

## ANNUAL REPORT TO COUNCIL: 2001

NATIONAL COMMITTEE FOR:

Radio Science

CHAIR

Dr. Phil Wilkinson

### Meetings of the National Committee and sub-Committees

*The National Committee met:*

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

*The following subcommittees also met during 2000:*

The WARS02 sub-committee met periodically to manage the planning of the WARS02 meeting.

*The following meetings are proposed for 2002:*

The National Committee will hold its Annual Meeting on 19 February 2002, immediately before the WARS02 meeting (20-22 February 2002) at the Mercure, Leura, NSW.

### Meetings of International Organisations Affiliated with ICSU

*In 2002 there will be a General Assembly of:*

↓ International Union of Radio Science (URSI) at Maastricht, The Netherlands, 22-29 August 2002.

*I recommend to Council the following voting Australian Delegation for the URSI General Assembly:*

Australian Delegate to URSI	Dr. Phil Wilkinson
Commission A	Dr. Peter Fisk
Commission B	Dr. Geoffrey James
Commission C	Prof. Robin Braun
Commission D	Dr. Le Nguyen Bihn
Commission E	Prof. Kevin Flynn
Commission F	Dr. David Noon
Commission G	Prof. Peter Dyson
Commission H	Prof. Brian Fraser
Commission J	Prof. Ray Norris
Commission K	Dr. Ken Joyner

### Australian Office Holders in ICSU and Affiliated Bodies

**Australians who held office in 2001 were:**

Person	International Body	Position	Term
John Brooks	IAA SETI post-detection committee	Member	2003-06
Wim Brouw	IAU SOFA Review Board	member	1997-
Wim Brouw	IAU working group on astronomical data	member	2000-
Jessica Chapman	SOC for IAU Symposium 206 on Cosmic Masers,	Member	2000-01

	March 2001, Brazil		
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	IAU	President-elect, member of exec. committee.	2000-2003
Ron Ekers	IAU	President,	2003-06
Ron Ekers	URSI Global VLBI working group	Member	
Ron Ekers	IAU working group on "large scale facilities"	member	2000-2003
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	2000-2003
Michelle Storey	IAU Working Group on Publishing	Chair	2000-2003
Michelle Storey	UNESCO/ICSU conference on electronic publishing Feb 2001	IAU delegate	2001
Michelle Storey	IAU Comm. 50, Protection of Existing and Potential Observatory Sites Organising Committee	member	2000-2003
Elaine Sadler	IAU commission 28 (Galaxies)	Vice-President	2000-03
Tasso Tzioumis	ITU Radiocommunication Study Group 7 (Sciences Services).	Member	2001-03
Tasso Tzioumis	URSI representative on IUCAF	Voting delegate of URSI	1999-2002
Tasso Tzioumis	IAU working group on interference mitigation	Chair	2000-2003
Richard Thompson	International Space Environment Services (ISES)	Member	
Bruce Ward	URSI-COSPAR Working Group on the International Reference Ionosphere	Member	1999-02
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	Vice-Chairman	1997-00

	Services).		
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 2002 are:

None have been notified in advance.

### Membership of National Committees and sub Committees

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

### Activities of the National Committee

I submit the following report to Council on the activities of the National Committee for Radio Science (NCRS) in 2001.

#### **2001 – 2002**

The NCRS has set up a electronic mailing list primarily for contacting people in Australia who are interested in radio science activities. However, this list is open for anybody to subscribe to. The entry point can be found at <http://www.ips.gov.au/mailman/listinfo> under the heading **nrcs-general**. The NCRS has also set up a website at <http://www.ips.gov.au/nrcs/>, which contains contact details for the Committee and has a link to the WARS'00 Proceedings and will shortly have a link to the WARS02 Proceedings.

The 2001 Asia-Pacific Radio Science Conference (AP-RASC'01) held at Chuo University, Tokyo, Japan, 1-4 August 2001 was a Japanese initiative to launch a new URSI-based radio science oriented meeting in the Asia-Pacific region. Several members of the NCRS Committee had roles in all aspects of the meeting: on the International Advisory Board (Phil Wilkinson); the International Steering Committee (David Skellern); convenors of sessions (Peter Fisk, Brian Fraser, Ken Joyner, David Noon, Phil Wilkinson) Commission

meetings (Phil Wilkinson) and Working Groups and through the presentation of papers by several more Australian delegates. The strong Australian attendance at this meeting, together with a large commitment to session organisation and presentation of papers demonstrates good regional support for radio science.

In October, a short note was prepared for the Academy of Science on the role of the NCRS.

The NCRS considered bidding for the 2005 URSI General Assembly. Although the NCRS believe that our bid would have been competitive, because Australia has a good standing within URSI as our collective contributions demonstrate, at the time of preparing this report the NCRS is recommending that we do not go ahead with the bid as we feel there are significant financial risks associated with it.

### **2002 - 2003**

The two key activities for the NCRS in the next year are WARS02 and the URSI General Assembly.

The WARS02 Conference will be held in Leura, NSW, February 20-22, and has an interactive format based around the presentation of poster papers together with a small number of invited reviews. Between 80 and 100 people will attend (including a small number of overseas people). There will be five invited reviews plus a discussion session on the Square Kilometer Array (SKA). The focussed discussion forum is an addition to the established WARS format and is intended to showcase a topic of high national interest in radio science. WARS meetings include a Prize for the best student paper submitted and this year there will be 9 student presentations. The NCRS members formed the WARS Conference Proceedings editorial panel and were responsible for appointing referees and maintaining the scientific standards for all papers submitted.

The XXVIIth General Assembly of the International Union of Radio Science (URSI) will be held in Maastricht, The Netherlands during 17 -25 August 2002. Several sessions will have Australian Convenors (Trevor Bird, David Noon, Le Nguyen Binh (2), Arnold Dekker, Manuel Cervera, Phil Wilkinson, Brian Fraser, Graeme James, Michael Kesteven). Phil Wilkinson is a sub-editor for the URSI Review of Radio Science 2000-2002, published in conjunction with the General Assembly, and David Noon will be contributing a chapter to it. Phil Wilkinson will also Chair the Commission G activities at the Assembly. Australia, through the NCRS, is making a good contribution to URSI.

### **Other Activities relevant to the NCRS**

A sample of the many radio science activities in Australia is bullet-pointed in the next section.

### **2001 – 2002**

- € AC quantum Hall resistances have been measured at frequencies up to 2 kHz. The resistances are well defined over a sufficiently wide range of magnetic field for them to be considered as the basis for an ac resistance standard. The current and frequency coefficients of the resistances are being investigated. (CSIRO-NML)
- € A trapped-ion clock using buffer-gas cooling has achieved a time stability having an Allen variance of  $\omega_y(x) = 5 \times 10^{-14} \delta^{1/2}$  and an absolute accuracy of 5 parts in  $10^{14}$ , and is expected to reach a limiting accuracy of less than a few parts in  $10^{15}$ . (CSIRO-NML)
- € CSIRO NML is conducting twice-weekly, Two-Way Satellite Time and Frequency Transfer sessions with the Communications Research Laboratory (Tokyo, Japan), the United States Naval Observatory (Washington, USA), the National Institute of Standards and Technology (Boulder, USA) and the Telecommunications Laboratory (Taipei, Taiwan).
- € The application ultra-high stability microwave oscillators based on cryogenic sapphire-loaded superconducting oscillators as local oscillators on Cesium fountain frequency standards has been demonstrated in a collaboration between the Department of Physics, University of Western Australia, and the Laboratoire Primaire des Temps et Fréquences, Paris, France.
- € The Department of Physics, University of Western Australia, has commenced development of an optical frequency measurement system based on femtosecond comb technology.

- € The Australian Consortium for Interferometric Gravitational Astronomy (ACIGA – comprising staff members from the Australian National University, The University of Adelaide and the University of Western Australia) has received funding to build an 80 metre Michelson interferometer at a site approximately 100 km North of Perth, WA. The Australian system is intended to serve as a test bed for the behavior of the optical components of a large scale optical interferometer at high optical power densities. The Australian interferometer will be in integral part of the Laser Interferometer Gravitational Wave Observatory (LIGO) project, based in the USA.
- € The most significant direction for work in Commission C is in support of the burgeoning Mobile and Networking fields. This includes some significant work in the direction of Telecommunications Systems. A significant development has been the creation of the Advanced Research Institute for Information and Communications Technology 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.
- € Another significant activity is the initiation of the federally funded Centre of Excellence in Information and Communications Technology which will steer over \$300M into research, providing up to 300 high level research staff.
- € *General trends of photonic technology and optical communications:* In 2001 there was considerable worldwide downturn in photonic technology due to severe slow down of the global telecommunications systems and networks. This is however an opportunity for Australia to restructure and strengthen its developments and research work in the field of photonic technology.
- € *On research and development of integrated photonic technology in Australia:* In integrated photonic technology, on-going development of ultra-fast integrated optical modulators has been conducted in universities in Victoria. Redfern Integrated Photonics Pty Ltd has also opened its new facilities for integrated optic technology works, especially in polymeric material systems. The integration of ultra-fast optical modulators in advanced optical communication systems and networks has also been implemented, especially in telecommunication operating in the region of 40 to 80 Gb/s at Monash University in conjunction with Nortel Networks Advanced Technology Centre.
- € *On quantum teleportation:* The Center of Advanced Quantum Electronics and Telecommunications of the University of Canberra has demonstrated a world transmission record for transmission of quantum keys in free air – the distance between the Telecom tower on Black Mountain in the A.C.T. to the University. This work will be described at the WARS02 Conference. Currently this work has been extended in the development of an ultra-fast integrated quantum transmitter which would be a significant breakthrough for economical and error performance improvement.
- € *On photonic signal processing techniques:* The Photonics and Optical Communications group of Sydney University and Monash University have developed considerable theoretical and practical experience with several photonic signal processors for applications in beam forming antenna systems and photonic routers for photonic transport layer for future all-optical transport networks. The Centre for Ultra-broadband Networks has investigated several topologies for optical networks and a Workshop on Optical Networking was organized in Victoria.
- € *On interaction between public sector and R&D institutions:* Multi-media Victoria, of the State Government of Victoria, has organized together with universities research groups and industrial partners, a non-profit organization – the Victorian Photonic Network – for collaborative work, teaching and training of photonics and optical communications.
- € *On facilities for teaching advanced electronics, photonics and telecommunications engineering:* over the last two decades of the 20<sup>th</sup> century Australia has paid no attention in the modernization of teaching and research laboratories in university and TAFE sectors. This trend can not be ignored further and significant investments must be made to reverse this trend in order to modernize the laboratories and catch up with other universities in the Asia Pacific region.
- € *On Australian photonic technology industrial sectors:* In 2001 a number of senior career-established engineers and scientists in the field of advanced photonic technology left Australia for other international laboratories. Associated with this, in late 2000, there were some major take-over activities in photonic

technology start-up companies as well as a significant closure of a number of research and development groups in mid-2001 (e.g. The closure of Nortel Networks R&D laboratory in Sydney).

- € The Federal Health Minister announced a further round of research grants totalling \$522,575AUD for research into health issues around electromagnetic energy emitted by mobile phones, mobile phone towers, and other communication devices. The new studies are:
  - € *Human physiological responses to exposure to mobile phone type radiation* Volunteers will be exposed to radiation similar to that received during a mobile phone call in order to identify immediate effects mobile phone use has on performance. Their ability to respond to visual and auditory stimuli will be assessed by measuring brain electrical activity. The quality of their sleep during the subsequent night will be measured.
  - € *Effects of radio frequency electromagnetic radiation from long-term mobile phone use on vision and hearing.* The study will build on an existing large-scale eye study to examine consequences of long-term mobile phone use on standard measures of vision, eye disease and hearing.
- € An Australian research group published a paper showing no effects on the blood brain barrier in mice following 60-minute exposure to GSM digital mobile phone signals at 4W/kg whole body exposure.
- € *Regulatory and Standards Issues:* The Senate Inquiry into EME issues finally handed down its report on May 4. The Inquiry found no substantiated scientific evidence for any health effects due to mobile phones, or their base stations that comply with the safety guidelines. The overall report contained two dissenting reports by the Government and major opposition party Senators, which were critical of the main report drafted by the Chairperson. The Chairperson, who is from a minority party, was criticized heavily by both major parties and the Government has not formally responded to the Inquiry. The major parties agreed on a number of key issues and there was support from both groups for:
  - € the review of Australian standard by the Health Agency ARPANSA,
  - € extension of \$1M/yr fund for research,
  - € provision of more public information including SAR reporting,
  - € increased community consultation re mobile infrastructure.
- € The Standards Committee of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) Committee finalized the new Australian standard for human exposure to radio frequency energy. The new standard is based on the international limits and should be published early in 2002.
- € IPS Radio and Space Services is developing a Space Weather Plan for monitoring space weather for forecasting purposes and enhancing our knowledge of the near-Earth space environment. The draft plan has been circulated to members of the STP community and their comments have been taken into account. As part of the objectives of this plan, IPS has been endorsed by the World Data Center (WDC) community and is now a WDC for Solar Terrestrial Science.
- € TIGER (Tasman International Geospace Environment Radar) is in its second year of operation as a component of the international SuperDARN (Super Dual Auroral Radar Network). A 5-member delegation attended the SuperDARN Workshop in Venice in May 2001 to present results and participate in planning future SuperDARN operations.
- € *Major National Research Facilities (MNRF) Program:* A successful proposal to the Federal Government's Major National Research Facilities (MNRF) Program was led by Ray Norris (CSIRO) on behalf of the Australian astronomical community. \$23.5m was awarded, which will be used to enhance the effectiveness of Australia's research in astronomy, at a range of wavelengths. Part of the funding will be used to increase Australia's share of the world-leading Gemini optical telescopes, and part will be used to develop technology for the next-generation radio telescope - the Square Kilometer Array (SKA). This technology development will both upgrade our existing facilities and demonstrate technologies that will be needed for the SKA. Australia is a key player in the international consortium which will build the billion-dollar SKA, and the MNRF funding significantly enhances the likelihood of Australia being asked to host it. This international project is in the planning stage, with technology and site choice to be made in 2005, and construction to start in 2010. Australia is in a prime position to be the location for this telescope, primarily because of relatively

low Radio Frequency Interference (RFI) levels, coupled with access to appropriate expertise and infrastructure. Further details are available at <http://www.atnf.csiro.au/mnrf2001/>

- € *ATNF upgrade:* The ATNF's \$11M upgrade is nearing completion. Australian-designed cryogenic InP MMIC low-noise amplifiers operating at 3mm wavelength have been installed on three of the antennas of the Australia Telescope Compact Array, and successful observations have yielded the first scientific results from these first millimetric interferometer observations in the Southern Hemisphere. See <http://www.atnf.csiro.au/mnrf/mnrf1996.html> for more details. Further upgrades under the MNRF program will include increasing the bandwidth of the array to 2 GHz, and the addition of two prototype SKA elements to the array.
- € *Sydney University:* The Sydney University Molonglo Sky Survey (SUMSS) is producing some of the deepest radio images ever obtained of large parts of the Southern sky. It will continue to be upgraded under the MNRF program (see above) as a testbed for some of the technologies for the SKA.
- € *Productivity Commission Inquiry into the Telecommunications Act:* CSIRO made two submissions (one from Australia Telescope National Facility (ATNF) and one from CSIRO Division of Telecommunication and Industrial Physics (CTIP)) to this enquiry. The ATNF submission, prepared by Tasso Tzioumis, Bruce Thomas, and Michelle Storey, is of particular relevance to URSI Commission J as it outlines the need for adequate protection of radio observatories, and proposes the concept of a radio protected zone around the future Square Kilometre Array.

#### Meetings relevant to the NCRS:

- € OECC/IOOC 2001 International Conference on Integrated Optics and Optical Communications and Optoelectronics and Communications Conferences (IOOC/OECC) incorporating the Australian Conference on Optical Fibre Technology were held in July 2001 in Sydney. The principal sponsors were the IEEE, Institution of Engineers (Australia), Australian Photonics CRC and industrial companies. Around 800 delegates attended OECC/IOOC from around the world.
- € Subsurface Sensing Technologies and Applications III, San Diego, USA, 29 July - 3 August 2001. David Noon was a member of the Technical Program Committee. Dr David Noon chaired a session and presented a technical paper.
- € The International Geoscience and Remote Sensing Symposium (IGARSS'01) was held in Sydney, Australia during 9-13 July 2001. This conference was sponsored by URSI. Over 1000 international delegates attended the meeting. Professor Dennis Longstaff, the previous Commission F representative, was a member of the Technical Committee. Australian radio scientists presented many papers.
- € IAU Symposium 206: Cosmic Masers: from Protostars to Black Holes This symposium was held in March 2001, in Rio de Janeiro, Brazil. Several Australians attended, and Jessica Chapman from CSIRO was a member of the SOC.
- € ITU/IUCAF meetings, Geneva, April and May 2001 Tasso Tzioumis from CSIRO played a significant role in spectrum management meetings in Geneva held by ITU and IUCAF.
- € URSI/COSPAR International Reference Ionosphere Workshop - Modeling the Low Latitude Ionosphere was held in Instituto Nacional de Pesquisas Espaciais (INPE), Sao Jose dos Campos, Brazil, June 25-29, 2001.

#### **2002 – 2003**

Several Conferences and Workshops will be held during the forthcoming year.

- € Currently, Australia is commissioning a synchrotron source and its construction should be complete around 2007. In preparation, Commission D, of the NCRS, under the sponsorship of the Victorian Government, is organizing a workshop in April 2002 on potential applications of synchrotron radiation in manufacturing of micro-optic and integrated photonic components, Monash university, April 2002. In addition, Session D4, at the URSI General Assembly, on “*Nanotechnologic processes for advanced optic and electronic systems*” will deal with the applications of synchrotron radiation for processing of electronic and photonic components.

- € URSI Commission-F Open Symposium on Radiowave Propagation and Remote Sensing, Garmisch-Patenkirchen, Germany, 12-15 February 2002. Commission F Business Meeting for voting delegates will be held in conjunction with symposium.
- € The European Frequency and Time Forum will be held in St Petersburg, Russia, between March 12 and 14, 2002.
- € Optical Fibre Communication Conference, March 2002, CA, USA
- € Nineth International Conference on Ground Penetrating Radar (GPR 2002) will be held in Santa Barbara, USA during 29 April - 2 May 2002. Drs David Noon and Glen Stickley are members of the Technical Review Committee for this conference, and they will be attending. Dr David Noon is on the International GPR Advisory Committee which will meet during this conference.
- € The Third URSI International Symposium on the High Latitude Ionosphere will be held in Fairbanks, Alaska, in May 2002 with a focus on High-Latitude Space Weather.
- € The IEEE Frequency Control Symposium will be held in New Orleans, USA, between May 29 and June 1, 2002.
- € IUCAF workshop on spectrum management, Greenbank, WVa, Geneva, June 2002. Tasso Tzioumis from CSIRO is helping organise this workshop, which is sponsored by IUCAF.
- € The International Conference on Precision Electromagnetic Measurements (CPEM) (co-sponsored by URSI) will be held in Ottawa, Canada from 16-21 June 2002.
- € IAU Symposium 213: Bioastronomy 2002: Life Among the Stars. An International Conference on Bioastronomy is to be held on Hamilton Island in July 2002. Ray Norris (CSIRO) chairs the SOC and Carol Oliver (Macquarie University) chairs the LOC. This inter-disciplinary conference ranges from the origin of life to searches for extra-terrestrial intelligence (SETI). Confirmed speakers include at least two Nobel prizewinners and several other high-profile international scientists. Details are on <http://aca.mq.edu.au/bioastronomy/>
- € Australian Institute of Physics 15th Biennial Congress, July 8-11, 2002, Sydney
- € The International Congress on Plasma Physics (ICPP) held in Sydney 15 to 19 July, 2002. One of the themes for the ICPP meeting is the observation of natural plasmas, which covers all aspects of the space environment from geospace to galactic cosmic rays.
- € The World Space Environment Forum - WSEF2002, to be held in Adelaide 21-25 July, 2002. The WSEF2002 is an international conference with papers being delivered by invitation. The focus is on space weather, with an emphasis on computer-intensive simulations of the space environment.
- € Opto-electronics and Communications Conference, July, Japan
- € International Conference on Optical MEMS, Switzerland, August 2002.
- € CODATA. Ray Norris from CSIRO will represent the IAU at the CODATA meeting in Montreal, Canada, in September 2002
- € European Conference on Optical Communications ECCOC 2002 in September 2002.
- € IEEE International Semiconductor Laser Conference, October, Sept. 2002.
- € ITU/IUCAF meetings, Geneva, February and September 2002. Tasso Tzioumis from CSIRO will play a significant role in spectrum management meetings in Geneva to be held by ITU and IUCAF.
- € The 34th COSPAR Scientific Assembly combined with the Second World Space Congress Houston, Tx, USA, 10-19 October 2002

## Budget

Expenditure by the NCRS is expected to increase in 2002 due to activities associated with the URSI General Assembly. The following paragraphs are provided to support our funding request. Note that no funds will be sought to support WARS02 since sponsors were found to underwrite expenses in excess of the funds collected from registration fees.

### Financial support for the NCRS Annual Meeting

Members of the NCRS will hold their Annual Meeting in conjunction with the WARS02 meeting in Leura, NSW. While travel costs associated with the Meeting will be shared with WARS02, an additional night accommodation in Leura will be necessary.

### Travel Support for the URSI General Assembly

Up to 10 voting delegates are required for the URSI General Assembly, which is held in August, a peak period for air travel. Some delegates are expected to request travel support. In addition, in the past the Committee has requested travel support for URSI Young Scientist Award recipients. In the past, a total of \$5000 has been requested for travel support.

### Australian Delegates Meeting at URSI

The Chair of the NCRS will convene a meeting of the Australian delegates during the URSI General Assembly to discuss issues pertinent to Australian radio science. Venue hire and meeting costs are expected to be around \$1000.

### **Summary**

NCRS Annual Meeting	\$1000
URSI Travel support	\$5000
Delegates Meeting	\$1000
<u>TOTAL</u>	<u>\$7000</u>