

**UNION RADIO-SCIENTIFIQUE INTERNATIONALE  
INTERNATIONAL UNION OF RADIO SCIENCE**



**Rapports des Assemblées Générales de l'URSI  
Records of URSI General Assemblies**

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# INTRODUCTION

## ACKNOWLEDGEMENT

The XXVIIth General Assembly of URSI was held at the Maastricht Exhibition & Congress Centre in Maastricht, The Netherlands, from 17 to 24 August 2002. In introducing this account of the records, it seems appropriate to offer the warmest thanks of the Union to:

- the Dutch Committee for URSI;
- the Dutch Organising Committee;
- the Coordinator and the Associate Coordinator of the Scientific Programme;
- the Chairs and Vice-Chairs of URSI Commissions, who planned the scientific sessions, and to the session Chairs and speakers;
- the organisations which provided funds in support of the Young Scientist Programme: ICSU, the URSI Member Committees in Ireland, Japan and the United States and the Royal Society of London.
- to the sponsors of this meeting : Vodafone (main sponsor), Agere Systems, Agilent Technologies, Astron, Delft University of Technology - IRCTR, Dutch Space, Eindhoven University of Technology, ESA/ESTEC, Joint Institute for VLBI in Europe, NWO/Physical Sciences, Paradigit Computers, Philips Research and TNO Physics and Electronics Laboratory.

## OUTLINE OF THE ASSEMBLY

The URSI Council - which is composed of the official representatives of the Member Committees - met in Maastricht on four occasions between 18 and 24 August 2002. 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.

An abundant scientific programme, consisting of 1523 papers (782 oral communications and 741 posters), had been prepared for the 1352 registrants (among them 97 official “Young Scientists”). The programme consisted of 3 General Lectures, 1 Public Lecture, 10 Tutorials, 65 Commission Sessions, 39 Joint Sessions and 3 Workshops.

The General Lectures, of interest to all participants, were entitled :

- \* Probing the Origin and Evolution of the Universe with the Cosmic Microwave background Radiation

- \* Health Effects of Electromagnetic Fields
- \* Synthesizing Optical Frequencies with a Femtosecond Laser

On the last day of the conference, a special session was held, focusing on "Radio Science in the Low Countries", organised by the Dutch and Belgian National URSI Committees. Subsequently during the last hour of the conference, before the Closing ceremony, a Public Lecture was delivered with the theme - A Century of Radio Science in the Low Countries -.

Each Commission had been asked to provide a Tutorial Lecture in its own sphere of interest. The titles of these Lectures were as follows :

- Cold Atom Fountain Clocks
- Inverse Scattering and its Applications to Sub-Surface Sensing and Medical Imaging
- Modelling of Directional Wireless Propagation Channels
- Ultra-Fast Photonic Networks Based on Optical Code-Division Multiplexing
- Lightning Electromagnetic Effects: Do We Know Everything About It?
- Recent Development of Data Processing in Polarimetric and Interferometric SAR
- Ionospheric Irregularities
- "Complexity" in Space Plasmas: Resonances, Coherent Structures and Forced and/or Self-Organized Criticality
- Radio Astronomy on the Move toward Microarcsecond Accuracy from Geodesy to Cosmology
- High Field Human MRI: Applications and Safety Aspects

# LIST OF URSI OFFICERS AND OFFICERS OF MEMBER COMMITTEES

Following the elections at the XXVIIth General Assembly in Maastricht, The Netherlands, the Officers of the Union and the URSI representatives on other Organisations are as given below. The list of Presidents and Secretaries of URSI Member Committees is based on information available at the URSI Secretariat up to the time of going to press.

## HONORARY PRESIDENTS

Prof. W.N. Christiansen (Australia)  
Prof. W.E. Gordon (USA)  
Dr. A.P. Mitra (India)  
Prof. F.L.H.M. Stumpers (the Netherlands)  
Prof. J. Van Bladel (Belgium)

## BOARD OF OFFICERS

President: Prof. Kristian Schlegel (Germany)  
Past President: Prof. Hiroshi Matsumoto (Japan)  
Vice-Presidents: Prof. Chalmers M. Butler (USA)  
Dr. François Lefeuvre (France) (URSI Exposure Officer)  
Prof. Andrzej W. Wernik (Poland) (Treasurer)  
Prof. Paul H. Wittke (Canada)  
Secretary General: Prof. Paul Lagasse (Belgium)

## SCIENTIFIC COMMISSIONS AND COMMITTEE

Commission A:  
Chair Prof. Quirino Balzano (U.S.A)  
Vice-Chair : Dr. Stuart Pollitt (U.K.)  
Commission B:  
Chair : Prof. Makoto Ando (Japan)  
Vice-Chair : Prof. Lotfollah Shafai (Canada)

Commission C:

Chair : Prof. Masami Akaike (Japan)  
Vice-Chair : Dr. Andreas F. Molisch (U.S.A.)

Commission D:

Chair : Prof. Peter Russer (Germany)  
Vice-Chair : Dr. Frédérique de Fornel (France)

Commission E:

Chair : Prof. Pierre J. Degauque (France)  
Vice-Chair : Prof. Flavio G. Canavero (Italy)

Commission F:

Chair : Prof. Martti T. Hallikainen (Finland)  
Vice-Chair : Prof. Piotr Sobieski (Belgium)

Commission G:

Chair : Prof. Christian Hanuise (France)  
Vice-Chair : Prof. Paul S. Cannon (U.K.)

Commission H:

Chair : Prof. Umran Inan (U.S.A.)  
Vice-Chair : Dr. Richard B. Horne (U.K.)

Commission J:

Chair : Prof. Makoto Inoue (Japan)  
Vice-Chair : Prof. Richard Schilizzi (The Netherlands)

Commission K:

Chair : Prof. Bernard Veyret (France)  
Vice-Chair : Dr. Frank Prato (Canada)

Scientific Committee on Telecommunications :

Chair : Mr. Martin P.M. Hall (U.K.)

## **STANDING COMMITTEES**

Standing Finance Committee

Chair : Prof. Susan K. Avery (USA)

Standing Publications Committee

Chair : Dr. W. Ross Stone (USA)

Standing Committee on Developing Countries

Chair : Prof. Sandro M. Radicella (Italy)

Standing Committee on Young Scientists

Chair : Prof. T.B.A. Senior (U.S.A.)



Long Range Planning Committee  
Chair : Prof. Tatsuo Itoh (USA)

Scientific Programme for the next URSI General Assembly  
Coordinator : Prof. Gert Brussaard (the Netherlands)  
Assistant Coordinator : Dr. P. Banerjee (India)

## **URSI REPRESENTATIVES ON OTHER SCIENTIFIC ORGANISATIONS**

CAWSES (Climate and Weather of the Sun-Earth System):  
Dr. Su. Basu (USA)

COSPAR (Committee on Space Research):  
Dr. Z. Klos (Poland)

FAGS (Federation of Astronomical and Geophysical Data Analysis Services):  
Prof. R.S. Booth (Sweden) and Dr. P. Wilkinson (Australia)

ICSU (International Council for Science):  
Prof. K. Schlegel (Germany)

ICSU Panel on World Data Centres (Geophysical and Solar) :  
Dr. D. Bilitza (USA)

IGBP (International Geosphere-Biosphere Programme) :  
Dr. P. Bauer (France)

ISES (International Space Environment Service) :  
Dr. D. Boteler (Canada)(Director), Dr. R. Pirjola (Finland, Com. E), Dr. S.  
Pulinets (Mexico, Com. G), Dr. P. Wilkinson (Australia)

IUCAF (Inter-Union Commission on Frequency Allocations for Radio Astronomy and  
Space Science) : Dr. W. Van Driel (France,Chairman), Dr. W.A. Baan (the  
Netherlands), Dr. A. Gasiewski (USA, Com. F), Dr. Y. Gupta (India), Dr. K.  
Ruf (Germany), Dr. T. Tzoumis (Australia, Com. J), Dr. D. Emerson (USA), Dr.  
G. Wannberg (Sweden, Com. G)

IUGG / IAGA (International Union of Geodesy and Geophysics / International  
Association of Geomagnetism and Aeronomy) : Prof. H. Matsumoto (Japan)

SCAR (Scientific Committee on Antarctic Research) :  
Dr. A.J. Smith (U.K.)

SCOR (Scientific Committee on Oceanic Research) :  
Prof. P. Sobieski (Belgium)

SCOSTEP (Scientific Committee on Solar-Terrestrial Physics) :  
Prof. S.A. Avery (USA)

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UNITED KINGDOM	President : Dr. H.J. Strangeways Secretary : Prof. P.S. Cannon
USA	President : Prof. U.S. Inan Secretary : Prof. P.L.E. Uslenghi

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   Secretary : Mr. S.U.B. Ezekpo  
YUGOSLAVIA                President : Prof. A.S. Marincic

### **URSI SECRETARIAT**

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Assistant Secretary General :        Prof. Frank Olyslager  
   Dr. W. Ross Stone (Publications)  
Secretary :                                    Ms. Inge Heleu (Executive Secretary)  
   Ms. Inge Lievens (Administrative Secretary)

## **OPENING MEETING**

The Opening Ceremony was held on Sunday 18 August 2002 in Auditorium I of the Maastricht Exhibition and Congress Center (MECC).

The Ceremony started with a piano solo performed by Mrs. Doré van Deijk, after which the Honorary Presidents, Officers of the URSI Board and primary speakers took their seats on stage.

### **WELCOME BY THE CHAIR OF THE DUTCH ORGANISING COMMITTEE**

Prof. F.W. Sluijter

Prof. F.W. Sluijter, Chair of the Dutch Organising Committee, welcomed the attendants and the primary speakers and he gave the floor to Mr. B.P.Th. Veltman, Chairman of the Advisory Council for Science and Technology Policy (AWT).

### **REPLY BY THE PRESIDENT OF URSI**

Prof. H. Matsumoto

Prof. Sluijter, Mr. Veltman, distinguished Guests, Honorary Presidents,  
Dear Colleagues, Ladies and Gentlemen,

May I thank you, Frans and Ben, for your kind words of welcome and for honoring with your presence the Opening session of this General Assembly of URSI. I also want, in the name of all participants, to express our warm thanks to the Netherlands URSI Committee for having invited us to hold our Assembly in this beautiful and historical city of Maastricht, the name of which calls to mind inevitably that most important Treaty, signed here in 1992, by the Member States of the European community. All of us are delighted to gather here at the time of the General Assembly in the 21st century. We are particularly indebted to Prof. Frans Sluijter, Prof. Gert Brussaard, Dr Leon Kamp and Prof. Arnold van Ardenne and their colleagues, who did not spare any effort to ensure the success of our scientific meetings, to take care of us during our stay here and, last but not least, to raise the necessary financial support. On behalf of URSI, I would like to express our heartiest thanks to them. Through personal experience, I know how much time and work they have devoted to that purpose.

Already 48 years elapsed since our Union met in this country at The Hague in 1954, a time when I was still a school boy. Now we have come back to this country which is, to my knowledge, symbolized by the following key words: HERRINGS symbolizing its strength in shipbuilding and the largest fleet in Europe in the 17<sup>th</sup> century, WOODEN SHOES AND CHEESE symbolizing the early stage advanced agriculture and horticulture, WINDMILLS symbolizing early industrialization of natural energy resources, AMSTERDAM symbolizing a staple market for regional economy in the 17<sup>th</sup> century and on, TULIPS symbolizing early maturity of the international financial market, REMBRANDT symbolizing the rise of mass consumption in visual arts and other goods, and EASTERN INDIAN COMPANY reminding me of a special relation with my country. The Dutch was the only European country which could trade with Japan during the Shogun era for 300 years.

The Dutch URSI Committee, which adhered to our Union as early as 1922, has a long-standing tradition not only in the field radio astronomy, but also in other areas of radio science. To illustrate this, I need only mention the names of the late Jan Oort, Hendrik Van de Hulst, Hendrik Bremmer and Balthasar Van der Pol, and also of our Honorary President Prof. F.L.H.M. Stumpers.

At this point I should like to say how much we do appreciate the presence of our Honorary Presidents, Prof. Gordon, Prof. Van Bladel and Dr. Mitra, who has just been elected to that high position and to whom we address our warm congratulations. We regret the absence of our two other Honorary Presidents, Prof. Stumpers and Prof. Christiansen, who are unable to be with us today.

I should like to extend a warm welcome to the family of Prof. Van der Pol, and especially to his grandson Mr. Balth. Roessingh, and also to Commander Robert Booker a son of the late Prof. Henry Booker, who will both take part in our Awards Ceremony.

URSI is well known for its close cooperation with a number of scientific unions and other international bodies. We are grateful to have representatives from them. I wish to extend our hearty welcome to Dr. Kevin Hughes for the ITU-R and ITU, Dr. Andy Smith for IUGG/IAGA, Mr. P. Paquet for FAGS, Dr. Pierre Bauer for COSPAR, and Dr. D. Emerson for IUCAF.

Thank you again, generous hosts. I now declare the 27<sup>th</sup> General Assembly of URSI open.

## **REPORT OF THE SECRETARY GENERAL OF URSI**

Prof. P. Lagasse

Ladies and Gentlemen,

It is the traditional duty of the secretary general to present a concise report of the scientific activities, the finances and the general administrative situation of the Union. Three years ago our previous general assembly was held in Toronto. Only three years and

so much change. Restricting ourselves to matters closely related to URSI, I recall that at the Toronto GA we all contemplated the limitless opportunities for wireless communications that were opening up.

Since the bursting of both the telecommunications and Internet bubble the outlook of the general public on telecommunications has changed drastically. While investment in infrastructure and equipment may have fallen drastically, it is probably not so well understood outside our community of radioscientists that the scientific and technological race for ever-higher performance devices and systems has certainly not slowed. On the contrary, difficult economic conditions have made scientific and technological advances even more important. The changing situation offers a number of challenges to URSI. Those challenges however can be turned into opportunities. Allow me to elaborate somewhat on that, while reviewing the main activities of the past triennium.

The core scientific activities of URSI as a scientific union are threefold: the organisation and support of scientific conferences, the publication of scientific papers and reports, and finally all activities that allow a better interaction between individual Radioscientists, between the member committees and between URSI and organisations such as ITU, ICSU or other scientific Unions.

In general enabling and stimulating the interactions and scientific exchanges within the radioscience community and between this community and outside organisations was recognised as the main aim of URSI.

In the past triennium, URSI has sponsored or co-sponsored 68 meetings. For XXX of those meetings and initiative lies with URSI. It is important for URSI to further enhance the success and expand the number of those conferences. It is therefore with pleasure that I mention here the new initiative of the Asia Pacific Radio Science conference. The first in this series of conferences was held in August last year in Tokyo and was very successful. More than 700 participants from 34 countries and regions attended this conference where nearly 600 papers were presented covering the main theme, which was: Radio science – communications, environment and energy. I would also like to specially mention the fact that the organizing committee managed to support 48 Young Scientists from 17 countries. As on previous occasions, I would like to express the gratitude of the radioscience community to all the colleagues who by their effort and commitment ensured the success of all the URSI conferences.

Mesdames et messieurs,

La conférence la plus importante pour URSI est indiscutablement notre Assemblée Générale. C'est l'occasion par excellence où les scientifiques, travaillant dans les divers sous-domaines de la science radio se rencontrent et où des échanges de vue fructueux ont lieu aussi bien d'un aspect purement scientifique que pour l'organisation du travail dans les commissions. Ce qui donne un intérêt particulier à notre Assemblée Générale par rapport à la plupart des conférences est la possibilité d'avoir des contacts scientifiques au delà de la spécialisation pointue qui caractérise de nos jours la recherche scientifique. En effet c'est justement dans l'interaction entre les différents domaines que l'on trouve souvent

le champ de recherche le plus fructueux. L'Assemblée Générale est aussi l'occasion de réunir dans les différentes parties du monde les chercheurs en science radio et leurs échanges scientifiques. Contrairement à beaucoup d'associations professionnelles qui sont étroitement liées à l'un ou l'autre pays, l'ouverture vers le monde, sans exception ni de race ni de nationalité, est la vocation primaire d'URSI. L'Assemblée Générale doit être l'expression de cette vocation universelle d'URSI. Ni les problèmes économiques actuels ni les restrictions budgétaires imposées par beaucoup de gouvernements, ne peuvent nous empêcher d'exprimer le caractère vraiment international d'URSI à travers l'organisation de l'Assemblée Générale.

Ladies and Gentlemen,

Publications are another important way for URSI to provide a useful service to the radioscience community. In an age where a wide variety of scientific journals are available on paper and electronically, it is clear that substantial talent and experience in the area of scientific publications is required in order for URSI to provide a really useful and reasonably unique service in the field. URSI was therefore very fortunate that Ross Stone graciously accepted to join the secretariat team as Assistant Secretary General with a special interest for the publications. We are all confident that under his competent and diligent editorship, the Radio Science Bulletin will further evolve and grow into a substantial and much appreciated publication. I really hope we can count on all of you to submit papers for publication in the Radio Science Bulletin. Please keep this in mind during the business meetings of this General Assembly but especially during the years between the General Assemblies. We are looking for scientific papers that are not very highly specialised but that are of interest to the whole radioscience community. There are already a large number of scientific publications, most of which are highly specialised. We do believe that there is room and opportunity for a journal, which allows one to benefit from the cross-fertilisation between the different specialised sub domains of radioscience.

Over the past 10 years a number of people have devoted much time and energy to grow the Radio Science Bulletin from the largely administrative Bulletin into the publication it is today. I would like to express my heartfelt thanks to Dick Dowden, Paul Delogne and to Peter Sobiesky for their work and enthusiasm, which made this transformation possible. As on previous occasions URSI is also indebted to Ross Stone for having taken on the heavy burden of editing the Review of Radio Science. With the help of the commission editors he managed again to produce on time a most interesting and valuable book of which you all have received a Cdrom version at registration.

At this General Assembly new proposals will be discussed to further streamline and focus our publication efforts, enhancing its added value to the radioscience community while keeping the costs within budget. This last word forms a perfect transition to my next topic, namely the financial situation of URSI. Let me immediately reassure you, the financially URSI is in a good condition and I am personally willing to testify that our



published accounts reflect the reality. Obviously the value of our reserves has not increased over the past triennium, but since it was invested conservatively, the decrease has been much smaller than what one would expect from evolution of the stock market.

Under the careful supervision of our treasurer, Professor Schlegel, administrative costs have been kept in check and averaged over a triennium, operating income and expenditure is approximately in equilibrium. URSI is extremely grateful to all the people from member committees for their efforts to convince their academies and governments to continue to pay the dues to URSI. This is very much appreciated and necessary because URSI is a union of member committees. The member committees form the basis of URSI both by their own activities and by their contribution to the work of our URSI commissions. Dues from the member committees constitute also our sole financial basis.

Our healthy financial situation has allowed us to continue our Young Scientist program. Thanks to this program 100 young scientists from all over the world receive support to attend this general Assembly. URSI is grateful to the national committees from the USA, from Japan, from the UK and from Ireland for their donations supporting this program. The support we give to Young Scientist is an expression of the vocation of URSI to reach out to all radioscintists everywhere in the world. At a moment when telecommunications become all pervasive and when the Internet covers the world, this may seem no longer necessary. In reality however inequalities are growing and finding ways in which we can serve the whole world as a community is a difficult challenge upon which we all should reflect.

Let me conclude, Ladies and Gentlemen, by stating that our union is in an excellent shape, both scientifically and financially, and that I am confident that the dynamism and enthusiasm of all of you will enable us to tackle successfully the challenges posed by the rapidly changing times we currently live in.

## **MESSAGE FROM THE INTERNATIONAL TELECOMMUNICATION UNION (ITU)**

Kevin A. Hughes

Head, Radiocommunication Study Group Department

I wish to bring warm greetings from Mr. Bob Jones, Director of the ITU Radiocommunication Bureau, who very much regrets not being able to be with you today for personal reasons. Being the last time as Director that he can extend such greetings, he has asked me not only to send his best wishes for a successful Assembly but also to remark on the excellent relationship between URSI and ITU-R that he has experienced during his tenure as Director. Mr. Jones has requested me to deliver the following address on his behalf.

During the last GA in Toronto, there was much discussion on how liaison could best be effected between URSI and the ITU. The roles that both organisations played within the field of radio were reflected upon, and their respective responsibilities in the

ever-developing world of telecommunications were identified. Over the past three years, nothing has essentially changed as regards these fundamental starting points – URSI promotes radio science whilst ITU addresses spectrum use – and it would still be true to say that the activities of the two organisations complement each other.

Since GA-99, there has been a major WRC (Istanbul, 2000) from which several decisions impacted significantly upon radio services of interest to the URSI community. In particular, these concerned passive services such as the Radio Astronomy Service (RAS) and Earth Exploration Satellite Service (EESS) where either new frequency allocations were made, existing allocations re-arranged, or sharing conditions with other services refined. The next WRC (mid-2003) will be no less important for such services, with agenda items addressing allocations and sharing criteria affecting the EESS, RAS and Space Research Service (SRS). The consideration of spurious emission limits with respect to protecting passive services is another agenda item that has generated considerable emotion. In the extensive preparations for WRC-03, and for the Conference Preparatory Meetings (CPM) beforehand, URSI and IUCAF have again been instrumental in supporting the interests of the users of the services concerned. As underlined in the past, this is a notable example of the deep involvement of the scientific URSI community in a major event of the ITU.

Liaison activities at a more fundamental level have also been evident. In 2001, a further symposium in the series “CLIMPARA” was held in Budapest – a forum that concentrates on climatic effects on radiowave propagation. As for previous CLIMPARAs, it was held immediately prior to meetings of two ITU-R Working Parties of Study Group 3 (Radiowave propagation) whose work depends on a knowledge of radiometeorological information as the basis for developing prediction methods. The contiguous holding of the events allowed the possibility for some of the URSI scientists to participate in the ITU-R meetings as members of their country delegation – an excellent example of exploiting the potential synergy between the two disciplines.

Perhaps however, the most fruitful liaison between URSI and ITU-R arises from personal contacts and from participation in events of mutual interest. We are privileged to have several eminent and long-standing URSI participants as key players in ITU-R Working Parties and Task Groups, and in some cases chairmen of such groups. A number of these people are present here at this Assembly, thereby providing the possibility of carrying forward the scientific expertise presented here this week into future studies of ITU-R. It would also be appropriate to mention at this point that we were extremely pleased to see your current President and Assistant Secretary General at a meeting of the ITU-R Radiocommunication Advisory Group (RAG), held earlier this year in Geneva. Although managerial in nature (and perhaps a little political at times), this Group has considerable influence on the way ITU-R does its business and it was good to see URSI using its Sector Membership by attending such an event.

Allow me to dwell a little longer on the theme of ITU Membership. URSI’s Sector Membership of ITU-R enables URSI to be represented at meetings of the Sector, including

the Study Groups, Working Parties and Task Groups that deal with issues of particular interest to several URSI commissions. Examples that come to mind include the activities of:

- Study Group 7 covering subjects such as time signals and frequency standards emissions, the EESS and RAS
- Study Group 1 dealing with spectrum management issues
- Study Group 3 (radiowave propagation) which address not only fundamental aspects but also the development of prediction procedures used for spectrum management purposes.

Of course, for practical or budgetary reasons, personal representation of URSI at such meetings may not often be possible but it must be remembered that Sector Membership also provides access to the working documents which would in turn allow the progress of studies to be followed back home. Therefore, perhaps we could suggest that this aspect of URSI's membership be further explored in the future.

A relatively new category of ITU-R Membership is that of Associates. This was introduced two years ago and allows entities with perhaps limited means, and with interests focussed on one particular area of the Sector's activities, to participate in the work of a selected Study Group. An example might be a university department specialising in one particular area of radio technology. Unfortunately, the response so far to this new membership category has been disappointing but I mention it here since it might well be relevant to the URSI community. With the intention of promoting Associate membership, a series of brochures has been produced, publicizing the work of the various Study Groups. Having in mind the potential URSI interest, the brochures for Study Groups 7 and 3 appeared in the previous two editions of Radio Science Bulletin where we hope that some of you would have already seen them and had a chance to read them.

The previous General Assembly saw the re-installment of the Scientific Committee for Telecommunications (SCT) which has the role of nurturing and promoting liaison between the two organisations. Whilst it has not been possible to exploit the potential of this Committee in the period leading up to this Assembly, there has nevertheless been considerable discussion and debate as to how such an entity should operate. What is clear is that there is much interest in optimising the mutual benefits that can accrue from good liaison and it remains to find the most effective way of realising this aim. The recent SCT web pages are an impressive start and I know that there will be further discussions this week as to how to develop this facility further.

However, whether the SCT continues to exist or not perhaps is not the main issue. What is vital is that both communities – those of URSI and ITU – continue to recognise the need for strong liaison in the form of personal contact and access to information of common interest. We feel sure that with the efforts that are already so apparent in this respect, that the two organisations will continue to enjoy their close association as in the past.

## PRESIDENTIAL ADDRESS

Prof. H. Matsumoto

Distinguished Guests, Honorary Presidents,  
Dear Colleagues, Ladies and Gentlemen,

Notre Union se réunit tous les trois ans en Assemblée Générale pour passer en revue les développements intervenus depuis la dernière Assemblée dans les différents domaines de la radioélectricité scientifique et pour explorer les voies à suivre dans nos futures recherches. C'est aussi l'occasion pour nos membres de confronter leurs vues sur les différents aspects de nos études et d'établir des plans de coopération.

C'est pour moi un grand honneur, en tant que Président de l'URSI, d'ouvrir les travaux de cette vingt-septième assemblée générale.

The General Assembly of our Union is convened every three years for the purpose of reviewing the developments that have taken place during the past triennium in the many fields of radio science, and of exploring lines of research in the years to come. It offers also the possibility to our members and participants to exchange ideas on the various aspects of their studies, and to make plans for future cooperation, coordination and collaboration. Another advantage of our Assemblies, and not the least, is that they favor human contacts and give us the opportunity to see and meet one another as individuals to renew old friendships and find new friends, as I believe that even academic deed is strongly influenced by human relations.

It is indeed a great honor for me, as President of URSI, to open this 27<sup>th</sup> General Assembly, and to offer words of welcome to all participants and especially to those participants who have come to an URSI Assembly for the first time, and particularly to the younger scientists. I extend also a special word of welcome to the accompanying families attending our meeting.

Before referring to our activities in the past triennium, I have the sad duty to record with profound sorrow the passing of those scientists, who were associated with our Union. Unfortunately since our last General Assembly in Toronto, we suffered the loss of a number of distinguished colleagues and friends.

Our Honorary President, Prof. Walter Dieminger, passed away on 29<sup>th</sup> September 2000 at the age of 93. Early in his scientific career Prof. Dieminger became associated with URSI, and lead German Member Committee from 1954 to 1967. He served as Vice-President of the Union from 1963 to 1969, and as President from 1969 to 1972. In 1978, the title of Honorary President was conferred upon him. His scientific work includes about 120 articles on various geophysical and radio propagation topics, some of which are still regarded as landmark papers. May I remind you that Prof. Dieminger was closely involved in the numerous discussions, which developed in the period 1963-1975 on the reorganization of our Union. Thus the international Union of Radio Science, URSI, is greatly indebted to the work and achievements of Professor Walter Dieminger.

Professor Paul Hontoy passed away on 28 January 2000. He has been a very active member of the Belgian URSI Committee, and its President from 1975 to 1978. At the General Assembly in Helsinki in 1978, he was elected Secretary General of the Union, after Dr. Minnis' retirement. Unfortunately, soon after his election, he was taken ill with a viral disease, which endangered his life for several weeks. However, with great courage Prof. Hontoy resumed his duties as Secretary General of the Union and at the Universite Libre de Bruxelles. In 1979, he participated actively in the organization of the 60<sup>th</sup> Anniversary Colloquium of URSI, held in Brussels. Sadly enough, he was never to recover completely and, in 1980, aware of the state of his health, he asked to be relieved of his charge in URSI. One cannot but admire the strength of character, the never failing kindness and sense of humor he showed in the years to come until the end of his life.

Others whose death was reported and who acted as office-bearers in our Union are:

- Prof. Aleksandar Prokhorov (Russia), Vice-President of URSI 1960-1965 and Nobel Prize Winner in 1964.
- Dr. Louis Essen (UK), past Chairman of Commission A 1963-1966.
- Prof. Moto Kanda (USA), past Chairman of Commission A 1996-1999.

We also mourn the death of those who were active in URSI and had contributed to our radio science. They are;

- Prof. Vitold Belevitch (Belgium)
- Prof. Sun Yun-ren (China CIE), Past Chair of Chinese National Member Committee
- Prof. G. Eckart (Germany)
- Dr. Heinz Thieman (Germany)
- Prof. H. Pöeverlein (Germany)
- Prof. Aldo Gilardini (Italy)
- Prof. Henk van de Hulst (Netherlands)
- Dr. Martin Jeuken (Netherlands)
- Prof. Hanbury-Brown (UK)
- Prof. Alexei Sitenko (Ukraine)
- Prof. Boris Makarenko (Ukraine)
- Dr. Kenneth Evenson (USA)
- Prof. Millett Morgan (USA)
- Prof. Phillip Rice (USA)

I would also like to mourn our URSI lady, Mrs. Elva Gordon, the wife of our Honorary President Prof. William Gordon. As his constant companion, she was known everywhere in URSI circles, and her cheerful disposition and gracefulness were always appreciated by those with whom she came into contact. May I ask you to stand in silent tribute for a minute to those who are no longer with us. Thank you.

Ladies and Gentlemen,

I now wish to turn to a review of developments in radio science during the past three years, but I can hardly attempt to make a broad survey of the work of our ten

Commissions. However, on the basis of reports kindly provided by the Commission Chairs, I shall note some of the highlights of developments that took place. I shall undoubtedly overlook a number of important items, and I beg your indulgence, for you know that the whole of the scientific domain of URSI is far beyond the competence of any one person.

As to Commission A, in the field of electromagnetic metrology, atomic fountain frequency standards have matured to be operated regularly and to contribute to the realization of the International Atomic Time. They realize the SI second with relative uncertainty of about 1 part in 10<sup>15</sup>. One of our General Lectures at this Assembly is related to this development. It is given by Prof. Theodor Haensch of Germany.

Regarding Commission B, spectacular results are being achieved in the area of Computational Electromagnetics where, among other problems, the properties of absorbing boundary conditions have been studied extensively and applied in a variety of contexts. Within the field of Electromagnetic Theory, methods have been developed for formulating EM wave propagation and scattering in materials with complicated shape.

In the domain of Commission C, signal processing has pervaded all areas of scientific research, particularly in areas where stochastic signals or measurements are involved such as, for example wave propagation in turbulent plasmas, interference and noise reduction in radio astronomy, and scattering from trees and foliage. Also it is worthwhile to note that enormous strides occurred in the past three years toward a world in which the preferred access to telecommunication services will be based on radio waves.

In Commission D, the central subject for research has been the development of widely tunable monolithic semiconductor lasers, commercial realization of 40 Gb/s IC technology, and carbon nanotube technology. The multi-Tb/s transmission over optical fiber over transoceanic distances has been achieved using wavelength division multiplexing of 10 Gb/s or 40 Gb/s channels.

Commission E devoted attention to the two main areas: natural noise and artificial noise. A technique has been developed to monitor lightning activity from space, and its global distribution. The possibility to predict earthquakes has been investigated, but still more studies will be required in order to draw meaningful conclusions. Regarding artificial noise, investigations have been conducted on techniques permitting to reduce emissions emitted unintentionally by various electronics devices. One of the subjects to be discussed at this Assembly concerns high power EM noise emitted intentionally to attack communications systems.

In the area of Commission F, theoretical studies have been devoted to polarimetric and interferometric Synthetic Aperture Radar (SAR) technologies. These have become available for practical remote sensing satellites. It is noted that Commission F contributed much to the interaction with ITU-R through many ways such as CLIMPARA meetings with partners of Working Parties of ITU-R.

In the field of Commission G, research associated with ionospheric observations using the GPS (Global Positioning System) has increased considerably. During the past triennium, the significance of coherent radar observations, of the ionosphere has become

more widely accepted. The development of real-time links between radars represents one of the most exciting experiments of the last three years, and it is paralleled by increased incoherent scatter radar programs.

As to Commission H, one should mention the successful satellite missions such as GEOTAIL, WIND, POLAR, IMAGE and CLUSTERS, which demonstrated the very effective use of plasma waves to remotely sound macroscopic regions of the magnetosphere, including the plasmopause, magnetotail, magnetosheath, magnetopause, bow shocks and interplanetary space. Major advances were also made in theoretical modelings of space plasmas, which are going to be increasingly important as near Earth-space is populated by man-made objects.

Regarding developments in Commission J during the past three years, the most significant by far is the detection of fluctuations in the cosmic microwave background (CMB) radiation. Several experiments have been conducted concerning this subject. Prof. John Carlstrom of United States will give a General Lecture on this during this Assembly. Another important milestone in Radio Astronomy and perhaps all astronomy is the ALMA Project which uses an array of 64 antennas with a diameter of 12 meters for mm/submm interferometry. They are to be built in the Chilean Andes.

Our Commission K conducted investigations in two main areas: Biological effects and Medical applications. The subjects for research in the first area were power line frequency fields, and RF and microwaves. These topics attract interests and concern from the general public but are still at an early stage of research, though many several noteworthy experiments have been carried out. Concerning the Health effects of EM exposure, Dr. Michael Rapacholi of World Health Organization will give us a General Lecture during this Assembly. In the second area, we note that studies on high-field MRI have advanced substantially and enhanced the capability of MRI as a real-time imaging modality with vastly improved spatial resolution for functional imaging of brain and cardiovascular activities in humans.

Ladies and Gentlemen,

I am now going to touch upon some of the important topics to be mentioned.

#### *Young Scientist Programme*

I am pleased to report that our young Scientists Programme attracted about 150 applicants, both from developing and developed countries. One hundred of them have been selected under the new procedure initiated for this Assembly. We are grateful to Prof. David Olver and his Committee for their very efficient work. This programme, which was initiated as early as 1969, has proved to be one of the most successful actions taken by our Union. Not only does it give a fresh impetus to our activities but, at the same time, it gives the young people the opportunity to benefit from the knowledge and experience of their elders. Last but not least, it makes it possible for young scientists from developing countries to participate in our meetings, and thus to contribute to the

advancement of radio science in their region. Our warm thanks go to our Dutch hosts for their generous support of living expenses for young scientists. The funds for travel expenses for young scientists from developing countries and countries in a difficult economic situation are provided generously by, in alphabetical order, ICSU, the Japanese URSI Committee, the Royal Irish Academy, the Royal Society of UK, and the United State National Committee. On behalf of URSI, I would like to express our gratitude to those institutes. It has become almost a tradition to ask young scientist awardees to stand up at this moment so that all of us may recognize and congratulate them. May I ask the awardees of our young scientist programme to stand up for a moment? Congratulations! Thank you.

Before I leave this topic, I would like to stress that URSI has also supported young scientists and colleagues from countries in a difficult economic situations in the inter-Assembly period. Most of the support was given to them through the budget of Scientific Commissions.

#### *Long Range Planning Committee*

According to the URSI Statutes, the Members of the Union are Committees, which are established in a given territory by the academy of sciences, or a similar institution, and the applications of which are accepted by the Council. The question of the possible controlled admission of individual scientists to URSI has been a subject for discussion ever since 1969. Following a recommendation adopted in 1987 by the Corsendonk meeting, which had been convened to reassess the goals and structure of the Union, and as a result of a widely based inquiry involving all Member Committees, it was decided in 1990 to establish the current Network of URSI Correspondents. However, there was still a feeling that there was a need for some mechanism to permit individual scientists to affiliate with URSI and to be recognized as being part of the Union. At the General Assembly in Toronto in 1999, the Board asked the Long Range Planning Committee under the able chairmanship of Prof. Tatsuo Itoh, to consider carefully the full implications of creating a category of individual members. The Committee discharged the task with great diligence and I take this opportunity to express our appreciation of the work done. It will be up to the Council to discuss the proposals contained in the Report of the Long Range Planning Committee, but I may already mention that the term "URSI Correspondent" would be changed to "URSI Radio Scientist" implying recognition by URSI and some other benefits.

While referring to the work of the Long Range Planning Committee, I would like to mention another proposal, i.e. the introduction of a Traveling Lecturers Programme. A list of scientists willing to participate in that programme would be maintained at the URSI Secretariat, and published in the Radio Science Bulletin. Any Member Committee could then extend an invitation directly to any of the Lecturers. It would be up to the inviting entity to defray his travel and living expenses, but no honorarium would be paid. The aim of the Programme is, on the one side, to allow Member Committees to benefit from the competence and experience of recognized radio scientists and, on the other side, to give URSI more visibility.



### *URSI Conferences*

The Secretary General has already reported on the conferences and symposia sponsored or co-sponsored by URSI during the last triennium. Nevertheless, I wish to refer briefly to one of them, which was held following a recommendation of the Long Range Planning Committee regarding the organization of regional URSI conferences involving several Member Committees and scientific Commissions, the aim being to stimulate and coordinate research activities in all fields of radio science. The Asian Pacific Radio Science Conference, AP-RASC '01 in short which was held in Tokyo in 2001, was the first regional URSI meeting in that part of the world. The Chairman of the Conference was Dr. Yoji Furuhashi, and the main theme was "Radio Science - Communications, Environment and Energy". The programme included a session entitled. "Solar Power Satellite and Wireless Power Transmissions", two General Lectures on "Mobile Communications Technology - Most Brilliant Application of Radio Science" and "Engineers at the Frontiers of Science and Engineering in Radio Astronomy", delivered respectively by Prof. Yasuhiko Yasuda and Prof. Govind Swarup. The Conference was attended by 704 participants from 34 countries, including 48 young scientists and numbered about 400 oral presentations, and about 200 poster papers.. In view of the great success of the event, it was agreed unanimously by the International Advisory Board and the Steering Committee that an Asian Pacific Radio Science Conference should be organized triennially in the interval between General Assemblies. The next one, AP-RASC '04 will be held in China in 2004.

### *Scientific Committee on Telecommunications*

For many years, URSI has maintained, in one form or another, a body the task of which was to ensure cooperation with the International Telecommunication Union (ITU), and especially with ITU-R (former International Radio Consultative Committee, CCIR). The basis of the interaction between the two bodies was established in the 1920's. The URSI Scientific Committee on Telecommunications (SCT), established in 1990, was reactivated in 1999 on the initiatives by Dr. Joe Shapira, our Vice-President, and Prof. Paul Delogne. However, owing to various reasons, its role has slowed down. In April 2001, after the resignation of the current chairman, the Board asked Mr. Martin P. M. Hall to assume that responsibility and take a role of acting Chair and its responsibility. Since then Mr. Hall with the members of his Committee has been very active, consulting Commission Chairs and others in order to define how best to serve the interests of both organizations. I would like to express our deep appreciation and gratitude, on behalf of the Board, for his unselfish contributions including a web forum interaction with his members. Following the decision of the Board, I myself visited ITU twice on behalf of the Union and had a chance to exchange views with the Secretary General of ITU, Mr. Yoshio Utsumi, and the Director of Radio Communication Bureau of ITU-R, Dr. Robert Jones. We agreed to continue mutual interactions between URSI and ITU-R such as the activities of CLIMPARA and requests for availability of radio frequencies for radio science in alliance with IUCAF. Also we discussed a possibility of extending our efforts to involve

other sectors of the ITU, ITU-T and ITU-D. On my second visit to ITU with our assistant secretary general, Prof. Frank Olyslager, Dr. Kevin Hughes, who has just addressed our Assembly, suggested that another possible interaction fruitful for both Unions may be in the area of Bio-Radio studies, with a possible involvement of the World Health Organization, WHO. Mr. Martin Hall will propose to extend the Terms of Reference of the SCT so as to embrace exchange of information with other parts of ITU, and possibly with WHO as well in conjunction of our Commission K. He would appreciate any contributions to the subject and has prepared a detailed report to be submitted to the Council.

#### *URSI Publications*

Prof. Lagasse, has already discussed our activities on Publications, but I would like to add a few words with regard to the Radio Science Bulletin. First I would like to thank warmly Dr. Piotr Sobieski, who acted as Editor from March 1997 to June 2001 and made significant contributions in this context. Second, it is my pleasure to refer to the decision, made by the Board of Officers in May 2001, to name Dr. Ross Stone, a well-known personality in URSI community, as Assistant Secretary General for Publications. He already demonstrated his exceptional ability in that capacity, and we thank him for his excellent job and wish him every success for the future.

He has also served as Editor-in-Chief of the Review of Radio Science (RRS) for four triennia with four books of approximately 1000 pages and CD-ROM version for the most recent edition to which I would like to express our sincere thanks on behalf of the Board of Officers and all colleagues in the Union

Ladies and Gentlemen,

The last but not least the core and heart of our Union lie in

#### *Scientific Programme for this General Assembly*

This time, instead of the customary booklet, full use was made of the Web to carry the bulk of information. More than 1500 papers were submitted, and about half will be presented orally and the other half will be given in poster sessions. We will have one Public Lecture by Prof. Sluijter, and three General Lectures as stated before.

A reading of the excellent and splendid scientific program for this Assembly shows a tremendous amount of work that has gone into its preparation. On behalf of URSI and the Board of Officers, I would like to express our gratitude to the Coordinator of the Scientific Program, Mr. Martin Hall, Associate Coordinator, Prof. Gert Burussaad, ten Commission Chairs and 104 Oral Session Conveners, in addition to those responsible for the specific poster sessions.

#### *Concluding Remarks*

Before concluding my Address, I should touch upon our relations with ICSU. ICSU has changed its structure, and the International Council of Scientific Unions has now become the International Council of Science. One of the factors for the feeling that the ties between

the scientific Unions of hard sciences and ICSU have weakened is the increase in the total number of Union members, 26 at this time, with almost half of them being related to biology. The result is that the latter pay a smaller amount of dues, and yet they have an independent equal voting power in ICSU. Being aware of such complaints, ICSU has decided to convene meetings of the International Scientific Unions in order to re-establish better contacts. I attended the first of these meetings on behalf of URSI in February 2001. Following frank and fruitful discussions, the Unions and the ICSU Head-quarters agreed to improve their cooperation and to define those areas where scientific unions could participate more actively on the basis of their respective professional competence and experience. However, it would be necessary for us to analyze the current situation and devise a firm strategy on how we could best contribute to ICSU and on how to derive benefits from such cooperation. The Board of Officers feels that this might be an appropriate task for the next Long Range Planning Committee.

I confess that I would not have been able to fulfill my duties as URSI President without help and assistance by other members of the Board and Secretariat. Prof. Tom Senior, Prof. Joseph Shapira, Prof. Kristian Schlegel, Prof. Andrzej W. Wernik, Prof. Paul H. Wittke and Prof. Paul Lagasse in the Board, and Prof. Peter van Daele, Prof. Frank Olyslager, Dr. W. Ross Stone, Mrs. Inge Heleu and Mrs. Inge Lievens in the Secretariat. I would also like to express my gratitude to those who devoted themselves to URSI through Commissions and Standing Committee as well as ad hoc Committee. The new Advisory Panel on Future General Assemblies, the members of which are Mr. Martin Hall, Dr. Ross Stone and Dr. Francois Lefevre have done an excellent work with our Secretary General. I should like to express my deep appreciation to them. It is also fortunate that I have been given a personal friendship from Mrs. Yela Stevanovitch whose knowledge and enthusiasm about URSI and its history have been indispensable for me. I am also grateful for unselfish help and hard work by my secretaries in my office at my University, Mrs. Keiko Miwa and her assistants.

May I conclude my address by quoting very interesting words by our former Honorary President Prof. W. E. Eccles. In 1934 in London, earlier than my birth year, he said "The creation of URSI meant mixing two types of men, the engineer and the physicist. This will attract not only the best radio engineers and the best radio physicists, but also the best research workers from all other scientific fields." This foresight by Prof. Eccles has been proven and URSI at present attracts many researchers from various fields, not only telecommunications area with half our Commissions, but also in the areas of space plasma physics, aeronomy, astronomy and biology with the other half. I am confident that URSI will extend the horizon with new frontiers, new usage and findings of radio for the well-being of all humans in this rather difficult century.

Now, I wish that your stay in Maastricht will prove interesting, stimulating and fruitful, and I hope that you will bring back good memories and professional gains. *Thank you, Merci beaucoup, Dank U wel, Danke schön, Spasibo, Shoklan, Toda raba, Dzienuje, Muchas Gracias, Grazie tante, She-she, Kamsa-hamnida and Arigatou.*

## **AWARDS CEREMONY**

*The Awards Ceremony was chaired by Prof. T.B.A. Senior, immediate Past President and Chairman of the Awards Panel.*

This is the occasion when we get to honor some of the outstanding radio scientists from around the world, and this year, for the first time, there are five awards to be presented. I would like to acknowledge the assistance of my colleagues on the Honors and Awards Panel - John Evans, Akira Ishimaru and Ron Woodman - as well as the input received from over two dozen reviewers.

The first award to be handed out is the van der Pol Gold Medal, named after one of the founders of this organization. We are honored to have with us Mr. Balthasar Roessingh, a grandson of Professor van der Pol, and I invite him to say a few words about his grandfather and then make the presentation.

### **PRESENTATION OF THE BALTHASAR VAN DER POL GOLD MEDAL**

by Mr. Balthasar Roessingh

Thank you very much Professor Senior for your kind words and introduction.

Ladies and Gentlemen,

In February 2001 I received a letter from Professor Thomas Senior of URSI, asking me to present the van der Pol Gold Medal today. I was really honoured. One of the questions I asked was, would be possible to say a few words in Dutch? The answer was of course no! What I want to say is that my grandfather stole all the brains of the entire family. None of his children, grandchildren or great grandchildren have yet managed to achieve anything in Science so far. And now I am standing in front of you to present a scientific award, initiated by my grandmother, the late Mrs. Petronetta Le Corbeiller (van der Pol) Posthuma in 1963 at the 14th General assembly in Tokyo. I am very honoured and proud to have been asked to make this presentation.

When my grandmother initiated this award, she had one purpose, I quote: *“the purpose of the medal is to keep alive the memory of my husband and to stimulate, especially the younger scientists among you, to work patiently and seriously with the Officers of URSI for radio science in its widest scope”*.

My grandfather was a remarkable man. He was born in Utrecht in 1889. After primary and secondary school, he graduated cum laude in physics from the University of Utrecht on 27th of April 1916 under Professor W.H. Julius He developed his thesis entitled “*The Effect of an Ionized Gas on Electromagnetic Wave Propagation and its Flow Discharge Measurements*”. The next three years were spent in England working first with John Ambrose Fleming (University College of London) and later under J.J. Thomas at Cambridge in the famous Cavendish laboratories. At this time he also became a good friend of the Nobel prize-winner Sir Edward Appleton. They both shared an interest in radio waves. In September 1920 he worked at the Teyler Foundation in Haarlem. It was here he became the theoretical assistant of the great Nobel Prize Winner Professor Lorentz for a period of three years. He was even a founder member, in 1920, of the Netherlands Radio Society. In the following year he was also one of the founder members of the Dutch Physics Society.

In 1922 he became head of the Philips Research Laboratories in Eindhoven. He held this position until his retirement in 1949.

He became the leader of the fundamental radio-research. You even can find my grandfather on the internet; I quote: “*He investigated electrical circuits employing vacuum tubes and found that they have stable oscillations, now called limit cycles. When these circuits are driven with a signal whose frequency is near that of the limit cycle, the resulting periodic response shifts its frequency to that of the driving signal. That is to say, the circuit becomes “entrained” to the driving signal. The waveform, or signal shape, however, can be quite complicated and contain a rich structure of harmonics and sub harmonics.*

In the September 1927 issue of the British journal Nature, he and his colleague van der Mark reported that an “irregular noise” was heard at certain driving frequencies between the natural entrainment frequencies. By reconstructing his electronic tube circuit, we now know that they had discovered deterministic chaos. Their paper is probably one of the first experimental reports of chaos—something that they failed to pursue in more detail.

Van der Pol built a number of electronic circuit models of the human heart to study the range of stability of heart dynamics. His investigations with adding an external driving signal were analogous to the situation in which a real heart is driven by a pacemaker. He was interested in finding out, using his entrainment work, how to stabilize a heart’s irregular beating or ‘arrhythmias’. In 1927 he had an important role in the establishment of the first radiotelephone connected Holland with India. From 1938 until 1949 he had been nominated professor of theoretical electricity at the Technical University of Delft. Since 1947 he devoted himself, above all, to international activities, having accepted his election as Director of the International Radio Consultative Committee (C.C.I.R) at Geneva. He also received the Medal of Honour of the I.R.E, the Poulsen Medal of the Danish Academy of Technical Science. He was a member of the Royal Netherlands Academy of Science, corresponding member of the Academy of Science in Paris, Honorary Doctor of the Warsaw Polytechnics and Honorary Doctor of the University of Geneva.

And, of course, he was an Honorary President of URSI.

So now you can imagine how proud I am of my grandfather, Professor van der Pol, in short : “Opa”. Of course I am also proud of my grandmother who true to her wish to keep his name alive by this award. But also with my name: Balthasar. This name will be a tradition in our family. In May this year I became the luckiest man of the world; my daughter was born. If she would have been a boy, of course we would have called him Balthasar.

As I said earlier, Opa was a remarkable man. He did things I never could. He managed during family or official dinners to write down mathematical formulas on the beautiful damask linen tablecloth. But nobody dared to say anything about it. It seemed to be normal.

On the other hand there were a few things common with him and myself. First he smoked a lot, which, especially nowadays, is a bad habit. He also drove a Buick cabriolet in Summer and Winter. I also drive an open car. and of course my clothes - like his - are full with burned cigarette holes.

Not a lot of people know that he had a great interest in farming. He was the owner of a farmhouse in the little Dutch village Haarlo. During the Second World War he was in hiding there from the Nazis. I think that this interest, I called it ‘back to nature’, is a result of his scientific way of life.

And what about his great passion and sense of classical music? He lectured and prepared a number of papers on the relationship between music and mathematics. He recognized for example the mathematical nature of the music of Johann Sebastian Bach. He used to say “that music was the most beautiful of arts and mathematics of science”.

He had a lot of sayings. For example: “Parties are places where everybody is talking, but nobody is listening”. In this case another one: “A wise old owl was sitting on his oak. The more he heard, the less he spoke. The less he spoke, the more he heard. Why can’t we be like this wise old bird?” I understand that after this ceremony there will be a reception. Will it be a silent one?!

Ladies and Gentlemen, I think I also said too much.

On behalf of the Union Radio-Scientifique Internationale it gives me great pleasure to reveal the name of the person to be honoured with the Balthasar van der Pol Gold Medal 2002. It is a ‘he’.

I quote the following citation of URSI; *“For fundamental contributions to the theory of radiation and scattering of waves. The stature of this man is simply enormous. He has not one but two immense contributions to the understanding of electromagnetic wave propagation and has further established a school to disseminate this knowledge. Scholar, teacher, and extraordinary researcher, Adrian de Hoop deserves the recipient of the Balthasar van der Pol Gold Medal award 2002.* Professor De Hoop, please come forward to accept “Opa’s” award. Thank you for your attention.

## REPLY BY PROFESSOR ADRIANUS T. DE HOOP

I can hardly find the words that would adequately express my feelings of gratitude for the honor that the Board of Officers of URSI has bestowed upon me in awarding me the Balthasar van der Pol Gold Medal for the year 2002. Feelings of gratitude I have, but also feelings of pride. Pride, first of all, that the Medal bears the name of Balthasar van der Pol, Dutch radio scientist *par excellence*. I have had the privilege of meeting him on a few occasions and have once heard him presenting a lecture. Larger parts of his scientific work have inspired me for some of my own research. I mention just a few:

- his plea for symmetrizing Maxwell's electromagnetic field equations by including in them not only electric, but also magnetic losses,
- his *magnum opus* on the use of the Laplace transformation as a tool for analyzing the properties of electric circuits, transmission lines and radio waves (for example, their reception by a linear antenna terminated in a resonant load), a book written in collaboration with H. Bremmer, and, shortly before his death,
- his theory of impulsive radio wave propagation over a planar air/earth interface, which theory he apparently developed independently of the French seismologist Louis Cagniard, who had invented the same method to analyze seismic wave propagation in the earth.

With van der Pol I share an immense admiration for Hendrik Antoon Lorentz's scientific insights with regard to Maxwell's electromagnetic theory and for the ingenuity of Oliver Heaviside, who solved intractable problems in telecommunication engineering by a method (his 'operational calculus') nobody else could understand. Balthasar van der Pol's *Selected Scientific Papers*, edited by H. Bremmer and C.J. Bouwkamp and with a preface from H.B.G. Casimir, comprising more than 1330 pages, find themselves at an easily accessible place on my bookshelves. From the closing part of Casimir's preface to this collection I quote: "The impact of van der Pol's work can be stated in still another way. Although the study of electromagnetic waves was originally one of the most fundamental branches of physics, radio might have remained a field of haphazard empiricism along with wild commercial ventures, but for the influence of men like van der Pol who stressed the need for a more scientific approach."

Feelings of pride also come up when consulting the list of fellow-recipients of previous years, several of whom have unmistakably influenced the composition of my own mixture of physics, mathematics and engineering that makes radio science such a challenging and interesting field of research.

The citation of the Award mentions my "*Contributions to the theory of radiation and scattering of waves*", which I interpret as acoustic and elastic waves, side by side with electromagnetic waves. Indeed, the common structures of these different types of wave phenomena have fascinated me for quite a number of years already, while their not

so obvious differences in structure present a number of unsolved riddles as subjects for further research.

I am deeply grateful that Delft University of Technology, Delft, the Netherlands, has provided me for so many years with the facilities for carrying out my research and I am deeply honored that its *Rector*, Professor Fokkema, has taken the trouble to attend this Ceremony.

Professor Senior, I feel proud and privileged to be the most recent addition to the list of Laureates of the Balthasar van der Pol Gold Medal. I thank everybody who has participated in the administrative duties that are involved on such occasions and wish URSI a happy future in which it can continue to be a meeting place where radio scientists can share their achievements and can draw mutual inspiration for developing further ideas.

Now, this could be the end of my short speech of thanks, but – as the announcement of the XXVII-th General Assembly of URSI states – the official languages of the meeting are English and French. So I thought it appropriate to add a few words in the second one of the official languages.

L'Union Radio-Scientifique Internationale étant une organisation à deux langues officielles, le français et l'anglais, il me semble justifié que j'essaie aussi à exprimer dans quelques mots en français mes sentiments de reconnaissance pour l'honneur que le Bureau de l'URSI m'a fait par décerner à moi la Médaille d'Or Balthasar van der Pol pour l'année 2002. Comme je l'ai dit déjà, l'œuvre de Balthasar van der Pol m'a inspiré considérablement pour quelques recherches de ma part et j'admire beaucoup la propre mixture de physique, de mathématique et de la technologie dont il s'est servi pour construire les solutions d'une grande série de problèmes de grande importance dans la domaine de la radio-électricité.

Je suis heureux d'être considéré comme un candidat pour le supplément la plus récente de la liste de Lauréats de la Médaille d'Or Balthasar van der Pol et je remercie beaucoup chacun et chacune qui ont contribué aux préparations pour faciliter ce supplément.

Je finis par souhaiter que l'URSI continuera de servir la communauté internationale des radio-électriciens dans un avenir splendide et dans le même esprit qu'elle a fait preuve dès sa fondation. Je vous remercie pour votre attention. Thank you for your attention.

*Professor T.B.A. Senior excuses Professor Gary Brown for not being able to present the Dellinger Gold Medal: "The next award is the Dellinger Gold Medal sponsored by the US National Committee for URSI. Unfortunately, the chair of that Committee, Professor Gary Brown, recently suffered a heart attack and is unable to present. I am pleased to report that he is recovering well from a bypass operation, and in his stead, the vice-chair of the Committee, Professor Umran Inan, will make the presentation."*



## PRESENTATION OF THE JOHN HOWARD DELLINGER GOLD MEDAL

by Professor Umran Inan

The John Howard Dellinger Gold Medal is awarded triennially to a distinguished scientist to recognize outstanding scholarship in any of the branches covered by URSI, but preferentially in the field of radio wave propagation. Traditionally, this medal is presented by the Chair of the United States National Committee of URSI, who at this time is Professor Gary Brown of Virginia Tech. Unfortunately, Gary is currently recovering from a recent heart attack, and is not able to be here, so he has asked me to represent him in this honor as Vice Chair of USNC and Head of the U.S. delegation to this General Assembly.

The Dellinger Award was established in 1964 in honor of the memory of former URSI Vice-President and Honorary President, John Howard Dellinger, whose career was devoted to science and public service as a leading figure in the U. S. National Bureau of Standards. He was the President of IRE in 1925 and was awarded the IRE Medal of Honor in 1938 for his discoveries of the relation between radio propagation and natural phenomena (such as solar eruptions) as well as for his leadership in the development of radio measurements and standards, and world wide cooperation in telecommunications.

The 2002 recipient of the Dellinger Gold Medal is Professor Donald L. Carpenter of Stanford University. Having known him and worked side by side with him over the past 30 years, I am especially honored to be making this presentation. Don Carpenter has been associated with the Stanford very low frequency (VLF) research group for the past 45 years. He has authored or co-authored more than 125 papers on VLF whistler-mode probing of the Earth's ionosphere and magnetosphere, thermal plasma dynamics, and wave-induced electron precipitation. His famous 1966 paper reporting the discovery of the plasmopause (a sharp drop in thermal plasma density enveloping the Earth which is affectionately referred to as Carpenter's knee) was listed as a 'Citation Classic' in the February 1980 issue of *Current Contents*, having being cited no less than 320 times at that time. This important and fundamental discovery paper continues to be cited often, having been referred to 8 times during 1998.

Don Carpenter has served as the Associate Editor of *Radio Science* and of the *Journal of Geophysical Research* and has been a member of several committees of the National Academy. He was the honoree at the Commission H Tutorial/Workshop "The Plasmasphere Rediscovered: A Tribute to Donald Carpenter" held at the Toronto General Assembly in 1999.

Above and beyond his outstanding scientific achievements, Professor Carpenter is well known as a true gentleman and indeed more importantly as a 'gentle' man. He has always gone out of his way to be kind and fair towards his colleagues, patient in training new students, and diligent in promoting scientific careers of his collaborators. He is held in a special esteem by his colleagues and friends and is well liked and respected by all who know him.

It is my distinct pleasure and honor to present the 2002 Dellinger Gold Medal to Professor Donald Carpenter for his 'Discovery of the plasmopause, for pioneering studies of the plasmasphere structure and dynamics, and for development and use of whistler-mode waves as diagnostic probes of the magnetosphere'. Please join me in warm congratulations to Professor Carpenter.

#### REPLY BY PROFESSOR DONALD L. CARPENTER

Thank you Dr. Inan, and my thanks to the URSI Board of Officers, to the Awards Panel, and to the many who have supported my nomination. Prominent among these latter was Joseph Lemaire, who has shared with me a passion for understanding the properties of the plasma envelope surrounding the earth.

It is a great honor to receive an award of this kind from URSI. The name John Dellinger is meaningful to me not only because of his stature as a scientist and member of URSI, but also on a personal level. I understand that he was president of the Institute of Radio Engineers in 1925, and therefore believe that he knew my grandfather, H. V. Carpenter, who was a professor of Electrical Engineering at Washington State College and was instrumental in establishing the first radio station in the south eastern part of the state of Washington in 1921.

I am grateful to URSI for many reasons. In 1963 at the Tokyo Assembly I was given an opportunity to have a major impact on the career of another scientist. I had brought a slide, showing how lunar rocket results obtained by Konstantin Gringauz and his colleagues in the USSR agreed with our ground based results from natural very low frequency whistler signals. Gringauz had not been widely believed at home, in part because the boundary in space that we were investigating, or "knee" effect, had not been predicted by theory. Imagine my pleasure on meeting Gringauz for the first time in Tokyo, and realizing later that the data comparison at the Assembly had been a turning point in his career.

I am grateful to URSI because in 1966 at the Munich Assembly there was a special debate about whether or not the knee effect, or plasmopause as we had begun to call it, was real, its existence having been challenged by a group from Goddard Space Flight Center. There was a spirited, friendly, discussion before a room full of people, involving, among others, Sig Bauer, Don Gurnett, and Bob Smith. In the end, most in the audience appeared to favor the knee effect, including Alex Dessler, who stood up and said "I vote for Carpenter." But this was not until a number of very useful points had been made on both sides of the issue concerning the physics involved in the satellite and ground-based measurement techniques.

I am grateful to URSI for that special kind of warm friendship with colleagues in which you are together primarily at meetings, and thus see one another only once a year, or once in three years, or perhaps only once in a solar cycle. On such occasions, intervening

events disappear and it is as if you had been together only yesterday. For me there are now a great many such friendships, many with people at this Assembly, and I find them to be a great blessing. I must tell you that one of those friends, Yvonne Corcuff, whom I have known since the 1963 Assembly, is here with me and my family tonight.

I am grateful to URSI for someone special, Yela Bogitch, for many years my private channel to the heart and soul of the triennial Assembly. I first met Yela in 1963, and was captivated by her warmth and by her willingness to speak with me in one of her native languages, Serbian, whenever we would meet.

In my voyages of discovery I have traveled on ships built largely by others, among them pioneers such as Owen Storey, Bob Helliwell, and Bob Smith in the case of whistlers and the great pioneers of ionospheric radio sounding in the case of my current work. I am now privileged to be studying the plasmagram records of the Radio Plasma Imager on the IMAGE satellite, for which Bodo Reinisch is the Principal Investigator. On some days I sit in my office late into the afternoon, just as I did 40 years ago, fascinated by what I see in the data as the satellite approaches and then plunges into the plasmasphere, a region to which I have devoted so much of my career. Near 6 o'clock, I call my dear wife Betty, and say "Honey, I can't leave. I'm like a kid in a candy store." This wonderful medal may suggest to some that I am near the end of my career, but the data tells me that that day is still many years away! Again my thanks, and my best wishes to you all for a rewarding Assembly.

## **PRESENTATION OF THE APPLETON PRIZE**

by Prof. Peter Watson

The Appleton Prize is awarded by the Council of the Royal Society on the recommendation of the Board of Officers of URSI. The prize commemorates the life and work of Sir Edward Appleton who was a former President of URSI and who received the Nobel Prize for his work in Ionospheric Physics.

Appleton's contribution to Ionospheric Physics is perhaps best known through his first experimental demonstration of the existence of the ionosphere in 1924. He was also active in the early 1930's in the establishment of an ionospheric station in Scandinavia, leading to the earliest descriptions of the morphology of the polar ionosphere. Even when Principal and Vice Chancellor at the University of Edinburgh, he maintained an interest in the polar ionosphere through the establishment there of an Auroral Laboratory. Appleton also devoted much time to the encouragement of the international aspects of scientific cooperation at a time when the need for such activities was not so obvious as it is now.

Involvement in experimental studies of the polar ionosphere and the encouragement of international collaboration are very much the pedigree of today's recipient of the Appleton Prize, Dr Ray Greenwald.

As a Postdoctoral Research Associate at NOAA in 1969, Dr Greenwald built one of the first auroral radar systems in Alaska. In the 1970s he went on to develop the Scandinavian Twin Auroral Radar Experiment (STARE). Then, in the 1980's, Ray Greenwald conceived and established the first multi-beam HF radar giving, in about one minute, a view of the ionosphere extending over  $3 \times 10^6$  square km. This led in the 1990's to the SuperDARN network of radars with 9 in the northern hemisphere and 6 in the southern hemisphere.

The SuperDARN project currently involves over 20 laboratories in 11 different countries and is still growing. SuperDARN radar data are now being routinely used to substantially improve space weather predictions leading to better and safer operation of all earth orbiting satellites.

SuperDARN was Ray's Greenwald's brainchild and he has shown the organisational and interpersonal skills necessary to see it through into an international programme, over 80 scientists having participated in the most recent SuperDARN meeting.

In addition Dr Greenwald has published over 130 refereed journal papers on ionospheric physics, many of which have changed the peer community view on the subject.

Dr Greenwald's distinguished contributions to ionospheric physics, in terms of his pioneering work in experimental techniques and his contributions to leadership and international collaboration, do indeed make him a worthy recipient of the Appleton Prize. The citation reads *"For conceiving, designing, developing and deploying two ground-breaking measurement techniques that have provided unparalleled spatial and temporal measurements of the ionosphere, and for international leadership"*.

#### REPLY BY DR. RAYMOND GREENWALD

I am both pleased and honored to receive this prize presented by the Royal Society of London in honor of Sir Edward Appleton. During his career, Sir Edward made many contributions to ionospheric research and received many honors. Most notable of these was his receipt of the Noble Prize in 1947. Sir Edward was the President of URSI for many years and also served as Chair of numerous URSI Commissions and Committees. He promoted the international use and application of ionospheric radio and the use of radio wave techniques to study the ionosphere. In 1957-1958, as Chair of the URSI Committee for the International Geophysical Year, he did much to encourage international collaboration in the scientific study of the ionosphere.

I did not become involved with ionospheric research until well after Sir Edward's death. My university training was as a laboratory plasma physicist. This area of research differs from ionospheric research in two important ways. First, the laboratory researcher creates his plasma, whereas the sun and other natural sources of ionization create the plasma that is the ionosphere. The laboratory plasma is more or less controlled, whereas

the ionosphere and the surrounding regions of near-Earth space are fully subject to the vagaries of nature. Second, the laboratory researcher is fully able to diagnose his plasma using an array of instrumentation arranged in any manner that he chooses. Normally, this leads to a good understanding of the workings of his plasma, but this knowledge may not be useful to another researcher in a different laboratory with a different type of plasma. Diagnosing the global ionosphere is much more difficult, but improved understanding is beneficial to everyone who uses the ionosphere as a communications medium.

The ionosphere is vast and complex and its interconnections with the magnetosphere and interplanetary space are even more so. It is truly sad that Sir Edward died so early in the Space Age, when we were only beginning to appreciate the complex interactions that exist between the ionosphere, magnetosphere and solar wind, and the full range of conditions that the sun quite literally throws at us. We have gone into space and we have probed the plasmas of the ionosphere, magnetosphere, and solar wind. We have found all of these plasmas to be highly variable on time scales that can be short relative to the orbital period of scientific satellites. Thus, it does not appear that *in situ* observations, alone, are sufficient to fully diagnose the complex plasmas of space. The ionosphere, however, differs from most space plasmas in that it is easily accessed by both satellites and ground-based instrumentation. Ground-based instruments, particularly those operated in a coordinated manner, can provide the global data sets that are needed to put other observations into context. I believe this is what Sir Edward was trying to do through his URSI work during the IGY, and the goal applies equally well today.

I first became involved in ionospheric research while at NOAA in 1970, where I held a post-doctoral fellowship to study laboratory plasmas. My experience began with helping Ben Balsley and Warner Eckland in their studies of radar aurora from Anchorage, Alaska. I remember thinking back then that doing plasma research in the ionosphere was challenging and rewarding because the research benefited a very large community of users. In 1975, I moved to the Max Planck Institut for Aeronomie in Lindau, Germany and began the development of the Scandinavian Twin Auroral Radar Experiment (STARE). During the development of STARE, I discovered the benefits of international cooperation through the support I received from Tor Hagfors of Norway and Risto Pellinen of Finland. After STARE became operational, numerous satellite and ground-based researchers became interested in its data products and many research collaborations were initiated.

After returning to the United States in 1979, I became involved in a number of research activities, two of which were particularly important. First, I, in collaboration with several international colleagues, successfully proposed the Dual Auroral Radar Network, DARN, as a ground-based element of the NASA OPEN Mission. OPEN eventually became the International Solar Terrestrial Physics (ISTP) Mission and included participation from the European Community, Japan, Russia, and the United States. Second, after noting the success of Swedish and French radar investigations of the high-latitude ionosphere at HF frequencies, I began to experiment with combining HF operation with the sophisticated phasing and processing techniques used in STARE. Eventually, I received funding to construct the HF radar system at Goose Bay, Labrador.

The Goose Bay radar was quite successful and became an element within DARN. Additional radars were constructed at Schefferville, Quebec and Halley, Antarctica. Eventually, at a 1991 meeting of the DARN science team, several participants advanced the concept of a global high-latitude HF radar network. This suggestion was enthusiastically received by the membership and the name SuperDARN was born. Over the next decade, the network has grown well beyond the original conception. Currently, there are 9 SuperDARN radars in the northern hemisphere and 6 in the southern hemisphere. Additional radars are being planned and constructed. SuperDARN is an outstanding example of international collaboration in the field of radio science and in the study of the ionosphere. The radars are operated continuously in a coordinated manner and the data products from all of the radars are stored in standard formats and distributed to all of the membership. SuperDARN is truly capable of providing global-scale diagnostics of plasma circulation in the high-latitude ionospheres of both hemispheres. As such, it would be the envy of any laboratory plasma physicist. Moreover, it offers us views of the global dynamics of the ionosphere that should lead to improved understanding of ionosphere-magnetosphere and ionosphere-atmosphere interactions. I believe that Sir Edward would have regarded SuperDARN as truly representative of the type of international collaboration that he was trying to achieve during the IGY.

While I am pleased to accept the Appleton Prize, I recognize that I would not be here today were it not for the extraordinary efforts by my many colleagues within the SuperDARN community, particularly the efforts of my fellow Principal Investigators of the various SuperDARN radars. I feel it would be remiss if I did not mention their names. They include Peter Dyson of Australia, Geoge Sofko of Canada, Jean-Paul Villain of France, Natsuo Sata and Takashi Kikuchi of Japan, A. David M. Walker of South Africa, Mark Lester and Mike Pinnock of the United Kingdom and Bill Bristow of the United States. I would like to thank them and you for the honor that is bestowed on me today.

Professor T.B.A. Senior introduces a new medal “The Booker Gold Medal”, named after Professor Henry George Booker (1910-1988), who served URSI in many capacities, including Chair of Commission H (1963-1969) and Vice President (1969-1975). In 1978 he was elected Honorary President. *“Professor Henry Booker is a former Honorary President of URSI, and for over 20 years a fund set up by his friends and colleagues has supported the attendance of a young US scientist at the General Assembly. The Booker Fellows for this year are Professor Joel Johnson and Professor Susan Hagness. I believe Susan is in the audience. Would you stand up so we may recognize you ? With additional funds that have become available, the Booker Committee has now established the Booker Gold Medal for outstanding contributions to telecommunications or a related science. We are fortunate to have with us today Commander Robert Booker, a son of Professor Booker, and I invite him to say a few words about his father and then make the presentation.”*

## PRESENTATION OF THE BOOKER GOLD MEDAL

by Commander Robert Booker

I am very pleased to be here to assist URSI in making the first award of the Booker Gold Medal. I am the second of four children born to Adelaide and Henry Booker. Like my two sisters, I am not a scientist, but my elder brother is a geophysicist and a professor at the University of Washington in Seattle. Four days ago, he became a grandfather through the birth of the first great grandchild of Adelaide and Henry Booker.

My father was born in east London in 1910. Early recognition of his academic abilities, especially in mathematics, afforded him the exceptional opportunity to attend the University of Cambridge as a member of Christ's College. He received a B.A. degree in 1933 and a Ph.D. degree in 1936. In 1937 he traveled to the United States as a visiting scientist supported by the Carnegie Institution. His host in Washington, DC, was Alvin McNish, who invited him to dinner one evening. There, he met a rebellious young woman from San Francisco named Adelaide McNish, whose mother had sent her to live with her aunt and uncle for a while. He married her within the year and took her back to Cambridge. From there she wrote her mother to explain she was now married and living in England. Meanwhile, Henry's friends at Christ's College had wagered he would return with an American wife, which cost him a bottle of scotch.

During the Second World War, Henry Booker was affiliated with the British Telecommunications Research Establishment. He was intimately involved with the development of radar systems that were essential to the defense of Britain and the ultimate success of allied forces. After the war, he returned to Cambridge as a fellow of Christ's College. Then, in 1948 he emigrated to the United States to join the School of Electrical Engineering at Cornell University in Ithaca, NY. He was there for 16 years. In 1965 he undertook establishment of a Department of Applied Mathematics and Electro-physics on the new campus of University of California in San Diego. He was there for 23 years. Until a just few months before his death in 1988, he was actively engaged in scientific research and the education of undergraduate and graduate students. [Please see the biographical memoir written by William E. Gordon for more detail regarding the life and work of Henry G. Booker: *Biographical Memoirs*, Volume 79, National Academy Press, Washington, D.C., 2001.]

My father's research largely focused on the effect of the ionosphere upon the propagation of electromagnetic energy. Equally important to him was the development of young minds and careers. He was honored by his former students and colleagues with creation of the Henry G. Booker Fellowship. The creation of the Booker Gold Medal is an extension of that honor, which assures him a visible place in the history of radio science. My family and I are very grateful to those who have made both the fellowship and the medal possible.

When I was informed of Simon Haykin's selection to receive the Booker Gold Medal, I noted remarkable similarities between his life and my father's, even though they

were 20 years apart in age and not acquainted with each other. Both experienced a wartime childhood, and both were educated in the United Kingdom. Simon Haykin received his B.Sc. in 1953 and Ph.D. in 1936 from the University of Birmingham. Both spent some postgraduate years engaged in laboratory research, followed by brief academic appointments prior to emigrating to North America. Simon Haykin worked as an electrical engineer for General Electric (UK) until 1961, and he became a professor of electrical and computer engineering at McMaster University in Hamilton, Ontario, Canada, in 1996.

Like my father, Professor Haykin has had an impressive academic and scientific career in the broadly defined field of electrical engineering, sharing a common interest in radar, but for divergent applications. Professor Haykin has become a leading authority on signal processing and data transmission. Also, like my father, Professor Haykin has received many honors and other forms of recognition for his achievements. I dare to say, though, that this award - named for one and awarded to the other - is the highest tribute for their scientific accomplishments.

Now, I invite Professor Haykin to join me at the podium to receive the medal. The award citation reads: *For significant and fundamental contribution to adaptive signal processing and neural networks, and their applications to radar and digital communications, the characterization of which are dominated by nonstationary physical phenomena.*

#### REPLY BY PROFESSOR SIMON HAYKIN

First and foremost, I wish to express my gratitude to the Booker Committee of URSI for awarding me the Henry G. Booker Gold Medal for 2002. This award is all the more gratifying, considering the fact that I am the first recipient of this prestigious medal.

I have spent all of my professional life working on signal processing applied to radar and communications. Considering the pioneering work done by Professor Henry Booker in telecommunications, it is therefore befitting that I use this occasion to say a few words on “New Directions for Signal Processing in the 21st Century”.

Much of the statistical signal processing literature in the 20th century was dominated by the assumptions of Gaussianity and stationarity. These assumptions were made largely for mathematical tractability. Another distinctive feature of the literature in that era was the (almost universal) use of signal-to-noise ratio and mean-square error as the criteria for optimization. Here again, the motivation for doing so was mathematical tractability.

However, signal processing realities teach us that nearly all of the physical phenomena encountered in practice are non-Gaussian and nonstationary, thereby compromising the solutions to signal-processing problems based on the traditional framework. Moreover, minimizing the mean-square (estimation) error or, equivalently, maximizing the output signal-to-noise ratio, is no guarantee for predicting the real-world success of the solutions.



With this brief background, I see important trends in signal processing in the 21st century, which are summarized as follows:

1. The every-increasing use of information-theoretic criteria (including the maximum a posteriori probability) for algorithmic optimization.
2. Improved system performance through the use of
  - regularization for overcoming the ill-posed nature of inverse problems;
  - learning and adaptation to account for statistical variations in input data;
  - feedback around the receiver to provide for short-term memory and other beneficial effects.
3. Sequential state-estimation with emphasis on particle filters rooted in Bayesian theory and Monte-Carlo simulation.
4. Distributed signal processing with emphasis on sensor fusion.
5. Increased emphasis on stochastic differential (difference) equations as the requisite mathematical framework for signal processing problems.

These exciting developments will be made possible through the every-increasing reliance on the use of computers and eventually the wide-spread use of high-performance computers for solving difficult signal processing problems in a cost-effective manner.

To conclude, I would like to thank my home university, McMaster University, Hamilton, Ontario, Canada, for providing me the facilities for doing my research; the Natural Sciences and Engineering Research Council of Canada for providing me the financial support to do the work; and my many graduate students for teaching me new ideas in the course of the challenging problems posed to them for their thesis topics. Last, but by no means least, I like to thank my wife Nancy for sacrificing the time that we could have spent together so that I can get on with my research on a daily basis.

## **PRESENTATION OF THE ISSAC KOGA GOLD MEDAL**

by Hiroshi Matsumoto, President of the Japanese URSI Committee

In 1982, the Japanese Member Committee of URSI proposed to establish a Gold Medal with the purpose of encouraging young scientists within the Union. The Gold Medal honors a young scientist of age under 35, who has made outstanding contributions to any of the branches of radio science covered by the ten Commissions of URSI. The Medal was named after Professor Issac Koga, who held young scientists in great affection. Prof. Koga was closely associated with URSI, and he served as Vice-President of the Union from 1957 to 1963, and as President from 1963 to 1966. The first Issac Koga Gold Medal was awarded on the occasion of the Florence General Assembly in 1984. The award at this Assembly is the seventh.

Professor Koga's research covered a wide variety of topics in radio science. Particularly noteworthy was his invention, in 1932, of a Piezo-electric crystal oscillator having an almost zero frequency-temperature coefficient. This is widely known as the

Koga cut crystal, and has been used in a wide range of applications, in particular in international radio communications and broadcasting.

It is indeed a great pleasure for me to introduce the 2002 awardee, Prof. Frank Olyslager. Prof. Olyslager is an enthusiastic and creative young scientist. His research has been devoted to the study of the electromagnetism and its applications. His contributions are twofold: theoretical and numerical electromagnetics. In his theoretical studies, he developed closed form solutions of Maxwell's equations, in particular the derivation of closed form Green functions in anisotropic and bi-anisotropic materials. With respect to numerical simulations, he developed new techniques, which can be applied to a number of practical problems. His research work is of the highest quality and deserves well being rewarded. In parallel with his research work, Prof. Olyslager started acting as Assistant Secretary General of URSI since 2000. I should add that I have really enjoyed working with him - a man of sincerity.

It is my pleasure to hand over the 2002 Issac Koga Gold Medal to Prof. Frank Olyslager from Belgium, with the following citation: "*In recognition of his work on theoretical and numerical electromagnetics (in particular in the field of boundary integral equations, waveguides and bi-anisotropic media)*". May I ask the audience to join me in congratulating warmly Prof. Olyslager? Frank, would you please come up to the podium to receive this seventh Issac Koga Gold Medal?

#### REPLY BY PROFESSOR FRANK OLYSLAGER

It is an exceptional honor and great pleasure for me to stand here and to receive the Issac Koga Gold Medal. This certainly is one of the nicest distinctions a Junior Scientist can get. It is by far the most important recognition of my scientific career. Many people played a crucial role in guiding me towards this place and I would like to use this exceptional occasion to say a few words to some of them.

As you search my scientific output you will frequently encounter two other names namely that of Daniël De Zutter and that of Ismo Lindell. Daniël, you have been and still are an exceptional mentor for me. You gave me the necessary scientific freedom, you always supported me in my work and you often guided me through difficult problems, not only scientific ones. Many thanks!

In January 1993 I went for the first time to Helsinki. Not to experience the cold – it was cold though – but to visit Ismo Lindell. The warm hospitality I received highly compensated for the cold outside. Ismo, you really learned me how to solve electromagnetic problems. You introduced me in the secrets of dyadic magic but as a good magician you kept some of the tricks to yourself. That first visit to Helsinki was a milestone in my career, it was the start of a very fruitful, enjoyable and privileged collaboration and I owe at least 50% of this medal to you. Ismo, we finally should start writing that book on Green dyadics.

Dear audience, as you probably know the Department of Information Technology at the University of Ghent in Belgium where I work is a special place. Not only because the URSI Secretariat is located there but also because of its former director and still very active member Professor Van Bladel. It is an honor to literally walk almost daily in his footsteps. Professor, you are of great inspiration to my work and I respectfully thank you for all you did for me. And, Professor, we are all anxiously waiting for your new book, please go on!

I also would like to thank the students and friends at the department and in particular its current director Paul Lagasse. Paul, perhaps without knowing, you created the perfect soil to flourish. I gratefully thank you for the opportunities you gave me and my wife.

An important word of thank also goes to Emmanuel Van Lil and the whole Belgian URSI Committee. Although, I am still a novice in the Committee I enjoyed our meetings and I thank you all for nominating me.

It was my mother who decided when I was 6 months old that I should become an engineer. Mom, a very wise decision! Together with grandpa, you have triggered my fascination for science. I am very happy that you are here with us for celebrating this unique event.

There is someone very special that I kept as last. Ann, Maxwell's equations brought us together and your own dedication to them is a strong stimulus for me to proceed. But more importantly you showed me during the past six years that there is more in life than science. Ann, I dedicate this medal to you and to our lovely boys Paul and Louis.

Dear members of the Board I am very grateful to you and to the whole of URSI for awarding me this high distinction. I will carry this medal with dignity and adore it as one of my children. Thank you!

*Mr. Rob van Reyn, a famous Dutch pantomime artist, then entertained the multi-cultural audience with the art of pantomime. The performance was most enjoyable. A reception followed this Opening Ceremony at 7 p.m. in the Trajectum of the MECC.*

## CLOSING MEETING

### CLOSING REMARKS BY THE SECRETARY GENERAL

Prof. P. Lagasse

At the request of the President, I am pleased to announce the results of the elections of the Board of Officers and of the Chairs and Vice-Chairs of the Commissions for the next triennium.

The incoming President is Prof. Kristian Schlegel (Germany) and the Vice-Presidents are: Prof. Chalmers M. Butler (U.S.A.), Prof. François Lefevre (France), Prof. Andy W. Wernik (Poland), Prof. Paul H. Wittke (Canada).

The election results of the Chairs and Vice-Chairs of the Commissions are as follows:

Commission A:

Chair Prof. Quirino Balzano (U.S.A.)  
Vice-Chair Dr. Stuart Pollitt (U.K.)

Commission B:

Chair Prof. Makoto Ando (Japan)  
Vice-Chair Prof. Lotfollah Shafai (Canada)

Commission C:

Chair Prof. Masami Akaike (Japan)  
Vice-Chair Prof. Andreas Molisch (U.S.A.)

Commission D:

Chair Prof. Peter Russer (Germany)  
Vice-Chair Dr. Frédérique de Fornel (France)

Commission E:

Chair Prof. Pierre J. Degauque (France)  
Vice-Chair Prof. Flavio Canavero (Italy)

Commission F:

Chair Prof. Martti T. Hallikainen (Finland)  
Vice-Chair Prof. Piotr Sobieski (Belgium)

Commission G:

Chair Prof. Christian Hanuise (France)  
Vice-Chair Prof. Paul S. Cannon (U.K.)

Commission H:

Chair Prof. Umran Inan (U.S.A.)  
Vice-Chair Prof. Richard B. Horne (U.K.)

Commission J:

Chair Prof. Makoto Inoue (Japan)  
Vice-Chair Dr. Richard Schilizzi (The Netherlands)

Commission K:

Chair Prof. Bernard Veyret (France)  
Vice-Chair Prof. Frank Prato (Canada)

I would like to inform you also of a few important decisions taken by Council:

- The Council accepted the invitation of the Member Committee in India to organise the next General Assembly. The venue will be New Delhi, 23 - 29 October 2005. Council decided for this time not to select the venue of the 2008 General Assembly.
- Council did approve the merger between the Radio Science Bulletin and the Review of Radio Science. We hope to begin to publish reviews in the Radio Science Bulletin as early as the end of next year. The expansion of the technical content of the Radio Science Bulletin will continue with the publication of the general and tutorial lectures and other contributed papers. Council approved making the Radio Science Bulletin available on the web.
- It has been agreed at this General Assembly that the Scientific Committee on Telecommunications should broaden its activities under the leadership of Martin Hall, who graciously accepted to chair this scientific committee. It will continue as essentially a liaison committee for exchanging information, but it will require a number of enthusiastic individuals to progress some five or six specific activities.
- Council also approved the recommendations of the Long Range Planning Committee to replace the concept of "URSI Correspondent" with the "URSI Radioscientist" status and to implement an "URSI Travelling Lecturer" Program. More details about this will be published in the Radio Science Bulletin.
- As usual the terms of reference of the Commissions were adjusted. The one change I would like to mention is that - with the approval of Council - Commission C changed its name from "Signals and Systems" to "Radio-Communication System and Signal Processing".

At this time I would like to congratulate Frans Sluijter, Gert Brussaard, Leon Kamp and the complete local organising committee for the excellent organisation of this General Assembly. Exactly 50 years ago radioscientists had the time to make a leisurely 5-week trip by ship to Australia to attend a 3-week URSI GA. Nowadays our GA is crammed into one week making it a complex, high pressure event certainly for the organisers and the secretariat. I would like therefore to express my sincere gratitude to the local organisers for their help and friendliness in resolving all the problems that the secretariat encountered during the course of this GA.

Allow me to conclude with some personal observations. Most importantly, I was very much impressed by the high quality of the scientific presentations. This quality and the interest it generates in the radioscience community is the best guarantee for the further growth and success of our Union. We clearly should be grateful to Martin Hall, the scientific coordinator, to Gert Brussaard, the associate scientific coordinator and to all the commission chairs, vice-chairs and convenors who by their work and dedication have ensured this scientific success. I am confident that our next General Assembly will build and improve on this scientific success while at the same time reaffirming the vocation of URSI to reach out to the world and to open up new horizons.

I look forward to welcome all of you and many more colleagues 3 years from now in New Delhi.

### **CLOSING REMARKS BY THE OUTGOING PRESIDENT**

Prof. H. Matsumoto

Dear Colleagues, Distinguished Guests, Ladies and Gentlemen,

First of all, I would like to report that Prof. Paul Lagasse was re-elected as our Secretary General for the next triennium to whom I would extend my congratulations. I also would like to extend our warm welcome to the new Board members and new Commission Chairs and Vice Chairs as Office-bearers within URSI.

I wish to offer my sincere thanks to my colleagues on the Board of Officers for all the help and advice they have given to me. A special word of gratitude goes to Prof. Senior and Dr. Shapira, whose term of office is coming to an end with the close of this Assembly. The support they have given me and URSI during the last three years is indeed invaluable and vital. I am sure I speak on behalf of all of us in addressing to them our very best wishes for the future.

I would also like to place on record my appreciation of the work done by the Chairmen and Vice-Chairmen of our Commissions. The success of our scientific programme at this Maastricht Assembly depends ultimately on their excellent works to select the themes and speakers for our various sessions, but also on the interaction which exists between them. Concerning the scientific content, I am certain that all of us have really enjoyed the three General lectures and Public Lecture. On behalf of URSI I warmly extend our hearty thanks to the four speakers.

In no small part, the success of this Assembly is due to the efforts of our Dutch colleagues in the Local Organizing Committee and the MECC personnel, and the team behind them, known and unknown, who gave so freely of their time and energy to make this 27<sup>th</sup> General Assembly an unforgettable event. Thank you, Prof. Sluijter for your leadership and Dr. Leon Kamp, and Prof. van Ardenne for all their efforts of organizing this beautiful Assembly. On top of the successful scientific sessions we have had, the

banquet in the cave was one of the events we will remember for long time. That was really an experience for us to remember. Our gratitude to the Dutch Local Organizing Committee will be expressed formally in a resolution of the URSI Council.

With deep sincerity we also say thank you to Scientific Coordinator Mr. Martin Hall and Associate Coordinator Prof. Gert Brussaard for their work on the splendid scientific program we have seen. The Council members and the Office bearers worked very hard from early morning to late evening almost every day for the sake of this successful Assembly. I would like to express my gratitude and respect to the Council members for their decisions and wisdom shown at this Assembly. My sincere appreciation goes also to the valuable works done by the Chairs and members of the Standing and ad hoc Committees who have spent many hours for their works during this week.

Also I was much impressed by the efficient and diligent work done by our Secretariat. I would like to express my heartiest thanks to our Secretary General, Prof. Paul Lagasse, and his members, Prof. Frank Olyslager, Dr. Ross Stone, Mrs. Inge Heleu and Mrs. Inge Lievens. They all worked so hard during the past 10 days here and now they will be relieved after this Assembly for a while, though I understand a lot of work awaits them.

And finally, we thank heartily all the participants for coming and sharing with us their discoveries and expertise. You must have renewed your friendship and have had opportunity to have discussions with our Honorary Presidents, our Past Presidents and others colleagues. I am sure, on the way back to your countries, you will keep the best memories of your stay in Maastricht and the professional gains you have achieved during this Assembly.

Ladies and Gentlemen, I thank you for the opportunity to serve as President of URSI, which has been a great privilege and honor for me. Now I hand over the Office of President to Prof. Kristian Schlegel. Kristian!

## **CLOSING REMARKS BY THE INCOMING PRESIDENT**

Prof. K. Schlegel

First of all, I would like to thank you for the great support that I received from many national committees for my nomination, and for your confidence, shown when you elected me as President. It is a great honor for me and also for my country, and I will try my best to serve the Union.

I am particularly grateful and proud that I can step into the footsteps of my respected teacher, Prof. Walter Dieminger, who served URSI as President from 1969-1972. This was just about the time when I came to his institute, the Max-Planck-Institute for Aeronomy, as a young post-doc. He was an inspiring person, and he influenced my scientific career in many ways.

When I entered the URSI Board of Officers three years ago, as Vice President, I was somewhat shy, but I soon realized that the Board worked together very harmoniously, and acted like a big family. I hope that this spirit can be preserved in the following three years, and I am very grateful that I will have the opportunity to work together with a very able Board of Officers, including the Past President, Prof. Matsumoto, as a valuable and experienced advisor.

When I look back at the 8 General Assemblies of URSI that I have attended so far, I will remember the Maastricht Assembly as a particularly smooth one. There were neither great problems, which distracted us from our scientific work, nor was the schedule very hectic. This is certainly, to a great extent, due to the excellent work of the Local Organizing Committee and, particularly, of the Scientific Programme Coordinators. So I wish to join in the thanks to them that have already been expressed.

We have experienced an excellent scientific conference, with high-quality presentations, oral as well as posters. In addition, we were also able to perform the necessary organizational tasks in our Commissions and working groups. Thus, I think that everybody will agree when I state that within the Union, we successfully acted according to our objectives, namely, “to stimulate and to coordinate, on an international basis, studies, research, applications, scientific exchange and communication in the field of radio science”.

But we also have to ask ourselves the question, “How is this excellent work seen and put into practice outside the URSI community?” I was very much struck by a remark of one of the members of the LOC: When they approached the European Union for financial support of this General Assembly, they learned that URSI was virtually unknown in the respective bodies of the EU. I think this is a deficit that we have to eliminate. We should try to improve URSI’s appearance and visibility, and try to make the public more aware of our work and our aims. By “the public”, I do not mean the “man on the street”, but influential people in politics and society, as well as in national and international organizations.

At this General Assembly, we have already made an important step in this direction by merging the Radio Science Bulletin and the Review of Radio Science. Thereby we have practically created a new journal, which will also be available on the Web, free of charge. This will certainly enhance URSI’s visibility to the public. - I think, however, that we should do more in this public-relations aspect of URSI. It will certainly be a task with a high priority in our work over the next triennium. I would like to encourage everybody in the audience and in the whole Union: If you have ideas or suggestions in this direction, please contact me or any other Board member. You will always find an open ear!

Finally, it is my duty to officially declare the 27<sup>th</sup> General Assembly of URSI closed. May I wish you a good trip home to your families and to your laboratories. I also would like to express my hope of meeting many of you in three years’ time, at the 28<sup>th</sup> GA in New Delhi, to be held in October 2005.



## **CONCLUDING REMARKS BY THE PRESIDENT OF THE DUTCH MEMBER COMMITTEE**

Prof. A. van Ardenne

Ladies and Gentlemen, Members of the Board, National representatives and Sponsors,

At the closure of the XXVII-th URSI General Assembly, I like to thank you all who have made this event worthwhile to organise and to make it possible through your active participation on behalf of the URSI Member Committee in the Netherlands. It allowed us to present Radio Science, its scientific scope and breadth and its impact on society, to our country. It allowed you to enjoy this event in the wonderful city of Maastricht at the crossroads of many other European countries in a keen and pleasant international atmosphere.

In co-operation with the Board, we decided to try to stimulate the interaction between (young) academics and industry as much as possible. This process was facilitated through an exhibition, a knowledge plaza and a number of travel grants and it is on you to judge the success of this.

Of course at the time of candidating Maastricht, we did not know that the expected amount of sponsors became worryingly small as a result of external political and economic factors. From here, I therefore I like to thank our sponsors again as without them it would certainly have become very difficult. In this context, it is interesting to know that our request for European funding of this Assembly failed on grounds having to do with 'not scientific enough' and 'not enough connected to main European themes e.g. wireless telecom' (my wording). From this by the way, one may distil subjects of future URSI action, as it has to do with the positioning and perception of URSI at large.

Fortunately, the total program was high in quality and spirits and the amount of participants was high in quality and numbers. Hence as Organising Member Committee we now feel happy and relieved and wish the Indian Member Committee good luck for organising the next General Assembly in Delhi. In closing, I wish you all a good journey home!

# REPORTS OF MEETINGS

## BOARD OF OFFICERS

### Summary Report

#### **17 August 2002**

The Board reviewed the agenda of the Council meetings and the Coordinating committee meeting. The Board also discussed matters concerning the opening ceremony, the Young Scientist Party and the Closing Ceremony.

#### **24 August 2003**

- The President welcomes the officers of the Board and in particular the new members: Prof. Chalmers M. Butler and Professor François Lefeuvre.
- Prof. Schlegel proposes to assign an officer for public relations in order to acquaint the radio science community with URSI. The Board strongly supports this idea. This “URSI Exposure”-officer, with the help of the other officers, should come up with initiatives in science and science policies. Prof. Lefeuvre accepts the assignment as “URSI Exposure”-officer. Prof. Wernik accepts the invitation to take on the task of Treasurer.
- The Board discusses a request by Professor Radicella for the ICT School and concludes not to allocate money to the ICTP School and to redefine the Standing Committee on Developing Countries and its Charter.
- The aim of the possible establishment of a “Radioscientist committee” would be to investigate applications for “Radioscientist” from regions where there is no member committee in order to screen the proposals this committee has to define criteria. The Board decides that the Board itself will take care of this in the first year.
- The Board allocates 9,000 Euro per Commission for the 2002-2005 triennium.
- The Board accepts the request from Commission H to transfer the remaining 880 Euro from the budget of the past triennium to the present one.
- Prof. Lagasse explains that he is supposed to look into and negotiate in detail the proposal of the Indian committee. He agrees to report to the Board by the end of the year.

The Board of Officers will meet in Ghent on 8-10 May 2003.

## COUNCIL

### Summary Report

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

Council met on Sunday 18 August (8.30 to 11.30 a.m.), Tuesday 20 August (6 to 8.30 p.m.), Thursday 22 August (6 to 8.30 p.m.) and Saturday 24 August (8.30 to 10.45 a.m.).

#### 1. Membership of the Council

President : Prof. H. Matsumoto

Secretary General: Prof. P. Lagasse

Australia : Dr. P. Wilkinson

Austria : Prof. R. Leitinger

Belgium : Prof. E. Van Lil

Brazil : Prof. P. Kaufmann

Canada : Dr. Y. Antar

China CIE : Prof. Z. Sha

China SRS : Prof. C.H. Liu

Czech Republic : Dr. V. Fiala

Denmark : Prof. P. Høeg

Egypt : Prof. S. El-Khamy

Finland : Prof. M. Hallikainen

France : Prof. M. Pyée

Germany : Prof. K.J. Langenberg (Alternate: Dr. G. Mann)

Greece : Prof. J.N. Sahalos

Hungary : Prof. L. Nagy

India : Prof. S. Prasad

Ireland : Dr. M. O'Droma

Israel : Prof. E. Heyman

Italy : Prof. G. Tofani

Japan : Prof. Y. Hosoya  
the Netherlands : Dr. A. van Ardenne  
New Zealand : Dr. N. Thomson  
Norway : Prof. J. Trulsen  
Peru : Dr. J. Chau  
Poland : Prof. S. Hahn  
Russia : Prof. N. Danilkin  
Slovak Republic : Prof. L. Sumichrast  
South Africa : Prof. K.M. Reineck (Alternate: Dr. E. Mravlag)  
South Korea : Dr. H.J. Eom  
Spain : Dr. R. Villar Gomez  
Sweden : Prof. G. Kristensson  
Switzerland : Prof. M. Ianoz  
United Kingdom : Prof. P.A. Watson  
USA : Prof. U.S. Inan

Commission A	Prof. E. Bava, Chair Dr. Q. Balzano, Vice-Chair
Commission B	Prof. S. Ström, Chair Prof. M. Ando, Vice-Chair
Commission C	Prof. E. Bonek, Chair Prof. M. Akaike, Vice-Chair
Commission D	Prof. A. Seeds, Chair Prof. P. Russer, Vice-Chair
Commission E	Dr. R.L. Gardner, Chair Prof. P. Degauque, Vice-Chair
Commission F	Dr. Y. Furuhashi, Chair (the Vice-Chair is the official delegate of the Finland)
Commission G	Prof. C. Hanuise, Vice-Chair (the Chair is the official delegate of Australia)
Commission H	Dr. G.H. James, Chair (the Vice-Chair is the official delegate of the USA)
Commission J	Prof. J.N. Hewitt, Chair Prof. M. Inoue, Vice-Chair
Commission K	Prof. S. Ueno, Chair Prof. B. Veyret, Vice-Chair

The Officers of the Board, the Coordinator of the Scientific Programme and the Assistants Secretary General attended in an advisory capacity. An Observer from Argentina, Chairs of Standing Committees and representatives from ITU, IUCAF, ESA and various URSI officials also attended the meetings, partially or totally.

## 2. Election of Dr. A.P. Mitra as Honorary President

Council elected Dr. A.P. Mitra as Honorary President of URSI by acclamation.

## 3. Formation of temporary committees and ad hoc groups

Council approved the formation of a drafting committee with as members : Dr. W.R. Stone (English), Prof. P. Degauque (French) and Prof. C. Hanuise (French).

Council approved the continuation of the panel on future General Assemblies with as members : the new scientific programme co-ordinator, Prof. F. Lefevre, Dr. W.R. Stone and Prof. P. Lagasse (ex officio).

## 4. Organisation of the XXVIIth General Assembly

Professor Brussaard referred to the booklets for the general arrangements of this General Assembly. He also mentions some late time additions and changes to the arrangements.

Mr. Hall emphasises that a lot of people put in a tremendous amount of work to make the scientific programme a success. He draws attention to the documents which are distributed at the meeting:

- Requirements for the scientific programme for URSI GA 2002
- Statistics related to GA 2002”
- Preliminary document on the SCT

Those documents were briefly discussed and further comments were welcomed.

## 5. Finances

The Standing Committee on Finance recommended Council to approve the accounts as presented by the Treasurer. Council formally accepted the Treasurer’s report.

The triennial report on the finances of the Union, including the audited accounts for 1999, 2000 and 2001, was accepted by the Council.

## 6. URSI Membership

The Council accepted the decision of the Member Committee in Argentina to transfer to Associate Membership, from January 2002 onwards.

The Council accepted the decision of the Member Committee in Thailand to withdraw its membership, from January 2002 onwards.

The Council discussed the problem of the Member Committees with arrears extending to more than two years. Nigeria is considered to have resigned from the Union because of its large arrears in dues. It may apply for Associate Membership, by means of an official letter from its academy. According to the statutes the Associate Members should inform in writing their wish to continue as Associate Member. Council grants the Board authority to accept Nigeria as Associate Member and also to accept written requests of the existing Associate Members to continue their membership. The Secretariat will write a letter reminding them of the obligation to make this request.

## 7. Discussion of a scientific topic

At the end of the first Council meeting Council discussed the relationship between URSI and ICSU as suggested by the President, Prof. Matsumoto.

## 8. Elections

The President, Professor Matsumoto, expressed his concern about the limited number of nominations that were received for the election of the Board of Officers. He hopes that in the future the Member Committees will nominate more candidates.

The results of the elections were as follows :

### *a) President*

Only one candidate was nominated for President: Professor K. Schlegel (Germany). Council elected Prof. K. Schlegel as President of URSI by acclamation. Prof. K. Schlegel thanked the Council for its confidence and he assured to do his best to serve the Union.

### *b) Vice-President*

The result of the elections for Vice-President, conducted by secret ballot, was as follows: Prof. C.M. Butler (USA), Prof. F. Lefevre (France), Prof. A.W. Wernik (Poland), Prof. P.H. Wittke (Canada).

### *c) Secretary General*

Prof. P. Lagasse was elected for another term by acclamation.

### *d) Commission Chairs*

According to the Statutes the Vice-Chairs automatically become Chair except in unusual cases. The Council votes that all the current Vice-Chairs become Chairs :

Commission A:	Quirino Balzano (U.S.A.)
Commission B:	Makoto Ando (Japan)
Commission C:	Masami Akaike (Japan)
Commission D:	Peter Russer (Germany)
Commission E:	Pierre J. Degauque (France)
Commission F:	Martti T. Hallikainen (Finland)
Commission G:	Christian Hanuise (France)
Commission H:	Umran Inan (USA)
Commission J:	Makoto Inoue (Japan)
Commission K:	Bernard Veyret (France)

### *e) Commission Vice-Chairs*

Commission A:	Stuart Pollitt (UK)
Commission B:	Lotfollah Shafai (Canada)

Commission C:	Andreas F. Molisch (USA)
Commission D:	Frédérique de Fornel (France)
Commission E:	Flavio Canavero (Italy)
Commission F:	Piotr Sobieski (Belgium)
Commission G:	Paul S. Cannon (UK)
Commission H:	Richard B. Horne (UK)
Commission J:	Richard Schilizzi (The Netherlands)
Commission K:	Frank Prato (Canada)

## 9. Publications

Council approves the following recommendations by the Standing Committee on Publications :

- that the publication of the Final Program with the 100-word abstracts be continued. It was recommended that an author index be incorporated, and that larger print be used if possible.
- that the publication of the Proceedings of the General Assembly on CD-ROM be continued, with the incorporation of a link between the author and the paper if possible.
- that the reviews of the *Review of Radio Science* should be published in the *Radio Science Bulletin*, spread over a triennium. The current system for defining topics, inviting authors, having Commissions editors, and for reviewing should be maintained.
- that there be continued expansion and improvement of the technical content of the *Radio Science Bulletin*
- that the *RSB* should be published on the Web, as outlined above. It was also recommended that the back issues for each triennium be made available to General Assembly registrants on the *Proceedings* CD-ROM if they fit, or, if they do not, on a separate CD-ROM to be made available for the cost of production.
- that the URSI Council express its gratitude to Robert Hunsucker for the outstanding job he has done as Editor for eight years [the Council did so by acclamation]. The Committee recommended continuing the publication of *Radio Science* through the AGU. The Chair of the Publications Committee will contact the AGU to try to accelerate the identification of a new Editor.
- to continue the current status of the two other URSI-sponsored publications, the *Journal of Solar & Terrestrial Physics (JASTP)* and *Wireless Networks*, which appear to be doing well.
- the following membership for the URSI Standing Committee on Publications for the coming triennium: J. Hamelin, R. D. Hunsucker, P. Lagasse, W. R. Stone (Chair), P. Wilkinson, the new Editor of *Radio Science*, G. Brussaard (Scientific Program Coordinator), URSI contacts for *JASTP* and *Wireless Networks* (to be identified by the Committee) and one to two younger scientists (to be identified by the Committee).

## 10. Future General Assemblies

### *10.1 Selection of the venue of the XXVIIIth General Assembly( in 2005)*

Representatives of China (Beijing), India (New Delhi) and USA (Denver) each gave a presentation about their proposal to host the 2005 General Assembly. After the presentations Council asked some questions for further clarification.

Since no representative from Turkey was present to present the proposal (Professor H. Serbest could not attend the General Assembly because of health reasons, and had not been able to find a substitute) Council decided to exclude Turkey from the ballot.

After election, the invitation of the Committee in India is accepted. The location of the XXVIIIth General Assembly will be New Delhi. After some discussion based on the weather conditions, Council decided to follow the advice of the Indian committee and have the XXVIIIth General Assembly from 23 to 29 October 2005.

### *10.2 Selection of the venue of the XXIXth General Assembly(in 2008)*

Council decided by a weighted ballot to delay the election of the venue of the XXIXth General Assembly until the General Assembly in 2005.

### *10.3 Preparation of Scientific Programme, and designation of a Coordinator and an Associate Coordinator for 2005*

- Council elected Professor G. Brussaard as Coordinator of the Scientific Programme by acclamation.
- The appointment of a new Associate Coordinator was delayed until suggestions are received from the Indian Member Committee.

## 11. Commissions

Council approved the updated terms of reference of the Commissions, which are :

### *1. Commission A - ELECTROMAGNETIC METROLOGY, Electromagnetic measurements and standards.*

The Commission promotes research and developments in :

- (a) Measurements and standards in time and frequency, including infrared and optical frequencies;
- (b) Measurements in the time domain;
- (c) Measurements in the frequency domain;
- (d) Measurements in telecommunications;
- (e) Measurements using lasers;
- (f) Quantum metrology and electrical methods in fundamental constants;
- (g) Measurements and standards from dc to optical frequencies.

### *2. Commission B - FIELDS AND WAVES, Electromagnetic theory and applications.*

The interest of Commission B is fields and waves, encompassing theory, analysis,



computation, experiments, and validation. Areas of emphasis are :

- (a) Time-domain and frequency-domain phenomena;
- (b) Scattering and diffraction;
- (c) General propagation including waves in specialised media;
- (d) Guided waves;
- (e) Antennas and radiation;
- (f) Inverse scattering.

The Commission fosters the creation, development, and refinement of analytical, numerical, and measurement techniques to understand these phenomena. It encourages innovation and seeks to apply interdisciplinary concepts and methods.

### *3. Commission C - RADIO-COMMUNICATION SYSTEMS AND SIGNAL PROCESSING*

The Commission promotes research and development in :

- (a) Radio-Communication and Telecommunication systems;
- (b) Spectrum and Medium Utilisation;
- (c) Information Theory, Coding, Modulation and Detection;
- (d) Signal and Image Processing in the area of radio science.

The design of effective radio-communication systems must include scientific, engineering and economic considerations. This Commission emphasises research into the scientific aspects, and provides enabling technologies to other areas of radio science.

### *4. Commission D - ELECTRONICS AND PHOTONICS*

The Commission promotes research and reviews new development in :

- (a) Electronic devices, circuits, systems and applications;
- (b) Photonic devices, systems and applications;
- (c) Physics, materials, CAD, technology and reliability of electronic and photonic devices, with particular reference to radio science and telecommunications.

The Commission deals with devices for generation, detection, storage and processing of electromagnetic signals together with their applications, covering all frequencies, including those in the microwave and optical domains.

### *5. Commission E - ELECTROMAGNETIC NOISE AND INTERFERENCE*

The Commission promotes research and development in :

- (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 natural and intentional emissions on equipment performance;
- (e) The scientific basis of noise and interference control;
- (f) Spectrum management/utilisation and wireless telecommunications;

(g) Geo-electric and -magnetic fields and seismic associated electromagnetic fields.

Note : Many of the subjects mentioned are treated under the common title of Electromagnetic Compatibility.

*6. Commission F - WAVE PROPAGATION AND REMOTE SENSING (planetary atmospheres, surfaces and subsurfaces)*

The Commission encourages :

- (a) The study of all frequencies in a non-ionised environment :
  - (i) wave propagation through planetary, neutral atmospheres and surfaces,
  - (ii) wave interaction with the planetary surfaces and subsurfaces (including land, ocean and ice),
  - (iii) characterisation of the environment as it affects wave phenomena;
- (b) The application of the results of these studies, particularly in the areas of remote sensing and communications;
- (c) The appropriate co-operation with other URSI Commissions and other relevant organisations.

*7. Commission G - IONOSPHERIC RADIO AND PROPAGATION (including ionospheric communications and remote sensing of ionised media)*

The Commission deals with the study of the ionosphere in order to provide the broad understanding necessary to support space and ground-based radio systems. Specifically, the study includes the following areas :

- (a) Global morphology and modelling of the ionosphere;
- (b) Ionospheric space-time variations;
- (c) Development of tools and networks needed to measure ionospheric properties and trends;
- (d) Theory and practice of radio propagation via the ionosphere;
- (e) Application of ionospheric information to radio systems.

To achieve these objectives, the Commission co-operates with other URSI Commissions, corresponding bodies of the ICSU family (IUGG, IAU, COSPAR, SCOSTEP, etc) and other organisations (ITU, IEEE, etc.).

*8. Commission H - WAVES IN PLASMAS (including space and laboratory plasmas)*

The goals of the Commission are :

- (a) To study waves in plasmas in the broadest sense, and in particular :
  - (i) the generation ( i.e. plasma instabilities) and propagation of waves in plasmas,
  - (ii) the interaction between these waves, and wave-particle interactions,
  - (iii) plasma turbulence and chaos,
  - (iv) spacecraft-plasma interaction ;
- (b) To encourage the application of the results of these studies, particularly in the areas of

solar/planetary plasma interactions, and an increased exploitation of space as a research laboratory.

9. *Commission J - RADIO ASTRONOMY (including remote sensing of celestial objects)*

- (a) The activities of the Commission are concerned with observation and interpretation of all radio emissions and reflections from celestial objects.
- (b) Emphasis is placed on :
  - (i) the promotion of technical means for making radio-astronomical observations and data analysis,
  - (ii) support of activities to protect radio-astronomical observations from harmful interference.

10. *Commission K - ELECTROMAGNETICS IN BIOLOGY AND MEDICINE*

The Commission is charged with promoting research and development in the following domains :

- (a) physical interactions of electromagnetic fields with biological systems;
- (b) biological effects of electromagnetic fields;
- (c) interaction mechanisms;
- (d) human exposure assessment;
- (e) experimental exposure systems;
- (f) medical applications.

The Commission emphasises its interdisciplinary character and fosters research co-operation among various disciplines.

Council approved the following working groups : an inter-commission working group on supercomputing in space radio science (Commissions HGEJ) and an inter-commission working group on Solar Power Satellites (Commissions ABDFGHJK).

12. Report of the Chair of the Long Range Planning Committee

Council approved the recommendations of the Long Range Planning Committee as described in its report. This includes the replacement of the concept of “URSI Correspondent” by the “URSI Radioscientist” status and the implementation of an “URSI Travelling Lecturer” Programme.

13. Any other business

Mr. Hall drew attention to the distributed document and its addendum concerning the statistics of the General Assembly in Maastricht. He wished Prof. Brussaard all the best as the new Scientific Programme Coordinator.

Prof. Matsumoto expressed his appreciation for the dedication and all the work done by Mr. Hall as Scientific Programme Coordinator.

Professor Brussaard stated that there were 1276 registrants for the scientific sessions and 76 registrants for the exhibition. From these 121 were students and 96 Young Scientists.

## CO-ORDINATING COMMITTEE

### Summary Report

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

The Co-ordinating Committee met on Saturday 17 August (2 to 5.30 p.m) and Saturday 24 August 2002 (1.30 – 4.30 p.m.).

#### **First Co-ordinating Committee meeting**

##### *Local arrangements for the Maastricht General Assembly (Prof. Brussaard)*

Professor Brussaard refers to the booklets for the general arrangements of this General Assembly. He also makes some extra remarks about late time additions and changes to the arrangements.

##### *Scientific Programme*

Mr. Hall draws attention to the document “Requirements for the scientific programme for URSI GA 2002” that is distributed during the meeting and in particular to the questionnaire at the end. He asks that the Commissions consult with their members on the different aspects of this document.

##### *Instructions to Commissions and matters for Business meetings*

Professor Lagasse instructed the Commissions Chairs about the following matters :

- review and update of the terms of reference according to developments in recent years
- scientific report (by the incoming Chairs) on the business transacted during the General Assembly (for the Records of the General Assembly and the Radio Science Bulletin)
- procedure for the election of Vice-Chairs
- responsibilities of Chairs and Vice-Chairs
- the Secretariat needs receipts for all financial transactions.

- *dedicated* Associate Editor need to be appointed for the Radio Science Bulletin
- reconstitution and creation of working groups for the following triennium

*The Young Scientist Programme in Maastricht and in the future*

Philips gave a 1000-euro “Philips Prize” for the best Young Scientist paper of this General Assembly.

*Publications (Dr. W.R. Stone)*

Dr. W.R. Stone highlighted the benefits of incorporating the Review of Radio Science in the Radio Science Bulletin. The members of the Co-ordinating committee discussed the idea of putting the Radio Science Bulletin on the web.

**Second Co-ordinating Committee meeting**

All Commissions reported on the outcome of the discussions at their Business Meetings and on their scientific sessions.

*Statistics*

Mr. Hall distributed an addendum to “Statistics relating to GA2002” and Comments to the Co-ordinating Committee from questionnaires and elsewhere. He emphasises that one should carefully look into the size of the rooms, the no-shows and the geographical distribution of convenors and invited speakers. Prof. Brussaard agrees to produce a new document during the next half year, based on the current document with the comments and the questionnaires.

*General comments*

The following further comments were made:

- the importance of time keeping of the sessions.
- there was a problem with the accessibility of the chairs in the rooms.
- a suggestion to allow 40 minutes talks.
- after the Lille GA it was decided that all Young Scientists have to stay in the accommodation arranged by the organisers. Since some Young Scientists from developed countries prefer to take care of their own lodging this will be looked into.
- students should get a more substantial discount on the regular fee, e.g. one third.
- in order to gain time, all the “private” laptops should be connected before the session.

*Book of abstracts*

Dr. Stone says that the book is well appreciated in general. In the future the point size should be larger and an author index has to be added. After a discussion it is decided to have one booklet instead of two and to retain only the names of the authors and their affiliation in the booklet. The addresses are available on the CD-ROM.

It is decided to have a one step submission process consisting of a 100-word abstract and a one-to-four page paper except for Commission H where only a one-page paper is recommended.

*Nominations of Associate Editors of the RSB & RRS*

The following Associate Editors were nominated : Commission A: Q. Balzano; Commission B: R.W. Ziolkowski; Commission C: A. Molisch; Commission D: F. de Fornel; Commission E: P. Degauque ; Commission F: P. Sobieski; Commission G: P. Cannon; Commission H: R. Benton; Commission J: (to be decided); Commission K: F. Prato

*Scientific Committee on Telecommunications*

- Technical topics where a useful collaboration with ITU is possible are welcomed.
- Names for representatives from the commissions are welcomed. It is up to the commission Chairs to appoint someone.
- At this stage the SCT does not need a budget.

## TREASURER'S REPORT ON URSI FINANCES

### 1. General overview of income and expenditure

The URSI accounts started with a deficit in 1999, the excess of income over expenditure was about -115 k€. This is to some extent normal, since the expenditures are always highest in the years of the General Assemblies. In this particular case, however, the deficit was unusually high because the revenue of the GA in Toronto was considerably less than expected, and most of it was paid late in 2000.

Fortunately this deficit was overcompensated in 2000 with an excess of income over expenditure of about 142 k€. Again this is normal, because expenditures are generally low in the years in between General Assemblies.

In 2001 URSI experienced again a small deficit of about -16 k€. This was due to a small income because of arrears of the member committees and a reinvestment of assets. In addition the expenditures were somewhat higher than in 2000 because of preparations for the 2002 GA, and more scientific activities of the Commissions.

Since the URSI accounts have always to be regarded over the whole triennial cycle, we can state that the **total excess of income over expenditure within 1999-2001 was positive with about 12 k€.**

Year	Total income (€)	Total expenditure (€)
1998 (for comparison)	229,049	143,919
1999	272,444	387,257
2000	283,776	141,747
2001	160,213	175,821
Total 1999-2001	716,433	704,825

### 2. Assets

The URSI assets rose steadily within the last 3 years, partly due to new investments, partly due to an increasing market value. The investments have performed quite well, despite of the turmoil at the stock markets. **The URSI assets thus provide a safe basis for the coming years.**

Year	Total net assets (€)	Investments (€)
1998 (for comparison)	558,276	385,646
1999	533,414	464,025
2000	718,139	515,920
2001	725,175	553,122
Total increase 1999-2001	166,898	167,476

### 3. General remarks

Details of the finances can be found in the attached balance sheets for the three years 1999-2001. Nevertheless a few remarks seem appropriate :

- URSI has 42 paying national members at present, two less than at the last GA in 1999 (Argentina and Thailand choose to change their status into “associate”). The total dues for 2002 are 185,106 €, which provides 78% of the regular URSI income. Unfortunately several member committees have accumulated quite large arrears, and it seems unlikely that these debts will be paid.

- The contribution from URSI’s parent organisation ICSU has steadily fallen from about 13 k€ in 1998 to 5 k€ in 2001. It might go down to zero in the future. ICSU will pay only for special grants which have to be well-founded and well-prepared and which are in competition with grants for other ICSU bodies.

- The expenditures for scientific activities rose from about 302 k€ in the triennium 1996-98 to about 331 k€ in 1999-2001. This increase of about 10% is well-spent money, since the advancement of radio science is URSI’s principal purpose.

- The publication costs on the other hand were reduced by about 15% with respect to the triennium 1996-98. This is certainly Ross Stone’s merit, keeping the publication standard high, despite of a cost reduction.

- The administrative expenditures have increased from 207 k€ in 1996-98 to 239 k€ in the past triennium. This increase of about 15% is caused by only quite small salary increases (5%), but by a considerable increase of accounting and auditing costs and losses of exchange.

The day-to-day financial business of URSI is very effectively handled by our Secretary General. The Treasurer wants to express his sincere thanks to him.

Kristian Schlegel

Enclosure : Balance sheets of 1999, 2000 and 2001



**INTERNATIONAL UNION OF RADIO SCIENCE (URSI)**  
**BALANCE SHEET : 31 DECEMBER 1999**

<b>ASSETS</b>		USD	EURO
Dollars			
	Merrill Lynch WCMA	20,943.00	20,839.22
	Générale de Banque	8,930.27	8,886.02
	Smith Barney Shearson	140.45	139.75
		30,013.72	29,864.99
Belgian francs			
	Banque Degroof	4,772.17	4,748.52
	Générale de Banque	69,752.42	69,406.77
		74,524.59	74,155.29
Investments			
	Demeter Sicav shares	22,794.75	22,681.79
	Rorento Units	111,084.59	110,534.13
	Rorento Units '99	885.14	880.75
	Aqua Sicav	64,103.22	63,785.56
	Merrill-Lynch Short Term (405 units)	3,717.19	3,698.77
	Massachusetts Investor Fund	251,274.57	250,029.40
		453,859.45	451,610.40
	342 Rorento units on behalf of van der Pol Fund	12,476.17	12,414.34
		466,335.62	464,024.74
Petty cash		911.71	907.19
<b>Total Assets</b>		<b>571,785.63</b>	<b>568,952.21</b>
Less creditors			
	IUCAF	17,727.76	17,639.91
	ISES	5,511.30	5,483.99
		-23,239.06	-23,123.90
	Balthasar van der Pol Medal Fund (1)	-12,476.17	-12,414.34
<b>NET TOTAL OF URSI ASSETS</b>		<b>536,070.41</b>	<b>533,413.97</b>
<b>The net URSI Assets are represented by :</b>			
Closure of Secretariat :			
	Provision for Closure of Secretariat	50,000.00	49,752.23
Scientific Activities Fund :			
	Scientific Activities in 2000	90,000.00	89,554.01
	Publications in 2000	60,000.00	59,702.68
	Young Scientists in 2000	50,000.00	49,752.23
	Administration Fund in 2000	80,000.00	79,603.57
	I.C.S.U. Dues in 2000	20,000.00	19,900.89
		300,000.00	298,513.38
XXIV General Assembly 2002 Fund :			
	During 2000 :	40,000.00	39,801.78
Total allocated URSI Assets		390,000.00	388,067.40
Unallocated Reserve Fund		146,070.41	145,346.58
		<b>536,070.41</b>	<b>533,413.97</b>

**Statement of Income and Expenditure  
for the year ended 31 December 1999**

	USD	EURO
<b>I. INCOME</b>		
Grant from ICSU Fund and US National Academy of Sciences	5,000.00	4,975.22
Allocation from UNESCO to ICSU Grants Program	2,000.00	1,990.09
UNESCO Contracts	0.00	0.00
Contributions from National Members	222,416.76	221,314.00
Contributions from Other Members	0.00	0.00
Special Contributions	8,492.75	8,450.67
Contracts	0.00	0.00
Sales of Publications, Royalties	199.74	198.75
Sales of scientific materials	0.00	0.00
Bank Interest	3,330.95	3,314.45
Gain on Exchange	0.00	0.00
Other Income	32,360.68	32,200.32
<b>Total Income:</b>	<b>273,800.89</b>	<b>272,444.10</b>
<b>II. EXPENDITURE</b>		
a1) Scientific Activities	233,017.05	
General Assembly 1999	215,375.48	214,308.21
Scientific meetings: Symposia/Colloquia	17,075.67	16,991.05
Working Groups/Training Courses	0.00	0.00
Representation at scientific meetings	1,726.35	1,717.79
Data Gather/Processing	0.00	0.00
Research Projects	0.00	0.00
Grants to Individuals/Organizations	0.00	0.00
Other	0.00	0.00
Less covered by UNESCO Contracts	0.00	0.00
a2) Routine Meetings	8,619.41	8,576.70
Bureau/Executive committee	8,619.41	8,576.70
Other	0.00	0.00
a3) Publications	35,569.06	35,392.80
b) Other Activities	10,763.00	10,709.67
Contribution to ICSU	8,763.00	8,719.58
Contribution to other ICSU bodies	2,000.00	1,990.09
Activities covered by UNESCO Contracts	0.00	0.00
c) Administrative Expenses	100,056.75	99,560.93
Salaries, Related Charges	50,705.08	50,453.82
General Office Expenses	11,885.45	11,826.55
Office Equipment	0	0
Audit Fees	1,911.16	1,901.69
Bank Charges	1,916.17	1,906.67
Loss on sale of Merrill Lynch Short		
Term Global Income	1,352.59	1,345.89
Loss on Exchange	32,286.30	32,126.31
<b>Total expenditure:</b>	<b>389,185.71</b>	<b>387,257.14</b>
Excess of Income over Expenditure	-115,384.82	-114,813.04
Accumulated Balance at 1 January 1999	651,455.23	558,276.23
Currency translation difference (USD -> EUR)	89,950.78	
<b>Accumulated Balance at 31 December 1999</b>	<b>536,070.41</b>	<b>533,413.97</b>

ADDITIONAL INFORMATION

Rates of exchange :

1 January 1999:	\$1 =	BEF 34.57 CAD 1.54 FRF 5.62	=EUR 0.856968
31 December 1999:	\$1 =	BEF40.14 CAD 1.45 FRF 6.53	=EUR 0.995045

Balthasar van der Pol Fund :

The account indicated with (1) is represented by :  
342 Rorento Shares : market value on 31 December 1999 =  
(Acquisition value : US\$ 12,476.17)

Market value of investments on Dec. 31, 1999 (USD 1=40.14 BEF) :

	USD	EURO
DEMETER SICAV :	43,544.12	43,328.34
RORENTO UNITS (2) :	442,568.09	440,374.99
AQUA-SICAV :	69,155.06	68,812.37
M-L SHORT TERM :	3,114.00	3,098.57
MASSACHUSETTS INVESTOR FUND :	335,903.24	334,238.71
	<u>894,284.50</u>	<u>889,852.97</u>

(2) including the 342 Rorento of van der Pol Fund

**APPENDIX**

**Detail of Income and Expenditure**

**I. INCOME**

Other Income

	USD	EURO
Reimbursement administrative expenses	94.17	93.7
Reimbursement bank charges	4.56	4.54
Interest on Massachusetts Investor Fund	24,310.45	24,189.98
Sale of ML Short Term	7,045.50	7,010.59
Reimbursement URSI Support to Cancelled Meetings	906	901.51
	<u>32,360.68</u>	<u>32,200.32</u>

**II. EXPENDITURE**

General Assembly 1999

General Assembly - Organization	8,821.06	8,777.35
V.d.Pol Medal	890.03	885.62
General Assembly - Travel Expenses Officials	73,392.46	73,028.77
General Assembly - Scientific	15,901.13	15,822.34
General Assembly - Young Scientists	56,463.10	56,183.30
General Assembly - MRS/RRS	59,149.17	58,856.06
Correspondents Cards (Printing + Mailing)	758.52	754.74
	<u>215,375.48</u>	<u>214,308.21</u>

Symposia/Colloquia/Working Groups :			
Commission A	1,514.90	1,507.39	
Commission B	0	0	
Commission C	1,500.00	1,492.57	
Commission D	0	0	
Commission E	1,884.90	1,875.56	
Commission F	1,704.98	1,696.53	
Commission G	2,149.56	2,138.91	
Commission H	2,804.33	2,790.44	
Commission J	4,400.00	4,378.20	
WG Spectral Congestion	1,116.99	1,111.46	
Other	0.00	0.00	
		17,075.67	16,991.05
Contribution to other ICSU bodies			
IUCAF (1999)	2,000.00	1,990.09	
		2,000.00	1,990.09
Publications :			
Printing "The Radio Science Bulletin (No. 287 to 290)"	14,587.89	14,515.60	
Mailing "The Radio Science Bulletin (No. 287 to 290)"	14,349.38	14,278.27	
Electronic publications - WWW-page	6,631.79	6,598.93	
		35,569.06	35,392.80

**INTERNATIONAL UNION OF RADIO SCIENCE (URSI)  
BALANCE SHEET: 31 DECEMBER 2000**

**ASSETS**

	USD	EURO
Dollars		
Merrill Lynch WCMA	17,969.03	19,311.15
Smith Barney Shearson	96.41	103.61
Fortis	63,690.98	68,448.12
	81,756.42	87,862.88
Belgian Francs		
Banque Degroof	3,490.67	3,751.39
Fortis	124,805.70	134,127.56
	128,296.37	137,878.95
Investments		
Demeter Sicav Shares	22,794.75	24,497.31
Rorento Units	111,969.73	120,332.86
Aqua Sicav	64,103.22	68,891.15
Merrill-Lynch Short Term (405 units)	3,717.19	3,994.83
Massachusetts Investor Fund	277,478.91	298,204.09
	480,063.80	515,920.24
342 Rorento units on behalf of van der Pol Fund	12,476.17	13,408.03
	492,539.97	529,328.27
Petty Cash	644.78	692.94
<b>Total Assets</b>	<b>703,237.54</b>	<b>755,763.04</b>
Less Creditors		
IUCAF	17,371.70	18,669.21
ISES	5,161.30	5,546.80
	-22,533.00	-24,216.01
Balthasar van der Pol Medal Fund	-12,476.17	-13,408.03
<b>NET TOTAL OF URSI ASSETS</b>	<b>668,228.37</b>	<b>718,139.00</b>

**The net URSI Assets are represented by:**

Closure of Secretariat		
Provision for Closure of Secretariat	50,000.00	53,734.55
Scientific Activities Fund		
Scientific Activities in 2001	90,000.00	96,722.19
Publications in 2001	60,000.00	64,481.46
Young Scientists in 2001	50,000.00	53,734.55
Administration Fund in 2001	80,000.00	85,975.28
I.C.S.U. Dues in 2001	20,000.00	21,493.82
	<u>300,000.00</u>	<u>322,407.30</u>
XXIV General Assembly 2002 Fund: During 2000 & 2001	110,000.00	118,216.01
Total allocated URSI Assets	<u>460,000.00</u>	<u>494,357.86</u>
Unallocated Reserve Fund	<u>208,228.37</u>	<u>223,781.14</u>
	<u><b>668,228.37</b></u>	<u><b>718,139.00</b></u>

**Statement of Income and expenditure  
for the year ended 31 December 2000**

**I. INCOME**

	USD	EURO
Grant from ICSU Fund and US National Academy of Sciences	5,000.00	5,373.46
Allocation from UNESCO to ISCU Grants Programme	2,000.00	2,149.38
UNESCO Contracts	0.00	0.00
Contributions from National Members	180,437.78	193,914.86
Contributions from Other Members	0.00	0.00
Special Contributions	0.00	0.00
Contracts	0.00	0.00
Sales of Publications, Royalties	0.00	0.00
Sales of scientific materials	0.00	0.00
Bank Interest	534.00	573.89
Other Income	76,081.68	81,764.30
<b>Total Income</b>	<u><b>264,053.46</b></u>	<u><b>283,775.89</b></u>

**II. EXPENDITURE**

A1) Scientific Activities	30,379.90	32,649.00
General Assembly 1999	4,240.82	4,557.57
General Assembly 2002	1,263.41	1,357.77
Scientific meetings: symposia/colloquia	24,067.67	25,865.31
Working groups/Training courses	0.00	0.00
Representation at scientific meetings	808.00	868.35
Data Gather/Processing	0.00	0.00
Research Projects	0.00	0.00
Grants to Individuals/Organisations	0.00	0.00
Other	0.00	0.00
Loss covered by UNESCO Contracts	0.00	0.00
A2) Routine Meetings	7,901.79	8,491.98
Bureau/Executive committee	7,901.79	8,491.98
Other	0.00	0.00
A3) Publications	22,574.37	24,260.47

B) Other Activities		10,290.34		11,058.93
Contribution to ICSU	8,438.56		9,068.84	
Contribution to other ICSU bodies	1,851.78		1,990.09	
Activities covered by UNESCO Contracts	0.00		0.00	
C) Administrative Expenses		60,749.10		65,286.51
Salaries, Related Charges	44,886.33		48,238.93	
General Office Expenses	4,097.79		4,403.86	
Office Equipment	2,981.14		3,203.80	
Audit Fees	3,561.46		3,827.47	
Bank Charges	1,861.90		2,000.97	
Loss on Exchange	3,360.48		3,611.48	
<b>Total Expenditure:</b>		<b>131,895.50</b>		<b>141,746.89</b>
Excess of Income over Expenditure		132,157.96		142,029.00
Currency translation difference (USD => EURO) - investments				36,148.27
Currency translation difference (USD => EURO) - bank accounts				6,511.51
Currency translation difference (USD => EURO) - others				36.25
Accumulated Balance at 1 January 2000		536,070.41		533,413.97
		<b>668,228.37</b>		<b>718,139.00</b>

**ADDITIONAL INFORMATION**

Rates of exchange

January 1, 2000	\$ 1 = 40.14 BEF	0.995045 EUR
	\$ 1 = 1.45 CAD	
	\$ 1 = 6.53 FRF	
December 31, 2000	\$ 1 = 43.35 BEF	1.074691 EUR
	\$ 1 = 1.54 CAD	
	\$ 1 = 7.58 FRF	

Balthasar van der Pol Fund

342 Rorento Shares : market value on December 31, 2000  
(Aquisition Value: USD 12.476,17)

Market Value of investments on December 31, 2000

	USD	EURO
Demeter Sicav	42,765.56	45,959.76
Rorento Units (1)	443,941.56	477,100.00
Aqua-Sicav	66,392.08	71,350.97
M-L Short Term	3,167.10	3,403.65
Massachusetts Investor Fund	307,368.84	330,326.53
	<b>863,635.14</b>	<b>928,140.91</b>

(1) Including the 342 Rorento Shares of v d Pol Fund

**APPENDIX****Detail of Income and Expenditure**

	USD	EURO
<b>I. INCOME</b>		
Other Income		
Fee URSI Correspondents	297.57	319.80
Levy General Assembly	48,415.73	52,031.95
Interest on M-L Short Term	1,158.50	1,245.03
Interest on Massachusetts Investor Fund	5.54	5.95
Reinvestments on Massachusetts Investor Fund	14,023.74	15,071.19
Reinvestments on Massachusetts Investor Fund	12,180.60	13,090.38
	76,081.68	81,764.30
<b>II. EXPENDITURE</b>		
General Assembly 1999		
Support URSI	486.28	522.60
Records Toronto	1,682.38	1,808.04
Correspondent cards	918.83	987.46
Mailing records	1,153.33	1,239.47
	4,240.82	4,557.57
General Assembly 2002		
General Assembly - Travel Expenses Officials	1,263.41	1,357.77
	1,263.41	1,357.77
Symposia/Colloquia/Working Groups		
Commission A	3,722.00	4,000.00
Commission C	4,652.50	5,000.00
Commission D	4,652.50	5,000.00
Commission E	2,326.25	2,500.00
Commission G	930.50	1,000.00
Commission H	925.88	995.04
Commission J	1,856.39	1,995.05
Commission K	372.20	400.00
Central Fund	4,629.44	4,975.22
	24,067.66	25,865.31
Contribution to other ICSU bodies		
FAGS 2000	1,851.78	1,990.09
	1,851.78	1,990.09
Publications		
Printing 'The Radio Science Bulletin'	14,000.91	15,046.65
Mailing 'The Radio Science Bulletin'	8,573.46	9,213.82
	22,574.37	24,260.47

**INTERNATIONAL UNION OF RADIO SCIENCE (URSI)  
BALANCE SHEET: 31 DECEMBER 2001**

ASSETS	USD	EURO
Dollars		
Merrill Lynch WCMA	12,505.68	14,043.88
Fortis	36,530.38	41,023.62
Smith Barney Shearson	48.60	54.58
	49,084.66	55,122.08
Belgian Francs		
Banque Degroof	2,351.10	2,640.28
Fortis	40,782.36	45,798.59
	43,133.46	48,438.87
Investments		
Demeter Sicav Shares	22,794.75	25,598.50
Rorento Units	111,969.73	125,742.01
Aqua Sicav	64,103.22	71,987.92
Merrill-Lynch Short Term (405 units)	3,717.19	4,174.40
Massachusetts Investor Fund	277,478.91	311,608.82
	480,063.80	539,111.65
684 Rorento units on behalf of van der Pol Fund	12,476.17	14,010.74
	492,539.97	553,122.39
Short Term Deposito	105,039.88	117,959.79
<b>Total Assets</b>	<b>689,797.97</b>	<b>774,643.13</b>
Less Creditors		
IUCAF	26,935.74	30,248.84
ISES	4,640.80	5,211.62
	-31,576.54	-35,460.46
Balthasar van der Pol Medal Fund	-12,476.17	-14,010.74
<b>NET TOTAL OF URSI ASSETS</b>	<b>645,745.26</b>	<b>725,171.93</b>
<b>The net URSI Assets are represented by:</b>		
Closure of Secretariat		
Provision for Closure of Secretariat	60,000.00	67,380.00
Scientific Activities Fund		
Scientific Activities in 2002	90,000.00	101,070.00
Publications in 2002	60,000.00	67,380.00
Young Scientists in 2002	50,000.00	56,150.00
Administration Fund in 2002	80,000.00	89,840.00
I.C.S.U. Dues in 2002	20,000.00	22,460.00
	300,000.00	336,900.00
XXVII General Assembly 2002 Fund:		
During 2000 - 2001 -2002	150,000.00	168,450.00
Total allocated URSI Assets	510,000.00	572,730.00
Unallocated Reserve Fund	135,745.26	152,441.93
	<b>645,745.26</b>	<b>725,171.93</b>

ADDITIONAL INFORMATION

Rates of exchange

January 1, 2001	\$ 1 = 43.35 BEF	1.074691 EUR
December 31, 2001	\$ 1 = 45.30 BEF	1.123000 EUR



**Statement of Income and expenditure  
for the year ended 31 December 2001**

**I. INCOME**

	USD	EURO
Grant from ICSU Fund and US National Academy of Sciences	5,000.00	5,615.00
Allocation from UNESCO to ISCU Grants Programme	0.00	0.00
UNESCO Contracts	0.00	0.00
Contributions from National Members	127,293.57	142,950.68
Contributions from Other Members	0.00	0.00
Special Contributions	5,226.14	5,868.95
Contracts	0.00	0.00
Sales of Publications, Royalties	1,780.94	2,000.00
Sales of scientific materials	0.00	0.00
Bank Interest	13.05	14.65
Other Income	3,351.50	3,763.73
<b>Total Income</b>	<b>142,665.20</b>	<b>160,213.01</b>

**II. EXPENDITURE**

A1) Scientific Activities	57,954.09	65,082.44
General Assembly 2002	19,965.74	22,421.53
Scientific meetings: symposia/colloquia	32,281.02	36,251.58
Working groups/Training courses	0.00	0.00
Representation at scientific meetings	5,707.33	6,409.33
Data Gather/Processing	0.00	0.00
Research Projects	0.00	0.00
Grants to Individuals/Organisations	0.00	0.00
Other	0.00	0.00
Loss covered by UNESCO Contracts	0.00	0.00
A2) Routine Meetings	5,643.93	6,338.13
Bureau/Executive committee	5,643.93	6,338.13
Other	0.00	0.00
A3) Publications	17,379.72	19,517.43
B) Other Activities	9,449.72	10,612.03
Contribution to ICSU	5,887.83	6,612.03
Contribution to other ICSU bodies	3,561.89	4,000.00
Activities covered by UNESCO Contracts	0.00	0.00
C) Administrative Expenses	66,135.82	74,270.53
Salaries, Related Charges	48,007.45	53,912.37
General Office Expenses	9,085.90	10,203.47
Office Equipment	2,240.85	2,516.47
Audit Fees	4,864.12	5,462.41
Bank Charges	1,937.50	2,175.81
Currency translation difference (USD => EURO)	0.00	0.00
<b>Total Expenditure:</b>	<b>156,563.28</b>	<b>175,820.56</b>

Excess of Income over Expenditure	-13,898.08	-15,607.55
Currency translation difference (USD=>EURO) - investments	20,651.30	23,191.41
Currency translation difference (USD=>EURO) - bank accounts	1,578.42	1,772.57
Currency translation difference (USD=>EURO) - others	0.10	0.11
Accumulated Balance at 1 January 2001	668,228.37	750,420.46
	<b>654,330.29</b>	<b>734,812.91</b>

Balthasar van der Pol Fund

684 Rorento Shares : market value on December 31, 2000  
(Aquisition Value: USD 12.476,17)

Market Value of investments on December 31, 2000

Demeter Sicav  
Rorento Units (1)  
Aqua-Sicav  
M-L Short Term  
Massachusetts Investor Fund

(1) Including the 684 Rorento Shares of v d Pol Fund

	USD	EURO
	<u>23,023.33</u>	<u>25,855.20</u>
Demeter Sicav	43,210.31	48,525.18
Rorento Units (1)	437,577.92	491,400.00
Aqua-Sicav	66,024.73	74,145.77
M-L Short Term	3,175.20	3,565.75
Massachusetts Investor Fund	<u>229,858.43</u>	<u>258,131.02</u>
	<u>779,846.59</u>	<u>875,767.72</u>

**APPENDIX**

**Detail of Income and Expenditure**

**I. INCOME**

Special contributions

Young Scientist Programme  
Young Scientist Programme

Other Income

Interest on Short Term Deposito  
Interest on M-L Short Term  
Interest on Massachusetts Investor Fund

**II . EXPENDITURE**

General Assembly 2002

General Assembly - Travel Expenses Officials

Symposia/Colloquia/Working Groups

Commission A  
Commission B  
Commission C  
Commission D  
Commission E  
Commission F  
Commission G  
Commission H  
Commission J  
Commission K

Contribution to other ICSU bodies  
IUCAF 2000 and 2001

Publications

Printing 'The Radio Science Bulletin'  
Mailing 'The Radio Science Bulletin'

	USD	EURO
Young Scientist Programme	5,000.00	5,615.00
Young Scientist Programme	226.14	253.95
	5,226.14	5,868.95
Interest on Short Term Deposito	2,635.61	2,959.79
Interest on M-L Short Term	713.97	801.79
Interest on Massachusetts Investor Fund	1.91	2.15
	3,351.49	3,763.73
General Assembly - Travel Expenses Officials	19,965.74	22,421.53
	19,965.74	22,421.53
Commission A	2,046.66	2,298.40
Commission B	7,541.49	8,469.09
Commission C	1,780.94	2,000.00
Commission D	890.47	1,000.00
Commission E	5,339.28	5,996.01
Commission F	5,342.83	6,000.00
Commission G	890.47	1,000.00
Commission H	3,373.18	3,788.08
Commission J	890.47	1,000.00
Commission K	4,185.22	4,700.00
	32,281.01	36,251.58
IUCAF 2000 and 2001	3,561.89	4,000.00
	3,561.89	4,000.00
Printing 'The Radio Science Bulletin'	8,469.71	9,511.48
Mailing 'The Radio Science Bulletin'	8,910.02	10,005.95
	17,379.73	19,517.43

## REPORTS OF THE STANDING COMMITTEES

### URSI STANDING FINANCE COMMITTEE

August, 2002

#### Accounts for the years 1999-2001

The Standing Finance Committee met during the 27<sup>th</sup> General Assembly in Maastricht, Netherlands to examine and review the accounts for the last three years as submitted by the Secretary General and the Treasurer. The accounts were prepared by a professional accountant and were audited by Ernst & Young. The committee noted that during the last triennium, URSI has maintained a healthy financial foundation. In this report, figures are quoted in U.S. Dollars, which at the time of writing were nearly identical to the European EURO. The following items summarize the last three years financial reports:

- The average expenditures are approximately \$240K/year with the largest outlay of capital occurring during the year of the General Assembly. During this triennium, the excess income over expenses was approximately \$12K.
- Increased expenditures occurred as a result of enhanced accounting and auditing costs. New procedures are now in place that meets the ICSU requirements for financial accountability.
- An increase from one full time to 1.2 full time employees has resulted in a very modest increase in administrative salaries.
- Publication costs have been reduced. Mailing costs now drives publication costs.
- Several national members are in arrears in the payment of their dues that will likely not be recovered.
- The assets increased by 30% over the last three years as a result of excellent return on the investments. The investment portfolio is well diversified with a tendency towards conservative investment strategies. The total assets at the end of 2001 are approximately \$21K over the expenses paid out during the 1999-2001 period. As a result, the current net assets are sufficient to pay out the needed expenses over one triennium. The ratio of net assets (based on buying price) to average annual expenditures is approximately 3. A higher ratio would be realized using market values. While the net assets are very strong, the market has been extremely volatile in 2002. Therefore the committee believes it to be prudent to exercise a bit of caution in the optimism represented by these numbers.

### **Financial plan for 2003-2005**

The committee reviewed the planned budget for 2003-2005, which was prepared by the Secretary General. This budget is based on years of experience and financial accountability by the Secretariat. The following summary bullets articulate the budget assumptions:

- It was assumed that the main income, associated with the dues from the national members, would continue to be assessed according to the current assessment. Furthermore, it was assumed that this income stream would be reduced due to reassignment of certain countries to associate status.
- Income from the 2002 General Assembly is assumed to be \$150K.
- Income from ICSU has been zeroed due to a change in policy for the use of ICSU funds. ICSU will now accept proposals for projects that will compete with proposals from other ICSU entities. These proposals must be well formed, be interdisciplinary, and further the ICSU goal of using science to aid in the solving of societal problems. In the event URSI proposes such a project, the ICSU funds would represent “seed” funding for the particular project.
- URSI contributions to ICSU have decreased from approximately \$9K/year to \$6K due to a change in ICSU category for URSI.
- Publication costs are still budgeted for \$30K/year. However, it is recognized that continued discussions by URSI might result in a merger of the Radio Science Bulletin and the Reviews of Radio Science that may alter this figure.
- The Young Scientist Program currently costs approximately \$100K in the year of the General Assembly. This figure represents a rough estimate for travel, lodging and per diem, and waived registration fees. The committee believes this is a good investment in the future of radio science and worth the financial commitment from URSI and the national members.
- The result of this planning indicates a net deficit between income and expenditures resulting in a reduction in the assets by approximately \$24K over the next three-year period.

### **Conclusion and recommendations**

The budget plan for the period 2003-2005 seems to be financially sound and realistic. It represents a conservative and cautious approach that is appropriate given the many uncertainties in the present global economy. The anticipated losses would be covered by the existing reserves that are extremely healthy.

We recommend that the contributions from the national members continue to be determined by the current policy.

Prof. S. Avery, Chair  
Dr. V. Fiala  
Prof. M. Hayakawa  
Prof. M. Ianoz

## URSI STANDING COMMITTEE ON PUBLICATIONS

This is an expanded version of the report of the URSI Standing Committee on Publications, as presented to the URSI Council Thursday, August 22, 2002. The report is based on the results of extensive e-mail communication within the Committee prior to the Maastricht General Assembly, and the meetings of the Committee on August 19 and 21, 2002, at Maastricht. In addition to the summary of activities and recommendations presented to the Council, a more complete record of the Committee's discussions has been added. During the Maastricht General Assembly, at the request of the Committee, a survey was taken by the Commissions of their membership at the Commission business meetings, regarding various aspects of URSI publications. Responses were received from Commissions A, B, F, G, H, J, and K. More complete information on the responses from that survey are included. The recommendations made by the Committee to Council are noted *in italics*; all recommendations were unanimously approved by Council.

### General Assembly Publications

**Final Program.** For the first time this triennium, the Final Program was produced including 100-word abstracts for each paper. The feedback from the Commissions was unanimous in liking this format. There was a widespread feeling that the print was too small (the effective size of the print was about 6 pt). This was done to reduce the size of the program. It was noted that using an effective (as-printed) type size of about 9 pt (similar to the size used in most journals) would probably increase the total size of the printed program booklets by about 50%. It was felt that this would be a good tradeoff. There were several requests for an author index. Some suggested the inclusion of marginal tabs or markings to help locate sessions.

*Recommendation: The Committee recommended that publication of the Final Program with the 100-word abstracts be continued. It was recommended that an author index be incorporated, and that larger print be used if possible.*

**GA Proceedings on CD-ROM.** Also for the first time this triennium, a *Proceedings* of the General Assembly on CD-ROM, containing the full four-page (maximum length) papers in PDF format, was prepared and included in the registration package. Again, the feedback from the Commissions unanimously supported this. It was noted that it would be nice to have a link between the author and the associated paper.

*Recommendation: The Committee recommended that publication of the Proceedings of the General Assembly on CD-ROM be continued, with the incorporation of a link between the author and the paper if possible.*

## Review of Radio Science

The *Review of Radio Science, 1999-2002*, was published by IEEE Press/John Wiley, and was available at the General Assembly. The printed version of the book contained in excess of 998 pages, with 38 chapters. Each chapter was a fully peer-reviewed, original paper. The book was included in CD-ROM form in the registration packets at the General Assembly. A copy of the printed version was given to each author, and was available for sale at the General Assembly. The printed version includes the CD-ROM. It is being marketed world-wide by John Wiley and the IEEE Press. The printed version does include an index. However, the CD-ROM version is fully indexed electronically, and the full text is searchable. The feedback from the Commissions indicated that the *Review of Radio Science (RRS)* was very well received, and is highly regarded.

It was also noted that the production of the *RRS* has become more and more of a challenge over each of the four triennia in which it has been published. The process of trying to get almost 40 sets of authors and editors from 10 Commissions to complete the authoring and reviewing process at even approximately the same time is difficult, and, quite frankly, not a particularly robust method of operation. For this reason, the Committee discussed the idea of incorporating the *RRS* into the *URSI Radio Science Bulletin (RSB)*. This would be accomplished by spreading the *RRS* papers for each triennium across three years of the *RSB*, beginning two years before the next General Assembly and continuing for one year after. This would give the authors of the first papers to be published a year in which to write them and have them reviewed. This would work out to about three papers per issue for the quarterly *RSB*. The General and Tutorial Lectures, which are also going to be published in the *RSB* this year (as a result of action by the Council at the previous General Assembly), would add approximately one additional paper per issue. With the one to two additional contributed papers per issue that have been coming in, this would yield a typical issue size of about five to six papers, which was felt to be a good size for the *RSB*.

The Committee felt that incorporating the *RRS* into the *RSB* would have several potential advantages. It would enhance the *RSB*, without making the burden on the editorial staff too excessive (because the reviewing would still be done by the Commissions, and because the workload would be spread over the triennium). With this reasonably steady stream of papers, the *RSB* would be able to achieve significant status as a valued source of scientific review material. One topic of ongoing discussion within URSI has been how to enhance the value of being an URSI Correspondent (or, as a result of the action taken by Council in Maastricht, an URSI Radio Scientist). An enhanced *RSB* is one way to do this. Because the reviews would be prepared and published over the course of a triennium, it should be possible to make them more timely. This would be a distinct incentive for some authors. Because the *RSB* is indexed in INSPEC, the *RRS* papers would be, too. Finally, it would remove the above-mentioned flaw of having to bring the output of all the authors and Commissions together at a single point in time. Put another way, in combing

the *RRS* with the *RSB*, if one paper was delayed an issue or two it would not create a major problem (and there might be another paper that was early, to compensate).

The following summarizes the comments received from the Commissions regarding the idea of incorporating the *RRS* into the *RSB*:

- There was unanimous support for the concept.
- Several expressed the need to insure that the quality of the content and acceptance criteria be maintained.
- Several asked if the title should be changed to reflect the inclusion of reviews; however, this was not a strong preference. It was noted that changing the title of a publication that contains cited material is generally strongly discouraged by librarians.

*Recommendation: The Committee recommended that the reviews of the Review of Radio Science should be published in the Radio Science Bulletin, spread over a triennium. The current system for defining topics, inviting authors, having Commissions editors, and for reviewing should be maintained.*

### **Radio Science Bulletin**

The recent efforts to increase the amount of technical content in the *Radio Science Bulletin (RSB)* have been very well received. The feedback from the Commissions was that this was a significant improvement.

*Recommendation: The Committee recommended that there be continued expansion and improvement of the technical content of the Radio Science Bulletin.*

Over the year or so prior to the General Assembly, there has been discussion of the possibility of making the *RSB* available on the Web. This is not a proposal to eliminate the printed version of the *RSB*, but rather to add Web-based publication of the same material. Most of the potential advantages are obvious. One that may not be as obvious as the others is the potential for reducing printing and (more significantly) postage costs associated with distributing unneeded printed copies of the *RSB*. If the *RSB* was available on the Web, URSI might be able to provide printed copies only to those who specifically request printed copies. The plan would be to continue to include the cost of production of the *RSB* in the registration fee for the General Assemblies. Consideration could be given to instituting an additional charge for those who wanted to receive the paper copy. The intent would be to have the *RSB* available for free on the Web. However, it would be necessary to register to access it, so that URSI would be able to contact those who sought access to the *RSB* on the Web and were not URSI Radio Scientists regarding information about URSI-sponsored conferences and the General Assemblies.

The following were the responses of the Commissions regarding this idea:

- There was unanimous support for putting the *RSB* on the Web.
  - Almost all asked that back issues be made available as well (i.e., from the time we start putting the *RSB* on the Web).
  - It was suggested that the previous triennium's worth of *RSB* issues be made available on CD-ROM at each General Assembly: free if it fits on the *Proceedings* CD, or for the cost of production if a separate CD-ROM is necessary.
  - Commission G had several specific suggestions:  
It will be important to make the site easy to access and download: Web access can be difficult in some parts of the world.  
HTML files are usually smaller than PDF, and it might be worth taking advantage of this [however, other Commissions strongly supported the use of PDF as the format].  
There will be a fair number of people who will still want paper copies.
- In discussions with the Secretariat, it was noted that PDF was the preferred format for Web-based publication of the *RSB*: it would relatively straightforward to produce a PDF version of each issue. Production of an HTML version would probably involve significantly more labor.

*Recommendation: The Committee recommended that the RSB should be published on the Web, as outlined above. It was also recommended that the back issues for each triennium be made available to General Assembly registrants on the Proceedings CD-ROM if they fit, or, if they do not, on a separate CD-ROM to be made available for the cost of production.*

### **Radio Science**

The Committee reviewed the status of the URSI journal *Radio Science*, published by the American Geophysical Union (AGU). The Committee commended Editor Robert Hunsucker for his eight years of excellent leadership. Most of the information regarding *Radio Science* was provided by Prof. Hunsucker. The number of submissions has been increasing recently. The journal is considered to be a "tier 1" publication by the AGU. This means that it is sufficiently successful financially that AGU strongly supports it. The Impact Factor, as reported by *Journal Citation Reports*, remains good. There have been some technical problems over the past year or so, related to the AGU's conversion to computer-to-plate publishing. However, these are being worked out. There has been a delay in identifying a new Editor to replace Prof. Hunsucker, who is planning on stepping down from the position at the end of 2002. However, by the end of the General Assembly it appeared that a process was in place to expedite the selection.

*Recommendation: The Committee requested that the URSI Council express its gratitude to Robert Hunsucker for the outstanding job he has done as Editor for eight years [the Council did so by acclamation]. The Committee recommended continuing the publication of Radio Science through the AGU. The Chair of the Publications Committee will contact the AGU to try to accelerate the identification of a new Editor.*



## **Other Publications**

*Recommendation: The two other URSI-sponsored publications, the Journal of Solar & Terrestrial Physics (JASP) and Wireless Networks appear to be doing well, and the Committee recommended continuing their current status.*

## **Committee Membership**

*Recommendation: The Committee recommended the following membership for the URSI Standing Committee on Publications for the coming triennium:*

*J. Hamelin*

*R. D. Hunsucker*

*P. Lagasse, Secretary General*

*W. R. Stone (Chair)*

*P. Wilkinson*

*The new Editor of Radio Science*

*G. Brussaard, Scientific Program Coordinator*

*URSI contacts for JASP and Wireless Networks, to be identified by the Committee*

*One to two younger scientists, to be identified by the Committee*

W. Ross Stone, Chair

## **URSI LONG RANGE PLANNING COMMITTEE**

After the General Assembly in 1999, the Long Range Planning Committee (LRPC) was assembled. The members are Drs. Pierre Bauer, Roy Booth, Chalmers Butler, Paul Delogne, James Lin, Bodo Reinisch, David Olver, David Skellern, Roberto Sorrentino and Ross Stone. Tatsuo Itoh was asked to serve as Chair.

In late December 1999, LRPC Chair consulted President Hiroshi Matsumoto as to possible long-range issues of concern by URSI Board. It was decided, due to logistical reasons, that LRPC would primarily work through e-mail discussions. The LRPC carried out two rounds of discussions in the subsequent period. In both rounds, the LRPC Chair summarized the issues, possible solutions and other relevant information. All LRPC members were then asked to provide their opinions, advice and clarifications. The first round of discussions started in January 2000.

Although there were several long-range issues, the LRPC decided to select the two most pressing issues for further discussions, so that the LRPC could be most effective. Those selected were (1) Individual Membership of URSI and (2) Enhanced Commission Activities. Heated discussions followed, particularly on item (1). All of these discussions were summarized in the E-mail Discussions 2<sup>nd</sup> Round distributed from the Chair to all Members of the LRPC on February 15, 2000. For item (1), the topics of discussions were: Definition of Individual Membership, Implementation, Member Benefits, Selection of Individual Members, Implementation of URSI Affiliates, Commission Membership, URSI Member Committees and No Change in Commission Elections. For the item (2), the topics of Inter-Commission Working Group, Multi-Commission Regional Activities and Traveling Lecturer were discussed.

On March 13, 2000, the LRPC sent a recommendation to the URSI Board. Subsequently, the URSI Board discussed this recommendation, and responded back to the LRPC with a number of questions. In return, the LRPC carried out discussions and formulated its response to the Board. This response was placed on the URSI Web page, so that any individuals and entities could study the LRPC recommendations and responses.

At the Board Meeting on May 8 – 9, 2001, the URSI Board decided to send a questionnaire to the Member Committees to ask their opinions on the Individual Membership issue. The LRPC looks forward to learning the responses to the questionnaire. The Traveling Lecturer program, under the item (2) (Enhanced Commission Activities), was approved for implementation.

#### **Amendment and final Recommendation of LRPC**

- (1) At the recent Board Meeting in April, the Board accepted and appreciated the spirit of the recommendation of LRPC in regard to the Individual Membership. However, the Board has had taken into account potential detrimental effects associated with the individual membership implementation, mainly on financial uncertainties related to several countries relative to their academies and has decided to choose the terminology “**URSI Radioscientist**” instead of “Individual Member.” It is expected that the LRPC recommendations would be respected except for the change of terminology. Evaluation of URSI Radioscientist would be carried out by each member country. If there is no such entity, evaluation will be done centrally. Therefore, Mode II used in the Board survey would be used. Candidates need to be qualified only once rather than for three year period, for instance. *LRPC recommends that this amended version be approved for implementation.*
- (2) In regard to **URSI Traveling Lecturer** program, the Board has provided approved with implementation of enhanced visibility of URSI organization to be conveyed to the audience at Lecturer’s presentation. This would be carried if the Lecturer spends 10 minutes at his presentation to explain what URSI is all about. Some material could be prepared for this and made available on the URSI website. *LRPC recommends implementation of this program as described here and in Appendix 1 Section 2c.*

## REPORTS ON ACTIVITIES OF INTER-UNION ORGANISATIONS

### IUCAF, THE SCIENTIFIC COMMITTEE ON FREQUENCY ALLOCATIONS FOR RADIO ASTRONOMY AND SPACE SCIENCE (1999 –2002)

Founded 1960 as an "Inter-Union-Commission for the Allocation of Frequencies" by the International Astronomical Union, IAU, and the International Radio Science Union, URSI, and with strong support from the Space Research Committee, COSPAR, IUCAF has developed into an Interdisciplinary Body of its own within the ICSU family. IUCAF maintains strong relations to the parent unions, a vital part of which is the regular funding that IUCAF receives from IAU, URSI, and COSPAR. Perhaps even more important is the active membership: all parent organisations delegate members into IUCAF. The relation to URSI has been particularly strong; most IUCAF chairmen have also been members of URSI.

Initially, the aim of founding IUCAF had been to make the spectrum requirements of science services known to the International Telecommunication Union, ITU, which is responsible of dividing the cake of the useable radio spectrum among an ever growing user community. It can be said today that IUCAF has accomplished this objective fairly well: radio astronomy, Earth exploration, and space science are well established radio services with frequency bands reserved for their use in the table of frequency allocations and with a study group in the radiocommunication sector of ITU. But this is no reason to lean back; the task has only become more difficult and urgent.

More and more radiocommunication services and radio applications require to be accommodated in the frequency spectrum, and none of the old ones wants to move. The situation has become so tense that the term "spectrum congestion" has already been used, and most of the work in ITU study groups and World Radiocommunication Conferences goes into finding out, how we all can share this limited resource. Consequently, IUCAF has developed into an expert group to negotiate sharing conditions and technical means to accommodate more radio applications, while at the same time maintaining the ability of the very sensitive and vulnerable scientific radio services to perform their very demanding measurement programs.

Further information about IUCAF and its membership can be found in the annual reports and on the IUCAF home page. The new URL is: <http://www.iucaf.org> .

Klaus Ruf (Germany, Secretary)  
Darrel T. Emerson (United States, Chairman)

## Report for 1999

### 1. Introduction

The Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science, IUCAF, has been formed in 1960 by URSI, IAU, and COSPAR. Its brief is to study the requirements of radio frequency allocations for radio astronomy, space science, and remote sensing in order to make these requirements known to the national and international bodies that allocate frequencies. IUCAF operates as a standing committee under the auspices of ICSU, the International Council for Science and is strongly supported by URSI, IAU, and COSPAR. ICSU works under the umbrella of the United Nations organization UNESCO.

### 2. Membership

At the end of 1999 the composition of membership for IUCAF was:

URSI	W.A. Baan	The Netherlands
	M. Davis	USA
	W. van Driel	France
	A. van Eyken	Norway
	P. Poiares Baptista	The Netherlands
	K. Ruf	Germany
	A. Tzioumis	Australia
IAU	S. Ananthkrishnan	India
	A.R. Thompson	USA
	M. Ohishi	Japan
COSPAR	B.A. Doubinsky	Russia
	D. Breton	France
	A. Gasiewski	USA

Ex Officio Advisers:

Director ITU Radio Bureau	Robert Jones	Canada
Chairman ITU Radio Board	M. Miura	Japan

IUCAF continues to maintain its network of Correspondents in 35 countries in order to interact with national authorities responsible for radio frequency management.

At the end of 1998, the membership of IUCAF had decided to appoint Dr. Klaus Ruf from the Max-Planck- Institut für Radioastronomie in Bonn, Germany, as chairman after Dr. Willem Baan had expressed the desire to step down. The transition of Chairmanship took place in the meeting of IUCAF in Grenoble in January 1999.

### **3. International Meetings**

During the period of January to December 1999, IUCAF Members and Correspondents took part in the following meetings:

January	Commshere in Toulouse, France
January	ITU-R Task Group 1-5 on Unwanted Emissions in Phoenix, AZ, USA
March	IUCAF Pre-Meeting at IRAM in Grenoble, France
March	ITU-R Working Party 7D in Geneva, Switzerland
April	Meeting of CRAF, the Committee on Radio Astronomy Frequencies of the ESF in Torún, Poland
July	IAU Symposium 196 in Vienna, Austria
August	URSI General Assembly in Ottawa, Canada
August	ITU-R Task Group 1-5 on Unwanted Emissions in Assen, The Netherlands
September	Meeting of CRAF, the Committee on Radio Astronomy Frequencies of the ESF in Cambridge, UK
September	CEPT/EU Workshop on European Preparations for WRC2000 in Brussels, Belgium
November	Conference Preparatory Meeting in Geneva, Switzerland

#### *3.1 IUCAF Meeting*

During the year 1999, in March, IUCAF has met as a committee with invited guests at Institute Radio Astronomie Millimetric (IRAM) in Grenoble, France. This pre-WP7D meeting was held with the purpose of discussing and focussing on important issues without the interference of other (non-science) interest groups. At the end of this meeting, the membership of IUCAF confirmed the transition in chairmanship to Dr. Klaus Ruf, who has been acting since. IUCAF is thankful for the hospitality given by IRAM and its Director, Dr. Michael Grewing.

### **4. Contact with the Unions**

IUCAF keeps regular contact with the secretariats of the supporting unions and with the ICSU secretariat. The Unions plays a strong supporting role for IUCAF and the membership is greatly encouraged by their support.

#### *4.1 Relations with IAU*

IUCAF members and correspondents assisted in the preparations of and actively participated in IAU Symposium 196 in Vienna, Austria in July 1999. This conference on “Preserving the Astronomical Skies” addressed all issues of pollution related to astronomy including light pollution, radio interference, and the issue of space debris. The topical meeting was held the week preceding the UNISPACE III conference organized by UNESCO on the “Peaceful Use of Space”, for which the IAU Symposium worked out resolutions. At the Vienna meeting, the relation of IUCAF with the IAU and its president,

Johannes Andersen, was strengthened considerably. The papers presented at Vienna will be printed as a book and appear in time for the IAU General Assembly in August 2000.

#### *4.2 Relations with URSI*

##### *4.2.a Commsphere*

IUCAF members actively participated in the organization and the meeting of Commsphere held from 25 to 28 January, 1999, in Toulouse, France. This URSI meeting was co-sponsored by ITU and provided a discussion forum between passive (scientific) spectrum users, government regulators, telecom operators, and manufacturers. The need for protection of the science bands was clearly relayed. In addition, the talks by Joe Shapira (URSI VP, Israel) and Ryszard Struzak (ITU, Geneva) also reemphasized the needs for the scientific services.

##### *4.2.b The URSI General Assembly*

In August 1999 URSI held its General Assembly in Ottawa, Canada. IUCAF members are appointed by the scientific unions, and URSI holds the largest share. Hence, a large fraction of the IUCAF membership was under review. The Chairman of IUCAF had asked to leave the membership unchanged, exceptionally, because IUCAF is in the middle of WRC-2000 preparations, and all IUCAF members are involved in this difficult process. URSI, however enforced the rule, from the statutes of ICSU, that members should not serve longer than 2 terms of three years each on the committee. Victims of this rule became Drs. R.J. Cohen from the UK and J. Whiteoak from Australia. Both Dr. Cohen and Dr. Whiteoak are radio astronomers and both are very experienced in frequency protection. Jim Cohen is chairman of CRAF and co-organizer of the IAU Symposium 196 in Vienna, John Whiteoak is chairman of ITU-R Working Party 7D (Radioastronomy) and had been tasked to chair the co-ordination of WRC-2000 preparations for the whole of ITU-R Study Group 7 (Science Services). IUCAF owes a lot to Jim Cohen and John Whiteoak, and the chairman would like to take the opportunity to express his sincerest thanks to the two colleagues. I am particularly grateful for their continued valuable work for IUCAF, which they now continue as IUCAF correspondents.

URSI was, however, flexible enough to exempt the former IUCAF chairman, Dr. Willem Baan from the two-term rule, and leave him on the committee as ex-officio member, much to the relief of the current chairman, who still profits much from the experience of Willem Baan.

Dr. W. Keydel, Germany, from the remote sensing community, gave up his membership after one term, due to excessive workload. I would like thank Dr. Keydel for his engagement and for the time he devoted to IUCAF.

URSI newly appointed Drs. M. Davis from the Arecibo Observatory in Puerto Rico, W. van Driel from Nancay Observatory in France, and A. Tzioumis from CSIRO in Australia. During the URSI General Assembly, an important topic in the discussions was, how to strengthen the relations between URSI and ITU. The Commsphere conferences have

brought together expert from both arenas, and co-operation has been discussed there already. Now, the URSI board set up a new standing committee called the SCT, Scientific Committee on Telecommunications, under the auspices of Vice-President Joseph Shapira (Israel). Paul Delogne (Belgium) will chair SCT with Willem Baan (Netherlands) as one of the vice-chairs. As a start into this new activity, Prof. Delogne and Willem Baan organized a tutorial, at the URSI GA with the title: Spectrum Congestion. Spectrum Congestion will be a mayor topic at the next URSI General Assembly in Maastricht, in summer 2002.

## **5. Affairs of the International Telecommunication Union**

### ***5.1 The ITU-R World Radiocommunication Conference 2000***

The World Radiocommunication Conference, WRC2000, will be held in Istanbul, Turkey, during the period of 8 May – 2 June 2000. The Agenda Items that relate to Passive Scientific use of the spectrum can be found at the IUCAF Web site. The Agenda of WRC-2000 also set a large fraction of the agendas for Working Parties 7C, 7D, and Task Group 1/5 as much of the preparatory work for the Conference is done in the ITU-R Study Groups.

### ***5.2 The WRC-2000 Agenda Items Related to Radio Science***

( The following acronyms are used: RAS: Radio Astronomy Service; EESS: Earth Exploration Satellite Service; MSS: Mobile Satellite Service; FSS: Fixed Satellite Service; SR: Space Research)

- 1.2 Finalize the remaining issues on spurious emission in Appendix S3 for space services,
- 1.4 Consider issues relating to allocations and regulatory aspects related to RESOLUTIONS 126 (WRC-97), 128 (WRC-97), 129 (WRC-97), 133 (WRC-97), 134 (WRC-97) AND 726 (WRC-97);
- 1.5 Consider regulatory provisions and possible additional frequency allocations for services using High Altitude Platforms taking into account the results of RESOLUTION 122 (WRC-97);
- 1.6.1 Review the spectrum requirements for the operation of terrestrial IMT-2000 with the view to identify future expansion bands and adjustments to the Table of Allocations,
- 1.9 Take into account the results of ITU-R studies in evaluating the feasibility of an allocation in the space-to-Earth direction to the MSS in a portion of the 1559 - 1567 MHz frequency range, in response to Resolutions 213 (WRC-97) AND 220 (WRC-97);
- 1.10 To consider the results of ITU-R studies in accordance with Resolution 218 (WRC-97) (Use of the bands 1525 - 1559 MHz and 1626.5 - 1660.5 MHz by the MSS),
- 1.11 Consider constraints on existing allocations and to consider additional allocations on a worldwide basis for the non-GSO/MSS below 1 GHz, taking into account Resolutions 214 (Rev WRC-97) and 219 (WRC-97);

- 1.13 On the basis of the results of the studies in accordance with Resolutions 130 (WRC-97), 131 (WRC-97) and 538 (WRC-97): on the “Use of NGSO (non-geo-stationary-orbit) systems in the FSS in certain frequency bands”,
- 1.14 Review the results of the studies on the feasibility of implementing NGSO MSS feeder links in the 15.43 - 15.63 GHz range in accordance with Resolution 123 (WRC-97),
- 1.15.1 To consider new allocations to the radio-navigation-satellite service required to support developments in the range from 1 to 6 GHz,
- 1.16 To consider allocation of frequency bands above 71 GHz to the EES (passive) and RAS, taking into account Resolution 723 (WRC-97);
- 1.17 To consider possible worldwide allocations for the EES (passive) and SR (passive) services in the band 18.6 - 1.8 GHz taking into account the results of the ITU-R studies.

### ***5.3 IUCAF Activities Related to the Agenda Item 1.16 of WRC-2000***

WRC-2000 will provide the last opportunity for the radio science community to make significant changes in the frequency allocation table above 71 GHz. Such changes are needed in order to reflect the changes in scientific insights that were gained since the current table was adopted at WARC-79. Proposals have been prepared for this agenda item and submitted to the ITU by a number of countries from all three ITU Regions, which were mostly based on the results of the IUCAF mm Wave Working Group. The guiding principles for re-allocation of the RAS bands have been the following: 1) the RAS can share some spectrum with terrestrial services by means of protection zones around the few mm wave observatories, 2) satellite down-links and aeronautical operations need to be located adjacent to each other at the edges of atmospheric spectral windows, 3) any potentially damaging active operations need to be located in places where they do least damage to passive spectrum use, and 4) all services need to have continued access to the spectrum.

This issue was finally addressed and brought in line with the requirements of the remote sensing community during the Conference Preparatory Meeting in the Fall of 1999. The current proposals would give the remote sensing community access to bands that are of crucial importance for the studies of the Earth atmosphere and the surface. Similar the RAS will obtain dramatic increases in spectrum shared with terrestrial telecommunication services.

### ***5.4 CPM-2, Preparation for WRC2000***

The second Conference Preparatory Meeting, CPM-2, concluded about the studies performed in ITU-R in preparation of WRC-2000. CPM also writes the CPM-Report, a 500+ pages document, which is normally accepted by the conference as the guideline in all technical questions. This meeting is therefore often considered to be of comparable importance as the conference itself.



Seven radio astronomers from different countries of the world participated in CPM, three of them are IUCAF members, but more than 1000 delegates of administrations, sector members (operators and manufacturers), and regional/scientific organizations participated in the meeting. The meeting organization was divided into 7 Working Groups: one for each CPM chapter. Each of the Working Groups was divided into a number of sub-working groups and even sub-sub-working groups. Proposals were submitted to the CPM-2 and were discussed in the various Working Groups, which in turn produced modified text for the final CPM Report. The “Input CPM Report” was produced by the ITU-R Study Groups. Working hours continued into late evening hours and on Saturday and Sunday.

The end result of the exhausting experience, the CPM Report, is generally in agreement with the protection requirements for radio astronomy in most cases, where allocations to radio astronomy are part of an agenda item of WRC-2000, explicitly or by consequence. IUCAF is moderately optimistic about the outcome of WRC-2000.

### ***5.5 ITU-R Task Group 1-5 on Unwanted Emissions***

IUCAF members have been playing a leading role in the ongoing work of Task Group 1-5, providing many input papers and the chairmen of large and critical drafting groups. IUCAF has considered TG 1-5 and its work very important for radio science and both TG 1-5 meetings in 1999 had some six radio astronomy participants from various countries. Nevertheless, protection of passive services from unwanted emissions remains one of the tasks on which TG1-5 could not yet conclude. Many action items on TG1-5’s agenda could be closed, like the preparation of text for the CPM of WRC-2000, where inclusion of spurious emission limits to space services into the Radio Regulations is now proposed, which until now are qualified as design objectives only. Out-of-Band emission limits will not make into the Radio Regulations. This concession had to be made in order to achieve progress on ITU-R Recommendation SM.329 on Out-of-Band emissions, which has now been finalized in TG1-5. Protection procedures for the safety and passive services, however, are among the few remaining issues to be solved.

Although Recommendation 66 was initially meant to promote the study of new standards for unwanted emissions in order to protect the passive services, this part of the objective has been pushed back further and further. As a result of an Space Services effort the protection of the passive services and of the safety services have been relegated to a consideration on a “band-by-band” basis. Rather than having general limits that would benefit all spectrum users by reducing unwanted emissions as intended by Rec. 66, this proposal will only protect the radio science bands to a level that is practical for the interfering service. Last years work in TG1-5 has shown, based on a good will action of Eutelsat, first evidence that at least some satellites in the geostationary orbit could meet the protection requirements of radio astronomy.

Despite the goodwill and the hard work of the IUCAF and RAS participants, the protection of the radio science bands will remain in jeopardy. The Draft New Resolution on the Protection of Passive Services is very weak, apart from being still in a preliminary form, and it is still lacking input from the satellite operators or their ITU-R Working Groups.

## **5.6 ITU-R Working Parties 7D and 7C**

Working Party 7D (Radio Astronomy) met only once last year. The autumn meeting did not take place because of the meeting of the Conference Preparatory Meeting for WRC-2000 in November 1999. WP7C addresses the issues of the remote sensing community. WP7C met at the same time as WP7D. Some twelve to fourteen radio scientists participated in the WP7D meeting of which six were IUCAF members.

A major effort for Study Group 7 has been the preparation of the guidance text on all relevant issue to be included in the Report for the Conference Preparatory Meeting for WRC-2000. CPM text has been produced on the following major issues:

- a) the use by the Fixed Satellite Service of the 42.5-43.5 GHz band, which is adjacent to an important RAS band (Item 1.4 & Resolution 128),
- b) the use of the 48 GHz band by High Altitude Platforms above major metropolitan areas for high density (broad band) applications (Item 1.5 & Resolution 122),
- c) the use of the 1626.5-1660.5 MHz band usage by the Mobile Satellite Service (Item 1.10 & Res. 218). This concerns a revision of text and application of Recommendation ITU-R M.1316 “Principles and methodology for frequency sharing in the 1610.6-1613.8 and 1660-1660.5 MHz bands between the MSS (Earth-to-Space) and the RA service”,
- d) the re-allocation of bands below 1 GHz Item 1.11 (Res. 214 and 219),
- e) the creation of a global allocation for the Earth Exploration Satellite Service in the 18 GHz band as contained in Item 1.17,
- f) the mm wave radio spectrum for the EES and the RAS above 71 GHz (Item 1.16 & Res. 723), and
- g) Item 1.2 relating to Recommendation 66 and Unwanted Emissions as part of the work of Task Group 1-5 (see section 4.5.1 above).

Other important issues within WP7D during the 1999 meeting have been:

- a) the “x percent issue”, relating to the amount of observing time or data that can be lost to man-made interference,
- b) the use of Monte Carlo methods for the determination of coordination distances between mobile spectrum users and radio astronomy observatories, and
- c) the use of the bands 1390-1400 MHz and 1427-1432 MHz by the Mobile Satellite Service and the interference to the RAS in the 1400-1427 MHz band, which may become a WRC item in the future.

## **6. Specific Spectrum Issues**

IRIDIUM has kept radio astronomy frequency protectors busy since 1992. IRIDIUM offered to provide world-wide telephone (and fax and data transmission) service via a fleet of 66 low-Earth-orbit satellites. Unfortunately, these satellites use frequencies in the band 1621.35 - 1626.5 MHz to connect to the mobile Earth stations with both up-links and down-links. However, satellites had been designed such that unwanted emissions

would spill over into the nearby Hydroxyl OH frequency band 1610.6 - 1613.8 MHz, at an unacceptable level at already moderate traffic loads on the system. Even though licensing conditions had been developed in many countries, pointing at the necessity to protect radio astronomy, before the system went into operation in November 1998, much negotiation work remained to be performed in the year 1999. The regulation found in Europe had asked for finding further agreement, between Iridium and CRAF, the ESF supported Committee for Radio Astronomy Frequencies, about the “time sharing” until the year 2005, and about mitigation factors. Time sharing in this context means sharing between a service with a primary allocation and the unnecessary, unwanted emissions of a service with a secondary allocation in a nearby frequency band. Given that a special footnote in the Radio Regulations explicitly says that harmful interference to radio astronomy in the band 1610.6 – 1613.8 MHz shall not be caused by the Mobile satellite Service in the band 1610 – 1626.5 MHz, it is still difficult to understand, why we had to negotiate so much. The Iridium system never achieved traffic density levels high enough to produce the really bad level of unwanted emissions, and the forecasts are, that it never will in future. We had to learn the lesson, however, that even the best rules do not protect us, if they are not enforced, and they will not be enforced, if we do not fight for it.

## **7. Publications and Reports**

IUCAF has contributed a number of documents to the proceedings of Task Group 1-5 and Study Group 7. These documents have all appeared on the ITU-R Home Page and have not all been distributed by email. As a result there was less need to post these documents on the IUCAF Home Page. Information about IUCAF documents and meeting reports is generally available on the IUCAF Home Page and has been distributed by email to the general IUCAF electronic mailing list.

## **8. Conclusion**

The pressure for commercial spectrum applications has remained steady and intense during recent years. In order to obtain access to large bandwidths the commercial applications are now calling for spectrum up to the edge of the atmospheric window at 60 GHz. These applications mostly relate to high density (and wide band) applications such as Internet from the sky or from stratospheric (aerostat) platforms located above major cities, and as terrestrial wide-area distribution systems. This drive for spectrum results in part from the desire to be first in the targeted market. In addition, the technology for operating at these high frequencies is now becoming commercially available, in part as a result of the pioneering work of the radio astronomers and Earth exploration scientists. In this regard it is of extreme importance that the band allocations above 71 GHz are being considered at WRC-2000. This will indeed be the last chance for the radio science community to change things in that part of the spectrum. It is good to see that IUCAF has been able to take up a central role in the preparations for this Agenda Item at WRC-2000.

IUCAF members and correspondents clearly have their plate full of spectrum issues relevant to radio science. Many existing spectrum issues have remained and the interference

problems continue to expand to higher frequencies. IUCAF will continue to emphasize the message of protecting the radio science for future generations. In particular, the need for expounding on the relevance of such efforts in developing countries and for expanding personal contacts there remain urgent for the coming years. Also the satellite down-link issues will continue to draw attention.

IUCAF is thankful for the moral and financial support that has been given for these continuing efforts by ICSU, URSI, IAU, and COSPAR during the recent years. IUCAF also recognizes the clear support that has been given by radio astronomy observatories and universities to individual members in order to participate in the work of IUCAF.

Klaus Ruf, Chairman

## Report for 2000

### 1. Introduction

The Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science, IUCAF, has been formed in 1960 by URSI, IAU, and COSPAR. Its brief is to study the requirements of radio frequency allocations for radio astronomy, space science, and remote sensing in order to make these requirements known to the national and international bodies that allocate frequencies. IUCAF operates as a standing committee under the auspices of ICSU, the International Council for Science and is strongly supported by URSI, IAU, and COSPAR. ICSU works under the umbrella of the United Nations organization UNESCO.

### 2. Membership

At the end of 2000 the composition of membership for IUCAF was:

URSI	W.A. Baan	The Netherlands
	M. Davis	USA
	W. van Driel	France
	A. van Eyken	Norway
	P. Poiares Baptista	The Netherlands
	K. Ruf	Germany
	A. Tzioumis	Australia
	IAU	S. Ananthkrishnan
R.J. Cohen		United Kingdom
D.T. Emerson		USA
M. Ohishi		Japan
K.F. Tapping		Canada

COSPAR	D. Breton	France
	A. Gasiewski	USA

Ex Officio Advisers:

Director ITU Radio Bureau	Robert Jones	Canada
Chairman ITU Radio Board	M. Miura	Japan

IUCAF continues to maintain its network of Correspondents in 35 countries in order to interact with national authorities responsible for radio frequency management.

### 3. International Meetings

During the period of January to December 2000, IUCAF Members and Correspondents took part in the following meetings:

January	ITU-R Task Group 1-5 on Unwanted Emissions in Bangalore, India
January	IUCAF Pre-Meeting in Orlando, Florida, USA
January	ITU-R Working Parties 7C and 7D (Space Science and Radio Astronomy) in Orlando, USA
March	CEPT Project Team for the Preparation of WRC-2000 in Geneva, Switzerland
April	Meeting of CRAF, the Committee on Radio Astronomy Frequencies of the ESF in Granada, Spain
May/June	World Radiocommunication Conference, WRC-2000, in Istanbul, Turkey
July	ITU-R WP7E on Inter-Service Sharing, in Vancouver, Canada
August	IUCAF Pre-Meeting in Penticton, Canada
August	ITU-R WPs 7C and 7D in Vancouver, Canada
August	General Assembly of the International Astronomical Union, IAU, in Manchester, UK
September	Meeting of CRAF, the Committee on Radio Astronomy Frequencies of the ESF in Budapest, Hungary
November	ITU-R Task Group 1-5 on Unwanted Emissions in Geneva, Switzerland

Additionally, a number of IUCAF members and correspondents participated in national or regional preparatory meetings for WRC-2000

#### 3.1 IUCAF Meetings

During the year 2000 IUCAF had two meetings as a committee. These pre-WP7D meetings took place in Orlando, Florida (USA), and at the Dominion Radio Astronomy Observatory near Penticton, BC (Canada). They were held with the purpose of discussing and focussing on important issues without the interference of other (non-science) interest groups. During the WRC-2000 in Istanbul, Turkey, a number of ad-hoc meetings of IUCAF were held to discuss the IUCAF strategy during this important conference.

#### **4. Contact with the Unions**

IUCAF keeps regular contact with the secretariats of the supporting unions and with the ICSU secretariat. The Unions plays a strong supporting role for IUCAF and the membership is greatly encouraged by their support.

##### ***4.1 The IAU General Assembly***

IUCAF members and correspondents assisted in the preparations of and actively participated in the General Assembly of the International Astronomical Union, IAU, in Manchester, UK, in August 2000. A topic of main interest to the astronomy community has been, of course, the results of the World Radiocommunications Conference, WRC-2000, where radio astronomy and space science have been exceptionally successful in getting a large fraction of the radio spectrum reserved for scientific use. Other frequency bands of interest to radio astronomy, which fall into the region of highest radio frequencies not yet assigned by the International Telecommunication Union to any radio service, are now subject to studies, following a recommendation of WRC-2000 and the General Assembly of IAU set up a working group to discuss and define the astronomical requirements. This working group is led by the Japanese IUCAF member, Dr. Masatoshi Ohishi.

The GA of IAU set up another working group, also, to deal with ways to mitigate the effects of radio frequency interference to radio astronomy. Also this group is chaired by an IUCAF member, Dr. Anastasios Tzioumis from Australia.

The committee membership was reviewed by the IAU GA. IAU had sent four representatives to IUCAF, and two of these asked to be replaced after having reached retirement age. Following the IUCAF chairman's proposal, IAU nominated three new IUCAF members, increasing the number of IAU representatives to five. The two leaving members are Dr. Boris A. Dubinski from Russia and Dr. A. Richard Thompson from the US. Both Boris and Dick have been IUCAF members with an enormous experience gained in numerous meetings and conferences. Boris Dubinski is with the Space Science Institute of the Russian Academy of Science at Moscow and his activity centered around radio astronomy from space. Dick Thompson is senior scientist at the National Radio Astronomy Observatory in Charlottesville. His superb technical expertise in all fields of radio astronomical measurements was of greatest value in Working Party 7D of ITU-R. As new members of IUCAF, IAU nominated Drs. R. James Cohen from National Radio Astronomy Laboratory, Jodrell Bank, UK; Darrel T. Emerson from NRAO, Tucson, USA, and Kenneth F. Tapping from Dominion Radio Astronomy Observatory, Penticton, Canada.

##### ***4.2 Relations with URSI***

IUCAF members actively participated in a number of national URSI meetings.

#### **5. Affairs of the International Telecommunication Union**

##### ***5.1 The ITU-R World Radiocommunication Conference 2000***

The World Radiocommunication Conference, WRC2000, held in Istanbul, Turkey, during the period of 8 May – 2 June 2000, was by far the most important conference for IUCAF since a number of years. The Agenda Items that relate to Passive Scientific use of the spectrum were: ( The following acronyms are used: RAS: Radio Astronomy Service; EESS: Earth Exploration Satellite Service; MSS: Mobile Satellite Service; FSS: Fixed Satellite Service; SR: Space Research)

- 2.2 Finalize the remaining issues on spurious emission in Appendix S3 for space services,
- 4.4 Consider issues relating to allocations and regulatory aspects related to Resolutions 126 (WRC-97), 128 (WRC-97), 129 (WRC-97), 133 (WRC-97), 134 (WRC-97) and 726 (WRC-97);
- 1.5 Consider regulatory provisions and possible additional frequency allocations for services using High Altitude Platforms taking into account the results of Resolution 122 (WRC-97);
- 1.6.1 Review the spectrum requirements for the operation of terrestrial IMT-2000 with the view to identify future expansion bands and adjustments to the Table of Allocations,
- 1.9 Take into account the results of ITU-R studies in evaluating the feasibility of an allocation in the space-to-Earth direction to the MSS in a portion of the 1559 - 1567 MHz frequency range, in response to Resolutions 213 (WRC-97) AND 220 (WRC-97);
- 1.10 To consider the results of ITU-R studies in accordance with Resolution 218 (WRC-97) (Use of the bands 1525 - 1559 MHz and 1626.5 - 1660.5 MHz by the MSS),
- 1.11 Consider constraints on existing allocations and to consider additional allocations on a worldwide basis for the non-GSO/MSS below 1 GHz, taking into account Resolutions 214 (Rev WRC-97) and 219 (WRC-97);
- 1.13 On the basis of the results of the studies in accordance with Resolutions 130 (WRC-97), 131 (WRC-97) and 538 (WRC-97):on the “Use of NGSO (non-geo-stationary-orbit) systems in the FSS in certain frequency bands”,
- 1.14 Review the results of the studies on the feasibility of implementing NGSO MSS feeder links in the 15.43 - 15.63 GHz range in accordance with Resol. 123 (WRC-97),
- 1.15 To consider new allocations to the radio-navigation-satellite service required to support developments in the range from 1 to 6 GHz,
- 1.16 To consider allocation of frequency bands above 71 GHz to the EES (passive) and RAS, taking into account Resolution 723 (WRC-97);
- 1.17 To consider possible worldwide allocations for the EES (passive) and SR (passive) services in the band 18.6 - 1.8 GHz taking into account the results of the ITU-R studies.

#### **5.1.a Agenda Item 1.16 of WRC-2000**

The complete reallocation of the radio spectrum between 71 and 275 GHz has been considered the single most important issue of WRC-2000 for the science services and

preparations by IUCAF have been intense. Proposals had been prepared for this agenda item and submitted to the ITU by a number of countries from all three ITU Regions, which were mostly based on the results of the IUCAF mm Wave Working Group. The guiding principles for re-allocation of the RAS bands have been the following: 1) the RAS can share some spectrum with terrestrial services by means of protection zones around the few mm wave observatories, 2) satellite down-links and aeronautical operations need to be located adjacent to each other at the edges of atmospheric spectral windows, 3) any potentially damaging active operations need to be located in places where they do least damage to passive spectrum use, and 4) all services need to have continued access to the spectrum.

The proposals for Agenda Item 1.16 from the different regions were very similar and could be aligned easily. The conference adopted the proposal quite early in its deliberations and without major resistance. IUCAF noted with satisfaction that the intense preparation has paid and the result was welcomed as a great victory for science in general and for mm wave astronomy and passive remote sensing in particular. Two thirds of the whole radio spectrum, which is administered by the ITU, has been redistributed to satisfy our needs! This has been made possible, of course, by the sense of compromise and good citizenship in spectrum land, by which the proposals worked out by scientific radio services respect the needs of the commercial radio services as well and envisage intensive sharing of frequency band, wherever this appears feasible. This feasibility of sharing between active and passive services will become the subject of studies within the ITU-R study groups, as soon as active service technical and operational parameters become available.

### *5.2 ITU-R Task Group 1-5 on Unwanted Emissions*

With two meetings in January and November 2000, Task Group 1-5 of ITU-R completed its term. IUCAF members have been playing a leading role in the ongoing work of Task Group 1-5, providing many input papers and the chairman of the most critical drafting group.

Task Group 1-5 was very successful and produced a number of recommendations on several aspects of Unwanted Emissions, including a general recommendation on the protection of passive services. These recommendations were approved by Study Group 1 of the ITU-R and are at present in the process of circulation, seeking approval by the member states of ITU. Protection procedures for the safety and passive services, however, are the remaining issues to be solved.

As a result of an Space Services effort the protection of the passive services and of the safety services have been relegated to a consideration on a “band-by-band” basis. Rather than having general limits that would benefit all spectrum users by reducing unwanted emissions as intended by Rec. 66, this proposal will only protect the radio science bands to a level that is practical for the interfering service. This “band-by-band study” will be continued in a new Task Group, TG1-7 of ITU-R Study Group 1. IUCAF has been very active in achieving another Task Group to deal with this issue, which has been very high up on the priority list of science service’ frequency managers for more than 20 years now.



And the new Task Group was set up against strong opposition by some satellite operators and their favorite national administrations. In fact, it could be achieved that Dr. Willem Baan, IUCAF member and former IUCAF chairman, was nominated to be co-chairman of the new Task Group. This is certainly a well merited tribute to his excellently fair guidance of the TG1-5 Drafting Group on passive services, which he had chaired.

### *5.3 ITU-R Working Parties 7D and 7C*

Working Parties 7C and 7D met twice year. WP7C addresses the issues of the remote sensing community. WP7C met at the same time as WP7D on Radio Astronomy. The January meeting was to a large fraction devoted to finalizing the Working Parties view on the WRC-2000 agenda items, and the August meeting considered the results of the conference and started to organize the work towards the next conference, which will take place in summer 2003.

The Conference Preparatory Meeting for WRC-2000 had produced its report to WRC-2000 already in fall 1999, so no production work for the preparation of the conference was required. WP7D had time to consider TG1-5 issues, and could finally get agreement on a new recommendation on the permissible data loss to interference. This recommendation had been through a long and controversial creation process. It was triggered by the advent of modern mobile services, which did not want to respect large exclusion zones around radio observatories, explaining that the equipment is used only sporadically, and coordination calculations involving radio astronomy stations have in the past only considered the static case of fixed or broadcasting service stations. This has to be seen in the context of spectrum management tools, making use of Monte Carlo simulations of complex sharing scenarios, which cannot work with the data loss being exactly equal to zero.

Initially, the proponents of this Monte Carlo methodology had hoped they could get radio astronomers agree to a number as high as 10 % for the data loss, because in the static calculations of coordination distances radio astronomy had agreed to the use of a propagation model, which gives the required attenuation with a probability of 90 %. It took us long to convince the other side that radio astronomy is a serious undertaking and that our funding agencies would not understand our acceptance of a loss rate so far in excess of corresponding numbers for other, particularly for commercial services. (Or could the reader imagine to accept television with interference throughout 10 % of the program?) The numbers finally agree are 2% for individual systems or services, and 5 % for the aggregate of all possibly interfering transmitters. Additionally, during the long time of improving this draft recommendation, it was made much more generally applicable and now covers interference due to unwanted emissions from services in nearby frequency bands as well as satellite services, which generally cannot share frequency bands with radio astronomy.

The August meeting of the Study Group 7 Working Parties spent much time and effort to complete a document dealing with the band-by-band study of Task Group 1-5. From the

WRC-2000 results, which require studies in WP7C and WP7D, the coordination with a new type of service seems to be most remarkable: the high-altitude platforms. This new application to provide broadband access to interactive services is considered to be a terrestrial fixed service by ITU. Accordingly, WRC-2000 started to dedicate fixed service bands to the use by HAPS. Terrestrial fixed used to be the service which can share frequency band with radio astronomy most easily. We will have to revise this picture, if HAPS are becoming the wide-spread application that its inventors hope. Coordination between HAPS and radio observatories will be a bit more difficult.

## **6. Publications and Reports**

IUCAF has contributed a number of documents to the proceedings of WRC-2000, Task Group 1-5 and Study Group 7. These documents have all appeared on the ITU-R Home Page and have not all been distributed by email.

## **7. Conclusion**

It is of extreme importance that the band allocations above 71 GHz have been considered so favorably at WRC-2000. IUCAF has been able to take up a central role in the preparations for this Agenda Item at WRC-2000. Sharing at lower frequencies and limitations to unwanted emissions of active services in passive service bands, as well as the satellite down-link issues will continue to draw attention.

IUCAF is thankful for the moral and financial support that has been given for these continuing efforts by ICSU, URSI, IAU, and COSPAR during the recent years. IUCAF also recognizes the clear support that has been given by radio astronomy observatories and universities to individual members in order to participate in the work of IUCAF.

Klaus Ruf, Chairman

# **Report for 2001**

## **1. Introduction**

The Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science, IUCAF, was formed in 1960 by URSI, IAU, and COSPAR. Its brief is to study the requirements of radio frequency allocations for radio astronomy, space science, and remote sensing in order to make these requirements known to the national and international bodies that allocate frequencies. IUCAF operates as a standing committee under the auspices of ICSU, the International Council for Science and is strongly supported by URSI, IAU, and COSPAR. ICSU works under the umbrella of the United Nations organization UNESCO.

## 2. Membership

At the end of 2001 the composition of membership for IUCAF was:

URSI	W.A. Baan	The Netherlands
	M. Davis	USA
	W. van Driel	France
	A. van Eyken	Norway
	P. Poiares Baptista	The Netherlands
	K. Ruf	Germany
	A. Tzioumis	Australia
IAU	S. Ananthkrishnan	India
	R.J. Cohen	United Kingdom
	D.T. Emerson (Chair)	USA
	M. Ohishi	Japan
	K.F. Tapping	Canada
COSPAR	S. Gulkis	USA
	A. Gasiewski	USA

Ex Officio Advisers:

Director ITU Radio Bureau	Robert Jones	Canada
ITU Radio Board	Ryszard Struzak	Poland
Councilor Study Group 7	Kevin Hughes	United Kingdom
Councilor Study Group 1	Albert Nalbandian	

During the year 2001, the chairmanship of IUCAF changed from Klaus Ruf to Darrel Emerson. There was also a change in the IUCAF membership representing COSPAR. Daniel Breton retired from France Meteo, and COSPAR agreed with IUCAF on the nomination of Samuel Gulkis. IUCAF wishes to express its appreciation to the long lasting active work of Dr. Breton, and, at the same time, to welcome Dr. Gulkis.

IUCAF continues to maintain its network of Correspondents in 35 countries in order to interact with national authorities responsible for radio frequency management.

## 3. International Meetings

During the period of January to December 2001, IUCAF Members and Correspondents took part in the following meetings:

February	Meeting of UN-Copuos in Vienna, Austria
March	Workshop on Interference Mitigation, Bonn, Germany
April	Task Group 1-7 of ITU-R on the Protection of Passive Services in Geneva, Switzerland

May	ITU-R Working Parties 7C and 7D in Geneva, Switzerland
June	ITU-R Task Group 1-7 in Maastricht, The Netherlands
September	Meeting of the Space Frequency Coordination Group in Cayenne, French Guayana
November	ITU-R Task Group 1-7 in Geneva, Switzerland

Additionally, many IUCAF members and correspondents participated in national or regional meetings, dealing with spectrum issues in general or preparing for WRC-2003.

### *3.1 IUCAF Meetings*

During the year 2001 IUCAF had a number of face-to-face meetings as a committee. These meetings took place in Geneva, Switzerland, and in Maastricht, The Netherlands. They were held before Working Party 7D or Task Group 1-7 meetings, with the purpose of discussing and focusing on important issues on the agenda of WP7D or TG 1-7, in preparation for the public ITU meetings. During these ITU sessions, typically lasting a week to 10 days, a number of ad-hoc meetings of IUCAF were held to discuss further the IUCAF strategy. Other IUCAF business such as changes in the chair and the membership, action plans for future workshops or initiatives, and future contributions to international spectrum meetings were also discussed at these meetings.

Although such face-to-face meetings at the ITU venues have been convenient and effective, throughout the year much IUCAF business continues to be undertaken via email communications between the members and correspondents.

### *3.2 Meeting of UN-COPUOS*

The Meeting of the United Nations' "Committee for the Peaceful Use of Outer Space", COPUOS, February 2001 in Vienna, Austria, had an item on its agenda dealing with the future of observational radio astronomy in a commercially exploited radio spectrum. The concept, which is not new, is to create in effect a "World Heritage Astronomical Site" – or ideally several such sites. The goal is to preserve access to the sky throughout the entire electromagnetic spectrum from at least one site on Earth. The existing protection afforded to Radio Astronomy is limited to a number of relatively narrow bands. Many scientists fear that mankind could blind itself for ever to observations outside these protected bands; some potential discoveries might never be made, because the observational conditions are compromised by active uses of the radio spectrum. This concept has also lead to establishing a Task Group of OECD, in which high-ranking industry representatives discuss the future of radio astronomy with science managers and government officials.

In order to bring this idea to the attention of a UN committee dealing with both scientific and commercial use of satellites and space stations, for the benefit of all mankind, COPUOS invited IAU, ITU, and the OECD Task Force to present the case to the Science and Technology Sub-Committee. IAU invited the chairman of IUCAF, and ITU sent Mr. Nalbandian, one of IUCAF's councillors in ITU-R. Their presentations were very well received and a section of that meeting report is devoted to this topic.

### *3.3 Workshop on Interference Mitigation*

Active radio service spectrum managers often tell us that radio astronomy and the Earth exploration satellite service are simply too sensitive, and that adequate suppression of unwanted emissions from the transmitting radio services cannot be accomplished without unreasonable effort. They recommend that the scientific services rely on so-called mitigation techniques, a term that includes a wide range of technical or operational measures to avoid or excise interference in observations by the passive services. From the very beginning of the science of radio astronomy, many observations have only been possible by ingenious applications of technology and special observing techniques, and further such innovations are being studied and developed in an attempt to minimize the impact of radio interference. Today, in the presence of many man made signals with their diverse characteristics, digital signal processing appears to be the most promising tool, but other technical developments ranging from fast multi-bit samplers to high-temperature superconducting filters are under intense study. Such research is not limited to the field of radio astronomy

Scientists working on the implementation of practical RFI mitigation techniques have not always been in close contact with those involved in spectrum management. To try to foster the exchange of ideas, IUCAF organised a 3-day workshop on interference mitigation, involving about 50 experts from both technical and regulatory fields. Many excellent presentations were given, but the workshop emphasis was in increasing the mutual understanding between the different areas of expertise. This workshop was a great success, and IUCAF intends to organize more such events in the future.

### **4. Contact with the Unions**

IUCAF keeps regular contact with the secretariats of the supporting unions and with the ICSU secretariat. The Unions plays a strong supporting role for IUCAF and the membership is greatly encouraged by their support.

None of the IUCAF parent unions, IAU, URSI, and COSPAR held general assemblies in 2001, however, IUCAF members actively participated in national URSI meetings and in IAU Seminars and Symposia.

### **5. Affairs of the International Telecommunication Union**

#### *5.1 ITU-R Task Group 1-7 on the Protection of Passive Services from Unwanted Emissions*

With three meetings in April, June, and November 2001, Task Group 1-7 of ITU-R constituted the biggest workload on the committees.

As a result of the continued pressure from the active Space Services the protection of the passive services has been limited to a consideration on a “band-by-band” basis. Rather than having general limits that would benefit all spectrum users by reducing unwanted emissions as specified in Rec. 66, compromises are being discussed, limiting the degree

of protection afforded to the radio science bands to what is considered practical by the interfering service in specific bands. This “band-by-band study” is continued in Task Group 1-7 of ITU-R Study Group 1.

Additionally, TG 1-7 is responsible for preparing text on agenda item 1.8.2 for the preparatory meeting of WRC-03. This agenda item asks for consideration of regulatory measures to protect the passive scientific radio services in their frequency bands, taking into account the results of the “band-by-band studies”. The deadline for the submission of CPM text, which will form part of the CPM Report that helps delegated at the WRC to discuss and take decisions on the agenda items, is May 2002. Hence the concentrated work during and between the meetings. IUCAF had been very active in the formation of TG 1-7, continuing the work of TG 1-5 and with the appropriate mandate. Dr. Willem Baan, IUCAF member and former IUCAF chairman, was nominated to be co-chairman of the new ITU Task Group. Largely due to his and his co-chairman’s able guidance, but also due to excellent IUCAF contributions, an initial impasse could be overcome in the last meeting of 2001, and timely delivery of input to the Conference Preparatory Meeting is within reach. This text will not go as far as radio astronomers and remote sensing scientists would have liked, but should represent a reasonable compromise that leaves all options open for the World Radiocommunication Conference in 2003.

Many “band-by-band studies” are under way, and more may be started when new satellite systems are proposed by industry. These studies may become part of the normal life of the frequency managers of the scientific services.

### *5.2 ITU-R Working Parties 7D and 7C*

Working Parties 7C and 7D met once this year, in May 2001. WP7C addresses the issues of the remote sensing community. WP7C met at the same time as WP7D, which is devoted to Radio Astronomy.

The largest fraction of the work was devoted to issues related to TG1-7 matters. A number of band-by-band studies was brought forward and liaison statements written for TG1-7. From the other work, one topic deserves special mention; one satellite company is working on wide-band communication systems, including earth-to-space, space-to-earth and satellite-to-satellite links, which will operate at optical frequencies. This early-stage study was brought to the attention of WP7D. 7D radio astronomers are now talking to their colleagues who observe at optical wavelengths, to try to convince them of the benefits of ITU-R work; the ITU now considers optical frequencies to be within its scope. Optical astronomers have been fighting “light pollution” for long time and with good success in some cases. However, the use of the optical spectrum has so far not been regulated by an international agency like ITU, and protection of optical telescopes against light pollution has to be done locally, and individually for each site. At least for the use of the optical spectrum for communication purposes, this picture may change in future.

The more regular work in WPs 7C and 7D comprises revisions of many ITU-R recommendations, which need to be updated following the very significant changes in

the frequency bands above 71 GHz that occurred at WRC-2000, and also to accommodate improved technical parameters. One new recommendation, which could be completed within WP7D and handed upwards to the approval process, deals with radio frequency bands above the current limit of 275 GHz, and which are of importance to radio astronomy. Additionally, WP7D has started to revise the ITU-R Handbook on Radio Astronomy and plans to publish a second edition soon. In all cases, IUCAF members play key roles in bringing these issues forward.

## **6. Publications and Reports**

IUCAF has contributed a number of documents to the proceedings of Task Group 1-7 and Study Group 7. These documents have all become available on the ITU-R web pages, so have not necessarily been distributed separately by email. IUCAF now has a permanent web address, <http://www.iucaf.org>, where the latest updates on the organization's activities will always become available.

## **7. Conclusion**

IUCAF interests and activities range from preserving what has been achieved through co-ordination or mitigation techniques, to looking very far into the future of highest frequency use. Current priorities, which will certainly keep us busy through the next two years, include the band-by-band studies for cases where allocations are made to satellite down-link services close in frequency to the radio astronomy bands, and the preparations for WRC-03.

IUCAF is thankful for the moral and financial support that has been given for these continuing efforts by ICSU, URSI, IAU, and COSPAR during the recent years. IUCAF also recognizes the clear support that has been given by radio astronomy observatories and universities to individual members in order to participate in the work of IUCAF.

Darrel Emerson, Chairman  
Klaus Ruf, Retiring Chairman.  
IUCAF, Tucson, AZ, USA  
<http://www.iucaf.org>

## **BUSINESS TRANACTED BY COMMISSIONS**

### **COMMISSION A - ELECTROMAGNETIC METROLOGY**

Chair: Prof. E. Bava (Italy)  
Vice-Chair Dr. Q. Balzano (USA)

The Commission held three Open Commission Meetings, respectively on 19, 21 and 23 August 2002.

#### **Meeting of August 19, 2002**

Chairman Prof. Bava called the meeting to order at 6 p.m. He circulated an attendance sheet, requesting the name, the country, the address and the voting status of those present. A total of 16 voting Members were present.

##### *Approval of the Agenda.*

Prof. Bava proposed an agenda for the business meeting. After a short discussion the agenda was unanimously approved.

##### *Election of the 2002 Vice-Chair*

Prof. Bava reminded the audience that the curricula of the candidates had been mailed to the voters. He then briefly summarized the candidates' scientific activities; all have experience in organizing meetings and symposia. The names of the candidates are: Boisrobert (FR), Chou (USA) and Pollitt (UK)

Chairman Bava informed those present that they had the opportunity to change their vote. No representative elected to do so. There was the tallying of the votes by mail plus those of the attending voting members Leschiutta (IT) and de Vreede (ND). The candidates collected the following preferences:

1. Pollitt
2. Boisrobert
3. Chou

There was a brief procedural discussion and a new round of votes was collected to establish a possible new level of preference between the two candidates Boisrobert and Pollitt. The outcome of the second round of voting was: Pollitt (26), Boisrobert (22)



*Transition from Review of Radio Science to Radio Science Bulletin.*

Chairman Bava invited the audience to discuss the proposal to eliminate the Review of Radio Science and publish instead its articles on the Radio Science Bulletin. There is also a proposal to post the R. S. Bulletin on the Web. If the proposal is accepted then an editor for Commission A must be selected and charged with the article editing process.

There was a discussion following these proposals. The final unanimous sense of the members was to accept the transition provided that the content and the acceptance criteria of the articles are maintained. The Web posting of the R.S. Bulletin met unanimous acceptance. At this time no editor for Commission A has been nominated.

*Terms of Reference for Commission A.*

The current terms of reference of Commission A were presented by Chairman Bava. The discussion of possible changes was remanded to future meetings of the Commission.

*Scientific Commission for Telecommunication.*

Chairman Bava stated that the link between URSI and ITUR is in the charge of the S.C. of this GA, Mr. Martin P. Hall. If members of Commission A want to participate in the link activities, they can contact Chairman Bava during the next Commission A business meeting on Wednesday for the transmittal of their name. There will be a meeting chaired by Mr. Hall on Thursday, August 22<sup>nd</sup>, at lunch time. Interested parties can prepare written contributions and place them in Mr. Hall's pigeonhole.

Prof. Leschiutta (IT) will make a short presentation at the next Commission A meeting on the issues between Commission A and ITUR, in particular on the leap second problem.

*Philips Award*

Chairman Bava stated that the Philips Co. will present "una tantum" a Y. S. award of 500 Euros for the best written paper. Commission A has three candidates that can compete for the prize. The commission Chair, supported by few advisors, will propose the best Y. S. contribution of Commission A for the final selection which will occur next Friday at lunch time after a short interview between the selected Y.S. (one per Commission) and an ad hoc committee.

*Procedure for Abstract Acceptance.*

The procedure for abstract acceptance was discussed. Some members prefer the short 1 page abstract submission, while others wish to maintain the current four-page limit.

No resolution was found and the discussion will be continued at the next business meeting.

There was a short discussion on how to control absenteeism. The current policy of not refunding the registration fee is good, but additional measure could be added.

Prof. Leschiutta proposed a reduced URSI registration fee for retired members of the Union.

### *Question on the Procedures of Session Organization*

Mr. Martin Hall circulated a document with the requirements for organization of the URSI scientific sessions. Suggestions for amendments to the procedures were requested by chairman Bava.

## **Meeting of August 21, 2002**

Chairman Prof. Bava called the meeting to order promptly at 18:00 and passed an attendance sheet for those present. Chairman Bava proposed an agenda (see attachment B) for meeting, which was unanimously approved by the attending members.

### *1. Summary of Council Meeting of August 20, 2002.*

Chairman Bava informed the audience of the outcome of the election of the Chairs and Vice-Chairs of the URSI Commissions. The Vice-Chair election process was completed except for Commissions D and E, whose decisions will be firmed at the council meeting of August 22, 2002.

#### Commissions' Propositions

- a) A French resolution of refunding the registration fee to members of poor countries who cannot receive travel support was rejected after show of hands
- b) Following a resolution proposed by Commission J, working group was established to resolve the leap second issue
- c) A French recommendation to timely distribute information about topics to be discussed at Council meetings was approved.

Chairman Bava informed the members that there are three (3) contending sites for the 2005 URSI GA : Beijing (China), New Delhi (India) and Denver, CO (USA). Site selection will be decided at the Council meeting of August 22, 2002.

Member for Solar Power Satellite IWG. Prof. Andrew Marvin is interested in participation.

### *2. Meeting Sponsored by Commission A*

Prof. Bava presented the list of the scientific meetings sponsored by Commission A (see attachment C). Type B support entails funding; type A only a statement of support.

### *3. Participation to Scientific Meetings.*

The reports available from URSI representatives nominated by Commission A in International Bodies can be found in the web site [www.ursi.org](http://www.ursi.org) (reports from the commissions)

The URSI Commission A representatives concerned with the following Bodies: CPEM Executive Committee (the Chair), CIPM-CCTF(Mc Steele or Leschiutta), CIPM-CCL (Helmcke), CIPM-CEM (Erard), CIPM-RF-WG of CCEM (Stumper), Luden(IEC and ISO). Except for the Chai, Mc Steele and Leschiutta, the other

representatives were not present; the incoming Chair will check the availability of those absent or will nominate other representatives.

#### *4. Responsibilities of Chair and Vice-Chair.*

Prof Bava showed a viewgraph with the list of duties for the Chair and V.C. Commission A needs to set up its own Web site and name an editor for Review of Radio Science. Prof. Bava invited those present to suggest changes for the duty lists, none were offered.

#### *5. One vs. Four Page Abstract.*

Chairman Bava solicited the view of the audience. There was a lively discussion, as opinions were divided on this issue. The final, unanimous sense of the group was as follows: Authors must provide a short summary (one hundred words) for the program and one page abstract of the presentation. This is the only prerequisite for possible acceptance of the work. An author at his/her discretion can supplement the abstract with additional pages (e.g. figures and equations) up to a total of four (4) pages.

#### *6. Scientific Committee for Telecommunications (SCT)*

Commission A has to provide a contact name to Mr. Martin Hall. Prof. Leschiutta offered his services until a suitable member is identified. The incoming Chairman was charged with the task.

#### *7. Terms of Reference for Commission A.*

Prof. Bava presented a viewgraph with the current Commission A terms. He solicited comments and suggestions for change from the audience. There was no discussion because the meeting had to come to an end so members could participate at the banquet dinner.

#### *8. Procedure GA*

Chairman Bava showed the audience the 35-page document of the URSI GA Standard Procedures. He invited comments from the audience. Given the length of the SP's comments are expected at a later date.

Chairman Bava closed the meeting at 18:50.

### **Meeting of August 23, 2002**

Chairman Bava called the meeting promptly at 6 PM. He circulated an attendance sheet and proposed an agenda (see attachment A). The agenda was approved with no modification. This was the least attended business meeting with only 8 members present.

#### *1. Contributions of Commission A to the Scientific Program of the GA*

Chairman Bava showed viewgraphs with the titles of the general lecture, the tutorial lecture, the 5 sessions (A1-A5) and the 6 joint sessions headed by Commission A. In total

there were 78 platform papers and 31 posters, with a few withdrawals. In addition there were 6 joint sections with participation from Commission A. Chairman Bava commented that a session on fundamental constants has been discouraged; he also noted that DC and low frequency standards had no session in this GA. Both topics are in the terms of reference of Commission A.

### *2. News from the Council*

Prof. Bava informed the audience of the outcome of the elections held at the Council meeting during the evening of August 22, 2002. Results were as follows: President K. Schlegel (D); Vice Presidents: CM Butler (USA), F. Lefeuvre (F), A. Wernick (Poland), P. Wittke (Canada). The Commission D and E Vice-Chair were announced: Commission D, F.de Fornel (F); Commission E: F. Canavero (I). The next GA will be held in New Delhi, India during the second half of October 2005. The scientific coordinator for the XXVIII GA is Prof. G Brussard and the associated coordinator from India will be appointed in the near future.

### *3. Passage of the Chair.*

Prof. Bava introduced the incoming Chair, Dr. Balzano who, after a short introduction, continued with agenda items.

### *4. Topics Proposed for Next GA.*

Dr Balzano solicited the audience for topics for the next GA in addition to or in the place of the traditional ones that can be found in the Toronto and Maastricht list of Commission A sessions.. There were several suggestions:

1) Numerical Techniques in Metrology (Marvin); 2) 50 years of atomic time keeping (McSteel); 3) Links between electric metrology and fundamental constants. Stability of fundamental constants. Time stability influence on fundamental constants (Leschiutta) 4) Intercomparison between Cs fountain clocks and limits of performance(Leschiutta). 5) Characterization of receivers for radio astronomy (joint session with Commission J); Characterization of photonic and electronic devices (joint with Com. D) (Bava). 6) Dielectric and electromagnetic field measurements in materials and living tissues; Measurements in non-linear devices RF- submillimeter frequencies; Optical frequencies measurements and standards; Antenna and Radome measurements; Time domain measurements. (Balzano)

### *5. Suggestions for the terms of Reference.*

There were two suggestions: 1) Drop term (e) Measurements using lasers;2) Reincorporate in Commission A the EM measurements in the bioeffects domain. The reinstatement of the bioeffect measurements in Commission A must be approached softly to avoid a turf collision with Commission K. There were too few members present to vote on this suggestions. Chair Balzano was charged with circulating the suggestions and poll the membership of Commission A.

*6. Summary of the Meeting with Ross Stone.*

Commission A needs to supply 6 review papers for the Radio Science Bulletin, which now will publish the papers that used to appear on Radio Science Review. Dr. Stone needs the titles or at least the topics by the end of 2002 or very beginning of 2003. Publication will start in Dec. 2003. Members of Commission A are invited to submitted titles and authors for these papers, which are expected to be about 12 pages long. Papers must be submitted and completed 6 weeks before the publication of RSB. Dr. Balzano will serve as Commission A editor

*7. Commission A representatives in other organizations.*

Dr. Balzano invited the audience to communicate to him the names of members who sit in other scientific societies.

*8. Topics from those present*

Dr. Balzano invited comments from the audience on any topic. There was a complaint on a 10 minute time intrusion in the general lecture of Commission A by the convener of tutorial lecture of Commission G. Dr. Balzano was requested to convey a complaint to the Council (it was done during the New Coordinating Committee meeting of August 24).

*9. Closing.*

Since there were no additional topics from the audience Dr. Balzano thanks those present and closed the meeting at 19:15.

## **COMMISSION B - FIELDS AND WAVES**

Chair: Prof. Staffan Ström ( Sweden)

Vice-Chair: Prof. Makoto Ando (Japan)

### **I. Report on the Open Commission meetings (Business Meetings)**

The Commission held three Open Commission meetings, respectively on 19, 21 and 23 August 2002. The Commission B Chair, Prof. Staffan Strom, opened the meeting and welcomed all members who are interested in and supporting Commission B activities. They were attended by more than 50 delegates and members.

*1. Schedule*

Business meeting I: 18:00-19:00, 19 August

Business meeting II: 18:00-19:00, 21 August

Business meeting III: 18:15-20:00, 23 August

## *2. Completion of the vote concerning Commission B incoming vice-chair*

An important point on the agenda was the completion of the vote concerning incoming vice-chair. At the first business meeting, any Official Member who was present and had previously voted was given the opportunity to change his vote, and any Member who had not voted was allowed to do so. The result was that Prof. Lotfollah Shafai was elected, with Prof. Roberto Tiberio as alternate. ( The URSI Council subsequently appointed Prof. Makoto Ando and Prof. Shafai as Commission B chair and vice-chair respectively, for the triennium 2002-2005 ).

## *3. Discussion of a proceedings in GA, a proposal to merge RRS and RSB and RSB on the web.*

Dr. W. Ross Stone, URSI publication committee chair, explained the publication-related questions.

·How have CD-ROM proceedings and program with 100 words abstracts been received? The changes were substantially supported with the exception of incomplete linkage to authors and the too small font-size for abstracts.

·Should the Review of Radio Science be incorporated into the Radio Science Bulletin? Generally supported especially in view of wider distributions and indexed in INSREC, more timely reviews and enhances RSB. The contents must be review articles so that they may compete with Radio Science.

·Should the Radio science Bulletin be made on the Web ?

Various advantages are discussed such as availability of back-numbers, wider distribution, reduction of printing and mailing cost and also enhancing the number of URSI correspondences.

## *4. Discussion of a proposed new format for Abstracts of papers submitted to the next GA: 4 pages*

In 2002 GA, text only abstracts were submitted for review and the final version of the manuscript with the maximum of 4 pages +100 word abstract was requested for each accepted paper. The proposal of the new format for submission in the next 2005 GA, where a 4-page manuscripts are submitted once for both review and the proceedings, received substantial support.

## *5. Commission B Editor for RRS/RRB 2002-2005*

Prof. R. Ziolkowski of the University of Arizona was appointed as Commission B Editor for RRS/RRB 2002-2005. ( Dr. Ross Stone emphasized that the Commission Editors should select reiewreview topics and authors ASAP ).

Each Commission had been asked to appoint Commission Editor for Review of Radio Science and Radio Science Bulletin. Prof. R. Ziolkowski of the University of Arizona was charged with the Commission Editor for RRS/RRB 2002-2005. He accepted. Commission should select review topics and authors with him in due course.

*6. Special Section in Radio Science, based on papers presented at the 2001 Victoria EMT.*

Prof. A. Ishimaru reported on the current status of the editing of this Special Section in Radio Science. Prof. A. Ishimaru of Washington University is Co-Editor, together with the and Prof. S. Strom of Royal Institute of Technology, for this Special Section. Twenty one papers had been accepted and six more are under revision. The Special Section will appear in the 2002 Nov.-Dec. issue of Radio Science.

Radio Science has a special issue devoted to selected papers presented at the 2001 Electromagnetic Theory Symposium in Victoria. It is edited by Prof. Akira Ishimaru of Washington University and Prof. Staffan Strom of Royal Institute of Technology. The current status of the editing of the issue was explained. Twenty one Papers were accepted and six more are under revision. This will appear in Nov.-Dec. issue of Radio Science.

*7. Announcement of URSI Commission B Electromagnetic Prize*

The present status of the Electromagnetic Prize with the first problem appearing on the web on September 15, 2001 and with the deadline of 15 January, 2003 was announced.

The second problem will be announced soon. During the next triennium after this GA, the panel that will evaluate the entries consists of Prof. Tom Senior, Dr Carl Baum, Prof Chalmers Butler, Prof. Karl Langenberg, and the Commission B ( Past ) Chair Staffan Strom.

The present status of the Electromagnetic Prize with the first problem appearing on the web on September 15, 2001 and with the deadline of 15 January, 2003 was announced. (The interim panel for evaluation was formed by fivemembers: Profs. Tom Senior, Carl baum, Chalmers Butler, Karl Langenberg and the Comiission B Chair Staffan Strom. This may not be disclosed in the minutes ???) The second problem will appear soon.

*8. Inter-Commission Working Group (IWG) on Solar Power Satellites (SPS)*

Formation of IWG was proposed by Commission H. Microwave power transmission from space to earth is a challenging technology for Commission B and active participation as the commission is adopted. Dr. W. Ross Stone, Prof. Y. Rahmat Samii of UCLA, USA and Dr. Andrew J. Parfitt of CSIRO, Australia Several experts had applied upon the solicitation and their names were transmitted to the Commission H.

*9. Presentation of the Italian proposal to host the future EMTS*

Prof. G. Manara of University Pisa made a presentation of a proposal to hold the 2007 URSI ELECTROMAGNETIC THEORY SYMPOSIUM (EMTS) in Pisa, Italy. The symposium could take place at the Congress Centre of the University of Pisa. Additional information on the proposal can be found at the following web address: [www.ing.unipi.it/MRL/URSI](http://www.ing.unipi.it/MRL/URSI).

The Chair, Prof. S. Strom, added that Commission B had received only one proposal for 2007 EMT-S and that the proposal had been reviewed and recommended by the

Commission B ad hoc committee for EMTS proposals. After some questions and discussions, the Italian proposal was accepted by Commission B.

Prof. G. Manara of University Pisa made a presentation for proposal to hold the 2007 URSI Electromagnetic Theory Symposium (EMTS) in Pisa, Italy. The symposium could take place at the Congress Centre of the University of Pisa. Additional information on the proposal can be found at the following web address: [www.ing.unipi.it/MRL/URSI](http://www.ing.unipi.it/MRL/URSI).

The Chair, Prof. S. Strom, added that Commission B received only one proposal for 2007 EMT-S and that the proposal had been reviewed and qualified by Commission B ad hoc committee. After some questions and discussions, Italian proposal was accepted by Commission B with the time of the symposium unspecified in view of the next agenda.

#### *10. Discussion of related questions concerning 2004 and 2007 EMTS*

The Chair, Prof. S. Strom, first explained that the upcoming 2004 EMTS was projected to bring about a break in a trend of somewhat decreased participation in EMTS series. He mentioned that the Commission B Chair and Vice-chair had discussed and assessed with Prof. S.E. El-Khamy, Chair of the local organizing committee of 2004 EMTS in Alexandria, the apprehension expressed by many members of the Commission B community concerning the latest political situation in neighbouring Middle East areas. They also were in contact with Prof. G. Manara and his colleagues, who were behind the Italian proposal concerning the 2007 EMTS.

With this background, the following was proposed by the Commission B Chair. The venues/organizers of the 2004 and the 2007 EMTS are switched, so that instead of Alexandria in 2004 and Pisa in 2007, the 2004 EMTS will take place in Pisa in the last week of May (tentative) and the 2007 EMTS will take place in Alexandria. The proposal was approved unanimously by the meeting.

Furthermore, Commission B resolved unanimously to thank the Egyptian and Italian delegates for their gracious and constructive collaboration in reaching the above-mentioned consensus decision. Finally, the Chair brought the very tight schedule of less than two years for the preparation of 2004 EMTS in Pisa to the attention. The EMTS in Alexandria, Egypt, originally scheduled in 2004 was changed and postponed to 2007.

#### *11. Best young scientist paper (BYSP) award*

The chair announced that Dr. Maurizio Bozzi of Univ. of Pavia who was a YSA recipient and a member of the Commission B community had won the Philips' best young scientist paper (BYSP) award. The meeting congratulated Dr. Bozzi towith his award.

#### *12. Vote of Thanks*

Prof. Staffan Strom introduces the incoming chair, Prof. Makoto Ando, Japan. On behalf of the Commission B members, he warmly proposed a vote of thanks to the outgoing Chair, Prof. Strom, for the excellent way in which he had led the Commission during the last triennium. This was carried by acclamation.



### *13. The Commission B Technical Advisory Board (B-TAB):*

The incoming Chair, Prof. Ando explained the mission and role of Commission B Technical Advisory Board (B-TAB), which is a follow-up of the discussion that started at the 2001 EMTS in Victoria, Canada. The role of TAB is to discuss the future directions of study topics of Commission B and take the necessary action for realizing it. TAB investigate,

- Long-term directions of technical program. Advice and support to Technical Program Committees (TPC) of EMT-Symposia. and GA.
- Possible cooperation with other Commissions and Societies. (SIAM was suggested in Victoria)
- How to attract and motivate young engineers or students in electromagnetics and/or related fields.

The current member list as well as the action time-table was announced. All the Commission members are solicited to support B-TAB discussion.

### *14. Any other business and announces during GA*

The following topics were discussed or announced in other meetings such as Opening Ceremony, Coordinating Committee and Council during GA.

#### **Issac Koga Gold Medal**

In the opening ceremony of the GA, the Issac Koga Gold Medal for this triennial was awarded to Prof. Frank Olyslager of University Ghent, who is the active young scientist in the field of Commission B.

#### **Update of the terms of reference**

It was not felt necessary to modify them.

#### **Scientific Committee for Telecommunications (SCT)**

The Council agreed the resolution on SCT. The resolution as well as the terms of reference are available on the URSI Website. SCT is reactivated to encourage the exchange of information between URSI and ITU. It is chaired by Mr. M. Hall and the membership tentatively comprises representatives of 10 Scientific Commissions and Participants. Anybody who wish to contribute to the "SCT discussion" is solicited to contact with Mr. M. Hall at <Martin.Hall@rl.ac.UK> . Commission B is also requested to coopt the individuals with any involvement in ITU-R, ITU-T, ITU-D and WHO.

#### **Communications**

During the triennium the Chair has communicated with the Commission B representatives through a series of e-mail " Letter no X ". All these letters and annexes can be viewed on the URSI Homepage at <http://www.ursi.org/Maastricht/Comreportstri.htm>. (tick Commission B)

The Commission B web page, which is still under development, contains information at this stage devoted primarily to the 2004 Electromagnetic Theory Symposium.

## II. Commission B Program in Maastricht GA

### 1. 2002 Maastricht GA Commission B Sessions (Number of submitted papers)

BT. Tutorial: 1 hour

Inverse Scattering and Its Applications to Sub-Surface Sensing and Medical Imaging

M. Van Den berg, Convener: Staffan Strom (Chair B)

#### *Sessions organised by Commission B alone*

B1. Electromagnetic Theory ( I&C&P ) : 2 hours (46)

Convenors: I.V. Lindell and P.D. Smith

B2: Scattering and Diffraction ( I&C&P ) : 3 h. 20 min. (38)

Convenors: Karl J. Langenberg and Marc Saillard

B3: Time Domain Electromagnetics ( I&C&P ) : 3 h. 20 min. (27)

Convenors: E. Miller and R. Gomez-Martin

B4: Inverse scattering and imaging ( I&C&P ) : 3 h. 20 min. (25)

Convenors: G. Kristensson and T. Habashy.

B5: Fast Methods for CEM ( I&C&P ) : 2 h. 20 min. (10)

Convenors E. Michielssen and J. Volakis

B6: Numerical methods for PDEs - Adaptive feedback processes and multigrid techniques 2 h. 20 min. (9)

Convenors: J-F Lee and M. Salazar-Palma

B7: Asymptotic and hybrid methods ( I&C&P ) : 2 h. 20 min. (16)

Convenors: P. Pathak and G. Manara

B8: Design, Analysis and Synthesis of Antenna Arrays ( I&C&P ) : 3 h. 20 min. (32)

Convenors: S. Maci and T.S. Bird

BP: Electromagnetic waves in complex environments (39)

Convenors: N. Engheta and E. Heyman

#### *Joint sessions led by Commission B*

BCF Antennas in mobile communication systems ( I&C&P ) : 2 h. 20 min. (25)

Convenors: M. Ando and G. Frolund Pedersen

BD Time and frequency 3D circuit modelling ( I&C&P ) : 2 hours (10)

Convenors: F. Olyslager and A. Cangellaris

#### *Joint sessions led by other Commissions*

AB1: Antenna and Electromagnetic Field Measurements (I&C) (25)

Convenors: T. Schrader and A. Yaghjian

AB2: Time-Domain Measurements and Analysis (I&C) (4)

Convenors: H Garbe and Anton G. Tijhuis

CBF: Wave Propagation Modeling for Mobile Communication Systems (I) (15)

Convenors: W. Wiesbeck and H. Bertoni

CFAB: Subsurface Remote Sensing with its Applications (11)

- Convenors: D. Noon, G. Smith, and P. v.d. Berg  
 DB: Electromagnetic Band Gap Structures and Their Applications (11)  
 Convenors: R. Ziolkowski and Y Rahmat Samii  
 JBC: Wideband Array Technology and Systems (I) (16)  
 Convenors: A. van Ardenne G. L. James and H. Boelskei  
 KB: Computation of Electromagnetic Fields in the Human Body (I, C, P) (14)  
 Convenors: O. Gandhi and M. Okoniewski

## 2. Commission B Sessions Statistics

Session	Oral	Invited	Poster	No show	Participants	Submission (Approx.)
B-Tutorial		1	0	0	>200	1
B1	6	5	37	0	>100	46
B2	10	9	22	0	40	38
B3	11	11	9	0	40	27
B4	10	4	14	1	45	25
B5	6	5	3	0	70	10
B6	6	5	1		40-50	9
B7	7	5	9		50	16
B8	10	10	22	1	50	32
BCF	5	2	20	1	48	25
BD	6	4	4	1	30	10
BP		5	34			39
Total	77	67	175			277

## COMMISSION C - RADIO-COMMUNICATION SYSTEMS AND SIGNAL PROCESSING

### I. Business Meetings

#### 1. Welcome to URSI General Assembly in Maastricht

The Commission held 3 open business meetings on 19, 21 and 23 August 2002. The following persons were present at least at one meeting, but mostly at several: Ernst Bonek, Austria (Chair); Masami Akaike, Japan (Vice-Chair); Paul Wittke, Canada; Maurice

Bellanger, France; Witold Krzymien, Canada; Guido Tartara, Italy; Eleary Beonard, Denmark; Ernst Zollinger, Switzerland; David Thomson, Canada; Reiner Thoma, Germany; Jean-Claude Bic, France; Joseph Shapera, Israel; Jan-Olof Gustavsson, Sweden; Zhihua Wang, China; Blagovest Shishkov, Bulgaria; Said EL Khamy, Egypt; Mairtin Odroma, Ireland; Mark Cummings, USA; Kensuke Ogawa, Japan; Alfred Hero, USA; Robert Weigel, Germany; Lajos Nagy, Hungary; Andy Molisch, USA; Börje Forsell, Norway.

At the opening of the first business meeting, the Chair welcomed everyone to the meeting and attendees introduced themselves. The Chair then reported briefly the activity of Commission C in this triennium and set the scene.

### *2. Future of Review of Radio Science*

The Chair proposed a slight change in the style of the Review of Radio Science (RRS), that is, the future RRS will not be a triennium publication but will be a quarterly publication, merging into the Radio Science Bulletin (RSB). All members of the meeting expressed their agreement.

### *3. Election of the next Vice-Chair*

Two candidates, Peter Farkas (Slovakia) and Andreas F. Molisch (Austria), for the next Vice-Chair were nominated. Andreas F. Molisch was elected as a result of 36 points to Peter Fakas of 24 points.

### *4. Commission Editor for the new Radio Science Bulletin*

A. Molisch was agreed to serve as Commission Editor for RSB (incorporating RRS).

### *5. Review of the Terms of Reference*

The Terms of Reference was discussed on the business meeting on 23rd August. The existing Terms of Reference are considered to be very broad, relating not only to proper radio science technology but also infrastructural technologies to radio communication systems. Among them, Commission C is considered necessary to focus on radio communication systems and signal processing technologies. As Commission C provides enabling technologies for many other commissions' work, collaboration with other commissions is also essential.

Now Commission C has concreted new Terms of Reference “**Radio-Communication Systems and Signal Processing**”. The Commission promotes Research and Development in:

- a. Radio-Communication and Telecommunication Systems;
- b. Spectrum and Medium Utilization;
- c. Information Theory, Coding, Modulation and Detection;
- d. Signal and Image Processing in the area of radio science.

The design of effective radio-communication systems must include scientific, engineering and economic considerations. This Commission emphasizes research into the scientific

aspects, and provides enabling technologies to other areas of radio science.

#### *6. Role of National Representatives of "C"*

Further enhancement of the national and international activity of Commission C should strongly be prompted for the next triennium. While National Representatives are desired to have close contact with Commission C, Commission C also is encouraged to try to cooperate with radio scientists in each country in parallel to National Representatives

#### *7. The program for the next General Assembly*

The program of the next General Assembly will focus the sessions on mobile radio communications, including wireless access and ultra-wide-band access, and image processing. Since the field of Commission C is very broad, cooperative organization of sessions with other Commissions is necessary.

For organizing the next General Assembly held in New Delhi, a wide contact with Indian scientists in the field of Commission C will be solicited.

A list of leading scientists in India based upon the international conferences held in India so far will be helpful.

#### *8. Other business*

Further discussions will be made on the following points:

- (1) Necessity for the steering committee to assist chair,
- (2) Representative of Commission C for SCT,
- (3) Future Terms of Reference, as it is or the commission split and renamed,
- (4) Competition, cooperation, and/or interaction with other international conferences and organizations.

## **II. Review of General Assembly**

Commission C organized one tutorial, five C sessions (including one poster session), and twelve joint sessions. Among twelve joint sessions, five sessions were led by Commission C. Since the technical field that Commission C deals with is wide and has relating parts with other Commissions, such joint sessions show characteristic feature of Commission C. Close contact/collaboration henceforth with other Commissions will be further encouraged.

Each session room was filled to capacity and the discussions among the presenters and audience were quite active, which reflects a wide interest to technical subjects of Commission C.

The following are the sessions organized by Commission C:

Tutorial: Modeling of directional wireless propagation channels," presented by A. Molisch

C1: Software reconfigurable radio systems," organized by R. Kohno,

C2: Antenna array signal processing and multiple-input multiple-output, organized by A. Molisch and M. Viberg,

C3: Blind signal detection," organized by V. Koivnen,

- C4: Recent advances in telecommunication systems, organized by P. Wittke,  
CAF: Broadband access systems in wireless communication, organized by H. Ogawa and T. Tanem,  
CFAB: Subsurface remote sensing and its application, organized by J. Sachs, D. Noon, G. Smith, and P. van den Berg,  
CBF: Wave propagation modeling for mobile communication systems, organized by W. Wiesbeck and H. Bertoni,  
CF: Adaption to changing radio channel, organized by R. Bultitude and Y. Karasawa,  
CFA: Channel sounding in mobile communication systems, organized by R. Thoma and S. Saunders, and Q. Balzano.

## **COMMISSION D - ELECTRONICS AND PHOTONICS**

Chair: Professor A. Seeds (United Kingdom)  
Vice-Chair: Professor P. Russer (Germany)

The Commission held two business meetings on 19 and 21 August 2002. This is a report on the main business transacted as well as on the Scientific Programme organised at the XXVIIth General Assembly of URSI.

### **1. Chair's report (Prof. Alwyn Seeds)**

The last triennium has been active and successful. The commission focused financial support on international meetings of high scientific value (ISSSE01, AP-RASC01) and also supported six other meetings with publicity and technical informationship.

The balance of the commission budget in the amount of € 9,000 was used to support the registration fees for the general lecturer and a geographically spread group of invited speakers at the XVII<sup>th</sup> General Assembly. The closing balance of € 75 should be carried forward by the incoming chairman.

A detailed report on the triennium is on the URSI WEB site.

### **2. New Chair and Vice Chair for 2002-2005**

At the conclusion of the General Assembly, Professor Peter Russer, former Vice Chair, took over the Chair from Professor Alwyn Seeds. Two candidates had been nominated for the position of Vice-Chair of Commission D for 2002 to 2005, namely: Dr. Frédérique de Fornel, France and Dr. Hiroyo Ogawa, Japan

According to the URSI rules any official member who was present at the business meeting was given the opportunity to change his vote (if previously cast by mail). The votes cast for the Vice Chair candidates were: Dr. Frédérique de Fornel ( 21) and Dr. Hiroyo Ogawa (21).

Since either candidates won equal numbers of votes, Commission D recommended to the Council to choose one of the candidates under consideration of the international balance of the chairs. Subsequently, Dr. de Fornel was appointed by the Council Vice Chairman of the Commission D for the triennium 2002-2005.

### **3. Appointment of Commission D Editor for Review of Radio Science**

The Vice-Chair will be appointed editor of RRS. Both candidates for Vice Chair had indicated that they would undertake this task, if elected.

### **4. Radioscience Bulletin. Appointment of Comm. D Associate Editor**

The commission editor will be Smail Tedjini, replacing Roberto Sorrentino who completed his three-year term in this post.

### **5. Evaluation of Young Scientist program**

The Commission D decided to grant the Young Scientist Award to Ondrej Cip, Josef Lazar and Frantisek Petru for their contribution „ *Frequency Method of Sub-Nanometer Distance Measurement*“.

The paper has been considered extremely clearly written. The results are truly state of the art. This work solved an actual scientific and engineering problem excellently.

### **6. Terms of Reference**

Since electronic and photonic devices have reached system level, the commission noted that this development has to be considered in the terms of reference. Changes in the first two terms of reference were suggested: The first term of reference “*Electronic devices and applications*“ should be changed to “*Electronic devices, circuits and applications*” and the second term of reference “*Photonic devices and applications*“ should be changed to “*Photonic devices, systems and applications*“. It was resolved unanimously to change the terms of reference in the proposed way.

In the Council meeting the wider extension of the terms of reference into “**Electronic devices, circuits, systems and applications**”

(a) *Photonic devices, systems and applications*

(b) *Physics, materials, CAD, technology and reliability of electronic and photonic devices, with particular reference to radio science and telecommunications*

was been discussed and approved.

The Commission deals with devices for generation, detection, storage and processing of electromagnetic signals together with their applications, covering all frequencies, including those in the microwave and optical domains.

### **7. Proposed nominations for URSI Committees**

A Committee on Extraterrestrial Solar Power Generation is proposed. Prof. Tatsuo Itoh should represent Commission D in this Committee. Professor Itoh has indicated that he would undertake this task.

## **8. International Symposium on Signals, Systems and Electronics**

Professor Robert Weigel from the University Erlangen-Nürnberg offered to organize the 2004 International Symposium on Signals, Systems, and Electronics (ISSSE'04) in Austria. As conference venue he proposed either Linz (Johannes Kepler University) or Salzburg (Congress Center). The conference duration will be three days. Three parallel Sessions are planned. Both cities have very good accessibility by train and by car. Due to the University infrastructure the conference costs in Linz would be much lower than in Salzburg. The attendees had some preference to Linz but decided to agree with either venue options.

## **9. Scientific Program of Next General Assembly**

The Commission discussed possible topics for the Scientific Program of the next General Assembly. Professor Russer reminded attendees that they should respond to the form "Commission D Suggested Topics for 1999 GA". This form should be sent to Professor Russer ([russer@ei.tum.de](mailto:russer@ei.tum.de)).

Suggestions should start now and may be made up to 18 months before the next GA. Suggestions made at the business meeting were

- Wide band gap materials (diamond, SiC) for devices at microwave frequencies.
- Micromachined millimeterwave devices.
- Spin state electronics.
- Tutorial on so-called electromagnetic band gap structures.

## **10. Scientific Program at XXVII URSI General Assembly**

The Commission organised seven technical sessions, and co-organised ten additional sessions in cooperation with other Commissions or other Organisations, such as ICO and IWGP. In three of such sessions Commission D was the principal Organiser.

Most of the sessions were very well attended, particularly those covering topics of broad interest, such as MMIC's, wide band gap devices, etc. A few of them were focused on specialized topics, in which case the attendance was somewhat less.

Here is a summary of the technical sessions held during the XXVII General Assembly:

*Session D1: Radio over Fiber Technologies,*

Chairpersons: T. Berceli (Hungary) and H. Ogawa (Japan)

In recent years optical fiber links have gained wider applications in mobile communications, local area and subscriber access networks, television programme distribution, etc. In most cases the optical link is combined with wireless connections. The radio over fiber approach allows for optical transmission of information channels transposed on radio frequency carriers simplifying this way the optical/wireless interfaces. The session gave a survey on the new device, circuit and system technologies for the radio over fiber approach.



*Session D2: Femtosecond Terahertz Technology,*

Hiromas ITO (Japan) and Osamu WADA (Japan)

The objective of this session was to examine techniques for the generation, processing and detection of ultra-fast signals in both the time and frequency domains. The topics included quantum well excitons, THz-wave parametric generators, stimulated emission in the THz region and superradiant semiconductor heterolasers.

*Session D3: Optical-Microwave Interactions.*

Chairperson: Le Nguyen Binh (Australia)

Interactions between microwaves and optical waves find application in spectrum analysis of RF signals, guided waves in photonic crystal structures and detection of microwave fields by optical radiation. The topics included photonic spectrum analysis of wideband rf pulsed signals, photonic crystal optical waveguides, so-called photonic band gap structures, and microwave detection in semiconductor structures by optical radiation.

*Session D4: Nanotechnologic Processes for Advanced Optic and Electronic Systems,*

Chairpersons: Pierre-Noël Favennec (France) and Frédérique de Fornel (France)

Nanotechnology processes allow the realisation of new electronic and optical devices and systems; they also allow goal-improved performances for more classical devices. Specific topics included: atomic or molecular deposition, semiconductor microcrystallites in various matrixes, nanolithography, nanoscale processes, nanomanipulation, molecular engineering, nanostructure characterization, novel electronic devices and nanosensors.

*Session D5: Wave Propagation in Fast Photonic Devices,*

Chairperson: Le Nguyen Binh (Australia)

Electro-optic devices are essential for ultra-high speed optical modulation of light waves in optical communications and photonic signal processing systems. Topics included the design and implementation of travelling wave electrodes, noise of mode-locked lasers, electrooptic Mach-Zehnder waveguide modulator design, and electrooptic travelling-wave modulator simulation.

*Session D6: MEMS (Microelectromechanical Systems) in Microwaves, Millimeterwaves and Optics,*

Chairperson: Peter Russer (Germany)

Microelectromechanical systems allow switching and other operations in fast electronic systems to be carried out with remarkably reduced size and circuit parasitics relative to conventional techniques. Ingenious applications in low loss compact optical switching have also been shown to be possible. This session addressed both the technology and the applications of these devices. Topics included rf MEMS switches and high-Q elements, distributed rf-MEMS circuits, electromagnetic modelling of rf MEMS structures and future nanoscale MEMS devices.

*Session D7: Photonic Signal Processing,*

Chairperson: Le Nguyen Binh (Australia)

Processing of signals at extremely high radio frequency up to and beyond several hundred GHz is critical for ultra-high speed optical communications and defence systems. Generation, detection, filtering and regeneration of these signals in the time and optical frequency domain by in-line optical guided systems were treated in this session.

*Session DP: Open Contributed Poster Session,*

M. Pyée (France)

This session was open to papers in all aspects of electronics and microelectronics materials or components not covered by the other sessions as well as to new results.

*Session DB: Electromagnetic Band Gap Structures and their Applications,*

Chairpersons: R W. Ziolkowski (D, USA) and Yahya Rahmat-Samii (B, USA)

Electromagnetic band gap (EBG) structures are finite/infinite periodic 1D/2D/3D arrangements of electric or magnetic materials, which produce a band gap in either the temporal or spatial frequency response of that structure. Contributions to this session included transmission lines, filters, coupled cavities and antennas on periodic band-gap structures.

*Session DJ: Photonics in Radio Astronomy,*

Chairpersons: C. H. Cox (D, USA) and J.M. Payne (J, USA)

Photonics is increasingly being used to perform a variety of roles in radio astronomy instruments. Originally considered only hypothetically as a technology for remoting the antenna signals, photonics has recently moved to the enabling technology for several radio astronomy telescopes. Speakers who are actively engaged in the challenge of implementing these new or upgraded telescopes have contributed to this session, discussing the options they considered, the tradeoffs of the various photonic approaches and the approach they have implemented.

*Session DJA: Advances in Superconductor Components and Applications,*

M. Pyée (D, France) and G. Beaudin (J, France)

This session focused on the advancement of the superconductor components as well as on applications. The following topics were covered: Advances in the new high T<sub>c</sub> superconductor materials for electronics applications, RSFQ logic circuits, Advances in magnetic fields measurements using SQUIDS, applications in metrology, microwave circuits and receivers for radio-astronomy.

*D-Tutorial: Ultra-Fast Photonic Networks based on Optical Code-Division Multiplexing,*

Hideyuki Sotobayashi (Japan)

Professor H. Sotobayashi (Japan) presented an excellent introduction and overview on Photonic Networks based on Optical Code-Division Multiplexing

## COMMISSION E - ELECTROMAGNETIC NOISE AND INTERFERENCE

Chair: Pierre Degauque (France)

Vice – Chair: Flavio Canavero (Italy)

### **1) Working groups during the past triennium, their involvement in the sessions of the General Assembly and comments on their activities**

The Commission E activities are based on the work conducted by the working groups (WG). During the past triennium, the Chair or Co-Chairs organized a lot of sessions in EMC Symposia and, of course, they were very active in the preparation of the technical sessions of the General Assembly (GA). In the following, after recalling the names of these WG, a brief summary of the sessions they have organized is given, together with discussions within the business meetings on the opportunity or not to continue, modify or stop a WG.

#### *E.1: Spectrum Utilization Management and Wireless Telecommunication*

Co-Chairs: G. Hurt (USA) and R. Struzak (Poland)

The session proposed on this subject at the Maastricht URSI GA was entitled: “Mathematical Methods in Frequency Assignment”. Nevertheless, only three papers were planned and any speaker was present. Since it seems difficult to be attractive in this field, it has been decided not to maintain this working group in the next triennium.

#### *E.2: Intentional Electromagnetic Interference*

Co-Chairs: M. Wik (Sweden) and W. Radasky (USA)

Four papers were presented during the GA, the title of the session being the same as the name of the WG. Two contributions reviewed the different categories of EM threats and the susceptibility aspects of the electronic equipment. The two others were focused on specific technical aspects.

It must be recalled that this WG was created in 1999, following a recommendation introduced by Prof. Ianoz and supported by Com. E, for performing additional research pertaining to a EM Terrorism and to investigate techniques for appropriate protection.

During the business session, M. Wik suggested that M. Bäckström replaced him as a Co-Chair. This has been approved.

#### *E.3: High Power Electromagnetics*

Co-chairs: C.E. Baum (USA) and R.L. Gardner (USA)

9 papers were presented during the session organized by Baum and Gardner on this topic.

#### *E.4: Terrestrial and Planetary Lightning Generation of Electromagnetic Noise*

Co-Chairs: Z. Kawasaki (Japan) and V. Cooray (Sweden)

The conveners of the related session “Lightning observation from space and global

lightning activity” (6 papers) were Z. Kawasaki and A. Bondiou. V. Cooray did not wish to continue as a Co-Chair. Z. Kawasaki agreed to continue this work but proposed that the name of the WG became: “Lightning discharges and related phenomena”. This has been approved for the next triennium.

*E.5: Interaction with and Protection of, Complex Electronic Systems*

Co-chairs: J. Nitsch (Germany), P. Degauque (France), M. Ianoz (Switzerland) and J.P. Parmentier (France)

A full session entitled “EM interaction with complex system” took place at the GA and was organized by Parmentier and Ianoz. Related papers were also presented in two other sessions: “Radiation from and coupling to PCB” and “EM interaction with and susceptibility of analogue and digital electronics”.

Michel Ianoz being retired from the Ecole Polytechnique Federale de Lausanne, he wished to stop being a Co-Chair. Since this WG had already four Co-Chairs, it was decided not to nominate a new person.

*E.6. Effects of transients on equipment*

Co-Chairs: J. ter Haseborg (Germany), V. Scuka (Sweden) and B. Demoulin (France).

The Co-Chairs reported that it was difficult to gather information on this research area and it seems that the number of people involved in this field decreases rapidly. Any specific session dealt with this subject at the GA and it was decided during the business meeting to stop this WG.

*E.7. Extra-Terrestrial and Terrestrial Meteorologic-Electric environment*

Chair: H. Kikuchi (Japan)

Any session was organized on this subject and, during the discussion, it appeared that this WG must be renewed at least by changing its technical content. Nevertheless, it has been kept for the next triennium but keeping in mind that a new proposal must be made at the next URSI GA. Furthermore, the interest of the Com. E community must be clearly pointed out.

*E.8. Geo-electromagnetic disturbances and their effects on technological systems*

Co-Chair: M. Hayakawa and R. Pirjola (Sweden)

9 papers were presented in the session “Terrestrial Electromagnetic Phenomena”. M. Hayakawa suggested changing both the name of the WG and the Co-Chairs. He proposed for the new WG: “Terrestrial and Planetary Electromagnetic Noise Environment” co-chaired by: M. Hayakawa (Japan), A.P. Nickolaenko (Ukraine), Y. Hobara (France) and M. Füllekrug (Germany). This has been approved during the business meeting.

*E.9 Interference and Noise at Frequencies above 30 MHz*

Chair: J. Gavan (Israel)

Since this topic is clearly at the frontier between Com. E and Com. F, a joint session were organized. Any change has been proposed to this WG, except to add another Co-Chair

having a technical background related to Com. F

A number of Working Groups also organize joint technical sessions, three of them with Com. H.

## **2) Discussion on the objectives of a working group**

A discussion took place during a business meeting on the role of a Working Group. Indeed, it may sometimes appear that it is not easy to clearly know who is a member of a WG, how is the information disseminated between the members and what are the duties and responsibilities of a WG.

In a first step, each Chair or Co-Chairs will write a brief presentation (typically half a page) on their WG mainly describing promising research areas which must be developed during the next triennium. Furthermore, a list of WG members (Names and email addresses) would be useful.

## **3) Working Groups for the next triennium**

The new Working Groups that were voted for the new triennium are:

E1: Terrestrial and Planetary Electromagnetic Noise Environment

Co-Chairs: M. Hayakawa (Japan), A.P. Nickolaenko (Ukraine), Y. Hobara (France) and M. Füllekrug (Germany)

E2: Intentional Electromagnetic Interference

Co-Chairs: M. Bäckström (Sweden) and W. Radasky (USA)

E3: High Power Electromagnetics

Co-chairs: C.E. Baum (USA) and R.L. Gardner (USA)

E4: Lightning Discharges and Related Phenomena

Co-chairs: Z. Kawasaki (Japan)

E5: Interaction with and Protection of, Complex Electronic Systems

Co-chairs: J. Nitsch (Germany), P. Degauque (France) and J.P. Parmentier (France)

E6: Extra-Terrestrial and Terrestrial Meteorologic-Electric Environment

Chair: H. Kikuchi (Japan), E.A. Mareev (Russia)

E7: Geo-electromagnetic Disturbances and Their Effects on Technological Systems

Chair: A. Viljanen (Finland)

E8: Interference and Noise at Frequencies above 30 MHz

Chair: J. Gavan (Israel)

### *Joint Working Group*

EGH. Seismo Electromagnetics (Lithosphere-Atmosphere-Ionosphere Coupling)

Co-Chair for Commission E: M. Hayakawa (Japan)

Co-Chair for Commission G: S. Pulinet (Russia)

Co-Chair for Commission H: M. Parrot (France) and O.A. Molchanov (Russia)

## **4) Preparation of the New Delhi GA**

After discussion, few ideas on possible sessions, tutorials and General Lectures came

out. It was decided to go further in the discussion during the URSI meeting which will take place during the EMC Zurich Symposium, Feb. 2003.

### **5) Other business**

- Election of the Vice Chair. Pr. Flavio Canavero was elected as Vice-Chair. He will also serve as the Commission E Editor of the Radio Science Bulletin
- After discussion, it appears that it was not necessary to change the Terms of Reference for Commission E.
- Support for the various academic meetings. The following meetings will be supported in the coming triennium either in mode A (without financing) or in mode B (with financing): EMC Zurich, Feb. 2003, IEEE EMC, Istanbul, May 2003, Telecom 2003 et Journées Franco-Marocaines, Oct. 2003, EMC Europe, Eindhoven, 2004, EMC'04, Sendai, 2004, EMC Wroclaw, 2004, Colloque CEM, Toulouse, 2004.

In Europe, there is a debate and discussions between the organizers of the main EMC European events to merge or not the meetings. At the time of the URSI GA in Maastricht, there was any definitive decision. Therefore, the names of EMC meetings which will be sponsored beyond 2004 cannot be now specified.

## **COMMISSION F - WAVE PROPAGATION AND REMOTE SENSING**

Chair: Dr. Yoji Furuhamo (Japan)  
Vice-Chair: Prof. Martti Hallikainen (Finland)

### **1. Report on the Open Commission Business Meetings**

The Commission held three Open Business Meetings, respectively, on 19, 21, and 23 August 2002. Copies of the agenda and of the Commission F report to Council for 1999-2002 (published in the September 2002 issue of the Radio Science Bulletin) were made available to attendees. The following items were discussed at the meetings.

#### *1.1 Election of Vice-Chair*

Member Committee Representatives had had the opportunity to vote for Vice-Chair by mail, with the candidates being Dr. Gabriel Ajayi (Nigeria), Prof. Piotr Sobieski (Belgium) and Dr. Ed Westwater (USA). As the Council had in its meeting on 18 August decided to expel Nigeria from URSI due to unpaid membership dues, Dr. Ajayi was removed from the list of candidates and Representatives were given the opportunity to vote for the two remaining candidates by marking two points for the first choice and one point for the second choice. Credentials of those voting were checked.

Based on the election outcome, the following names were proposed to the Council, in order of preference: 1. Piotr Sobieski (Belgium), 2. Ed Westwater (USA)

The Commission confirmed its wish that Prof. Martti Hallikainen would become Chairman at the conclusion of the General Assembly. {The Council subsequently confirmed the appointment of Prof. Piotr Sobieski.}

## **2. 2002 General Assembly Programme**

### *2.1 Commission F Sessions*

Commission F organised nine scientific oral sessions of invited papers and a large poster session. The Session titles and convenors were as follows:

F1: Radiometeorology, Rod Olsen (Canada) and J. Pedro Poiares Baptista (The Netherlands)

F2: Climate parameters in radiowave propagation and their modelling, Terje Tjelta (Norway) and Carlo Riva (Italy)

F3: Millimetric, Sub-millimetric and optical wave propagation prediction, Chris Gibbins (UK) and Takeshi Manabe (Japan)

F4: Point to point and point to multipoint propagation, Joel Lemorton (France) and Marlene Sabino Pontes (Brazil)

F5: Microwave passive remote sensing, Ed Westwater (USA) and Adriano Camps (Spain)

F6: Microwave active remote sensing, Paolo Pampaloni (Italy) and Jouni Pulliainen (Finland)

F7: Polarimetric and interferometric techniques in remote sensing, Shane Cloude (UK) and Alberto Moreira (Germany)

F8: Active microwave remote sensing of ocean, Yoji Furuhamma (Japan) and Martti Hallikainen (Finland)

F9: Passive remote sensing of atmosphere, Haruhisa Simoda (Japan) and Thuy Le Toan (France)

FP: Wave propagation and remote sensing, Martti Hallikainen (poster session).

Dr. Furuhamma asked session convenors to provide a one-paragraph description to Prof. Hallikainen after their sessions for use in the report to be published in Radio Science Bulletin (RSB).

Ten sessions were organized jointly with other Commissions. The joint sessions (the first letter points out the lead Commission) and their convenors were:

FG: Wave propagation for satellite navigation and mobile services, Bertram Arbesser-Rastburg (F, The Netherlands) and David Rogers (F, Canada)

BCF: Antennas in mobile communication systems, Makoto Ando (B, Japan) and Gert Frølund Pedersen (C, Denmark)

CAF: Broadband access systems in wireless communication, H. Ogawa (Japan) and Torbjørn Tanem (Norway)

CBF: Wave Propagation modeling for mobile communication systems, Werner Wiesbeck (Germany) and Henry Bertoni (USA)

CF: Adaption to changing radio channel, Robert Bultitude (C, Canada) and Yashio Karasawa (F, Japan)

CFA: Channel sounding in mobile communication systems, Reiner Thoma (C, Germany) and Simon Saunders (F, UK)

CFAB: Subsurface remote sensing and its applications, Jürgen Sachs (C, Germany) and David Noon (F, Australia)

EF: Interference in communication, Jacob Gavan (E, Israel) and David Bacon (F, United Kingdom)

GF: Transionospheric signal degradation, Reinhart Leitinger (G, Austria) and Manuel Cervera (G, Australia)

JCF: Interference mitigation in radio science, Michael Kesteven (J, Australia) and Wolfgang-Martin Boerner (F, USA).

Sessions FG and GF were originally planned as Commission F and G regular sessions, respectively. In the Coordinating Committee meeting in April 2001 it was decided to organise them as joint sessions due to mutual interest.

Each session convenor was provided with a copy of the questionnaire prepared by Mr. Martin Hall, GA Scientific Programme Coordinator. Convenors were asked to fill in the questionnaire immediately after their sessions and return them to Mr. Hall with a copy to Prof. Hallikainen.

Commission F sessions were felt to be technically and geographically well balanced, but they could have involved more young scientists. (See 5.1.)

### *2.2 Commission F Tutorial*

The intended tutorial was replaced at short notice with the following presentation:

Shane Cloude (UK): Recent developments of data processing in polarimetric and interferometric SAR.

### *2.3 Commission F Contribution to Review of Radio Science (RRS) 1999-2002*

The Commission F chapters in the URSI Review of Radio Science 1999-2002 are:

- Adriano Camps (Spain) and Calvin Swift (USA): New techniques in microwave radiometry for Earth remote sensing (Chapter 22)
- Arnold Dekker (Australia) and Robert Bukata (Canada); Remote sensing of inland and coastal waters (Chapter 23)
- David Noon (Australia) and Ram Narayanan (USA): Subsurface remote sensing (Chapter 24)
- Bertram Arbesser-Rastburg (The Netherlands) and David Rogers (Canada): Wave propagation for multimedia satellite services (Chapter 25).

Prof. Hallikainen was to be Commission F Editor for RRS. Dr. Furuhama expressed his thanks to all those having contributed to Commission F presentations and contributions to RRS.

### *2.4 Philips' Young Scientist Paper Award*

Dr. Furuhama announced that Commission F had an opportunity to nominate a candidate for the special Philips' Young Scientist Paper Award; he showed the list of eight



Commission F Young Scientist Programme awardees. The task was entrusted to Dr. Furuhamu and he subsequently proposed Ms. Chieko Ito (Japan; paper no. 181) as the candidate of Commission F to the Philips' Award Committee.

### **3. Matters Relating to Council and the Coordinating Committee**

#### *3.1 Response to URSI Publications Committee's Proposals*

Dr. Furuhamu presented the report of URSI Publications Committee and its proposal to (a) combine the Review of Radio Science (RRS) with the Radio Science Bulletin (RSB) and (b) make it available on the Web (this would not eliminate the paper version). He also presented the reasoning for this proposal, including wider dissemination of RSB, more timely reviews and enhancing the technical content of RSB. Also back issues of RSB could be made available on the Web. Commission F recommended incorporation of RRS into RSB and making RSB available on the Web. Additionally, the new CD-ROM Proceedings and the 100-word abstracts were well received.

Prof. Piotr Sobieski was appointed as Commission F Editor for RSB/RRS. His responsibility is to select review topics and authors for reviews in the areas of interest to Commission F, or to set up a procedure to do so.

{The Council subsequently approved the merger of the Review of Radio Science with the Radio Science Bulletin.} Commission F has to submit 2 to 3 review articles per year on relevant topics to be published in the Radio Science Bulletin.

#### *3.2 Resolutions, Recommendations and Opinions*

Dr. Furuhamu said that information on URSI resolutions, recommendations and opinions was available on the Web.

#### *3.3 Terms of Reference*

An extensive discussion was conducted on Commission F Terms of Reference. It was generally felt that there was a need to modify them. A committee consisting of Dr. Yoji Furuhamu, Dr. Thuy Le Toan, and Prof. Richard Moore was established, and they later presented a draft for the new Terms of Reference.

{The Council subsequently confirmed the Terms of Reference in the following form:

**“Commission F – Wave Propagation and Remote Sensing (planetary atmospheres, surfaces and subsurfaces)**

The Commission encourages:

- (a) The study at all frequencies in a non-ionised environment:
  - (i) wave propagation through planetary neutral atmospheres and surfaces,
  - (ii) wave interaction with planetary surfaces and subsurfaces including land, ocean and ice,
  - (iii) characterization of the environment as it affects wave phenomena;
- (b) The application of the results of these studies, particularly in the areas of remote sensing and communications;

(c) The appropriate co-operation with other URSI Commissions and other relevant organizations.”}

### *3.4 Relations between URSI and ITU*

Mr. Hall briefly commented on relations between URSI and other application-oriented organisations, a topic that URSI Council considers to be important. He invited people to attend the open meeting of SCT (Scientific Committee on Telecommunications) to be organised during the General Assembly. (See also 9.)

## **4. Inter-Assembly Meetings**

### *4.1 Commission F Meetings in Last Triennium*

Commission F was sponsor or co-sponsor of 23 meetings between the 1999 and 2002 URSI General Assemblies. URSI can sponsor meetings in Mode A, B, or C (see URSI Home Page). Mode A meetings can explicitly use the name and logo of URSI, but no financial commitment is involved. URSI grants a fixed, unconditional sum to meetings under Mode B sponsorship, but the support is strictly restricted to cover expenses of Young Scientists, key speakers, or other scientists considered essential to the meeting (but not organisational costs). Awards to such individuals may be appropriate if normal funding from outside URSI is not available. Under sponsorship Mode C URSI grants to a meeting a sum that is to be regarded as a loan. This sum may typically be used to cover preparatory expenses. It may be combined with an additional, fixed unconditional sum to be used in accordance with Mode B. URSI should be involved in sharing any profits from the meeting under Mode C sponsorship.

The main Commission F meeting between URSI General Assemblies was the Commission F Triennial Open Symposium, held this time in Garmisch-Partenkirchen, Germany on February 11-15, 2002 (Mode B). The Commission F Specialist Meeting on Microwave Remote Sensing of the Earth, Oceans, Ice, and Atmosphere (Mode B) was held in Boulder, CO, USA on November 5-9, 2001. Climpara'01 was held in Budapest, Hungary on May 28-30, 2001 (Mode B); this was the fifth in a series of meetings which link closely with ITU-R Working Parties 3J and 3M.

Commission F, as usual, co-sponsored with the IEEE Geoscience and Remote Sensing Society three International Geoscience and Remote Sensing Symposia (IGARSS), all as Mode A. These are the largest annual remote sensing meetings and continue to draw about 1000 presentations. IGARSS 2000 was held in Honolulu, Hawaii, USA on July 24-28, 2000, IGARSS 2001 was held in Sydney, Australia on July 6-10, 2001, and IGARSS 2002 was held in Toronto, Canada on June 28 - July 2, 2002.

The locations, dates and Modes of the sponsored meetings are shown below. Available meeting Home Pages are indicated, although they may not be accessible in the future. Conference reports in the Radio Science Bulletin (RSB) are also indicated.

#### **Mode A:**

- Radio Africa'99: Third Regional Workshop on Radiocommunication in Africa,

- Gaborone, Botswana, October 25-29, 1999 (RSB, September 2000, pp. 6-8)
- AP2000: Millennium Conference on Antennas & Propagation, Davos, Switzerland, April 9-14, 2000 (<http://www.estec.esa.nl/AP2000/>)
  - EUSAR 2000: European Conference on Synthetic Aperture Radar, Munich, Germany, May 23-25, 2000 (<http://www.fgan.de/fhr/eusar2002>) (RSB, March 2001, p. 14)
  - GPR 2000: Eighth International Conference on Ground Penetrating Radar, Gold Coast, Queensland, Australia, May 23-26, 2000 (<http://www.cssip.uq.edu.au/gpr2000>) (RSB, June 2001, p. 19).
  - 33rd COSPAR Scientific Assembly, Warsaw, Poland, July 23-26, 2000 (<http://cospar.itodys.jussieu.fr>) (RSB, June 2001, pp. 20-22)
  - IGARSS 2000: IEEE International Geoscience and Remote Sensing Symposium 2000, Honolulu, Hawaii, USA, July 24-28, 2000 (<http://www.igarss.org>)
  - ISAP 2000: International Symposium on Antennas and Propagation, Fukuoka, Japan, August 22-25, 2000 (<http://www.crl.go.jp/pub/ISAP2000>)
  - MMET 2000: International Conference on Mathematical Methods in Electromagnetic Theory, Kharkov, Ukraine, September 12-15, 2000 (<http://www.kharkov.ukrtel.net/MMET2000>) (RSB, March 2001, pp. 17-19)
  - Antennas and Propagation for Wireless Communications, Waltham, MA, USA, November 6-8, 2000.
  - EPMCC 2001: Fourth European Personal Mobile Communications Conference, Vienna, Austria, February 20-22, 2001 (<http://www.epmcc.com>)
  - ICAP 2001: Eleventh International Conference on Antennas and Propagation, Manchester, UK, April 18-20, 2001 (<http://www.iee.org.uk/Conf/ICAP>)
  - Remote Sensing for Monitoring the Baltic Sea and Other Interior Basins, Kaliningrad, Russia, May 14-17, 2001 (<http://www.ire.rssi.ru>)
  - MSMW 2001: Fourth International Symposium on Physics and Engineering of Millimeter and Submillimeter Waves, Kharkov, Ukraine, June 4-9, 2001 (<http://www.ire.kharkov.ua/MSMW2001/msmw.htm>) (RSB, September 2001, pp. 19-21)
  - IGARSS 2001: IEEE International Geoscience and Remote Sensing Symposium, Sydney, Australia, July 9-13, 2001 (<http://www.IGARSS2001.org>)
  - ICEAA 2001: International Conference on Electromagnetics in Advanced Applications, Turin, Italy, September 10-14, 2001.
  - AMEREM 2002: The American Electromagnetics 2002 Symposium, Annapolis, Maryland, USA, June 3-7, 2002 (<http://www.amerem.org>)
  - EUSAR 2002, Cologne, Germany, June 4-6, 2002 (<http://www.fgan.de/fhr/eusar2002>)
  - IGARSS 2002: IEEE International Geoscience and Remote Sensing Symposium, Toronto, Canada, June 24-28, 2002 (<http://www.igars02.ca>).

**Mode B:**

- MST9-COST76 Workshop (Ninth International Workshop on Technical and Scientific Aspects of MST Radar combined with the COST-76 Final Profiler Workshop), Toulouse, France, March 13-17, 2000 (156 participants from 27 countries) (<http://>

- [www.cnrm.meteo.fr/mst/](http://www.cnrm.meteo.fr/mst/))
- Climpara'01 (Climatic Parameters in Radiowave Propagation Prediction), Budapest, Hungary, May 28 - 30, 2001 (<http://www.climpara.org/>)
  - 2001 Asia-Pacific Radio Science Conference (AP-RASC'01), Tokyo, Japan, August 1-4, 2001 (704 participants from 34 countries/regions) (<http://www.kurasc.kyoto-u.ac.jp/ap-rasc/>)
  - MWRS'01 (URSI Commission F Symposium on Microwave Remote Sensing of the Earth, Oceans, Ice, and Atmosphere combined with the Seventh Specialist Meeting on Microwave Radiometry), Boulder, Colorado, USA, November 5-9, 2001 (150 participants from 20 countries) (<http://www.etl.noaa.gov/mrs01>) (RSB, March 2002, pp. 57-58)
  - Commission F Triennial Open Symposium, Garmisch-Partenkirchen, Germany, February 11-15, 2002 (130 participants from 22 countries) (<http://www.dlr.de/HR/URSI-F-2002>).

Mr. Hall and Dr. Furuhashi emphasised that the reports of Mode B meetings should be made available for publishing in the Radio Science Bulletin.

#### *4.2 Proposed Commission F Meetings for Next Triennium*

The following meetings were preliminarily accepted for Commission F sponsorship. Especially for Mode A, the list is not final. For Mode B, availability of funding limits the number of financially sponsored meetings.

Dr. David Noon volunteered, together with Prof. Dennis Longstaff, to organise the Commission F Triennial Open Symposium in Australia in 2004. Due to a potential conflict with IGARSS'04 (September 2004 in Anchorage, Alaska, USA), it was recommended to hold the meeting in April or May 2004. Volunteers for organising the Commission F Symposium on Microwave Remote Sensing of the Earth, Oceans, Ice, and Atmosphere (to be held early 2005) should contact Prof. Hallikainen.

#### **Mode A:**

- MMET: International Conference on Mathematical Methods in Electromagnetic Theory, Kiev, Ukraine, September 10-13, 2002 (<http://www.kharkov.ukrtel.net.mmet02>)
- The 34<sup>th</sup> COSPAR Scientific Assembly, Houston, Texas, USA, October 10-19, 2002 (<http://www.cosparhq.org>)
- Getting the Most out of the Radio Spectrum, London, United Kingdom, October 24-25, 2002 (<http://www.iee.org/Events/e24oct02.cfm>)
- APMC 2002: 2002 Asia-Pacific Microwave Conference, Kyoto, Japan, November 19-22, 2002 (<http://www.apme-mwe.org>)
- ISAR-3: Third International School on Atmosphere Radar, ICTP Trieste, Italy, November 25 – December 13, 2002 (<http://www.ictp.trieste.it>)
- ISAP-i02: Intermediate International Symposium on Antennas and Propagation,

- Yokohama, Japan, November 26-28, 2002 (<http://www.icicce.org/cs/ap/ISAP2002>)
- ISMOT 2003: Ninth International Symposium on Microwave and Optical Technology, Ostrava, Czech Republic, August 11-15, 2003 (<http://www.ismot2003.cz>).

**Mode B:**

- Commission F Triennial Open Symposium, Queensland, Australia, April/May 2004
- ClimDiff03, Fortaleza, Brazil, November 17-19, 2003 (<http://www.climdiff.com>)
- Specialist Meeting on Microwave Remote Sensing, Rome, Italy, February 2004
- Commission F Symposium on Microwave Remote Sensing of the Earth, Oceans, Ice, and Atmosphere, early 2005
- AP-RASC'04: 2004 Asia-Pacific Radio Science Conference, Beijing, China
- MST: Tenth International Workshop on Technical and Scientific Aspects of MST Radar, Lima, Peru, May 2003.

*4.3 Responsibilities of URSI Representatives at Meetings Sponsored by Commission F*

Dr. Furuhama emphasised the importance of the role of Commission F representatives in organising Commission F-sponsored meetings under the three modes of sponsorship: A, B and C. Detailed information and forms for applying for URSI sponsorship and for reporting on the meeting are available on the URSI Home Page (<http://www.ursi.org>).

**5. 2005 General Assembly (New Delhi, India)**

Several persons have made proposals for topics of sessions, tutorials and general lectures at the 2005 GA, including Dr. Ed Westwater (USA), Dr. Paolo Pampaloni (Italy), Dr. Alberto Moreira (Germany), Dr. Bertram Arbesser-Rastburg (The Netherlands), Dr. David Noon (Australia) and Prof. Martti Hallikainen (Finland). These proposals will be rationalized and grouped together. Dr. Furuhama requested additional proposals to be sent to Prof. Hallikainen.

*5.1 Commission F Sessions*

Traditionally, Commission F oral sessions have been organised based on invitation only. It was agreed for the future to open the oral sessions for contributed papers in order to have opportunities especially for Young Scientist Programme awardees to present their results. Each convenor will decide, based on his/her invitations, how many contributed papers he/she can accommodate in the session. The new principle should be clearly stated in the Call for Papers.

Sessions will continue to be organised jointly with other Commissions, when appropriate.

*5.2 General Lectures and Commission F Tutorials*

No proposals for General Lectures and Commission F Tutorials were made at the Business Meetings, but some have since been received in writing.

**6. Intercommission Working Groups**

Dr. Furuhama mentioned that the term of each Working Group automatically ends at a

General Assembly unless renewed by Resolution to Council. It was felt that results from Working Groups should be made known through the Radio Science Bulletin, as well as in reports to the Council.

It was agreed to continue WG GF.1 (Middle atmosphere); however, the new abbreviation is GF. It was also agreed to continue WG GFA1, but with the designation FG and title slightly changed. Commission F is to participate in the work of WG HCDFG (Solar power satellite). The Working Groups and Commission F Co-Chairs are:

FG: Ionosphere and atmosphere remote sensing using satellite navigation systems  
Co-Chairs: Bertram Arbesser-Rastburg (F, The Netherlands) and Catherine Mitchell (G, UK)

GF: Middle atmosphere  
Co-Chairs: J. Röttger (G, Germany) and C.H. Liu (F, China SRS)

HCDFG: Solar power satellite (SPS)  
Co-Chair for Commission F: Steven Reising (USA).

## **7. Representatives to Other Organisations**

Dr. Furuhama reminded each representative that they should prepare a report to the 2005 General Assembly.

### *7.1. SCOR (Scientific Committee on Oceanic Research)*

Commission F interests are looked after by Prof. Piotr Sobieski (Belgium).

### *7.2. IUCAF (Inter-Union Committee on Frequency Allocations for Radioastronomy and Space Research)*

Commission F to be represented by Dr. Albin Gasiewski (USA). Dr. Furuhama requested him to prepare a report on IUCAF to the Radio Science Bulletin.

### *7.3. COSPAR (Committee on Space Research)*

Since wave propagation and remote sensing are not among the main topics for COSPAR, it was felt that appointing a Commission F representative is not necessary.

## **8. Publications and Publicity**

### *8.1. Review of Radio Science and Commission F Editor*

See Section 3.1.

### *8.2. Commission F Home Page*

Establishing Commission F Home Page was felt necessary for efficient dissemination of information. Prof. Hallikainen agreed to do it. Any material for the Home Page should be sent to him.

### *8.3. Commission F Member Committee Representatives*

Dr. Furuhama commented on the problems in contacting some Member Committee

Representatives and the fact that certain Member Committees did not even have Representatives for Commission F. He said that information on new appointments should be immediately sent to Prof. Hallikainen (and to URSI Headquarters).

### **9. Any Other Business**

Mr. Martin Hall, Chair of SCT (Scientific Committee on Telecommunications) told about recent developments in SCT to broaden its activities. The Committee will continue as essentially a liaison committee to exchange information, but active individuals are needed to advance its specific activities. An open meeting on various objectives and relations with ITU was organised during the 2002 General Assembly. A resolution was put forward to the Council including a change in the Terms of Reference. Commission F expressed its support to the change in the Terms of Reference. {The Council subsequently approved the resolution.} It was agreed that Dr. Jean Isnard (France) should represent Commission F.

## **COMMISSION G- IONOSPHERIC RADIO AND PROPAGATION**

### **1. Business Meeting 1: Monday, 16 August 2002**

#### *1.1 In Memorium*

The business meeting commenced with a brief moment remembering past friends of Commission G. They were Dr Mike Buonsanto, Dr. Yury Chasovitin, Prof. Walter Dieminger, Dr. Andrei I. Galkin, Prof. Yury Illich Galperin, Mr. Nate Gerson, Prof. Dr. Ewald Harnischmacher, Professor Erukhimov Lev Mikhailovich, Prof. Millett Morgan, Prof. Leif Owren, Belyaev Pavel Petrovich, Dr. A. K. Saha, Mr. Arnold Stanbury, Dr. Heinz Thiemann, Dipl.-Phys. H.-U. Widdel

#### *1.2 Election of Commission G Vice-Chair for 2002-2005*

Three candidates were nominated: P. Cannon (UK), K. Oyama (Japan) and B. Zolesi (Italy). Votes were distributed to 43 Commission G national delegates and, including votes cast during the assembly, 25 countries voted with P. Cannon being the successful candidate and K. Oyama second.

Subsequently, the URSI council endorsed P. Cannon as the Vice-Chairman of Commission G for 2002-2005.

#### *1.3 Terms of reference*

The terms of reference of Commission G were reviewed and it was decided that no amendment was necessary.

#### *1.4 Commission G triennial report*

The report on commission G activities during the past triennium was prepared by Chairman

P. Wilkinson and published well in advance of the General Assembly on the Commission G web site.

### *1.5 Commission G Working Groups and Joint Working Groups, 1999-2002*

All Working Groups triennium reports were included in the Commission triennium report that is available on the Commission G web site. These reports are the responsibility of the lead commission representative. Below the current Commission G Working Groups and Joint Working Groups are summarized together with brief reports and recommendation for future activity.

- *G.1. Ionosonde Network Advisory Group (INAG).*  
Chair: T. Bullett (USA); Vice-Chairs: P. Wilkinson (Australia) and J-C. Jodogne (Belgium). The last three years have seen a great deal of consolidation in INAG, with all older bulletins placed on the web site and an electronic mailing list set up for communications. Recommend continuing with C. Davies (UK) replacing J-C. Jodogne as vice-chair and P. Wilkinson will be the INAG Bulletin Editor.
- *G.2. Studies of the Ionosphere Using Beacon Satellites.*  
Chair: R. Leitinger (Austria); Vice-Chairs: J.A. Klobuchar (USA) and P.V.S. Rama Rao (India). The two main areas of interest are summarised by the key words 'Electron Content' and 'Scintillations'. One sub-group on Ionospheric Tomography has been created. Recommend continuing with the same officers.
- *G.3. Incoherent Scatter.*  
Chair: T. Van Eyken (Norway); Vice-Chair: W. Swartz (USA). The main objective is to schedule the Incoherent Scatter World Day program. Recommend continuing with W. Swartz becoming chairman and a new vice-chair will be appointed soon.
- *G.4. Ionospheric Informatics.*  
Chair: S.M. Radicella (Argentina); Vice-Chair: R. Hanbaba (France). The work of this working group is now complete. This group has been terminated.
- *New G.4. Ionospheric Research to Support Radio systems.*  
Chair: P. Wilkinson (Australia); Co-Chair: M. Angling (UK). Recommends this working group be formed for the next triennium.
- *GF. Middle atmosphere.*  
Co-Chair for Com. G: J. Röttger (Germany), Co-Chair for Com. F: C.H. Liu (China, SRS). This working group had a successful triennium. Recommend continuing with the same officers.
- *URSI-COSPAR on International reference Ionosphere (IRI).*  
Chair: D. Bilitza (USA); Vice-Chair for COSPAR: K.I. Oyama (Japan); Vice-Chair for URSI: B.W. Reinisch (USA). The main activity of this working group was the development and release of the newest version of the IRI model (IRI-2000).  
Recommend to continue.

The reports of commissions G and H joint working groups were presented during the joint business meeting on Wednesday, 18 August.



### *1.6 Publications*

The Chair, P. Wilkinson, on behalf of the Commission, thanked the commission G editors for Reviews of Radio Science, J. Sahr (USA), and for Radio Science Bulletin, D. Hysell (USA), for their excellent work.

The proposal to merge both publications was discussed. Review of Radio Science would be incorporated in the Radio Science Bulletin and made primarily available on the web. The URSI General Lectures will be published in the new RSB, together with articles (2 per year) and three reviews submitted by each commission. Questions concerned the possibility of CD distribution (due to downloading time in some countries), visibility of URSI for a web publication versus a printed journal, and the refereeing policy. It was agreed that the proposal was in the right direction.

P. Cannon, the incoming vice-chair of commission G accepted to act as the commission G editor for the new Radio Science Bulletin.

### *1.7 Commission G resolutions*

A resolution on the construction of an incoherent and turbulent scatter sounder in the Antarctic was submitted by the Japanese representative to Commission G, K.I. Oyama. The past Commission G chair, B. Reinisch agreed to examine the wording of this resolution for the commission GH business meeting.

### *1.8 Discussion on GA 2002 organisation and program*

The following issues were raised during the discussion:

- **Submission of abstracts:** length of abstract (1 versus 4 pages), need to submit 1 page abstract followed by 4 page paper. There was a general agreement on having a one-step only submission with a maximum of 4 pages (for possibility of being referred to as a Conference Proceedings).
- **Level of conference fee** considered much too high for some participants
- **Problem of early registration fee** in order to have papers included in the CD-Rom

### *1.9 Proposals for sessions in 2005*

A large number of proposals for sessions had already been received by the Commission Chair, P. Wilkinson. They were presented and a call for further proposals was made. The incoming Chair, C. Hanuise, with the help of present Chair and incoming Vice-Chair, prepared a draft of sessions for GA 2005 for the last business meeting.

### *1.10 SCT*

M. Hall has been tasked to re-activate the Scientific Committee on Telecommunications (SCT). SCT is trying to collect the names of people active in both URSI and one or more of ITU-R, ITU-D and ITU-T. A search for volunteers to represent Commission G commenced.

### *1.10 Membership of URSI*

Information was presented for discussion on the proposal made by the URSI long-range planning committee of adding individual membership for URSI. Individual membership would replace the present system of URSI correspondents. Selection would be made through either national committees or URSI membership committee where selection through national committee is not readily available.

## **2. Business Meeting 2: Wednesday, 18 August 2002**

This business meeting is a joint meeting between commissions G and H.

### *2.1 Joint Working Groups 1999-2002*

Activities during the past triennium and recommendations for future activities were presented for the joint commissions G and H working groups. New Working Groups were also proposed.

- *GH.1. Active Experiments in Plasmas.*  
Co-Chair for Com. G: Sa. Basu (USA);  
Co-Chair for Com. H: T. Leyser (Sweden).  
Recommend continuing with the same officers.
- *GH.2. Computer Experiments, Simulation and Analysis of Wave Plasma Processes.*  
Co-Chair for Com. G: H. Thiemann (Germany);  
Co-Chair for Com. H: H. Matsumoto (Japan).  
The work of this group is complete. Both commissions recommend to terminate this group.
- *HGEJ. Supercomputing in Space Radio Science.*  
Co-Chair for Com. H: H.Y. Omura, others to be announced.

Commissions G and H recommend forming a new working group replacing the former GH2 working group, and extending the range of work covered.

Proposed Terms of Reference:

- 1) To promote supercomputing in space plasma physics and space radio engineering,
  - 2) To promote computer simulations by training young scientists in the field of space radio science,
  - 3) To promote international collaboration and projects of supercomputing in space radio science
- *GHC. Wave and Turbulence Analysis.*  
Co-Chair for Com. H: T. Dudok de Wit (France)  
Co-Chair for Com. C: G.C. Kubin (Austria)  
Co-Chair for Com. G: David Hysell (USA).

It is proposed that the inter-commission links of this group are extended (HGJC) and the lead commission altered, Com. H becoming the lead commission.

- *URSI/IAGA VLF/ELF Remote Sensing of the Ionosphere and Magnetosphere (VERSIM).* Co-Chair for URSI Commissions G and H: M. Parrot (France);

Co-Chair for IAGA Commissions 2 and 3: A.J. Smith (UK).

Recommend continuing with the same officers.

- *EGH. Seismo-electromagnetics.*

Co-Chair for Com. H: M. Parrot (France).

Endorsed by Commissions G and H.

- *Inter-commission Working Group on Solar Power Satellites.*

Chair: H. Matsumoto (Japan).

Commission G representative: M. Rietveld (Germany).

Endorsed by Commissions G and H.

### *2.2 Proposals for joint G/H sessions in 2005*

The following joint symposia were suggested for the General Assembly in 2005:

- Data analysis techniques for diagnosing plasma fluctuations with radio methods (H: T. Dudok de Wit, G: A. Wernik, J: tbd, C: G. Kubin)
- Dusty plasmas (H leading)
- ULF/VLF impacts on the radiation belts
- Image (R. Benson, J. Green)
- Waves and boundaries
- Deep(Space active and passing probing (H: B. Thide, G: tbd, J: tbd)
- Lightning – Ionosphere interactions (H: V. Pasko)
- Radiation belts (H: R. Horne)

### *2.3 Notice of Commissions G and H resolutions*

The resolution presented by Japan on building an Incoherent Scatter Radar in the Antarctic was supported by both commissions G and H.

### *2.4 Proposed URSI Representatives*

Commissions G and H recommended the following representatives:

- COSPAR: Dr Klos for a second term.
- IUCAF: G. Wannberg (Sweden). T. Van Eyken has resigned from this group.
- ISES: S. Pulnits (Russia) for Com. G, with R. Pirjola (Com. E, Finland) being the second representative.
- SCAR: A. Smith (UK) for a second term.
- SCOSTEP: S. Avery (USA) for a second term.
- SRAMP: Su. Basu (USA) until SRAMP is terminated in this triennium. Recommend that Su. Basu (USA) become the URSI representative on the new SCOSTEP initiative, CAWSES (Climate And Weather of the Sun-Earth system).
- SCT: P. Lassudrie-Duchesne (France) for Commission G.

### *2.5 Proposals for ICS (ICSU) projects*

ICS (former ICSU) has shifted its financial support towards granting funds to interdisciplinary projects, preferably within thematic programs defined by ICSU. These

projects should be inter-union in order to have a better chance of being funded. Deadline for submission of grant proposals to ICSU is February.

### *2.6 Other business*

There was no time to discuss any other business during the meeting.

## **3. Business Meeting 3: Friday, 20 August 2002**

### *3.1 Commission G sessions for GA 2005*

The incoming Chair, C. Hanuise presents the draft session list and convenors for the 2005 General Assembly. It tries to cover as much as possible all interests within Commission G and to involve convenors from younger scientists and various countries.

#### Sessions with Commission G leading:

- *G(1). Imaging of the ionosphere.*  
Includes data driven, assimilation and other techniques.  
Convenors: B. Wilson (USA), M. Cordrescu (USA), C. Mitchell (UK).
- *G(2). Ionospheric effects on radio systems.*  
Includes all latitude propagation, HF and transionospheric.  
Convenors: Chandra (India), P. Lassudrie (France).
- *GF(3). Remote sensing using global navigation satellite systems.*  
Convenors: N. Jakowski (Germany), P. Spalla (Italy).
- *G(4). Computation and networking in ionospheric radar systems.*  
Includes coherent and incoherent scatter, ionosondes, etc  
Convenors: J. Sahr (USA), K. Oyama (Japan).
- *G(5). Electron density profiling and validation.*  
Incoherent scatter, ionosondes, occultation, comparisons between different techniques, and models, etc.  
Convenors : J. Foster (USA), D. Bilitza (USA).
- *G(6). Open session and latest results.*  
Convenors: P. Wilkinson (Australia), J. Wu (China).
- *G (7). Small-scale structures in the ionosphere.*  
Convenors: J.P. St Maurice (Canada), J. Chau (Peru).
- *GHJ (8). Novel ground-based radio techniques for studying the sun-earth plasma environment.*  
Includes meteors.  
Convenors: C. Hanuise (G, France), B. Thide (H, Sweden), J (to be decided).
- *GP (9). Combined poster session.*  
Convenors: P. Cannon (UK), B. Zolesi (Italy).

#### Sessions with other commissions leading:

- *FG. Transionospheric signal degradation.*  
Convenors: A. Coster (G, USA), R. Leitinger (G, Austria), F tbd.
- *HG(1). Radio-frequency observations in space.*

Convenors: B. Reinisch (G, USA), G. James (H, Canada).

- *HG(2). Ionospheric modification by high power radio waves: coupling of plasma processes.*

Convenors: T. Leyser (H, Sweden), Sa. Basu (G, USA).

- *HGCJ. Data analysis techniques for diagnosing plasma fluctuations with radio methods.* Convenors: T. Dudok de Wit (H, France), A. Wernik (G, Poland).

- *HGE. Ionospheric effects of lightning.*

Convenors: E. Blanc (G, France), others tbd.

#### Suggestions for Commission G tutorial at GA 2005:

- Space weather: basic processes, effects.
- Ionospheric effects on spaced-based systems and GPS related topics.
- Highlights in ionospheric theory and experiment from 1925 to 2005.
- Mechanisms of HF wave attenuation in the ionospheric plasma.
- Use of the regularization methods for the inverse problem of ionospheric radio sounding.
- Imaging techniques for ionospheric studies.
- Satellite observation of lightning.
- Modelling the topside and plasmasphere.
- Introduction to GPS remote sensing.

#### Suggestion for commission G General Lecture at GA 2005:

- Peculiarities of electromagnetic wave propagation in non-stationary environments.
- Space weather and human health.
- Present and future applications of GNSS.

### *3.2 Publications*

The incoming Vice-Chair, P. Cannon was confirmed as the Commission G editor for the new Radio Science Bulletin, incorporating the Review of Radio science.

The first paper submitted by Commission G will be the tutorial lecture given by J.P. St Maurice on 'Ionospheric Irregularities'. Further contributions are requested.

### *3.3 Review of GA 2002*

The General Assembly was quite successful for Commission G. Several sessions attracted over 100 scientists, many from other commissions.

### *3.4 Resolutions*

It was recalled that Commissions G and H passed the following Commission resolution at their joint business meeting ***“Incoherent and Turbulent Scatter Sounding in the Antarctic Commission G Ionosphere”***

*Considering*

- a. that important parameters describing the ionosphere and the atmosphere can be obtained by using the incoherent scatter sounding technique;
- b. that there is no such sounder in the Antarctic region;

- c. that such a sounder would help to improve our understanding of the Earth's environment and its changing climate, and especially the structure and dynamics of the whole atmosphere including lower, middle and upper atmosphere;

*resolves* to urge the scientific community to construct an incoherent scatter sounding station in Antarctica.

### *3.5 Closing Comments*

At the conclusion of this meeting, the outgoing Chair, P. Wilkinson, thanked the commission for the support they have given to him during his tenure and especially for the assistance given by the incoming Chair, C. Hanuise and the Vice Chair, P. Cannon during the General Assembly. The incoming Chair, C. Hanuise, then acknowledged the work put by P. Wilkinson and thanked him for his efforts and expressed the pleasure he had working with him, as well as expressing his pleasure at being the incoming Chair.

## **4. Sessions held in the 2002 General Assembly**

### *4.1 Tutorial*

- GT. Ionospheric Irregularities. J.P. St Maurice (Canada)

### *4.2 Sessions organized by Commission G or with Commission G leading*

- G1. Ionospheric effects on HF propagation: 12 papers  
Convenors: P. Cannon (UK), L. Bertel (France).
- G2. Operational ionospheric models including data ingestion: 10 papers  
Convenors: D. Bilitza (USA), K. Igarashi (Japan).
- G3. Open session and latest results: 7 papers  
Convenors: B. Reinisch (USA), A. Belehaki (Greece).
- GP1. General Poster Session: 110 papers  
Convenor: E. Blanc (France)
- GP2. Short term variability in the ionosphere: 11 papers  
Convenor M. Cordrescu
- GF. Transionospheric signal degradation: 10 papers  
Convenors: R. Leitinger (G, Austria), M. Cervera (G, Australia), B. Arbesser-Ratsburg (F, Netherlands), D.V. Rogers (F, Canada).
- GH1. Ionospheric modification by high power radio waves: coupling of plasma processes: 11 papers  
Convenors: Sa. Basu (G, USA), T.B. Leyser (H, sweden).
- GH2. Topside Ionosphere and Plasmasphere: 7 papers  
Convenors: J. Foster (G, USA), I. Kilura (H, Japan).
- GHE. Space weather effects on systems: 11 papers  
Convenors: P. Wilkinson (Australia), A. Hilgers (H, Netherlands).
- GJ. New approaches to radio sensing of the terrestrial plasma environment: 17 papers

Convenors: C. Hanuise (G, France), J. Röttger (G, Germany), C. Lonsdale (J, USA).

#### 4.3 Sessions with Commission G participation

- EGH. Lithosphere-Atmosphere-Ionosphere coupling: 7 papers  
Convenors: M. Hayakawa (Japan), S. Pulinets (G, Russia).
- FG. Wave propagation for satellite navigation and mobile services: 10 papers  
Convenors: B. Arbesser-Rastburg (F, Netherlands), D.V. Rogers (F, USA), R. Leitinger (G, Austria), M. Cervera (G, Australia)
- HG1. Spacecraft and ground-based observations of stimulated and natural space-plasma waves: 10 papers  
Convenors: K. Hashimoto (H, Japan), R.R. Anderson (H, USA)
- HG2. Experiments in space and laboratory plasmas: 7 papers  
Convenors: W.E. Amatucci (H, USA), R. Hatakeyama (H, Japan)
- HGE1. Lightning effects in the ionosphere and radiation belts: 10 papers  
Convenors: S.A. Cummer (H, USA), C.J. Rodger (G, New Zealand)
- HGE2. Dynamics of dusty plasmas in space and laboratory: 7 papers  
Convenors: G. Ganguli (H, USA), S. Avery (G, USA)
- HGJC. Analysis methods for plasma waves and turbulence: 6 papers  
Convenors: T. Dudok de Wit (H, France), A. Wernik (G, Poland).

## COMMISSION H- WAVES IN PLASMAS

### a) Working group reports

Commission H scientists have been active in a number of working groups (WG) during the triennium. Almost all of these have Commission G leading; the reports therefore are found in the Commission G triennial report.

*VLF/ELF Remote Sensing of the Ionosphere and Magnetosphere (VERSIM), URSI/IAGA Joint WG)*

CoChairs: M. Parrot(France) and A.J. Smith(U.K.)

This WG serves as a forum for researchers studying the behaviour of the magnetosphere and ionosphere by means of ELF and VLF waves. Since the 1999 URSI General Assembly (GA), the VERSIM WG had a half-day session at IAGA2001, maintained a bibliography and circulated three newsletters. A detailed VERSIM triennial report and other WG information may be read at: <http://www.nerc-bas.ac.uk/public/uasd/versim.html>.

### b) Specialist conferences and meetings sponsored by Commission H

*Mode A (Without financial support)*

- COSPAR Scientific Assembly, Warsaw, Poland, 16-23 July 2000.

- Report published in the June 2001 issue of the Radio Science Bulletin (RSB).
- First STEP-Results, Applications and Modeling Phase (S-RAMP) Conference, Sapporo, Japan, 2-6 October 2000.  
Report published in the June 2002 issue of the Radio Science Bulletin (RSB);
- Int. Space Environment Conference (ISEC) 2001 - Radiation Belt Science and Technology, Queenstown, New Zealand, 23-27 July 2001.  
Report published in the March 2002 issue of the RSB .
- International Conference on Electromagnetics in Advanced Applications (ICEAA) 2001, Turin, Italy, 10-14 September 2001.  
Report published in the March 2002 issue of the RSB.

*Mode B (With financial support)*

- Sources and Scintillations: Refraction and Scattering in Radio Astronomy, Guiyang, China, 17-21 April, 2000 (in collaboration with IAU); EUR 500.  
Report published in the December 2000 issue of the RSB.
- International Conference on Mathematical Methods in Electromagnetic Theory(MMET)'2000, Kharkov, Ukraine, 12-15 September 2000; EUR 560.  
Report published in March 2001 issue of the RSB.
- Sixth International School for Space Simulations (ISSS-6), Germany, June 2001; EUR 1,000.  
Report published in the March 2002 issue of the RSB.
- IRI Workshop - Modeling the Low Latitude Ionosphere, Sao Jose dos Campos, Brazil, 25-29 June 2001; EUR 300.  
Report published in the DECEMBER 2001 issue of the RSB
- 2001 Asia-Pacific Radio Science Conference (AP-RASC'01), Tokyo, Japan, August 1-4, 2001; EUR 1,000.  
Report published in the JUNE 2002 issue of the RSB.
- La Londe School "Analysis techniques for plasma data as obtained by satellites", Marseille, France, 8-13 October 2001; EUR 1,000.  
Report published in the DECEMBER 2001 issue of the RSB.

## **COMMISSION J – RADIO ASTRONOMY**

Chair: Professor J.N. Hewitt (United States)

Vice-Chair: Professor M. INOUE (Japan)

### **1. First Business Meeting: 19 August 2002**

#### *1.1 Election of Vice-Chair*



Three candidates were nominated for the position of vice-chair, and Richard Schilizzi was elected by votes of Commission J national delegates.

### *1.2 Discussion of Commission J budget*

A motion was made and seconded to allocate half of the next triennium's budget to travel support for the General Assembly, encouraging participation from many countries. Professor Hewitt reviewed the activities and budget expenditures of the previous triennium.

### *1.3 Nomination of a candidate for the Philips Prize*

Professor Hewitt announced the existence of the Philips Prize for the best Young Scientist paper in this triennium. A committee consisting of Makoto Inoue, Roy Booth, and Peter Napier was appointed to review the papers and to put forward to the Board Commission J's candidate.

### *1.4 Commission J resolutions*

Resolutions on radio quiet zones and the redefinition of UTC eliminating the leap second were discussed. Concerning the former, an amendment was approved and a drafting group was appointed. The second resolution was unanimously approved with eight delegates present to vote.

### *1.5 Submission of abstracts and papers, and merging of RRS and RSB*

The submission procedure of abstracts and papers was discussed. Submission procedures involving fewer actions on the part of the author were supported. It was voted that the two publications (Review of Radio Science and Radio Science Bulletin) should be combined. A suggestion was made that the review articles should be indexed in the NASA Astrophysics Data System (ADS).

## **2. Second Business Meeting: 21 August 2002**

### *2.1 Report on Tuesday Council Meeting*

It was reported by the Chair that in the Council Meeting on 20 August, R. Schilizzi had been approved as the Vice Chair. The resolution on the leap second was approved with the provision that "committee" be replaced by "working group," and a discussion of radio quiet zones was postponed until 22 August.

### *2.2 Reports of working groups and IUCAF*

Activity reports of the Global VLBI Working Group (GVWG) and Leap Second were presented. A new Chair of the GVWG (J. Romney, NRAO) was proposed by R. Schilizzi (current GVWG Chair) and approved. The IUCAF Chair (D. Emerson) reported on the status of IUCAF membership from URSI: five URSI members - W.A. Baan, P.P. Baptista, M. Davis, K. Ruf, and A. van Eyken - have completed their terms, and W.A. Baan and K. Ruf, both former chairs, were co-opted. A new member, Professor Yashwant Gupta (India), was proposed and approved.

### *2.3 Resolutions*

A proposal for the inter-commission resolution on the Solar Power Satellite (SPS) from the host Commission H was supported, with amendments. The inter-commission working group on RFI was proposed by A. van Ardenne, and approved. Participants were skeptical about the effectiveness of the inter-commission working group, Scientific Committee for Telecommunications (SCT).

## **3. Third Business Meeting: 23 August 2002**

### *3.1 Report on Thursday Council Meeting*

The resolution on Radio Quiet Reserves had been approved, and New Delhi will be the site for the next GA in 2005.

### *3.2 Scientific program for GA 2005*

Some proposals were given for the scientific sessions for GA 2005. However, it was argued that we should circulate proposals for the sessions more widely after this GA, as the number of participants in the last business meeting was limited. This was agreed.

## **COMMISSION K - ELECTROMAGNETICS IN BIOLOGY AND MEDICINE**

Chair : Professor S. Ueno (Japan)  
Vice-Chair : Professor B. Veyret (France)

### **1. Open Commission Meeting: Tuesday 19 August**

The Commission held one Open Commission meeting, on Tuesday 19th August 2002 at 6 p.m. It was attended by a about 50 delegates and members. The approved agenda was the following:

- Introduction
- Election of Vice Chair for 2002-2005
- GA 2002 Organization and Program
- Session proposals for GA 2005
- Report on K articles in Radio Science Bulletin
- Scientific Committee on Telecommunications (SCT) (interaction between Commission K and WHO)
- Intercommission Working Group on Solar Power Satellite lead by Commission H
- Other business

#### *1.1 Election of a Vice-Chair*

Three candidates had been nominated for the position of Vice-Chair for the next

triennium : F. Prato (Canada), K. Hansson Mild (Sweden) and G. D’Inzeo (Italy). At the business meeting, any Official Member who was present and had previously voted was given the opportunity to change his vote, and any Member who had not voted was allowed to do so. In the ballot, 35 votes were cast, resulting in the submission to the Council of the following two names, in order of preference:

1. F. Prato
2. G.D’Inzeo

### *1.2 Terms of Reference*

The following Terms of Reference were not modified.

The Commission is charged with promoting research and development in the following domains :

- (a) physical interactions of electromagnetic fields with biological systems;
- (b) biological effects of electromagnetic fields;
- (c) interaction mechanisms;
- (d) human exposure assessment;
- (e) experimental exposure systems;
- (f) medical applications.

The Commission emphasises its interdisciplinary character and fosters research co-operation among various disciplines.

### *1.3 Review of Radio Science*

The Commission K Editor of the Review of Radio Science for the last triennium, Bernard Veyret reported on the procedure he had used to select the topics and authors of the Commission K chapters. The result was good reviews of important topics.

The incoming Commission K editor is F. Prato.

### *1.4 Inter-Commission Working Groups*

There is only one Joint Working Group KE : EMI with Medical Equipment (Co-Chair for Commission E : S. Alfars, Denmark), which was not discussed further.

### *1.5 2004 Symposium*

A Symposium on topics to be announced will be organised by B. Veyret in Bordeaux, France, in the Spring of 2004.

### *1.6 Commission K Programme in Maastricht*

The Chair initiated a discussion on the Commission K Programme in Maastricht. The technical contents of the sessions were considered to be well balanced between the Commission sessions and the joint sessions organised with other Commissions (see list below).

### *1.7 SCT*

B. Veyret will be Commission K’s member of SCT, as a liaison with WHO.

### *1.8 Vote of Thanks*

There was a vote of thanks for Prof. S. Ueno who had worked hard during the last triennium.

## **2. Scientific programme**

Commission K organised six scientific sessions, namely:

- K1: Mechanisms & modelling of electromagnetic interaction with biological systems  
F. Barnes (USA) and G. d’Inzeo (Italy)
- K2: Biological effects of electromagnetic fields  
L. Anderson (USA) and T. Shigemitsu (Japan)
- K3: Hazard assessment for wireless communication  
B. Veyret (France) and M. Taki (Japan)
- K4: Biomedical applications of electromagnetic fields and waves  
J. Lin (USA) and C. Gabriel (UK)
- K5: Epidemiology of exposure to environmental electromagnetic fields  
R. de Seze (France) and N. Yamaguchi (Japan)
- K6: Topics in biomagnetics  
S. Ueno (Japan} and B. Veyret (France)

Commission K further participated in four joint sessions.

- KA: Exposure Assessment For Cellular And Personal Telecommunications  
N. Kuster (K, Switzerland) and Q. Balzano (A, Italy)
- KB: Computation of Electromagnetic Fields in the Human Body  
O. Gandhi (K, USA) and M. Okoniewski (B, Canada)
- KC: Health Effects of Mobile Telephones  
M. Taki (K, Japan) and G. Neubauer (C, Austria)
- KE: Electromagnetic Interference with Medical Devices  
T. Nojima (K,Japan) and Michael R. Murphy (USA)

## RESOLUTIONS AND RECOMMENDATIONS OF THE COUNCIL

### U.1. International Radio Quiet Reserves

The URSI Council,

*Considering that:*

- a) to explore the far reaches of the Universe, a limited number of very large, extremely sensitive radio telescopes is being planned for construction in the coming 10 - 20 years;
- b) because the spectral features of distant sources are shifted in frequency by the universal cosmic expansion to well outside the frequency bands allocated to the Radio Astronomy Service, these new radio telescopes will need to operate across a wide range of spectrum;
- c) such telescopes will therefore be extremely vulnerable to interference from emissions from space stations, especially those using non-geostationary satellites;
- d) the current Radio Regulations make no provision for protecting radio astronomical observation outside the designated frequency bands;
- e) developing such protection will involve cross-sectoral issues in the areas of global telecommunications, international trade, regulation of radio spectrum utilization, as well as scientific research, which issues taken together lie outside the competency of any single existing regulatory body;
- f) the inter-governmental Global Science Forum of the OECD has therefore sponsored a Task Force on Radio Astronomy and the Radio Spectrum, which has brought together international experts drawn from the telecommunications satellite industry, the radio spectrum regulatory community, and the radio astronomical research community, to consider whether this diversity interests might be reconciled;
- g) said Task Force has made proposals to this end, including a proposal for a small number of internationally recognized radio quiet reserves in which the planned new radio telescopes might be located;
- h) although designation of such reserves is not within the established procedures of the ITU, that body currently provides the most appropriate forum in which to consider the possibility;

*Recommends that:*

- 1) the draft agenda of the WRC-2006 include the following item: “To consider the possibility of creating one or more internationally recognized radio quiet reserves, and take appropriate action.”
- 2) the ITU-R undertake the necessary preparatory studies, possibly soliciting input from the Scientific Committee on Telecommunications of URSI, the Commission on Frequency Allocations for Radio Astronomy and Space Science (IUCAF) of ICSU, and other bodies of experts as appropriate.

## **U.2. Establishment of a working group on the possible redefinition of UTC**

The URSI Council,

*Considering*

- a) That in 1971, the ITU-R (International Telecommunications Union - Radiocommunications, formerly the CCIR, the International Consultative Committee for Radiocommunications) proposed the present form of UTC, based upon the SI second but linked to the variable rotation of the Earth through the introduction of leap seconds in such a manner that  $|UT1-UTC|$  will always be less than 0.9 seconds,
- b) That while this system has worked well for most purposes, the future implementation of satellite and other systems may not easily incorporate the leap second system,
- c) That the ITU-R has formed a Special Rapporteur Group to study a possible change in the definition of UTC, and that this Special Rapporteur Group has asked URSI and other international bodies to advise it,
- d) That a committee formed by URSI Commission J has conducted a survey of the effects of a redefinition of UTC, and delivered that report to the Committee Chair, and
- e) That this report found no systems maintained by URSI members that would be adversely affected should UTC be redefined by fixing the number of leap seconds to its current value, or its value at any future date,
- f) That discussion of possible redefinition of UTC has important significance to URSI;
  - That a large number of non-URSI members voiced strong objections to any change, citing the inconvenience to amateur astronomers along with possible legal or philosophical objections, and
  - That all URSI members may not have had a chance to respond, or might respond differently if polled today;

*Resolves*

- 1) That an URSI-wide working group be formed to inform and poll the URSI membership,
- 2) That the chair of this working group act as URSI representative to the ITU/R Special Rapporteur Group, and
- 3) That this working group be requested to prepare a resolution for the URSI General Assembly of 2005.

### **U.3. the Scientific Committee on Telecommunications**

The URSI Council

*Considering that*

- a) Scientific aspects of telecommunications are present in the terms of reference of most Commissions and that this situation calls for some liaison,
- b) It would be appropriate for the SCT to now be associated with more entities than ITU-R alone,
- c) The interests of Science Services in the frequency allocation process are represented by IUCAF,

*Resolves*

1. To extend the terms of reference as defined below,
2. That the SCT will include a representative of each Commission, appointed by the Chairs of the Commissions, and participants in the work of the ITU-R and such other entities as it may decide. It may co-opt up to eight other individuals active in work covered by its terms of reference. It will appoint its own Chair, the relevant Commission to then nominate a replacement representative.

*Terms of Reference*

1. To initiate, promote and co-ordinate inter-commission activities in the telecommunications area on specified topics to be identified, and through the organisation of joint symposia.
2. To identify areas of common interest to URSI and to ITU-R or similar entities, and, where appropriate, to exchange relevant information between the URSI Commissions and the working groups (e.g. ITU-R Study Groups), and to promote collaborative activities.
3. To keep the URSI community informed on ITU-R and similar matters through the Radio Science Bulletin.
4. To initiate, co-ordinate and liaise any formal URSI contributions to ITU-R or similar bodies.”

### **U.4. Communication with URSI Board**

The URSI Council,

*Considering*

- a) That it is of the highest importance that a close contact be maintained between the

Board of URSI on the one hand, representatives of the Member Committees, Chairs and Vice- Chairs of Commissions and Members of the Standing Committees, on the other hand;

- b) That this proximity and this reciprocal communication among the various structures of URSI allows the efficient support of the Board;
- c) That current information and communication technologies make it possible, at low cost and without excessive effort, to implement these principles;

*Recommend*

- 1) That the annual calendar of meetings of the Board of URSI be known to the representatives of the Member Committees, Commission Chairs and Vice-Chairs and members of the standing committees by any means chosen by the Board;
- 2) That the agenda of meetings of the Board be sent as soon as possible to the persons defined in article (1) to permit reciprocal communication;
- 3) That the reports of these meetings be sent to the people defined in article (1) as soon as possible.

**U.5. Inter-Commission Working Group on the Middle Atmosphere**

The URSI Council,

*Recognising* the importance of studies of the middle atmosphere for understanding the global change problems;

*Noting*

- a) that proven techniques exist for applying electromagnetic waves to investigate
  - (i) the physics and chemistry of the middle atmosphere,
  - (ii) the coupling of the middle atmosphere to regions above and below;
- b) that these topics are included in the terms of reference of both Commissions G and F;

*Resolve* to establish an Inter-Commission Working Group on the Middle Atmosphere, with the following terms of reference :

- 1) to co-ordinate within URSI and with other ICSU bodies the relevant activities for studies of the middle atmosphere;
- 2) to estimate research for understanding both the dynamic processes in the middle atmosphere and the climatology of these regions, and to cover, for instance, the development and application of : (i) MST and related radar and radio techniques, (ii) Lidar and related optical techniques, and (iii) satellite-borne and ground-based passive remote sensing techniques.



## **U.6. Inter-Commission Working Group on Atmospheric Remote Sensing using Satellite Navigation System**

The URSI Council,

*Considering*

- a) the importance of using space- and ground-based observations of GPS and GLONASS signals to monitor the global environment of the atmosphere;
- b) the use which future spaceborne observations of the temperatures of the lower atmosphere and the electron densities of the ionosphere will make of this technique;

*resolves* to establish an Inter-Commission Working Group on Atmospheric Remote Sensing and propagation research using Global Positioning Systems (GPS / GLONASS), with Bertram Arbesser-Rastburg (ESA, Netherlands) as Coordinator and Cathryn Mitchell (United Kingdom) as the Commission F representative.

## **U.7. URSI Radioscientist**

The URSI Council,

*having considered* the report of the Long Range Planning Committee

*resolves* to accept the recommendation of the Long Range Planning Committee to request the Board to implement the “URSI Radioscientist” status (replacing the concept of “URSI Correspondent”).

## **U.8. URSI Travelling Lecturer Program**

The URSI Council,

*having considered* the report of the Long Range Planning Committee

*resolves* to accept the recommendation of the Long Range Planning Committee to request the Board to implement an “URSI Travelling Lecturer” program.

## **U.9. XXVIIIth General Assembly**

The URSI Council,

*having considered* the invitations for the XXVIIIth General Assembly which had been submitted by the URSI Member Committees in China (Beijing), India (New Delhi) and the USA (Denver, Colorado);

*resolves*

1. to accept the invitation of the Indian URSI Committee to hold the XXVIIIth General Assembly in New Delhi in October 2005;
2. to record its thanks to the Member Committees in China (CIE) and in the U.S.A. for their invitations.

#### **U.10. Vote of Thanks to the Dutch URSI Committee**

The URSI Council,

*resolves* unanimously to convey to the Dutch URSI Committee its warm thanks and appreciation for the organisation of the XXVIIth General Assembly in Maastricht.

# RESOLUTIONS, RECOMMENDATIONS AND OPINIONS OF THE COMMISSIONS

## Joint URSI Commissions G and H Resolution

### C.1 Incoherent and Turbulent Scatter Sounding in the Antarctic

Commissions G and H,

*Considering*

- (a) that important parameters describing the ionosphere and the atmosphere can be obtained by using the incoherent scatter sounding technique;
- (b) that there is no such sounder in the Antarctic region;
- (c) that such a sounder would help to improve our understanding of the Earth's environment and its changing climate, and especially the structure and dynamics of the whole atmosphere including lower, middle and upper atmosphere;

*resolves* to urge the scientific community to construct an incoherent scatter sounding station in Antarctica.

### C.2 Resolution to Inter-Commission Working Group on SPS (Solar Power Satellites)

Commission H,

*Considering,*

- a) that SPS research has become increasingly important for a possible clean power supply for mankind and that one of the key issues of the SPS is microwave power transmission (MPT) from space to earth,
- b) that URSI – which covers various fields related to MPT – should contribute to the SPS,

- c) that MPT technology has not yet been explicitly covered by the existing commissions although there is emerging interest by a number of commissions, and
- d) that this field has so far been covered by a Union Session at the AP-RASC meeting and H Special Session at this meeting,

*Resolves*

- 1) that in addition to SPS technologies and science, other related issues such as interference and compatibility of SPS with environments should be discussed,
- 2) that an IWG to discuss all aspects of SPS and MPT should be created, and
- 3) that the IWG should contribute to assessment of the present MPT technologies and development of new ones and clarification and reduction of interference caused by SPS.

## RÉSOLUTIONS ET RECOMMANDATIONS DU CONSEIL

### U.1. Zones internationales de silence radio

Le Conseil de l'URSI,

*Considérant que :*

- a) dans le but d'explorer l'Univers lointain, la construction d'un nombre limité de très grands télescopes à haute sensibilité est prévue au cours des 10 à 20 prochaines années ;
- b) du fait de l'expansion cosmique, la fréquence des raies spectrales des sources éloignées est déplacée bien en dehors des bandes de fréquence attribuées au Service de radioastronomie et, par conséquent, ces nouveaux radiotélescopes devront fonctionner dans une large gamme de fréquence ;
- c) de tels télescopes seront dès lors extrêmement vulnérables aux interférences provoquées par les émissions des stations spatiales, et plus particulièrement celles des satellites non-géostationnaires ;
- d) les réglementations actuelles en matière d'ondes radio ne prévoient aucune disposition concernant la protection des observations radioastronomiques en dehors des bandes de fréquence désignées ;
- e) le développement d'une telle protection soulèvera des questions intersectorielles dans les domaines des télécommunications à l'échelle mondiale, du commerce international, de la réglementation de l'exploitation du spectre radio et de la recherche scientifique, lesquelles questions, considérées dans leur ensemble, ne relèvent de la compétence exclusive d'aucun organisme de réglementation existant ;
- f) le Forum mondial de la science de l'OCDE a, à cette fin, parrainé un groupe de travail sur la radioastronomie et le spectre radio, qui a rassemblé des experts internationaux provenant de l'industrie des télécommunications par satellite, de la communauté de réglementation du spectre radio et de la communauté de recherche radioastronomique, afin d'examiner si les différents intérêts étaient conciliables ;
- g) ledit groupe de travail a formulé des propositions dans ce sens, dont l'une vise à prévoir un petit nombre de zones de silence radio reconnues à l'échelle internationale dans lesquelles les nouveaux radiotélescopes en projet pourraient être construits ;

- h) bien que la désignation de telles zones ne s'inscrive pas dans les procédures établies de l'UIT, cet organisme semble constituer le forum le plus adéquat pour envisager cette possibilité ;

*Recommande que*

- a) le projet d'ordre du jour de la réunion WRC-2006 contienne le point suivant : «Prise en considération de la création éventuelle d'une ou plusieurs zones de silence radio reconnues à l'échelle internationale et adoption de mesures appropriées».
- b) l'ITU-R entreprenne les études préparatoires nécessaires, en sollicitant éventuellement la participation du Comité scientifique sur les télécommunications de l'URSI, de la Commission inter-Unions pour l'allocation des fréquences à la radioastronomie et aux sciences spatiales de l'ICSU (IUCAF) et, le cas échéant, d'autres groupes d'experts.

## **U.2. Création d'un groupe de travail sur la redéfinition éventuelle du TUC**

Le Conseil de l'URSI,

*Considérant*

- (a) Qu'en 1971 l'UIT-R (l'Union Internationale des Télécommunications-Secteur des Radiocommunications, anciennement CCIR) a proposé la réalisation actuelle du TUC (temps universel coordonné), laquelle est basée sur la seconde SI, mais liée à la rotation variable de la Terre par l'introduction de secondes intercalaires, de sorte que  $|UT1 - TUC|$  soit toujours inférieur à 0.9 seconde.
- (b) que si ce système a bien fonctionné dans son ensemble, le développement futur des systèmes satellites (et autres) pourrait ne pas facilement s'accomoder du système de la seconde intercalaire.
- (c) que l'UIT-R a formé un groupe chargé d'étudier la possibilité d'un changement de définition du TUC, et que ce groupe a demandé l'avis de l'URSI, ainsi que celui d'autres institutions internationales.
- (d) qu'un comité formé par la Commission J de l'URSI a fait un relevé des effets d'une nouvelle définition du TUC, et a envoyé un rapport à ce sujet au Président du Comité UIT-R.
- (e) que ce rapport conclut qu'aucun des systèmes utilisés par les membres de l'URSI ne subirait d'effets adverses suite à une définition qui fixerait le nombre de secondes intercalaires à sa valeur présente, ou à sa valeur à une date future.
- (f) que la possibilité d'une nouvelle définition du TUC est un sujet d'importance pour l'URSI
- qu'un nombre considérable de personnes qui ne sont pas membres de l'URSI ont formulé de fortes objections à tout changement, citant en particulier les problèmes

- que pourraient connaître les astronomes-amateurs, ainsi que les objections légales et philosophiques que le changement pourrait créer;
- que tous les membres de l'URSI n'ont peut-être pas eu la possibilité de réagir, et que ceux qui l'ont fait pourraient avoir changé d'avis depuis

*décide*

- (1) de former un groupe de travail « URSI », chargé d'informer les membres de l'URSI et de recueillir leurs réactions,
- (2) de charger le Président de ce groupe de travail de représenter l'URSI au sein du groupe UIT-R susnommé,
- (3) de demander à ce groupe de travail de préparer une résolution destinée à l'Assemblée Générale de l'URSI de 2005.

### **U.3. le Comité Scientifique pour les Télécommunications**

Le Conseil de l'URSI

*Considérant que*

- a) les aspects scientifiques des télécommunications sont présents dans les termes de référence de la plupart des Commissions, et que cette situation demande une forme de liaison,
- b) qu'il serait approprié que le CST soit maintenant associé à d'autres entités que la seule UIT-R,
- c) que les intérêts des services scientifiques dans le processus d'allocation des fréquences sont représentés par l'IUCAF,

*décide*

1. d'étendre les termes de référence comme défini ci-dessous,
2. que le SCT comprendra un représentant de chaque Commission, nommé par les présidents des Commissions, ainsi que les participants aux travaux de l'UIT-R et d'autres entités qu'il pourra définir. Il peut co-opter jusqu'à huit autres personnes actives dans des travaux couverts par ses termes de référence. Il nommera son propre président, sa Commission d'appartenance nommant alors un représentant en remplacement.

*Termes de Référence*

1. Initier, promouvoir et coordonner les activités inter-commissions dans le domaine des télécommunications sur des sujets précis à identifier et par l'organisation de symposiums communs.

2. Identifier les domaines d'intérêt commun à l'URSI et à l'UIT-R ou autres organisations, et échanger les informations pertinentes entre les Commissions de l'URSI et les groupes de travail (e.g. Groupes d'Etude de l'UIT-R), et promouvoir les activités de collaboration.
3. Informer la communauté de l'URSI des activités de l'UIT-R et similaires par l'intermédiaire du 'Bulletin des Sciences Radio'.
4. Initier, coordonner et transmettre toute contribution formelle de l'URSI à l'UIT-R ou organismes similaires.

#### **U.4. Communication avec le Bureau de l'URSI**

Le Conseil de l'URSI

##### *Considérant*

- a) Qu'il est de la plus haute importance qu'un contact étroit soit maintenu entre le Bureau de l'URSI d'une part, les représentants des Comités Membre, les Présidents et vice-Présidents de commission et les membres des comités permanents d'autre part ;
- b) Que cette proximité et cette communication réciproque des différentes structures de l'URSI entre elles permet d'apporter une aide efficace au bureau ;
- c) Que les technologies actuelles de l'information et de la communication permettent, à faible coût et sans lourdeur excessive, de mettre en œuvre ces principes ;

##### *Recommande*

- 1) Que le calendrier annuel des réunions du Bureau de l'URSI soit connu des représentants des Comités Membre, des Présidents et vice-Présidents de commission et des membres des comités permanents par tout moyen choisi par le bureau ;
- 2) Que l'ordre du jour des réunions de Bureau soit adressé aussitôt que possible aux personnes définies à l'article (1) pour permettre une communication réciproque ;
- 3) Que le compte rendu de ces réunions soit adressé aux personnes définies à l'article (1) dans les meilleurs délais.

#### **U.5. Groupe de Travail Inter-commissions sur l'Atmosphère Moyenne**

Le Conseil de l'URSI,

*Reconnaissant* l'importance des études de l'atmosphère moyenne pour comprendre les problèmes de changement global ;

##### *Notant*



- a) que des techniques éprouvées existent pour appliquer les ondes électromagnétiques à l'étude (i) de la physique et de la chimie de l'atmosphère moyenne, (ii) du couplage de l'atmosphère moyenne avec les régions d'altitudes inférieure et supérieure ;
- b) que ces sujets font partie des termes de référence des deux commissions G et F ;

*Décide* d'établir un Groupe de Travail Inter-commissions sur l'Atmosphère Moyenne, avec les termes de référence suivants :

- 1) Coordonner au sein de l'URSI et avec les autres membres de l'ICSU les activités associées aux études de la moyenne atmosphère ;
- 2) Estimer les recherches nécessaires à la compréhension des processus dynamiques de l'atmosphère moyenne et de la climatologie de ces régions, et couvrir, par exemple, le développement et l'application : (i) des radars MST et autres techniques radios, (ii) des lidars et autres techniques optiques, et (iii) des techniques de télédétection passives satellitaires ou au sol.

#### **U.6. Groupe de Travail Inter-commissions sur la Télédétection Atmosphérique à l'aide de Systèmes de Navigation par Satellite**

Le Conseil de l'URSI,

*Considérant*

- a) l'importance d'utiliser les observations dans l'espace et au sol des signaux GPS et GLONASS pour surveiller l'environnement global de l'atmosphère,
- b) l'utilisation que les futures observations spatiales de la température de la basse atmosphère et des densités électroniques de l'ionosphère feront de cette technique ;

*Décide* d'établir un Groupe de Travail Inter-commissions sur la Télédétection Atmosphérique et la Propagation à l'aide des Systèmes de Positionnement par Satellite (GPS/GLONASS), avec, pour coordinateur, Bertram Arbesser-Rastburg (ESA, Pays-Bas) et, pour représentant de la commission F, Cathryn Mitchell (Royaume Uni).

#### **U.7. Radioscientifique URSI**

Le conseil de l'URSI,

Ayant examiné le rapport du Comité de Planification à Long Terme

*Décide* d'accepter la recommandation du Comité de Planification à Long Terme demandant au Bureau de mettre en place le statut de 'Radioscientifique URSI' (remplaçant le concept de 'Correspondant URSI')

## **U.8. Programme de Conférencier de l'URSI**

Le Conseil de l'URSI,

*Ayant examiné* le rapport de Comité de Planification à Long Terme

*Décide* d'accepter la recommandation du Comité de Planification à Long Terme demandant au bureau de mettre en place un programme de 'Conférencier URSI'

## **U.9. XXVIIIe Assemblée générale**

Le Conseil de l'URSI,

*Ayant examiné* les invitations pour la XXVIIIe Assemblée générale soumises par les comités membres de l'URSI en Chine (Pekin ou Beijing), Inde (New Delhi) et aux Etats-Unis (Denver, Colorado) ;

*décide*

1. d'accepter l'invitation du comité indien de l'URSI pour organiser la XXVIIIe Assemblée générale à New Delhi en octobre 2005;
2. d'adresser aux comités membres en Chine (CIE) et aux Etats-Unis ses remerciements pour leurs invitations.

## **U.10. Remerciements au Comité néerlandais de l'URSI**

Le Conseil de l'URSI,

*Décide* à l'unanimité de transmettre au comité néerlandais ses vifs remerciements et son appréciation pour l'organisation de la XXVIIe Assemblée générale à Maastricht.

## **RÉSOLUTIONS, RECOMMANDATIONS ET AVIS DES COMMISSIONS**

### **Résolution conjointe des Commissions G et H**

#### **C.1 Sondage par diffusion incohérente et turbulente en Antarctique**

Les Commissions G et H,

*Considérant*

- a) que des paramètres importants pour la description de l'ionosphère et de l'atmosphère peuvent être obtenus par la technique de sondage par diffusion incohérente,
- b) qu'il n'existe pas de tel sondeur dans la région antarctique,
- c) qu'un tel sondeur aiderait à améliorer notre compréhension de l'environnement terrestre et de ses changements climatiques, et plus particulièrement la structure et la dynamique de la basse, moyenne et haute atmosphère ;

*Décide* d'inciter la communauté scientifique à construire une station de sondage par diffusion incohérente en Antarctique.

#### **C.2 Résolution sur un Groupe de Travail Inter-Commissions sur les SES (Satellites d' Energie Solaire)**

La Commission H,

*Considérant,*

- a) que la recherche en SES est devenue de plus en plus importante en vue d'une source possible d'énergie propre pour l'humanité et que l'un des problèmes clés est le transmission d'énergie micro-onde (TEM) entre l'espace et le sol,
- b) que l'URSI – qui couvre divers domaines reliée à la TEM- devrait contribuer aux SES,

- c) que la technologie de TEM n'a pas encore explicitement du ressort des commissions existantes, bien qu'il y ait un intérêt émergeant dans plusieurs commissions, et
- d) que ce domaine a été jusqu'à présent couvert par une session de l'Union au congrès AP-RASC et une session Spéciale H à ce congrès,

*Décide*

- 1) qu'en plus des technologies et de la science des SES, des problèmes reliés tels les interférences et la compatibilité des SES avec les environnements doivent être discutés,
- 2) qu'un groupe de travail inter-commissions doit être créé afin de discuter tous les aspects des SES et des la TEM
- 3) que le groupe de travail inter-commissions doit contribuer à l'évaluation des technologies actuelles des SES et au développement de nouvelles ainsi qu'à la clarification et à la réduction des interférences provoquées par les SES.