs. switched capacitor filters, and descri-

bed some recent work.

The session demonstrated the importance of microelectronics, circuit theory and CAD in the telecommunication activities of interest to URSI.

Session C.7 - Communication Reliability

Organized and chaired by Josef Skwirzynski

- 1) E.A. Palo, "Reliability Aspects of VLSI-based systems". Mr. Palo considered reliability aspects of VLSI-based systems where ever increasing complexity and packing density requires continuous testing. Such testing is called 'concurrent' in the sense that it occurs continuously and simultaneously with the operation of the device. He exemplified this method with several device structures.
- 2) J.W. Schwartz, "Reliability in Satellite Design". Dr. Schwartz presented error-control methodology to achieve reliability in autonomous spacecraft operation. He defined carefully the meaning of "faults", "errors", and "failures", then exhibited some examples of data processing operations illustrating typical functions of satellites. Typical requirements for error control were shown and related to the effects of these errors. Finally, techniques for error control and tolerance were categorized and cross-related.
- 3) M. Giraud, "Some Pitfalls in Spare Provisioning, Outlook of the Needs". Dr. Giraud discussed difficulties of planning and predicting cost and requirements of spares during design/development stages of production. He illustrated these problems with examples of history of some equipment and described analytic and simulation methods used.
- 4) W.J. van Gils, "The (4,2) Concept in Fault Tolerant Systems". In this paper the structure of a fault-tolerant computer system whose operation is based on the error-correcting properties of (4,2) code over the Galois field (GF(16)) is described. With redundancy (doubled memory and quadrupled processors) this computer ensures the correct operation in the presence of processor failures, double-bit errors in memories, and faults in combination with bit errors. The input/output operation is based on the "Byzantine Generals" algorithm.

Session C.8 - Stochastic Processes

Organized and chaired by S. Schwartz

The general theme of the session was the theory of stochastic models and processes, with applications to communication.

- 1) G. Lindgren, "Slepian Models for Extremes and Crossings in Random Processes with Applications to FM Noise". Prof. Lindgren discussed in detail the Slepian model and associated level crossing problem. He applied the model to obtain the distribution of FM-click deviation and shape.
- 2) E. Biglieri, "Analysis of Random Digital Signals". Prof. Biglieri characterized digital signals that occur in satellite communications as a digitally modulated random process. Using the theory

of Markov chains, he obtained the power spectral density of the signal and was able to evaluate the performance of the optimal detector and compute the error probability of a conventional receiver.

- 3) D. Tjøstheim, "Some Doubly Stochastic Time Series Models". Prof. Tjøstheim discussed a class of doubly stochastic time series models; these are ARMA models with random coefficients. He discussed some of their properties and showed how they could be applied to problems in nonlinear filtering theory and nonstationary environments.
- 4) P. Bremaud, "Dynamic Point Process System: A Review". Prof. Bremaud reviewed the theory of point processes and showed how they could be applied to problems in queueing networks, detection and filtering, and stochastic control.
- 5) S.C. Schwartz, "Detection of Signals in Narrowband Non-Gaussian Noise". Prof. Schwartz concluded the session with an application of the Middleton Class A model to detection of deterministic and stochastic systems. He observed that a few terms of the probability density function give very accurate results. This leads to suboptimum procedures very similar to those already in use. For stochastic signals, the optimum detection was a bank of estimation - correlators.

COMMISSION D - ELECTRONIC AND OPTICAL DEVICES
AND APPLICATIONS

Chairman: M. J. Le Mézec (France)

Vice-Chairman: Prof. W.A. Gambling (United Kingdom)

REPORT ON BUSINESS SESSIONS

Four business sessions have been held by Commission D. They were open to Official Members, but also to every one interested in the future of Commission D, inside and outside URSI. Ten to twenty people attended these meetings. It should be put forward that:

- a large number of Member Committees had no Commission D representative at the General Assembly;
- many Member Committees have the same delegate for several Commissions, so that they do take part in the vote but are not active in examining the problems encountered by Commission D.

1. Vote for the next Vice-Chairman (1984-1987)

Following the tradition, the past Vice-Chairman, Prof. W.A. Gambling, from United Kingdom, was proposed as Chairman of the Commission for the period 1984-1987. This was accepted by the Council of URSI.

There were two candidates for the vice-chairmanship of the Commission:

Prof. T. Okoshi (Japan)
Dr. B. Mroziewicz (Poland)

These names were submitted to the Council, in the above order of preference. Prof. Okoshi was elected Vice-Chairman for the period 1984-1987.

2. Sponsorship of Scientific Meetings

This problem was discussed in connection with a letter from the USSR delegation asking URSI to sponsor the International Symposium on Surface Waves in Solid and Layer Media (June 1986, Novosibirsk, USSR). The Commission recommended that URSI should give its sponsorship without any financial obligations. However, two more general problems were raised:

- the question of language, the problem being that URSI cannot sponsor all the symposia held in national languages;
- the question of access of all scientists from all countries to meetings sponsored by URSI.

These problems were discussed by the Commission, but the decision is relevant to the competence of the URSI Council.

3. Role and Place of Commission D inside and outside URSI

This is a broad topic which occupied the main part of the discussions in the business meetings of Commission D. The comments on the scientific sessions (see below) show that this question is crucial for Commission D.

One aspect of the problem is that, for many scientists and organizations, URSI is seen as exclusively active in the radio field. However expanding its activities to other domains might be a source of conflicts with well-established societies and should be made very carefully.

The discussions resulted in a Recommendation which is reproduced on page 135 of this Volume. One of the suggestions which has to be looked at carefully is the organization of an Open Symposium in the field of Commission D during the next General Assembly, with the sponsorship of another international scientific society: the subject of compound semiconductors (specially 3-5) and their applications has been suggested.

4. Inter-Commission Working Groups

Commission D participated in the work of two Inter-Commission Working Groups.

4.1 Inter-Commission Working Group on Time Domain Waveform Measurements.

This Working Group held several meetings between the XX and the XXI General Assemblies and Commission D representative, Dr. A. Scavennec, France, has been very active. Its work resulted in the joint sessions held at Florence and should be continued during the next triennium.

4.2 Inter-Commission Working Group on Coordination of URSI's Activities at Optical Wavelengths for Communication, Sensing and Processing

Prof. W.A. Gambling, Vice-Chairman of Commission D, was in charge of this Group. It was difficult to hold meetings with the representatives of other Commissions. However, a first preliminary draft report was prepared at Florence by Prof. Gambling. This report proposes the division of optical topics of interest to URSI between Commissions A, B, C, D and F. These proposals should be taken into account when preparing for the next General Assembly. The Working Group should be kept active for preparing the relevant part of the programme, and for coordination with other scientific societies in this domain.

REPORT ON SCIENTIFIC SESSIONS

Seven scientific sessions were planned by Commission D (D1 to D7); however, D5 had to be cancelled. Besides Commission D participated with other Commissions in the organization of the joint sessions on Optical Fibre Measurements (one session) and on Time-Domain Waveform Measurements (two sessions).

Some other sessions of the programme were of interest to Commission D members, either from the point of view of device measurements for specific devices for metrology (A1: Time transfer metrology; A(T1): Prospects for atomic frequency standards; A(T2): Automatic network analyzers and six-port systems; JS4: Microwave and mm wave metrology in guided systems; JS6: Submillimetre and laser metrology), of device applications (C6: Switched-capacitor and digital filters) or even because they dealt with devices, though organized by other Commissions (B5: Microwaveguides for planar and integrated circuits and JS3: Cryogenic low noise detection).

The sessions of Commission D were tutorial, made of invited papers, according to the role traditionally adopted by Commission D, i.e. "that of a service Commission to other Commissions of URSI, bringing to them information on the state of the art in electronic and opto-electronic technologies, as well as providing a prospective view on the progress in these technologies".

The attendance at the sessions was 30 to 40 people, which can be considered as satisfactory if compared with the sessions of other Commissions, and which corresponded to the size of the room allocated to Commission D. The scientific level was high, which is also satisfactory.

Nevertheless, the situation must be considered as being bad. In fact, the goal of Commission D was not attained because very few members from other Commissions attended these sessions. One of the reasons is that they had to attend at the same time the sessions organized by their own Commissions. Furthermore, this situation leads to great frustration for the invited speakers: the majority of them discharge important responsibilities in their respective organizations and they made the travel for the small benefit of meeting a few colleagues who work in the same field and whom they have the opportunity to meet several times a year in other scientific conferences with a much larger attendance. The summit was attained with the decision to shift B5 from Wednesday morning to Wednesday afternoon: speakers of equally high scientific quality were presenting papers on very close subjects in two neighbouring rooms, each with thirty people attending.

This unsatisfactory situation was discussed during the business meetings and resulted in a Recommendation of Commission D.

Concerning the subjects of the sessions, three dealt with optical techniques:

- D1: Recent progress in polarization - maintaining optical fibres;
- D2: Optical bistability;
- D6: Optical techniques, applications in communications and radio science.

These three sessions were completed by JS2 (A, B, D): Optical fibre measurements, and by some aspects of JS1 (A, B, C, D, E, F, G, H, J): Time domain waveform measurements.

D1, D2, D6 and JS2 were held in the first week of the General Assembly, in order to offer a series of sessions on optical techniques gathered in three days.

Two sessions dealt with microelectronics:

- D3: Microelectronics 1;
- D4: Microelectronics 2 (GaAs technology).

The clash between D4 and B5, which resulted from the shift of the latter to Wednesday afternoon, 5 September, has been quoted.

Two sessions, D5 and D7, were planned on millimeter and sub-millimeter devices and techniques. Only one of them could be held; one of the main reasons was the difficulty encountered by the organizers to finance the expenses of the invited speakers: many private companies are not willing to take in charge the travel expenses of their scientists or engineers in view of the too small impact of the papers presented to the General Assembly of URSI. From the point of view of Commission D, it can be considered that the programme of the General Assembly had not been optimized.

Nevertheless, all participants in the scientific sessions of Commission D agreed on the high quality of the papers presented.

The conveners of the sessions organized by Commission D were as follows:

- D1: T. Okoshi
- D2: S.D. Smith
- D3: J. Henaff and P. Antognetti
- D4: J. Henaff and M. Sauzade
- D6: W.J. Stewart and W.A. Gambling
- D7: A.A. Oliner and P. Lampariello.

COMMISSION E - ELECTROMAGNETIC NOISE AND INTERFERENCE

Chairman: Prof. S. Lundquist (Sweden)

Vice-Chairman: Prof. F.L.H.M. Stumpers (Netherlands)

REPORT ON BUSINESS MEETINGS

1. Acting Chairman

In July 1984, Prof. S. Lundquist informed the members of his Commission that personal reasons would prevent him from attending the General Assembly in Florence; he asked Prof. Stumpers, Vice-Chairman, to act as Chairman. The Commission expressed its thanks to Professor Lundquist for the work he did for the Commission, especially in preparation of the scientific sessions for the General Assembly.

2. Minutes of Previous Meetings

The draft Minutes of the Washington business sessions were circulated by Mr. Hagn, and the draft Minutes of the Zurich 1983 meeting were circulated by Dr. Scuka. The Minutes were approved unanimously without modification. The Chairman thanked Mr. Hagn and Dr. Scuka for their work.

3. Nomination of Vice-Chairman

The result of the vote for the vice-chairmanship of the Commission was as follows, in order of preference:

- i) Dr. R. Strużak (Poland)
- ii) Dr. J. Hamelin (France).

The Council elected Dr. R. Strużak as Vice-Chairman of the Commission.

4. Reports of Working Groups

4.1 Working Group on Natural Noise

Dr. Scuka presented the report drafted by Prof. Lundquist, who had announced earlier that he wished to withdraw as Chairman of the Working Group. A circular had been sent to 92 persons involved in natural noise research, and replies had been received from 19 persons. The Working Group has had contacts during the Electromagnetic Compatibility Meetings, and had produced drafts relating to CCIR documents.

At the proposal of the Chairman, Dr. J. Hamelin was appointed Chairman of the Working Group on Natural Noise.

4.2 Working Group on the Scientific Basis of Noise and Interference Control

This Working Group, which is chaired by Dr. C.E. Baum, is organizing a scientific session on this topic at the present Assembly. Dr. Baum drew attention to some issues in the new periodical *Electromagnetics* of interest to the Working Group.

4.3 Working Group on the Effects of Transients

Dr. Scuka reported that he had been elected Chairman of this Working Group during the business meeting of Commission E in Zurich.

In 1984 the subject of the Working Group had been defined to include physical processes of lasting effects and the physics of electromagnetic transient protection. A first workshop had taken place in Zurich in 1983 just before the EMC Symposium. The papers presented had been reproduced in a booklet by the University of Uppsala. A session is organized also at the present Assembly, and it is hoped that the contributions will be edited in the same way.

Summing up, Dr. Scuka saw the task of his Working Group as:

- Identification and better physical understanding of lasting effects of transients on components, equipment and on telecommunication systems;
- Identification, classification and research on sources of transients, within the scope of Commission E;
- Investigation of propagation mechanisms of transients and their interference with telecommunication equipment;
- Creating the standards for testing the equipment, and also the work in design of appropriate testing generators;
- Design of proper protection measures for telecommunication apparatus and equipment;
- Listing the areas of preferential research.

5. Participation in the Inter-Commission Working Groups

5.1 Influence on Man's Activities on Telecommunications

Prof. Kikuchi reported on the activities that had taken place at the EMC Symposia in Wroclaw in 1982 and 1984, and in Zurich in 1983. He distributed a questionnaire to the members of Commission E on the desirability of Commission E participation in the study of the subjects covered by this Inter-Commission Working Group. He indicated that he was organizing a Workshop on the nonlinear responses to large amplitude electromagnetic pulses, to be held after the EMC Symposium in Tokyo.

This Inter-Commission Working Group has been later discontinued by the URSI Council.

5.2 Remote Sensing

The Commission appointed Mr. E.K. Smith as its representative on the Inter-Commission Coordinating Group on Remote Sensing. Dr. Horner also accepted to represent Commission E on conferences on remote sensing.

6. Editor for Review of Radio Science 1981-1986

Dr. Giordano not being in a position to continue his work as Editor, the Chairman proposed Prof. Kikuchi to succeed him. This was accepted unanimously. The Chairman thanked Dr. Giordano for the good image he had given of the work of Commission E in the *Review of Radio Science*. He was sure that Prof. Kikuchi would get the help of all Official Members, and receive their contributions in time.

7. Terms of Reference

The Chairman proposed a change in the terms of reference so as to include planetary noise (as treated in Session E.1 in Florence). As far as he remembered this had already been agreed to in Lima in 1975. At the suggestion of Mr. Hagn, it was decided to seek the opinion of the incoming Chairman of Commission J, Prof. Wielebinski. It was later reported that there was no objection to this.

The Japanese Committee had suggested to include whistlers and power line radiation expressly in the term of reference "the composite noise environment". The majority, though agreeing to the importance of the subject, did not think it necessary to include it in the terms of reference. Another point was whether NEMP (nuclear electromagnetic pulse) should be added, especially in view of the fact that the Board of Officers, not being aware that this subject was within the terms of reference of Commission E, had appointed a special committee to advise ICSU. Dr. Scuka mentioned that, in the opinion of Prof. Lundquist, this subject could well be treated in his Working Group. It was decided to leave it at that, without specifically mentioning NEMP in the terms of reference. The Chairman indicated that the special committee was chaired by Mr. P.O. Lundbom and Dr. M. Wik. The following members of Commission E participated in the preparation of the draft document issued by the Committee: Dr. Tesche, Prof. Kikuchi, Dr. Hamelin, M. Lefeuvre and Prof. Stumpers. The document was accepted later with minor amendment by the URSI Council. The Commission considered that further study was necessary.

The terms of reference of Commission E for the next triennium are as follows:

- a) Terrestrial and planetary noise of natural origin; man-made noise;
- b) The composite noise environment;
- c) The effects of noise on system performance;
- d) The lasting effects of transients on equipment performance (this includes NEMP);
- e) The scientific basis of noise and interference control;
- f) Spectrum utilization.

8. Report on Conferences held in 1981-1984

The Chairman reported on the EMC Conferences in Wrocław in 1982 and 1984, and in Zurich in 1983. He thought that over 50% of the contributions in such symposia are in the domain of Commission E. This was confirmed by Prof. Showers. Prof. Degauque reported on the Symposium in Trégastel in 1983 which, though of a more national character, attracted over 400 participants.

9. Meetings planned for the period 1984-1987

Major meetings are planned for Tokyo 1984, Zurich 1985, 1987, Wrocław or Gdańsk 1986. The Chairman noted that in the period just closed URSI had spent \$1,500 on subsidies to EMC Symposia. He proposed to recommend to the Board that continued support be given to

the Symposia in Zurich and Wroclaw (Category B). This was agreed.

10. Subjects for Further Study Before and During the Next General Assembly

- a) Nonlinear effects (already mentioned in Section 5.1).
- b) CCIR and CCITT Questions and Study Programmes. The Chairman hoped that it would be possible to organize a Workshop on this theme on the Monday preceding the Zurich EMC Symposium (4 March 1985).
- c) EM noise environment.
- d) NEMP (see section 7).
- e) Winter storm lightning and related triggered lightning.
- f) Power line radiation and whistlers.

SUMMARY OF SCIENTIFIC SESSIONS

The programme of Commission E consisted of 8 sessions:

- Satellites and the planetary noise environment
Chairman: E.K. Smith
7 papers and round table discussion.
- Scientific principles of noise and interference control
Chairman: C. Baum
6 papers.
- Natural noise environment, phenomena
Co-chairmen: G. Dubro, E. Garbagnati
7 papers and film.
- Natural noise environment, measurement
Chairman: P. Krider
6 papers and Panel on The maximum dI/dt produced by lightning.
- Man-made noise measurement, standards and statistics
Chairman: F.L. Stumpers
6 papers.
- Modelling of noise environment
Chairman: G. Hagn
6 papers.
- Communication through noise
Chairman: A.A. Giordano
9 papers.
- Lasting effects of transients
Chairman: V. Scuka
5 papers and film.

Commission E contributed greatly to Joint Session 1: Time-domain Waveform Measurements (Chairman: S.J. Halme; 3 papers out of 5).

Commission E first session was strongly related to the Open Symposium on Radio Techniques in Planetary Exploration. This Symposium was sponsored jointly by URSI and the ICSU Coordinating Committee on the Moon and Planets (11 papers; convenors: K. Runcorn and W.J.G. Beynon).

The Open Symposium on the Interaction of Electromagnetic Fields with Biological Systems also drew many lecturers and listeners from Commission E.

The scientific sessions of Commission E attracted between 25 and 50 participants.

COMMISSION F - REMOTE SENSING AND WAVE PROPAGATION -
NEUTRAL ATMOSPHERE, OCEANS, LAND, ICE

Chairman: Dr. D. Gjessing (Norway)

Vice-Chairman: Dr. F. Fedi (Italy)

REPORT ON BUSINESS MEETINGS

1. Nomination of Vice-Chairman

The following candidates as Vice-Chairman of Commission F were submitted to the Council, in order of preference:

Dr. R.K. Crane (USA), Dr. K.S. McCormick (Canada).

2. URSI Representation in SCOR and SCOSTEP

Commission F recommended the following designations as URSI representatives:

- Scientific Committee on Oceanic Research (SCOR): G. Valenzuela(USA)
- Scientific Committee on Solar-Terrestrial Physics (SCOSTEP):
R. Woodman (Peru).

3. URSI-CCIR-CCITT Liaison Committee

Commission F, considering that it is desirable to maintain and develop further the cooperation between URSI and the Consultative Committees of the International Telecommunications Union (CCIR and CCITT), recommends that the following be designated as representatives of Commission F: A. Blomquist (Sweden), L. Boithias (France), F. Fedi (Italy), M.P.M. Hall (UK), and that representatives be designated by the other URSI Commissions whose activities are relevant to the work of CCIR and CCITT.

4. Review of Radio Science

The Vice-Chairman, Editor for Commission F in the past triennium, expressed his sincere thanks to the members of the Commission for their cooperation.

Commission F resolved (1) to appoint the incoming Vice-Chairman Editor for the next issue of *Review of Radio Science*; (2) to ask the new Editor for Commission F to circulate within the Commission the complete list of references provided by the various members.

5. Scientific Activities in the Past Triennium

The Chairman expressed his satisfaction for the intense activities of Commission F during the past triennium and thanked the organizers of the four successful symposia held in this period. The particular attention given in these activities to applications to remote sensing was noted.

6. Inter-Commission Coordinating Group on Remote Sensing (ICCGRS)

After having considered the report of the ICCGRS submitted by Dr. J. Gower, Commission F recommended that the Inter-Commission Coordinating Group be maintained for the next triennium; that D. Gjessing (Norway) and J. Gower (Canada) be included in the ICCGRS as representatives of Commission F; that the Chairman of the ICCGRS be one of the two Commission F representatives; that a maximum of two representatives be designated by each of the interested Commissions.

7. Title and Terms of Reference of Commission F

Commission F considered the report of the Working Group composed of R.K. Crane and P. Delogne (Co-Chairmen), D. Groom and F. Fedi. It was felt that the present title of the Commission: "Remote Sensing and Wave Propagation: Neutral Atmosphere, Oceans, Land, Ice" decided by the Council at the XX General Assembly in Washington, D.C. (1981) was inadequate since it could give the impression that the task of Commission F was to study remote sensing and, incidentally, its relation with wave propagation. The Commission recommended the adoption of a new title: "Wave Propagation in Neutral Media (with application to remote sensing and communications)". This title would reflect the fact that Commission F, as part of URSI, was mainly concerned with wave propagation. The terms between brackets indicate the two main application fields of the studies of Commission F, written in the order of their present relative importance in the work of the Commission.

It was further agreed that the following terms of reference be adopted for the Commission:

- 1) To study all aspects of wave propagation at all frequencies in the non-ionized environment:
 - wave propagation over the Earth's surface;
 - wave propagation in, and interaction with, the neutral atmosphere;
 - wave interaction with the Earth's surface, oceans, land, ice;
 - wave propagation through, and scattering by, the subsurface medium;
 - characterization of the environment as it affects wave phenomena.
- 2) To encourage the application of the results of these studies, particularly in the areas of remote sensing and communications.
- 3) To develop the required cooperation with other URSI Commissions and other relevant organizations.

8. Scientific Activities in the Next Triennium

Considering the success of the symposia held in the past triennium as well as the leading role of Commission F in dealing with the study of wave propagation in non-ionized media, with particular emphasis to remote sensing and communications applications, the Commission recommended that the following symposia be held during the next triennium:

- Wave Propagation: Remote Sensing and Communications, to be held in 1986 with the following as organizers: R.K. Crane (Chairman), P. Delogne and F. Fedi;
- Microwave Signatures in Remote Sensing, to be held in 1986 or early in 1987 with the following as organizers: F. Eklund and A. Blomquist.

TITLES OF SCIENTIFIC SESSIONS

- Multiparameter Radar Measurements of Precipitation - Recent Results and Highlights of Commission F Symposium in the United Kingdom, August 1982.
Chairman: M.P.M. Hall (UK)
- Clear Air Effects on Wideband Transmission Systems
Chairman: J.P. Mon (France)
- Wave Propagation in Remote Sensing - Recent Results and Highlights of Commission F Symposium in Belgium, June 1983.
Chairman: A. Guissard (Belgium)
- Frontiers of Remote Sensing of the Oceans and Troposphere - Recent Results and Highlights of Commission F Symposium in Israel, May 1984
Chairman: J. Goldhirsh (USA)
- Microwave Signatures in Remote Sensing - Recent Results and Highlights of Commission F Symposium in France, January 1984.
Chairmen: R.K. Moore (USA) and E. Schanda (Switzerland)
- Satellite Communications - Signal Transmission Impairment - Their Modelling and Amelioration (joint session).
Chairmen: G. Hyde (USA) and A. Viterbi (USA)
- Scattering and Radiation by Objects near Media Interfaces (joint session).
Chairman: Ch.M. Butler (USA)
- Time Domain Waveform Measurements (joint session).
Chairmen: N.S. Nahman (USA) and S.J. Halme (Finland)
- Waves in Geophysical Media (joint session)
Chairman: J.R. Wait (USA)
- Propagation in Random Media (joint session).
Chairmen: A. Ishimaru (USA) and F. Eklund (Sweden).

COMMISSION G - IONOSPHERIC RADIO AND PROPAGATION

Chairman: Dr. P. Bauer (France)

Vice-Chairman: Dr. J. Aarons (USA)

REPORT ON COMBINED BUSINESS MEETING OF COMMISSIONS G AND H

This combined meeting was convened to consider the actions to be taken in pursuance of Resolution U.13 adopted at the XX General Assembly (Washington, D.C., 1981) regarding the possible merger of Commissions G and H. It was chaired by Dr. C.G. Little, Chairman of the ad hoc Committee formed by the Council to report on the progress of merging the two Commissions.

Dr. Little outlined briefly the purpose of his Committee, and asked the Chairmen and Vice-Chairmen of Commissions G and H to express their views.

Dr. P. Bauer, Chairman of Commission G, put forward the case for merging and tabled two documents relevant to the case:

- (i) a note from the URSI Secretariat on the history of the merging proposal which goes back to the 1960's;
- (ii) the report prepared by the Chairmen of Commissions G and H on the period 1981-1984.

Dr. Bauer made the following points:

- a) The joint reporting of results in the fields of Commissions G and H over the past three years has been no problem, and will be seen from the *Review of Radio Science 1981-1983*. The report needed less space because duplication could be avoided.
- b) There have been no problems regarding the organization of meetings between the Assemblies. Commissions G and H have organized jointly 17 meetings, and have given particularly strong lead in 5 of these: Fairbanks, Hawaii, Lindau and 2 meetings on the International Reference Ionosphere.
- c) The organization of the General Assembly did not raise any problem either. At the Washington Assembly, there were 100 contributors in both Commissions, whereas this number had been increased to 274 in Florence, including papers for poster sessions and some papers presented in the Open Symposia on Active Experiments in Space Plasmas and on Data, Signal and Image Processing.

Dr. Bauer expressed some fears that, if no merging took place, Commissions G and H, in particular regarding the International Reference Ionosphere, could split into an 'applied' section (G) and a 'theory' section (H).

Dr. M. Petit, Chairman of Commission H, added that the programme for the Florence General Assembly had accommodated all the suggestions put forward in Washington by the members of Commissions G and H for scientific sessions and open symposia.

Dr. J. Aarons, Vice-Chairman of Commission G, stated that the excellent cooperation over the past three years between the Chairmen of Commissions G and H should be a model for the future, even if it were decided not to merge the two Commissions.

He considered that the important problem was that of the size, but that there seemed to be little argument regarding the very close links between Commissions G and H. He proposed that there should be no merging, and added that, in the United States, the allegiance of scientists to Commissions was quite marked, with Commission H members attending the meetings of the American Geophysical Union, and those of Commission G attending URSI meetings.

Prof. R.L. Dowden, Vice-Chairman of Commission H, made the point that Commissions G and H have proved that they were able to work well as separate Commissions and, therefore, why take the risk of merging. He quoted the example of the Hawaii meeting, organized by Commission H, at which ULF (usually IAGA) and VLF scientists participated. The cooperation over the past three years showed that it was a good thing, but not necessarily that the fusion of the Commissions would be good.

Dr. Little invited the comments of the Official Members of the two Commissions and conducted a vote on the desirability of merging, the results of which were as follows:

	<u>Commission G</u>	<u>Commission H</u>
In favour	9	7
Opposed	6	3
No opinion	3	2
Absent	20	26

x x x x x

The report submitted to the URSI Council by the ad hoc Committee on the Merger of Commissions G and H is reproduced below:

The Committee considered the various submissions made to it, and also attended the joint and separate business meetings of the two Commissions that discussed the merger on 29 August.

After deliberation, the Committee concluded that, at the present time, there was no international consensus for a merger of Commissions G and H.

The Committee also identified that there is strong international agreement on the benefits of close cooperation between the two Commissions.

The Committee therefore recommends:

1. that URSI Commissions G and H be not merged at this time;
2. that the excellent cooperation during the past three years between the two Commissions be continued, and specifically that the Council instruct the Chairmen and Vice-Chairmen of Commissions G and H to cooperate on a continuing basis in:

- a) the planning of joint and separate inter-Assembly symposia,
 - b) the preparation of joint G/H triennial reviews for the *Review of Radio Science*,
 - c) the planning of joint and separate scientific sessions of the two Commissions at General Assemblies;
3. that, where Member Committees find it appropriate to identify a single individual to represent both Commissions, they are encouraged to do so;
 4. that at least one joint business meeting of Commissions G and H should be held at each General Assembly. In addition, where possible, individual business meetings of Commissions G and H should be held at non-conflicting times.

REPORT ON BUSINESS MEETINGS

1. Vice-Chairman for the period 1984-1987

The following were nominated for the position of Vice-Chairman of Commission G and their names were submitted to the Council in the order of preference indicated by the vote:

1. H. Rishbeth (UK)
2. S.J. Bauer (Austria).

Dr. Rishbeth was later elected by the Council as Vice-Chairman of the Commission.

2. Reports of Working Groups

2.1 Ionospheric Network Advisory Group (INAG)

Dr. W.R. Piggott presented the report published in the June 1984 issue of the *URSI Information Bulletin*. He retired as Chairman of INAG and received a standing applause for his considerable work for many years with INAG.

Prof. J.A. Gledhill was elected as new Chairman of this Working Group. He outlined the new organization of INAG. This name will stand in future for Ionosonde Network Advisory Group. The Executive Secretary will be R. Haggard (South Africa), replacing A.S. Rodger, and R. Conkright will continue as Publications Secretary. The terms of reference were modified to include those of IDIG.

2.2 International Digital Ionosonde Group (IDIG)

Dr. J.R. Dudeney announced the decision of this Working Group to dissolve and to merge with INAG. He presented a written report on the activities of IDIG, containing a proposed nomenclature for digital ionosonde data.

2.3 Southern Hemisphere Atmospheric Studies Group (SHAGS)

Prof. S. Radicella reviewed the progress in analyzing the results of the International South Atlantic Anomaly Campaign (ISAAC). This Group will be continued.

2.4 International Reference Ionosphere (IRI) (joint Working Group with COSPAR)

Prof. K. Rower reviewed the progress of the Working Group. The International Reference Ionosphere is available as a computer programme and a revised edition is expected to be issued in 1986. Prof. Rower resigned as Chairman and Dr. A.D. Danilov as Vice-Chairman. They will be replaced by Prof. L. Bossy as Chairman and Dr. Gulyaeva as Vice-Chairman.

2.5 Mapping of Characteristics at the Peak of the F2 Layer

A new Working Group on mapping, combining the theoretical and the empirical aspects, was established with Dr. K. Davies as Chairman, and C.M. Rush, N. Danilkin, N. Matuura, L. McNamara, K. Rower and P. Bradley as members.

2.6 Ionospheric Knowledge Needed to Improve Radiocommunications

Dr. C.M. Rush, Chairman of the Group, recommended dissolving this Working Group due to its lack of activity.

2.7 Incoherent Scatter

Dr. M.J. Baron, Chairman, and Dr. M. Blanc, Vice-Chairman, will be replaced by Dr. V.B. Wickwar and Dr. K. Schlegel respectively. Dr. Wickwar's recommendation that the Working Group should be joint with Commission H was accepted. A resolution will be proposed regarding the central data base for incoherent scatter data.

2.8 Panel on Southern Hemisphere Incoherent Scatter Facility (SHISCA II)

Prof. J.A. Gledhill, Chairman of the Group) stated that funds for study for possible establishment of a southern hemisphere facility were not available. It was decided to disband this Working Group and to merge its activities with the Working Group on Incoherent Scatter.

2.9 Studies of the Ionosphere Using Beacon Satellites

Dr. R. Leitinger, Chairman of the Group, stated that a meeting of the Working Group had been held in February 1983 in New Delhi, India, with representatives from over 20 countries attending. Some of the results of this meeting were published in a special issue of *Radio Science* (May-June 1984). Dr. Kersley will be replaced as Vice-Chairman by Dr. A. Wernik. Dr. J.A. Klobuchar will continue as the other Vice-Chairman.

Dr. Leitinger indicated that the Working Group was seeking actively cooperation with geodetic and radio astronomy applications groups.

3. Joint Working Groups

3.1 Joint URSI/ITAG Working Group on Wave Instabilities in Plasmas

Dr. Fejer will replace Dr. E.V. Fremouw as co-chairman for URSI Commission G. The Working Group will coordinate the 1987

meetings of IAGA and URSI regarding the activities of Commissions G and H.

3.2 *Joint Working Groups with Commission H*

The Commission accepted that the Working Groups on Active Experiments and on Computer-aided Plasma Wave Analysis be joint with Commission G.

4. Scientific Programme of the XXI General Assembly

Some general comments were made on the following items:

- The Call for papers was issued too late.
- The coordination among the conveners of sessions and symposia was inadequate.
- The posters were co-located improperly with the oral presentations.
- The session chairmen sometimes switched the order of the papers or changed the times of presentations without regard to parallel sessions.

5. Proposed Symposia for the Next Triennium

These are listed in Recommendation G.11 which appears on p.142.

6. Formation of an Advisory Group

Dr. P. Bauer turned the meeting over to Dr. J. Aarons, the incoming Chairman of Commission G. Dr. Aarons thanked Dr. Bauer for his excellent work as Chairman of the Commission, and announced that he had appointed an Advisory Group to assist him with Commission G matters. The members are: H. Rishbeth (incoming Vice-Chairman), P. Bauer (outgoing Chairman), K. Davies, S. Radicella and A. Wernik.

TITLES OF SCIENTIFIC SESSIONS

- Modelling of the ionosphere: application to radio systems
Conveners: C.M. Rush (USA); K. Rawer (FRG); A. Danilov (USSR).
- Plasma instabilities in the magnetospheres (joint session with Commission H)
Conveners: H. Oya (Japan); F.C. Michel (USA).
- Ionospheric plasma phenomena (joint session with Commission H)
Conveners: M. Baron (USA); D.T. Farley (USA).
- Active and passive radio techniques as diagnostic tools in the magnetosphere and ionosphere - Latest developments (joint session with Commission H)
Convener: R. Leitinger (Austria).
- Computer study and modelling of plasma and radio waves (joint session with Commission H)
Conveners: M. Abdalla (USA); H. Matsumoto (Japan); T. Sato (Japan).

COMMISSION H - WAVES IN PLASMAS

Chairman: Dr. M. Petit (France)

Vice-Chairman: Prof. R.L. Dowden (New Zealand)

REPORT ON COMBINED BUSINESS MEETING OF COMMISSIONS G AND H

This Report is reproduced on page 93.

REPORT ON BUSINESS MEETINGS

1. Vice-Chairman for the period 1984-1987

Dr. M. Petit, Chairman of Commission H, reported that, taking into account the confusion in the nomination procedure resulting from the project of merging Commissions G and H, Commission H was permitted by the Board of Officers to receive new nominations for the election of the incoming Vice-Chairman. Three more names were thus added to the two ones submitted prior to the Assembly.

Dr. H. Matsumoto (Japan) was elected with absolute majority as the first choice of the Commission. Dr. H. Benson (USA) was elected as the second candidate. Dr. Matsumoto was later elected by the URSI Council as Vice-Chairman.

2. Working Groups

The three existing Working Groups will remain active during the next triennium. However, Commission H would appreciate to see these Working Groups becoming inter-Commission Working Groups if Commissions C and G so wish. The Working Groups are as follows:

- Wave Analysis (joint with Commission C)
Co-chairman for Commission H: D. Jones (UK)
- Active Experiments (joint with Commission G)
Co-chairman for Commission H: R.L. Dowden (New Zealand)
- Computer-aided Plasma Wave Analysis (joint with Commission G)
Co-chairmen for Commission H: M. Ashour-Abdalla (USA) and
H. Matsumoto (Japan).

3. Proposed Meetings for the period 1984-1987

These are listed in Recommendation H.2 which appears on page 143.

4. URSI/IAGA Working Groups

The Commission recommended the continuation of the two joint Working Groups with IAGA, as follows:

- Passive Electromagnetic Probing of the Magnetosphere
Co-chairman for Commission H: U. Inan (USA)
- Wave Instabilities in Plasma
Co-Chairman for Commission H: T. Sato (Japan).

5. XXII General Assembly

Suggestions were made regarding topics for joint sessions and open symposia at the next General Assembly in Tel Aviv. It was felt, however, that the final decision on the programme of Commission H should be made at a later stage.

There was also a discussion concerning the organization and the duration of URSI General Assemblies.

TITLES OF SCIENTIFIC SESSIONS

- ULF and VLF waves
Conveners: J.W. Hughes (USA); A. Roux (France).
- Plasma instabilities in the magnetospheres (joint session with Commission G)
Conveners: H. Oya (Japan); F.C. Michel (USA).
- Ionospheric plasma phenomena (joint session with Commission G)
Conveners: M. Baron (USA); D.T. Farley (USA).
- Active and passive radio techniques as diagnostic tools in the magnetosphere and ionosphere - Latest developments (joint session with Commission G)
Convener: R. Leitinger (Austria).
- Computer study and modelling of plasma and radio waves (joint session with Commission G)
Conveners: M. Abdalla (USA); H. Matsumoto (Japan); T. Sato (Japan).

COMMISSION J - RADIO ASTRONOMY

Chairman: Prof. V. Radhakrishnan (India)

Vice-Chairman: Dr. R. Wielebinski (FRG)

REPORT OF THE CHAIRMAN

Activities 1981-83

A Symposium on Measurement and Processing for Indirect Imaging, sponsored by URSI and co-sponsored by IAU, was held in Sydney, Australia from 30 August to 2 September 1983. It was attended by 115 delegates from 11 countries. The Proceedings of the Symposium will be published by the Cambridge University Press (Editor: Dr. J. A. Roberts).

Review of Radio Science 1981-83

The Chairman compiled a report from various national reports received from respective representatives and sent it to Prof. Bowhill. Twenty countries sent in their reports. The typed version of the report of Commission J was about 35 pages long, including references. Thanks are due to all those Official Members who responded to the Circular, to N. V. G. Sarma and to the Library of the Raman Research Institute for much help in compiling it.

Commission J Internal Report; Review of Radio Astronomy 1981-83

As for the past two General Assemblies, Commission J has again brought out its Internal Report *Review of Radio Astronomy 1981-83*. Again, this is a collection of various Member Committees' reports and thanks are due to those Official Members who responded to the circular. As can be seen in the Preface to the Review, in the case of those Member Committees who were not willing to put in the additional effort of contributing to this report, we have just retyped/reproduced the report sent by them for the preparation of *Review of Radio Science*.

This Review has been published with partial support from the URSI, and the Raman Research Institute. Copies will be on sale and can be obtained at the price of US\$7 per copy.

Inter-Commission Working Group on Time Domain Waveform Measurements

Dr. R. J. Fisher was requested to represent Commission J on the Inter-Commission Working Group on Time Domain Waveform Measurements.

Environmental Consequences of Nuclear War (ENUWAR)

Dr. R. Wielebinski, the present Vice-Chairman of Commission J, was requested to represent the Commission on this Committee.

International Symposium on Millimeter and Sub-Millimeter Wave Technology, Granada, Spain

This Symposium, sponsored by URSI and co-sponsored by IAU, will be held from 11 to 14 September 1984 at Granada, Spain. The Chairman is on the Organizing Committee.

URSI Open Symposium 4

As Commission J is obviously interested in this Open Symposium on Data, Signal and Image Processing, Dr. R.H. Frater was requested to act as one of the Conveners.

Unwanted Effects of Man's Activities

As decided in 1981, Dr. R. Wielebinski participated in the discussion group and attended the meeting held during the Washington General Assembly. The present representative is Dr. J.W.M. Baars.

REPORT ON BUSINESS MEETINGS

Chairman: Prof. V. Radhakrishnan

Present: Some 60 members of Commission J

1. Chairman's Report

The Chairman presented his report on the various activities of Commission J over the past three years.

2. Election of Vice-Chairman

The names of the candidates proposed by correspondence prior to the Assembly were announced. The result of the vote for the Vice-Chairman was as follows, in order of preference:

- i. Prof. R.H. Frater (Australia)
- ii. Prof. M. Tiuri (Finland).

3. Membership of the FAGS Council

Commission J was asked to nominate a representative on the Council of the Federation of Astronomical and Geophysical Services. The Chairman nominated R. Wielebinski. This was approved by acclamation.

4. Editor of *Review of Radio Science*

The Chairman explained the situation with the editing of Commission J report for the *Review of Radio Science*. The question of duplication of information in the separate Commission J Report (available for sale) and the printed Review (also available during the General Assembly) was discussed. R. Wielebinski, Vice-Chairman, felt that, in view of the speed of publication of the *Review of Radio Science*, a separate report may not be necessary. W.N. Christiansen suggested that the Vice-Chairman should be, in future, the Editor. After some discussion, the Chairman nominated R. Wielebinski as the next Editor for Commission J. This was approved by acclamation.

5. Project VEGA

J.W. Findlay presented a report on the problems arising out from the use of an allocated (passive) radio astronomy band at 1660 MHz for active space transmissions in the framework of project VEGA.

He also mentioned that IUCAF had made a recommendation dealing with this problem, which will be presented to the Council. All the members of the Commission expressed their concern over the use of passive bands for this experiment. During the discussion on this subject, W.N. Christiansen suggested that Commission J should take the responsibility of protecting the radio astronomy bands. Pankonin wanted the Directors of the various Institutes to be informed in place of the project managers for more effective control.

Commission J approved the resolution on interference protection prepared by Prof. Christiansen et al. This Resolution was later adopted by the Council of URSI (see Resolution U.16 on page).

6. Other Business

J. Baldwin (UK) suggested that astronomers should make maps using epoch 2000 coordinates. After some discussion it was proposed to leave this matter to the International Astronomical Union.

W.N. Christiansen felt that Commission J was not having enough symposia between the General Assemblies, e.g., 1 or 2 as compared to 4 or 5 for some other Commissions. Morimoto announced the availability of NRO to outside astronomers, preferably with Japanese collaboration.

TITLES OF SCIENTIFIC SESSIONS

- Radio astronomy at metre and decametre wavelengths
Conveners: W.C. Erickson, A. Boischot.
- Radio science studies of comets
Convener: W.M. Irvine.
- Problems affecting low-frequency radio astronomy measurements
 - a) Ionospheric effects
Convener: T. Hagfors
 - b) Interference identification and elimination
Convener: J.R. Fisher
- Recent advances at various observatories
Conveners: V. Radhakrishnan, R.J. Wielebinski, G. Setti.
- Tutorial session on Quasi-optical techniques at mm and sub-mm wavelengths
Speaker: P.F. Goldsmith.

INTER-COMMISSION WORKING GROUPS

INTER-COMMISSION COORDINATING GROUP ON REMOTE SENSING (ICCGRS)

This group was brought into being to improve coordination among URSI Commissions in the field of remote sensing, and hence to prepare for future coordination with IUGG and other bodies on the "user" side of remote sensing in a proposed Inter-Union Commission on Remote Sensing (IUCRS).

The earlier Inter-Union Commission on Radio Meteorology (IUCRM), formed between URSI and IUGG to explore radar and other microwave techniques in meteorology, became known for bringing users and sensor specialists together in a very successful series of meetings that combined formal presentations with extended informal discussion periods. The subjects of the meetings progressed from meteorology, through radar oceanography and on to general space oceanography. These changes occurred faster than the Commission's title could keep pace. URSI and IUGG decided to terminate the IUCRM in 1981, and URSI has since led attempts to form an IUCRS as an acceptable follow-on.

"IUCRM" meetings have in effect continued, the latest being in Sendai, Japan, 19-25 July 1984 on "Wave breaking, turbulent mixing and radio probing of the ocean surface", which followed naturally from the similar meeting, with nearly identical title, in Miami in 1981 and which was sponsored by most of the same bodies, URSI among them.

The Inter-Commission Coordinating Group on Remote Sensing took an active part in the period 1981-1984 in communicating plans and timing of various remote sensing meetings in that period, and making recommendations for URSI sponsorship. Further activities waited on the formation of the proposed IUCRS. Among these meetings were:

- IAMAP Symposium 15 (Climate), Fed. Rep. of Germany, Aug 1983;
- IGARSS 1983, USA, Aug 1983;
- Spectral signatures, France, Sept 1983;
- COSPAR Symposium 4 (Climate), Austria, June 1984;
- Radar probing of oceans, Japan, July 1984.

In addition to those meetings, Commission F of URSI organized meetings on:

- Wave propagation in remote sensing, Belgium, June 1983;
- Microwave signatures in remote sensing, France, Jan 1984;
- Remote sensing of oceans and troposphere, Israel, May 1984.

Together with national and regional conferences, and the international series (IGARSS and Ann Arbor Symposia), these add to a relatively large number of remote sensing meetings.

In correspondence, members of the ICCGRS made several suggestions as to how URSI should procede, with the most generally agreed points being as follows:

1) Discussions of remote sensing as a technique are of wide interest to users as well as to specialists of em wave propagation sensor and signal processing. URSI can therefore afford to press ahead, even without IUGG involvement, to "give remote sensing a home", as is being done by the successful work of Commission F, for example.

2) Other groups, notably COSPAR and IEEE, have the same interest. Some means of cooperation, to avoid clashes and to enhance meetings, should be found. We have contacts with both groups. We should foster contact and cooperation with these groups and others within ICSU and elsewhere.

3) Exchange of information on meetings should be improved. A newsletter (IEEE APS) or the International Journal of Remote Sensing could be used, and perhaps there should be a central coordinator. This communication should be extended to cover IUGG and other Unions and groups.

4) URSI should cover the scientific and technical problems of remote sensing data interpretation while still leaving the actual applications to the users community, e.g. as covered by the Ann Arbor Symposia series.

5) The Coordinating Group should be continued for the next three years to provide communication and coordination as to timing, topic and location of meetings relevant to remote sensing. The Chairmen of Commissions are requested to provide input on meetings to the Coordinating Group as early as possible, and to work to avoid any clashes thus identified (the present ICARSS/URSI clash was noted as a particularly unfortunate example).

6) Commissions are asked to provide members for the Group, preferably two per Commission.

7) The Coordinating Group wishes to nominate the following two candidates for Chairman for the next 3 years, 1984-87, J. Gower (Canada), D. Gjessing (Norway).

8) The Coordinating Group recommends for URSI sponsorship the following remote sensing meetings which cover interests of more than one Commission:

1. Passive microwave measurements of ocean/atmosphere parameters: outlook for the future.

This meeting would focus specifically on the technical potential of microwave instruments, which are currently being rather neglected in favour of the infrared. Some review of infrared capability and discussion of joint systems will also be needed. The recent decision to put a 4-meter antenna, low-frequency microwave radiometer on NROSS makes this topic timely.

Suggested time and location are to fit with, but be separated from, the ICARSS 85 meeting in October 1985. A workshop/study atmosphere is needed.

Commissions F, E and G.

2. Problems of applying HF radar techniques to surface based mapping of ocean and ice properties, and to ship location.

Ionospheric problems have led to the use of long range techniques. URSI Commissions B and G should be able to help here. We recommend this as a special topic at the North American URSI/IEEE meeting in Vancouver, BC, Canada, June 1985.

Commissions B, F and G.

3. Microwave signatures in remote sensing.

This would be a follow-on to the very successful meeting in Toulouse, France. It should logically be held in 1986 and Sweden has been proposed as host country. Recommended sessions include inverse methods, and propagation effects through the ionosphere.

Commissions F, B and G.

9) We recommend that URSI include an Open Symposium on Remote Sensing at the 1987 General Assembly in Tel Aviv. Such a meeting could be timely in that it could include sessions on the several new satellites and instruments due to be launched in 1988-90. We understand that ICARSS would be held in North America in that year.

10) The Coordinating Group was informed of the series of "digital image processing" meetings held every 3 years in Florence, and to be sponsored by Commission C in the future. The next of these starts immediately after the URSI General Assembly in the same building. The 1987 meeting will follow the 1987 Assembly in Tel Aviv. Since these meetings contain several sessions relevant to remote sensing, we recommend that this close link be maintained.

11) The Coordinating Group noted that, at the Venice meeting on Oceanography from Space in 1980, sponsored by COSPAR, SCOR and IUCRM and attended by several ICCGRS members, it was suggested that a similar meeting should be held at this location in 1990. It now appears that such a date will be extremely timely in that many new ocean-related instruments will then have just been launched. The Group recommends that URSI keep this idea in mind in its long-range planning.

J.F.R. Gower
Chairman, ICCGRS

INTER-COMMISSION WORKING GROUP ON TIME DOMAIN
WAVEFORM MEASUREMENTS

The Inter-Commission Working Group on Time Domain Waveform Measurements was created in 1981 on the proposal of Commission A.

The Working Group organised two review paper scientific sessions during the General Assembly in Florence. These were well received with an attendance for each paper ranging between 50 and 80 attendees.

The Working Group established its agenda for the next triennium.

For the 1987 General Assembly to be held in Tel Aviv, Israel, the Working Group recommended to the Council that:

1. An Open Symposium on Time Domain Waveform Measurements be organized by the Working Group;
2. Joint sessions devoted to review papers, be organized by the Working Group;
3. URSI provide financial assistance for publicizing the Open Symposium.

N.S. Nahman
Chairman, IWG/TDWM

INTER-COMMISSION WORKING GROUP FOR COORDINATION OF URSI
ACTIVITIES AT OPTICAL WAVELENGTHS FOR COMMUNICATION,
SENSING AND PROCESSING
(Preliminary Report)

An analysis of all the presentations at the 1984 General Assembly shows that the bulk of papers (17) on optical techniques were in Commission D sessions and the next largest number (6) in the joint session on Optical Fibre Measurements (Commissions A, B and D).

It is proposed, therefore, that the division of optical topics among the Commissions should be broadly as follows:

Commission A

The development of standards of measurement of optical quantities and related factors, and the use of optical techniques in metrology. It is clear that other Commissions will be interested in measuring properties of devices, components and systems, as indicated below.

Commission B

This Commission deals mainly with the theory of guided and unguided optical waves.

There is a potential overlap with Commission D on optical waveguides, which is best solved by discussion and coordination.

Commission C

Commission C covers signals and systems at all frequencies, including optical frequencies.

It is concerned with the design, properties, measurement and application of optical systems, such as telecommunication networks, local-area networks, as well as sub-systems, and the associated coding theory, reliability, networks and information theory.

Commission D

Commission D deals with devices for the production, transmission and detection of optical radiation, in communication sensing.

These devices will include, but will not be limited to, incoherent sources and lasers; integrated optical circuits, optical fibres, micro-optics and other optical waveguides; devices for modulation, switching and otherwise processing optical radiation; single detectors, detector arrays and opto-electronic displays.

Commission D will be concerned with research on new materials and structures; the technology of fabrication of devices, as far as this influences applications in the broad field of radio science; and with the characterization and measurement of optical devices and circuits.

Commission D is obviously interested in the application of optical devices and techniques to systems of all kinds and should collaborate with other Commissions on joint programmes on relevant topics.

Commission F

Commission F covers remote sensing by optical (and of course other) means and deals mainly with remote sensing systems but also with particular remote sensing optical components. So far there has been no overlap with other Commissions on optical techniques. Commission F may be particularly concerned with the propagation of unguided optical waves in the atmosphere and space.

W.A. Gambling
Chairman.

REPORTS ON ACTIVITIES OF INTER-UNION ORGANIZATIONS

INTER-UNION COMMISSION ON FREQUENCY ALLOCATION FOR RADIO ASTRONOMY AND SPACE SCIENCE

by

J.W. Findlay, Chairman

From September 1983, the Secretary of the Inter-Union Commission on Frequency Allocation for Radio Astronomy and Space Science (IUCAF) has been Dr. A.R. Thompson, a radio astronomer at the NRAO, Charlottesville, Virginia, USA. Dr. F. Horner, the previous Secretary, remains a member of IUCAF, representing COSPAR.

Discussions on the future role of IUCAF have led to the conclusion that it should broaden its activities in Earth sensing by both passive and active techniques. Hitherto, the associated frequency allocation and interference problems have been studied mainly in the space research context, but there are few aspects which are not common to the Space Research and Earth Exploration Satellite services, and it is appropriate that studies should embrace both. To this end a new member, Mr. S. Hieber of ESA Headquarters, has been appointed as a COSPAR representative on IUCAF. He replaces M. M. Thué, who has given valuable service over many years but who has resigned in order to devote more time to his other international commitments. Mr. Hieber has a special interest in the use of satellites for geodesy and geodynamics, and both COSPAR representatives will be giving close attention to the problem of earth sensing on frequencies which are, in some bands, shared with other services. It is evident that these matters will become of increasing interest in a wide range of scientific disciplines. There has been one other change in IUCAF membership. At its 1982 General Assembly, the International Astronomical Union (IAU) appointed Dr. G. Swarup, a radio astronomer in India, to replace Dr. G. Westerhout of the USA, who has been a most active member for several years. At a time when many radio astronomers are extending their observations to higher frequencies, Dr. Swarup's expertise and interest in the lower frequencies will help the Commission to maintain a balanced programme of work.

With the above changes, the membership of IUCAF becomes

Dr. J.W. Findlay (URSI, Chairman)
Dr. A.R. Thompson (Secretary)
Dr. B.J. Robinson (URSI)
Dr. R. Schilizzi (IAU)
Dr. G. Swarup (IAU)
Dr. F. Horner (COSPAR)
Mr. S. Hieber (COSPAR).

Mr. R.C. Kirby (CCIR) and Mr. P. Kurakov (IFRB) continue as advisors. Among the matters scheduled for discussion during the XXI General Assembly of URSI will be the effects on radio astronomy of

the increasing number and radio power of satellites and space probes. The Commission will also plan its work during the next three years in view of the forthcoming World Administrative Radio Conference on access to the geostationary orbit to be held in 1985-1988.

FAGS AND THE PERMANENT SERVICES

FAGS COUNCIL

by

C.M. Minnis, Representative of URSI

A. General

At the present time, nine Services constitute the Federation of Astronomical and Geophysical Services (FAGS). Each Service operates under a Directing Board which includes representatives of the interested Unions, and the Director of the Service itself. URSI is directly concerned, together with IAU and IUGG, only with the Bureau International de l'Heure (BIH) and the International Ursigram and World Days Service (IUWDS). IAU and IUGG are concerned respectively with four and eight Services.

The necessary accommodation and many other facilities required by the Services are provided by the national laboratories or observatories in which they are located; for example, the Paris Observatory (BIH and IUWDS) and De Bilt (Geomagnetic Indices). However, expenditure incurred by the Services cannot be provided entirely from national sources, and it is essential that each Service shall receive an adequate annual grant from the FAGS Council.

The three Unions and ICSU are represented in the FAGS Council which meets annually and makes decisions on the size of the grant to be made to each Service. Unfortunately, the increasing number of Committees and other bodies created by ICSU in recent years has resulted in decreases in the grants made by ICSU to FAGS. These decreases have been partially compensated by the grants made to FAGS by the Unions. However, the Unions cannot be expected to provide the whole amount required (\$60,000 approximately per year).

Representations on the importance of the work of the Services have been made to the President of ICSU by the Secretaries General of the Unions. It is hoped that, as a result, ICSU will increase its grant in 1984.

URSI has suggested that each Union should make a grant proportional to the total grants made to the Services in which it is interested. At present the IAU and IUGG grants are insufficient on this basis, given that the URSI grant for 1984 is \$2,000.

URSI is at present represented in the FAGS Council by Dr. Ribes (President of the Council) and Dr. Minnis. On the expiry of Dr. Ribes' term of office as President, URSI will again be responsible for

providing the Secretary of the Council. Consideration should be given to this when the future URSI representatives in the FAGS Council are designated by the URSI Council.

B. FAGS Council Meeting, Brussels, May 1984

The ICSU Scientific Priorities Committee will consider the financial needs of FAGS during the Assembly in Ottawa.

In view of the intended withdrawal of the USA from UNESCO, the grant payable to ICSU in 1985 is expected to be much less than in recent years. The grant from ICSU to FAGS will most likely also be decreased.

In 1984, the funds available to the FAGS Council are

	£
ICSU	40,000
IUGG	8,000
URSI	2,000
IAU	2,000
	<u>£52,000</u>
	<u>£52,000</u>

The grants payable to the Services in 1984 are

	£(000)
IPMS	6.8
BIH	11.0
QBSA	5.1
ISGI	1.5
PSMSL	7.9
BGI	5.0
ICET	6.7
IUWDS	1.2
PSFG	4.0
Contingency Reserve	2.8
	<u>£(000) 52.0</u>
	<u>£(000) 52.0</u>

The delays incurred and the high cost of printing booklets of tabulated data can no longer be justified in many cases, and the Services will be encouraged instead to make data available on magnetic tape. Print-outs would be kept for archival purposes in the WDCs.

The Centre for Stellar Data and the Sunspot Index Data Centre have applied through IAU for membership of FAGS. It was agreed that IAU should be invited to provide funds at least temporarily for these Services until increased grants can be obtained from ICSU or the Unions.

A FAGS Workshop will be organized in 1985 at which the Directors and other individuals will be able to compare notes and exchange views on the treatment of astronomical and geophysical data.

INTERNATIONAL URSIGRAM AND WORLD DAYS SERVICE

by

P. Simon, Director

The IUWDS is a permanent service of URSI, in association with IAU and IUGG. According to its terms of reference, the International Ursigram and World Days Service "aims to provide information rapidly to the world scientific community to assist in the planning, coordination and conduct of scientific work in relevant disciplines".

Two basic mechanisms have been selected to accomplish this programme:

1) The International Geophysical Calendar

Programmes of coordinated observations are currently organized under the leadership of IAU, IAGA, URSI, WMO or SCOSTEP. The related programmes and their schedules are summarized in this calendar which shows the designated "World Days" and "World Geophysical Intervals" in the following fields: Meteor showers, Airglow and aurora phenomena, Atmospheric electricity, Geomagnetic phenomena, Ionospheric phenomena, Meteorology, Solar phenomena and Space research. For the Middle Atmosphere Programme running from 1982 to 1985, a special Middle Atmospheric Dynamic Calendar has been published.

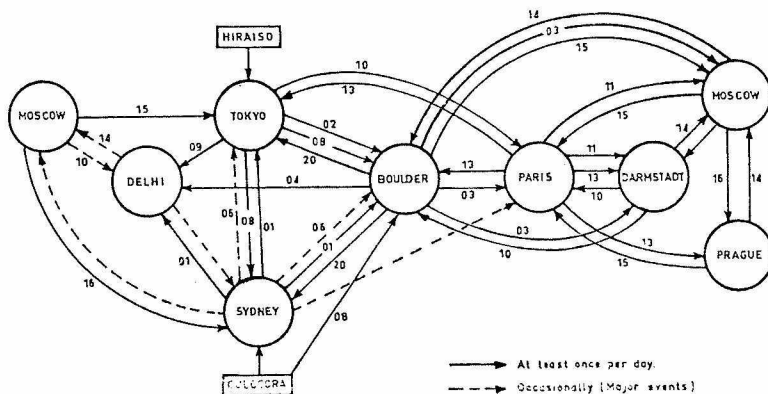
Each year, a new calendar is edited taking into account both the new programmes and the dates of natural phenomena such as the New Moons and the Solar Eclipses. The International Geophysical Calendar and the Middle Atmospheric Dynamic Calendar are printed in several relevant publications and 2,000 copies are distributed free of charge in most of the countries.

2) The International Ursigram Service

The last pieces of information available in the field of the solar-terrestrial physics are distributed daily by 9 Regional Warning Centres operating respectively at Boulder (USA) (the World Warning Agency), Darmstadt (FRG), Moscow (USSR), New Delhi (India), Paris (France), Praha (Czechoslovakia), Sydney (Australia), Tokyo (Japan) and Warsaw (Poland): all these Regional Warning Centres cooperate in the framework of the IUWDS. More than one hundred solar and geophysical observatories as well as several space experiments supply by telex and telephone their RWC with daily and prompt reports. Then the RWCs prepare their daily data and forecast messages that they distribute promptly, on one side, to the interested scientists or technicians, and on the other side, to the other RWCs according to an established schedule.

Outstanding events such as large flares, solar proton arrivals and large geomagnetic storms are immediately reported in high priority messages. This network also contributed to the prompt circulation of special messages devoted to the coordination of world-wide programmes such as the last Solar Maximum Year. The Service is also involved in a prompt circulation of the International Relative Sunspot Number (monthly) and of Antipodal Geomagnetic Index (weekly) both by contributing to a prompt gathering of the related data and to

the prompt distribution of the preliminary values of these indices: the IRSN is currently used in the radio communication forecast needed for the planning of the frequency allocation programme of the CCIR. The Boulder World Warning Agency prepares an abbreviated report named "Geoalert" which is widely distributed through the World Meteorological Service and printed monthly in the *Solar Geophysical Data* by the WDC-A for STP (Boulder, USA).



The total number of recipients of these various categories of messages is of the order of several hundreds: this number is moving according to the number of programmes in progress, to the level of the solar activity and to the popularity of the Service.

All the code formats and the scientific programmes for this Service are under the responsibility of the IUWDS Steering Committee which decides the printing of the Code Booklet (last edition 1973) and the updating of the Code sheets (1982). At each meeting, the RWC representatives report on the activity of their Centre and discuss the updating of the programmes. Since 1979, the Steering Committee acknowledged the usefulness of organizing special Workshops devoted to the forecasting techniques: the Second Solar Terrestrial Prediction Workshop will take place next June 1984 at Meudon (France).

Another important contribution of the IUWDS is related to the Space programmes: under the auspices of IUWDS and on behalf of COSPAR, the WDC-A for R and S (Greenbelt, USA) summarizes in the *Spacewarn Bulletin* the status of the satellite circulation around the Earth and of the space probes in the interplanetary medium: monthly are listed the recent International Designations, announced the next launchings, listed the spacecraft particularly suited for international participation, announced the satellite decays into the atmosphere and reported the actual decays. 600 copies of the *Spacewarn Bulletin* are distributed free of charge in all countries by the WDC-A for R and S (Greenbelt, USA).

THE BUREAU INTERNATIONAL DE L'HEURE

by

B. Guinot, Director

The BIH has been conceived in 1911 and became operational, officially, in 1920, with the task of unifying time over the world. This was accomplished during several decades by publishing the best estimates of the emission time of radio time-signals, in the astronomical time scale based on the rotation of the Earth and designated by Universal Time (UT1 in the present terminology).

When the results of atomic clocks began to be currently available (starting with 1955), the BIH has undertaken to establish an atomic time scale, which became the International Atomic Time, TAI, after the recognition by the 14th General Conference of Weights and Measures in October 1971.

In the present situation, the unification of time is obtained

- by establishing TAI on the basis of readings of a large number of atomic clocks;
- by publishing the corrections to be added to the readings of the master clocks of time services in order to get TAI.

The evolution of this activity during the last three years will be described thereafter. But we wish first to recall that the traditional activity on the evaluation of UT1 at BIH was maintained and even considerably developed by the extension to the variable coordinates of the pole of the Earth. The continuing need of knowing the orientation of the Earth in space, both for geophysical research and technical applications (especially in space sciences) led to new measurement methods based on space geodesy techniques. The understanding of the discrepancies of the data of various sources, the attempts to an optimum combined evaluation, the geophysical interpretations are an important activity of BIH, officially recognized by the IAU and the IUGG, which entrusted the BIH with the task of general coordination in the framework of their international programme MERIT.

But it is clear that the two activities of BIH on atomic time and on the Earth's rotation are increasingly divergent, and that a change of structure of the service is unavoidable.

Current evaluation of TAI

No changes have been brought to the general method of establishment of TAI.

- (a) A stability algorithm based on the data of 185 (January 1984) cesium clocks produces an intermediate time scale EAL.
- (b) The duration of the scale unit of EAL is estimated according to the data of frequency standards having accuracies of the order of 10^{-13} or better (these standards have been built by NBS, NRC (four), PTB; except for NBS, they are in quasi-continuous

operation as "primary clocks").

- (c) TAI is derived from EAL by applying an intentional frequency offset, in order to keep the agreement with the above frequency standards.

The computations are made every month and published in the BIH monthly Circular D, under the form of corrections to the master clocks of 36 time services (in January 1984). In practice these data are referred to the UTC time scale which differs from TAI by an integral number of seconds. The delay of availability ranges from one to two months.

The accuracy of the reading of TAI is limited by the accuracy of the comparisons between distant clocks. For the laboratories linked between themselves by GPS/NAVSTAR (see below), the uncertainties should be less than 50 ns (this is probably a conservative statement but we still lack of experience concerning the accuracy of this method). For the laboratories linked by LORAN-C and television the uncertainties are of the order of a few 0.1 μ s.

The accuracy of the scale unit of TAI is such that it should not differ from the SI second at sea level by more than 1×10^{-13} s, on averages extended over several months.

The long term stability (over several months and more) is of a few 10^{-14} .

Researches and improvements

Time comparisons. Use of GPS/NAVSTAR

At the beginning of 1984, 7 laboratories are equipped with GPS time receivers: National Bureau of Standards NBS, US Naval Observatory USNO, Paris Observatory OP, Van Swinden Laboratorium VSL, Technische Universität Graz TUG, Physikalisch-Technische Bundesanstalt PTB, Tokyo Astronomical Observatory TAO. Several of these receivers have been made and lent by the NBS. In particular, the BIH received one of these instruments which is operated jointly by BIH and the Laboratoire Primaire du Temps et des Fréquences at OP.

The instruments are used in the common view mode (Allan D.W. and Weiss M.A., *Proc. 34th Ann. Freq. Control Symp.*, Fort Monmouth, May 1980).

The data are stored in GE Mark III files where they can be accessed by users. In some cases, the direct reading of the memory of the receivers by telephone is employed. At BIH procedures have been developed for the computation of time differences and transfer to the local computer. In the long-distance clock comparisons, we observe discrepancies between the results of different satellites amounting typically to 10 ns. The agreement with the clock transportations seems to lie within the limits of uncertainty. An evaluation of the statistical properties of GPS time comparisons is in progress; at the present stage it appears that an accuracy of 10 to 20 ns for the ten-day averages used at BIH is achieved, which agrees with Allan and Weiss.

The consequences of the use of GPS on the BIH work are twofold.

- 1 - The worldwide coverage opened the participation of Far East laboratories to the evaluation of TAI, which are linked to TAO by the LORAN-C Northern Pacific chain. First, the UTC-UTC(i) published in Circular D were improved in June/July 1983 for the laboratories of China and Japan, then the clock data of these laboratories are progressively introduced in the computations.
- 2 - The GPS, together with the clock transportations, revealed discrepancies, typically of the order of $0.5 \mu\text{s}$ in the BIH results published in Circular D for 1983, based on LORAN-C. In the preparation of the BIH Annual Report for 1983, these discrepancies have been progressively removed.

Use of hydrogen masers

The BIH algorithm can accept the data of any type of clocks. In practice, only the data of Cs clocks have been used up to now. The data of a few hydrogen masers have been received and processed. However, they have not contributed effectively to TAI either because they do not extend over a sufficiently long period, or on account of frequency drifts. Nevertheless, we wish to receive the data of hydrogen masers and we expect to use them.

Seasonal variations

The observed annual variations between independent atomic time scales (with amplitude of the order of $1 \mu\text{s}$ or less) seem to be due partly to LORAN-C signals propagation, partly to some real variations of the rate of the industrial cesium clocks. Some progress is expected, in the study of this problem, from the GPS time comparison. An algorithm, with modelled annual variations of clocks is being prepared.

Algorithms

In view of improvement of the BIH algorithm, the Kalman filtering and the ARIMA model have been studied. But, the limitations of the present procedures seem mainly due to unmodelled non-random effects and to the uncertainties of the clock comparisons.

The only change which has been made was to favour the most stable clocks: it corresponds to a general improvement of the long term stability of the industrial cesium clocks.

Current operation of the UTC system

No difficulty was found in the prediction of the DUT1 values and of the date of occurrence of leap seconds. The excess of the duration of the day over 86400s, which was about 3 ms in 1971-1978, began to decrease in 1979, and is 2 ms in 1984.

Administration of the BIH

The BIH work on atomic time is made in cooperation with the Bureau International des Poids et Mesures (BIPM). The BIPM staff

comprises a physicist, working full time at BIH on TAI. The role of the BIPM, with regard to TAI, is being discussed when writing this report. It appears that, in any case, it will be strengthened.

At present the major contributor to the BIH costs is the Paris Observatory, which, with the help of the French Centre National de la Recherche Scientifique, provides the staff (except for the BIPM physicist), the housing, and covers most of the current expenses. A financial assistance is provided by the Federation of Astronomical and Geophysical Services.

The BIH enjoys a full cooperation of all the time keeping laboratories in the world. It is not possible to express individually thanks to all those who contributed in some way to our activity. Nevertheless, we wish to mention the help of NBS (loan of equipment) and USNO (loan of equipment, administration of world-wide computing networks, dissemination of results).

URSI OPEN SYMPOSIA IN FLORENCE

OS 1: INTERACTION OF ELECTROMAGNETIC FIELDS

WITH BIOLOGICAL SYSTEMS

This Open Symposium was held from 27 to 30 August 1985. It was organized by URSI Commissions A and B, in cooperation with the Bioelectromagnetics Society (BEMS), the International Radiation Protection Association (IRPA) and the Istituto Superiore di Sanita. The membership of the Steering Committee was as follows: S.W. Rosenthal (Chairman), P. Bernardi, M. Grandolfo, E. Postow and T.C. Rozzell.

The programme of the Symposium included the following sessions:

- Session 1 - Interaction of Electromagnetic Fields with Biomolecules
Co-chairers: W. Grundler and D.I. McRee
- Session 2 - Interaction of Electromagnetic Fields with Biomolecules
Co-chairers: F.S. Barnes and A. Checcucci
- Session 3 - Interaction of Electromagnetic Fields at Cellular Level
Co-chairers: A.J. Berteaud and C.F. Blackman
- Session 4 - Interaction of Electromagnetic Fields with Biological Systems
Co-chairers: C.K. Chou and H.R. Korniewicz
- Session 5 - Responses of Biological Systems to Electromagnetic Fields
Co-chairers: E.R. Adair and P. Vecchia
- Session 6 - Responses of Biological Systems to Electromagnetic Fields
Co-chairers: L. Millanta and R.D. Phillips
- Session 7 - Characterization of Exposures to Electromagnetic Fields
Co-chairers: J. Bach Andersen and S.W. Rosenthal
- Session 8 - Diagnostic and Therapeutic Uses of Electromagnetic Energy
Co-chairers: G. Mariutti and M.A. Stuchly
- Session 9 - Diagnostic and Therapeutic Uses of Electromagnetic Energy
Co-chairers: B.F.M. Bosnjakovic and T.C. Rozzell
- Session 10 - Safety Considerations and Standards for Electromagnetic Environments
Co-chairers: P. Bernardi and A.W. Guy
- Session 11 - Invited Review Papers
Co-chairers: M. Grandolfo and E. Postow.

OS 2: ACTIVE EXPERIMENTS IN SPACE PLASMAS

This Open Symposium was held on 30 and 31 August 1985. It was one of several symposia held by the URSI Commission H Working Group on Active Experiments, but the first held within an URSI General Assembly. The conveners were: R.L. Dowden, J. Fejer and P. Stubbe. Due to the limited time available (three half-day sessions) and to the large number of contributed papers, the organizers decided to devote two sessions to poster contributions introduced by pre-viewers, and one session to invited review papers. The programme included the following topics:

- Ionospheric modification by powerful HF waves
- VLF wave injection from the ground
- Wave injection from space vehicles
- Beam injection
- Neutral gas and plasma releases
- Rocket exhaust effects
- Unintentional man-made modification effects.

OS 3: RADIO TECHNIQUES IN PLANETARY EXPLORATION

This Open Symposium was held on 3 September 1985, under the joint sponsorship of URSI and of the ICSU Coordinating Committee on Moon and Planets (CCMP). The conveners were: K. Runcorn and W.J.G. Beynon. The objective of the Symposium was to review current and future developments in radio techniques for ground based and spacecraft planetary exploration. It included two sessions.

OS 4: DATA, SIGNAL AND IMAGE PROCESSING

The main objective of this Symposium, which was held on 4 and 5 September 1985, was to review and to examine primarily the techniques and problems associated with the reception and analysis of signals derived from multi-sensor arrays on the ground and in space. Two previous symposia in this series had been held at the URSI General Assemblies in Lima (1975) and in Helsinki (1978).

The Symposium was convened by J.L. Lacoume, D. Jones, K. Tsuruda and R.H. Frater. Its programme consisted of two major parts: Measurements with Sensor Array(s), and Methods of Analysis of Multi-Sensor Data. The titles of the sessions are given below:

- Session 1 - Tomography, Two- and Three-Dimensional Type Measurements
Chairman: D. Jones
- Session 2 - N-Dimensional and Non-Stationary Signal Analysis
Chairman: J.L. Lacoume

Session 3 - Space-Time Resolution, Maximum Entropy and other
Inversion Techniques

Chairman: R.H. Frater

Session 4 - Plasma Waves and VLF Emissions

Chairman: K. Tsuruda.

RESOLUTIONS AND RECOMMENDATIONS OF THE COUNCIL

U.1 Admission of Member Committees

The URSI Council,

considering

- (a) that the Post and Telegraph Department of Thailand has applied for membership of URSI in Category 1;
- (b) that the Chinese Institute of Electronics, Beijing, has applied for membership of URSI in Category 3;
- (c) that the conditions specified in Articles 2, 3 and 4 of the URSI Statutes are satisfied;

resolves to admit to membership of URSI, in Categories 1 and 3 respectively:

1. the Committee which will be formed under the auspices of the Post and Telegraph Department of Thailand;
2. the Committee which will be formed under the auspices of the Chinese Institute of Electronics, Beijing.

U.2 URSI Finances

The URSI Council,

noting the recommendations contained in the Report of the Standing Finance Committee, dated 3 September 1984;

resolves

1. to approve the audited accounts of URSI for the years ending 31 December 1981, 1982 and 1983;
2. to approve the Income and Expenditure Budgets given in Table I (model B modified) and Table II of this Report;
3. to adopt the unit contributions proposed in Table I of this Report, namely \$610 for each of the years 1985, 1986 and 1987;
4. to publish the Report of the Standing Finance Committee in the *Proceedings of URSI General Assemblies*, Volume XX;
5. in view of the fluctuations in the world economic situation, to authorize the Board of Officers to make annual budget corrections as appropriate.

U.3 Standing Finance Committee

The URSI Council

resolves to appoint the following as members of the Standing Finance Committee:

Dr. M. Petit (Chairman)
Prof. A.L. Cullen
Prof. F. Gardiol
Prof. S. Radicella
Prof. M.E. Zhabotinskij.

U.4 URSI Publications

The URSI Council,

noting the recommendations contained in the Report of the Publications Committee, dated 3 September 1984, regarding the future of the following publications of the Union:

- (a) *URSI Information Bulletin*,
- (b) *Proceedings of URSI General Assemblies*, Volume XX,
- (c) *URSI Brochure*,
- (d) *URSI Statutes*,
- (e) *Review of Radio Science*,
- (f) *INAG Bulletin*,
- (g) *International Reference Ionosphere*;

resolves

1. to accept these recommendations;
2. to publish the Report of the Publications Committee in the *Proceedings of URSI General Assemblies*, Volume XX.

U.5 Proposed Union of Commissions G and H

The URSI Council,

noting the recommendations of the ad hoc Committee set up to consider the actions to be taken in pursuance of Resolution U.13 adopted at the XX General Assembly (Washington, D.C., 1981);

resolves

1. that Commissions G and H be not merged at this time;
2. that the excellent cooperation achieved during the past three years between the two Commissions be continued, and specifically that the Chairmen and Vice-Chairmen of Commissions G and H be instructed to cooperate on a continuing basis in:
 - (i) the planning of joint and separate symposia in the intervals between General Assemblies,
 - (ii) the planning of joint and separate scientific sessions of the two Commissions at General Assemblies,
 - (iii) the preparation of a joint report on results for inclusion in *Review of Radio Science*;
3. that, where Member Committees find it appropriate to identify a single individual to represent them in both Commissions, they should be encouraged to do so;
4. that, at each General Assembly, Commissions G and H should hold at least one joint business session. In addition, where possible, individual business sessions of Commissions G and H should be held at non-conflicting times.

U.6 Commendation of Chairmen of Commissions G and H, 1981-84

The URSI Council

resolves to commend Drs P. Bauer and M. Petit, Chairmen of Commissions G and H respectively during the triennium 1981-1984, for the exemplary level of cooperation achieved during this period between the two Commissions.

U.7 Title and Terms of Reference of Commission F

The URSI Council,

noting the recommendations submitted by Commission F;

resolves

1. to change the title of Commission F to "Commission F - Wave Propagation and Remote Sensing";
2. to approve the following terms of reference for the Commission:
 - 1) to study all aspects of wave propagation at all frequencies in a non-ionized environment:
 - (i) wave propagation over the Earth's surface,
 - (ii) wave propagation in, and interaction with, the neutral atmosphere,
 - (iii) wave interaction with the Earth's surface, oceans, land and ice,
 - (iv) wave propagation through, and scattering by, the sub-surface medium,
 - (v) characterization of the environment as it affects wave phenomena;
 - 2) to encourage the application of the results of these studies, particularly in the areas of remote sensing and communications;
 - 3) to develop the required cooperation with other URSI Commissions and other relevant organizations.

U.8 Role of Commission D

The URSI Council,

considering that the role of Commission D can be twofold:

- (a) that of a service Commission to other Commissions of URSI, bringing to them information on the state of the art in electronic and opto-electronic technologies, as well as providing a prospective view of the progress in these technologies;
- (b) that of a Commission playing an active part in the progress of its own field;

resolves

1. that the role of service to other Commissions, traditionally adopted by Commission D, should be continued, thereby improving its impact on other URSI Commissions;
2. that Commission D should develop energetically its second role, in

order to increase its impact both inside and outside URSI, in particular by emphasizing its interest towards fundamental aspects, including the material aspects and physics of rapidly emerging technologies.

U.9 Committee on URSI Membership

The URSI Council,

considering that the efforts towards encouraging new Member Committees to join the Union should be pursued;

resolves to maintain the Committee on URSI Membership and to appoint the following as members:

Prof. S. Okamura (Chairman)
Prof. J.A. Gledhill
Prof. J. Oyinloye
Prof. S. Radicella
Prof. M. Rodriguez Vidal
Prof. A. Smolinski.

U.10 Committee on Future General Assemblies

The URSI Council,

considering the importance of the task devolved on the Committee on Future General Assemblies in seeking invitations from the Member Committees for the organization of the General Assemblies of the Union;

resolves to maintain the Committee on Future General Assemblies and to appoint the following as members:

Prof. V. Zima (Chairman)
Prof. R.L. Dowden
Prof. V. Kose
Prof. H. Tanaka.

U.11 URSI-CCIR-CCITT Liaison Committee

The URSI Council,

noting the recommendations made by the URSI-CCIR-CCITT Liaison Committee in order to further develop and improve the cooperation between URSI and the Consultative Committees of the International Telecommunications Union (ITU);

resolves

1. to accept these recommendations;
2. to express its appreciation to M. M. Thué, outgoing Chairman of the Committee, for his efficient leadership;
3. to maintain the URSI-CCIR-CCITT Liaison Committee and to appoint the following as members:

Chairman: Mr. G. Hagn
Past Chairman: M. M. Thué
Commission A: Prof. S. Leschiutta

Commission B: Prof. P.J.B. Clarricoats
Commission C: Dr. J.G. Lucas
Commission E: Prof. F.L. Stumpers
Prof. A.D. Spaulding
Commission F: Dr. F. Fedi
Dr. A. Blomquist
Dr. L. Boithias
Dr. M. Hall
Commission G: Dr. C. Rush
Commission J: to be designated.

U.12 Cooperation with CCIR and CCITT

The URSI Council,
considering

- (a) that one of the objectives of URSI is "to stimulate and coordinate studies of the scientific aspects of telecommunications using electromagnetic waves, guided and unguided";
- (b) that many results presented during URSI General Assemblies or symposia, or other symposia sponsored by URSI, in particular in review papers, may be helpful for the progress of the work of the CCIR and CCITT Study Groups;

invites the Member Committees of the Union, on the occasion of their national or regional scientific meetings or of specialized symposia with which they are associated, to encourage the preparation of contributions for CCIR and CCITT Study Groups (in collaboration with the authorized CCI national organizations if any), to be sent to the relevant CCI Secretariat through the General Secretariat of URSI.

U.13 Committee on Developing Countries

The URSI Council,
considering

- (a) the fruitful activities developed by the Committee on Developing Countries since its creation in 1981;
- (b) the programme proposed by the Committee regarding the organization of workshops and the preparation of handbooks designed for radio scientists in developing countries;
- (c) the proposal to establish an International Radio Measurement Instruments Exchange System for developing countries;

resolves

- 1. to commend the Committee for its work during the past triennium;
- 2. to maintain the Committee on Developing Countries and to appoint the following as members:

Prof. S. Radicella (Chairman)
Prof. S. Feng
Prof. J. Oyinloye
Dr. B.M. Reddy
Dr. A. Sadik
M. J. Voge.

U.14 XXII General Assembly 1987

The URSI Council,

noting

- (a) that in 1969, in 1972 and in 1975 the Israeli URSI Committee invited URSI to hold a future General Assembly in Israel;
- (b) that this invitation was renewed during the present Assembly with specific reference to the XXII General Assembly in 1987;

resolves to accept the invitation of the Israeli URSI Committee to hold the XXII General Assembly of URSI in Tel Aviv, Israel, during the period 24 August - 4 September 1987.

U.15 Invitations from India and New Zealand for XXII General Assembly

The URSI Council,

noting the invitations to hold the XXII General Assembly received from the URSI Member Committees in India and in New Zealand;

resolves to record its thanks to these Committees for their invitations.

U.16 Protection of Passive Radio Observations

The URSI Council,

recognizing the need for the protection of passive radio observations by the provision of interference-free bands;

noting that URSI, IAU and COSPAR have collaborated over many years in the Inter-Union Commission on the Allocation of Frequencies for Radio Astronomy and Space Science (IUCAF) in obtaining such bands by international agreement;

noting further with great regret that certain experiments have been planned in which transmissions will take place from space in one of these bands, and that these transmissions are likely, for example, to interfere with observations of OH emission from Halley's comet;

resolves, in view of the specific danger of interference to radio astronomy from space-based radio transmissions, to urge all those concerned in the design of experiments requiring radio transmissions from space to consult with IUCAF at the planning stage to ensure that the protection of sensitive passive radio observations which has been acquired through wide cooperation and with great effort is not jeopardised in the future.

U.17 The Vega Mission to Venus and Halley's Comet

The URSI Council,

noting

- (a) that the Vega mission is planned to use a transmitter emitting at about 1667.8 MHz, in the band 1660-1670 MHz allocated primarily to radio astronomy and space research for passive use only;
- (b) that the comet encounter makes the mission time-critical and that it is now too late to alter this frequency;

- (c) that scientists around the world need to be kept informed about this project in order to reduce the probability of interference with their observations;

resolves

1. to ask the Inter-Union Commission on the Allocation of Frequencies for Radio Astronomy and Space Science (IUCAF) to undertake the following tasks:
 - (i) to obtain from the project managers as much technical and operational information as possible on the planned transmissions on frequencies within the bands allocated for passive use by the Radio Astronomy and Space Research Services;
 - (ii) to arrange for scientists to be informed, e.g. by publications in the COSPAR, IAU and URSI Bulletins and by other means as needed, of possible cases where sensitive observations may be affected by these transmissions;
2. to urge the Member Committees of COSPAR, IAU and URSI to work with IUCAF as a consultative body when planning any active radio frequency usage in future scientific missions which may cause interference to passive observations.

U.18 Designation of Honorary President

The URSI Council,

considering that, in accordance with Art.47 of the URSI Statutes, it is authorized to confer the title of Honorary President on former members of the Board of Officers and Chairmen of Commissions who have made notable contributions to the achievement of the objects of the Union;

resolves to confer the title of Honorary President on Professor W.N. Christiansen in recognition of his major contributions to radio science and of his devoted services to URSI over many years.

U.19 Modification to URSI Statutes

The URSI Council,

considering

- (a) that the function of Secretary General of the Union is an honorary one;
- (b) that the work involved is too heavy for a scientist able to devote only part of his time to URSI;

resolves

1. to authorize the Board of Officers to designate an Assistant Secretary General, on nomination by the Secretary General;
2. to add to Article 37 of the Statutes the following sentences: "The Board is empowered to appoint, on nomination by the Secretary General, an Assistant Secretary General, who will serve from the date of his appointment until the end of the next ordinary General Assembly. The Secretary General may delegate some of his duties to

the Assistant Secretary General".

U.20 Inter-Commission Coordinating Group on Remote Sensing

The URSI Council,

noting the recommendations of the Inter-Commission Coordinating Group on Remote Sensing regarding

- (i) the improvement of cooperation with IUGG, COSPAR, IEEE and other interested bodies;
- (ii) the dissemination of information on meetings in the field of remote sensing;
- (iii) the coordination of remote sensing activities within URSI;

resolves to maintain the Inter-Commission Coordinating Group on Remote Sensing and to appoint the following as members:

Chairman:	Dr. J. Gower
Vice-Chairman:	Dr. D. Gjessing
Secretary:	to be nominated by Chairman
Commission B:	to be nominated by the Commission
Commission C:	Prof. F. Carassa
Commission E:	Dr. E.K. Smith
Commission G:	Dr. D.B. Jones
	Dr. C.L. Rino
Commission H:	Dr. R. Gendrin.

U.21 Inter-Commission Working Group on Effects of Human Activities on the Ionosphere and Magnetosphere, and on Telecommunications

The URSI Council,

noting the recommendations made in the Report of the Inter-Commission Working Group on Effects of Human Activities on the Ionosphere and Magnetosphere, and on Telecommunications;

resolves

1. to dissolve this Inter-Commission Working Group;
2. to appoint Prof. K. Rawer to act as a liaison between URSI and CCIR regarding problems which were specified in the terms of reference of the former Working Group.

U.22 Inter-Commission Working Group on Coordination of URSI's Activities at Optical Wavelengths for Communication, Sensing and Processing

The URSI Council,

noting the recommendations made by Prof. W.A. Gambling, Chairman of the Inter-Commission Working Group on Coordination of URSI's Activities at Optical Wavelengths for Communication, Sensing and Processing, regarding the future activities of the Working Group;

resolves to maintain this Working Group for the following triennium and to confirm Prof. W.A. Gambling as Chairman of the Working Group.

U.23 Inter-Commission Working Group on Time Domain Waveform Measurements

The URSI Council,

considering

- (a) the very successful scientific meetings organized by the Inter-Union Commission Working Group on Time Domain Waveform Measurements during the present General Assembly;
- (b) the recommendations made by Dr. N.S. Nahman, Chairman of the Working Group, regarding the future activities of the Working Group;

resolves to maintain the Inter-Commission Working Group on Time Domain Waveform Measurements for the following triennium with Dr. N.S. Nahman as Chairman and the same membership.

U.24 Joint Working Groups of Commissions G and H

The URSI Council,

noting the recommendations of Commissions G and H;

resolves to approve the following joint Working Groups of the two Commissions:

- 1. Incoherent Scatter
Chairman: Dr. V.B. Wickwar
Vice-Chairman: Dr. K. Schlegel;
- 2. Active Experiments
Chairman: Prof. R.L. Dowden;
- 3. Computer-aided Plasma Wave Analysis
Co-Chairmen: Dr. M. Ashour-Abdalla
Dr. H. Matsumoto.

U.25 Joint Working Group of Commissions C and H

The URSI Council,

noting the recommendations of Commissions C and H;

resolves to approve the following Joint Working Group of the two Commissions:

Wave Analysis
Chairman: Dr. D. Jones.

U.26 Vote of Thanks to Chairman of INAG

The URSI Council,

considering

- (a) that Dr. W.R. Piggott has been active, as Chairman of the Ionospheric Network Advisory Group (INAG), in supporting the operation of the network of ionospheric stations for more than 25 years;
- (b) that he is now retiring from this office;

expresses its warmest thanks to Dr. W.R. Piggott for his extraordinary services in aiding and supporting ionospheric stations and operators and, in general, the international community of radio science.

U.27 Greetings to the Institute of Electrical and Electronics Engineers, Inc.

The URSI Council,

salutes the Institute of Electrical and Electronics Engineers, Inc. on a century of progress that has transformed the way man communicates, engages in business, interacts socially - literally, the way man lives;

expresses its gratitude to IEEE for sixty-five years of fruitful collaboration with URSI, and

looks forward to continuing that experience in the exciting, rapidly changing world ahead.

U.28 Vote of Thanks to Italian URSI Committee

The URSI Council,

noting

- (a) the excellent facilities made available in Florence for the scientific and administrative sessions of the XXI General Assembly of URSI, and the Open Symposia associated with it;
- (b) the opportunities provided to the participants for visits to scientific institutions;
- (c) the programme of social events and visits to Museums arranged by the Organizing Committee for the participants and the accompanying persons;
- (d) the cordial hospitality shown to the participants and their families during the Assembly;

resolves to extend its warmest thanks and appreciation

1. to the Italian URSI Committee for the invitation to hold the XXI General Assembly in Florence and, in particular, to its President, Prof. C. Egidì;
2. to the members of the Organizing Committee for the successful completion of the detailed arrangements for the Assembly and, in particular, to Prof. V. Cappellini and to Prof. A.M. Scheggi, Chairman and Executive Secretary respectively of the Organizing Committee.

U.29 UNESCO Subventions

The URSI Council,

considering

- (a) that an important part of the activities of the Union consists of the organization of international scientific meetings, and the

issue of scientific publications;

(b) that the annual subventions received from UNESCO, via ICSU, are used to cover part of the cost of these activities;

resolves to convey to UNESCO the warm thanks and appreciation of the Union for the valuable support thus provided.

U.30 Young Scientists Programme

The URSI Council,

considering the importance of the Young Scientists Programme which enables young radio scientists from developing and developed countries to participate in the URSI General Assemblies by providing them with financial assistance;

resolves to record its thanks and appreciation to the following organizations which provided funds in support of the Young Scientists Programme:

- the United Nations Organization for Education, Science and Culture (UNESCO),
- the International Council of Scientific Unions (ICSU),
- the ICSU Committee on Science and Technology for Developing Countries (COSTED),
- the Italian URSI Committee,
- the Royal Society of London,
- the International Institute for Theoretical Physics in Trieste.

RESOLUTIONS AND RECOMMENDATIONS OF COMMISSIONS

COMMISSION A - ELECTROMAGNETIC METROLOGY

A.1 Transfer of TAI to BIPM

Commission A,

considering

- (a) that the present systems of International Atomic Time (TAI) and Coordinated Universal Time (UTC) have served well the needs of the scientific and technical community and the general public since 1972;
- (b) that UTC is based on astronomical and atomic time;
- (c) that it is foreseen that the coordination of the relevant astronomical observations and the generation of TAI will take place in separate locations;

recommends

- 1. that the responsibility for the maintenance of TAI be taken over completely by the Bureau International des Poids et Mesures (BIPM) within the framework of its present Committees;
- 2. that the function of announcing leap seconds and computation of DUT1 remain at the Bureau International de l'Heure (BIH);
- 3. that BIPM and BIH contribute to joint reports in order that publications such as "Circular D" and the BIH Reports maintain continuity.

A.2 Utility of Frequency-stabilized LF Emissions

Commission A,

considering

- (a) that frequency-stabilized LF emissions, such as the Loran-C chains, are available;
- (b) that these emissions provide a large number of users with convenient, precise, and inexpensive access to national and international time and frequency standards;
- (c) that the international time scale TAI is largely dependent upon comparisons made by means of Loran-C links;

recommends that serious consideration should be given to the needs of the large community of frequency and time users when changes in coverage or in system operation are being contemplated.

A.3 Improvement of Frequency Standards

Commission A,

considering

- (a) the new possibilities of improvement in the stability and the

accuracy of atomic frequency standards offered by:

- (i) the efficient application of optical pumping and detection methods to caesium devices,
 - (ii) the storage of hydrogen atoms at a very low temperature in bulbs lined with helium films,
 - (iii) the storage and cooling of ions in radio frequency and Penning traps,
 - (iv) the successful observation of a fine structure transition in a magnesium beam;
- (b) the need for improved frequency and time standards in scientific and technological applications such as time-keeping, navigation, radio astronomy, geodesy, and other branches of basic research;
- recommends* that fundamental and applied research on advanced frequency standards be actively pursued.

A.4 Working Group on Measurements Related to the Interaction of Electromagnetic Fields with Biological Systems

Commission A,

considering the Resolutions adopted at the XVIII, XIX and XX General Assemblies of URSI, which recognize the need for international cooperation between physical scientists, biological scientists and doctors to increase the knowledge of the interaction of electromagnetic fields with biological systems;

recommends

1. that the Working Group on Measurements related to the interaction of electromagnetic fields with biological systems be maintained;
2. that the Working Group be asked to continue its efforts towards
 - (i) convening symposia that stress the role of physical measurements related to the interaction of electromagnetic fields and biological systems,
 - (ii) cooperating with other organizations in the planning and convening of such symposia, and
 - (iii) giving active support to international organizations that are concerned with matters of health and safety related to electromagnetic fields;
3. that the URSI Working Group be provided with appropriate financial support for the establishment of symposia jointly sponsored with other organizations, in particular during URSI General Assemblies.

A.5 URSI Register of National Standards Laboratories

Commission A,

considering that the *URSI Register of National Standards Laboratories* is a valuable source of information on standards and calibration facilities for electromagnetic quantities world-wide;

recommends that revised editions of the Register should be produced on a continued basis every three years;

instructs the Working Group on National Standards Laboratories

1. to prepare a revised edition of the Register in 1987;
2. to investigate ways of giving maximum publicity to the existence of the Register, and
3. to explore the possibility of offering future editions of the Register for sale on a financially viable basis.

COMMISSION B - FIELDS AND WAVES

B.1 Symposium on Electromagnetic Wave Theory

Commission B,

considering

- (a) that the URSI Symposia on Electromagnetic Wave Theory have been held at intervals of three years in a series beginning in 1953;
- (b) that these Symposia are major events which represent the main effort of Commission B between Assemblies;
- (c) that invitations to host the next Symposium in the series have been received from the Member Committees in Hungary and Israel;

resolves

1. that the next Symposium in this series be held in 1986;
2. that the invitation to hold the Symposium in Budapest, Hungary, be accepted;
3. that the Symposium be held during the same week as the 8th Colloquium on Microwave Communication (MICROCOLL), with one or two days overlapping.

B.2 Co-sponsorship of International Conferences

Commission B,

considering that various forthcoming international conferences are of direct interest to the Commission;

recommends that URSI should co-sponsor the following conferences:

1. International Conference on Integrated Optics and Optical Communication, Venice, Italy (1-4 October 1985);
2. 8th Colloquium on Microwave Communication (MICROCOLL), Budapest, Hungary (1986);
3. European Microwave Conference, Paris, France (1985);
4. European Conference on Optical Communication, Spain (1986).

B.3 Activities in Remote Sensing

Commission B,

considering that it has a sustained interest in inverse scattering and its applications;

recommends that the Inter-Commission Coordinating Group on Remote Sensing continue its activities.

B.4 Inverse Scattering

Commission B,

considering the desire to give added focus and impetus to the work on inverse scattering within the Commission;

resolves to establish a Working Group on Inverse Scattering.

COMMISSION C - SIGNALS AND CIRCUITS

C.1 Remote Sensing

Commission C

recommends that the Inter-Commission Coordinating Group on Remote Sensing should be maintained for the next three years.

C.2 Co-sponsorship of Meetings

Commission C

recommends that URSI should co-sponsor the following meetings:

1. Workshop on Information Theory, USSR (1984);
2. E.C.C.T.D., Prague, Czechoslovakia (1985);
3. 8th Colloquium on Microwave Communication (MICROCOLL), Budapest, Hungary (1986);
4. IEEE International Symposium on Information Theory, UK (1985);
5. Joint Swedish/USSR Workshop on Information Theory, Sweden (1985);
6. Benelux Symposium on Information Theory, Netherlands (1985);
7. Conference on Digital Signal Processing, Florence, Italy (1987).

COMMISSION D - ELECTRONIC AND OPTICAL DEVICES
AND APPLICATIONS

D.1 Role of Commission D

Commission D,

considering

- (a) that the name and image of URSI, so far making no reference to electronics, does not attract a large number of leading scientists in the field of Commission D;
- (b) that the role of Commission D can be
 - (i) either that of a service Commission to other Commissions of URSI (bringing to them information on the state of the art in electronic and opto-electronic technologies, as well as providing a prospective view on the progress in these technologies);
 - (ii) or that of a Commission trying to play an active part in the progress of its own field;
- (c) that the first role has been traditionally adopted by Commission D and should be continued, provided its impact on other Commissions can be improved;
- (d) that the development of the second role is crucial for increasing the impact of Commission D both inside and outside URSI, as well as in the general community involved in electron technology;
- (e) that this development necessitates a shift of Commission D interest towards the fundamental research (including the material aspects and physics of rapidly emerging technologies);

recommends that the following three series of actions be taken:

1. a change of the name of URSI to include a reference to electronics without changing the URSI logo (the name "International Union of Radio and Electronic Science" has been proposed and seems adequate);
2. the organization of symposia by Commission D (if possible with other URSI Commissions, such as C, and perhaps A or B) before the next General Assembly, the following subjects having been considered:
 - (i) devices for signal processing (in cooperation with Commission C, to be held in 1986, perhaps in France);
 - (ii) some fundamental aspects of optical guided circuits and/or related devices (perhaps to be held in 1985 or 1986 in the UK, in cooperation with the Royal Society);
 - (iii) computer-aided design of VLSI circuits;
 - (iv) fast electronics for optical and gigabit applications;
3. the taking of various steps concerning the programme of the General Assembly, viz.:
 - (i) to reduce the overlap between sessions dealing with different aspects of the same subject, especially in the

- following broad domains: optics, electro-optics and optoelectronics (Commissions A, B, C and D, and also Commission J for the use of optical fibres in large radio telescopes); microwave, millimetre and submillimetre domains (Commissions A, B, C, D and J); microelectronics and gigabit electronics (Commissions C, D and J, the latter for III-V devices) and to ask the quoted Commissions to designate a corresponding member for each of these domains;
- (ii) to organize joint sessions with other Commissions in the domains referred to above;
 - (iii) to organize sessions of Commission D devoted to progress in the material aspects and physics of emerging technologies, as well as to related modelling and computer-aided design techniques;
 - (iv) to include a General Lecture on some topic of electron technology in the programme of the General Assembly;
 - (v) to organize an Open Symposium in the field of Commission D, perhaps on compound semi-conductor (specially III-V) devices, which could be co-sponsored by another international organization or by a local scientific or engineering society.

COMMISSION E - ELECTROMAGNETIC NOISE AND INTERFERENCE

E.1 Symposia on Electromagnetic Compatibility

Commission E,

noting the positive results of the cooperation between the Commission and the organizers of several Symposia on Electromagnetic Compatibility, in the form of URSI sessions and workshops organized during these Symposia;

recommends that URSI continue with its modest support for the Symposia in the Zurich and the Wroclaw series.

E.2 Working Groups

Commission E

resolves to maintain its Working Groups, as follows, for the next triennium:

1. Man-made noise (Chairman: A.D. Spaulding);
2. Natural noise (Chairman: J. Hamelin);
3. Damaging effects of transients on equipment (Chairman: V. Scuka);
4. Scientific basis of noise and interference control (Chairman: C. Baum).

COMMISSION F - REMOTE SENSING AND WAVE PROPAGATION -
NEUTRAL ATMOSPHERE, OCEANS, LAND, ICE

F.1 Title of Commission F

Commission F,

having considered the Report of the Working Group composed of R.K. Crane and P. Delogne (co-chairmen), D. Groom and F. Fedi, in which the present title of Commission F "Remote Sensing and Wave Propagation - Neutral Atmosphere, Oceans, Land, Ice" decided by the Council at the XX General Assembly (Washington, D.C., 1981) is felt to be cumbersome;

recommends the adoption of the new title "Wave Propagation, Remote Sensing and Communications"; this reflects the fact that Commission F, as part of URSI, is basically concerned with wave propagation, but recognizes that the two principal applications of Commission F studies lie in the field of remote sensing and communications.

Note: See Resolution U.7 of the URSI Council.

F.2 Scientific Activities in the next Triennium

Commission F,

considering

- (a) the success of the Symposia held in the past triennium;
- (b) the leading role of the Commission in dealing with the study of wave propagation in non-ionized media, with particular emphasis on remote sensing and communications applications;

recommends that the following Symposia be held during the next triennium:

- 1. Wave propagation: remote sensing and communications, 1986 (Organizers: R.K. Crane, P. Delogne and F. Fedi);
- 2. Microwave signatures in remote sensing, 1986 or early 1987 (Organizers: F. Eklund and A. Blomquist).

F.3 Inter-Commission Coordinating Group on Remote Sensing

Commission F,

having considered the Report of the Inter-Commission Coordinating Group on Remote Sensing (ICCGRS) submitted by its Chairman, Dr. J. Gower;

recommends

- 1. that the Inter-Commission Coordinating Group on Remote Sensing (ICCGRS) be maintained for the next triennium;
- 2. that Dr. D. Gjessing (Norway) and Dr. J. Gower (Canada) be included in the ICCGRS as representatives of Commission F;

3. that the Chairman of the ICCGRS be one of the two representatives of Commission F;
4. that a maximum of two representatives be designated by each of the interested Commissions;
5. that regular consultations be arranged between the Chairmen and the Vice-Chairmen of Commission F and of the ICCGRS.

F.4 URSI-CCIR-CCITT Liaison Committee

Commission F,

considering that it is desirable to maintain and develop further the cooperation between URSI and the Consultative Committees of the International Telecommunications Union (CCIR and CCITT);

recommends

1. that the following be designated as representatives of Commission F: A. Blomquist, L. Boithias, F. Fedi and M.P. Hall;
2. that representatives be designated by the other URSI Commissions whose activities are relevant to the work of CCIR and CCITT.

F.5 URSI Representative on SCOR

Commission F

recommends that Dr. G. Valenzuela be designated as URSI Representative on the Scientific Committee on Oceanic Research (SCOR).

F.6 Review of Radio Science

Commission F

resolves

1. to appoint Dr. R.K. Crane, incoming Vice-Chairman of the Commission, as Commission F Editor for the next issue of *Review of Radio Science*;
2. to ask the new Editor to circulate, within the Commission, the complete list of references provided by the various members for the 1984 edition of *Review of Radio Science*.

COMMISSION G - IONOSPHERIC RADIO AND PROPAGATION

G.1 INAG Bulletin and Meetings

Commission G,

recognizing

- (a) that it is difficult for the officers and members of the Ionospheric Network Advisory Group (INAG) to obtain sufficient support to attend INAG Meetings;

- (b) that the costs of preparing the *INAG Bulletin* are too high to be met by the individual organizations concerned, and that several other organizations have expressed their willingness to contribute to these costs;

recommends

1. that URSI Member Committees and other institutions should be urged to provide all possible assistance to overcome these difficulties;
2. that URSI should establish an international fund to finance the operation of INAG, under the control of the Chairman of INAG, and should invite the interested groups to contribute to this fund.

G.2 New Ionosondes

Commission G,

considering that many new ionosondes have been set up, which are not yet known to the World Data Centres;

recommends that the responsible Administrations should provide the appropriate World Data Centre with the details of the new stations, and inform the Ionospheric Network Advisory Group (INAG) of their existence.

G.3 Ionosonde Network and World Data Centres

Commission G,

noting that, in spite of an increase in the number of ionosonde stations during the last decade, the volume of data received by the World Data Centres has considerably decreased;

urges the ionosonde stations and the Administrations running such stations to ensure that the established interchange rules be respected and, in particular, that the monthly data reports be delivered regularly to the appropriate World Data Centres in the standardized format.

G.4 Ionosonde Station at Huancayo

Commission G,

recognizing that the ionosonde at Huancayo, Peru, has for more than 47 years, played a highly significant role in the understanding of the ionized atmosphere at equatorial latitudes and its relationship to other geophysical phenomena;

noting that this station has ceased regular operation;

urges that a routine programme of soundings be re-established and that the data be made available to the international community through the World Data Centres.

G.5 Ebro Observatory at Roquetes

Commission G,

noting that the Ebro Observatory at Roquetes has provided geomagnetic data continuously for the past 80 years, and ionosonde data for the

past 30 years, thereby contributing significantly to the understanding of ionospheric processes;

urges the responsible Administration to maintain this Observatory in operation.

G.6 Combined Catalogue of Ionosphere Vertical Soundings Data

Commission G,

noting

- (a) that the *Combined Catalogue of Ionosphere Vertical Soundings Data* is about to be published by the World Data Centres for Solar Terrestrial Physics;
- (b) that this Catalogue will be of great value to the scientific community;

encourages all stations and Administrations to examine the Catalogue closely and to bring any additions and corrections to the attention of the World Data Centre A in Boulder, USA.

G.7 Data Base for Incoherent Scatter Radar Data

Commission G,

noting that a data base for incoherent scatter radar data has been established at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, USA;

recommends that, in the interests of facilitating the interchange and exploitation of such data, the responsible Administrations should adopt a common format and provide the Data base with their data in a timely fashion.

G.8 Space Measurements

Commission G,

noting that, in order to interpret the new data being acquired at high latitude with a variety of radio and other techniques, it is essential to know the parameters of the interplanetary magnetic field;

urges that every effort be made by governments and governmental agencies involved in space measurements to ensure that the relevant parameters be acquired and made available in a timely fashion.

G.9 Draft Standard Nomenclature for Parameters Determined from Digital Ionosondes

Commission G,

noting that its Working Group G.10, the International Digital Ionosonde Group, has developed a draft standard nomenclature for parameters determined from digital ionosondes (*INAG Bulletin* No 40/41, 1983);

recommends that the scientific community should adopt this nomenclature as standard in documents and scientific publications.

G.10 Working Groups

Commission G,

having considered the reports submitted by its various Working Groups;

resolves

1. to merge Working Group G.1 "Ionosonde Network Advisory Group (INAG)" and Working Group G.10 "International Digital Ionosonde Group (IDIG)", and to give the new Group the title of "Ionosonde Network Advisory Group (INAG)",

Chairman: Prof. J.A. Gledhill (South Africa)

Executive Secretary: Dr. R. Haggard (South Africa)

Publications Secretary: Dr. R. Conkright (USA)

(see Annex I for Terms of Reference);

2. to dissolve Working Group G.6 "Ionospheric Knowledge Needed to Improve Radiocommunications";

3. to maintain Working Group G.3 "Southern Hemisphere Atmospheric Studies Group (SHAGS)",

Chairman: Prof. S. Radicella (Argentina);

4. to maintain Working Group G.4 "International Reference Ionosphere (IRI)" (joint with COSPAR),

Chairman: Prof. L. Bossey (Belgium)

Vice-Chairman: Dr. T.L. Gulyaeva (USSR);

5. to maintain Working Group G.12 "Studies of the Ionosphere Using Beacon Satellites",

Chairman: Dr. R. Leitinger (Austria)

Vice-Chairmen: Dr. A. Wernik (Poland)

Dr. J.A. Klobuchar (USA);

6. to constitute a new Working Group on "Mapping of Characteristics at the Peak of the F2 Layer",

Chairman: Dr. K. Davies (USA)

Members: Dr. P. Bradley (UK), Dr. N. Danilkin (USSR), Dr. N. Matsumura (Japan), Dr. L. McNamara (Australia), Prof. K. Rawer (FRG), Dr. C.M. Rush (USA).

(see Annex II for Terms of Reference).

Annex I - Terms of Reference of Ionosonde Network Advisory Group (INAG)

The Ionosonde Network Advisory Group (INAG) is established by Commission G to pursue the following objectives through the publication of a Bulletin, and by the organization of meetings in various locations:

1. to monitor, maintain and improve the standards of data produced by ionosondes and the ionosonde network;

2. to promote the interchange of data through the World Data Centres or by direct contact between stations and users, and the storing of such data;
3. to revise the list of the parameters to be reported and associated rules to match the needs of the users;
4. to evaluate, and make recommendations on, the international importance of proposed and existing stations as required;
5. to encourage the development of improved ionosonde methods and to inform the community about them;
6. to encourage the staff at ionosonde stations by informing them of the use made of their data and allied matters;
7. to promote the use of ionosondes in research campaigns;
8. to encourage theoretical studies as an aid to the acquisition and interpretation of ionosonde data.

Annex II - Terms of Reference of Working Group on Mapping of Characteristics at the Peak of F2 Layer

The Working Group on Mapping of Characteristics at the Peak of the F2 Layer is established by Commission G to make improvements in the present CCIR Maps of F2-layer characteristics through theory and observation and, in particular, to investigate the possibility of incorporating space data.

G.11 Symposia during Next Triennium

Commission G

recommends the organization of the following symposia to be sponsored and financially supported by URSI:

1. Global, including theoretical, studies of the upper atmosphere using incoherent scatter radars, alone and in combination with other techniques, Spring or Summer 1986 (Local organization: Dr. A. Richmond, NCAR, Boulder, CO, USA);
2. Ionospheric studies using satellite radio beacons, Summer or Fall 1986 (Local organization: Prof. A. Tauriainen, University of Oulu, Oulu, Finland);
3. International Conference on Artificial Modification of the Ionosphere by Heating.

G.12 Representatives on Inter-Commission Coordinating Group on Remote Sensing

Commission G

recommends that the following be designated as representatives of the Commission on the Inter-Commission Coordinating Group on Remote Sensing (ICGRS):

- Dr. C.L. Rino (USA) for synthetic aperture radar;
- Dr. Tudor Jones (UK) for HF remote sensing aspects.

G.13 Representative on URSI-CCIR-CCITT Liaison Committee

Commission G

recommends that Dr. C.M. Rush (USA) be designated as the representative of the Commission on the URSI-CCIR-CCITT Liaison Committee.

G.14 Editor for Review of Radio Science 1984-1986

Commission G

resolves to appoint Dr. Ken Davies (USA) as Editor for the joint Commissions G and H triennial report to be included in the 1987 edition of *Review of Radio Science*.

COMMISSION H - WAVES IN PLASMAS

H.1 Terms of Reference

Commission H

considering that the terms of reference of the Commission, as specified at the Lima General Assembly in 1975 and published in *URSI Information Bulletin* No 195 (Sept. 1975) are fully appropriate; *decides* to confirm these terms of reference.

H.2 Sponsorship of Symposia and Meetings

Commission H

recommends the co-sponsorship by URSI of the following meetings:

1. 2nd International School for Space Simulations, Kapaa, Kauai, Hawaii, 4-15 February 1985 (Conference Secretary: Dr. D.A. Dutton, USA);
2. 17th International Conference on Phenomena in Ionized Gases, Budapest, Hungary, 1985;
3. Symposium on Wave Particle Interactions and Associated Phenomena, Dunedin, New Zealand, late January 1986 (jointly organized by Drs U. Inan, USA; H. Matsumoto, Japan; R.L. Dowden, New Zealand);
4. Symposium on Ionospheric Modification Induced by High Power Radio Waves, USSR, to be held before the XXII General Assembly (jointly organized by Prof. W.E. Gordon, USA, and Prof. V.V. Migulin, USSR).

H.3 URSI/IAGA Working Groups

Commission H

resolves to maintain the URSI/IAGA Working Groups as follows:

URSI/IAGA.1 Passive Electromagnetic Probing of the Magnetosphere
Co-Chairman for Commission H: Dr. U. Inan (USA);

URSI/IAGA.2 Wave Instabilities in Plasmas

Co-Chairman for Commission H: Dr. T. Sato (Japan).

H.4 Inter-Commission Coordinating Group on Remote Sensing

Commission H

recommends

1. that the Inter-Commission Coordinating Group on Remote Sensing (ICCGRS) be continued, and
2. that Dr. R. Gendrin (France) be designated as representative of the Commission on ICCGRS.

H.5 Inter-Commission Working Group on Time Domain Waveform Measurements

Commission H

recommends

1. that the Inter-Commission Working Group on Time Domain Waveform Measurements be continued, and
2. that Dr. F. Lefevre (France) be designated as representative of the Commission on this Working Group.

RÉSOLUTIONS ET RECOMMANDATIONS DU CONSEIL

U.1 Admission de nouveaux Comités Membres

Le Conseil de l'URSI,

considérant

- (a) qu'une demande d'admission en Catégorie 1 a été soumise par le Département des Poste et Télégraphe de Thaïlande;
- (b) qu'une demande d'admission en Catégorie 3 a été soumise par l'Institut Chinois d'Electronique, Beijing;
- (c) que les conditions spécifiées aux Articles 2, 3 et 4 des Statuts de l'URSI sont satisfaites,

décide d'admettre comme membres de l'Union, en Catégories 1 et 3 respectivement:

1. le Comité qui sera formé sous les auspices du Département des Poste et Télégraphe de Thaïlande;
2. le Comité qui sera formé sous les auspices de l'Institut Chinois d'Electronique.

U.2 Finances de l'URSI

Le Conseil de l'URSI,

notant les recommandations formulées dans le Rapport du Comité permanent des finances, en date du 3 septembre 1984,

décide

1. d'approuver les comptes de l'Union apurés pour les années prenant fin au 31 décembre 1981, 1982 et 1983;
2. d'approuver les prévisions budgétaires figurant dans le tableau I (modèle B révisé) et le tableau II de ce Rapport;
3. d'adopter pour l'unité de contribution annuelle le montant proposé dans le tableau I de ce Rapport, à savoir: 610 dollars pour chacune des années 1985, 1986 et 1987;
4. de publier le Rapport du Comité permanent des finances dans le Volume XX des *Comptes Rendus des Assemblées générales de l'URSI*;
5. en raison des fluctuations liées à la situation économique mondiale, d'autoriser le Bureau à apporter des modifications annuelles aux prévisions budgétaires, s'il le juge approprié.

U.3 Comité permanent des finances

Le Conseil de l'URSI

décide de désigner les personnalités suivantes comme membres du Comité permanent des finances:

Dr. M. Petit (Président)
Prof. A.L. Cullen
Prof. F. Gardiol
Prof. S. Radicella
Prof. M.E. Zhabotinskij.

U.4 Publications de l'URSI

Le Conseil de l'URSI,

ayant pris connaissance des recommandations formulées dans le Rapport du Comité des publications, en date du 3 septembre 1984, concernant l'avenir des publications suivantes de l'Union:

- (a) *Bulletin d'Information de l'URSI,*
- (b) *Comptes Rendus des Assemblées générales de l'URSI,*
- (c) *Brochure de l'URSI,*
- (d) *Statuts de l'URSI,*
- (e) *Review of Radio Science,*
- (f) *INAG Bulletin,*
- (g) *International Reference Ionosphere,*

décide

1. d'accepter ces recommandations;
2. de publier le Rapport du Comité des publications dans le Volume XX des *Comptes Rendus des Assemblées générales de l'URSI.*

U.5 Projet d'union des Commissions G et H

Le Conseil de l'URSI,

ayant pris connaissance des recommandations formulées par le Comité ad hoc chargé d'étudier les mesures à prendre en application de la Résolution U.13 adoptée à la XXe Assemblée générale (Washington, D.C., 1981)

décide

1. que les Commissions G et H ne soient pas fusionnées pour le moment;
2. que l'excellente collaboration réalisée au cours des trois dernières années par les deux Commissions soit poursuivie et, en particulier, qu'il soit mandé aux Présidents et Vice-Présidents des Commissions G et H de poursuivre une collaboration permanente dans les domaines suivants:
 - (i) la programmation de colloques communs et séparés dans la période entre les Assemblées générales;
 - (ii) la programmation de séances scientifiques communes et séparées des deux Commissions au cours des Assemblées générales;
 - (iii) la préparation d'un rapport commun pour inclusion à la *Review of Radio Science*;
3. que, dans les cas où cela leur semble approprié, les Comités Membres soient encouragés à désigner une seule personne pour les représenter au sein des deux Commissions;
4. qu'au cours de chaque Assemblée générale, les Commissions G et H

organisent au moins une séance administrative commune ainsi que, si possible et selon un horaire approprié, des séances administratives séparées.

U.6 Eloge des Présidents des Commissions G et H 1981-84

Le Conseil de l'URSI

décide d'adresser ses félicitations au Dr. P. Bauer et au Dr. M. Petit, respectivement Présidents des Commissions G et H pendant la période 1981-1984, pour le degré de collaboration exemplaire réalisé entre les deux Commissions au cours des trois années écoulées.

U.7 Titre et mandat de la Commission F

Le Conseil de l'URSI,

notant les recommandations soumises par la Commission F,

décide

1. de modifier comme suit le titre de cette Commission: "Propagation des ondes et télédétection";
2. d'approuver le mandat suivant pour la Commission:
 - 1) étudier tous les aspects de la propagation des ondes à toutes les fréquences dans un environnement ionisé:
 - (i) propagation des ondes au-dessus de la surface de la Terre,
 - (ii) propagation des ondes dans l'atmosphère neutre et interaction des ondes avec l'atmosphère neutre,
 - (iii) interaction des ondes avec la surface de la Terre: océans, sol et glace,
 - (iv) propagation et diffraction des ondes dans le milieu souterrain,
 - (v) caractérisation de l'environnement en ce qu'il affecte les phénomènes ondulatoires;
3. encourager l'application des résultats de ces études, en particulier dans les domaines de la télédétection et des communications;
4. développer une collaboration appropriée avec les autres Commissions de l'URSI et les organisations concernées.

U.8 Rôle de la Commission D

Le Conseil de l'URSI,

considérant que la mission de la Commission D peut être double:

- (a) celle d'une Commission au service des autres Commissions de l'URSI, leur fournissant toutes informations sur les derniers résultats obtenus dans le domaine des technologies électronique et optoélectronique, ainsi que sur les perspectives qui s'offrent dans ce domaine;
- (b) celle d'une Commission prenant une part active dans le développement des connaissances de son propre domaine,

décide

1. que la mission de service, traditionnellement assurée par la Commission D, soit maintenue et que l'interaction avec les autres Commissions de l'URSI soit intensifiée;
2. que la Commission D prenne des mesures énergiques pour remplir l'autre volet de sa mission, afin d'accroître son rayonnement aussi bien au sein de l'URSI qu'en dehors, en particulier en se consacrant davantage à la recherche fondamentale, y compris les problèmes de physique et des matériaux des technologies en évolution rapide.

U.9 Comité pour l'adhésion à l'URSI

Le Conseil de l'URSI,

considérant qu'il est souhaitable de poursuivre les efforts en vue d'encourager de nouveaux Comités Membres à adhérer à l'Union,

décide de maintenir le Comité pour l'adhésion à l'URSI et de désigner les personnalités suivantes comme membres:

Prof. S. Okamura (Président)
Prof. J.A. Gledhill
Prof. J. Oyinloye
Prof. S. Radicella
Prof. M. Rodriguez Vidal
Prof. A. Smolinski.

U.10 Comité pour les Assemblées générales de l'URSI

Le Conseil de l'URSI,

considérant l'importance de la tâche dévolue au Comité pour les Assemblées générales de l'URSI, laquelle consiste à solliciter auprès des Comités Membres des invitations pour l'organisation des Assemblées générales futures de l'Union,

décide de maintenir le Comité pour les Assemblées générales de l'URSI et de désigner les personnalités suivantes comme membres:

Prof. V. Zima (Président)
Prof. R.L. Dowden
Prof. V. Kose
Prof. H. Tanaka.

U.11 Comité de liaison URSI-CCIR-CCITT

Le Conseil de l'URSI,

ayant pris connaissance des recommandations formulées par le Comité de liaison URSI-CCIR-CCITT afin de développer et de renforcer la collaboration de l'URSI avec les Comités consultatifs de l'Union Internationale des Télécommunications (UIT),

décide

1. d'accepter ces recommandations;
2. d'exprimer ses remerciements à Monsieur M. Thué, Président sortant du Comité, pour la façon efficace dont il en a dirigé les travaux;

3. de maintenir le Comité de Liaison URSI-CCIR-CCITT et de désigner les personnalités suivantes comme membres:

Président: M. G. Hagn
Président sortant: M. M. Thué
Commission A: Prof. S. Leschiutta
Commission B: Prof. P.J.B. Clarricoats
Commission C: Dr. J.G. Lucas
Commission E: Prof. F.L. Stumpers
Prof. A.D. Spaulding
Commission F: Dr. F. Fedi
Dr. A. Blomquist
Dr. L. Boithias
Dr. M.P. Hall
Commission G: Dr. C.M. Rush
Commission J: à désigner

U.12 Collaboration avec le CCIR et le CCITT

Le Conseil de l'URSI,

considérant

- (a) que l'un des buts de l'URSI est "de stimuler et de coordonner les études des aspects scientifiques des télécommunications utilisant les ondes électromagnétiques guidées et non guidées";
- (b) que bon nombre des résultats scientifiques présentés aux Assemblées générales et aux colloques de l'URSI, ou bien à des colloques copatronnés par l'URSI et, en particulier dans des exposés de synthèse, sont susceptibles de contribuer à l'avancement des travaux des Commissions d'études du CCIR et du CCITT,

invite les Comités Membres de l'Union, à l'occasion de leurs réunions scientifiques nationales ou régionales, ou bien de colloques spécialisés auxquels ils sont associés, à encourager la préparation (en liaison avec les organisations nationales compétentes s'il en existe) de contributions pour les Commissions d'études du CCIR et du CCITT; celles-ci seront transmises au Secrétariat du Comité consultatif intéressé par l'intermédiaire du Secrétariat général de l'URSI.

U.13 Comité pour les pays en développement

Le Conseil de l'URSI,

considérant

- (a) l'efficacité de l'activité déployée par le Comité pour les pays en développement depuis sa création en 1981;
- (b) le programme proposé par le Comité concernant l'organisation d'ateliers de travail et la préparation de manuels à l'intention des scientifiques radioélectriciens des pays en développement;
- (c) la proposition d'établir un Système international d'échange d'instruments de mesures radioélectriques pour les pays en développement,

décide

rendus à l'URSI pendant de nombreuses années.

U.19 Modification aux Statuts de l'URSI

Le Conseil de l'URSI,

considérant

- (a) que la fonction de Secrétaire général de l'Union a un caractère bénévole;
- (b) que le travail attaché à cette fonction est trop lourd pour un scientifique ne pouvant consacrer qu'une partie de son temps aux affaires de l'URSI,

décide

- 1. d'autoriser le Bureau à désigner un Secrétaire général adjoint, sur proposition du Secrétaire général;
- 2. d'ajouter à l'Article 37 des Statuts les phrases suivantes:
"Le Bureau a pouvoir de désigner, sur proposition du Secrétaire général, un Secrétaire général adjoint qui restera en fonction de la date de sa nomination jusqu'à la fin de l'Assemblée générale ordinaire suivante. Le Secrétaire général peut déléguer certaines des tâches qui lui incombent au Secrétaire général adjoint".

U.20 Groupe de coordination inter-Commissions sur la télédétection

Le Conseil de l'URSI,

ayant pris connaissance des recommandations du Groupe de coordination inter-Commissions sur la télédétection pour ce qui concerne

- (i) l'amélioration de la collaboration avec l'UGGI, le COSPAR, l'IEEE et les autres organismes intéressés,
- (ii) la diffusion d'informations sur les réunions dans le domaine de la télédétection,
- (iii) la coordination des activités de télédétection au sein de l'URSI,

décide de maintenir le Groupe de coordination inter-Commissions sur la télédétection et de désigner les personnalités suivantes comme membres:

Président: Dr. J. Gower (Commission F)
Vice-Président: Dr. D. Gjessing (Commission F)
Secrétaire: à désigner par le Président
Commission B: à désigner par la Commission
Commission C: Prof. F. Carassa
Commission E: Dr. E.K. Smith
Commission G: Dr. D.B. Jones
 Dr. C.L. Rino
Commission H: Dr. R. Gendrin.

U.21 Groupe de travail inter-Commissions sur les effets des activités de l'homme sur l'ionosphère, la magnétosphère et les télécommunications

Le Conseil de l'URSI,

considérant les recommandations formulées dans le Rapport du Groupe de travail inter-Commissions sur les effets des activités de l'homme sur l'ionosphère, la magnétosphère et les télécommunications,

décide

1. de dissoudre ce Groupe de travail inter-Commissions;
2. de désigner le Prof. K. Rawer pour assurer la liaison entre l'URSI et le CCIR pour ce qui concerne les problèmes qui figuraient au mandat de ce Groupe.

U.22 Groupe de travail inter-Commissions pour la coordination des activités de l'URSI pour les communications, la détection et le traitement des données dans la gamme optique

Le Conseil de l'URSI,

ayant pris connaissance des recommandations formulées par le Prof. W.A. Gambling, Président du Groupe de travail inter-Commissions pour la coordination des activités de l'URSI pour les communications, la détection et le traitement des données dans la gamme optique, concernant les activités futures de ce Groupe de travail,

décide de maintenir ce Groupe de travail pendant les trois années à venir et de confirmer le Prof. W.A. Gambling dans ses fonctions de Président du Groupe de travail.

U.23 Groupe de travail inter-Commissions sur la mesure des formes d'onde dans le domaine temporel

Le Conseil de l'URSI,

considérant

- (a) le succès des séances scientifiques organisées au cours de la présente Assemblée par le Groupe de travail inter-Commissions sur la mesure des formes d'onde dans le domaine temporel;
- (b) les recommandations formulées par le Dr. N.S. Nahman, Président du Groupe de travail, concernant les activités futures du Groupe de travail,

décide de maintenir le Groupe de travail inter-Commissions sur la mesure des formes d'onde dans le domaine temporel pendant les trois années à venir avec, comme Président, le Dr. N.S. Nahman et les mêmes membres,

U.24 Groupes de travail communs des Commissions G et H

Le Conseil de l'URSI,

notant les recommandations des Commissions G et H,

décide d'approuver les Groupes de travail communs suivants des deux

Commissions:

1. Diffusion incohérente
Président: Dr. V.B. Wickwar
Vice-Président: Dr. K. Schlegel,
2. Expériences actives
Président: Prof. R.L. Dowden,
3. Analyse des ondes de plasma par ordinateur
Co-présidents: Dr. M. Ashour-Abdalla
Dr. H. Matsumoto.

U.25 Groupe de travail commun des Commissions C et H

Le Conseil de l'URSI,

notant les recommandations des Commissions C et H,

décide d'approuver le Groupe de travail commun suivant des deux Commissions:

- Analyse des ondes
Président: Dr. D. Jones.

U.26 Remerciements au Président de l'INAG

Le Conseil de l'URSI,

notant

- (a) que le Dr. W.R. Piggott, en tant que Président du Groupe Conseil du réseau ionosphérique (INAG), n'a pas cessé, pendant plus de 25 ans, de consacrer ses efforts au bon fonctionnement du réseau des stations ionosphériques;

- (b) qu'il quitte la présidence de ce Groupe,

exprime sa plus vive reconnaissance au Dr. W.R. Piggott pour les services exceptionnels qu'il a rendus en prodiguant aide et encouragements aux stations ionosphériques et aux opérateurs de ces stations et, de manière générale, à la communauté internationale des scientifiques radioélectriciens.

U.27 Message à l'Institute of Electrical and Electronics Engineers Inc.

Le Conseil de l'URSI

adresse à l'Institute of Electrical and Electronics Engineers Inc. ses vives félicitations pour les progrès réalisés au cours d'un siècle d'existence, pendant lequel s'est littéralement transformée toute la façon de vivre de l'homme - sa façon de communiquer, sa façon de traiter les affaires, son rôle social;

exprime sa gratitude à l'IEEE pour la féconde collaboration qui a pu se développer avec l'URSI au cours des 65 années écoulées, et

émet le vœu que cette collaboration se poursuive dans le monde à venir, plein de promesses et en rapide évolution.

U.28 Remerciements au Comité italien de l'URSI

Le Conseil de l'URSI,

notant

- (a) l'excellente organisation matérielle mise en place à Florence pour les séances scientifiques et administratives de la XXIIe Assemblée générale et les colloques ouverts;
- (b) le programme des visites scientifiques organisé pour les participants;
- (c) le programme des réceptions et visites aux musées mis au point par le Comité organisateur italien pour les participants et les personnes accompagnantes;
- (d) l'accueil cordial réservé aux participants et à leurs familles pendant l'Assemblée,

décide d'exprimer ses plus vifs remerciements:

- 1. au Comité italien de l'URSI pour l'invitation de tenir la XXIIe Assemblée générale à Florence et, en particulier, à son Président, le Professeur C. Egidi;
- 2. aux membres du Comité organisateur italien pour leurs méticuleux travaux préparatoires qui ont assuré le succès de l'Assemblée et, en particulier, au Professeur V. Cappellini et au Professeur A.M. Scheggi, respectivement Président et Secrétaire exécutif du Comité organisateur italien.

U.29 Subventions de l'UNESCO

Le Conseil de l'URSI,

considérant

- (a) qu'une grande partie des activités de l'Union consiste dans l'organisation de conférences scientifiques internationales et l'impression de publications scientifiques;
- (b) que les subventions annuelles accordées par l'UNESCO à l'URSI, par l'intermédiaire du CIUS, permettent de couvrir une partie du coût de ces activités,

décide d'exprimer à l'UNESCO la vive gratitude de l'Union pour l'appui considérable qui lui est ainsi fourni.

U.30 Programme des jeunes scientifiques

Le Conseil de l'URSI,

considérant l'importance du Programme des jeunes scientifiques qui, mettant à la disposition de jeunes scientifiques de pays développés et en développement une assistance financière, leur permet de participer aux travaux des Assemblées générales de l'Union,

décide d'exprimer sa vive gratitude aux organisations suivantes:

- l'Organisation des Nations Unies pour l'Education, la Culture et la Science (UNESCO),

- le Conseil International des Unions Scientifiques (CIUS),
- le Comité du CIUS pour la science et la technologie dans les pays en développement (COSTED),
- le Comité italien de l'URSI,
- la Royal Society de Londres,
- l'Institut international de physique théorique à Trieste.

RÉSOLUTIONS ET RECOMMANDATIONS DES COMMISSIONS

COMMISSION A - METROLOGIE ELECTROMAGNETIQUE

A.1 Transfert au BIPM du maintien du TAI

La Commission A,

considérant

- (a) que les systèmes actuels du Temps Atomique International (TAI) et du Temps Universel Coordonné (TUC) ont répondu depuis 1972 de manière satisfaisante aux besoins de la communauté scientifique et technique, et à ceux des utilisateurs en général;
- (b) que le TUC est basé sur le temps astronomique et le temps atomique;
- (c) qu'il est prévu que la coordination des observations astronomiques, d'une part, et la réalisation du TAI, de l'autre, s'effectueront en des endroits séparés,

recommande

- 1. que le Bureau International des Poids et Mesures (BIPM), dans le cadre de ses Comités actuels, prenne l'entière responsabilité pour le maintien du TAI;
- 2. que le Bureau International de l'Heure (BIH) continue d'assumer la tâche d'annoncer les secondes intercalaires et de calculer le DUT1;
- 3. que le BIPM et le BIH collaborent pour la mise au point de rapports communs afin de maintenir la continuité des publications telles que la "Circulaire D" et les Rapports annuels du BIH.

A.2 Utilité des émissions en ondes kilométriques stabilisées en fréquence

La Commission A,

considérant

- (a) que des émissions en ondes kilométriques stabilisées en fréquence, telles que les réseaux Loran C, sont disponibles;
- (b) que, grâce à ces émissions, un grand nombre d'utilisateurs ont un accès facile, précis et peu onéreux aux étalons de temps et de fréquence nationaux et internationaux;
- (c) que l'échelle de temps internationale TAI dépend dans une grande mesure de comparaisons effectuées au moyen des réseaux Loran C,

recommande qu'il soit sérieusement tenu compte des besoins de l'importante communauté des utilisateurs des étalons de temps et de fréquence lorsque des changements dans la couverture ou dans le mode de fonctionnement des réseaux seront envisagés.

A.3 Perfectionnement des étalons de fréquence

La Commission A,

considérant

- (a) les nouvelles possibilités d'amélioration de la stabilité et de la précision des étalons de fréquence atomiques offertes par:
 - (i) l'application efficace des méthodes de pompage et de détection optiques aux dispositifs à jet de césium,
 - (ii) le stockage d'atomes d'hydrogène à très basse fréquence dans des cellules revêtues de films d'hélium,
 - (iii) le stockage et le refroidissement d'ions dans des trappes radio-fréquence et des trappes Penning,
 - (iv) l'observation réussie d'une transition de structure fine dans un jet de magnésium;
- (b) le besoin d'améliorer les étalons de fréquence et de temps pour des applications scientifiques et techniques telles que la conservation du temps, la navigation, la radioastronomie, la géodésie et d'autres branches de la recherche fondamentale,

recommande que les recherches fondamentales et appliquées soient activement poursuivies en vue du perfectionnement des étalons de fréquence.

A.4 Groupe de travail sur la métrologie dans le domaine des interactions entre champs électromagnétiques et systèmes biologiques

La Commission A,

considérant les Résolutions adoptées au cours des XVIIIe, XIXe et XXe Assemblées générales de l'URSI, qui soulignent la nécessité de la collaboration internationale des physiciens, des biologistes et des médecins pour améliorer la connaissance des interactions entre systèmes biologiques et champs électromagnétiques,

recommande

- 1. de maintenir le Groupe de travail sur la métrologie dans le domaine des interactions des champs électromagnétiques avec les systèmes biologiques;
- 2. d'inviter ce Groupe de travail à poursuivre ses efforts:
 - (i) en prenant l'initiative de l'organisation de colloques sur le rôle des mesures physiques relatives à l'interaction des champs électromagnétiques et des systèmes biologiques,
 - (ii) en collaborant avec d'autres organismes dans la planification et l'organisation de ces colloques,
 - (iii) en fournissant un appui actif aux organisations internationales qui s'occupent des influences des champs électromagnétiques sur la santé et des problèmes de sécurité qui s'y rattachent;
- 3. d'assurer à ce Groupe de travail de l'URSI un appui financier qui lui permette de prendre l'initiative de l'organisation de colloques patronnés en commun avec d'autres organisations, en particulier pendant les Assemblées générales de l'Union.

A.4 Registre de l'URSI des Laboratoires nationaux d'étalons

La Commission A,

considérant que le Registre de l'URSI des Laboratoires nationaux d'étalons constitue une importante source d'informations sur les établissements qui, dans le monde entier, s'occupent d'étalons et de systèmes d'étalonnage des quantités électromagnétiques,

recommande qu'une édition révisée du Registre soit publiée de façon régulière tous les trois ans,

charge le Groupe de travail sur les Laboratoires nationaux d'étalons

1. de préparer une édition révisée du Registre pour 1987,
2. d'étudier les moyens de donner le maximum de publicité à ce Registre,
3. d'explorer les possibilités de vente des futures éditions du Registre sur une base financière raisonnable.

COMMISSION B - ONDES ET CHAMPS

B.1 Symposium sur la Théorie des ondes électromagnétiques

La Commission B,

considérant

- (a) que les symposia de l'URSI sur la Théorie des ondes électromagnétiques se sont succédé à intervalles de trois ans depuis 1953;
- (b) que ces symposia revêtent une importance majeure et représentent l'essentiel des activités de la Commission B entre les Assemblées;
- (c) que des invitations pour organiser le prochain symposium ont été reçues des Comités Membres de l'URSI en Hongrie et en Israël,

décide

1. d'organiser le prochain symposium de cette série en 1986;
2. d'accepter l'invitation du Comité Membre hongrois de l'URSI de tenir le symposium à Budapest, Hongrie;
3. de fixer les dates du Symposium pendant la même semaine que le 8e Colloque sur les Communications en hyperfréquences (MICROCOLL), avec un recouvrement d'un ou deux jours.

B.2 Copatronage de conférences internationales

La Commission B,

considérant que certaines conférences internationales à venir présentent un intérêt direct pour la Commission,

recommande que l'URSI accorde son copatronage aux conférences suivantes:

1. Conférence internationale d'optique intégrée et de communications optiques, Venise, Italie (1-4 octobre 1985);
2. 8e Colloque sur les communications en hyperfréquences (MICROCOLL), Budapest, Hongrie (1986);
3. Conférence européenne sur les hyperfréquences, Paris, France (1985);
4. Conférence européenne sur les communications optiques, Espagne (1986).

B.3 Activités dans le domaine de la télédétection

La Commission B,

considérant que les méthodes inverses appliquées à la diffusion et leurs utilisations présentent un intérêt continu pour la Commission, *recommande* le maintien du Groupe de coordination inter-Commissions sur la télédétection.

B.4 Méthodes inverses appliquées à la diffusion

La Commission B,

considérant qu'il est souhaitable de consacrer une attention accrue aux méthodes inverses appliquées à la diffusion et de stimuler les travaux dans ce domaine au sein de la Commission,

décide d'établir un Groupe de travail sur les méthodes inverses appliquées à la diffusion.

COMMISSION C - SIGNAUX ET SYSTEMES

C.1 Télédétection

La Commission C

recommande le maintien du Groupe de coordination inter-Commissions sur la télédétection pendant les trois années à venir.

C.2 Copatronage de conférences

La Commission C

recommande le copatronage par l'URSI des conférences suivantes:

1. Atelier de travail sur la théorie de l'information, URSS (1984);
2. E.C.C.T.D., Prague, Tchécoslovaquie (1985);
3. 8e Colloque sur les communications aux hyperfréquences (MICROCOLL), Budapest, Hongrie (1986);

4. Symposium international sur la théorie de l'information de l'IEEE, Royaume-Uni (1985);
5. Atelier de travail suédo-soviétique sur la théorie de l'information, Suède (1985);
6. Symposium sur la théorie de l'information du Benelux, Pays-Bas (1985);
7. Conférence sur le traitement numérique des signaux, Florence, Italie (1987).

COMMISSION D - DISPOSITIFS ELECTRONIQUES ET
OPTIQUES ET APPLICATIONS

D.1 Rôle de la Commission D

La Commission D,

considérant

- (a) que, ne faisant pas référence à l'électronique, le titre de l'URSI et l'image qu'on s'en fait n'attirent qu'un nombre restreint des scientifiques les plus éminents dans le domaine de la Commission D;
- (b) que la Commission D peut jouer un double rôle:
 - (i) celui d'une Commission au service des autres Commissions de l'URSI (leur fournissant toutes informations sur les derniers résultats obtenus dans le domaine des technologies électronique et optoélectronique ainsi que sur les perspectives qui s'offrent dans ce domaine);
 - (ii) celui d'une Commission prenant une part active dans le développement des connaissances de son propre domaine;
- (c) que la Commission D a traditionnellement rempli le premier de ces rôles, lequel devrait être maintenu à condition d'augmenter l'interaction de la Commission avec les autres Commissions de l'Union;
- (d) qu'il est essentiel de développer le deuxième de ces rôles pour accroître le rayonnement de la Commission D aussi bien au sein de l'URSI qu'en dehors de celle-ci et, d'une manière générale, au sein de la communauté des spécialistes de la technologie électronique;
- (e) que, pour ce faire, la Commission D devrait accentuer son intérêt pour la recherche fondamentale, y compris les problèmes de physique et des matériaux des technologies en évolution rapide,

recommande que soient prises les trois séries de mesures suivantes:

1. modifier le titre de l'URSI de manière à insérer une référence à l'électronique, sans pour autant changer le sigle (le titre

proposé de "Union Radio-Scientifique et Electronique Internationale" semblerait approprié);

2. organiser, avant la prochaine Assemblée générale, des colloques de la Commission D (si possible en commun avec d'autres Commissions de l'URSI telles que la Commission C et, peut-être, les Commissions A et B) qui pourraient traiter les sujets suivants:
 - (i) les dispositifs pour le traitement du signal (en collaboration avec la Commission C, en 1986, peut-être en France),
 - (ii) les aspects fondamentaux des guides d'ondes optiques et/ou des dispositifs qui leur sont associés (peut-être en 1985 ou en 1986 au Royaume-Uni, en collaboration avec la Royal Society),
 - (iii) la conception assistée par ordinateur de circuits intégrés à très grande échelle,
 - (iv) l'électronique rapide et ses applications optiques dans les systèmes numériques à large bande (gigabits);
3. prendre des mesures appropriées concernant le programme de l'Assemblée générale, à savoir:
 - (i) réduire le recouvrement de séances consacrées aux différents aspects d'un même sujet, en particulier dans les domaines suivants, pris au sens large: optique, électro-optique et opto-électronique (Commissions A, B, C et D, mais aussi Commission J pour l'utilisation de fibres optiques dans les grands radiotélescopes), hyperfréquences, domaines des ondes millimétriques et sous-millimétriques (Commissions A, B, C, D et J), microélectronique et électronique rapide (Commissions C et D, ainsi que Commission J pour les dispositifs III-V), et demander aux Commissions mentionnées de désigner un membre correspondant pour chacun de ces domaines;
 - (ii) organiser des séances communes avec les autres Commissions dans les domaines cités en (i);
 - (iii) organiser des séances de la Commission D consacrées au progrès dans les problèmes de physique et des matériaux des technologies de pointe, ainsi que dans la modélisation et la conception assistée par ordinateur;
 - (iv) inclure au programme de l'Assemblée une Conférence générale sur un sujet de technologie électronique;
 - (v) organiser un Colloque ouvert consacré à un sujet du domaine de la Commission D: les dispositifs semi-conducteurs composés par exemple (en particulier les dispositifs III-V), qui pourrait être copatronné par une autre organisation internationale ou bien par une association scientifique ou d'ingénierie nationale.

COMMISSION E - BRUITS ET BROUILLAGES ELECTROMAGNETIQUES

E.1 Colloques sur la compatibilité électromagnétique

La Commission E,

notant les résultats positifs de la collaboration entre la Commission et les responsables de plusieurs colloques sur la compatibilité électromagnétique, résultats qui se sont traduits par l'organisation de plusieurs séances et ateliers de travail URSI dans le cadre de ces colloques,

recommande que l'URSI continue d'accorder un modeste appui financier aux colloques des séries de Zurich et de Wrocław.

E.2 Groupes de travail

La Commission E

décide de maintenir, pendant les trois années à venir, les Groupes de travail suivants:

1. Bruits artificiels (Président: A.D. Spaulding);
2. Bruits naturels (Président: J. Hamelin);
3. Effets nocifs des phénomènes transitoires sur les équipements (Président: V. Scuka);
4. Fondement scientifique de la maîtrise des bruits et des brouillages (Président: C. Baum).

COMMISSION F - TELEDETECTION ET PROPAGATION DES ONDES - ATMOSPHERE NEUTRE, OCEANS, TERRE, GLACE

F.1 Titre de la Commission F

La Commission F,

ayant pris connaissance du rapport du Groupe de travail composé de R.K. Crane et P. Delogne (co-présidents), D. Croom et F. Fedi, qui estime peu pratique le titre actuel de la Commission, "Télédétection et propagation des ondes - atmosphère neutre, océans, terre, glace" adopté par le Conseil à la XXe Assemblée générale (Washington, D.C., 1981),

recommande que soit adopté le nouveau titre: "Propagation des ondes: télédétection et communications" qui reflète le fait que la Commission F, en tant que partie intégrante de l'URSI, est essentiellement concernée par la propagation des ondes, mais qui reconnaît en même temps que les deux principaux champs d'application des études de la Commission sont la télédétection et les communications.

Note: Voir la Résolution U.7 du Conseil de l'URSI.

contributions à ce Fonds.

G.2 Nouvelles ionosondes

La Commission G,

considérant que, dans de nombreux cas, les Centres mondiaux de données n'ont pas été informés de l'installation de nouvelles ionosondes, *recommande* aux Administrations dont elles dépendent de fournir aux Centres mondiaux appropriés les détails concernant les nouvelles stations et d'informer le Groupe Conseil du réseau ionosphérique (INAG) de leur existence.

G.3 Réseau d'ionosondes et Centres mondiaux de données

La Commission G,

notant qu'en dépit de l'accroissement du nombre des stations ionosphériques au cours des dix années écoulées, le volume des données reçues par les Centres mondiaux de données a diminué considérablement, *invite instamment* les stations ionosphériques et les Administrations dont dépendent ces stations à faire en sorte que les règles d'échange établies soient respectées et, en particulier, que les rapports mensuels soient régulièrement communiqués, sous le format normalisé, aux Centres mondiaux appropriés.

G.4 Station ionosphérique d'Huancayo

La Commission G,

reconnaissant qu'au cours de plus de 47 années, la station ionosphérique d'Huancayo a joué un rôle extrêmement important dans la compréhension de la physique de l'atmosphère ionisée des latitudes équatoriales et de ses relations avec les autres phénomènes géophysiques;

notant que cette station ne fonctionne plus régulièrement,

recommande instamment qu'un programme de sondages de routine soit ré-établi et que les données soient mises à la disposition de la communauté internationale par l'intermédiaire des Centres mondiaux de données.

G.5 Observatoire de l'Ebre à Roquetes

La Commission G,

notant que l'Observatoire de l'Ebre à Roquetes a produit une série continue de données géomagnétiques au cours des 80 années écoulées, ainsi qu'une série de données ionosphériques au cours des 30 années écoulées, apportant ainsi une remarquable contribution à la connaissance des processus dans l'ionosphère,

demande instamment à l'Administration dont il dépend d'en maintenir le fonctionnement continu.

G.6 Combined Catalogue of Ionosphere Vertical Soundings Data

La Commission G,

notant

(a) la très prochaine publication, par les Centres mondiaux de données pour la physique solaire-terrestre, du *Combined Catalogue of Ionosphere Vertical Soundings Data*;

(b) la grande valeur que ce catalogue représentera pour la communauté scientifique,

encourage toutes les stations et Administrations concernées à examiner ce catalogue avec soin et à porter toutes additions et corrections qu'elles jugeraient nécessaires à l'attention du Centre mondial de données A à Boulder, Etats-Unis.

G.7 Base de données obtenues au moyen de radars à diffusion incohérente

La Commission G,

notant qu'une base de données obtenues au moyen de radars à diffusion incohérente a été établie au Centre National de Recherches Atmosphériques (NCAR) à Boulder, Colorado, Etats-Unis,

recommande aux Administrations responsables d'adopter un format commun pour leurs données et de communiquer celles-ci en temps opportun au Centre de données afin de faciliter l'échange et l'exploitation de ces données.

G.8 Mesures dans l'espace

La Commission G,

considérant que, pour pouvoir interpréter les nouvelles données acquises aux hautes latitudes au moyen de diverses techniques radio-électriques et autres, il est essentiel de connaître les paramètres du champ magnétique interplanétaire,

demande instamment aux gouvernements et aux agences gouvernementales s'occupant de mesures dans l'espace de faire tout leur possible pour assurer l'acquisition et la diffusion de ces paramètres en temps opportun.

G.9 Projet de nomenclature normalisée des paramètres obtenus à l'aide d'ionosondes numériques

La Commission G,

notant que le Groupe de travail G.10, Groupe de travail international sur les ionosondes numériques, a préparé un projet de nomenclature normalisée pour les paramètres obtenus à l'aide des ionosondes numériques (*INAG Bulletin*, No 40/41, 1983),

recommande que la communauté scientifique adopte cette nomenclature pour tous les documents et publications scientifiques.

G.10 Groupes de travail

La Commission G,

ayant pris connaissance des rapports présentés par ses différents Groupes de travail,

décide

1. de fusionner le Groupe de travail G.1 "Groupe conseil du réseau ionosphérique (INAG)" avec le Groupe de travail G.10 "Groupe international sur les ionosondes numériques (IDIG)" et de donner au Groupe ainsi formé le titre de "Groupe conseil du réseau d'ionosondes (INAG)",
Président: Prof. J.A. Gledhill (Afrique du Sud)
Secrétaire exécutif: Dr. R. Haggard (Afrique du Sud)
Secrétaire aux publications: Dr. R. Conkright (EUA)

(voir Annexe I pour le mandat du Groupe);
2. de dissoudre le Groupe de travail G.6 "Connaissance des caractéristiques ionosphériques nécessaires pour l'amélioration des systèmes de propagation radioélectrique";
3. de maintenir le Groupe de travail G.3 "Groupe d'études de l'atmosphère de l'hémisphère austral (SHAGS)",
Président: Prof. S. Radicella (Argentine);
4. de maintenir le Groupe de travail G.4 "Ionosphère de référence internationale (IRI)" (commun avec le COSPAR),
Président: Prof. L. Bossy (Belgique)
Vice-président: Dr. T.L. Gulyaeva (URSS);
5. de maintenir le Groupe de travail G.12 "Utilisation des émissions des satellites à balise",
Président: Dr. R. Leitinger (Autriche)
Vice-présidents: Dr. A. Wernik (Pologne)
Dr. J.A. Klobuchar (EUA);
6. de former un nouveau Groupe de travail "Cartographie des caractéristiques du sommet de la couche F2",
Président: Dr. K. Davies (EUA)
Membres: Dr. P. Bradley (Royaume-Uni), Dr. N. Danilkin (URSS),
Dr. N. Mattura (Japon), Dr. L. McNamara (Australie),
Prof. K. Rawer (FRA), Dr. C.M. Rush (EUA).

(voir Annexe II pour le mandat du Groupe).

Annexe I - Mandat du Groupe conseil du réseau d'ionosondes (INAG)

Le Groupe conseil du réseau d'ionosondes (INAG) est établi par la Commission G, avec mission de poursuivre les buts suivants au moyen de la publication d'un bulletin et de l'organisation de réunions:

1. surveiller, maintenir et améliorer la qualité des données fournies par les ionosondes et le réseau d'ionosondes;

2. promouvoir l'échange de données par l'intermédiaire des Centres mondiaux de données ou bien par des contacts directs entre les stations et les utilisateurs, ainsi que le stockage de ces données;
3. réviser la liste des paramètres et les règles en usage pour les adapter aux besoins des utilisateurs;
4. évaluer l'importance internationale des stations existantes et de celles qu'il serait proposé d'établir, et formuler des recommandations appropriées;
5. encourager la mise au point de méthodes améliorées pour l'utilisation des ionosondes et faire connaître ces méthodes à la communauté;
6. prodiguer des encouragements au personnel des stations ionosphériques en les tenant au courant de l'utilisation faite des données et de toutes questions susceptibles de l'intéresser;
7. promouvoir l'utilisation des ionosondes dans les campagnes de recherches;
8. stimuler les études théoriques pour améliorer l'acquisition et l'interprétation des données.

Annexe II - Mandat du Groupe de travail sur la cartographie des caractéristiques du sommet de la couche F2

Le Groupe de travail sur la cartographie des caractéristiques du sommet de la couche F2 est établi par la Commission G pour contribuer à l'amélioration des Cartes du CCIR donnant les caractéristiques de la couche F2, par des études théoriques et des observations. En particulier, la possibilité d'incorporer à ces études les données acquises à partir de l'espace sera envisagée.

G.11 Colloques 1984-1987

La Commission G

recommande l'organisation des colloques suivants qui seraient parrainés et financièrement supportés par l'URSI:

1. Etude globale, théorie y compris, de la haute atmosphère au moyen de radars à diffusion incohérente, utilisés seuls ou en relation avec d'autres techniques, printemps ou été 1986 (organisation locale: Dr. A. Richmond, NCAR, Boulder, Colorado, EUA);
2. Etudes ionosphériques au moyen de satellites à balises, été ou automne 1986 (organisation locale: Prof. A. Tauriainen, Université d'Oulu, Oulu, Finlande);
3. Conférence internationale sur la modification artificielle de l'ionosphère par échauffement.

G.12 Représentants au Groupe de coordination inter-Commissions sur la télédétection

La Commission G

recommande que les personnalités suivantes soient désignées comme représentants de la Commission au sein du Groupe de coordination inter-Commissions sur la télédétection:

- Dr. C.L. Rino (EUA) pour les radars à synthèse d'ouverture,
- Dr. Tudor Jones (Royaume-Uni) pour les aspects de la télédétection aux hautes fréquences.

G.13 Représentant au Comité de liaison URSI-CCIR-CCITT

La Commission G

recommande que le Dr. C.M. Rush (EUA) soit désigné comme représentant de la Commission au sein du Comité de liaison URSI-CCIR-CCITT.

G.14 Review of Radio Science 1984-1986

La Commission G

décide de désigner le Dr. Ken Davies (EUA) comme rédacteur du rapport triennal commun des Commissions G et H qui sera inclus à l'édition 1987 de la *Review of Radio Science*.

COMMISSION H - ONDES DANS LES PLASMAS

H.1 Mandat de la Commission H

La Commission H,

considérant que le mandat de la Commission, tel qu'il a été défini lors de l'Assemblée générale de Lima (1975) et publié au *Bulletin d'Information de l'URSI* No 195 (septembre 1975), est parfaitement approprié,

décide de confirmer les termes de ce mandat.

H.2 Patronage de colloques et de réunions

La Commission H

recommande que l'URSI accorde son copatronage aux réunions suivantes:

1. 2e Ecole internationale pour les simulations dans l'espace, Kapaa, Kauai, Hawaii, 4-15 février 1985 (secrétaire de la conférence: Dr. D.A. Dutton, EUA);
2. 17e Conférence internationale sur les phénomènes dans les gaz ionisés, Budapest, Hongrie, 1985;
3. Colloque sur les interactions entre les ondes et les particules, et phénomènes associés, Dunedin, Nouvelle Zélande, fin janvier 1986 (organisé en commun par les Drs U. Inan, EUA, H. Matsumoto,

Japon, et R.L. Dowden, Nouvelle Zélande);

4. Colloque sur les modifications de l'ionosphère provoquées par des ondes radioélectriques de haute puissance, URSS, avant la XXIIe Assemblée générale (organisé conjointement par les Professeurs W.E. Gordon, EUA, et V.V. Migulin, URSS).

H.3 Groupes de travail URSI/IAGA

La Commission H

décide de maintenir les Groupes de travail URSI/IAGA comme suit:

URSI/IAGA.1 Sondage électromagnétique passif de la magnétosphère

Co-président pour la Commission H: Dr. U. Inan (EUA);

URSI/IAGA.2 Instabilités des ondes dans les plasmas

Co-président pour la Commission H: Dr. T. Sato (Japon).

H.4 Groupe de coordination inter-Commissions sur la télédétection

La Commission H

recommande

1. que le Groupe de coordination inter-Commissions sur la télédétection soit maintenu;
2. que le Dr. R. Gendrin (France) soit désigné comme représentant de la Commission au sein de ce Groupe.

H.5 Groupe de travail inter-Commissions sur la mesure des formes d'ondes dans le domaine temporel

La Commission H

recommande

1. que le Groupe de travail inter-Commissions sur la mesure des formes d'ondes dans le domaine temporel soit maintenu;
2. que le Dr. F. Lefeuvre (France) soit désigné comme représentant de la Commission au sein de ce Groupe.

