

ANNUAL REPORT TO COUNCIL: 2000

NATIONAL COMMITTEE FOR: Radio Science

CHAIR Dr. Phil Wilkinson

Meetings of the National Committee and sub-Committees

The National Committee met:

The National Committee for Radio Science did not meet during 2000.

The following subcommittees also met during 2000:

The WARS '00 sub-committee met periodically to manage the planning of the WARS '00 meeting.

The following meetings are proposed for 2001:

The National Committee will hold its Annual Meeting on 22 February, 2001, at the University of Technology, Sydney at its Kuring-gai Campus.

Meetings of International Organisations Affiliated with ICSU

In 2000 there was a General Assembly of:

33rd COSPAR Scientific Assembly, 16-23 July 2000, Warsaw, Poland.

The IAU general Assembly took place in Manchester, UK, in August 2000. Several Australians were on SOC's and other organising committees for this, including Dick Hunstead (on SOC for JD10 (Cluster mergers and their connection to radio sources) and Ray Norris (chair of Working Group on Astronomical Data).

The IAA held its General Assembly in Rio, Brazil, in October 2000, and several Australians attended this. Ray Norris was appointed chair of the IAA SETI Post-detection Committee.

In 2001 there will be a General Assembly of:

SCOSTEP 10th Quadrennial STP Symposium, 18-22 June 2001, Longmont, Colorado, USA.

Asia-Pacific Radio Science Conference (AP-RASC'01) Tokyo 1-4 Aug 2001

IAGA Scientific Assembly, Hanoi Vietnam, 18-30 Aug 2001.

The next IAU General Assembly will take place in Sydney in 2003. Many members of the Australian community is heavily involved in organising this, and many people, too numerous to mention, have formal roles in its organisation.

I recommend to Council the following voting Australian Delegation:

Not relevant this year.

Australian Office Holders in ICSU and Affiliated Bodies

Australians who held office in 2000 were:

Person	International Body	Position	Term
John Brooks	IAA SETI post-detection committee	Member	2003-06
Wim Brouw	IAU SOFA Review Board	Member	
W. N. Christiansen	Honorary President URSI		
David Cole	Study Group 3, Radiocommunication Sector, ITU	Chair	
David Cole	Australian Radiocommunication Study Group 3,	Member	

Peter Dyson	PSMOS Steering Committee, SCOSTEP	Member	
Peter Dyson	URSI-COSPAR Working Group on the International Reference Ionosphere	Member	1999-02
Ron Ekers	President-elect of the IAU		
Ron Ekers	IAU	President,	2003-06
Ron Ekers	URSI Global VLBI working group	Member	
Ron Ekers	IAU working group on "large scale facilities"	Chair	
Brian Fraser	Scientific Discipline Representative SCOSTEP		
Brian Fraser	S-RAMP Steering Committee SCOSTEP 1999-2004	Member	
Brian Fraser	Working Group on Solar-Terrestrial and Astrophysical Research SCAR	Member	
Don Melrose	IAU commission 10 (Solar activity)	Vice-President	2000-03
Ray Norris	IAU working group on astronomical data	Chair	2000-03
Ray Norris	IAA SETI post-detection committee	Chair	2000-03
Ray Norris	CODATA	IAU Voting Delegate	2000-03
John Reynolds	IAU WG on reference Frames	Member	
Elaine Sadler	IAU commission 28 (Galaxies)	Vice-President	2000-03
Michelle Storey	IAU Task Group on Publishing	Chair	2000-03
Tasso Tzioumis	ITU Radiocommunication Study Group 7 (Sciences Services).	Member	2001-03
Richard Thompson	International Space Environment Services (ISES)	Member	
Jessica Chapman	SOC for IAU Symposium 206 on "Cosmic Masers, March 2001, Brazil	Member	2000-01
John Whiteoak	ITU Radiocommunication Sector	IAU Voting Delegate	1997-00
John Whiteoak	IAU Commission 40 (radio astronomy)	President,	1997-00
John Whiteoak	ITU Radiocommunication Study Group 7 (Sciences Services).	Vice-Chairman	1997-00
John Whiteoak	ITU Radiocommunication Working Party 7D (Radioastronomy, radar astronomy & SETI).	Chairman	1997-00
John Whiteoak	Inter-Union Commission on Frequency Allocation (IUCAF).	Ursi Representative	1997-00
Carol Wilson	Australian Radiocommunication Study Group 3,	Chair	
Phil Wilkinson	Commission G, URSI	Chair	1999-02
Phil Wilkinson	URSI Commission G Working Group 1, INAG	Secretary	1999-02
Phil Wilkinson	URSI-COSPAR Working Group on the International Reference Ionosphere	Member	1999-02
Phil Wilkinson	S-RAMP Committee on Space Weather, SCOSTEP	Member	

Nominations being made in 2001 are:

None have been notified in advance.

Membership of National Committees and sub Committees

	Commission	Term ends	Based
Dr. Peter Fisk	A	Pending confirmation	Sydney
Dr. Graeme James	B	2002	Sydney
Dr. Robin Braun	C	2002	Sydney
Dr. Le Nguyen Bihn	D	Pending confirmation	Melbourne
Prof. Kevin Flynn	E	Pending confirmation	Perth
Dr. David Noon	F	Pending confirmation	Brisbane
Prof. Peter Dyson	G	2002	Melbourne
Prof. Brian Fraser	H	2002	Newcastle
Prof. Ray Norris	J	2002	Sydney
Dr. Ken Joyner	K	2001	Melbourne
Dr. Phil Wilkinson	Chair	2004?	Sydney

Activities of the National Committee

I submit the following report to Council on the activities of the National Committee in 2000:

The Third Workshop on Applications of Radio Science – WARS'00

The third Workshop on Applications of Radio Science – WARS'00 – was held at the La Trobe University Beechworth Campus, 27-29 April 2000. As with the second meeting, the organising committee was a separate committee of the National Committee of Radio Science. The members were - Dr E. Essex, Prof. P. Dyson, Dr. R. Norman, B. Tate and L. Hart; all of La Trobe University. All WARS'00 papers were fully reviewed, to ensure DETYA E1 classification for publications, to encourage student attendance and support by Universities. The invited speakers and topics at WARS'00 were:

Bob Clark, University of NSW Quantum Computing

Peter Dyson, La Trobe University The TIGER Radar

Brian Fraser, University of Newcastle FEDSAT: An Australian Research Microsatellite

Peter Fisk, CSIRO Recent Advances in Time Keeping and Time Dissemination Technology

Peter Hall, CSIRO The Square Kilometer Array

Geoff James, CSIRO Tailoring computational electromagnetics to industry's needs

Papers were presented from almost all the URSI Commissions represented by the National Committee and the final proceedings has been placed on the Web at www.ips.gov.au/ncrs/wars00 and will also be published on a CD-ROM (ISBN 1864465328).

Mobile Phone Standards

The Australian Communications Industry Forum (ACIF) released for public comment a draft Code of Practice for the Deployment of Radiocommunications Infrastructure. The document can be found at http://www.acif.org.au/RERP_WC1/files/DR_C564.pdf. Public comment closed on 25 December 2000.

Australia is making a very important contribution to the research efforts in these areas. Briefly, in 1996 the Federal Government made available \$3.4M for research into possible health effects of mobile phones.

Australia is the only country within the International Agency for Research on Cancer (IARC) collaboration, which includes the European Union, the US, Israel and New Zealand, to have secured the cooperation of all network operators (Telstra, Optus and Vodafone) in retrieving and supplying data from consenting subjects.

The RF EME Expert Committee has now expanded a pivotal 18-month pilot study completed under its first round and now funded it as a full study in recognition of its groundbreaking and internationally acknowledged leadership in mobile phone and cancer research. This pilot study produced world-first scientific protocols, now adopted by the IARC and to be applied to all research under the international collaboration.

The following research has now been developed into a full four-year study: Does Mobile Phone Use Cause Brain Tumors? (Prof Bruce Armstrong – \$1,200,000): A case control study of brain and other tumors in adults and exposure to RF EME in the use of mobile phones. Use of mobile phones in people who have developed a tumor of the brain, salivary gland or auditory nerve, all tissues that are very close to the phone when in use, will be compared with that in people of the same age and sex who have not developed one of these cancers. This will allow us to determine whether or not use of mobile phones increases the risk of getting one of these tumors.

There is also an ongoing mobile phone study into possible links to cancer still underway from the first round of funding (this is a three-year full study):

Does Exposure to Radiofrequency Fields Cause an Increase in Cancer Rates in Mice? (Prof Barrie Vernon-Roberts – \$1,112,000): The project aims to determine whether the use of mobile phones affects cancer rates. Mice, which have been genetically modified to make them susceptible to developing certain types of cancer, will be exposed to electromagnetic fields similar to those emitted by mobile telephones and the incidence of cancer in exposure or non-exposed mice will be compared.

Australia also commits funding to the WHO International EMF Project currently directed by Dr Michael Repacholi, originally from WA.

The Environment, Communications, Information Technology and the Arts References Committee of the Australian Senate began an inquiry into electromagnetic energy and telecommunications. The terms of reference are:

- § an examination of the allocation of funding from the Commonwealth's \$4.5 million fund for electro-magnetic radiation research and public information;
- § a review of current Australian and international research into electro-magnetic radiation and its effects as it applies to telecommunications equipment, including but not limited to, mobile telephones;
- § an examination of the current Australian Interim Standard [AS/NZS 2772.1 (Int): 1998], as it applies to telecommunications;
- § an examination of efforts to set an Australian Standard dealing with electro-magnetic emissions;
- § an examination of the merits of the transfer of the responsibility for setting a new Australian standard for electro-magnetic emissions to the Australian Radiation Protection and Nuclear Safety Agency.
- § The inquiry is due to report at the end of March 2001.

Work continues on the development of the new Australian Standard for human exposure to radio-frequency energy. This work is being conducted by an expert group appointed by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) which is an agency within the Commonwealth Health and Aged Care portfolio and has the legislative authority to develop standards. A draft for public comment will be released in March/April 2001.

Antenna and Telecommunications Developments

At CSIRO Telecommunications and Industrial Physics in Sydney, on-going R&D continues in the general area of microwave and millimetre antennas and related systems. One major (on-going) project over the past year has been the design and manufacture of a large multibeam antenna for service in Europe to access several geostationary satellites simultaneously. Other major areas of activities include several design concepts for the Square Kilometre Array (the proposed next major international radio telescope with the prime purpose of probing the early universe) and antenna designs for ground probing radar applications.

Some examples antenna-related work elsewhere in Australia include: the University of Canberra (plasma antennas and Ku-band antenna performance); the University of Queensland (reflect-arrays and spatial power combining); Monash University (advanced numerical methods in electromagnetics); Griffith University (switched parasitic elements for arrays and feed systems); the University of Adelaide (fundamental problems in antennas and propagation); Macquarie University (FDTD analysis of microstrip and dielectric resonator antennas); RMIT University (microwave patch and millimetre-wave printed antennas); Radio Frequency Systems Pty Ltd (passive intermodulation problems in cellular base stations); DSTO (mm-wave imaging); the

University of Western Sydney (antenna design for low-frequency RF identification); the University of Sydney (W-band scanning antenna); James Cook University of North Queensland (microwave applications of superconductivity); the CRC for Satellite Systems (communications payload for FedSat).

Another significant direction for work is in support of the burgeoning Mobile and Networking. This includes some significant work in the direction of Telecommunications Systems. A significant development has been the creation of the Centre for Telecommunications Systems at the University of Technology, Sydney. It aims to bring together researchers from the various branches of a very competitive industry into a collaborative environment.

Square Kilometre Array

Australia is a key player in an international consortium to build the next-generation radio telescope (SKA), with a collecting area of 10^6 m². This billion-dollar international project is in the panning stage, with technology and site choice to be made in 2005, and construction in 2010. Australia is in a prime position to be the location for this telescope, primarily because of relatively low RFI levels in isolated areas such as Western Australia, coupled with access to appropriate expertise and infrastructure.

Australia's favoured option is an array of "Luneberg lenses", but is also looking other options including the Netherlands-led tiled array concept. It will involve several areas of new and innovative technology of interest to industry, so we are starting to build links with interested groups. Technologies include: broad-band antenna design, phased array and Luneberg Lens technology, interference excision and cancellation, fast samplers, DSP, etc. An international SKA consortium has now been set up, chaired by Australia's Prof. Ron Ekers, and an Australia SKA Consortium Committee has also been set up as a sub-committee of the Academy of Sciences, also chaired by Ron Ekers. (see <http://www.atnf.csiro.au/SKA/> for more details).

Further Radio-astronomy Developments

The ATNF's \$11M upgrade (funded under DIST's MNRF program) is nearing completion. A recent highlight has been the successful fabrication of cryogenic InP MMIC low-noise amplifiers operating at 3mm wavelength. These chips outperform any other chip elsewhere in the world.

Prototype receivers using the chips have now been installed on two of the antennas of the Australia Telescope Compact Array, and the first millimetric interferometer observations in the Southern hemisphere have now taken place successfully. The next year will see a continual process of debugging and commissioning, with full operation of the Compact Array at mm wavelengths taking place in late 2002. See <http://www.atnf.csiro.au/mnrf/> for more details.

The Sydney University Molonglo Sky Survey (SUMSS) received funding for the period 2001-2003 to enable the completion of the survey of the southern extragalactic sky.

In 1995 the Australian astronomical community prepared Australian Astronomy: Beyond 2000, a strategic plan laying out the community's vision for the decade ahead and prioritising new initiatives. The five years since have seen a revolution in international astronomy, with major overseas investments in new facilities dramatically raising the bar for international competitiveness. The community is now preparing a " Mid-term Review to update the priorities identified in Beyond 2000, to ensure that Australian investment in astronomy is aligned with national priorities and leads to the greatest benefits. The SKA (see above) is likely to be highly ranked in the resulting report. Also supported by the review is the concept of an Australian Virtual Observatory.

John Whiteoak has been an enthusiastic advocate for Australia and for radio-astronomy in many spectrum management arenas. In 2000 he successfully argued for large areas of international protection for radioastronomy at millimetre wavelengths. This means that the blossoming field of millimetre astronomy can now look forward to many years of interference free operation at all sites internationally. For this and for his lifetime commitment to radioastronomy, spectrum management, and Australian Science, John was awarded the Public Service Medal in the Australia Day 2001 Honours List; a fitting tribute on the eve of his retirement.

Two prominent issues in CODATA that affect Australian radio-astronomy are:

There is a worldwide shift towards increased protection for intellectual property. This has resulted in some proposed legislation with the very reasonable aim of protecting commercial databases, but with unwanted side-effects which will cause problems for open access to scientific data. Various groups, particularly in the US, have been arguing that such legislation needs to include clauses such as "fair use" provisions similar to those included in copyright law. Otherwise, our current freedom of access to public-domain databases is threatened by this legislation (see www.codata.org/codata/data_access/summary.html for a summary of the issues).

There is a world-wide move towards the establishment of an International Virtual Observatory. A virtual observatory, at its most basic, consists of a web page to access archive data from a "real" observatory. At its most sophisticated, it will be a powerful tool to serve national and international communities in science, education, and outreach, with access to data, theoretical models, and perhaps instrumentation, from all major observatories worldwide, together with powerful tools, high-bandwidth links, and a data grid to facilitate extracting good science from the data. Of course we have some tools which do this to a limited extent already but the "Virtual Observatory" is taking this a step further by making it the normal way of accessing the data from a telescope. To achieve this, there will be a need for a common architecture and policies. Many groups, including the US, Europe, and Australia, have plans for National Virtual Observatories, but the realisation of an "International Virtual Observatory" will need a high degree of coordination.

The TIGER Radar is Operational

The TIGER (Tasman International Geospace Environment Radar) radar is situated on Bruny Island off the coast of southern Tasmania. This is an excellent geophysical location that gives TIGER unique opportunities to study Geospace processes such as aurora. Tasmania is much closer to the south magnetic pole than the south geographic pole and this makes it an ideal location from which to monitor the interaction of the Solar Wind with the Earth's magnetic field. Its more equatorward location relative to the other similar radars in both the southern and northern hemisphere also allows it to better monitor events that move equatorwards during magnetic storms. TIGER commenced operation in November 1999 and during 2000 the first complete year of observations were made.

The TIGER radar is part of the SuperDARN (Super Dual Auroral Radar Network) consortium of radars that collectively monitor the earth's auroral regions. Australia hosted the annual SuperDARN Meeting, SuperDARN 2000, at the Beechworth campus of La Trobe University, 22 – 26 May 2000.

FEDSAT

Late in the year 2001 Australia expected to launch FedSat, a research microsatellite with a complement of four scientific and engineering payloads. This launch is now expected to take place in early 2002. It will be placed in a near-circular sun synchronous 10:30 LT polar orbit at an inclination of 98.7° and altitude 800 km. The primary scientific experiment is a fluxgate magnetometer which will observe field aligned current structures above the auroral zones and other current systems and ultra-low frequency (ULF) plasma waves in the upper ionosphere. A major objective is to study the ionospheric signatures of regular and impulsive ULF waves propagating from the magnetosphere along geomagnetic field lines. An on-board GPS receiver will monitor the vertical and oblique total electron content (TEC) up to the GPS satellites at an altitude of 20,000 km.

People

- § Prof. Ron Ekers, Director of the CSIRO Australia Telescope, is president-elect of the IAU, and will take office as President in 2003.
- § Dr Trevor Bird was awarded an IEEE Millenium Medal for his services to the IEEE.
- § Dr. Phil Wilkinson has been asked to serve as an associate editor during 2001 for the American Geophysical Union journal Radio Science.

Other meetings were held in Australia:

- § The biennial Conference on Precision Electromagnetic Measurements (CPEM), for which URSI is a permanent sponsor, was held in Sydney from 14-19 May 2000 and hosted by the CSIRO National Measurement Laboratory. It was only the second time that CPEM had been held outside North America and Europe, reflecting the growing importance of the Asia Pacific region in world metrology. 435 delegates

attended from 43 countries and presented 336 papers covering research developments in electrical and electromagnetic metrology at frequencies from DC to millimetre waves, including advances in quantum effect devices and their applications, automated instrumentation, calibration systems, electromagnetic compatibility, lasers and optoelectronics, optical metrology, time and frequency metrology, and also reports on fundamental constants and progress in the development of an atomic-based kilogram.

- § The annual Asia-Pacific Microwave Conference (APMC2000) was held in Sydney in December with the main sponsors being the IEEE and CSIRO. Around 450 delegates attended APMC2000 from around the world with emphasis on the Asia-Pacific region.
- § The Eighth International Conference on Ground Penetrating Radar (GPR 2000) was held at the Gold Coast, Australia during 23-26 May 2000. Dr David Noon was General Chair and Prof Dennis Longstaff was Technical Chair. 153 technical papers were presented, with 226 delegates attending from 29 countries.

Papers were also presented at:

- § AP2000 Millennium Conference on Antennas & Propagation, Davos, Switzerland, 9-14 April 2000. URSI Sponsored.
- § EuroEM 2000, Edinburgh, Scotland, 30 May - 2 June 2000. URSI Sponsored.
- § The International Geoscience and Remote Sensing Symposium (IGARSS 2000), Honolulu, Hawaii, 24-28 July 2000. URSI Sponsored.
- § SCOSTEP First S-RAMP Conference, October 2 – 6 2000, Sapporo, Japan.
- § The Solar, Terrestrial and Space Physics sessions of the 14th National Congress of the Australian Institute of Physics meeting held in Adelaide, December 2000.

Activities for 2001 will include:

- § The National Committee will redevelop its Website and data base of groups in Australia with a radio science interest.

Several meetings and activities, important for the National Committee, will also take place in 2001:

- § The Seventh Australian Symposium on Antennas (14-15 February 2001 CSIRO, Sydney)
- § URSI International Symposium on Electromagnetic Theory to be held in Victoria, Canada, 13-17 May 2001
- § The 2001 International Geoscience and Remote Sensing Symposium (IGARSS 2001) will be held in Sydney, Australia on 9-13 July 2001. It is sponsored by URSI.
- § Dr David Noon will be planning a joint technical session "Subsurface Remote Sensing with its Applications" at the XXVIIth URSI General Assembly, XXVIIth URSI General Assembly, the Netherlands, in August 2002.
- § Dr David Noon will be co-authoring a chapter "Subsurface Remote Sensing" in URSI Review of Radio Science 1999-2001.
- § FEDSAT is will be launched in February 2002. Delays associated with one of the partners that went out of business prevented a 2001 launch as originally projected.
- § An International Conference on Bioastronomy is being planned for 2002 to be held in Hamilton Island. It is being hosted by the University of Western Sydney, with Carol Oliver (UWS) as chair of the LOC and Ray Norris (CSIRO) as chair of the SOC. Sponsorship will be sought from IAU, URSI, and IAA.

Budget

In the past the Committee has sought extra funds during the URSI General Assembly year, while restricting its expenditure in non-Assembly years. During 2001 the Committee would like to make a request for a small amount of money to support travel to our Annual Meeting by Committee members travelling inter-state (\$175 each for Dr. Bihn, Dr. Noon and Prof. Dyson and \$275 for Prof. Fynn who is travelling from Perth). The National Committee for Radio Science did not meet in 2000. The total amount sought is \$800.