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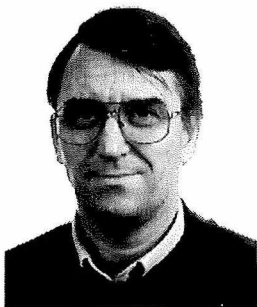
## Editorial



Dear URSI Correspondent,

Welcome to the autumn issue of the Radio Science Bulletin.

This issue of our URSI Bulletin is rather thin. You will find reports about past and recent events, such as Radio Africa 1999, Commsphere India 2000 or CEEM 2000 and CPEM 2000. These reports are interesting especially to the correspondents of the respective commissions who did not have the



opportunity to join colleagues attending these conferences.

In the administrative part of our Bulletin, you will find announcements about future conferences sponsored or cosponsored by our Union along with an event calendar. May I suggest you to have a look at it for scheduling your participation to future URSI meetings?

I wish you a pleasant reading.

Piotr Sobieski  
Editor

## UTC Time Step



On n'introduira pas de seconde intercalaire à la fin de décembre 2000.

La différence entre UTI et le Temps Atomique International Tai est :

du 1er janvier 1999, 0h UTC, jusqu'à nouvel avis : UTC - TAI = -32 s

Des secondes intercalaires peuvent être introduites à la fin des mois de décembre ou de juin, selon l'évolution de UTI-TAI. Le Bulletin C est diffusé deux fois par an, soit pour annoncer un saut de seconde, soit pour confirmer qu'il n'y aura pas de saut de seconde à la prochaine date possible.

No positive leap second will be introduced at the end of December 2000.

The difference between UTC and the International Atomic Time TAI is :

from 1999 January 1, 0 h UTC, until further notice : UTC - TAI = -32 s

Leap seconds can be introduced in UTC at the end of the months of December and June, depending on the evolution of UTI-TAI. Bulletin C is mailed every six months, either to announce a time step in UTC, or to confirm that there is no time step at the next possible date.

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As reported in RSB No.293, four important events of ITU-R took place in Istanbul during the months of May and June. The most significant of these was the World Radiocommunication Conference, WRC-2000, at which over 2300 delegates from the ITU membership participated in four weeks of intense deliberations that will pave the way for the expansion of existing telecommunication services and the development of new technologies and applications. The results of some of the major issues are summarised here.

## **IMT-2000 third generation mobile systems**

Three additional frequency bands were identified for third generation (3G) mobile systems (IMT-2000) which will enable high quality mobile multimedia services to be brought to a world-wide market estimated to reach 2 billion users by 2010. The new bands (806-960 MHz, 1710-1885 MHz and 2500-2690 MHz) are available on a global basis for countries wishing to implement the terrestrial component of IMT-2000 but the agreement does not preclude the use of the bands for other types of application or by other services to which the bands are allocated. The agreement also allows each country the flexibility to decide on the time-scale for implementation, depending on its own wishes regarding licensing and equipment availability. The Conference also identified additional frequency bands for the satellite component of IMT-2000.

## **Global satellite positioning systems**

The Conference provided additional frequency allocations (between 1 and 5 GHz) for the radionavigation-satellite service. The new spectrum will make it possible for the two current systems – Russia's GLOSNASS and the USA's GPS – to develop into second generation systems, while at the same time allowing room for Europe's new system, GALILEO. Measures were agreed to avoid sharing problems in the new bands between the two current systems and existing services, as well as to protect radionavigation systems that provide a safety-of-life aspect to aviation and shipping.

## **Sharing between non-geostationary and geostationary satellite systems**

The Conference addressed the problems of sharing between non-geostationary (non-GSO) satellite systems and geostationary satellite (GSO) networks in the fixed service bands between 10 and 30 GHz. This arises from the proliferation of newly planned voice and data services using non-GSO satellites and their need to coexist with the growing number of GSO networks aimed at providing high speed local access to global broadband services. The results obtained ensure protection of GSO networks while at the

same time allow new non-GSO systems to develop and operate without undue constraint. They include imposing power limits on non-GSO systems – limits that will also serve to protect terrestrial and broadcasting-satellite systems operating in the same bands. Another issue concerned the size of antennas used by the fixed-satellite service in the 13/14 GHz band and the need for a mandatory minimum limit in order to reduce interference to radars.

## **Radioastronomy and science services**

In recognition of the increasing difficulties for passive services such as radioastronomy to coexist with (active) radiocommunication services, the Conference agreed to a number of measures to improve protection to scientific services in some commonly used frequency bands. In addition, the Conference also provided new allocations to passive services in several bands as well as agreeing a world-wide primary allocation to the Earth exploration-satellite (passive) and space research (passive) services in the band around 18 GHz. Authorisation was also given to radioastronomy and deep space services to use, for experimental purposes, spectrum not yet allocated above 275 GHz.

## **High-density fixed systems (HDFS)**

This item addresses the growing number of new wireless point-to-point and point-to-multipoint systems providing fixed wireless access to a wide range of services stemming from broadband applications to low cost monitoring facilities. WRC-2000 provided spectrum for HDFS in bands between 30 and 60 GHz and also established, on a provisional basis, sharing conditions (e.g. power limits) and regulatory provisions to allow such systems to share with existing and future services, in particular space services (GSO and non-GSO) and radioastronomy. These limits will be re-examined at the next Conference in 2003.

## **High altitude platform stations (HAPS)**

The Conference recognised that additional studies were required on the conditions for HAPS to share with other services in the allocated frequency bands around 47 GHz. Additional spectrum is sought for HAPS in the fixed service bands between 18 and 32 GHz. Studies are also requested to consider the possibility of employing HAPS in the fixed and mobile service in bands above 3 GHz. The results of these studies will be examined at the next Conference in 2003.

## **Broadcasting-satellite service**

One of the major achievements of WRC-2000 was to draw up and agree a new frequency plan for Europe, Africa and the Asia-Pacific region for the broadcasting-satellite service

at 12 GHz. The plan provides, in general, one orbital slot per country from which an equivalent of 10 analogue channels can be delivered in Europe and Africa, and 12 channels in the Asia-Pacific region. Further studies are required to ensure compatibility of the plan with existing and future terrestrial and space services sharing the same band.

### **Allocations above 71 GHz**

The Conference agreed to re-arrange the allocations above 71 GHz to correspond to the needs of the Earth exploration-satellite, space research and radioastronomy services, with regard to both spectrum and protection requirements. The re-arranged allocations also take account of the spectrum requirements and sharing possibilities of active services with a view to maximising compatibility between all potential users.

### **Spurious emission limits**

The Conference confirmed spurious emission limits for space services contained in Appendix S3 to the Radio Regulations. It was decided that the next Conference should review the results of studies on the boundary between spurious and out-of-band emissions and further studies will be conducted on regulatory measures concerning the protection of passive services from unwanted emissions, in particular from space service transmission.

The Radiocommunication Assembly, held during the week prior to WRC-2000, reviewed and approved the work programme of the ITU-R Study Groups for the forthcoming study period, 2000-2003. The work programme is "defined" by some 400 ITU-R Questions allocated to the various Study Groups according to their terms of reference. Amongst

the ITU-R Recommendations submitted to the Assembly was that containing the detailed specifications of the radio interfaces of IMT-2000, the approval of which gave impetus to the decisions on 3G mobile systems at WRC-2000. As regards Study Group structure, the former Study Group 10 (sound broadcasting) was combined with Study Group 11 (television broadcasting) to form a new Study Group 6 covering all aspects of broadcasting. The Assembly also elected new, or confirmed existing, Study Group chairmen and vice-chairmen. The ITU-R Resolutions dealing with the more administrative aspects of the Sector's functions were also reviewed and revised as necessary.

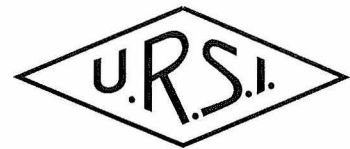
### **Preparation for WRC-03**

The next World Radiocommunication Conference is scheduled for June 2003. At meetings held immediately after WRC-2000, plans were laid down for the necessary preparatory studies within ITU-R, the majority of which are specified in Resolutions passed by WRC-2000. Some of the items on the agenda include:

- HF broadcasting (new modulation techniques, adequacy of current allocations)
- Radionavigation satellite and radiolocation services
- Amateur and amateur-satellite services
- HIPERLAN systems (around 5 GHz)
- High density fixed systems
- Unwanted (out-of-band emissions)
- Interactive wide-band multimedia services
- High altitude platform stations

As in the past, the studies undertaken in the Study Groups will be consolidated and agreed at a Conference Preparatory Meeting (CPM) which is scheduled to take place towards the end of 2002.

Kevin A. Hughes



### RADIO AFRICA '99

Gaborone, Botswana, 25-29 October 1999

Persuant to resolution 10 of the Second Regional Workshop on Radio Communications in Africa (Radio Africa '97), the Third Regional Workshop on Radio Communications in Africa took place in Gaborone, Botswana, from 25<sup>th</sup> to 29<sup>th</sup> October 1999. The theme of the Workshop was "Rural Communications for Development in Africa." One hundred delegates from 12 countries registered for the 5-day event, which was held at the Botswana Conference & Exhibition Centre. The countries represented were Bangladesh, Botswana, Brazil, Canada, Ghana, Italy, Kenya, Nigeria, South Africa, Switzerland, Swaziland, and United States of America.

National, regional, and international organisations represented included the following: International Telecommunications Union (ITU, Geneva,); International Centre for Theoretical Physics (ICTP, Trieste, Italy); Anatel (Brazil); Communications Research Centre (Ottawa, Canada); INTELSAT (Washington D.C.); Independent Broadcasting Authority (Pretoria, South Africa); South African Telecommunications Regulation Authority (SATRA); South African Broadcasting Corporation (SABC); Communications Commission of Kenya (CCK, Nairobi); and Botswana Telecommunications Authority. Other organisations included: Telkom Kenya, Botswana Telecommunications Corporation, Mascom Wireless (Botswana), Vista Cellular (Botswana), ZS Botswana, Simoco International (South Africa), and Freeplay Foundation (South Africa).

Academic and research institutions represented included: University of Durban-Westville (South Africa); EM Systems & Software (Stellenbosch, S. Africa); Ladoke Akintola University of Technology (Nigeria); Politecnico di Milano (Italy); Obafemi Awolowo University (Ile Ife, Nigeria); University of Science & Technology, Chittagong (Bangla Desh); University of Nairobi (Kenya); University of Swaziland; Kenya College of Communications Technology (Nairobi); United States International University Africa Campus (Nairobi); Maseno University College (Kenya); Botswana Technology Centre; and University of Botswana. Government departments included: Department of Information & Broadcasting; Botswana Police Department; Department of Meteorological Services; Botswana Defence Force; and Department of Civil Aviation. The media representatives were from Botswana Press Agency (BOPA), and The Voice.

Most of the 34 international delegates arrived on 23<sup>rd</sup> and 24<sup>th</sup> October, and were accommodated and registered

at Oasis Motel. The local delegates were registered on Monday 25<sup>th</sup> October 1999, after the Opening Session.

#### Opening Session

The first session of the Workshop took place from 8:30 a.m. to 10:00 a.m. on 25<sup>th</sup> October 1999. To grace this occasion were many prominent personalities. The Minister of Works, Transport and Communications, Hon. David N. Magang; opened the Workshop. The Vice-Chancellor of the University of Botswana, Prof. Sharon Siverts, gave the Welcome Address, and the Executive Chairman of Botswana Telecommunications Authority, Mr. C.M. Lekaukau, gave the Keynote Address. Messages of Goodwill were received from the following: Prof. Sandro Radicella, on behalf of ICTP; Dr. Kevin Hughes, on behalf of ITU; Prof. Tesi Raji, who represented Prof. Gabriel Ajayi and the Founders of Radio Africa during the Workshop; Dr. Roderic Olsen, on behalf of Communications Research Centre of Canada; and Mr. Dickson Oming'o, on behalf of Radio Africa '97 Secretariat.

In his Opening Speech, Minister Magang highlighted the relevance of the Workshop theme to the rural communities in Botswana and Africa in general, where the need for any type of communication cannot be overemphasised. He therefore invited delegates to seriously deliberate on the socio-economic impact of radio communications on rural areas. Prof. Siverts, in her Welcome address, praised the close relationship that the University of Botswana, through Physics Department, has had with the ICTP. She hoped that this collaboration would be extended to encompass radio-wave propagation studies currently being undertaken by researchers at the Department of Electrical Engineering of the University, for the benefit of radio broadcasters, operators, and regulators in Botswana. In his Keynote Address, Mr. Lekaukau highlighted the importance of radio as a cost-effective communications medium for the information society – especially for vast, sparsely populated countries such as Botswana. He stressed the need for proper management of the radio spectrum to avoid prohibitive costs associated with poor management and monitoring of this scarce resource.

#### Technical Sessions

There were a total of 12 technical sessions during the Workshop.

Rural Communications for Development in Africa, chaired by Mr. Ephraim Nkomo and Mr. Vikani Masuku, both of

Botswana Telecommunications Corporation. The two-hour session had two presentations, from Prof. Gabriel Ajayi (presented by Prof. Tesi Raji), and from Prof. Sandro Radicella.

Rural Communications, chaired by Dr. Pawlina-Bonati and Dr. Peter Chitamu. There were five presentations, from Dr. Thomas Yesufu, Prof. Lutfur Rahman, Ms. Julia Kukard with Ms Debra Masson, Mr. Paul Nalikka, and Dr. Farhad Aghdasi with Mr. Obok-Opok.

Telecommunications Policy, chaired by Prof. S.J. Shine and Mr. T. Motsoela. There were four presentations, from Dr. Kevin Hughes, Mr. Rogers Ngotwa, Councillor Kenneth Herold, and Mr. Stanley Kibe.

Radio and Television Broadcasting, chaired by Prof. Mauro Assis and Mr. Zibani Makali. There were two presentations both by Mr. Lynn Mansfield and Mr. Theunis Nel, of SABC.

Fibre Optics, chaired by Prof. Sandro Radicella and Dr. John Adedoyin. There were two presentations, from Mr. Dickson Oming'o and Dr. Vinod Sharma.

Cellular Networks and Mobile Communications, Chaired by Dr. Kevin Hughes and Mr. Suthani Mazhani. There were three presentations, from Prof. M. Assis, Dr. Farhad Aghdasi, and Dr. James Daka.

Tropospheric and Ionospheric Propagation, chaired by Prof. Tesi Raji and Dr. Rod Olsen. Seven papers were presented, by Dr. Olsen, Prof. Robert Akello, Dr. Thomas Yesufu, Prof. Sandro Radicella, Dr. Apolonia Pawlina-Bonati, Dr. Thomas Afullo, and Dr. John Adedoyin.

Social Aspects of Communications, chaired by Dr. Thomas Afullo. There were three presentations, from Mr. Dickson Oming'o (for Jared Baraza), Ms Grace Koteng', and Mr. Samuel Ritchie.

Signal Processing and Coding, chaired by Prof. Meoli Kashorda and Dr. Thomas Yesufu. There were three presentations, from Prof. Stanley Mneney, Dr. Peter Chitamu, and Mr. Musa Adongo.

Electromagnetic Compatibility and EM Theory, chaired by Dr. Frans Meyer and Dr. Joseph Mukolera. Three papers were presented - one by Prof. Robert Akello, and two by Dr. Frans Meyer.

Multimedia and Private Communications Networks, chaired by Prof. Stanley Mneney and Dr. Joseph Mukolera. Two papers were presented - one by Prof. Meoli Kashorda, and one by Mr. Robin Goodwin.

### **Brainstorming session Resolutions of Radio Africa'99**

This session, chaired by Prof. Tesi Raji and Mr. Dickson Oming'o, passed the following resolutions after a lengthy deliberation:

1. That the hosting country assumes the role of Secretariat for Radio Africa for the following two years after hosting the Workshop. In the case of Botswana, this means that the Secretariat will be based in Gaborone from 1999 to 2001. The role of the Secretariat includes the proper co-ordination of Radio Africa activities and information dissemination, including producing a periodic newsletter, and later, a Journal.

2. That a request be made so that the Radio-communication Research & Development Centre be hosted at the Obafemi Awolowo University UN Space Education Centre
3. That radio scientists and engineers should initiate research that addresses local and/or regional needs.
4. That co-operation between communications industries and scientists be initiated aggressively for mutually beneficial results.
5. That emphasis should be placed on the pursuit of viable radio technologies for rural access systems in Africa,
6. That African countries should address themselves to issues affecting their participation in ITU, IEC, and URSI activities.
7. That the next host of Radio Africa 2001 shall be determined as follows:
  - a) The Secretariat shall contact the appropriate institutions and personalities in Ghana to determine if they are willing to host the Workshop.
  - b) In the event that the Ghana option fails, the Secretariat shall invite Nigeria to host the Workshop (the Nigerian delegation at Radio Africa'99 Workshop have already affirmed their willingness to be the default hosts, if Ghana opts out).
  - c) In the event that Nigeria also experiences difficulties in playing host, then the Secretariat shall contact other countries represented in radio Africa'99.
  - d) The decision on the host country shall be circulated to all participants of Radio Africa'99.

### **Closing Session**

Mr. Meshack Mokone, the Community Services Manager of Mascom Wireless of Gaborone, Botswana, chaired this session, which took place on Friday 29th October 1999 at 8:30 a.m. Prof. Meoli Kashorda presented the rapporteur's report. Messages of farewell were received from the guest speakers, namely, Prof. Radicella, Dr. Hughes, Dr. Olsen, Prof. Raji, Prof. Akello, Dr. Pawlina-Bonati, and Prof. Assis. The Chairman of the Local Organising Committee, Mr. Tsietsi Motsoela, introduced members of the committee of Radio Africa'99 Workshop and bade farewell to the delegates. Eng. Arthur Ogwayo of Communications Commission of Kenya (CCK) gave the vote of thanks.

The Group Manager Corporate Business and Regulatory Affairs of Botswana Telecommunications Corporation, Ms Mmasekgoa Masire-Mwamba, gave the Closing Speech. In her address, she reaffirmed that radio remains a central and key component of effective development, particularly in rural areas. She stressed that since telecommunications and access to information stimulated economic development, they had to be regarded as a human right. She thanked the participants and organisers for selecting Botswana as the host of Radio Africa'99.

### **Sponsors**

The following organisations sponsored Radio Africa'99 Workshop:

1. Abdus Salaam International Centre for Theoretical Physics (ICTP), Trieste, Italy.

2. International Development Research Centre (IDRC), Regional Office for Eastern and Southern Africa, Nairobi, Kenya.
3. International Union of Radio Science (URSI), University of Gent, Belgium.
4. Botswana Telecommunications Authority, Private Bag 00495, Gaborone, Botswana.
5. Botswana Telecommunications Corporation, P.O. Box 700, Gaborone, Botswana. E-mail: megaleng@btc.bw
6. MASCOM Wireless, Private Bag B0298, Broadhurst, Gaborone, Botswana. E-mail: mascom@info.bw
7. University of Botswana, Private Bag UB0022, Gaborone, Botswana
8. Info Botswana Internet Services (IBIS) (PTY) Limited, P.O. Box 40393, Gaborone. E-mail: ibis@info.bw
9. Z.S. Botswana (PTY) Limited, P.O. Box 40091, Broadhurst, Gaborone, Botswana. E-mail: tmm@global.bw.
10. Yarona FM, Gaborone, Botswana.
11. Apple Centre (Botswana) (PTY) Limited, P.O.Box 1231, Gaborone, Botswana.

### Appreciation

The Local Organising Committee is grateful for the generous support received from all the sponsors, the delegates who chaired the various sessions, the rapporteurs (Prof. Meoli Kashorda and Dr. Peter Chitamu), the exhibitors (ZS Botswana, Apple Centre Botswana, and Freeplay Foundation) and all delegates.

With regard to the contributions towards the success of the Workshop, particular mention must be made of the following institutions:

1. International Centre for Theoretical Physics (ICTP). The ICTP, which was represented by Prof. Sandro Radicella, has played a key role in initiating the Radio Africa Workshop series. At the Radio Africa'99 Workshop, the ICTP sponsored the travel for Guest Speakers, as well as presenting one of the invited papers. The LOC acknowledges this very strong supportive role, and hope it continues in the future.
2. Botswana Telecommunications Authority. The Executive Chairman of BTA, Mr. C.M. Lekaukau, was also the Patron of Radio Africa'99. His personal interest and untiring intervention enabled the Workshop to obtain enormous material, logistic, and related support from local institutions and Government departments. He placed his personal esteem on the line for the success of Radio Africa'99. The LOC Chairman, Mr. Tsietsi Motsoela, also of BTA, worked tirelessly both during LOC meetings and at other informal fora towards the same end. The LOC is deeply indebted to BTA for this invaluable service, in addition to its considerable financial contribution.
3. The University of Botswana. The Vice-Chancellor, Prof. Sharon Siverts, took a keen interest on the Workshop from the very outset. She willingly accorded the Secretariat and the LOC her personal support, attention, and time, and was continually briefed on the progress of the LOC. Whenever institutional support was required for the Workshop, she readily committed the UB as the host institution. Through her office, the UB made a generous financial contribution to Radio Africa'99. At Faculty level, the Dean of FET, Prof. S.J. Shine, was equally supportive and concerned about the success of the Workshop. The LOC is most grateful to the UB for this contribution.

Dr. Thomas J. Afullo

## ICCEA'99

Beijing, China, 1-4 November 1999

The second International Conference on Computational Electromagnetic and Its Applications (ICCEA'99) was held successfully on November 1-4, 1999 at Media Center hotel, Beijing, China. The conference was sponsored by the Chinese Institute of Electronics (CIE), co-sponsored by International Union of Radio Science (URSI) and technical co-sponsored by the IEEE Antenna and Propagation Society. This conference also supported by the Beijing Institute of Technology and the China National Foundation of Nature Science.

About 220 submissions were received, and 170 papers were accepted and included in the Proceedings. 140 participants from 17 countries and regions attended this conference. The technical program consisted of an opening ceremony, an invited plenary session, and 24 technical parallel sessions, in which one hundred fifty-eight papers were scheduled for oral presentation.

In the evening of November 1, the welcoming reception was held from 6:00 PM to 8:00 PM in the multi-function hall in the hotel. Participants and their companions

were invited to enjoy Chinese dishes and wine. The farewell banquet was held on the evening of November 3, a greeting address was given by Prof. Z. Sha, after the speech, the banquet was in full swing, and people were greeting and meeting everywhere in the hall, and making promises to meet again. On the Thursday, November 4, a one-day excursion was scheduled to the Great Wall and Ming Tombs.

On the morning of November 1, the opening ceremony and the plenary session were held at the Multi-Function Hall in the hotel. The opening ceremony was kept steadily advancing by the Chairman of the Technical Program Committee, Prof. Benqing Gao, of the Beijing Institute of Technology. The General Chairman, Prof. Zong Sha, and the President of the CIE National URSI Committee and the Deputy President of CIE gave the first welcoming address. The co-General Chairman, DR. W. Ross Stone, and Editor-in-Chief of IEEE AP Magazine gave the next.

The welcoming address was followed by the plenary session, six invited lectures.



Invited lectures were given by Dr. Lee W. Henderson of Olson & Bear LLP, USA, under the title, "The Patentability of Software and Mathematical Algorithms for Computational Electromagnetics"; Prof. Benging Gao of the Beijing Institute of Technology, China, with the title, "Recent Progress of Computational Electromagnetics in China"; Prof. Kiyotoshi Yasumoto of Kyushu University, Japan, with the title "Numerical Analysis of Dielectric Waveguides Using Periodic Boundary Conditions"; Prof. Shixiong Li of Anhui University, China, with the title "High Frequency Approximation of Wave Equations, Caustic and Shadow"; Prof. George Pan of Arizona State University, USA, with the title, "Wavelets in EM and Microwave Device Modelling"; and Prof. Nader Engheta of the University of Pennsylvania, USA, with the title, "Fractional Derivatives, Fractional Integrals and Electromagnetic Theory".

In the afternoon of November 1 and all day of November 2, and 3, 24 the technical parallel sessions were held in three rooms in the hotel. The topics of these sessions were very wide, and covered almost all fields of the Computational Electromagnetic and its Applications. These topics were Analytical Method, Finite-Difference Time-domain Method (FDTD), Numerical Method, Genetic Algorithm and Wavelet Analysis, Antenna Array, Antenna Analysis and Optimisation, Microstrip Patch Antenna and Transition, Aperture Antenna, Radar Image and SAR, EMI/EMC, Dielectric, Magnetic and Complex Media, Optical Waveguide and Devices, Transmission and Waveguide, Microwave and Millimetre Components, Electromagnetic Scattering, Electromagnetic Scattering, Radar Cross Section, Bioelectromagnetics, Remote Sensing, Diffraction and Signal Processor, Communication and Broadcast, Computer Software Technique.

## COMMSPHERE 2000

Shennai, India, 28 February - 2 March 2000

Accessibility to telecom network is fast becoming a major factor determining the competitiveness of an individual, group, or society. Telecom and IT systems and solutions prevalent in the developed countries are not necessarily the best options for developing countries for making the network affordable and available to large sections of their people. For example, India has a teledensity (phones per 100 people) of barely two as against 50 in the Western world. The current costs of around \$1,000 to build infrastructure for a single line is too high for this country. Once finance costs, operations, maintenance and obsolescence are taken into account, a revenue of \$300 per year is required from each phone line simply to break even. "In most developing countries, \$300 per year for a telephone is accessible to less than five per cent of the population. How then can one hope for the development of telecom infrastructure and look for even some semblance of universal Internet access?" asks Ashok Jhunjhunwala, Professor, IIT Madras. While there have been very significant advances in telecom-related science in recent decades, most of these in developed countries have focused on providing better services and greater bandwidth to the user at a reducing cost which is affordable to most in these countries. The requirement in developing countries is, however, significantly different: to provide lower-cost basic access with a reasonable basket of important services such as Internet and voice communication. All the known techniques need to be harnessed to reduce the cost of telecom infrastructure in developing countries to, say, 25%-40% of the current costs. Such an endeavour alone can make telecom and Internet services widely affordable in the developing countries.

The Commsphere 2000 International Conference on "Affordable Telecom and IT Solutions for Developing Countries" organised by IIT Madras between Feb.28-

Mar.2, 2000, witnessed many focused discussions on the above issue. One of the key points which emerged during these discussions was that in addition to developing indigenous, cost-effective products, it is equally important to come up with innovative franchise-type service provisions.

The Government should open up the telecom sector by following the franchise model, rather than by auctioning the operation in large regions of a country. This was the unanimous call at the Commsphere 2000 conference.

The franchise model not only enables the rapid spread of the technology by allowing many small traders/businessmen to participate, but also provides a vital face-to-face interaction between the local service provider and the customer. Like the cable-TV model, the franchised basic phone plus Internet service will be driven by customer satisfaction, to ensure high uptime and good quality connectivity. In the following, we provide a report about some of the other highlights of the conference.

The focus of the Commsphere 2000 conference was on technologies and innovations which could make this possible in the not-too-distant future. The interconnection of computers spread over wide areas is the key to the growth of Information Technology. Low-cost innovative IT solutions are a must if IT is to make a mark beyond the top few percent of the population of developing countries. Hence non-conventional telecom, computer networking, and IT solutions that promise value-added services at significantly lower cost, were discussed at this conference.

The conference was preceded by 7 tutorial sessions on key access technologies on March 28, including Access Terminals, Wireless Access, xDSL Access, NMS, Access on Hybrid Fibre-Coax, Internet Networking and Optical Networks. There were 18 tutorial speakers, with 10 of them

from leading industries in India and abroad. The tutorials were very well attended, and most of the attendees were from industry.

The conference had 17 technical sessions spanning three days (Feb.29-Mar.2), with 70 (of the scheduled 73) speakers presenting their views. The speakers came from industry, government, private institutions and academia, and were drawn from various countries including Nigeria, Ethiopia, Brazil, Bangladesh, Nepal, Tunisia, South Africa, Belgium, Singapore, Malaysia, USA, UK, and India.

Prof. M.G.K. MENON, former Minister of State for Science and Technology, in his inaugural address said "Software share prices are zooming. This sector has the highest market capitalisation and has created millionaires. But the country's policymakers can't be misled by that. Software and telecom must represent an improvement in the life of the people of the country. We can't be misled by the glitter we see in newspaper headlines." He also emphasised the point that while a country can develop software expertise quite easily, it is more difficult and in the long term, more important to develop Telecom expertise. Only indigenous Telecom infrastructure design and development can keep costs down, and facilitate the spread of IT in developing countries and also sustain software exports.

The technical sessions covered various topics including telecom needs of developing countries, cost-effective solutions, technological innovations, manpower training, network planning and management issues. An overview of a sampling of these talks is provided below.

N.K.SINHA, Member-Technology, Telecom Commission of India, said that the Department of Telecommunications (DOT) will be adding 4.6million lines this year and another five million lines next year. Plans are on to lay 1,000 route kms of optical fibre cables. The national Internet backbone will be ready by end 2000 to connect 400-500 Internet nodes spread throughout the country. India plans to increase the tele-density to 7% from the current level of 2.6% by 2005, and subsequently hike it to 15% by 2010. (Courtesy: from a report by Venkatachari Jagannathan, [www.domainb.com](http://www.domainb.com))

ARUNMEHTA, President, STEM-India-emphasised that though ADSL, WLL, PLCC and Cable Modems show much promise, one should really look at providing even more low-cost solutions, say as affordable as a commercial radio. He also spoke about the need for technologists to take greater interest in policy-making in the area, and to engage in technological activism - making things happen in support of poor people getting access.

PETER O'NEILL, freelance journalist from UK, said that it is now possible using powerline communications to give 4.5 billion people the ability to leapfrog on to the Web wherever there is electricity supply, even without a traditional phone line connection and without a personal computer.

SAMUDRA HAQUE, a Minnesota-trained computer scientist who runs an ISP (Internet service provider) in Bangladesh, has a unique solution for which he has just had a patent registered in Dhaka. "We're combining the best

elements of radio engineering, telecommunications and computer science to offer a high-speed communication network in remote rural villages (in Bangladesh) spread over large areas. And we are doing this with relatively small budgets too," Haque told India Abroad News Service (courtesy: Frederick Noronha).

RAJEEV SANGAL of IIIT's language technology research centre, Hyderabad, India reported about early versions of machine-translation from one Indian language to another developed by his group in five Indian language pairs. Work is on in Hyderabad on a large-scale system which will allow e-texts, including Web-pages, to be accessed by Hindi readers on demand.

P.R. GOUNDAN of South-Central Railways said that by using the copper and optical fibres of the Indian Railway network, along with the access solutions developed by IIT Madras, Internet and telecom services can be provided to about 4,000 towns, giving out 100,000 Internet connections in about two years at barely Rs.15,000 (US\$ 350) per connection.

HARIOM SRIVASTAVA, All India Radio Director for planning and development talked about the DAB (digital audio broadcasting) pilot services that are planned to be started in India. There are still no Indian manufacturers for digital audio receivers. "We feel that if DAB is started, because of the big population in India (including a significant middle-class), the need for receivers will be very high, and costs could drop further," he added. Currently, he pointed out, India was also witnessing the final stages of bidding for the 108 private FM stations that are being set up across 40 broadcasting centres in India.

FAZLUR RAHMAN from Bangladesh said Networking telecommunication infrastructure - specially in the rural areas where 80% of its people live - is not normally affordable. The strategy needs increased productivity of existing resources, lowering the cost of infrastructure, diversification of services and concentration only on core competencies. Sharing existing infrastructure, like the use of railway fibre optic network, use of power pylons for overlaying optical fibre cable networks and sharing the capacity by all operators are reducing the investment cost. He further observed that Combined efforts by the government, non-government groups, financial institutions and local people are required for the networking revolution,

ABDELHAK, ADEL GHAZEL, K. BOULEIMAN - Tunisian researchers, reported development of an interactive virtual environment for web-based teaching and learning. This low-cost platform was developed in collaboration with INRS Telecommunications of Quebec. Using hypertext links, the environment offers a rapid and easy access to related documents and sites. Course documents contain text, graphics, animations, audio and video clips. This platform also integrates some communication facilities (chat, e-mail, conferences) to encourage interaction between students and teacher. The platform is currently under evaluation. One of the first courses developed is about electromagnetic compatibility (EMC) and its applications in telecommunications.

SUGATA MITRA described his work with the slum children Slum-children and Non English Speaking Kids are taking to computers in a jiffy. So reports Dr Sugata Mitra of the NIIT's Centre for Research in Cognitive Systems. Mitra is with the National Institute for Information Technology (NIIT), a prestigious up-market computer education network training a quarter-million affluent Indian youngsters. But what has drawn him nation-wide attention is his experiments in unravelling how speedily slum-children and the poor from non-English backgrounds can intuitively pick up computer concepts.

In two experiments conducted in India, PCs connected to the Internet were provided on the roadside and turned on without any instructions or announcement. In both instances it was seen that the acquisition of basic computing skills by groups of children was achieved through incidental learning and some minimal (human) guidance. He reported the observations, and compared the two experiments, besides suggesting steps to further the experiment and discuss the new pedagogy. Mitra also suggested a methodology for replicating the experiment for millions India-wide.

LISHAN ADAM of Ethiopia said The overwhelming majority of Africans have yet to get access to basic communication services. Though there is a growing understanding of the need for universal access, lack of clear direction, inadequate resources and limited political readiness have continued to widen the gap between policy objectives and actions and between expectations and realisation. Adam is Regional Adviser on Connectivity of the Development Information Services Division in Ethiopia.

RAMESH VAIDYA of Nepal National Planning Commission is of the opinion that Information Technology can play a vital role in the development process of Nepal: by enhancing economic development opportunities through software production and e-commerce by accelerating social development efforts through access to health and education-related information and by providing government services with transparency, accountability and good governance

OSEI K.DARKWA of University of Illinois Chicago looked at the need for and use of multipurpose community telecentres (MCTs) in Africa. These centres have the ability to provide access to information and communication to predominantly under-served rural populations. His research looks at the need of MCTs to confront rural Africa's problems, the increasing applications of MCTs and MCT technologies in enhancing options for education, health, and socio-economic development in rural Africa.

VANDA SCARTEZINI, the National Secretary for Information Technology Policy Brazil said Brazil is 'working hard' to accelerate the IT process. She gave a detailed presentation about- the Challenges & Opportunities of Information Technology in Brazil, laying emphasis on international co-operation to face the new context, use of new technologies to shorten the economic and social gap,

G.O. AJAYI, Professor O.A University Nigeria dealt in details the penetration of ICT into Africa. Massive awareness campaign conducted in many parts of Africa & several international Internet connectivity projects have led to growth of local access. Quoting a Chinese proverb "if

you give me a fish I will eat it but if you teach me how to fish I shall eat fish for ever", he emphasised the need for developing indigenous academic staff capacity for teaching and research Universities in developing countries, while making a reference of an UG course in Science & Maths of African Virtual University, the courses being basically prepared in USA & Europe

He further discussed some aspects of the development of information communication technology in Africa in relation to academic and research activities. The development of the information communication network at the Obafemi Awolowo University has been considered as a case study. Human resources development is a critical factor to be taken into consideration in the development of information communication technology in Africa and the developing world in general. Capacity building can be translated to the evolvement of affordable information communication network. Virtual laboratory concept can become a powerful tool for scientists in Africa and the developing world to participate in state of the art scientific research and development.

S.H. MNENEY, Professor from Durban University discussed issues related to provision of Telecommunication services in rural areas in general. He emphasised the distributed switching network for the terrestrial approach and believed the same to be the optimum network solution to the rural scenario. The communication system using the distributed switching network is defined. The characteristics of the rural fading channel obtained through measurements is reported and the influence of the channel on the receiver selection is highlighted. He also showed that by using CDMA access technique coverage range can be traded with traffic capacity, which suits well with the rural service requirements.

### Keynote and Panel Discussion

In keeping with the primary objective of the conference, two special events took place on the evening of the first day (29/2) of the conference.

Firstly, a keynote address on "Accelerating the Internet Revolution in Developing Countries" was delivered by Mr. Ray Stata, Chairman, Analog Devices Inc., USA. He said that it is essential for developing countries to indigenise telecom equipment manufacture in order to be cost effective. For this, it is vital that semiconductor manufacturers not only provide lower prices, but also have a commitment to support design efforts in developing countries. He pointed out the success of the switch technology developed by C-DOT in the Eighties, and recently, the corDECT and other access technologies developed by IIT Madras, Midas Communications and Banyan Networks.

This was followed by a panel discussion by 5 eminent industry leaders on the theme "What needs to be done to expand Telephone and Internet connections in developing countries?" S.S.Motial, CMD, ITI Bangalore moderated the panel.

Excerpts from the report of Mr. Noronha, a freelance journalist from GOA on the panel discussion are: "India's teledensity currently is between two to three per

hundred, which is far lower than the international average of 13 per cent or even the developing countries' average of five-six percent," said Himachal Futuristic Communications Limited (HFCL) chairman Mahendra Nahata. HFCL is one of the major private players in the Indian telecom sector. "We have no choice. We simply have to find technologies to increase teledensity and coverage very rapidly in the next few years. Or we will just be left behind," said British Telecom's India CEO Arun Seth. "If we find the proper solution, it can really transform the lifestyle of the citizen," said B.K.Jhawar, Chairman of the Usha Martin Group. The speakers also lauded the low-cost and rugged telecom switches being made by C-DoT (the Centre for the Development of Telematics), an experiment pushed forward by telecom expert Sam Pitroda in the eighties. They also spoke of the world grade cordless phones using wireless local-loop systems that save on expensive copper wire and drastically lower the cost of installing a telephone. All the telecom majors represented agreed, however, that India needed to work out its own "home grown" solutions and could not "blindly copy what the foreigners have done".

### **Exhibition**

An important feature of the conference was an exhibition of

Telecom and IT products and solutions which was open during all the three days. The exhibition had stalls from most of industrial sponsors of COMMSPHERE-2000, including HFCL, Shyam Telecom, Hindustan Cables, Tata Infotech, ARM, VSNL, Midas Communications, Banyan Networks, MITEL Semiconductors, Analog Devices, Usha Beltron and BPL.

It was good to see that not only were the exhibition stalls well attended by the conference delegates, but also many other casual visitors to IIT Madras and many students utilised the opportunity to learn more.

### **Feedback**

Overall, the feedback that we got from the conference delegates were very heartening. Many delegates from academic and government institutions felt that they learnt a lot from the inputs from industry, and about product needs and solutions of the industry. Delegates from industry felt that this conference was very useful for them to understand what others were doing, and also will go a long way in promoting more co-operation between various industrial, government, and academic institutions, which a common goal of making the Telecom and IT revolution useful and affordable to all.

## **CEEM' 2000**

Shanghai, China, 3-7 May 2000

The Second Asia-Pacific Conference on Environmental Electromagnetics (CEEM'2000) was held at Shanghai, China on May 3 to 7, 2000. It was cosponsored by China Institute of Communications (CIC), Beijing University of Posts and Telecommunications (BUPT), The Institute of Electrical Engineers of Japan (JEEJ) and The Institute of Electronics, Information, Communication Engineers of Japan (IEICEJ). Both IEEE EMC Society & IEEE Communication Society were Technical Cosponsors.

The Technical Program Committee received about 120 papers. 80% of these papers have been accepted and published in the Proceedings. The authors are from China, Japan, Korea, United States, Germany, Sweden, Switzerland, Italy, Poland, Finland, Singapore, Thailand and Hong Kong, China. More than 100 participants attended this

Conference. The Conference has provided a forum to exchange the information on the progress of the research & development in Electromagnetic Theory, Antenna, Wave Propagation, Electromagnetic Environment, Earthquake, ESD, Lightning & NEMP, Bioeffects, EMC & related area among different countries in the world.

The associate International Exhibition was held along with the Conference. Manufactures from China & other countries showed their products of high quality.

The Second Asia-Pacific Conference on Environmental Electromagnetics was a great success. Many experts hope to offer their support for the next Conference. The Third Conference on Environmental Electromagnetics will be held at Hangzhou, China in November 2003.

Prof. Gao Yougang

# CPEM' 2000

Sydney, Australia, 14-19 May 2000

The biennial Conference on Precision Electromagnetic Measurements (CPEM), for which URSI is a permanent sponsor, is the foremost international conference series in electromagnetic metrology. CPEM 2000, the 21<sup>st</sup> conference in the series, was held in Sydney, Australia, from 14-19 May 2000 and hosted by the National Measurement Laboratory (NML) of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia, and jointly organised with the Measurement Standards Laboratory of New Zealand. It was only the second time that the conference had been held outside North America and Europe, reflecting the growing importance of the Asia Pacific region in world metrology.

A total of 435 delegates attended from 43 countries. The CPEM tradition of supporting young metrologists was continued by providing 14 "Young Scientist" awards to assist recipients from the USA, UK, Switzerland, Mexico, Italy, Germany, France, Croatia, China, Canada and Australia to attend. There was also a special category of support for participation by representatives of developing economies, assisted by sponsorship from several of the National Metrology Institutes (NMIs) in developed economies.

CPEM 2000 recognised the ever-increasing emphasis on global trading and international trade agreements, and the need for mutual acceptance of national standards between economies and measurement traceability within economies. The global Mutual Recognition Arrangement (MRA) between NMIs for the mutual recognition of national standards and calibration certificates issued by NMIs was established in October 1999 to address this situation. Its success depends on the development of more accurate and more stable standards accessible either directly or indirectly by all economies. This challenge for NMIs was reflected in CPEM 2000 through a special provision for 'key comparison' papers, and an evening discussion session on participation by NMIs in the global MRA.

The pioneering work of Mr Ian Harvey in conceiving and developing the Cryogenic Current Comparator (CCC) was recognised at the conference dinner by the award of a medal on behalf of the international electrical metrology community. The CCC is now widely used in resistance measurements, including Quantum Hall Resistance, and in development work on Single Electron Tunnelling. The medal presentation was made by Dr Norman Belecki, Chairman of the CPEM Executive Committee. In reply, Mr Harvey gave a brief history of his work.

During the conference, seven plenary speakers discussed basic advances in physics, metrology in astronomy, and developments in national standards and international comparisons. The plenary speakers were Dr Michael Pepper (University of Cambridge, UK), Professor Ron Ekers (Australia Telescope National

Facility, CSIRO, Australia), Dr Barry Taylor, (National Institute of Standards and Technology [NIST], USA), Dr Clark Hamilton, (NIST, USA), Dr Robert Hebner (University of Texas, USA), Dr Ernst Göbel (Physikalisch Technische Bundesanstalt [PTB], Germany), and Dr Terry Quinn (Director of the International Bureau of Weights and Measures [BIPM], France).

CPEM 2000 coincided almost to the day with the 125<sup>th</sup> anniversary of the signing of the Convention du Mètre, which is the foundation for the harmonisation of international metrology. To commemorate this occasion, the subject of Dr Quinn's plenary paper was the history and future of the Convention du Mètre and the BIPM. Members of the International Committee of Weights and Measures (CIPM) held a meeting on the anniversary day, 20 May, at Sydney Observatory and a number of CPEM 2000 delegates joined them for a luncheon to mark 'World Metrology Day' as it is now to be known.

329 other technical papers were presented, covering research developments in the traditional areas of electrical and electromagnetic metrology at frequencies from DC to millimetre waves, and also advances in quantum effect devices and their applications, automated instrumentation, calibration systems, electromagnetic compatibility, lasers and optoelectronics, optical metrology, time and frequency metrology, along with reports on fundamental constants and on progress in the development of an atomic-based kilogram. The distribution of papers is shown in the following table.

Topic	No. of papers
Atomic Fountains and Clocks	8
Frequency Stabilised Lasers	9
Optical Frequency Standards and Frequency Chains	20
Time Transfer	9
Cesium Standards	5
Cryogenic Resonators	4
Optical Metrology	8
High Resolution Spectroscopy	3
Lasers and Length	12
DC Resistance and Comparators	21
DC Transportable Standards	5
DC Voltage and Current	12
Voltage Comparisons	6
AC Voltage and Current	4
Advances in AC-DC Transfer	17
Power and Energy	13
Impedance	24
Capacitance Standards and AC Voltage Ratio	6
High Voltage	11
Josephson Array Development	9
Quantum Hall Resistance	11

AC Quantum Hall Resistance	4
Single Electron Tunnelling	13
Microwave Reflectometry and Power	4
Microwave Field Probes, Materials and ESD	4
Microwave Oscillators	4
Microwave Noise and Material Parameters	9
Microwave Impedance and Power	13
Antennas, Fields and EMC	6
Avogadro Constant	9
Watt Balance and Newtonian Gravitational Constant	4
Gravitational Constant and Magnetic Levitation	4
Determination of G	4
Magnetic Measurements	9
International Comparisons	12
Calibration Processes	3
Signal Analysis	6
Micromechanics and Thermometry	4

Approximately two-thirds of these papers were presented as posters in sessions reserved solely for that purpose, with the remainder presented orally in three parallel sessions. All sessions were well-attended, and good use was made of the opportunities for extended interaction between presenters and delegates at the poster sessions.

Technical discussions at the conference included the following.

#### *Optical Frequency Standards and Frequency Chains:*

The problem of practical and routine multiplication of the microwave resonance frequency of the cesium atom (which defines the second in the SI system of units) to optical frequencies is now widely regarded as having been solved by a new system based on ultra-short pulses generated by a laser. The system was developed at the Max Planck Institute for Physics in Germany, and is an essential component of the next generation of ultra-stable atomic clocks, which will be based on optical absorption resonances in atoms.

#### *Atomic fountains and clocks:*

Cesium atomic fountain clocks are now in routine operation at the Laboratoire Primaire des Temps and Frequences (LPTF) in France, NIST, and the PTB. Many others are under development by other organisations. Some of these fountains have demonstrated, or are capable of, accuracies approaching 1 part in  $10^{15}$ , limited mainly by frequency shifts arising from collisions between the cold cesium atoms. LPTF and Yale University have recently developed rubidium fountain clocks, motivated by the much smaller susceptibility of rubidium atoms to collisional frequency shifts. For this reason, rubidium may be a more suitable atom for defining the SI second than cesium.

Several organisations are developing space-flyable cold atom clocks for a range of fundamental experiments mostly related to General Relativity.

#### *Voltage Comparisons:*

Comparisons of voltage between laboratories often use Zener-based standards, which are readily portable, but have been found to be sensitive to temperature, relative humidity and pressure. Several NMIs have started characterising such standards for these sensitivities to improve international comparisons of voltage.

The need to keep Zener standards continuously powered during transportation can cause problems. Some investigations into the effects of transporting unpowered standards have yielded promising results.

A Finnish company reported the development of micromechanical silicon devices for standards applications, including AC to DC converters suitable for batch fabrication, and a novel DC voltage reference which may prove more stable than the currently used Zener diode voltage references.

#### *High Voltage*

The PTB has developed a shielded resistive divider for 100 kV DC that uses compressed gas insulation and has a claimed uncertainty of 1 part in  $10^7$ , which is thought to be a limit for this type of design.

#### *AC-DC transfer*

The latest international comparisons show agreement between NMIs of around  $2 \times 10^{-6}$  at 1 kHz and  $1 \times 10^{-5}$  at 1 MHz. Several NMIs are working on further reduction of measurement uncertainty by means of an absolute AC voltage standard based on the Josephson effect. Josephson arrays have been well established for many years as fundamental standards of DC voltage. The most promising techniques to extend their application to AC voltage standards involve the so-called pulse-driven arrays.

#### *Impedance*

The National Physical Laboratory (NPL), UK reported on a new four terminal-pair bridge which will ultimately improve the traceability of impedance measurements in the frequency range up to 1 MHz.

#### *AC Quantum Hall Resistance:*

AC Quantized Hall Resistance (ACQHR) measurements made at the NPL and the PTB using the same samples achieved different results, particularly for the frequency dependence of the quantised Hall resistance, confirming the difficulties of such measurements.

The BIPM has been measuring the ACQHR in the presence of an applied back gate voltage, enabling the previously observed but unwanted current and frequency dependence to be reduced or eliminated.

#### *Electrical determination of the Kilogram*

A new superconducting levitated-mass mechanism is being constructed in Japan as a means of obtaining a link between the kilogram and electrical units.

## **Next CPEM**

The next CPEM will be held in Ottawa, Canada from 16-21 June 2002. The CPEM 2002 secretariat is contactable at CPEM02@nrc.ca .

## ASTRONOMICAL SITE EVALUATION IN THE VISIBLE AND RADIO RANGE

Marrakech, Morocco, 13-17 November 2000

The purpose of this meeting is to assess the state of the art with regard to astronomical site testing in the visible, IR and radio range. Emphasis will be placed on the physical mechanisms which govern the propagation of waves in the atmosphere, their origin and consequences. A special mention will be made to all the techniques which allow us to evaluate the perturbation along the beam path: remote sensing, in situ probing and atmospheric modelling. A detailed survey of the major astronomical sites will be presented, as well as the requirements of ground based astronomy for the next decades. Although this meeting is devoted to gaining a better insight into the physical phenomena, related fields of astronomy will be included, such as interferometry and adaptive optics. Special attention will be paid to Moroccan sites.

### Topics

The workshop will cover items related to "Astronomical Site Evaluation in the Visible and Radio Range" and give the opportunity to the optical and radio communities to compare methods and needs.

- Physical Mechanism of Atmospheric Turbulence
- Measuring Instruments in the Visible
- Site Characterisation and Atmospheric Transparency in the mm/submm Range
- Tropospheric Phase Instability and Compensation Schemes
- Forecasting
- Site Surveys
- Astroclimatic Stations
- Phase correction: Adaptive Optics and Interferometry

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## ICAP 2001

Manchester, United Kingdom, 18-20 April 2001

The International Conference on Antennas and Propagation is now a well-established event in the international calendar. Its format of invited keynote speakers, four parallel sessions of oral presentation plus a poster session served with a buffet supper provides a stimulating, but not hectic programme for the delegate. For the first time the conference venue is the University of Manchester Institute of Science and Technology. The city centre location with excellent conference facilities, high quality on-campus accommodation will, we believe, give us a successful event. We even have an Internet Café for those delegates that need to stay in-touch, or just need an Internet fix.

As it did in the first ICAP, back in 1979, the subject of Antenna and Propagation remains a buoyant and important area covering a broad range of applications in radar, communications and scientific exploration. Mass market products such as mobile communications, vehicular radar and informatics, and product radio tagging are examples of where our subject is being stretched to find new and novel solutions. The explosion in demand for the finite radio spectrum has led to the need to climb ever higher in frequency, which itself brings new challenges and opportunities.

The beginning of the 21<sup>st</sup> century will no doubt continue to be a harsh business climate for engineering in general. The winners will be those that have the engineering skills to combine the best from industry, academia and government. For this to happen engineers need to be well informed about the broad applications as well as the new advances in their subject. Over the years the ICAP series has proved to be an effective means for enabling this by bringing together workers from around the world to exchange ideas and information. We encourage you not to miss this opportunity to learn about the latest innovations in Antennas & Propagation.

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# MSMW'2001

Kharkov, Ukraine, 4-9 June 2001

The 4th International Kharkov Symposium "Physics and Engineering of Millimeter and Submillimeter Waves" (MSMW'2001) will be organised in Kharkov, Ukraine on June 4 -9, 2001. MSMW symposia were held several times in Kharkov since 1978 as a regular Soviet Union meeting on MM and SubMM waves and applications. The forthcoming MSMW'2001 symposium will have English as a working language to facilitate a closer interaction between the Western and Former Soviet Union (FSU) scientists and engineers.

## Topics

1. Problems of the electromagnetic theory
2. Numerical simulation
3. Wave processes in finite-size semiconductors and solid-state structures
4. High temperature superconductors
5. MM and SubMM wave propagation and scattering
6. MM and SubMM wave radio astronomy
7. MM and SubMM wave spectroscopy
8. Vacuum electronics
9. Gyrotron and free electron lasers
10. MM and SubMM wave solid state devices
11. Quasioptical techniques
12. MM and SubMM wave integrated circuits and devices
13. MM and SubMM wave antennas
14. MM and SubMM wave radar
15. MM and SubMM wave remote sensing
16. MM and SubMM wave communications
17. Scientific and industrial applications of MM and SubMM waves (fusion plasma diagnostics, control of technological processes, automotive systems)

18. New materials
19. Electromagnetic metrology
20. Biomedical applications of MM and SubMM waves

## Organisers

The National Academy of Sciences of Ukraine Scientific Council on the problem "Radio Physics and Microwave Electronics" in cooperation with IRE NASU, IRA NASU, KNU, IEEE AP/ED/MTT/AES-SS Joint Chapters of Ukraine, Ukrainian URSI Committee. Co-sponsorship of URSI, IEEE ED Society has been approved.

Chairman: Prof. Vladimir M. Yakovenko (IRE NASU)  
Co-Chairmen: Prof. Leonid M. Lytvynenko (IRA NASU) and Prof. Ilya I. Zalubovsky (KNU)  
Co-Organizers: Dr. Alexei A. Kostenko and Prof. Alexander I. Nosich (IRE NASU)

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## Deadlines

Deadline for submission : December 1, 2000  
3-page camera-ready papers : March 1, 2001.  
The authors of invited papers will be given special instructions.

## *Another meeting brought to our attention*

### 20TH ANNIVERSARY SYMPOSIUM ON IONOSPHERIC INTERACTIONS

Ramfjordmoen, Norway, 10-11 October 2000

Twenty years ago ionospheric HF heating experiments were outside of Tromso, Norway, on the EISCAT incoherent scatter radar site at Ramfjordmoen. To commemorate that event, we are organising a small symposium on Tuesday and Wednesday, October 10 and 11, 2000. The 20th Anniversary Symposium is expected to be held at the EISCAT Heating building, as was the inauguration 20 years ago.

The EISCAT HF facility, known as Heating, was originally constructed and operated by the Max-Planck-Institut für Aeronomie in Lindau, Germany, and is currently owned and operated by the EISCAT Scientific Association. EISCAT (European Incoherent SCATter) is an international association supported by the research councils of Finland, France, Germany, Japan, Norway, Sweden, and the United Kingdom. For further information please see <http://www.eiscat.uit.no/heater.html> and <http://www.eiscat.uit.no/eiscat.html>.

## Topics

- Past Heating achievements
- Present status and outlook for the Heating facility
- Status, capabilities, and results from other HF facilities
- Report on the upgraded EISCAT radars
- Future scientific directions in ionospheric interaction experiments
- Future plans (e.g. SPEAR, magnetospheric radar, solar radar, etc.)

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## September 2000

### Second International Symposium on Turbo Codes and Related Topics

*Brest, France, 4-7 September 2000*

Contact: Dr. Claude Berrou or Dr. Michel Jézéquel, Ecole Nationale Supérieure des Télécommunications de Bretagne, Technolpole de Brest Iroise, B.P. 832, F-29285 Brest Cedex, France, Tel. +33 2-9800 1306/1161, Fax +33 2-9800 1184, e-mail: Claude.berrou@enst-bretagne.fr and Michel.Jezequel@enst-bretagne.fr

### MMET'00 - 2000 Int. Conference on Mathematical Methods in Electromagnetic Theory

*Kharkov, Ukraine, 12-15 September 2000*

Contact : Dr. A. Nosich, MMET 2000 TPC Co-Chairman, c/o Dept. of Computational Electromagnetics, Institute of Radio Physics and Electronics, National Academy of Sciences, Ul. Proskury 12, Kharkov 61085, Ukraine, Fax : +380 572-140 738 or 441105

### Bianisotropics 2000

*Lisbon, Portugal, 27-29 September 2000*

Contact : Bianisotropics 2000, Prof. A.M. Barbosa, Dept of Electrical and Computer Eng., Instituto Superior Técnico, Av. Rovisco Pais, 1049-001 Lisboa, Portugal, Tel.: +351-21-8418482, Fax: +351-21-8417284, e-mail: Bian2000@lx.it.pt, www.lx.it.pt/bian2000

## October 2000

### The First S-RAMP Conference

*Sapporo, Japan, 2-6 October 2000*

Contact : Dr. Y. Kamide, Solar-Terrestrial Environment Laboratory, Nagoya University, Honohara 3-13, Toyokawa, Aichi 442-8507, Japan, Tel: 81-533-86-3154, Fax: 81-533-86-0811, E-mail: s-ramp@kurasc.kyoto-u.ac.jp

## November 2000

### Astronomical Site Evaluation in the Visible and Radio Range

*Marrakech, Morocco, 13-17 November 2000*

Contact: Dr. Benkhaldoun Zouhair, Faculte des Sciences Semlalia, Bd du Prince My Abdellah, Marrakech, BP S15, Morocco, Tel: +212 4 43 46 49, Fax: +212 4 43 74 10, e-mail: zouhair@unice.fr

### Antenna and Propagation for Wireless Communications

*Waltham, MA, USA, 6-8 November 2000*

Contact: Dr. Naftali (Tuli) Herscovici, 52, Agnes Drive Drive, Framingham, Ma 01701, USA, Tel: 508 788 5152, Fax: 508 788 6226, e-mail:naftali.herscovic@spke.com

## February 2001

### EMC Zurich

*Zurich, Switzerland, 20-22 February 2001*

Contact : Dr. G. Meyer, ETHZ-IKT, ETH-Zentrum, CH-8092 Zurich, Switzerland, Tel. : 41 1-2562 793, Fax : 41 1-2620 943

## April 2001

### ICAP 2001 - Eleventh International Conference on Antennas and Propagation

*Manchester, United Kingdom, 18-20 April 2001*

Contact: ICAP2001 Secretariat, IEE Conference Services, Savoy Place, London WC2R 0BL, United Kingdom, Tel:+44 (0) 20 7344 8425, Fax: +44 (0) 207240 8830, e-mail: icap@iee.org.uk

## May 2001

### 2001 URSI International Symposium on Electromagnetic Theory

*Victoria, BC, Canada, 13-17 May 2001*

Contact : Prof. S. Ström, Dept. of Electromagnetic Theory, Royal Institute of Technology, SE-100 44 Stockholm, Sweden, Tel.: +46-8-790 8195, Fax: +46-8-10 83 27, e-mail: staffan@tet.kth.se, www.nrc.ca/confserv/URSI-B2001

## June 2001

### ISSS-6 - Sixth International School for Space Simulations

*Katlenburg-Lindau, Germany, June 2001*

Contact: Dr. Jörg Büchner, MPI für Aeronomie, Max-Planck-Strasse 2, 37191 Katlenburg-Lindau, Germany, Fax: +49 5556-979 295, e-mail: buechner@linmpi.mpg.de

## July 2001

### ISSSE'01 - "Questing More Significant Harmony and Integration : Systems/Devices and Softwares/Hardwares"

*Tokyo, Japan, 24-27 July 2001*

Contact : ISSSE'01 secretariat, Dept.of Elec. Eng., Science University of Tokyo, 1-3 kagurazaka, shinjuku Tokyo 162-8601 Japan, E-mail: issse01@ee.kagu.sut.ac.jp, http://issse01.ee.kagu.sut.ac.jp

## August 2001

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*Tokyo, Japan, 1-4 August 2001*

Contact : AP-RASC'01 Secretariat, c/o REALIZE Inc., 4-1-4 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan, Tel.: +81-3815-8552, Fax: +81-3815-8529, E-mail: aprasc@oak.ocn.ne.jp, http://www.kurasc.kyoto-u.ac.jp/ap-rasc/

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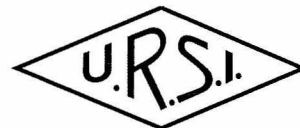
*Torino, Italy, 10-14 September 2001*

Contact : COREP - ICEAA'01, Politecnico di Torino, Corso Duca degli Abruzzi 24, I-10129 Torino, Italy, http://www.polito.it/iceaa01

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# News from the URSI Community



BOOK PUBLISHED BY AN URSI CORRESPONDENT

## Phased Array Antennas

by Robert C. Hansen, Ph.D., D.Eng.(hon), FIEE, FIEEE, NAE, Consulting Engineer,  
P.O. Box 570215, Tarzana, CA 91357

Upon reading the book, it is clear that Bob Hansen's new contribution to the phased array literature is directed primarily to practicing antenna engineers and radar engineers. Array hardware designers will find a wealth of information and insight into their various aperture and feed problems, and so it is an "indispensable tool-of-the-trade", to quote Wiley's advertisement on the back cover. Furthermore, even the most intensely theoretical "antenna array analyst" should enjoy the many photographs of real array hardware and performance curves. Hansen knows how to parameterize and graphically display the important relationships between the various design parameters and performance measures of the many array components and accessories. Wiley wants to stretch the audience of this reasonable specialized book to include "PCS and communications engineers", and predictably bill it as a textbook for "advanced undergraduate and graduate-level courses...". It is ideal for an industrial short course on phased arrays, especially considering that not many universities presently offer a specialized course on a class of antennas. Academics who teach such a graduate course would likely select a more theoretical or fundamental book as a primary text.

The layout of the book is attractive, it is a nice size and most importantly Hansen's style is succinct and enjoyable to read. For example, in describing the operation of beamforming networks, a couple of sentences accompanying well thought-out diagrams give a lucid explanation of the workings of the various architectures. Throughout the twelve chapters, the text points out comparative advantages and limitations of different implementations using realistic, quantitative data. Hansen knows just where to stop, usually. Some of his personal favorites, such as Taylor synthesis, finite array mutual-coupling analysis, and conformal arrays are covered in some depth. That is expected and welcome. Undoubtedly, many users of Phased Array Antennas will benefit from these original and timely summaries. Such a well-rounded perspective and insight can come only from a seasoned antenna engineer who understands both the physical theory and its practical realization. This book is a balanced account of the important aspects of phased array hardware and design from feeds to radiating apertures. Hansen sticks to his stated scope of main-stream arrays and resists any temptation to stray into adaptive arrays and other

peripheral signal processing and systems engineering topics.

Not the last word on any of the topics, each chapter supplies a comfortable number of pertinent references for background and further study. The references are assembled with great care. The valid or final papers have been culled out of the literature, resulting in a useful bibliography for practicing engineers. Hansen maintains historical accuracy without attempting historical completeness or "paying homage" to every contributor to the field. Such long lists can be found in standards such as Collin & Zuchner. When Hansen does refer to a classic, such as Schelkunoff's 1943 Bell System Technical Journal Paper, it is because the referenced work is still the best account of the subject. If you or one of your local colleagues (or library) have managed to amass the digests and proceedings from the many AP/URSI, tri-service radar, Illinois antenna applications, Boston phased array, and assorted meetings, then Phased Array Antennas is your key to some of the unindexed gems in the field. For cultural and political reasons, novel array concepts and hardware developments by the creative cold war engineers were first chronicled in internal industry and government reports, some classified, and later disclosed to the community at large via meetings and symposia. The company reports and conference papers that Hansen refers to record important events in phased array evolution. For example, Dick Kinsey's tandem series feed and the way he exploits symmetry and plain physical insight in feed-line synthesis is a source of inspiration and a great example of innovative "engineering design". Except for Hansen's chapter references, citations for many such works have so far been unavailable in a standard antenna reference. Another example, the origin of the often photographed bent-back or vee dipole that equalizes scan impedance behavior is refreshingly credited to its inventor Jack Reale, Reale's original Tri-Service Radar Symposium paper on the PAR (Perimeter Acquisition Radar) dipole is cited.

The only specific prerequisite background required of a BS engineer or physicist is some introduction to basic antenna theory and definitions. The mathematical level is that of a typical BS electrical engineer. Some chapters use an occasional series or integral, and these are all explained

or suitably referenced. Definitely written by a serious engineer, the single excursion from pure, no-nonsense technical prose is the statement on page 49: "In the days BC (before computers), aperture distributions were chosen..." After reading this passage, I was hopeful (but ultimately disappointed) that the author would share more of the little engineering idioms that he surely has accumulated over his career of fifty years.

The perceived clarity of a given section depends, of course, on the reader's background and expectations. The chapters on elements, synthesis, feeds, mutual coupling, lenses and conformal arrays are outstanding. Hansen provides a thorough summary of the effects on scan impedance of finite arrays versus infinite arrays. Some of that data is the result of his own recent papers where he introduces the Gibbsian model, in reference to the Gibbs phenomenon in a truncated Fourier series. It is intriguing.

A confusing part of the book is the beginning of section 10.4 on beam orthogonality. The results and conclusions are valid, but it takes a bit of work to straighten out the abbreviated development, due partially to notational changes (even though he carefully and explicitly calls attention to these) together with several unfortunate typos in the intermediate mathematics. In addition to Hansen's reference to a 1970 book by Harmuth, the parenthetical inclusion of the usual name Parseval's theorem would be sufficient to keep the typical reader in step. One note on the notation: throughout the book, limits on sums and integrals have sometimes, almost randomly, been omitted. This can be an acceptable style, provided the actual limits are clear from the context, and mature readers can adapt to the omissions. Given Hansen's usual meticulous attention to

detail and concerted adherence to consistency, such omissions are likely typos. On the other hand, sometimes the meaning of an integral such as

$$\beta_{\eta} \int E_1(\theta, \phi) d\Omega$$

is actually clearer as stated, without the explicit limits which would introduce distracting and irrelevant detail.

Systems engineers who get deeper into arrays than elementary pattern and directivity calculations will find this book accessible and appropriate. They should feel at home with Hansen, as his style reflects some obvious "system tendencies" and influences. Witness the use of three-letter variable names (acronyms!) in the last chapter on measurements and tolerances:

$$P(SLL \leq SLL_0) = \int_0^{SLL_0} P D F dSLL$$

Another delightful feature throughout the book is that Hansen tells us how to actually compute numbers for many of the formula and methods. Such words of advice from an experienced worker are invaluable. Phased Array Antennas will be a primary reference for such antennas and systems. Browsing through the book, I can't help but think what a pretty fun field it is.

1998, 486 pp, Wiley Interscience, ISBN 0-471-53076-X.

Reviewed by : Robert W. Scharstein,  
Electrical Engineering Department, University of Alabama

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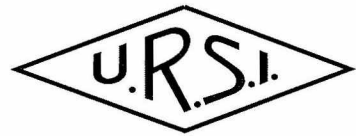
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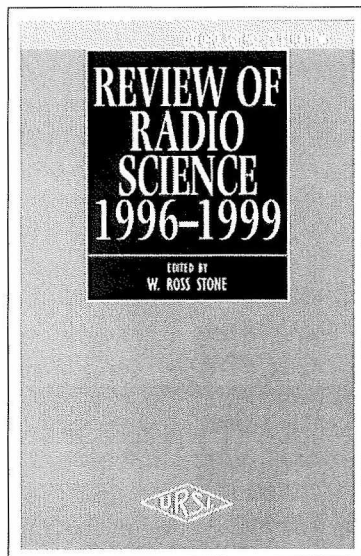
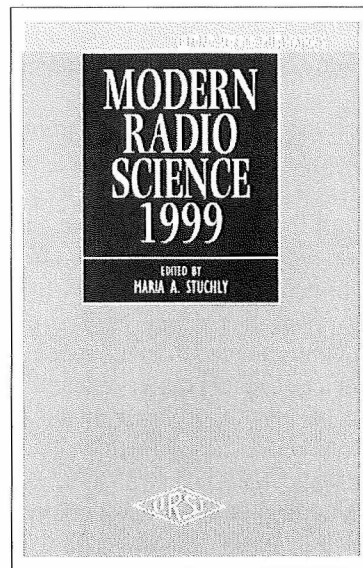


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Editor: W. Ross Stone  
August 1999/Hardcover/1044 pp  
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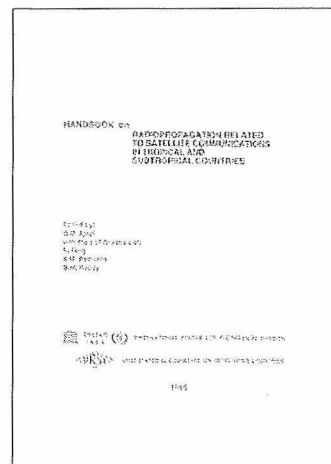
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Editor: G.O. Ajayi  
with the collaboration of :  
S. Feng, S.M. Radicella, B.M. Reddy

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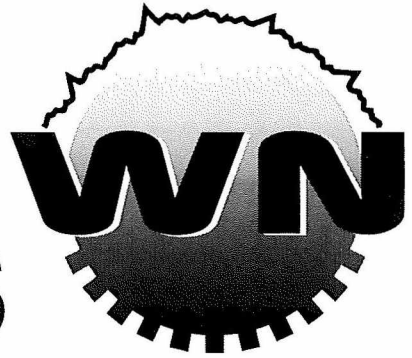
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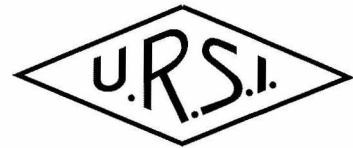
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*Family Name* *First Name* *Middle Initials*

Present job title: \_\_\_\_\_

Years of professional experience: \_\_\_\_\_

Professional affiliation: \_\_\_\_\_

I request that all information, including the bulletin, be sent to my  home  business address, i.e.:

Company name: \_\_\_\_\_

Department: \_\_\_\_\_

Street address: \_\_\_\_\_

City and postal / zip code: \_\_\_\_\_

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Phone: \_\_\_\_\_ ext: \_\_\_\_\_ Fax: \_\_\_\_\_

E-mail: \_\_\_\_\_

## Areas of interest (please tick)

- |   |   |
|---|---|
| <input type="checkbox"/> A Electromagnetic Metrology            | <input type="checkbox"/> F Wave Propagation & Remote Sensing      |
| <input type="checkbox"/> B Fields and Waves                     | <input type="checkbox"/> G Ionospheric Radio and Propagation      |
| <input type="checkbox"/> C Signals and Systems                  | <input type="checkbox"/> H Waves in Plasmas                       |
| <input type="checkbox"/> D Electronics and Photonics            | <input type="checkbox"/> J Radio Astronomy                        |
| <input type="checkbox"/> E Electromagnetic Noise & Interference | <input type="checkbox"/> K Electromagnetics in Biology & Medicine |

The fee is 40 Euro.

(The URSI Board of Officers will consider waiving of the fee if the case is made to them in writing)

Method of payment: VISA / MASTERCARD (we do not accept cheques)

Credit Card No             Exp. date: \_\_\_\_\_

Date: \_\_\_\_\_ Signed \_\_\_\_\_

Please return this signed form to:

The URSI Secretariat  
c/o INTEC, Ghent University  
Sint-Pietersnieuwstraat 41  
B-9000 GENT, BELGIUM  
fax (32) 9-264.42.88