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Australian Research Council

ARC Communications Research Network Annual Report 2005



ARC Communications Research Network

This Annual Report was mainly written by the ACoRN Network Convenor, Prof Lars Rasmussen. Edited contributions have been made by A/Prof Tad Wysocki, A/Prof Abbas Jamalipour, Prof Alex Grant, A/Prof Jamie Evans, Mrs Christine Thursby, and Mr Simon Patterson. Activity Reports from ACoRN Partner Organisations have been prepared by local ACoRN Representatives.

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1 The Convenor's Report

ARC research networks are platforms designed to bring together researchers at the forefront of their fields of expertise, sharing knowledge and collaborating across disciplinary and geographical boundaries. Building on existing research links, the ARC Communications Research Network (ACoRN) has grown into an impressive network of more than 175 esteemed Australian researchers and research students working in the field of information and communication technologies. ACoRN is administrated by University of South Australia with Prof Lars K Rasmussen from the Institute for Telecommunications Research taking on the role as Network Convenor.

ACoRN has now been up running for one busy year. It has been a challenge to provide both useful programs of activities for the ACoRN members, and to build up a functional administrative framework. After an initial start-up phase program activities as well as the administrative procedures have been developed and are constantly being improved. The member activities are still increasing and our online application system has eased the access to support. To reach this level of operation has been the joint effort of all ACoRN members, and for that we should all be congratulated.

Some members deserve to be further acknowledged. I would especially like to express my gratitude to the members of the 2005 ACoRN Executive Board for their hard work throughout the year. The same level of gratitude goes to our invaluable Team of Local ACoRN Representatives, and to the enthusiastic group of ACoRN members that took the time and effort to organise ACoRN events in 2005. Without the voluntary efforts of these people, ACoRN would not be able to operate. Finally, I would like to acknowledge the ACoRN Advisory Board for the great help and advice they have offered, making sure that our activities are streamlined and moving ACoRN towards national and international recognition.

In 2005 we set out with an ambitious program, including workshops, schools, international and national conference events, international visitors, and the development of the ACoRN website. It took some time to gain momentum and visibility for ACoRN, but we met most of our targets within the four programs of activities. 2005 saw the first *ACoRN AusCTW tutorial day*, the *ACoRN Workshop on cross-layer design problems for wireless communication*, the *CUBIN/ACoRN Information Theory Workshop*, the *ACoRN-NICTA Wireless Winter School*, and the *ACoRN Spring School on Coding and Information Theory*.

In addition, ACoRN provided financial sponsorship to the *IEEE International Symposium on Information Theory* held in Adelaide, the *IEEE Local Computer Networks Conference* held in Sydney and the *IEEE Vehicular Technology Conference* to be held in Melbourne in 2006. Two bids for hosting major International Conference events in 2009 and 2012 in Australia were submitted. Attendance grants for ACoRN members were further offered to attend ACoRN workshops and schools, International conference events overseas, established national conference events and International events hosted in Australia. A total of 161 attendance grants were awarded in 2005.

A series of international visitors, partly or fully supported by ACoRN, came to Australia to visit ACoRN members. In addition, ACoRN offered travel support for national and international research visits by ACoRN members. All together ACoRN supported 5 international visitors, 12 international travel fellowships/scholarships, 5 domestic travel fellowships/scholarships, and 1 industry Internship.

In 2005, we also released our new and improved ACoRN website featuring an online application system. This has significantly streamlined the application processes for funding support, and the system is continuously being updated to provide an even better interface. In conjunction with the website, ACoRN released a bi-monthly newsletter, containing relevant information for ACoRN members and others interested in the Australian telecommunications research community. The distribution of the newsletter is now over 700, reaching far beyond the boundaries of ACoRN.

Finally, in 2005 ACoRN and the European Union Network of Excellence in Wireless Communications (NEWCOM) signed a memo of understanding with respect to research collabora-

tion. As part of this collaboration, a jointly funded researcher exchange program has proven itself very useful. Another visible outcome is the joint ACoRN-NEWCOM annual workshop with the first event scheduled for September 2006 in Austria.

Through the wide range of ACoRN activities, we have enjoyed an encouraging series of success. We have, however, also recognised a series of challenges to be addressed in 2006 to improve the value of our Network. The spending rate across the ACoRN partner organisations needs to increase. The scale and focus of the ACoRN research themes needs to grow. The competitive funding barriers preventing domestic research collaboration and travelling must be circumvented. The industry involvement in ACoRN needs to be strengthened, and ACoRN must explore new ways to link to the general public in a meaningful way

Contrasting our successes against the challenges ahead, I think we can be satisfied with the accomplishments of ACoRN in 2005. There is room for improvements and more activities; however, in 2005 we presented, organised and hosted a breadth of engaging activities. We have established an enthusiastic and active group of local representatives, and ACoRN has vigorously been promoted as the Network for our community, and now enjoys a high level of visibility within ACoRN organisations and beyond. I am confident that we are well prepared for an even more successful 2006.

Prof Lars K Rasmussen

ACoRN Network Convenor

For more information, visit the ACoRN website at

<http://www.acorn.net.au>

2 Introduction

Information and Communication Technology is a key contributor to national productivity and growth. In support of developing information and communication technologies in Australia, ACoRN aims to stimulate creativity, innovation and breakthrough science, leading to technological advancement in telecommunications. The Network supports researchers in all aspects of telecommunications, but is particularly focusing on four main theme areas:

- Mobile and Wireless Data Communications;
- Broadband and Optical Fixed Networks;
- Rural Communications;
- Fundamentals of Emerging Media.

These themes are directed towards development of fundamental theories for application to emerging wired and wireless communications technologies. The four identified research themes span several research areas and is formulated to drive multidisciplinary, innovative research within existing activities as well as inspire new collaborative initiatives.

ACoRN is not meant to fund research projects in these areas directly. Instead the Network intends to support research-networking activities within the research themes. Specific Network objectives include consolidation of existing linkages; formation of new links; facilitation of multidisciplinary research; stimulation of commercial activity; improvement of postgraduate education; and increased International prominence. These intentions are captured in the ACoRN mission statement and objectives.

In support of the Mission and Objectives, the following four programs encapsulate the core activities of the Network:

- Researcher Mobility;
- National and International Workshops and Conferences;
- Postgraduate Education;
- Knowledge Management Systems.

Supporting the Convenor in governance of the Network is an Executive Board, consisting of a mixture of Australian senior researchers and young investigators and an International Advisory Board, consisting of respected senior scientists. In addition a centrally located Network Administrator and a team of Local ACoRN Representatives located at individual ACoRN Partner organisations provide operational support.

2.1 Mission and Objectives

Mission

Building on a strong platform of existing research excellence, the mission of the ARC Communications Research Network is to deliver benefits to the Australian telecommunications community, facilitating a healthy and sustainable collaborative research environment, and a culture of excellence that crosses disciplinary, organisational, institutional and geographical boundaries.

Objectives

The ARC Communications Research Network (ACoRN) will

1. Promote a culture of research excellence across the Network;
2. Initiate open exchange of pre-competitive information and sharing of resources;
3. Develop and implement integrated research plans for researchers in areas of common interest;
4. Inspire new inter-disciplinary research themes, focused on National Priority Areas;
5. Nurture the careers of Young Investigators and students, promoting a sense of community, collaboration and a culture of effective mentoring;
6. Encourage and support Young Investigators in positions of research leadership;
7. Facilitate links with end users such as telecommunications industries, government, and the broader community;
8. Raise the profile of Australian telecommunications research nationally and globally.

2.2 ACoRN Research Themes

The ACoRN Research Themes highlight the areas of focus within the Network and are designed to promote specific research directions of National importance, while cutting across existing disciplinary boundaries. The themes are described in more detail below

2.2.1 Mobile and Wireless Data Communications

Third-generation mobile communications systems are slowly unfolding worldwide, diverting the research focus onto the design of next generation systems. The desire to communicate freely and flexibly, inspired by the widespread use of the wired Internet, points towards systems designs with more adaptable network structures, and new innovative approaches across traditionally separated disciplinary areas of telecommunications.

2.2.2 Rural Communications

Australia's unique environment creates particular problems for the supply of telecommunications services to remote areas. The supply of cost-effective broadband communications to rural and remote areas will require the combination of several technologies, such as satellite communications, wireless data networks and backbone fibre trunks. This enforces a multi-disciplinary approach for providing viable solutions for a recognised Australian problem.

2.2.3 Broadband and Optical Fixed Networks

The overwhelming success of the Internet has led to an explosive growth in Internet-traffic over the last decade, leading to increasing demands on the supporting infrastructure. Typically, backbone telecommunications infrastructure relies on optical networks and wired distribution to the user's premises. Collaboration across areas of excellence in photonics and optical networks and areas of excellence in information theory, communication theory and signal processing provides a powerful constellation for innovation.

2.2.4 Fundamentals of Emerging Media

At the interface between communications theory and physics lies the development of new communications media, such as quantum channels, space-time channels and photonic channels. The development of such new physical media has in recent years driven considerable research and development activity. This is indicative of "break-through" technology, which causes a re-think of the standard ways of communicating.

2.3 ACoRN Programs

Where the research themes set the scope and over-arching directions of the Network, the proposed programs encapsulate the actual activities that are conducted in support of the research.

2.3.1 Researcher Mobility

The Researcher Mobility Program offers domestic and International visiting opportunities for researchers within ACoRN, opportunities for domestic internships in collaboration with industry, and visiting opportunities for relevant International researchers to work within ACoRN. Emphasis is placed on forming new linkages. The Program creates a stimulating multi-disciplinary research environment, spanning boundaries of industry and public organisations, and providing a forum for inter-disciplinary research collaboration aligned with National research priorities.

2.3.2 National and International Conferences and Workshops

The National and International Conferences and Workshops Program offers a forum for organising National and International technical meetings, International conferences and workshops held in Australia, bilateral workshops with relevant organisations/nations, thematic workshops and industry workshops. The program offers opportunities for larger forums of scientific exchange and networking, as well as industry linkages and public engagement. Technical workshops and conferences contribute to the propagation of research results into the research community, supporting the creative research environment, exposing postgraduates to the larger community, creating linkages between relevant researchers within public organisations as well as within industry, and promoting a united culture for stimulating innovation and commercialisation.

2.3.3 Postgraduate Education

The Postgraduate Education Program offers Domestic and International student visiting opportunities as well as Domestic Industry Internships. Summer/winter schools are also offered, covering important disciplinary, inter-disciplinary and thematic subjects. The program is focused on enhancing research education. It aims to provide enlightening experiences of research collaboration and excellence, building a foundation of confidence, individualism and initiative required for the development of successful Australian researchers.

2.3.4 Knowledge Management Systems

The Knowledge Management Systems Program is centred around the ACoRN web site. Activities include a newsletter, internal review processes, and efforts encouraging the use of information and communications technologies for establishing a virtual presence across geographical boundaries, strengthening the sense of community. The Program contains a public relations component, reaching out to the general public, aiming to showcase Australian telecommunications research capabilities domestically and internationally.

2.4 Organisation of the ACoRN Annual Report

The remainder of the Report is organised as follows. In Section 3 statistics and demographics of the ACoRN membership are presented and discussed. The Network Program activities in 2005 are presented and discussed in detail in Section 4, while the ACoRN Administration is detailed in Section 5. The performance of the Network is evaluated against the Approved Proposal as well as against the Network Objectives in Section 6, and the report is concluded with a presentation of the strategies and activities scheduled for 2006. In the appendices we include the ACoRN-NEWCOM Memorandum of Understanding, activity reports 2005 from ACoRN Partner Organisations, the register of participants, 2005 financial overviews, and a 2006 budget overview.

3 ACoRN Participants

Individuals can apply to be ACoRN participants, also known as members, via an on-line process at the ACoRN website. To be a full member of ACoRN it is required to be affiliated with an organisation that is part of ACoRN. Full membership is required to be eligible to apply for funding under the ACoRN Network.

Individuals not part of ACoRN organisations are still encouraged to complete the application process and may be granted a special ACoRN membership (an ACoRN Guest), but will not be eligible for ACoRN funding grants. For example, members of NEWCOM will be considered special members of ACoRN. This allows Guests to take advantage of features such as a Newsletter subscription.

The following subsections describe the demographics of the ACoRN Organisations and the ACoRN Membership.

3.1 ACoRN Organisations

Table 1 below shows the current list of ACoRN Organisations. This table also shows the number of Members within each Organisation. One of the final steps in the application process for full members is that they are required to sign a "Register of Network Participants" as required by the ARC. With the distributed nature of university campuses and other individual requirements, Local ACoRN Representatives can find this part of the process time consuming to finalise. Officially, Members that have not signed this form are not full members until it is complete. Table 1 shows the breakdown of these members by organisation.

ACoRN Organisation	Members		
	Un-signed	Signed	Total
Agere Systems Australia	7	3	10
Australian National University	10	10	20
CSIRO ICT Centre		7	7
Monash University	6	15	21
National ICT Australia	14	4	18
University of Adelaide	6	12	18
University of Melbourne	5	27	32
University of New South Wales	13	5	18
University of Newcastle		9	9
University of Queensland		14	14
University of South Australia		41	41
University of Sydney		12	12
University of Wollongong	1	9	10
Victoria University	8	4	12
Western Australian Telecommunications Research Institute	3	6	9
Total	73	178	251

Table 1: The breakdown of ACoRN Members that have signed the Register of Network Participants and those that have not at each of the ACoRN Partner Organisation.

It follows that the official count of ACoRN Members is 178. Among the organisations, the administrating organisation, University of South Australia, has the most ACoRN Members with University of Melbourne and Monash University following suit. In 2006, the central Administration will monitor the number of outstanding entries in the Register of Participants, making sure that all members have fulfilled the ARC requirements.

The current Register of Participants is found in Appendix C.

3.2 ACoRN Members

Table 2 and Figure 1 below describe some details about the demographic of the ACoRN Membership. New South Wales, Victoria, and South Australia are the big states in ACoRN with 60-70 ACoRN members each.

STATE	Un-signed*	Signed*	Total Members
ACT	20	12	32
NSW	25	46	71
QLD	0	14	14
SA	6	53	59
VIC	19	47	66
WA	3	6	9
Total		178	251

* See note relating to previous table.

Table 2: The detailed ACoRN Membership statistics by state used in Figure 1.

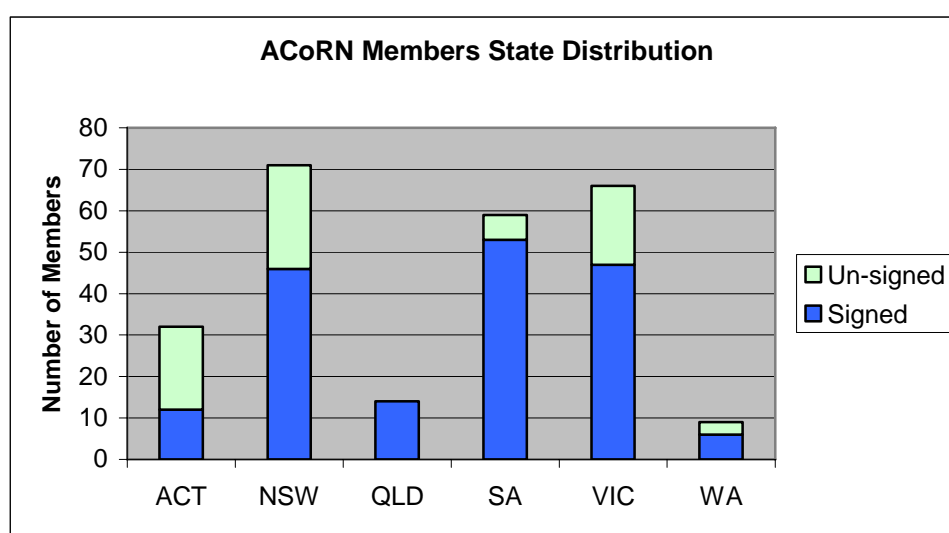


Figure 1: The number of ACoRN Members by State.

These numbers are based on 7 organisations in New South Wales, 3 organisations in Victoria and 2 organisations in South Australia. The Western Australian partner, the Western Australian Telecommunications Research Institute, is unfortunately leaving ACoRN in 2005. As a consequence, in 2006 there is no longer any representation of Western Australia in ACoRN.

Considering the 178 full ACoRN Members, the breakdown into Postgraduate Students, Early Career Researchers, and Senior and other Researchers is shown in Table 3 below. Post-graduate students constitutes more than 50% of the ACoRN membership, while almost 15% are early career researchers and 35% are senior and other researchers.

Member Type	Percent	Signed
ECR	14.6%	26
STUDENT	50.6%	90
OTHER	34.8%	62
Total		178

Table 3: Detailed membership breakdown of Postgraduate students, ECRs, and others.

4 Network Activities 2005

ACoRN is structured around four programs of activities, supporting and encouraging networking of researchers and postgraduate students across Australia and beyond. In Section 4.1 the ACoRN-NEWCOM Collaborative Agreement is presented and discussed. This agreement was a major achievement for ACoRN in 2005 and the resulting level of collaboration cuts across all the ACoRN programs. In subsequent sections, the activities within each program in 2005 are described.

4.1 ACoRN-NEWCOM Collaborative Agreement

Steering Committee: A/Prof Jamie Evans (ACoRN), Prof Lars Rasmussen (ACoRN), Prof Sergio Benedetto (NEWCOM), Prof Roberto Verdone (NEWCOM)

The ACoRN-NEWCOM¹ Memorandum of Understanding was signed in late May. The intention of the Memorandum is to establish close collaboration between ACoRN and NEWCOM through the existing programs of activity in the two networks. Joint activities currently being pursued are:

- Annual joint workshop;
- ACoRN and NEWCOM events open for members of both networks;
- Jointly funded researcher/student exchanges;
- Exchange of postgraduate coursework material;
- Jointly edited special journal issues, e.g. IEEE, Journal on Selected Areas of Communication.

A steering committee of four people has been appointed to coordinate the joint activities. The steering committee currently consist of the four people listed in Table 4 below.

ACoRN	NEWCOM
Prof Lars Rasmussen (ACoRN Convenor)	Prof Sergio Benedetto (NEWCOM Director)
A/Prof Jamie Evans (ACoRN Executive Board)	Prof Roberto Verdone (NEWCOM Executive Board)

Table 4: The members of the ACoRN-NEWCOM Steering Committee.

The joint ACoRN-NEWCOM collaboration agreement is a major achievement for ACoRN and will be a priority for establishing a strong Australian involvement in Europe.

4.1.1 European Union Network of Excellence in Wireless Communications

The EU Network of Excellence in Wireless Communications (NEWCOM) is a European research network with a similar mission and objectives as ACoRN. NEWCOM aims at creating a European network that links in a cooperative way a large number of leading research groups addressing the strategic objective "Mobile and wireless systems beyond 3G". This objective is a strategic research priority within the EU.

The joint programme of activities within NEWCOM involves:

- Researcher and student exchanges;
- Organisation of workshops and conferences;

¹ The European Union Network of Excellence in Wireless Communications is described in more detail in Section 4.1.1.

- Preparation of graduate courses coordinated with the PhD programs of the academic partners;
- Broad dissemination of scientific results;
- Promotion of entrepreneurship among its researchers, encouraging exploitation of IPR through the creation of start-up companies.

NEWCOM includes participants from almost all countries of the European Union (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, the Netherlands, Spain, Portugal, Sweden, and United Kingdom). An additional six countries outside the EU (Hungary, Israel, Norway, Poland, Switzerland and Turkey) are also associated with NEWCOM.

In terms of members, NEWCOM is significantly larger than ACoRN, including 61 academic and industry partner organisations, totalling hundreds of researchers and students. A large number of world-class European researchers and research groups are members of NEWCOM.

For a comprehensive description of NEWCOM, please visit the NEWCOM website at <http://newcom.ismb.it>.

4.2 Researcher Mobility Program

Program Leaders: A/Prof Tadeuzs Wysocki, A/Prof Abbas Jamalipour

The researcher mobility program offers domestic and international visiting opportunities for researchers within the ACoRN network, opportunities for domestic internships in collaboration with industry, and visiting opportunities for relevant international researchers to work within ACoRN.

The program currently contains four main activities, namely International Travel Fellowships, Domestic Travel Fellowships, Visitors Travel Fellowships, and travel grants for joint ARC proposal preparation. In 2005, all activities within the researcher mobility program were of equally high priority, as they all contribute directly to the networking objectives of ACoRN. No applications for travel grants for joint ARC proposal preparation were received in 2005. 6 International Travel Fellowships, 4 Domestic travel fellowships, and 5 Visitors Travel Fellowships were funded in 2005.

The program activities are summarised in Table 5 below.

	International Travel Fellowship	Domestic Travel Fellowship	Industry Internship	International Visitors Fellowship
ARC Eligible Organisations	4	0	0	4
ARC Non-Eligible Organisations	2	4	0	1
Total	6	4	0	5

Table 5: Overview of Fellowship activity in the Researcher Mobility Program.

4.2.1 International Travel Fellowship

The ACoRN International Travel Fellowships are intended for Australian researchers to visit recognised researchers and research groups abroad for longer periods of time. The travel fellowships are enabling grants, providing the seed funding to leverage further support from

other sources. The maximum amount of the fellowship is \$6,000 out of which 50% comes from ACoRN central sources and 50% from the applicant institution.

Reports for approved 2005 International Travel Fellowships are included below.

Dr Nemai Chandra Karmakar, Monash University visited Dr M. Ali, Department of Electrical Engineering, The University of South Carolina, USA for one week after attending the IEEE International Symposium on Antennas and Propagation in Washington DC on 8 July 2005. Under the leadership of Dr Ali, wireless communications research has gained momentum at University of South Carolina. Dr Ali has a good track record in research and PhD level supervision. He currently holds an NSF Young Scientist Award of US\$500,000. Besides this he has links with leading wireless communications companies such as Sony-Ericsson, Motorola and Nokia.

The visit objective was to identify common interests in research expertise and identify common interests. During the visit, it was interestingly observed that we had many common research interests such as internal antennas for mobile phones, wireless sensors and networks and microwave power beaming using smart antennas. The most suitable research collaboration was identified in the areas of wireless networks, high frequency device developments, wireless sensors for mobile and ad-hoc communications and similar areas.

As an outcome of the visit, strong research links has been developed. An ARC International Linkage Grant application is being prepared.

Dr Yi Hong, University of South Australia visited Prof Jean-Claude Belfiore at the École Nationale Supérieure des Télécommunications, Paris, France and A/Prof Emanuelle Viterbo at the Dipartimento di Elettronica del Politecnico di Torino, Italy for a total of four weeks. This visit was part of the ACoRN-NEWCOM collaborative exchange program. Yi worked with both professors on two topics:

- A Space-time block coded Multiuser MIMO Downlink Transmission Scheme. In this work they showed how to use threaded algebraic space-time block codes and perfect space-time block codes in the downlink of a space time block coded multiuser multiple-input multiple-output (MIMO) system in order to achieve the maximum data rate and diversity gain.
- High Rate Space-Time Trellis Coded Modulation. In this work, they present a concatenated scheme for a 2x2 multiple-input multiple-output (MIMO) system over slow fading channels, using simulations to show that performance gains can be achieved over uncoded Golden code.

Tangible outcomes from Yi Hong's visit include:

- An invited seminar: "New Space-time trellis codes for Slow Fading Channels", at Polito Torino, Italy, 8th Dec. 2005;
- Submitted papers:
 - Y. Hong, E. Viterbo, and J.-C. Belfiore, "A Space-time block coded Multiuser MIMO Downlink Trnasmission Scheme", submitted to *IEEE International Symposium on Information Theory*, Jan. 2006;
 - J.-C. Belfiore, Y. Hong, and E. Viterbo, "High data rate trellis coded modulations", prepare for submission to *IEEE Trans. on Inform. Theory*;
 - J.-C. Belfiore, Y. Hong and E. Viterbo, "High data rate trellis coded modulations", prepare for submission to *IEEE Information Theory Workshop'06*;
 - Y. Hong, E. Viterbo, and J.-C. Belfiore, "A space-time block coded multiuser MIMO downlink transmission scheme", submitted to *IEEE Commun. Lett.*, Feb. 2006;

- Application for ARC Discovery Project, entitled “Multiple antennas Downlink Techniques for Next Generation Wireless Communications”, with Prof Viterbo and Prof Belfiore as Partner Investigators;
- A potential visit by Prof Emanuelle Viterbo to UniSA for up to 7 weeks in 2006 (an ACoRN application has been submitted for 2006).

Dr Albert Guillen i Fabregas, University of South Australia travelled to Paris, spending three weeks at Ecole Nationale Supérieure des Telecommunications as a guest of Prof Joseph Boutros. This visit was part of the ACoRN-NEWCOM collaborative exchange program. Joseph Boutros received the electrical engineering degree in 1992 and the Ph.D. degree in 1996 from Ecole Nationale Supérieure des Télécommunications (ENST), Paris, France. Since September 1996, he has been with the Communications and Electronics Department at ENST as an Associate Professor. His fields of interest are codes on graphs, iterative decoding, joint source-channel coding, space-time coding and lattice sphere packings. He has made particular contributions to sphere decoding, rotated lattice constellation designs, capacity- and outage-approaching codes with iterative decoding and multiple antenna codes and receiver structures.

From the visit Albert produced results that significantly improve the understanding of code design for the block-fading channel. The outcomes of this study bring a complete picture of efficient communication in such non-ergodic channels, implying that higher data rates will be communicated more reliably. Tangible outcomes include:

- Published and submitted papers:
 - J. Boutros, A. Guillén i Fàbregas and E. Calvanese Strinati, “Binary Codes in the Block-Fading Channel”, to be submitted to the *IEEE Trans. on Information Theory*, March 2006;
 - J. Boutros, A. Guillén i Fàbregas and E. Calvanese Strinati, “Binary Codes in the Block-Fading Channel”, in *Proc. 2006 Australian Communications Theory Workshop*, Perth, February 2006;
 - J. Boutros, A. Guillén i Fàbregas, and E. Calvanese Strinati, “Analysis of coding on non-ergodic channels”, in *Proc. 43rd Annual Allerton Conference on Communication, Control and Computing*, Allerton, IL, Sept. 2005;
- Grant application: L. Cottatellucci, A. Grant, A. Guillen i Fabregas, J. Boutros, M. Debbah, E. Altman, Grant application to the Franco-Australian FAST program;
- Visit to Prof Boutros for 3 days following the Allerton Conference in Sept 2005;
- A plan to visit Prof Boutros again for three weeks in June 2006 (an ACoRN application has been submitted in 2006).

Dr Mehran Abolhasan, University of Wollongong visited Dr Jos H Weber at Delft University of Technology (TUDelft), The Netherlands, January 2006 (visit approved in 2005).

The aim of this visit was to strengthen collaborative research between the University of Wollongong (UoW) and Delft University of Technology (TUDelft). Having made initial contact with Delft and inviting one of their researchers to Wollongong in the area of Ultra-Wide Band (UWB), the aim of Dr Abolhasan’s visit to Delft was to show-case the research at Wollongong and build a stronger bond between the two Universities. During his visit to Delft, Dr Abolhasan gave a presentation to the wireless research team. Additionally, he discussed possible areas of collaboration with a number of researchers at Delft, which resulted in the identification of similar areas of interests. One such area of interest was in the area of routing and medium access control for ad hoc and personal area networks. The Wireless team at Delft is amongst the leading researchers in Europe investigating these areas and they are currently developing a number of prototypes based on Ad hoc and personal area networks. The Wireless Research Group at the UoW is also currently pursuing these areas of research. There-

fore, we envisage that the newly build research link between the UoW and TUDelft with further enhance research in this area.

Dr Kun-Chan Lan, National ICT Australia, Networks and Pervasive Computing Program, Sydney visited Dr Deepak Ganesan at the University of Massachusetts (UMass) at Amherst for three weeks in September. During his visit to University of Massachusetts, Kun-Chan presented his current research in wireless mesh networks in a seminar at Department of Computer Science at UMass. In addition, he interacted with a series of researchers at UMass, including Dr Deepak Ganesan, Dr Mark Corner, Dr Brian Neil Levine and Dr Arun Venkataramani and their students, exploring potential collaboration. In particular, the idea of a heterogeneous mesh/sensor network architecture were discussed, where an 802.11 mesh network is overlaid on a sensor network. In this architecture, sensor network traffic can enter and exit the mesh network at multiple points to improve the sensor network performance in terms of latency, reliability and less energy. Dr Deepak Ganesan has been invited to visit NICTA for further discussions towards ongoing collaboration.

Dr Kandeepan Sithampanath, National ICT Australia, Wireless Signal Processing Program, Canberra visited Prof Anbalagan, Wireless Access Networking Research Group at Ryerson University, Toronto, Canada for 10 days. An ongoing collaboration on frequency synchronisation and resource allocation for 3G+ systems was initiated and has so far resulted in a submitted conference paper and a submitted journal paper.

4.2.2 Domestic Travel Fellowships

The ACoRN Domestic Travel Fellowships are intended for Australian researchers to visit ACoRN member researchers and research groups for longer periods of time. This sub-program also supports industry researcher internships. The travel fellowships are enabling grants, providing the seed funding to leverage further support from other sources. The maximum amount of the fellowship is \$3,000 out of which 50% comes from ACoRN central sources and 50% from the applicant institution.

Reports for approved 2005 Domestic travel fellowships are included below.

Dr Zhenning Shi, Australian National University, Canberra visited Dr Jinhong Yuan at University of New South Wales for one week. The focus of the visit was collaborative research on iterative receiver structures for multiple-input, multiple output systems.

Prof Alex Grant, University of South Australia visited Dr Leif Hanlen, Prof Rod Kennedy, and Dr Thushara Abhayapala, National ICT Australia, Wireless Signal Processing Program, Canberra for two weeks. The focus of the visit was joint work on "statistical transmitter state information for MIMO systems" with Alex Grant and Leif Hanlen. The work has resulted in a journal paper submitted to IEEE Transactions on Information Theory.

Prof Rod Kennedy, National ICT Australia, Wireless Signal Processing Program visited Prof Sven Nordholm at the Western Australian Telecommunications Research Institute, Perth for three months. This visit was to develop a NICTA-WATRI project and to initiate stronger interaction between the two groups.

Dr Lavy Libman, National ICT Australia, Networks and Pervasive Computing Program, Sydney visited Prof Lars Rasmussen at University of South Australia for one day in connection with the ACoRN Workshop on Cross-Layer Design. The focus of the visit was to explore common interests on error control strategies for wireless resource-limited devices. The visit resulted in a joint project proposal being submitted to NICTA.

4.2.3 Visitors Travel Fellowships

The ACoRN Visitors Travel Fellowships are intended for recognised international researchers to visit ACoRN researchers and research groups for longer periods of time. The travel fellowships are enabling grants, providing the seed funding to leverage further support from other sources. The maximum amount of the fellowship is \$6,000 out of which 50% comes from ACoRN central sources and 50% from the applicant institution.

Reports for approved 2005 Domestic Travel Fellowships are included below.

Prof Leandro de Haro, Universidad Politécnica de Madrid, Spain visited A/Prof Tad Wysocki at the University of Wollongong for almost seven weeks, from 29 June till 14 August 2005. During that time he was engaged in research into channel capacity of MIMO systems taking into account antenna coupling and correlation among the MIMO channels. While staying in Wollongong he presented a seminar on his own research and research carried out at the Madrid Technical University. He also visited the National ICT Australia (NICTA) Laboratories in Canberra where he presented a seminar and held talks with researchers of the Wireless Signal Processing Program. In addition, he visited the CSIRO ICT Centre in Sydney-Marsfield, which is the prime centre of antenna research activities in Australia, and gave a seminar at the University of Technology, Sydney. The visit enabled strengthening the existing collaboration to the point that Prof de Haro became a Partner Investigator on an ARC Discovery grant submitted for funding in 2007.

Dr Alexandre Graell i Amat, Universitat Pompeu Fabra, Departament de Tecnologia, Barcelona, Spain visited Prof Lars Rasmussen at the University of South Australia for two weeks in September. Dr Amat's visit was part of the collaboration between ACoRN and NEWCOM. The visit was focused on collaboration between Dr Graell i Amat, Dr Fredrik Brannstrom (Sweden) and Prof Lars Rasmussen on the analysis and design of rate-compatible serial concatenated convolutional codes for high-speed applications. They combined the methods of upper bounds to the error probability based on uniform interleavers with the convergence method based on Extrinsic Transfer (EXIT) charts to optimize the constituent encoders and the puncturing patterns.

Tangible outcomes from Dr Amat's visit include:

- Papers accepted and submitted:
 - A. Graell i Amat, F. Brannstrom, and L. K. Rasmussen, "Design of rate-compatible serially concatenated convolutional codes," to appear at *International Symposium on Turbo Codes and Related Topics*, Munich, Germany, Apr. 2006.
 - F. Brannstrom, A. Graell i Amat, and L. K. Rasmussen, "Analysis and design of concatenated codes," submitted to *IEEE International Symposium on Information Theory*, Seattle, WA, July 2006.
- Grant application submitted to the French-Australian Science and Technology (FAST) Program entitled "Performance analysis and design of concatenated coding systems".
- A visit to Alexandre Graell and Fredrik Brannstrom in Sweden in November 2005 by Prof Rasmussen to follow up the joint work.

Dr Pascal Vontobel, Massachusetts Institute of Technology (MIT), Boston, USA visited Dr Sarah Johnson at University of Newcastle for one week prior to the IEEE International Symposium on Information Theory held in Adelaide. The purpose of the visit was to explore opportunities for collaboration in the area of iterative decoding research. Dr Vontobel presented a seminar to the School, which was well received, and shared his new research on pseudo-codewords and their relationship to sum-product decoding performance. The outcome of the visit is ongoing collaboration.

Prof Wei Yu, University of Toronto, Canada visited Raphael Cendrillon at University of Queensland for three days in connection with the IEEE International Symposium on Information Theory held in Adelaide. The focus of the visit was to explore future collaboration in the area of digital subscriber line technology. Prof Yu gave a seminar during his visit.

Prof Robert Heath, University of Texas at Austin, USA visited Dr Mark Reed and Dr Leif Hanlen at National ICT Australia, Wireless Signal Processing Program in Canberra for three days. The focus of the visit was to explore future research collaboration in the area of multi-path channel modelling. Prof Heath gave a seminar entitled *Grassmann Quantization and MIMO Beamforming Systems* during his visit.

4.3 National and International Conferences & Workshops Program

Program Leaders: A/Prof Jamie Evans, Prof Rodney Tucker

The National and International Conferences and Workshops Program offers a forum for organising technical meetings. These meetings are in the form of international conferences and workshops held in Australia, domestic conferences and workshops, bi-lateral workshops with relevant organisations/nations, and industry workshops.

The program aims to attract renowned international conferences to Australia by offering initial sponsorship, supports international and domestic conference attendance, and encourages members to organise workshops with important and perhaps non-traditional and cross-disciplinary themes.

The main achievements of this program in 2005 are listed below. More detailed reports on these successes appear in the sequel.

- Major sponsorship of the IEEE International Symposium on Information Theory, which was held in Adelaide in September 2005. The ACoRN sponsorship helped ensure the success of this major conference and provided great publicity for ACoRN to an audience of the world's leading researchers in communications and information theory.
- Two new technical workshops were organised by ACoRN members. The first was the ACoRN Workshop on Cross-Layer Design Problems for Wireless Communications held in Adelaide in June. The second was the ACoRN/CUBIN Information Theory Workshop held in Melbourne in September.
- ACoRN awarded a large number of conference attendance grants to allow researchers to attend a wide range of national and international workshops and conferences. These grants ensured strong attendance at local technical meetings and provided an opportunity for new research students to attend workshops, something that would not often have been possible without ACoRN.

4.3.1 ACoRN Sponsorships for Major Conferences Held in Australia

In 2005 ACoRN was a major sponsor for the IEEE International Symposium on Information Theory held in Adelaide, a bronze sponsor for the IEEE Conference on Local Computer Networks held in Sydney, and a major sponsor for the IEEE Vehicular Technology Conference to be held in Melbourne in 2006.

Summaries of the three events are included below.

IEEE International Symposium on Information Theory 2005

The IEEE International Symposium on Information Theory (ISIT) was held in the Adelaide Convention Centre on September 4 – 9. The General Co-Chairs were Alex Grant (University of South Australia) and Rod Kennedy (NICTA), supported by a team of ACoRN Members. The Technical Program Co-Chairs were Stephen Hanly (University of Melbourne) and Christian Schlegel (University of Alberta, Canada).

It was the first time ISIT was held in the southern hemisphere and it was a great success with close to 650 of the top researchers in information and communications theory from around the world attending. A total of 798 papers were submitted for review from 47 countries, with an acceptance rate of 62%. The technical program chairs put together an inspiring program, featuring 500 paper presentations organised into seven parallel sessions.

They were also four world-class plenary speakers to complement the 2005 Shannon Lecturer, Richard Blahut (University of Illinois, Urbana-Champaign, USA). In addition to the Shannon Lecturer, the plenary speakers were Benjamin Schumacher (Kenyon College, USA) lecturing on quantum and information theory, David Mackay (Cambridge University, UK) lecturing on hands-free writing, P. R. Kumar (University of Illinois, Urbana-Champaign, USA) lecturing on theoretical foundations for wireless and sensor networks, and Terry Speed (University of California, Berkeley, USA and Walter and Eliza Hall Institute of Medical Research, Melbourne) lecturing on information theory and bioinformatics.

ISIT in Adelaide was a memorable event, promoting Australia and Australian research. ACoRN was a proud major sponsor of the ISIT and enjoyed significant exposure to the international community.

The 30th IEEE Conference on Local Computer Networks

The IEEE Conference on Local Computer Networks (LCN) was held on November 16 – 17 in Sydney. ACoRN was a financial sponsor of the event together with NICTA, UNSW and BBN Technologies. The program boasted 87 papers from around the world, and two Australian keynote speakers. David Skellern (CEO, NICTA) gave a talk entitled “*Computer Networking for an Embedded Systems World*,” while Dr Geoff Huston (Asia Pacific Network Information Centre) gave a talk entitled “*The Evolution of Internet Architecture*.”

The 63rd IEEE Vehicular Technology Conference

The IEEE Vehicular Technology Conference (VTC) is to be held in Melbourne on 7-10 May 2006. A/Prof Fu-Chun Zheng, an ACoRN member from Victoria University is the General Chair for this prestigious event, and many other ACoRN members are taking part in the organisation.

Over the past 55 years, VTC has established itself as one of the premier conferences in the world on wireless communications. This VTC is making history in its own right as it will be the first ever VTC to be held in the Southern Hemisphere. The event will feature some of the latest R&D results in the wireless area with 615 papers to be presented, 5 plenary sessions covering hot topics, and 3 panel sessions discussing future directions.

4.3.2 Bids for hosting Major International Conference Events in Australia

The benefits of hosting major International conference in Australia are manifold. Therefore, it is important to keep bringing in such events on a regular basis. In 2005, ACoRN initiated two bids for conference events in 2009 and 2012, respectively. Although these events are scheduled to occur beyond the lifespan of ACoRN, we can still play a significant role in winning the bids. The two events are the *IEEE International Symposium on Personal, Indoor, and Mobile Radio Communications* and the *IEEE International Conference on Acoustics, Speech and Signal Processing*. Further details of the two conferences are presented below.

IEEE International Symposium on Personal, Indoor, and Mobile Radio Communications 2009

On behalf of ACoRN, A/Prof Abbas Jamalipour and Prof Lars Rasmussen have prepared an initial bid for the 19th IEEE International Symposium on Personal, Indoor, and Mobile Radio Communications (PIMRC) in 2009. This event attracts 500-600 delegates a year from the wireless communications research and industry communities. The IEEE Communications Society has positively received the bid and the chances of securing the event for Australia are looking good.

IEEE International Conference on Acoustics, Speech and Signal Processing 2012

On behalf of ACoRN, Prof Jonathan Manton has registered an intention with the IEEE Signal Processing Society to bid for the 37th IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) in 2012. ICASSP was also hosted in Australia in 1994, where the event was held in Adelaide, and attracted more than 1000 delegates. The bidding process is very competitive, so a strong bid is required to bring the prestigious event to Australia again.

4.3.3 ACoRN Workshop Events

In 2005 ACoRN organised one inter-disciplinary workshop on cross-layer design problems for wireless communications, and one joint workshop with CUBIN on Information theory held just prior to the IEEE International Symposium on Information Theory held in Adelaide. Summaries of the two events are presented here.

ACoRN Workshop on Cross-Layer Design Problems for Wireless Communications

The ACoRN Workshop on Cross-Layer Design Problems for Wireless Communications was held from June 23 – 24 in Adelaide. The workshop featured a series of invited speakers from Australian research groups working on cross-layer design problems for wireless communications. The invited talks were tutorial in nature, providing a discussion forum for researchers from all protocol layers with an interest in cross-layer design. The workshop was open to ACoRN members and to local industry. The speakers were: Stephen Hanly (University of Melbourne), Alex Grant (University of South Australia), Lavy Libman (NICTA), Peter Pham (Cohda Wireless), Adrian Barbulescu (University of South Australia), Sylvie Perreau (University of South Australia), Aruna Jayasuraya (University of South Australia), Graeme Woodward (Agere Systems Australia), John Papandriopoulos (University of Melbourne), and Lars K. Rasmussen (University of South Australia). The presentations covered a wide range of topic areas and problems, spanning virtually all layers in a wireless network. Topics included network coding, control protocols in wireless networks, UMTS packet data evolution, and top-down/bottom-up design approaches. The tutorial level of the presentations ensured a high level of interaction with the audience, providing a good foundation for future cross-disciplinary collaboration.

The workshop was very well attended, attracting more than 50 delegates from around Australia (5 from Victoria, 9 from New South Wales, 1 from Western Australia, 2 from ACT, 2 from Queensland and 32 from South Australia). The feedback from delegates regarding the workshop was very positive. The delegates found the workshop very useful for getting up to speed with the cross-layer research activities in Australia, and for identifying opportunities for future collaboration across ACoRN organisations. The success is very encouraging and will hopefully inspire many more such workshop across Australia.

ACoRN/CUBIN Information Theory Workshop

A special ACoRN/CUBIN Information Theory Workshop was held in Melbourne on Thursday and Friday, September 1 and 2, just before the IEEE International Symposium on Information Theory. The workshop program consisted of seminars from a number of the world's leading experts in communications and information theory. The speakers were: Robert Calderbank (Princeton), Suhas Diggavi (EPFL), Andrea Goldsmith (Stanford), Bruce Hajek (University of Illinois, Urbana-Champaign), Nihar Jindal (University of Minnesota, Twin Cities), David MacKay (Cambridge), Balaji Prabhakar (Stanford), Shlomo Shamai (Technion), Brooke Shrader (University of Maryland, College Park), Emina Soljanin (Bell Labs), David Tse (Berkeley), Rudiger Urbanke (EPFL) and Raymong Yeung (Chinese University of Hong Kong).

More than 80 people attended the workshop and heard exciting talks on diverse areas such as fountain codes and network coding, waveform design and the geometry of Weyl-Heisenberg groups, cross-layer design in MIMO systems and the information requirements of mechanism design.

The workshop was a great success and provided the perfect lead-in to the IEEE International Symposium on Information Theory.

4.3.4 ACoRN Supported Conferences and Workshops in Australia

Part of the program portfolio is to support attendance at established national conference and workshop events. In 2005 ACoRN supported attendance at the Australian Communications Theory Workshop in Brisbane, the Australian Telecommunications, Networks and Applications Conference held jointly with TENCON in Melbourne, and the Workshop on the Internet, Telecommunications and Signal Processing held at the Sunshine Coast.

Summaries of the three events are included below.

Australian Communications Theory Workshop 2005

The sixth Australian Communications Theory Workshop (AusCTW) was held from February 2 – 4, 2005 at the University of Queensland in Brisbane, Australia. This annual workshop concentrates on theoretical aspects of physical layer communications, in particular communications and information theory. Specific topics included coded modulation, coding theory and practice, communication systems, channel characteristics and modelling, detection and estimation, digital signal processing for communications, information theory and statistics, iterative decoding algorithms, multiuser detection and space-time coding and processing.

The 2005 AusCTW organising committee consisted of John Homer (University of Queensland), Vaughan Clarkson (University of Queensland), Iain Collings (University of Sydney), Jamie Evans (University of Melbourne), Alex Grant (University of South Australia), Rod Kennedy (Australian National University), Peter Kootsookos (United Technologies Research Center) and Steve Weller (University of Newcastle). The Technical Program Committee included Graeme Woodward (Agere Systems), Thushara Abhayapala (Australian National University), Hai Huyen Dam (WATRI), Leif Hanlen (NICTA), Sarah Johnson (University of Newcastle), Tony Pollock (NICTA) and Hans-Juergen Zepernick (WATRI).

Continuing the strong attendance of previous years, over 110 people attended the workshop in 2005. Presentations included three research overview talks, twelve 20-minute technical talks and three posters sessions (with over 25 posters presented in each session). The overviews were presented by Dr Steve Weller (University of Newcastle) who spoke on “Low Density Parity Check Codes”, Dr Kim Blackmore (Australian National University), who spoke on “The Price of Mobility in Ad-Hoc Networks” and Dr John Ness (EmSolutions), who talked about “Wireless Communications: Taking Theory to Practice”. The AusCTW 2005 student prize winners were Matthew McKay (best poster) and Nick Letzepis (best paper).

A number of ACoRN related activities were held during the workshop, including a one-day tutorial on Turbo Receiver Design, and ACoRN executive and planning meetings.

The Australian Telecommunications, Networks and Applications Conference

The Australian Telecommunications, Networks and Applications Conference (ATNAC) conference was this year part of the IEEE region 10 conference (IEEE Tencon 2005). The events were held on Nov. 21 – 24 in Melbourne under the theme “A Meeting Place for Converging Technologies and People”. The joint events attracted over 800 paper submissions from more than 40 countries, of which 530 papers were accepted for oral and poster presentations in 102 technical sessions. Among the six keynote speakers, Prof Rod Tucker gave a talk entitled “Towards an Optical Internet”.

Workshop on the Internet, Telecommunications and Signal Processing

The 2005 Workshop on the Internet, Telecommunications and Signal Processing (WITSP) was held together with the 8th International Symposium on DSP and Communication Systems. The events were held on 19 – 21 December at Noosa Heads on Queensland’s Sun-

shine Coast. The combined Symposium and Workshop were sponsored by: DSTO, AT-CRC, ACoRN, and supported by the SA Section of IEEE.

The response to the original call for papers exceeded the expectations of the Organising Committee, with 164 full paper submissions. All submitted papers were peer reviewed, and each paper received at least two but mostly three peer reviews. Based on those reviews, 80 papers were accepted, and finally, 77 included in the program - 50 for oral and 27 for poster presentation. In addition, there were two invited keynote presentations delivered by Bahram Honary (University of Lancaster) and Michael Steer (North Carolina State University). The titles of their respective presentations were “Recent Results on Construction of Structured LDPC codes” and “The Interplay of Signal Processing, Communication Technologies and RF Circuit Design with Perspectives on the Future of RF and Microwave Engineering.”

The event was very well attended by delegates from both Australia and overseas with the total number of attendees reaching 75.

4.3.5 ACoRN Attendance Grants

One of the most heavily utilised schemes within the National and International Workshops Program is the ACoRN workshop and conference attendance grant scheme. These ACoRN grants are intended to support ACoRN members attending international and domestic conferences and workshops. These grants have had significant impact on the research scene in two ways. Firstly, numerous students and early career researchers have been able to attend important technical meetings that they might not otherwise have been able to attend. This is especially true for new students who have been able to attend workshops without necessarily having a paper appearing in the proceedings. Secondly, the grants have ensured strong attendance at a number of domestic conferences (such as AusCTW and WITSP) and at the two special ACoRN workshops held in 2005.

A summary of the awarded Attendance Grants are shown in Table 6 below.

	International Conferences				Domestic Conferences				ACoRN Workshops			
	RS	ECR	SR	Total	RS	ECR	SR	Total	RS	ECR	SR	Total
Numbers	8	5	1	14	58	6	0	64	22	4	3	29

Table 6: A breakdown of Attendance Grants in ACoRN Workshops, International and Domestic Conferences. Further breakdown is shown into Research Students (RS), Early Career Researchers (ECR), and Senior Researchers (SR).

4.4 Postgraduate Education Program

Program Leaders: Dr Steve Weller, Prof Rodney Kennedy, Prof Lars K. Rasmussen

The postgraduate education program offers travel scholarships for research students to visit relevant research groups in industry and academia within Australia and abroad. In addition the program is organising seasonal school events covering important disciplinary, interdisciplinary and thematic subjects.

The main achievements of this program are listed below. More detailed reports on these successes appear in the sequel.

- Two popular school events were organised by ACoRN members. The first was the joint ACoRN-NICTA Wireless Winter School held in Canberra in July. The second was the ACoRN Spring School on Coding and Information Theory held in Adelaide in September.

- ACoRN supported several successful International and Domestic Student Research Visits. Two visits were part of the ACoRN-NEWCOM exchange program, while additional visits went to Japan, USA and New Zealand. Ongoing joint research collaboration was established between University of South Australia, CSIRO ICT Centre and the University of Sydney through a Domestic Student Travel Scholarship.

4.4.1 ACoRN Schools

A one-day tutorial was offered in connection with the Australian Communications Theory Workshop in February in Brisbane. Dr Mark Reed from NICTA presented the tutorial entitled, “*Turbo Receiver Design: From Theory to Practice.*” A total of satisfied 27 students and researchers attended the tutorial.

In July, ACoRN joined forces with NICTA in organising the ACoRN-NICTA Wireless Winter School held in Canberra. A total of 17 Australian researchers gave one-hour (or longer) research overviews throughout the week, to an audience of 46 research students from around Australia.

The last school event in 2005 was held in September in connection with the IEEE International Symposium on Information Theory. Located in Adelaide, the school featured three prominent international researchers, Prof D. Tse, A/Prof E. Viterbo and Dr G. Kramer, and was enjoyed by a record attendance of 64 students and researchers.

The school events were very popular in 2005, attracting many student delegates and received much praise among the attendees. The school events sub-program was clearly one of the success stories of ACoRN in 2005, and will continue to be one of the corner stones in the postgraduate education program in the future.

Detailed reports for each of the events are presented below.

ACoRN One-Day Tutorial: Turbo Receiver Design: From Theory to Practice

In connection with the Australian Communication Theory Workshop (AusCTW) in Brisbane in February, ACoRN organised a one-day tutorial. The tutorial was free of charge and held at the AusCTW venue the day before the workshop. A total of 27 researchers and students attended the tutorial, out of which 22 delegates were ACoRN members and 5 non-members.

The tutorial entitled “*Turbo Receiver Design: From Theory to Practice*” was presented by Dr Mark Reed from NICTA Wireless Signal Processing Program. Iterative processing inspired by Turbo Codes is becoming increasingly important in systems design. The tutorial focused on baseband signal processing techniques including detection criteria, decoding methods, transmitter configurations, wireless channel modelling, receiver design and analysis techniques. The tutorial provided the participant with a fundamental understanding of how to design and analyse efficient receivers, how to use the turbo principle to mitigate interference, what the key design steps are, and how the system benefits can be determined. Practical system examples were used to reinforce the underlying principle.

ACoRN-NICTA Wireless Winter school

The inaugural NICTA-ACoRN Wireless Winter School held in Canberra on July 11-15 was an open and informal week for students and researchers alike, with an interest in Communications and Signal Processing. Co-chaired by Mark Reed and Leif Hanlen from the NICTA Wireless Signal Processing Program, the school presented core topics for modern Communication systems, and future research directions in the form of Tutorials and Invited Talks, providing a broad range of related topics to inspire, motivate, and enlighten. The school was sponsored by the National Institute for Engineering and Information Science, NICTA and the Research School of Information Science and Engineering, while travel grants for attendance was offered by ACoRN.

Prof Bob Williamson opened the school with his talk “*Signal Processing, Information Theory and Machine Learning*”, setting the scene of multidisciplinary talks for the rest of the

week, amongst leading academic researchers from across Australia. As part of the program, the school also showcased new tools from Mathematica and Matlab, while Roslyn Hughes from Epicorp gave an interesting talk on "*The Path toward Entrepreneurship*". In total 17 tutorial talks were given by senior Australian Researchers.

The school also featured a Poster Session where several of the student participants demonstrated their research. The session successfully encouraged networking and collaboration between students. Siew Lee-Hew, from the University of Adelaide, won the Student Poster Prize. Siew's prize was a funded trip to Canberra to work with the ACoRN researchers at NICTA.

There were 46 student attendees from around Australia.

ACoRN Spring School on Information and Coding Theory

The ACoRN Spring School was a big success with more than 60 students and researchers from across Australia attending. Exploiting the opportunity of having the IEEE International Symposium on Information Theory in Adelaide in September, Albert Guillen i Fabregas (University of South Australia) organised a memorable event featuring Prof David Tse, A/Prof Emanuelle Viterbo, and Dr Gerhard Kramer.

Prof Tse (University of California, Berkeley) presented a two-day tutorial in "*Wireless Communications*." The tutorial covered a wide range of useful topics in wireless communications, such as diversity, multiple access and interference management, multiuser diversity, and spatial multiplexing. The tutorial was organised around his recently published book, "Fundamentals of Wireless Communications".

A/Prof Emanuelle Viterbo (Politecnico di Torino) presented a one-day tutorial on "*Algebraic Number Theory and its Applications to Code Design for Rayleigh Fading Channels*." The tutorial provided the algebraic background required for code construction for fading channels based on lattice theory.

The school was concluded with a two-day tutorial on "*Multiuser Information Theory*" presented by Dr Gerhard Kramer (Bell Labs Innovations). The tutorial gave a comprehensive background in the fundamentals of information theory, before venturing into the more complicated multiuser results. The tutorial inspired many questions, leading to interesting discussions. Dr Kramer presentation of the challenging material allowed the audience to bring with them a thorough understanding of multiuser information theory.

The ACoRN Spring School is so far one of the success stories of ACoRN. It has received very positive feedback from attending students, and ACoRN will make sure to organise similar events in connection with future prominent International conferences held in Australia. Plans are already in the making for an ACoRN Fall School in connection with VTC in Melbourne.

NEWCOM Schools

As part of the ACoRN-NEWCOM collaborative agreement, ACoRN and NEWCOM members were invited to attend school events organised and conducted by either of the two Research Networks. The agreement was in place in time for several NEWCOM members to attend the ACoRN Spring School and for ACoRN members to be invited to attend the NEWCOM Autumn School on estimation theory for wireless communications held on Nov. 24-28 in Paris. At the time, Ph.D. student Gilles Gorlier, University of South Australia was on an ACoRN travel scholarship in France and thus, was able to attend the NEWCOM Autumn School. We expect further opportunities for attending NEWCOM events will arise in 2006.

4.4.2 ACoRN School Attendance grants

As discussed above, the ACoRN school events have been very popular with 46 students attending the ACoRN-NICTA Wireless Winter School and 64 students and early career researchers attending the ACoRN Spring School on Coding and Information Theory. Among

the students attending the schools a total of 48 were granted ACoRN school Attendance Grants. A summary of the Awarded Attendance Grants are shown in Table 7 below.

	ACoRN School Attendance Grants			
	RS	ECR	SR	Total
Numbers	48	2	4	54

Table 7: A summary of ACoRN School Attendance Grants awarded in 2005.

4.4.3 ACoRN Travel Scholarships and Internships

Within the Postgraduate Education Program, there are several support opportunities for longer-term research visits.

The ACoRN Domestic Travel Scholarships are intended for Australian postgraduate research students to visit ACoRN member researchers and research groups. The ACoRN International Travel Scholarships are intended for Australian postgraduate research students to visit recognised researchers and research groups abroad for longer periods of time. The ACoRN Internships are intended for Australian postgraduate research students to visit ACoRN industry member researchers and research groups.

In 2005, ACoRN awarded 6 International Scholarships (11 weeks, 12 weeks, 14 weeks, 3 weeks, 1 week), 1 Domestic Scholarship (three weeks), and 1 internship (12 weeks). The activities are summarised in Table 8 below.

Summaries of the visits and corresponding outcomes are included below

	International Travel Scholarship	Domestic Travel Scholarship	Industry Internship
ARC Eligible Organisations	5	1	0
ARC Non-Eligible Organisations	1	0	1
Total	6	1	1

Table 8: Breakdown of Mobility Scholarships into Industry Internships, International and Domestic Scholarships.

ACoRN International Travel Scholarships

Gilles Gorlier from UniSA visited Prof Inbar Fijalkow ENSEA, University of Cergy-Pontoise, France for 11 weeks. The French Embassy partly supported Gilles visit. This was also part of the collaboration with NEWCOM, of which Prof Fijalkow is an active member. The input and guidance of Prof Fijalkow complemented well the work carried out at UniSA by Giles together with his supervisor Sylvie Perreau at UniSA. During the visit Gilles advanced his work on turbo equalisation and symbol detection and achieved the following tangible outcomes:

- G. Gorlier, S. Perreau, I. Fijalkow “*Improved equalisation using a modified channel noise variance for turbo-equalisation,*” submitted to the IEEE Vehicular Technology Conference 2006, Melbourne, Australia.

- Attended the NEWCOM Autumn School on Estimation Theory for Wireless Communications held at Ecole Nationale Supérieure des Telecommunications (ENST), Paris, France.

The exchange was successful and beneficial as existing links between the two universities was strengthened. Also, as Inbar Fijalkow is an active NEWCOM member, closer links to our collaborating Network was established. Finally, a strategic contact was made to Mr. Christian Faye, responsible for international relations in the engineering school. This contact may lead to work experience and research placements for French engineering students at UniSA.

Wen Hu from NICTA, Networks and Pervasive Computing Program in Sydney visited Dr Nirupama Bulusu at Portland State University, USA for 14 weeks. During the visit the goal was to design and implement a cross-layer communication protocol for wireless mesh sensor networks, capable of optimizing networking functionalities, such as data aggregation, congestion control, packet buffering, routing, and link control across traditional TCP/IP networking layers.

Traditional layer network design like TCP/IP enjoys two attractive advantages. Firstly, each networking layer can be regarded as black box. Secondly, communication need only take place at the layer appropriate for the task.

There is, however, one major drawback in layer network design, namely redundancy, which leads to inefficient use of network resources. While layer network design works well in traditional networks like the Internet, significant problems may arise in resource-constrained networks like sensor networks.

The research hypothesis for the work was that a carefully designed cross layer network protocol can optimize the use of network resources, and thus will be more suitable for sensor network where resources are severely limited.

Most of the components of the cross layer protocol have been designed and implemented, and the results are to be submitted to the ACM SenSys workshop 2006.

Matthew McKay from University of Sydney visited Associate Professor Peter Smith at the University of Canterbury for one week. Despite the short duration, the visit proved to be very productive, resulting in two major research outcomes. The first major outcome involved making further progress on work previously initiated, regarding the time-varying statistical behaviour of eigenvectors in MIMO communication channels. They were able to successfully obtain a full statistical characterization of eigenvector processes in MIMO channels. This work is currently being compiled into a full journal paper.

The second major outcome of the visit was on the topic of mutual information of correlated Rician MIMO channels. The first (easily computable) tight analytic bounds on the mutual information of general correlated Rician MIMO channels were obtained, allowing for two-sided spatial correlation and channel means of arbitrary rank. Further work on this problem (and other related problems) was also identified and initiated. Matt and Peter are currently in the process of compiling this work into an IEEE international conference paper.

Ehssan Sakhaee from University of Sydney visited Prof Nei Kato at Tohoku University, Japan for eight weeks. The topic of his research during this stay was “Ad Hoc Routing in Highly Mobile Pseudo-linear Mobile Entities” which falls in the field of Mobile Ad Hoc Networks (MANETs), being a primary field of research at the Kato Lab. During this visit, Ehssan established a strong relationship with the researchers at Tohoku University, which has been resulted in submission of several conference papers to be presented in 2006.

Mr Michal Pietrzyk, PhD student at the Delft University of Technology came to Wollongong under the ACoRN – NEWCOM agreement covering exchange of postgraduate students. During his visit (7/11/2005 – 30/01/2006), Mr Pietrzyk was involved in research activities related

to performance improvement of ultra-wide band (UWB) communication systems. In particular, he investigated application of orthogonal polarity and time-hopping (TH) sequences in UWB-IR systems with interleaved coding-modulation and polarity randomisation. At first, he studied the single-user scenarios examining performance of the system employing different classes of randomisation sequences. Based on those investigations, he performed an initial selection of the sequences, which allowed for better system performance in the presence of significant inter-symbol interference (ISI). Then, he considered the more complicated multi-user case where, apart from the ISI, a very strong multi-access interference (MAI) is present. This part of research will be continued after his return to Delft, and it is expected that the results will be published in a form of a journal paper. Mr Pietrzyk actively collaborated with other PhD students and research staff working in the WRG on related projects. In particular, he collaborated very closely with Mr Keni Popovski and Mr Peter Vial, and it seems that all the parties benefited strongly from that research collaboration. At the time of writing this letter, a joint publication is being prepared. While staying in Australia, Mr Pietrzyk presented two research seminars at the University of Wollongong and one at NICTA Wireless Signal Processing Labs in Canberra. He also participated at the 8th International Symposium on DSP and Communication Systems (DSPCS'2006) organized jointly with the 4th Workshop on the Internet Telecommunications and Signal Processing (WITSP'2006) in Noosa on Sunshine Coast, where he had his paper published.

Mr Rubaiyat Kibria, University of Sydney visited Dr Firoz Ahmad and Dr Mohibul Alam Bhuyan from the Independent University and the Daffodil University, Bangladesh, respectively for one day in connection with attending the First International Conference on Next Generation Wireless Systems. The visit was focused on exploring mutual interests in the area of networking beyond third generation networks and the integration of 3G and WLAN systems.

ACoRN Domestic Travel Scholarships

Allen Chuang from University of Sydney visited Lars K. Rasmussen at University of South Australia for 3 weeks, initiating collaborative work on automatic-repeat-request protocols based on concatenated coding. This is part of a joint project between Allen's supervisor, Dr Iain Collings and Prof Rasmussen on QoS-based adaptive coding schemes for wireless networks.

During the visit several directions of interest were explored. Transfer function analysis techniques for finite-length Turbo codes were examined for use in predicting frame error rates, which can be used to lower-bound the probability for a retransmission request in an ARQ system. Also, the design of rate-compatible code families for fading channels was considered for further studies.

The main outcome of the visit was a research plan for Allen, guiding his further studies towards formulating a suitable research project. Following the visit, there has been regular contact and an interesting research project has been formulated based on fundamental information theoretic results for ARQ systems in multi-terminal systems. The ongoing work in this direction is subject to a longer visit by Allen to UniSA in 2006.

ACoRN Industry Internships

In 2005, ACoRN supported an ongoing internship program, initiated by Agere Systems Australia. ACoRN became a co-sponsor together with the Australian Electrical and Electronic Manufacturers' Association (AEEMA) for the Agere Systems Australia Undergraduate Award for Excellence in Microelectronics Design and Telecommunications Engineering.

The winners were:

- **Natalia Galin**, University of New South Wales
- **Jayant Baliga**, University of Melbourne

where Jayant was partly funded by ACoRN through the funding pledged by Agere.

Natalia and Jayant each have outstanding academic records, and submitted interesting and original project proposals, which demonstrated their aptitude for tackling challenging engineering problems.

They each undertook a 12 week paid internship with the Agere's 3rd Generation (3G) Mobile Wireless R&D team, based in Sydney, in addition to a scholarship to support further studies. Travel grants, where required, was provided by ACoRN.

The standard of applicants this year was extremely high. The competitive internship programme is in its second year, but this is the first year that it has been promoted nationally. We hope to be running the programme nationally again in 2006.

4.5 Knowledge Management Program

Program Leaders: Prof Alex Grant, Prof Lang White

The main priority for the knowledge management program in 2005 was to create an efficient and functional web information portal. Major development of the web site has taken place in 2005, and procedures are in place for on-going update and maintenance. Other achievements for 2005 include bi-monthly publication of a newsletter and establishment of online user forums.

4.5.1 ACoRN Website

The network website underwent major development, migrating from the initial bid site. This was a six-month project involving a full-time web developer, who built the site in consultation with the executive committee and network members. For efficient information storage and retrieval, the website is built as a portal to the ACoRN database. In the last six months the website has had more than 25,000 visits in total by almost 17,000 unique visitors.

The website includes the following information and functionality:

About ACoRN, includes information regarding the network mission, programs, governance and member organizations.

Telecommunications provides general information about the areas of telecommunications within the scope of ACoRN. This information is provided as a service to the general public, and is suitable for the lay reader.

ACoRN Members provides access to public details of ACoRN members. Member details are stored in a database, and each member has an automatically generated home-page, which lists their biography, current interests, projects and publications. This information is maintained directly by network members via a web-based interface to the ACoRN database.

Forum is an online discussion area, where members can discuss topics such as events, research, publications and projects.

Event Calendar provides details of coming events, including network activities such as workshops, conferences, visits and schools. Selected third-party events are also listed, when they show close alignment with the ACoRN mission. NEWCOM events are also listed as part of the ongoing ACoRN-NEWCOM cooperation.

Reports on Past Events gives information about previous network activities.

News gives general news items, as well as access to the current and previous editions of the newsletter.

Funding Application. ACoRN members can apply for funding using online forms, facilitating access to ACoRN programs. The associated back-end database also streamlines the behind-the-scenes administrative procedures for processing and approval of funding applications.

Table 9 shows the number of Visitors from the time of the launch of the website to the time of writing this report. "Visitors" can be a single user who views possibly many pages within one session.

Month	Visitors	Pages
Oct-05	2515	15939
Nov-05	2781	11318
Dec-05	3112	11552
Jan-06	3119	12798
Feb-06	3596	16169
Mar-06 *	1802	6830
TOTAL	16925	74606

* Partial month only

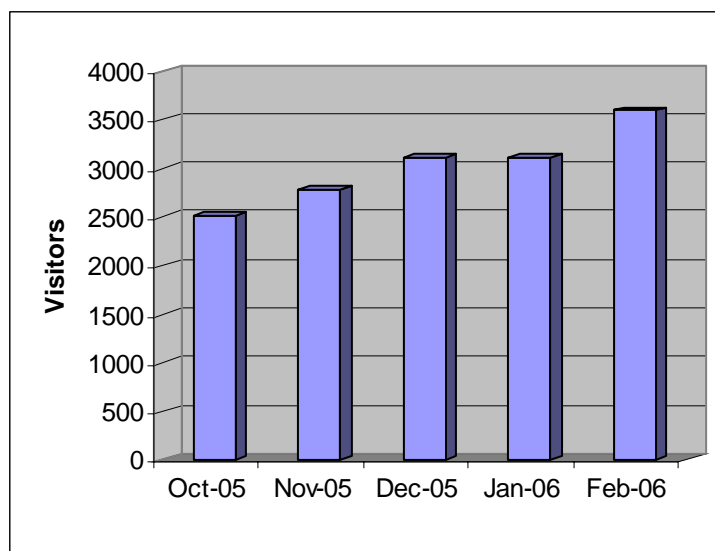


Table 9: The number of visitors to the ACoRN website from October 2005 to March 2006.

From Table 9 we observe an increasing trend in the number of visitors, which is a healthy sign. The continuing development of the website, including increasingly more information of value to the community will hopefully ensure further increase in the number of visitors to our website.

Table 10 shows the top most popular pages viewed for the period of October 2005 to March 2006. The total number of page views for this period was approximately 74600. Some non-content pages have been excluded for the benefit of this report.

The most popular area of the website is not surprisingly the online database of ACoRN members. The ACoRN website is quickly becoming the website of choice for providing a comprehensive overview of the telecommunications research community in Australia.

The second most popular area on the website is no surprise either, as it is the members-only area with access to the online funding system. As ACoRN is administrating a sizeable amount of funding, the online application system is seeing a lot of action.

The third most accessed area is the online forums. Unfortunately, it seems like most visitors are only checking the current postings, but are not taking active part in bringing the forums to life. The intention is for the forums to become electronic noticeboards for the ACoRN members, as well as tools for exchanging information in closed research clusters.

These three areas constitute almost 50% of the total page views on the site.

Website Activity Distribution (Oct 2005 – March 2006)			
Area of Website	Viewed Pages within Area	Percent of Total Page Views	Comment
/show/person	18471	24.76%	Where details about individual ACoRN members are shown.
/membersonly	9484	12.71%	When members login-in to maintain their own details, perform searches for other members and complete applications for funding.
/forums	8725	11.69%	It appears that many members view forum details, but limited posts were performed.
/telecoms	5345	7.16%	General information about the research and application areas and also the members that specialise in these areas.
/	4424	5.93%	The bulk of this traffic is to the home page of the website.
/membersarea	4308	5.77%	This is where information about joining ACoRN and other public information about member benefits and conditions are available.
/show/publication	3860	5.17%	Details about publications that members have been a part of.
/show/project	3319	4.45%	Details about projects that members have been a part of.
/show/org	2809	3.77%	Details about the organisations members are associated or affiliated with.
/about	2189	2.93%	General information about ACoRN governance, program areas, mission and objectives.
/newsletter	1403	1.88%	Where newsletters are posted and access from when a newsletter email is sent out.

Table 10: The most popular web pages being visited on the ACoRN web site.

4.5.2 ACoRN Newsletter

Starting with the inaugural issue in May 2005, five editions of the newsletter have been published, totalling 41 pages. The newsletter is distributed electronically in portable document format via email, and is publicly available on the web site. Members of the public can sign up online to receive the newsletter. Current circulation of the newsletter is 682.

Typical newsletter items include:

Convenors Report, summarising administrative issues, main events since the last newsletter and upcoming initiatives.

Program Reports for each of the four programs.

Opportunities, including fellowships, internships and employment.

Scholarships of interest to network members, including third-party agencies, e.g. DEST.

Graduations, PhD completions by member students.

Appointments, new staff at member institutions.

Visitors, current and upcoming research visitors to member institutions.

Member Profiles, biographies of network members.

Coming Events, upcoming conferences, workshops, schools, seminars, including ACoRN events, and other events relevant to ACoRN members.

Call for Papers, a table of upcoming paper submission deadlines for relevant conferences and workshops.

Event Reports from network activities such as workshops, schools and researcher visits.

5 Network Administration

It has been a significant task to set up the framework, policies and procedures for administering, managing and promoting ACoRN. In this section, the efforts, the entities and the outcomes towards creating an operational Research Network are described and discussed.

The section is organised as follows. First the Governance structure and the corresponding responsibilities are described. In Section 5.2 the Network Agreement is discussed, while planning efforts and management of the Network is included in Section 5.3. Marketing considerations are presented in Section 5.4, procedures for administering funds are found in Section 5.5, and finally, financial accounts for 2005 are summarised and discussed in some detail in Section 5.6.

5.1 Governance Structure

The governance arrangements of the Network are specifically designed to avoid pushing heavy administrative overheads back onto Network Participants. Supporting the Network Convenor is an eight-member Executive Board, a Network Administrator, a Team of Local ACoRN Representatives, and a five-member International Advisory Board. As illustrated in Figure 2, the Network Administrator and the Team of Local ACoRN representatives report to the Network Convenor, while the Advisory Board operates in a consultative manner with the Convenor. The Executive Board is chaired by the Network Convenor and works as the governing body of the Network. These arrangements provide for strong and efficient management structures with clear responsibilities.

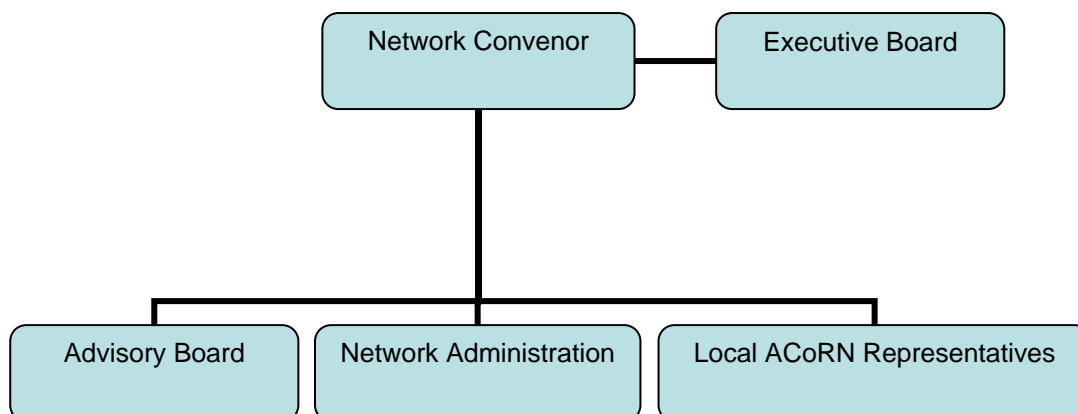


Figure 2: The organisational chart for ACoRN.

5.1.1 The Network Convenor

The Network Convenor Prof Lars Rasmussen is accountable to the ARC, having responsibility for the overall scientific, administrative and financial aspects of the Network. The Convenor chairs the Executive Board and acts as an interface to the Advisory Board. The Network Convenor is responsible for executing the decisions of the Executive Board and for supervising the life of the Network.

5.1.2 The Executive Board

The Executive Board consists of the Network Convenor and eight Executive Board Members. The members of the Executive Board are appointed in terms of two years by the Network Convenor.

Dedicated Executive Board members represent each inter-disciplinary ACoRN research Theme, with the intention of promoting a high level of cross-area collaboration. Maintaining

sensitivity to the requirements of particular technical societies, specific Board members are also responsible for the interests of individual Technical Disciplines within ACoRN. Directing a strong commitment to program implementation, two dedicated members take responsibility for each Program.

The Executive Board is mandated to make strategic decisions on the activities to be undertaken and on the distribution of funds among the various activities within Programs. Within that process, the Board will examine and evaluate the annual programs submitted through the planning procedures.

The responsibilities of the Executive Board are:

- Representation of Discipline areas and Application areas;
- Planning, monitoring and reporting on the programs of activities;
- Strategic directions for promoting collaboration and inter-disciplinary research;
- Facilitating the development and implementation of coherent and integrated research plans among researchers working on topics of common interest;
- Facilitating the implementation of protégé/mentor arrangements;
- Planning, monitoring and reporting on the financial management of the network;
- Promoting a sense of community and identity, leading to a culture of technical excellence across the network.

The Members of the 2005 Board and corresponding program leadership responsibilities are detailed in Table 11 below:

Name	Affiliation	Leadership Responsibilities
Prof Lars Rasmussen	University of South Australia	Chair, Network Convenor
A/Prof Tad Wysocki	University of Wollongong	Researcher Mobility Program
A/Prof Abbas Jamalipour	University of Sydney	Researcher Mobility Program
Prof Rod Tucker	University of Melbourne	Conference & Workshops Program
A/Prof Jamie Evans	University of Melbourne	Conference & Workshops Program
Prof Rod Kennedy	National ICT Australia	Postgraduate Education Program
Dr Steven Weller	University of Newcastle	Postgraduate Education Program
Prof Lang White	University of Adelaide	Knowledge Management Program
Prof Alex Grant	University of South Australia	Knowledge Management Program

Table 11: The Executive Board in 2005.

During 2005, Dr Steven Weller retired from the Board. In his place, the Network Convenor Prof Lars Rasmussen assumed the role as Program Leader for the Postgraduate Education Program. At the end of 2005, Prof Rod Tucker and Prof Rod Kennedy also retired from the Board. The Executive Board is in the process of appointing new Board members.

The Executive Board meets on a monthly basis, reporting operational activities, monitoring the performance of the Network and addressing strategic issues for improvements.

5.1.3 The Network Administrator

The Network Convenor is further supported by the Network administrator Christine Thursby, responsible for the administrative operation. The Network Administrator, an employee of the same institution as the Convenor and with experience in the management of large research programs, is responsible to the Network Convenor for the administrative management and day-to-day operation of the Network. Responsibilities of the Network Administrator include:

- Day-to-day operation of the Network;
- Implementation and operation of procedures and policies;
- Maintaining financial records;
- Reporting on the operation of the Network to the Network Convenor and the Executive Board;
- Interfacing with the team of Local ACoRN Representatives;
- Interfacing with organisers of ACoRN events.

The Network Administrator was appointed in April 2005.

5.1.4 Local ACoRN Representatives

A Local ACoRN Representative has been appointed at each of the member organisations. The Local ACoRN Representative is the contact point between ACoRN Administration and the organisation. The responsibilities of the Local ACoRN Representatives are:

- Preparation, implementation and monitoring of local ACoRN budgets;
- Recommendation of new ACoRN members, based on individual research excellence subject to opportunities;
- Review and recommendation of local ACoRN applications for funding support;
- Administration, accounting and reporting on local ACoRN funds;
- Planning and organisation of local ACoRN activities;
- Maintaining the local Register of Network Participants.

The responsibilities for financial administration, accounting and reporting may be delegated to the named representative in the finance section of the organisation.

The team of Local ACoRN Representatives in 2005 are listed in Table 12 below.

ACoRN Organisation	Local Representative
Agere Systems Australia	Dr Graeme Woodward
Australian National University	Dr Leif Hanlen
CSIRO ICT Centre	Dr Hajime Suzuki Dr Iain Collings
Monash University	A/Prof Jean Armstrong
National ICT Australia Wireless Signal Processing Program	Dr Leif Hanlen
National ICT Australia Networks and Pervasive Computing Program	Dr Lavy Libman
University of Adelaide	Dr Belinda Chiera
University of Melbourne	Dr Brian Krongold
University of New South Wales	Dr Jinhong Yuan Dr Jinho Choi
University of Newcastle	Dr Sarah Johnson
University of Queensland	Dr John Homer
University of South Australia	Dr Steven Gordon
University of Sydney	A/Prof Abbas Jamalipour
University of Wollongong	Dr Beata Wysocki
Victoria University	Dr Aaron Reid
Western Australian Telecommunications Research Institute	Prof Sven Nordholm

Table 12: The Team of Local ACoRN Representatives 2005.

The team of Local ACoRN Representatives meets with the Network Convenor and the Network Administrator twice a year.

5.1.5 The Advisory Board

The Advisory Board consists of five internationally respected senior scientists who have made outstanding contributions to the theory and practice of telecommunications and to the administration of large research programs. The Board is appointed in terms of two years by the Network Convenor.

The current Board Members are shown in Table 13 below.

Name	Affiliation
Prof Bob Williamson	Australian National University National ICT Australia
Dr Chris Nicol	Agere Systems Australia
Prof Des Taylor	University of Canterbury New Zealand
Prof Sergio Verdu	Princeton University USA
Prof Sergio Benedetto	Politecnico di Torino Italy

Table 13: The 2005 ACoRN Advisory Board.

The Advisory Board meets with the Convenor once a year, providing advice and guidance drawing from their extensive experience in research and research management. The Advisory Board acts as an independent body to evaluate the Network Program of Activities and the annual activity reports. The Advisory Board also provides opportunities for National and International networking beyond existing ACoRN boundaries.

5.2 Network Agreement

As part of the funding agreement with the ARC, the ACoRN administrating organisation (University of South Australia) was required to enter into a Network Agreement with all ACoRN partner organisations. The directions from the ARC did not prescribe a particular form or content of the Network Agreement. However, the ARC strongly recommended that the following elements be included:

- The core membership of the network (people and organisations), and the means by which members may enter and leave the Network, and by which inclusive openness, access and participation will be maintained;
- The sharing of Network resources, including ARC funding assistance, including the role of the Network Convenor and any Steering Committee or other advisory body with responsibilities for financial and other resources;
- The management of Intellectual Property (which must be consistent with the National Principles for Intellectual Property Management for Publicly Funded Research);
- The obligations of members to assist the Administering Institution and the Network Convenor to meet the conditions of the ARC Research Network Funding Agreement.

In addition to these issues, the ACoRN Network Agreement also contains an element regarding confidentiality.

The ARC Research Network Agreement needed the signed approval of all sixteen partners of the network. The first draft of the agreement was issued in February 2005. Several

amendments needed to be incorporated into the agreement to get the consensus of all parties. The final partner signed the agreement in December 2005.

5.2.1 ACoRN Membership

The inclusion of new participants to the network will only take place where the Executive Board is convinced that this will enhance the critical mass of activities, expertise and resources of the network. For individuals at an ACoRN partner organisation, there are online procedures for applying for membership. The application must be recommended by the Local ACoRN Representative. The exit of participants may be straightforward as long as the institutional commitments to the Network do not change.

An organisation can withdraw from the Network in any year by giving at least three months notice in writing to the Executive Board provided that the organisation has honoured its pledged funding commitment for that calendar year. The effective date of withdrawal, regardless of the date of the withdrawal notice, shall be the 31 December of that year.

An organisation can be admitted to the Network following an application process. Upon initial request for admission, the Executive Board evaluates the applicant organisation and decides whether or not an official invitation for submitting a full application for admission should be given. The full application consists of presenting a case for membership. In the presented case, the following issues are to be addressed:

- List of individuals proposed for ACoRN Membership;
- Established research excellence and expertise of the proposed ACoRN members;
- Annual cash commitment to ACoRN;
- Contribution of proposed ACoRN members for enhancing the existing research expertise, research activities, network activities and resources of ACoRN.

Should the Executive Board decide in favour of the new organisation, admission to the Network is conditional upon it first entering into a deed in which it acknowledges receipt of a copy of the Network Agreement, confirms the amount of its contribution to the Network and agrees to be bound by the provisions of the Network Agreement, as amended from time to time, and the Funding Agreement as if it was a signatory to the Network Agreement.

In 2005, University of Technology Sydney and Macquarie University have been invited by the Executive Board to present their respective cases for ACoRN membership.

5.3 Network Planning and Management

The first meeting of the Executive Board was held in September 2004. Until the end of 2004, discussions were held regarding program plans, appointment of staff, budgets, network agreements and planned events. The Network began operation in January 2005 with the first ACoRN event being a tutorial held in February 2005 in connection with the Australian Communications Theory Workshop in Brisbane.

5.3.1 Executive Board

The Executive Board meets monthly, four times a year in person and eight times a year via teleconferencing. The Convenor, the Administrator and the Program Leaders report on the operation of the network and the network activities. Operational policies are defined and policy decisions are made.

A significant part of the activities in the Executive Board is to define the annual program activity plans for the Network with corresponding program budgets. Based on the Approved Proposal, the Board prepares tentative activity plans and budgets for presentation to the ACoRN members and the Advisory Board. Following a consultative process, the activity plans and budgets are finalised and forwarded to the Network Administrator and the Team of Local ACoRN Representatives for implementation.

The 2005 activity plans and budgets were presented in February to the ACoRN members at several larger meetings. In August we conducted a half-year review, revealing that the level

of activity and the rate of expenditure among most of the ACoRN partner organisations were falling behind expectations. As a consequence, the budgets were revised to include an expected rollover of unused funds. To ensure in future years that ACoRN meets its objectives, specific plans and time lines need to be set. As an outcome of this exercise, a business plan for implementation will be formulated.

5.3.2 Team of Local ACoRN Representatives

An active Team of Local ACoRN Representatives, engaging the local ACoRN community is vital for the success of the Network. The Network Administrator is the point of contact between the local representatives and the central ACoRN administration. Formal meetings between the local representatives, the Network Administrator and the Network Convenor are held twice a year. The first meetings were held in October where the ACoRN Network Administrator visited the local representatives in Victoria and New South Wales. A meeting with all local representatives is scheduled for May 2006.

Based on the annual activity plans, each of the local representatives plans the local activities in a consultative manner with the local ACoRN members. As part of the local planning efforts the organisation of ACoRN events are considered. The outcome of this exercise is a local plan of activities and a corresponding local budget for the available ACoRN funds. This budget is forwarded to the central ACoRN administration for approval.

In the start-up year of 2005, this process was initiated and will be further developed in 2006. The central administration will be working closely with the local representatives, preparing local budgets according to the ACoRN priorities. Also, mechanisms for monitoring and tracking activities will be put in place to ensure a flow of activities throughout the year. It is important for ACoRN that all its partners have a high level of activities, exploiting the funding opportunities for networking. The Team of Local Representatives play a crucial role in keeping up the level of activities and the rate of spending available funds appropriately.

5.3.3 Advisory Board

In general, the Advisory Board meets once a year with the Network Convenor, where the Convenor reports on the activities of the Network as well as on the activity plans for the coming year. In 2005, the Convenor met twice with the Advisory Board; once in February via teleconference, and once in September in connection with the IEEE International Symposium on Information Theory in Adelaide.

At the first meeting, the activity plans for 2005 were presented together with the corresponding budgets. The Board was very supportive of the 2005 plans and budgets. A cautious warning was raised on keeping administrative costs under control. Also, the Board advised against organising a dedicated Australian Telecommunications Conference as the conference scene is already saturated with larger conference events. It was recommended to focus on smaller events with clear technical aims. A main achievement at the meeting was the support for approaching NEWCOM regarding close collaboration between the two networks.

At the second meeting in September, the Convenor reported the successes of ACoRN workshop and school events, the ACoRN-NEWCOM collaborative agreement, as well as the challenges of promoting researcher mobility. The findings of the half-year review were presented, and the concern of the rate of expenditure among most of the ACoRN partner organisations was raised. Revised 2005 and 2006 budgets were presented, where the 2006 budget included a significant financial commitment to the annual joint ACoRN-NEWCOM workshop.

The Board was cautiously supporting the commitment to the ACoRN-NEWCOM workshop, and recommended to be more proactive in keeping the level of local activities among ACoRN partners up to expectations.

5.3.4 Organisation of ACoRN Events

ACoRN workshops and schools are organised as self-contained events based on break-even budgets supported through attendance fees. Subject to approval of technical content and budget ACoRN takes on the financial responsibility by underwriting approved events. The

target for the ACoRN events is to break even. Potential surplus is maintained within the respective programs to offset events running below budget.

Most of the events are organised based on invitation from the ACoRN Executive Board. However, all ACoRN members are repeatedly encouraged to suggest relevant events for ACoRN to organise.

5.4 Marketing Activities

A challenging task at the outset of ACoRN was to market the network activities and opportunities among the ACoRN members and partner organisations. Early in the year, a series of promotional meetings were held, presenting tentative activity plans and encouraging input and involvement. In addition, to allow for a level of branding a logo was designed to provide ACoRN with a visible identity.

5.4.1 Promotion meetings

The first promotional meeting was held in Brisbane in February in connection with AusCTW. The Executive Board was presented to the community together with the tentative activity plans for 2005. The meeting was attended by 36 ACoRN members.

In March, the Network Convenor conducted a series of promotional meetings in Victoria, New South Wales and South Australia. In Sydney meetings were held at University of New South Wales, University of Sydney and Agere Systems Australia with 7, 8 and 22 attendees, respectively. In Melbourne, meetings were held at Monash University, Victoria University and University of Melbourne with 7, 7 and 19 ACoRN members, respectively, attending. In Adelaide, a meeting was held at Technology Park in Mawson Lakes with 15 people attending.

In 2006, a more focused promotional approach is required to reach and engage all ACoRN members. A marketing element will be included in the ACoRN Business Plan.

5.4.2 Logos and Promotional Material

As part of an organisational identity, an ACoRN logo was designed. A series of promotional material, including letterheads, posters, banners, brochures and the ACoRN website encompasses the ACoRN logo, theme and colours.

ACoRN posters with an interchangeable insert have been made and given to all local representatives for timely promotion of ACoRN events and activities. The posters have proven to be a good marketing tool and an efficient way to promote events. A two-meter pull up banner has been made for promotion at conference events and events jointly organised with other organisations. A generic brochure has been prepared, giving a brief overview of ACoRN and ACoRN activities. These brochures are handed out at national and international events, as well as inserted in conference bags for all events that ACoRN has sponsored.

5.5 Procedures for Funding Administration

A main task of the Network Administrator was to implement administrative application procedures for funding support. The objective was to have all applications for funding made online, streamlining distributed review and approval procedures. This was accomplished through the ACoRN website with processes automated and authorisation levels set for accessing information, applying for grants and approving grants.

To be eligible to receive an ACoRN grant, the applicant must be affiliated with an ACoRN member organisation, and be registered as an individual ACoRN member. Grants are funded 50% by pledged funds from an ARC eligible member organisation and 50% by central ACoRN funds. For non-ARC eligible organisations, the grants are funded exclusively by pledged funds from the member organisation.

A grant is reviewed based on the funding rules for each program. All grant applications are first recommended by the Local ACoRN Representative, then reviewed by ACoRN the administration before being assessed by the program leaders and a decision is made. All successful grant applications are approved in accordance with clause 5 of the Funding Agree-

ment. The application procedure for an ACoRN member to be considered for financial support for any of the ACoRN programs is as follows:

1. The ACoRN member completes the appropriate online ACoRN application form;
2. The application form is automatically forwarded to the local ACoRN representative. The local representative makes a recommendation of the application and forwards it to the ACoRN Network Administrator;
3. The ACoRN Network Administrator reviews the application and if found in order, forwards it to the relevant ACoRN program leaders for consideration;
4. The ACoRN program leaders assess the application and report back the decision to the ACoRN Network Administrator, who in turn informs the ACoRN member and the local representative of the outcome of the application;
5. For a successful application, then following the supported activity the ACoRN member submits a Activity Report to the ACoRN Network Administrator, summarising the activities and the corresponding outcomes;
6. Following the submission of the Activity Report, the ACoRN member submits a request for reimbursement for actual expenses up to the maximum amount approved through normal local university/organisation procedures;
7. The local university/organisation reimburses the ACoRN member and subsequently invoices ACoRN for 50% of incurred expenses. The invoice must detail the expenses against the approved funding application.

Payment of the grant is made on the reimbursement of expenses. When the total amount of expenditure has been finalised, an invoice is raised on University of South Australia for 50% of the total of the expenditure, but is not to exceed the grant. 50% of the expenditure is expensed against the organisations pledged funds. Any additional expenses need to be covered by funds external to ACoRN or the ACoRN pledged funding.

Organisations are to invoice ACoRN on a monthly basis. ACoRN will remit funds to the organisation 30 days from receipt of invoice.

5.6 Financial Accounts 2005

All funding received from the ARC has been placed in a separate cost centre. ACoRN administration conducts a separate accounting package which is balanced against the central University of South Australia records on a monthly basis. The funds are held in accordance with clauses 8.1, 8.2 and 8.3 of the Funding Agreement.

Where an organisation has agreed to make a cash contribution to the network, the funds are maintained by the contributing organisation and expended solely for the purpose of participation in the Activities of the Network. Each organisation is requested to report on the expenditure made on a six monthly basis. These records are agreed against central ACoRN financial records. All receipts are maintained by the institutions that received the grant and are to be made available upon request.

In Table 14 the cash commitments made by the ACoRN partner organisations to the Network is shown. These pledges are in accordance with the Approved Proposal with one exception. Agere Systems Australia regrettably had to adjust the cash commitment from \$15K to \$10K.

5.6.1 Expenditure under the Proposal

The original Approved Proposal was based on annual ARC funding of \$500K. As ACoRN was awarded \$300K annually, the budget for 2005 was adjusted accordingly.

At the end of July a review of ACoRN was undertaken by the Network Convenor and the Network Administrator, revealing that the level of activities and the rates of expenditure among most of the ACoRN partner organisations were falling behind expectations. One of the major contributing factors to the slow rate of spending was that Network Agreements were not finalised and organisations were wary of funds being spent without a signed agreement in place.

As a consequence of the slow burn rate, the budgets were adjusted to the level of activities, leading to an expected rollover from 2005 of \$57K of ARC funds and \$102K of pledged funds. This is in addition to the rollover from 2004 of \$150K of ARC funds.

ACoRN Organisation	Pledged Funds
Agere Systems Australia	\$10,000
Australian National University	\$10,000
CSIRO ICT Centre	\$10,000
Monash University	\$10,000
National ICT Australia Wireless Signal Processing Program	\$53,000
National ICT Australia Networks and Pervasive Computing Program	\$10,000
University of Adelaide	\$10,000
University of Melbourne	\$10,000
University of New South Wales	\$10,000
University of Newcastle	\$10,000
University of Queensland	\$10,000
University of South Australia	\$40,000
University of Sydney	\$10,000
University of Wollongong	\$10,000
Victoria University	\$10,000
Western Australian Telecommunications Research Institute	\$10,000
Total	\$233,000

Table 14: Pledged funds by ACoRN Partner Organisations.

An overview of the initial budget approved by the Executive Board in January 2005, the revised budget approved by the Executive Board in August 2005, and the actual expenditure in 2005 is shown in Appendix D. The data is also presented as a histogram in Figure 3 below. As shown in the figure, the revised budget made significant cuts in the Researcher Mobility Program and in the Postgraduate Education Program. In the Postgraduate Education Program it was mainly the mobility component that was adjusted.

Considering the actual expenditure, the disbursement in the Knowledge Management Systems Program was according to the revised budget. This is not surprising as all components in the program are under central ACoRN control. The Governance, the Researcher Mobility Program and the Postgraduate Program were within 78%, 69% and 63% of the revised budget, while the National and International Conferences and Workshops Program was 40% above the revised budget and even 7% above the initial budget.

Again, considering the actual expenditure, the concerns expressed in Section 4 and further discussed in Section 6 are clearly quantified in Figure 3. It is clear that more efforts must be directed towards promoting the researcher and student mobility programs, whereas the conference and workshop attendance to established events needs to be somewhat discouraged in 2006.

In Figure 4, the distribution of the actual expenditure over Governance and the four Programs is shown. This figure only emphasises the conclusions made above. In the initial 2005 budget, the share of Governance and the Knowledge Management Systems Program were 25% and 11%, respectively, while the Researcher Mobility Program, the National and International Conferences and Workshops Program and the Postgraduate Education Program were 24%, 24% and 16%, respectively. To reach the target distribution, the mobility programs need to be strengthened, while the conference attendance needs to be curbed.

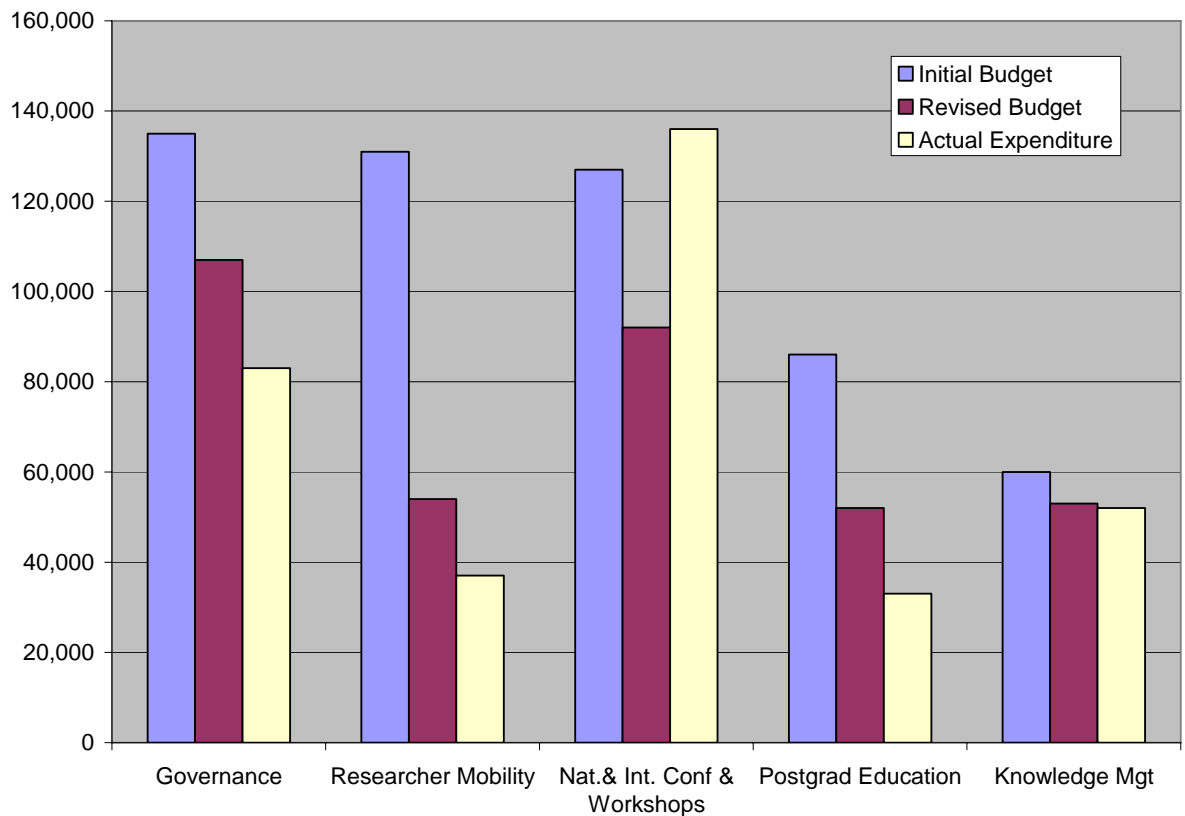


Figure 3: Overview of initial 2005 budget, revised 2005 budget and actual 2005 expenditure.

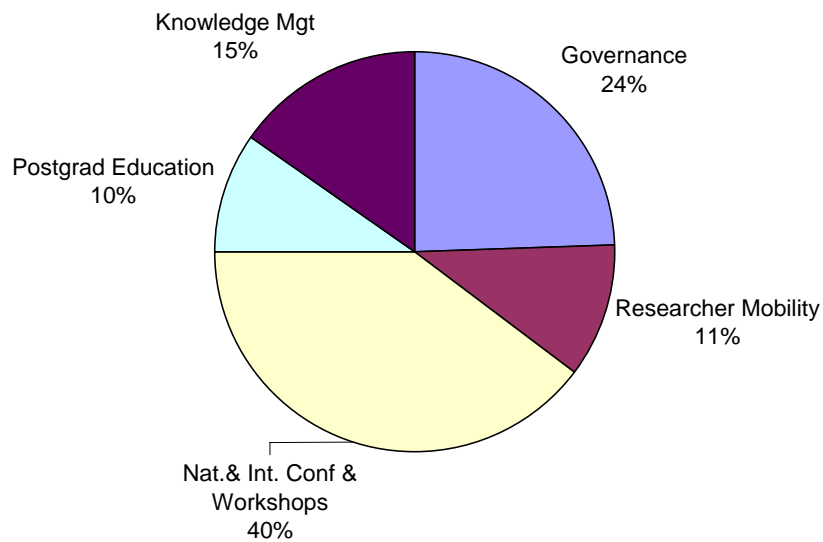


Figure 4: The distribution of 2005 expenditure over Governance and the four Programs.

In

Figure 5, the Percentage of pledged funds spent by each ACoRN Partner Organisation in 2005 is shown. From this figure it is clear that some organisations have already engaged

strongly with ACoRN while other partners are still to get fully involved in the ACoRN networking activities.

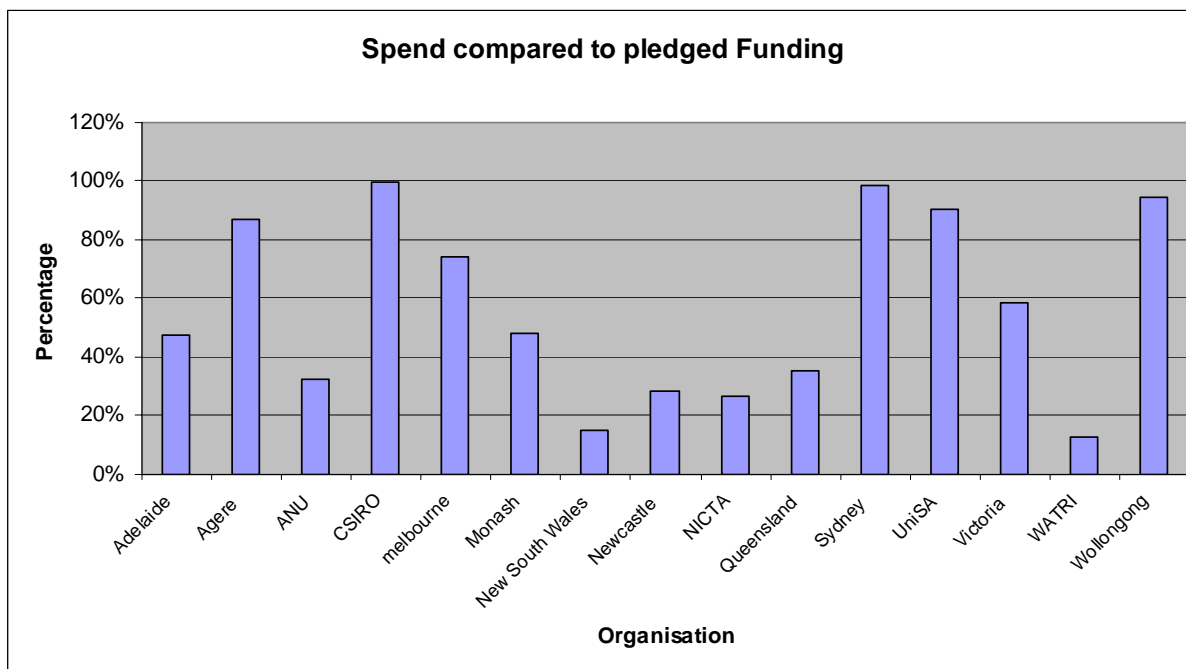


Figure 5: Percentage of pledged funds spent by each ACoRN Partner Organisation in 2005.

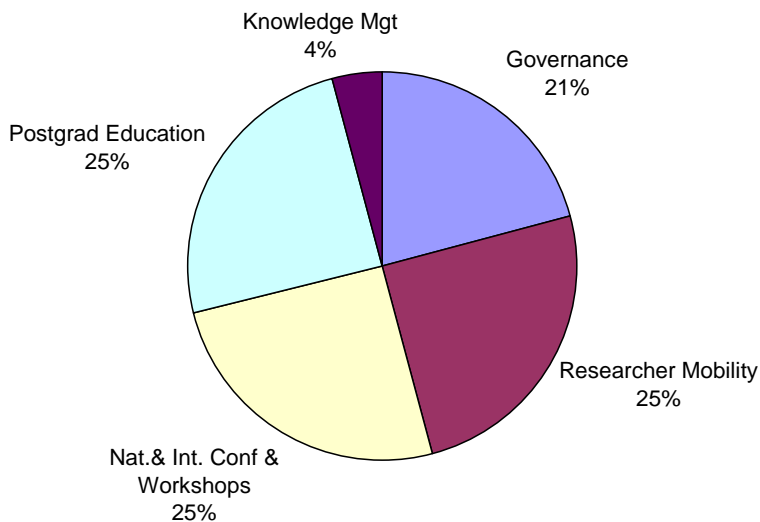


Figure 6: The distribution of 2006 budget over Governance and the four Programs.

5.6.2 Updated Budget 2006

An overview of the budget for 2006 is included in Appendix E. The budget contains a sizeable rollover from both ARC funds and pledged funds. The ARC rollover consists of \$150K from 2004 and \$84K from 2005, while \$118K of pledged funds from 2005 is carried over to 2006, making a total rollover of \$352K. In 2006 the aim is to reduce the rollover to \$150K of

ARC funds and \$81K of pledged funds. The ACoRN central administration will monitor the rates of expenditure closely and take action if required.

In 2006, a significant amount of funds is dedicated for the ACoRN-NEWCOM joint workshop. As mentioned previously it is the intention that central ACoRN funds will be allocated to support ACoRN members to attending in addition to the dollar-for-dollar support schemes in place. ACoRN partners with rollover pledged funds will be encouraged to use in connection with the workshop.

Disregarding the budget item dedicated to the ACoRN-NEWCOM Workshop, the distribution of the remaining funds for 2006 is shown in Figure 6. Each of the three programs with activities directly involving the ACoRN members as active participants is of equal size, namely 25% of the total budget. The recommendation to the Team of Local Representatives for 2006 is therefore that the local budgets should be equally divided between the three program activities. The central administration will expect budget to follow these guidelines. Once local budget entries are exhausted, corresponding funding applications will no longer be supported with dollar-for-dollar funding. Excess ARC funds will be directed towards rewarding organisations with a high level of activities within the ACoRN priorities.

6 Network Performance

The first part of 2005 was a start-up phase for ACoRN. The initial challenges were to establish an operational administration, an ambitious program of activities, a functional website, and most importantly, to promote the ACoRN Network throughout the ACoRN community. In hindsight, the toughest challenge has arguably been to reach the research community, and thus, engage and activate the ACoRN members. As Research Networks are a new concept, it has taken the community some time to learn and adjust to a new mindset of research networking. Also, the development of the ACoRN website with online funding application procedures was delayed and the signing of the Network Agreement were not finalised until December 2005.

As a consequence, the ACoRN activities experienced a slow start. As the awareness of the ACoRN opportunities propagated throughout the Network and the website got operational the last part of 2005 saw a healthy increase in activities. Despite this increase, the rate of expenditure did not reach expectations, causing a sizeable rollover of ARC funds. The 2005 rate of expenditure is considered an issue of concern and will be monitored and managed more carefully in 2006.

A main priority throughout 2005 has been to direct funding support towards postgraduate students and early career researchers. This has in turn resulted in additional funds being informally committed to ACoRN for funding involvement of senior researchers. This is to some extent an indication of the success of ACoRN activities.

The most significant achievement in 2005 is the formal agreement of collaboration between ACoRN and the European Union Network of Excellence in Wireless Communications, NEWCOM. The jointly funded students and researchers exchange program and the joint annual workshop starting in 2006 provide new and exciting ways for Australia to have an international impact in the area of wireless communications.

Another significant achievement is the ACoRN School program, which has been overwhelmingly successful. The ACoRN-NICTA Wireless School in Canberra, which is becoming an annual event, and the ACoRN Spring School in Adelaide were highlights in 2005 with a massive number of students enjoying overview research talks by senior Australian researchers in Canberra, and multiple-day tutorials by International experts in Adelaide.

The ACoRN Spring School took advantage of the IEEE International Symposium on Information Theory being held in Adelaide in 2005. Another 2005 highlight also took advantage of this event. The Joint ACoRN-CUBIN Information Theory Workshop featured thirteen of the world's top researchers in the area, and thus, attracted more than eighty delegates to Melbourne.

The success of these two events goes to show the utmost importance of Australia hosting major International conference events. Therefore, ACoRN has initiated bids for bringing the *IEEE International Symposium on Personal, Indoor, and Mobile Radio Communications 2009*, and the *IEEE International Conference on Acoustics, Speech, and Signal Processing 2012* to Australia

The achievements above are only the highlights of ACoRN 2005. Additional ACoRN achievements in 2005 are described and discussed in more detail below.

The performance evaluation in this section is organised as follows. First, the performance of each of the programs is evaluated against the Approved Proposal. Accomplishments and challenges are recognised, leading to new initiatives being suggested for 2006 in Section 7. We then evaluate the performance of the Network against the Network Objectives, and highlight National Benefits achieved by ACoRN. To wrap up the evaluation, we consider the impact of ACoRN according to the ARC report proforma.

6.1 Performance of Network Programs

In this section, the performance of the ACoRN programs is evaluated against the Approved Proposal. The original proposal was based on annual funds from the ARC of \$500K. Through

the review and approval processes, the awarded annual funding from the ARC was set to \$300K. The activities of the Network have not been scaled accordingly in a linear fashion, and as a consequence, some activities from the Approved Proposal have not yet been pursued.

6.1.1 Researcher Mobility Program

In the researcher mobility program the emphasis this year was put on supporting networking for early career researchers within all the program activities. In the start-up phase, equal priority was directed to all activities, promoting all levels of researcher mobility. Longer-term research visits and visitors were given preferential considerations. The total number of funded research visits and international visitors funded through ACoRN is summarised in Table 15² below. Also included in Table 15 for comparison are the numbers proposed in the Approved Proposals. Details about the fellowships can be found in Section 4.2.

	International Travel Fellowships			Domestic Travel Fellowships			Industry Internships	International Visitors Fellowships
	ECR	SR	Total	ECR	SR	Total		
2005	5	1	6	2	2	4	0	5
Approved Proposal	7			6			5	10

Table 15: The number of Researcher Mobility Fellowships against the Approved Proposal.

As shown in Table 15, the number of International and Domestic Fellowships are close to the proposed targets in the Approved Proposal. The number of International Visitors did not reach the target, but was still acceptable given the start-up phase of the program. The number of Industry Internships was far from the target and is an issue to be addressed in 2006. It is encouraging to see that our emphasis on ECRs has been successful with 7 out of 10 fellowships being awarded to ECRs. Also encouraging was that 2 of the International Fellowships and 1 of the Visitors Fellowships were part of the ACoRN-NEWCOM exchange program. We have high expectations for our ACoRN-NEWCOM collaboration, and the 2005 exchanges were the first steps in bringing the networks closer together.

Our preference for researcher mobility is for longer-term visits of the order of six weeks or more. Such longer-term visits take significant planning, and in 2005 all fellowships but one were for 4 weeks or less. It was a particular challenge to promote longer-term Domestic Fellowships, where all granted visits but one were of 2 weeks duration or less.

Stronger emphasis on longer-duration fellowships is an issue for attention in 2006. The ACoRN-NEWCOM Researchers Exchange Program was put in place late in the year, so we expect to see an increase in 2006 through this activity.

Program Highlights, Outcomes and Challenges

The three ACoRN-NEWCOM exchanges were strategically important, and also turned out to be very successful. Dr Yi Hong's visit to Prof Belfiori (France) and A/Prof Viterbo (Italy) has so far resulted in four submitted papers and a joint ARC Discovery Grant Application. Dr Guillen's visit to Prof Boutros (France) has so far resulted in two accepted papers and one

² In the Table, the Fellowships and Industry Internships have been separated into Early Career Researchers (ECR) and Senior Researchers (SR).

submitted, as well as a joint application to the France-Australia Science and Technology Program.

Similarly, the visit by Dr Amat (Spain and France) to University of South Australia has so far resulted in one accepted paper and one submitted paper as well as a joint application to the France-Australia Science and Technology Program. Furthermore, this collaboration has been extended to include additional NEWCOM researchers.

Also the visit by Prof de Haro (Spain) to Australia was very productive, resulting in several joint paper submissions as well as a joint ARC Discovery Grant application.

On the Domestic Fellowships, the highlight was Prof Kennedy from NICTA, Canberra visiting the Western Australian Telecommunications Research Institute for three months, setting up several joint projects.

In conclusion of the 2005 activities, the program performed at an acceptable level in a start-up year. Through the activities, we have encountered some challenges that need considerations in order to further improve the value of the program. Those challenges are:

- Longer-duration International, Domestic and Visitors Fellowships;
- Increase the number of International Visitors Fellowships;
- Increase the number of Industry partners in ACoRN
 - Increase the number of Industry Internships.

We will address these challenges through some new initiative in terms of program activities and funding administration. The new initiatives are detailed in Section 7.2.

6.1.2 National and International Conferences and Workshops Program

The National and International Conferences and Workshops Program is the most diverse of the ACoRN programs, containing conference and workshop organisation, sponsorship and bidding for major International conferences, and supporting national and International conference and workshop attendance. As such, the activities are naturally separated into facilitating and organising event, and supporting attendance at relevant events. The priorities in 2005 were towards organising useful workshop events, establishing a close relationship with NEWCOM for organising a joint bilateral workshop, initiating bids for future major events, and support for early career researchers and students to attend events. A high priority was to have a workshop event in connection with the IEEE International Symposium on Information Theory held in Adelaide in September.

The activities in terms of facilitating and organising events are summarised in Table 16 below. The activities are set against the proposed activities included in the Approved Proposal.

	Conference Sponsorships	Conference Biddings	Thematic Workshops	Industry Workshops	Bilateral Workshops	ACoRN Conference
2005	3	2	2	0	0	0
Approved Proposal	0	0	2	2	1	1

Table 16: The activities in the National and International Workshops Program against the Approved Proposal.

ACoRN provided sponsorship to 3 major International conferences held in Australia. In the Approved Proposal, no sponsorships were expected in the first year. However, sponsoring opportunities with the IEEE International Symposium on Information Theory in Adelaide and the IEEE Local Computer Networks in Sydney presented themselves and provided excellent

exposure for ACoRN both nationally and internationally. In 2006, the sponsorship of the IEEE Vehicular Technology Conference will extend the streak of excellent exposure. To continue the stream of major event to be hosted in Australia, ACoRN initiated 2 new bids for leading IEEE conference events. This activity was not explicitly part of the Approved Proposal.

In terms of conference and workshop organisation, ACoRN offered two thematic workshops in 2005, namely the inter-disciplinary event, *ACoRN Workshop on Cross-Layer Design Problems for Wireless Communications*, and the *ACoRN/CUBIN Information Theory Workshop*. Both workshops were very successful, attracting in the excess of fifty and eighty delegates, respectively, including many ACoRN members of which were not funded by ACoRN.

In 2005, we did not organise any Industry Workshops. So far ACoRN has only one Industry participant, and we decided to postpone such events until more industry partners have joined ACoRN. Also, one bilateral workshop and an ACoRN Bi-Annual Conference were planned in the Approved Proposal. The ACoRN-NEWCOM agreement was not finalised in time for organising an event in 2005, but the first bilateral ACoRN-NEWCOM workshop is scheduled for 2006. The plans for a dedicated ACoRN Bi-Annual Conference have been abandoned following advice from the ACoRN Advisory Board and the ACoRN Executive Board. It was concluded that the substantial number of established national conference/workshop events already in Australia does not allow for a new event. Instead the budgeted funding is directed towards ACoRN-NEWCOM joint workshop activities.

The activities in terms of awarded grants for attending International and Domestic conference events, as well as ACoRN workshop events, are summarised in Table 17³ below.

	International Conference Attendance Grants				Domestic Conference Attendance Grants				ACoRN Workshop Attendance Grants			
	RS	ECR	SR	Total	PG	ECR	SR	Total	RS	ECR	SR	Total
2005	8	5	1	14	58	6	0	64	22	4	3	29
Approved Proposal	20				20				60			

Table 17: Breakdown of Attendance grants in ACoRN Workshops, International and Domestic Conferences against the Approved Proposal.

As illustrated in Table 17, the target for International Conference Attendance was not quite reached, but still acceptable. The target for grants supporting attendance at ACoRN workshops was further from being reached. However, it should be noted that the attendance at the workshops were close to the target number, where support from alternative sources were used as funding. Finally, the number of granted Domestic Conference Attendance Grants far exceeded the target from the Approved Proposal. The vast majority of these grants have been awarded to students for attending national events. Although this explains the large number of applications, it is still an issue of concern that ACoRN members seek support for attending established events rather than attending ACoRN workshops or take on mobility scholarships/fellowships. This is an issue that will be addressed in 2006.

Across the attendance grants, it is encouraging to see that the priority towards research students and early career researchers have been successful with more than 80% of the grants going to students and 14% going to early career researchers.

³ In the Table, attendance grants have been separated into Research Students (RS), Early Career Researchers (ECR) and Senior Researchers (SR).

Program Highlights, Outcomes and Challenges

The hosting of the IEEE International Symposium on Information Theory in Adelaide in 2005 was of strategic importance to ACoRN and to the Australian research community. With more than six hundred researchers travelling to Australia from around the world, it provided a unique opportunity to showcase Australian excellence. ACoRN was a major sponsor and enjoyed an outstanding international exposure. ACoRN took additional advantage of the massive number of world class researchers by organising a workshop jointly with CUBIN, featuring many of the conference delegates. More than 80 Australian researchers attended this very useful workshop.

To promote inter-disciplinary research, the first workshop event organised by ACoRN was focused on cross-layer design. The workshop brought together researchers from all the protocol layers in a relaxed environment, facilitating informal discussions. The main objective was to create new contacts and linkages across discipline boundaries.

A final highlight is our bid for bringing the International Symposium on IEEE Personal, Indoor, and Mobile Radio Communications 2009 to Australia. Even though we are still to submit a detailed proposal, early indications are that we have a strong case for securing the event coming to Australia.

In summary, the program performed well, given the diverse level of activities on offer. The efforts on bringing International events to Australia are moving forward beyond expectations. The funding for International conference attendance is on track. The target for thematic workshops was reached, and through the strong link with NEWCOM, an annual bilateral workshop has been but in place.

The challenges for 2006 identified in the above evaluation of the program are summarised as:

- Increase the number of Industry partners in ACoRN;
 - Organise industry-oriented workshops;
- Influence the traditional view of research networking;
 - Increase the number of inter-disciplinary events;
 - Increase focus on ACoRN Research Themes;
 - Decrease the number of attendance grants to established domestic conference.

We will address these challenges through some new initiative in terms of program activities and funding administration. The new initiatives are detailed in Section 7.3.

6.1.3 Postgraduate Education Program

The main priority in 2005 was to offer high-quality school events, complementing the post-graduate coursework available at the partner universities. A separate part of the program was focused on domestic and international student mobility, where both components were of equal priority.

In the Approved Proposal, two annual school events were proposed, and in 2005 two school events were indeed organised, attracting large numbers of ACoRN students. In addition, a one-day tutorial was also held in connection with AusCTW 2005.

In July the week long ACoRN-NICTA Wireless Winter School was held in Canberra, featuring seventeen talks by senior Australian researchers and attracting more than forty six student delegates. This success was followed up by the week long ACoRN Spring School on Information and Coding Theory in September in connection with ISIT. This event featured three renowned International researchers offering high profile tutorials. More than sixty students and researchers attended the event. The feedback from the event was overwhelming, encouraging more events of this calibre in the future. All together, ACoRN awarded fifty four

school attendance grants in 2005, with forty eight given to students, which is close to the target of sixty attendance grants included in the Approved Proposal.

The student mobility part of the program experienced mixed results. A summary of the scholarships awarded is shown in Table 18⁴ below.

	International Scholarships	Domestic Scholarships	Industry Internship	ACoRN School Attendance Grants			
				RS	ECR	SR	Total
2005	6	1	1	48	2	4	54
Approved Proposal	6	6	5	60			

Table 18: Breakdown of the activities in the Postgraduate Education Program against the Approved Proposal.

As seen in Table 18, the number of International Travel Scholarships reached the proposed target from the Approved Proposal. However, Domestic Travel Scholarships and Industry Internships were significantly less attractive to ACoRN students.

The low number of domestic research visits and the low spending rate in the program are important issues to address in 2006, as mobility is an essential part of networking Australia.

Program Highlights, Outcomes and Challenges

The highlights of the program are also among the main highlights of ACoRN in 2005. The two school events were highly successful, attracting a high number of ACoRN students, leading to a high number of attendance grants being awarded. The student feedbacks we have received from both events have been excellent, warranting continuing school events in 2006.

The International Travel Scholarships were also successful with duration of three of the 6 research visits being considerably longer than six weeks. The visit by Gilles Gorlier to France was of strategic importance, as it was the first ACoRN-NEWCOM student exchange. Also, the visit was productive, leading to one joint publication so far. The visit by Michael Pietrzyk from Holland to the University of Wollongong was the second ACoRN-NEWCOM exchange in the reverse direction, resulting in similarly productive joint work.

Although only one Domestic Scholarship was awarded, the visit by Allen Chuang to the University of South Australia was very useful, leading to ongoing collaboration between Allen Chuang, University of Sydney, Dr Iain Collings, CSIRO, Dr Albert Guillen i Fabregas and Prof Lars Rasmussen, University of South Australia. This is a prime example of successful research networking, strengthening existing links.

Similarly, only one Industry Internship was awarded, spending twelve weeks at Agere Systems Australia. The internship was very successful both for the student and Agere, leading to a submitted provisional patent.

In conclusion, the postgraduate education program is running very well. Significant value has been added to the quality of research education throughout the ACoRN network. The next step is to expand the success into more domestic travel activity and collaboration across Australia. The two main challenges for 2006 are:

- Increase the industry involvement in ACoRN;

⁴ In the Table, attendance grants have been separated into Research Students (RS), Early Career Researchers (ECR) and Senior Researchers (SR).

- Increase the number of Industry Internships;
- Increase the number of domestic student research visits.

We will address these challenges through some new initiative in terms of program activities and funding administration. The new initiatives are detailed in Section 7.4.

6.1.4 Knowledge Management Program

The main priorities in 2005 were to create a useful network website with online application processes for funding administration, and to establish an informative newsletter for distribution among ACoRN members and guest members.

Following intensive design work, the new website was released in October, including online procedures for funding applications and administration, online electronic forums, as well as relevant information for the operation of ACoRN and generally useful information for the community. As previously mentioned, the ACoRN website has had almost 17,000 unique visitors from the release in October to mid March. The main pages visited are the listings of ACoRN members with contact details, demonstrating the benefit of having one Australian website providing details for almost the entire telecommunications research community in Australia. The majority of visits are from Australia, but also a significant number of hits is from European countries, demonstrating the impact of the joint ACoRN-NEWCOM collaboration. The online forums have also attracted interest, however, mostly for visitors checking out the postings, rather than contributing to the forums.

The newsletter has also been a success both within ACoRN as well as way beyond. The distribution has almost reached 700 with new subscribers worldwide every month. The benefits for ACoRN and Australia from the ACoRN newsletter are manifold. Particular important impact has been on postdoctoral recruitment, where open positions advertised in the ACoRN newsletter has attracted increased interests from overseas applicants.

Public outreach is part of the program, but no dedicated efforts have been done in 2005. In 2006, outreach activities will be stepped up, targeting general public lectures and more media exposure.

Program Highlights, Outcomes and Challenges

The program has been overly successful in reaching the targets for 2005. The website and the newsletter speak for themselves. The main challenge for 2006 is to get the online forums to be used more regularly, creating the "ACoRN electronic noticeboards" they were intended to become. In summary the challenges for 2006 are:

- Promotion of electronic web tools for networking;
- Continuing development of the website;
- Public outreach.

We will address these challenges through some new initiative in terms of program activities. The new initiatives are detailed in Section 7.5.

6.2 Performance against Objectives

In this section, we attempt to evaluate the network performance against the ACoRN objectives listed in Section 2.1.

1. Promote a culture of research excellence across the Network

In 2005, our efforts have been directed towards raising the general level of research excellence across the network. This has in first hand been achieved by organising ACoRN work-

shops and schools, and by strongly supporting International conference events hosted in Australia. Domestic and International fellowships and scholarships promote excellence across the network through extended visits at high profile research groups in Australia and abroad. The ACoRN-NEWCOM collaborative agreement is focused entirely on promoting a culture of research excellence across two research networks across the world. High profile International visitors also bring with them an aura of excellence that inspire and encourage.

In conclusion, ACoRN has made the initial steps towards reaching this objective. Challenges are still ahead and to further promote excellence in 2006, some new initiatives are aiming at rewarding research excellence in terms of annual best-paper prizes and semi-annual linkage prizes for excellent conference papers. More about new initiatives can be found in Section 7.

2. Initiate open exchange of pre-competitive information and sharing of resources

The ACoRN website is our most important achievements towards an open exchange of information and sharing of resources. The electronic forums within the website are tools for encouraging further exchange. Again, ACoRN workshops and strong support for researcher and student mobility are initiatives for promoting a higher level of information exchange across the Network. On a lighter note of information exchange, the ACoRN newsletter has an impressive distribution, providing a wide spread of information from the Network.

Again, important steps have been made towards reaching this objective. Still more work is required to break through traditional barriers, facilitating a significant increase in long-term domestic research visits by students and researchers across the Network

3. Develop and implement integrated research plans for researchers in areas of common interest

Only limited progress has been made on this objective. In the first year of operation, it was considered more important to get the ACoRN community engaged and excited about ACoRN activities, rather than promoting the formulation of joint integrated research plans and themes. Some efforts among smaller groups of researchers have been done. Joint research efforts are ongoing between NICTA and University of South Australia, as well as between University of Sydney, CSIRO, and University of South Australia, involving all levels of researchers and students.

In 2006, more focused efforts are planned for promoting the ACoRN research themes and for promoting the creation of research clusters with the aim of addressing the themes in a coordinated fashion.

4. Inspire new inter-disciplinary research themes, focused on National Priority Areas

Initial efforts have been made towards this objective. An ACoRN workshop on cross-layer design issues attracted a diverse audience with researchers from virtually all layers in the communications stack. Similarly, the ACoRN-NICTA school brought together a wide range of Australian researchers to lecture to a large group of research students. The intension was to educate and pass on an understanding for research areas beyond the limitation of a research student project. The ACoRN-NEWCOM collaboration is also a strong vehicle for promoting inter-disciplinary work. NEWCOM is organised exactly to facilitate and promote collaboration across traditional research boundaries. ACoRN is working towards a stronger involvement in these activities in NEWCOM.

5. Nurture the careers of Young Investigators and students, promoting a sense of community, collaboration and a culture of effective mentoring

A great effort has been directed towards this objective, creating a fruitful environment for students and early career researchers. A vast majority of the mobility and attendance support has been allocated to students and early career researchers to provide the best possible op-

opportunities for development. The school events have brought the young researchers and students together, and facilitated initial networking links. A substantial support for domestic and international conference attendance has also contributed. Finally, strong links are formed between the group of Local ACoRN Representatives and the ACoRN convenor. The group of Local ACoRN Representatives counts seven early career researchers and eight more senior researchers, providing a level of mentoring.

6. Encourage and support Young Investigators in positions of research leadership

This objective is a significant challenge to meet in a meaningful way. Throughout ACoRN encouragement and support are constantly offered to young researchers with the desire and talents for taking on research leadership. However, such support may not be sufficient to make a difference. More focused efforts are required to nurture the confidence and create the abilities for research leadership. Within the group of local representatives, responsibilities are given to young researchers and backed up with strong administrative and managerial support. In addition, plans are in the making for dedicated grant proposal workshops for identifying and educating the next generation of research leaders.

7. Facilitate links with end users such as telecommunications industries, government, and the broader community

It is a challenge for ACoRN to bring into the Network additional industry partners. At this point in time, only Agere Systems Australia is an ACoRN partner. Despite the lone existence, Agere has taken on a strong role within the Network. The internship program with Agere facilitates useful links between the student body and industry. ACoRN aims to expand these activities to involve new industry partners.

The ACoRN website and newsletters facilitate direct links with the outside telecommunications industries, government and a broader community within Australia and abroad. We have received queries from many places around the globe. To reach the broader community in a more educating fashion, outreach activities will be given higher priority in 2006.

8. Raise the profile of Australian telecommunications research nationally and globally

Internationally ACoRN has been very successful in raising the research profile of Australian telecommunications. This has been achieved through sponsoring international events hosted in Australia, and subsequently using these events to bring in renowned international researchers to take part in ACoRN events and to initiate research collaboration. In addition, the ACoRN-NEWCOM collaborative agreement has single-handedly made ACoRN known throughout the European research community, and has attracted many hits on our website. We experience a growing European interest in postdoctoral positions in Australia. The joint ACoRN-NEWCOM workshop scheduled for September 2006 will undoubtedly make the links to the European research community even stronger and hopefully lead to jointly funded research projects of larger scale.

6.3 National Benefits

“Innovation” has been identified by the Australian Government as a key driver of productivity and economic growth. The cycle of developing skills, generating new ideas, and pursuing them for commercial success demonstrates the central role of innovation in achieving National economic benefits. In 2005 ACoRN has made important contributions to several key elements recognised as the basis for Australian innovation; namely:

- Developing and retaining research skills;
- Stimulating collaboration and research cluster building;
- Raising the International profile of telecommunications research in Australia.

Developing and Retaining Research Skills

Through the schools and mobility programs, ACoRN contributed to developing and enhancing research skills and capabilities at all levels of the research community. The same activities also have a stimulating and productive effect on research and developments, as researcher and student mobility schemes promote the values of research collaboration and linkages. Workshops and conferences attendance supported by ACoRN offered larger forums for scientific exchange and for fostering new linkages as well as exposing postgraduates to the larger stimulating community.

Stimulating Collaboration and Research Cluster Building

ACoRN was partly successful in linking the telecommunications research community together, facilitating closer collaboration and an increase in the scale of research activities. The intentions of the researcher and student domestic mobility schemes are to stimulate collaboration and research cluster building. In 2005, the domestic mobility activities fell short of the projected targets. However, those domestic visits that did take place have fulfilled the expectations. University of South Australia was in particular active, hosting one domestic visitor and conducting two domestic visits, all of which have initiated ongoing collaboration. It is, however, still required to increase the amount of such activities network-wide.

2005 saw a strong attendance by ACoRN members at workshops and national conference events, providing the required opportunities to foster links that can lead to research visits supported by the Domestic Mobility Programs.

Finally, strong links have been established between Local ACoRN Representatives, which include seven early career researchers. The close interactions between local representatives' foster relationships between people, which in turn improves the chances of subsequent research collaboration.

It is expected that the increase in initial linkage building will lead to significant increase in research collaboration across the Network.

Raising the International Profile of Telecommunications Research in Australia

ACoRN has contributed significantly to raising the International profile of Australian research. This success has come from three directions. Firstly, the collaborative agreement with NEWCOM has established formal links in the research community in the European Union. The joint exchange program between ACoRN and NEWCOM has made Australian research considerably more visible and fostered new useful links. Although no jointly funded projects have yet been established, the opportunities have never been better for Australia to take active part in the NEWCOM research portfolio towards standardisation of next-generation mobile wireless communications systems.

The exposure and promotion of ACoRN in Europe through this collaboration has also been outstanding. The joint workshop in September 2006 and the exchange program have made all researchers in NEWCOM aware of ACoRN and the opportunities for working closely with Australia.

In addition to the ACoRN-NEWCOM agreement, the international researcher and student mobility programs have also been successful in engaging other parts of the world, leading to new links and tangible outcomes. Finally, the IEEE International Symposium on Information Theory hosted in Adelaide in 2005 was also a significant promotion of Australian organisation and research capabilities. As ACoRN was a major sponsor of the event, ACoRN received significant exposure at the event and was able to include information brochures with the official conference material.

6.4 Impact of Network

The ACoRN Network has had a significant impact on many aspects of the telecommunications research community. In the following sections, we have highlighted the impact of the

Network within the three areas noted as specific interest to the ARC in the Annual Report Proforma.

In addition to the aspects below, an important impact of ACoRN has been bringing together in large numbers research students and early career researchers on multiple occasions throughout 2005. Due to the priority of awarding attendance grants primarily to students and early career researchers, the schools, the ACoRN workshops, and the domestic conference events have seen an unprecedented number of student and ECR attendees, providing the opportunities to form lasting links with high potential of subsequent research collaboration. Although this could also have been accomplished without a research network, it has not happened in the past. We believe that introducing the concept of research networks has indeed inspired the community to network through avenues that in some sense already were in place.

6.4.1 Activities Enabled by the Network

Among all the activities that ACoRN has enabled, we have specifically identified three achievements, which would not have been possible without the research network program.

ACoRN-NEWCOM Collaborative Agreement

Without the concept of research networks, Australia would not have been able to interface formally with NEWCOM as an equal partner. Engaging with NEWCOM on an equal footing has already resulting in new links and tangible outcomes. The goal is for ACoRN to take active part in the mission of NEWCOM towards standardisation of the fourth generation mobile communications system.

Coordinated Engagement of the Australian Telecommunications Research Community

Research funding in Australia and anywhere else in the world is awarded mainly based on research excellence. As a consequence the Australian research community is driven by a high level of competition between research fields, research areas, research organisations and research groups. The competitive spirit between universities and research groups makes it a significant challenge to engage and coordinate the telecommunications research community nationwide. Although it is clear that raising the level of research excellence in the community through coordinated pooling of expertise and resources will make the research area as a whole more competitive domestically and internationally, individual organisations in leading positions are hesitant in sharing.

ACoRN provides a platform for objectively pursuing a coordinated engagement. As discussed above it is a difficult challenge as it goes against common practice. However, ACoRN is taking cautious steps forward, facilitating the creation of research clusters by bringing researchers and students together for workshops, schools and conference events.

Without ACoRN, this would not have been possible to the extend that ACoRN has already accomplished.

Coordinated Bidding for Major International Conference Events

Australia is on a streak of hosting major International conferences in the telecommunications area. In 2004 the *IEEE International Symposium on Spread Spectrum Techniques and Applications* was held in Sydney. In 2004 the *IEEE International Symposium on Information Theory* was held in Adelaide. In 2006 the *IEEE Vehicular Technology Conference* will be held in Melbourne. These major events have a remarkable effect on the research quality and research outcome of the Australian telecommunications research groups. Also, Australian research enjoys significant exposure, as well as benefiting from an increasing number of international visitors in connection with these events.

In the past, bringing major events to Australia has relied on industrious individuals in the community. As a consequence, major events appear irregularly in Australia. Through

ACoRN, we can coordinate the process of bringing events to Australia. Also, ACoRN can provide support in the bidding process, and subsequently support for running events through the vast existing experience from previous major events hosted in Australia. Again, without ACoRN it is doubtful that a nationwide coordination would be possible.

6.4.2 Impact on Scale and Focus of Research Activities

As mentioned above, ACoRN facilitates an environment for objectively pursuing the creation of research clusters, pooling expertise and resources. In the process ACoRN is battling common practices for organisations protecting competitive positions. The first cautious steps in this delicate process is taken by linking researchers and students closer together network-wide through workshops, schools and conference events. The strategy is first to get researchers to know each other before putting mechanisms in place for encouraging larger-scale collaborations. Although ACoRN has nothing tangible yet to show for the invested efforts, the networking wheels are in motion for raising the scale and focus of the network research activities. Natural research clusters are intended in the directions of the ACoRN research themes and discipline areas.

6.4.3 Internationalisation and International Links

The impact of the ACoRN-NEWCOM collaborative agreement has been stressed repeatedly. The importance in terms of exposure, involvement, linkages and profile is by far exceeding our expectations. As mentioned above, the goal is for ACoRN to take active part in ongoing research in the NEWCOM Departments and Projects, and ultimately contribute to the standardisation activities for next-generation wireless systems.

The impact of major international conferences hosted in Australia has also been stressed repeatedly. Using these opportunities to showcase Australian research excellence, to explore common research interests with the visiting international research profiles, and to promote Australian industry has notably strengthened international links and internationalised Australian research to a higher degree. A strong Australian presence at major international conference events hosted overseas further complements the international position ACoRN is in the process of consolidating.

Internationalisation and creating international links are areas where ACoRN has performed beyond expectations in 2005.

7 Strategies and Activities 2006

The objectives for 2006 is to address areas with room for improvement, consolidate our areas of success, and broaden our priorities to include more of the activities suggested in the Approved Proposal. Our main challenge is to expand the traditional networking mindset in the research community and get researcher mobility to be a natural part of research planning, execution and education. A number of strategies and new initiatives are being put in place in 2006 specifically to promote and strengthen researcher and student mobility, as well as international visitors. Particular attention is again directed towards students and early career researchers. Linkage prizes for top students and early career researchers will be introduced, where support for domestic or international visits will be awarded. Collaboration with IEEE sections and chapters across Australia will be initiated to bring international researchers in as IEEE Distinguished Lecturers. Finally, the concept of a "student-mentor" workshop will be introduced to encourage students to establish links across the network.

To influence the next generation of researchers, an important direction is to further involve local ACoRN representatives in the planning processes. Most of the local representatives are early career researchers, and thus, are more open to new ways. Having a united front across the network for promoting and implementing the ACoRN strategies also significantly increases the probability of success.

In terms of consolidating successful activities from 2005, we again in 2006 have an ambitious plan of activities in terms of workshops, schools and international and national conference events. The flagship event is the joint ACoRN-NEWCOM workshop in September in Vienna, Austria. In addition, we are looking at running three national ACoRN workshops in the areas of multiple antenna systems, wireless multihop networks, signal processing for optical communications, as well as a workshop on writing successful grant applications.

In terms of school events, we are having the ACoRN-NICTA Autumn Winter School in connection with VTC in Melbourne, presenting a series of tutorial talks by international research profiles. Furthermore, ACoRN will bring a NEWCOM school in coding and information theory to Australia, presented by Dr Jossy Sayir (FTW, Austria) and Ingmar Land (AAU, Denmark).

On the International conference scene in Australia, ACoRN is a major sponsor of the IEEE Vehicular Technology Conference in Melbourne in May as well as the conference proceedings sponsor for the Passive and Active Measurement Workshop in Adelaide in March. In 2006, we will also strongly push our bids for bringing PIMRC 2009, ICC 2010 and ICASSP 2012 to Australia.

In the following sections, the general strategies and the specific activities in each of the programs are described and discussed in more detail.

7.1 *Strategies for Enhancing Network Performance*

As concluded in Section 6, ACoRN is performing well against the Approved Proposal. Still there is room for improvements to further enhance the Network performance. In this section, we outline our 2006 strategies for addressing the issues we have recognised as in need of attention. The major issues are recapitulated here:

- Rate of expenditure by ACoRN Partner Organisations;
- Scale and focus of research on ACoRN Research Themes;
- Student and Researcher mobility;
- Industry involvement;
- Public outreach.

In order to have a dedicated action plan for improving the Network performance, ACoRN is in the process of formulating a business plan for 2006, incorporating all the issues discussed in more detail below.

7.1.1 Rate of Expenditure by ACoRN Partner Organisations

The 2005 expenditure of all but a small number of ACoRN partner organisations was well below the corresponding pledged funds. This under-spending is to some degree due to the start-up process of the Network. The online application process had some initial difficulties, which were resolved mid-year. The signing of the Network Agreement was not completed until December and there was some difficulties in ACoRN reaching individual ACoRN members for promotion and marketing of ACoRN, resulting in only limited engagement in the early stages.

These issues have been resolved and we therefore do not expect any expenditure problems in the 2006 budget. The ACoRN Central Administration will monitor closely the rate of expenditure with an evaluation conducted mid-year. In case some partners are still experiencing problems in terms of engaging with ACoRN, the central administration will work with particular partners in defining realistic budgets and action plans for reaching 2006 expectations. Guidelines and templates with respect to 2006 local budgets will be distributed by the central administration, reflecting the priorities for this year. In return, ACoRN will expect to get an activity plan with corresponding adjusted budget from each Local ACoRN Representative.

As many organisations did not reach the 2005 budget of pledged expenditure, ACoRN is requesting a detailed plan for additional funded activities from each relevant organisation. Due to the start-up phase of the network, rollover pledged funds from 2005 may still enjoy limited dollar-for-dollar matching towards priority areas from rollover central ACoRN ARC funds. However, in future years rollover pledged funds may not be subject to dollar-for-dollar matching, but must still be allocated to ACoRN activities according to the Network Agreement.

The rollover ARC funds created by under-spending, and thus no longer subject to funding matching, will in future years be kept under central control and be dedicated for rewarding active ACoRN partners. Partners with a high level of activities are likely to have funding requests exceeding local budget limits. In these cases, applications can be forwarded directly to the ACoRN central administration for funding considerations from the rollover funds.

In many cases, alternative funds have been contributed to the network in support of ACoRN activities. In fact, most involvement by senior researchers is not funded by ACoRN, but instead by existing alternative funds. To a large extent this has not been captured in the 2005 Annual Report. In 2006, we will introduce a reporting procedure for lodging activities towards the ACoRN objectives, but not directly funded by ACoRN.

In order to get a stronger connection with the local ACoRN communities, closer links to the Local ACoRN Representatives are to be established. In 2006, we target to have three planning and information workshops with all the local representatives. In most cases, these are going to be conducted in connections with ACoRN events. Also, smaller meetings with clusters of local representatives are scheduled to strengthen links to ACoRN and to facilitate networking between local representatives. State-wise clusters of local ACoRN representatives are encouraged to strengthen collaboration and increase jointly organised activities across geographically co-located organisations.

7.1.2 Scale and Focus of Research on ACoRN Research Themes

Little effort was dedicated towards promoting the ACoRN research themes in 2005. Also, only limited effort was made towards developing integrated research plans for researchers working in common areas. In 2006, we will introduce some new initiatives for more strongly promoting the ACoRN research themes and for creating research clusters within common research areas across the network. Specific workshop events in 2006 are targeted towards the research themes. Also, we will actively encourage smaller invited workshop events for bringing like-minded researchers together with the aim of forming collaborative research clusters, increasing the scale and the focus on dedicated research areas of relevance to the ACoRN research themes and of importance to Australia.

The workshop events are discussed in more detail in Section 7.3.

7.1.3 Student and Researcher mobility

In Sections 4.2 and 4.4 it was recognised that the mobility programs in general and domestic mobility sub-programs in particular have not been sufficiently promoted and are thus under-utilised. In 2006 a series of new initiatives will be introduced to promote the programs more strongly and to make them more attractive to the ACoRN community. Specifically, we are going to introduce:

- Student and ECR linkage prizes;
- Minimum student and ECR mobility requirements on each partner organisation;
- Student-Mentor workshops.

These issues are discussed in more detail in Sections 7.2 and 7.4.

7.1.4 Industry involvement

In 2005, ACoRN only had one industry partner organisation, namely Agere Systems Australia. It has been very useful for ACoRN to have Agere involved in the Network activities, and according to Agere, the involvement has also been of significant benefit to them. In 2006, we seek to expand on the number of industry partners in ACoRN. A portfolio of promotion material, specially targeting industry is being prepared. The distribution of this material is to be followed up by personal contact and potential onsite ACoRN presentations. We hope to have at least two more industry partners in ACoRN at the end of 2006.

7.1.5 Public outreach

Public outreach has not been a high priority with ACoRN in 2005. In 2006 we plan to increase our activities in this direction. ACoRN will sponsor the topic of Telecommunications on the NOVA website, published by the Australian Academy of Science. ACoRN will also contact local IEEE Sections and NICTA proposing jointly organised public lectures in the area of telecommunications.

7.2 Researcher Mobility Program

Researcher mobility was a high priority in 2005, almost meeting the proposed targets in terms of numbers. The conducted research visits, however, were not as long in duration as expected. In 2006, researcher mobility is still a high priority and some new initiatives will be introduced to further promote and encourage international and domestic research visits. New initiatives will also be introduced for increasing the number of international research profiles visiting ACoRN organisations.

7.2.1 ACoRN International Travel Fellowships

The International Travel Fellowship Program will continue as before, supporting international research visits. To complement this activity, some expectations will be imposed on ACoRN partner organisations. It will be expected that at least one researcher, preferably an early career researcher, from each partner organisation takes on a travel fellowship in 2006. It will also be expected that ACoRN members attending international conferences with ACoRN support, will visit at least one international research group as part of the travel. This will especially be expected in connection with the ACoRN-NEWCOM joint workshop, where NEWCOM will cover local expenses in connection with such visits.

Furthermore, ACoRN will introduce so-called ECR International linkage prizes in connection with attending overseas conferences. Twice a year, early career researchers are invited to submit papers accepted for international conference presentation in the following half-year. The best paper among the submissions will be awarded an International linkage prize, supporting a research visit in connection with the conference travel.

7.2.2 ACoRN Domestic Travel Fellowships

In addition to the established activities, ACoRN will also introduce ECR domestic linkage prizes, awarded according to the same principles as international linkage prizes.

7.2.3 ACoRN Visitors Travel Fellowships

To create opportunities for international visitors to engage with multiple ACoRN partner organisations, dates for confirmed ACoRN visitors will be advertised on the ACoRN website. This will allow other organisations to make contact, suggesting additional visits.

In order to increase the number and duration of international visitors, ACoRN will encourage joint applications from clusters of ACoRN partners for bringing down renowned researchers for longer periods of time. The intention is to inspire new research directions and collaborations evolving around international visitors, creating networking across the corresponding cluster. ACoRN will actively identify organisations with common interests, and bringing them together with suggestions for international research profiles to approach.

In 2006, ACoRN will approach Australian IEEE Sections and Chapters to establish a joint approach for organising IEEE Distinguished Lecturer Tours. Again, the intention is to increase the number of renowned international researchers visiting Australia.

7.2.4 Australian Alumni Society

In 2005, only limited efforts were made to establish the ACoRN Australian Alumni Society. This year, a more concerted effort will be made to establish and grow the Society, providing a natural international networking link for the community.

7.3 National and International Conferences & Workshops Program

The National and International Conferences and Workshops Program performed very well in 2005, and we will continue to offer a wide range of events for the community. This year, the priority for attendance grants will be on ACoRN organised workshops rather than established conference and workshop events. ACoRN will promote more networking-directed activities and only support a limited number of conference attendance grants.

The selection of events in 2006 is described in some detail in the following sections.

7.3.1 ACoRN Sponsorships for Major Conference Events Held in Australia

An important role for ACoRN is to provide administrative support for bringing major conference events to Australia, and to provide financial sponsorship to ensure a proper foundation for the organisation of such events. In 2006, ACoRN is sponsoring the IEEE VTC in Melbourne and the PAM in Adelaide.

The seventh Passive and Active Measurement (PAM) conference will be held on 30-31 March 2006 in Adelaide. This event focuses on research and practical applications of network measurement and analysis techniques. ACoRN is the Program and Proceedings sponsor of PAM 2006, and have several ACoRN members involved in the organisation.

The 2006 IEEE 63rd Vehicular Technology Conference (VTC) will be held at the Grand Hyatt Melbourne, Melbourne, 7-10 May 2006. As the first ever VTC to be held in the southern hemisphere, the 63rd VTC will feature world-class technical sessions and tutorials. ACoRN is a proud major sponsor of VTC, and have many ACoRN members involved in the organisation of the event.

7.3.2 ACoRN Bids for Major Conference Events to be held in Australia

Since 2004, Australia has hosted three major conference events in the telecommunications area, namely IEEE International Symposium on Spread Spectrum and Applications 2004, IEEE International Symposium on Information Theory 2005, and now IEEE Vehicular Technology Conference 2006. To ensure a continuing stream of such events to come to Australia, ACoRN is assisting the bid process for bringing PIMRC 2009, ICC 2010, and ICASSP 2012 to Australia.

A/Prof Abbas Jamalipour and Prof Lars Rasmussen initiated the bidding process for the **IEEE 19th International Symposium on Personal, Indoor, and Mobile Radio Communications (PIMRC) 2009** in 2005. Invitation from the PIMRC Steering Committee to submit a more detailed bid is expected in the middle of 2006. We believe ACoRN has a strong bid and thus are hopeful for being successful. This event attracts 500-600 delegates from academia and industry.

Prof Jonathan Manton has initiated the bidding process for bringing the **IEEE 37th International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2012** to Australia. This event attracts more than a thousand delegates from academia and industry, and thus, the competition for securing this event is fierce. ACoRN will support Jonathan in this quest.

In 2006, ACoRN will begin the bidding process for bringing the **IEEE 45th International Conference on Communications (ICC) 2010** to Australia. Again, this is an event that attracts more than a thousand delegates, and thus, again the competition will be fierce. A/Prof Abbas Jamalipour will approach the ICC Steering Committee in connection with the ICC 2006 in Turkey in June.

7.3.3 ACoRN Workshop Events

The ACoRN workshop events were very well received in 2005. Therefore, the program of workshop events have been extended in 2006. The main event is the joint ACoRN-NEWCOM workshop. This event will be held in Vienna in September. To complement this main event, ACoRN is organising a series of local workshops, bringing together relevant researchers in an informal environment. This year, the topics of the workshops are MIMO systems, signal processing for optical channels, wireless multihop networks, and the art of writing successful grant proposals. More details about the individual events are found below.

ACoRN-NEWCOM Workshop will be held on 20-22 September 2006 in Vienna, Austria.

The organisation of the joint workshop is progressing in terms of technical program and local arrangements. The tentative technical program offers 4 half-day tutorials on the first day of the workshop. The remaining two days offer two parallel tracks with three sessions for oral presentations and one session for poster presentations per track per day. Each day will further feature a panel discussion and a plenary speaker. Submitted papers will be peer-reviewed and accepted papers will be published in the workshop proceedings on a CD. The expected number of delegates at the workshop is around 235 with 200 expected participants from NEWCOM and around 35 participants from ACoRN.

The General Chairman of the Workshop is Professor Ernst Bonek from Vienna University of Technology. The Technical Program Committee (TPC) is formed by:

- Pierre Duhamel, CNRS – Supelec, France (NEWCOM) ;
- Alex Grant, University of South Australia (ACoRN) ;
- Sergio Palazzo, Università di Catania, Italy (NEWCOM)
- Frederik Petre, IMEC, Belgium (NEWCOM)
- Mark Reed, NICTA (ACoRN)
- Lang White, University of Adelaide (ACoRN)

and is chaired by Alex Grant. Jossy Sayir, FTW Austria, chairs the organizing committee. The objective of the workshop is for ACoRN and NEWCOM researchers to present their current research and to facilitate and promote research collaboration across the two networks. The ACoRN Executive Board has decided to use central funds to support attendance costs for a small number of ACoRN members from each ACoRN organisation eligible to receive ARC funding. Up to ten thousand dollars per ARC-eligible organisation will be allocated.

ACoRN Workshop on MIMO – From Theory to Practice will be held on 4-5 May 2006 in Melbourne. Prof Mike Faulker and Dr Aaron Reid from Victoria University are organising the

event, which will bring together all research groups in Australia with an interest in testbed implementation for multiple antenna systems. The workshop is also taking advantage of the IEEE VTC conference being held in Melbourne on May 7-9, inviting international MIMO testbed experts to attend.

ACoRN Workshop on Signal Processing in Optical Communications will be held on 14 July 2006 in Melbourne in connection with the Australian Conference on Optical Fibre Technology. The workshop is organised by A/Prof Jean Armstrong from Monash University. The event is intended to bring together Australian researchers from the two areas of optical communications and signal processing with the aim of initiating new interdisciplinary research directions.

ACoRN Early Career Researcher Workshop on Wireless Multihop Networking will be held in Sydney on 17-18 July 2006. Dr Lavy Libman from the Networks and Pervasive Computing Program in NICTA and Dr Aruna Jayasuriya from University of South Australia are organising this event, which is targeting early career researchers. Inspired by the success of the Australian Communications Theory Workshop that started as the Workshop for Early Career Researchers in Communications Theory in 2000, the objective is to provide a focused national workshop, bringing together all aspects of wireless networking.

ACoRN Workshop on Grant Proposal Writing will be held in November in Adelaide. The exact dates are still to be determined. Prof Lars Rasmussen from University of South Australia will be organising the event. The workshop will feature senior ACoRN researchers with strong records of winning competitive grants, as well as senior researchers with experience in the ARC evaluation and selection processes. The event will target early career researchers, and be "hands-on", with participants expected to have draft proposals prepared before the workshop. Depending on interest, the number of delegates will be limited, subject to selection based on submitted draft proposals.

7.3.4 ACoRN Supported Conference and Workshop Events in Australia

In 2006, ACoRN will continue to support established national conference and workshop events, in terms of awarding attendance grants to students and early career researchers.

The Australian Communications Theory Workshop (AusCTW) 2006 was held on 1-3 February in Perth. An exciting program was put together with informative research overviews, detailed technical talks and many poster presentations. A detailed report will be included in the 2006 Annual report.

The IEEE International Conference on Wireless Broadband and Ultra Wideband Communications (AusWireless) 2006 was held on 13-16 March in Sydney. A detailed report will be included in the 2006 annual report.

The Australian Conference on Optical Fibre Technology (ACOFT) will be held on 10-13 July 2006 in Melbourne.

The Australian Telecommunications, Networks and Applications Conference (ATNAC) will be held in November 2006, with dates and location to be decided later in the year.

The Workshop on the Internet, Telecommunications, and Signal Processing (WITSP) will be held in December 2006, with dates and location to be decided later in the year.

7.3.5 ACoRN Attendance Grants

Priority will be on supporting members to attend ACoRN organised workshops. Using ACoRN funds for traditional conference and workshop attendance will be discouraged as there are other funding opportunities supporting such activities. Students awarded a conference attendance grant must acknowledge the ACoRN funding support in the published paper and display the ACoRN logo on their presentation slides. When subsequent journal papers are submitted and accepted for publication, the ACoRN support and the ACoRN membership should also be acknowledged.

The ACoRN Executive Board has decided to use central funds to support attendance costs for a small number of ACoRN members attending the Joint ACoRN-NEWCOM workshop. Up to a maximum of ten thousand dollars per ARC-eligible organisation will be allocated.

7.4 Postgraduate Education Program

Student mobility and ACoRN school events were of equal priority in 2005. The school events were exceptionally successful, while the activities in the mobility program have some room for improvements. As a consequence, school events will continue as in 2005, while more attention will be directed towards promoting mobility. In 2006, new initiatives, similar to initiatives in the researcher mobility program, will be introduced to further promote and encourage international and domestic research visits. In addition, subject to interest by ACoRN members, a "Student-Mentor Research Workshop" will be introduced as a trial.

The selection of events in 2006 is described in some detail in the following sections.

7.4.1 ACoRN Schools

The ACoRN schools were very popular in 2005, so again in 2006 two school events are on offer, as well as a one-day tutorial in connection with AusCTW 2006. The ACoRN-NICTA school is establishing itself as an annual event, while the ACoRN members at University of South Australia are also attempting to make the ACoRN Spring School a returning event in Adelaide. In addition, NEWCOM school events conducted in Europe are open for ACoRN members to attend for free.

The ACoRN One-Day Tutorial at AusCTW 2006 was again on offer in Perth on 31st January. Prof Lang White, University of Adelaide presented a tutorial on Internet Technologies, which was well received with over twenty students attending. A detailed report will be included in the 2006 Annual report.

The ACoRN-NICTA Wireless Autumn School 2006 will be held on 10-12 May 2006 in Melbourne in connection with IEEE VTC. The school is organised by Dr Mark Reed and Dr Leif Hanlen from the Wireless Signal Processing Program at NICTA. Mark and Leif have been able to secure an impressive list of international researchers, presenting one-hour tutorials at the event. Research leaders from Europe, USA, and Japan will feature on the program.

The ACoRN Spring School on Coding and Information Theory 2006 will be held in October in Adelaide. Following the overwhelming success of the 2005 ACoRN Spring School in Adelaide, in 2006 we will bring a week-long school developed within NEWCOM to Australia. Dr Jossy Sayir, FTW, Austria and Dr Ingmar Land, Aalborg University, Denmark have developed a highly acclaimed postgraduate course in coding and information theory, which they will present in Adelaide. The dates are to be finalised later in the year.

NEWCOM School on Mathematical Aspects of High Performance Codes: State of the Art and Open Problems was held on January 31st to February 3rd in Pisa, Italy. The school featured Prof Andrea Montanari (Ecole Normale Supérieure, Paris, France) presenting a tutorial entitled "Large random systems: From coding to optimization and statistical mechanics," Prof Tom Richardson (Flarion Technologies, USA) presenting a tutorial entitled "Low density and turbo codes: structure and iterative decoding," and Prof Pascal Vontobel (University of Wisconsin-Madison, USA) presenting a tutorial entitled "Codes over graphs and decoding algorithms". Unfortunately, no ACoRN members were able to attend.

7.4.2 ACoRN Internships and Travel Scholarships

The International Travel Scholarship Program will continue as before, supporting international research visits. To complement this activity, some expectations will be imposed on ACoRN partner organisations. It will be expected that at least one student from each partner organisation takes on a travel scholarship in 2006. It will also be expected that ACoRN student members attending international conferences with ACoRN support, will visit at least one international research group as part of the travel. This will especially be expected in connec-

tion with the ACoRN-NEWCOM joint workshop, where NEWCOM will cover local expenses in connection with such visits.

Similar to the Researcher Mobility Program, ACoRN will introduce a so-called Student International linkage prize in connection with attending overseas conferences. Twice a year, students are invited to submit papers accepted for international conference presentation in the following half-year. The best paper among the submissions will be awarded an International linkage prize, supporting a research visit in connection with the conference travel. A Student Domestic Linkage Prize will be introduced according to the same principles as the international linkage prize.

In order to further facilitate the level of domestic student mobility, ACoRN will compile and display on the ACoRN website a list of senior researchers willing to host research students from other organisations for visits of two weeks duration and above. Corresponding areas of research excellence and interest will also be included in the list.

An ACoRN One-Day Student-Mentor Research Workshop 2006 will be introduced in connection with ATNAC in November 2006. The concept of this workshop is inspired from the Computer Science community where students are invited to submit papers up to one month before the event. The best student papers are selected for presentation at the workshop. A number of senior ACoRN researchers are also invited to attend the workshop, with the intention of having the same number of students and senior researchers. The first half of the day will feature student presentations, while the second half of the day will be a one-to-one research brainstorming between one student and one senior researcher. The intention is to provide new inspiration and new ideas into the research, and to instigate collaboration across ACoRN partner organisation, resulting in follow-up domestic research visits.

7.4.3 ACoRN School Attendance Grants

ACoRN will continue to support ACoRN students attending ACoRN and NEWCOM school events.

7.5 Knowledge Management Program

In 2005, the priority was to develop a functional website and an informative newsletter. Both the website and the newsletter will continue to develop and improve in 2006. Also in 2006, more attention will be directed towards public outreach and web-based research networking.

7.5.1 Website Developments

The website is in a constant state of development. Specific improvements for 2006 include:

- Advertising open research positions within ACoRN and abroad;
- Display of submission deadlines for major conferences and journals;
- Display of upcoming International visitors to ACoRN;
- Display of logos of ACoRN Partner Organisations with corresponding web links;
- Display of list of senior researchers willing to host research visits by postgraduate students;
- Internal peer-review of pre-submission journal papers and grant applications.

7.5.2 Public Outreach

In 2006, ACoRN will develop and sponsor a topic on the NOVA website. Also, together with local IEEE Sections and NICTA, ACoRN will organise Public Lectures by outstanding national and international researchers. The focus will be on popular science lectures intended for the general public with interests in the telecommunications areas.

Appendices

A. ACoRN-NEWCOM Memorandum of Understanding

Between Australian Research Council (ARC) Communications Research Network, an Australian Government funded program under the ARC Research Networks Program ('ACoRN');

And Network of Excellence in Wireless COMmunication, funded by the European Commission under the VI Framework Program ('NEWCOM');

RECITALS

- A The parties have mutual interests in advancing international researcher and research student interaction and collaboration in the area of telecommunications and intend to undertake cooperative activities to their mutual benefit
- B The cooperative activities to be undertaken by parties may include:
- Exchange of visiting researchers and research students;
 - Provision of links to the other party on the respective websites;
 - Involvement in thematic workshops and symposia;
 - Joint annual workshop for the respective network partners, to be held alternately in Europe and Australia;
 - Other activities considered by the parties to be of benefit to each party's charter.
- C This Memorandum records the understanding of the parties in relation to the cooperative activities.

INTENT

- 1.1. The parties agree that they shall harness their complementary resources and expertise to work together to develop and pursue cooperative activities considered to be of benefit to each party.
- 1.2. The parties shall use their best endeavours to further their mutual interests and, so far as they are able to do, make available to the cooperative activities their expertise, resources and information.
- 1.3. Each party acknowledges that the extent of the cooperative activities will be limited by the resources of each party and the parties agree to work together to identify and obtain appropriate financial support for the cooperative activities.
- 1.4. Detailed plans and conditions of all cooperative activities will be agreed between the parties.
- 1.5. Each party will inform the other party of a person who shall be that party's contact and supervisor in relation to this Memorandum and the cooperative activities.
- 1.6. If within twelve months from the date of this Memorandum no cooperative activities have been formalised, this Memorandum shall be deemed to have expired. Either party may terminate this Memorandum by notice in writing to the other party. In the event of termination, activities already in progress may be carried out to an orderly conclusion.

- 1.7. Nothing in this Memorandum amounts to a licence or transfer of any intellectual property or information disclosed. Each party agrees to keep confidential all information disclosed by the other party on a confidential basis.
- 1.8. This Memorandum is not legally binding upon either of the parties and neither party has any authority to act on behalf of the other party. Where any cooperative activities give rise to a legally binding relationship between the parties, a separate legally binding agreement shall be entered into for those cooperative activities. No undertaking of a party shall be considered as legally binding unless such agreement is entered into and neither party shall have a claim against the other party by virtue of this Memorandum.

Signed on behalf of ACoRN:

Professor Lars Rasmussen
Network Convenor, ACoRN

Signed on behalf of NEWCOM

Professor Sergio Benedetto
NEWCOM Scientific Director

B. Activity Reports from ACoRN Partner Organisations

B.1 Agere Systems Australia

Local ACoRN Representative: Dr Graeme Woodward

Activities supported by ACoRN

The following activities were completed in 2005 and at least partly funded through Agere's financial pledge to ACoRN.

- Travel grants for two research engineers to attend the ACoRN workshop on cross-layer design, Adelaide, Jun 23, 24th.
 - Recipients: Dr Graeme Woodward, Dr Adriel Kind.
 - Dr Graeme Woodward presented seminar on "3G Evolution: High Speed Downlink Packet Access and Beyond". Intention was to raise awareness of current research topics of particular relevance to local industry and motivate the academic community to pursue research in these fields. Highly worthwhile workshop, well attended with many interesting seminars and provided a valuable forum for interaction between industry participants and academia.
- Travel grants for 2 research engineers and 2 development engineers to attend the ACoRN spring school on coding and information theory, Adelaide, Sept '05.
 - Recipients: Dr Graeme Woodward, Dr Adriel Kind, Uwe Sontowski, Long Ung.
- Student travel grant for summer intern, Agere Systems, Nov'05 through Feb'06.
 - Recipient: Jayant Baliga.
 - Covered flights and subsidised accommodation for final year undergraduate student to gain valuable industrial experience with Agere Systems. Enhanced links between Agere Systems and University of Melbourne (student originating institution). Student demonstrated very high aptitude for research type work, and a direct outcome of this work was the draft of a patent application to be filed with the US patent office.

Budget summary for activities completed in 2005

Date	Amount	Purpose
21/Jun/05	\$500.00	Travel grant, Graeme Woodward, Cross-layer workshop
22/Jun/05	\$500.00	Travel grant, Adriel Kind, Cross-layer workshop
26/Aug/05	\$500.00	Travel grant, Adriel Kind, Spring School
26/Aug/05	\$500.00	Travel grant, Long Ung, Spring School
26/Aug/05	\$500.00	Travel grant, Uwe Sontowski, Spring School
26/Aug/05	\$500.00	Travel grant, Graeme Woodward, Spring School
1/Dec/05	\$2500.00	Student grant, Jayant Baliga, summer internship
TOTAL 2005	\$5500.00	

Note, an additional \$3200 in grants was approved during 2005 for activities to be undertaken in 2006. These will be reported in the 2006 report.

Additional benefits to Agere Systems through membership of ACoRN, 2005.

- Co-branding and promotion of the Agere competitive summer internship programme. Two top-of-class students were selected from a strong field of applicants. These students undertook 3-month internships with Agere Systems in Sydney, and were tasked with researching industry relevant topics with impact on future products. The competitive internship programme has enabled Agere to enhance existing links with academic institutions and form new links with other institutions. The programme assists Agere position itself as an employer of choice amongst the top electrical engineering students within the country. Feedback from students indicate that they gain enormous experience by working on real-world research problems, and that it helps them at a critical decision time for their future career directions.
- Circulation of the ACoRN newsletter within Agere Systems Australia has raised considerably the profile of the Australian academic community amongst the non-research staff of Agere Systems Australia. There is no doubt that the academic community is perceived as more relevant to Agere's business, and the potential to engage the local community to learn and solve problems has been enhanced through the increased exposure facilitated by Agere.
- ACoRN has been promoted by Agere Australia to Agere internationally as an effective way to engage academia and to benefit from the wealth of knowledge available within this community. This has been a very effective catalyst to promote the depth of expertise which can be tapped within Australia, and has thus assisted Agere Systems Australia promote its own strengths within Agere as a whole.
- Hosting of ACoRN introductory seminar by Prof Lars Rasmussen, March 2005. This was a valuable introduction to ACoRN for all staff of Agere Systems Australia.
- Hosting of ACoRN committee meeting, bringing many of the Local ACoRN Representatives from the greater Sydney/Wollongong area together to review ACoRN objectives and brainstorm future initiatives. Valuable networking opportunity between representatives from Agere Systems, Macquarie University, Wollongong University, NICTA, CSIRO, UNSW, Uni. Newcastle and Christine Thursby (network administrator).

B.2 Australian National University

Local ACoRN Representative: Dr Leif Hanlen

Conference attendance

Australian Communications Theory Workshop 2006, Perth, Feb 2006.

Several ANU students were supported for travel to Perth

- Ying Chen, Matt Ruan, Sandra Chen, Michael Anderson, Lin Luo and Ming Zhao were each supported by ACoRN for \$500 travel, and \$500 from ANU to attend the Australian Communication Theory Workshop.

Other events

- Lei Qiu attended the Spring coding school, and was supported for \$250

Events supported by ANU, in relation to ACoRN

Wireless Winter School

ANU provided \$1000 support through Info Eng and \$2500 support through NIEIS.

Overseas travel by staff/students

- Dhammika Jayalath IEEE PIMRC 2005 Berlin Germany & Visit IMST
- Dhammika Jayalath IEEE ISPACS 2005 Hong Kong

Domestic Travel

- Sandra Chen DSPCS 2005, Gold Coast, QLD, Australia
- Sandra Chen ACoRN workshop on Cross-Layer Problems for Wireless Communications - Adelaide
- Lei Qiu ACoRN workshop on Cross-Layer Problems for Wireless Communications - Adelaide
- Roy Timo attended the International Symposium on Information Theory, and the Spring Coding School

B.3 CSIRO ICT Centre

Local ACoRN Representative: Dr Iain Collings

No report has been received.

B.4 Monash University

Local ACoRN Representative: A/Prof Jean Armstrong

2005 was an exciting and successful year for the ACORN researchers at Monash University. Most of the ACORN academic staff members (four out of five) joined Monash in 2004, so in 2005 many new research collaborations were developed within Monash as well as more widely.

Monash offers many opportunities to researchers in the communications field. Geographically it is near to many telecommunications companies. It has a long track record in telecommunications research and it is able to attract outstanding postgraduate from around the world. In 2005 ACORN members at Monash were able to build on this foundation.

Activities Directly Supported by ACORN

Monash researchers benefited from many of the programs offered by ACORN.

- ACORN directly supported a number of postgraduate and early career researchers to attend the ACORN 2005 Spring School on Coding and Information Theory in Adelaide, the Australian Communications Workshop in Brisbane, and the CUBIN/ACORN Information Theory Workshop in Melbourne. These stimulated many new research ideas and encouraged networking with many other Australian researchers. At least one postgraduate is working on joint papers with other ACORN members whom he met through ACORN events.
- Support was given to Himal Suraweera (postgraduate), to present two papers at IEEE Personal, Mobile and Indoor Radio Conference in Berlin and to Tsun Yue Ho (Early Career Researcher) to present a paper at IEEE Globecom in St Louis.
- Five ACORN postgraduate members presented papers at IEEE TENCON held in Melbourne.
- Dr Nemai Karmakar was awarded an International Travel Fellowship to visit the University of South Carolina, Columbia to work with Dr M. Ali. This has led to continuing research collaboration.

Other Activities

The ACORN members were also involved in many other activities.

- Undergraduate projects supervised jointly by staff from Analog Devices Australia and Jean Armstrong Monash University, resulted in a successful implementation of a baseband OFDM transceiver using fixed point processors. A paper by the five undergraduates involved (one as first author) and the supervisors have been accepted for IEEE VTC conference to be held in Melbourne in 2006.
- Three undergraduate students were awarded summer holiday scholarships to work with ACORN members. The students contributed to papers which will be published in 2006. Several of the students now plan to undertake postgraduate research degrees.
- In 2005, Dr Xiaolin Zhou formerly of Alcatel Shanghai began a twelve month period as an academic visitor in the Department. The visit started well when he was able to attend the CUBIN/ACORN workshop in the first week. Since then he has collaborated with ACORN Monash members to write a number of joint papers. The input of Xiaolin's industrial expertise has been most welcome.
- Dr Nemai Karmakar was successful in applying for an ARC Discovery grant to commence in 2006 on Chipless RFID for Barcode Replacement.
- The variety of backgrounds of the Monash ACORN members has led to some new and interesting projects. For example, OFDM researchers (worked with MIMO experts to publish papers on MIMO-OFDM. Jean Armstrong and Arthur Lowery brought together their separate expertise on OFDM and optical communications to develop interesting new results showing how OFDM could be applied in optical systems.

Finally, in 2005 the undergraduate course at Monash was redesigned. ACORN members consulted extensively with local industry to develop a course to suit the needs of industry and of students.

B.5 NICTA Networks and Pervasive Computing Program

Local ACoRN Representative: Dr Lavy Libman

The following activities of NICTA researchers were supported by ACoRN in 2005. Note that, being a commonwealth-funded organisation, NICTA did not receive matching funding for ACoRN activities from the ARC; thus, all of the ACoRN support for NICTA researchers used 100% NICTA's own funds.

Dr Lavy Libman attended the ACoRN Workshop on Cross-Layer Design Problems for Wireless Communications in 23-24 June as an invited speaker. His tutorial presentation on "Error Control and Recovery from Outages in Mobile Environments" was attended by a large audience of fellow researchers and students. This presentation explained the research challenges in the space of on-board mobile networks – an architecture used, for instance, to deploy passenger connectivity in public transport vehicles – and focused on the techniques that enable taking advantage of the vehicles' predictable mobility to cope with wireless link errors and outages by anticipating them in advance.

Dr Lavy Libman visited Prof Lars Rasmussen at University of South Australia for one day in connection with the ACoRN Workshop on Cross-Layer Design Problems for Wireless Communications. The focus of the visit was to explore common interests on error control strategies for wireless resource-limited devices. The visit resulted in a joint project proposal being submitted to NICTA.

Mr. Wen Hu visited the Portland State University, Oregon, USA, for three months between August and November, and spent this time for collaborative work in the area of sensor networks. During the visit the goal was to design and implement a cross-layer communication protocol for wireless mesh sensor networks, capable of optimizing networking functionalities,

such as data aggregation, congestion control, packet buffering, routing, and link control across traditional TCP/IP networking layers.

Traditional layer network design like TCP/IP enjoys two attractive advantages. Firstly, each networking layer can be regarded as black box. Secondly, communication need only take place at the layer appropriate for the task.

There is, however, one major drawback in layer network design, namely redundancy, which leads to inefficient use of network resources. While layer network design works well in traditional networks like the Internet, significant problems may arise in resource-constrained networks like sensor networks.

The research hypothesis for the work was that a carefully designed cross layer network protocol can optimise the use of network resources, and thus will be more suitable for sensor network where resources are severely limited.

Most of the components of the cross layer protocol have been designed and implemented, and the results are to be submitted to the ACM SenSys workshop 2006.

Dr Kun-chan Lan visited the University of Massachusetts at Amherst, USA, for three weeks in September. His visit established new research collaboration links with the sensor research group. During his visit to University of Massachusetts, Kun-Chan presented his current research in wireless mesh networks in a seminar at Department of Computer Science at UMass. In addition, he interacted with a series of researchers at UMass, including Dr Deepak Ganesan, Dr Mark Corner, Dr Brian Neil Levine and Dr Arun Venkataramani and their students, exploring potential collaboration. In particular, the idea of a heterogeneous mesh/sensor network architecture was discussed, where an 802.11 mesh network is overlaid on a sensor network. In this architecture, sensor network traffic can enter and exit the mesh network at multiple points to improve the sensor network performance in terms of latency, reliability and less energy. Dr Deepak Ganesan has been invited to visit NICTA for further discussions towards ongoing collaboration.

B.6 NICTA Wireless Signal Processing Program

Local ACoRN Representative: Dr Leif Hanlen

Conference attendance

Australian Communications Theory Workshop 2005, Brisbane, Feb 2005.

The Workshop was attended by a large number of WSP staff and students, including (staff) Thushara Abhayapala, Rod Kennedy, Tony Pollock, David Smith, Leif Hanlen, Mark Reed, Andrew Zhang, Zhenning Shi, Kandeepan Sithampanathan. Students included: Roy Timo, Glenn Dickins, Michael Williams, Dino Minuitti, Snezana Krusevak, Zarko Krusevak, Tharaka Lamehewa, Rasika Perera.

IEEE International Symposium on Information Theory 2005, Adelaide, Sep 2005.

The ISIT conference was well attended by staff and students from WSP, attendance was funded through NICTA's ACoRN contribution, and also part-funded through RSISE (Australian National University)

- Kandeepan Sithampanathan attended the IEEE International Symposium on Information Theory, Sep 2005, Adelaide Australia. Dr Sithampanathan presented a paper titled *Analysis of a Discrete Complex Sinusoidal Frequency Estimator Based on Single-Delay Multiplication Method*. Dr Kandeepan's travel was supported at \$254AUD
- Leif Hanlen attended the IEEE International Symposium on Information Theory, in Sep. 2005. Dr Hanlen presented a paper titled "Optimal Input Covariance for MIMO channels with Statistical Transmitter Side Information". Dr Hanlen's trip was funded at \$289AUD

- Zhenning Shi attended the IEEE International Symposium on Information Theory, Sep 2005, Adelaide Australia. Dr Shi presented his paper "*Iterative Multiuser Detection based on Monte Carlo Probabilistic Data Association*", and his travel was supported at \$342AUD
- David Shepherd attended ISIT, and was supported at \$118AUD
- Rod Kennedy and Thushara Abhayapala attended the IEEE International Symposium on Information Theory, in Sep. 2005.

ACoRN Spring Coding School

- Lei Qiu attended the ACoRN Spring Coding School Sep 2005, Adelaide, and his trip was supported at \$357AUD
- Ming Zhao attended the ACoRN Spring Coding School, Sep. 2005, Adelaide Australia. His trip was funded \$394AUD
- Leif Hanlen attended the ACoRN Spring Coding School in Sep 2005, Adelaide Australia. His trip was funded for \$114AUD
- Sandra Chen attended the ACoRN Spring Coding School

Other events

- Ming (Matt) Ruan attended the Xfset workshop in Sydney, June 2005. His trip was designed to give maximum expertise in small-scale logic design. His trip was funded \$295AUD
- David Smith attended the Australia Pacific Communications Conference in Perth, Oct 2005. Dr Smith was supported at \$745AUD
- Dr Leif Hanlen attended APCC, presenting joint work with his student Glenn Dickins
- Prof Rod Kennedy & Dr Thushara Abhayapala also attended APCC.
- Kandeepan Sithampanathan attended the TMS320C6000 Integrated Workshop in India
- Tony Pollock attended six IEEE 802 workshops in the USA
- Jian (Andrew) Zhang attended the IEEE International Conference on Ultra Wideband (ICU) 2005, held in Zurich, Switzerland, Sep. 2005
- Andrew Zhang attended PIMRC 2005 Conference in Berlin, Germany, Sep. 2005
- Andrew Zhang attended the UWB05 Conference in China in Nov. 2005, giving a plenary talk
- Kandeepan Sithampanathan attended the PIMRC conference in Germany
- Kandeepan Sithampanathan attended the International Symposium on Intelligent Signal Processing and Communications Systems (ISPACS) in Hong Kong
- Thushara Abhayapala attended the 4th Workshop on the Internet, Telecommunications and Signal Processing, WITSP'2005 and presented 3 papers.
- Sandra Chen attended the 8th International Symposium on DSP and Communication Systems, where she presented "*Cross Layer Design for Mobile Ad-hoc Networking in Fast Fading Channels*".

Workshop/School organization

Wireless Winter School 2005

Mark Reed and Leif Hanlen organized the inaugural Wireless Winter School in Canberra, July 2005.

The inaugural NICTA-Acorn Wireless Winter School (July 11 - 15) was an open and informal week for students and researchers alike, with an interest in Communications and Signal Processing. Co-chaired by Mark Reed and Leif Hanlen from the Wireless Signal Processing Program, the WWS presented core topics for modern Communication systems, and future research directions in the form of Tutorials (1/2 day & full day) and Invited Talks, providing a broad range of related topics to inspire, motivate, and enlighten. The school was sponsored by the National Institute for Engineering and Information Science, NICTA and the Research School of Information Science and Engineering.

The winter school had over 40 student participants, and 15 distinguished lecturers. The WWS Banquet with NICTA CEO David Skellern and MC Ric Clark, NICTA COO provided access to several representatives from the wireless industry and academia, in an informal setting.

The WWS Poster Session saw several of the student participants demonstrating their research and encouraged networking and collaboration between students. The Student Poster Prize was won by Limin Yu, from the University of Adelaide. Limin's prize is a funded trip to Canberra to work with WSP researchers.

The school was an excellent opportunity for students, researchers and industry representatives alike. It received great positive feedback, from all attendees and is to become an annual event.

Australian Communication Theory Workshop, 2005 Tech Prog Committee + Organising Committee membership

- Leif Hanlen, Tony Pollock, Thushara Abhayapala TPC members
- Rod Kennedy, organizing committee member

IEEE International Conference on Wireless Broadband and Ultra Wideband Communications, Sydney, Australia

- Kandeepan Sithampanathan, Andrew Zhang technical committee members

ISIT 2005 Adelaide Australia

- Rod Kennedy co-chair
- Leif Hanlen, Thushara Abhayalpala co-chair publications
- Mark Reed, co-chair sponsorship

Asia Pacific Conference on Communications, Perth Australia

- Thushara Abhayapala, Leif Hanlen, Kandeepan Sithampanathan, Technical review committee

63rd Vehicular Technology Conference, Melbourne Australia

- Thushara Abhayapala, Leif Hanlen, TPC members
- Mark Reed, co-chair publications

Conference sponsorship

- NICTA sponsored the banquet of the IEEE International Symposium on Information Theory for \$2000. As part of this, Prof Bob Williamson presented an outline of NICTA's use-inspired research objectives.
- NICTA-WSP sponsored the Australian Communications Theory Workshop through the production and printing of the proceedings and CD-ROM. The total value was \$2500 AUD

- NICTA-WSP provided the Wireless Winter School with a \$1000 cash donation, toward morning tea costs.

Internships

WSP hosted 10 scholars over the 2004-2005 summer break, *Yong Kang Wong*, *Dang Khua*, *Kien Nguyen*, *Raymond Louie*, *Jayant Baliga*, *Desmond Ng*, *Ning Wang*, *Dev Ahluwalia*, *Tam Cao* and *Roy Timo*.

- The students were supervised by several WSP researchers, including Tony Pollock, Leif Hanlen, Mark Reed, Thushara Abhayapala, Kandeepan Sithamparanathan and Rod Kennedy.

Visits, staff/student ACoRN funded

Rod Kennedy, WATRI visit

Rod Kennedy visited WATRI (Perth, Western Australia) for 3 months, starting in April 2005. This visit was to develop a NICTA-WATRI project, and interaction between both groups. The visit also provided opportunities for several students including Michael Williamson, Glenn Dickins and Dino Minuitti to visit WATRI. The total cost for the trip was \$1048AUD

Kandeepan Sithamparanathan, Ryerson University

Kandeepan visited Ryerson University in Toronto, Canada. The trip was funded through the NICTA ACoRN contribution for \$3806AUD

National Visitors

- The students were supervised by several WSP researchers, including Tony Pollock, Leif Hanlen, Mark Reed, Thushara Abhayapala, Kandeepan Sithamparanathan and Rod Kennedy.
- Sarah Johnson, University of Newcastle, Australia. Sarah visited Tony Pollock, working on Low Density Darity Check (LDPC) code designs and her trip was funded for \$359AUD
- Alex Grant, University of South Australia. Alex Grant visited Leif Hanlen, Rod Kennedy and Thushara Abhayapala in July 2005. His trip was funded at \$432AUD. Alex worked on statistical transmitter state information for MIMO systems with Leif Hanlen, resulting in a submitted IT Trans Journal Paper.

International Visitors

- Robert Heath Jr. from the University of Texas, Austin. Robert visited Mark Reed and Leif Hanlen in August 2005, and his trip was funded \$766. Robert worked on various topics with Dr Reed and Dr Hanlen, including multipath modeling, and presented a seminar on feedback constraints for MIMO systems.

B.7 University of Adelaide

Local ACoRN Representative: Dr Belinda Chiera

ACoRN members based at The University of Adelaide enjoyed a busy and research productive year in 2005. The focus of this inaugural year was to provide support to postgraduate students through sponsoring attendance to internationally renowned conferences as well as domestic workshops. In both cases, students and academic staff were able to present the results of collaborative research efforts to an international audience. As overseas conference attendance generates high funding requirements, the presence of internationally renowned research leaders attending ACoRN organised and/or sponsored domestic work-

shops and conferences, provided Australian postgraduate students and research academics with the opportunity to learn from the masters in telecommunications. Of paramount importance to The University of Adelaide was the attendance of young researchers to the diverse and unparalleled ACoRN School series, which also hosted internationally recognised leaders in their selected fields of research. The provision for postgraduate students to learn from, and network with, researchers of the highest calibre in 2005 was an unsurpassed opportunity, made possible only by the availability of the ACoRN-funded travel and research grants.

A summary of the grants awarded is shown in Table 1 with a justification of spending following

Activity	Applications	Granted (\$)
<i>Researcher Mobility</i>		
International Travel Fellowship	3	2,880.00
Domestic Travel Fellowship	0	0.00
International Visitors Fellowship	0	0.00
<i>National & International Workshops</i>		
Domestic Workshop Attendance Grant	2	1000.00
International Workshop Attendance Grant	0	0.00
ACoRN Workshop Attendance ⁵	2	0.00
<i>Postgraduate Education</i>		
International Student Travel Scholarship	0	0.00
Domestic Student Travel Scholarship	0	0.00
Summer/Winter Schools	5	875.00
	TOTAL	\$4755.00

Geographical disparity between the local representative and local ACoRN members, a problem singular to the University of Adelaide, led to a late (April) start-up and induction into the ACoRN funding scheme. For this reason, the budget in 2005 was not fully met, however the ease of the ACoRN funding application process, as well as the helpfulness of the ACoRN staff, contributed to the gathering momentum of grant applications in the latter half of the year, leading to the following tangible outcomes:

Publications

1. Sudarev, J, White, L.B. and S. Perreau, **Performance Analysis of 802.11 CSMA/CA for Infrastructure Networks under Finite Load Conditions**, *The 14th IEEE Workshop on Local and Metropolitan Area Networks, LANMAN 2005*, Chania Greece, 18-21 Sept. 2005.
2. Hew, S.L. and L.B. White, **Fair Resource Bargaining Solutions for Cooperative Multi-Operator Networks**, *2006 International Zurich Seminar On Communications*, ETH Zurich, Switzerland, Feb. 22-24, 2006.
3. Yu, L. and L.B. White, **A new complex wavelet and its applications in communications**, *4th Workshop on the Internet, Telecommunications and Signal Processing, WITSP'2005*, Noosa Heads, Australia, 19-21 Dec. 2005.
4. Chiera, B.A. and L.B. White, **Model-Free End-to-End TCP Congestion Control**, *4th Workshop on the Internet, Telecommunications and Signal Processing, WITSP'2005*, Noosa Heads, Australia, 19-21 Dec. 2005.

⁵ Funded by an external source.

Further, the attendance at the ACoRN School Series by The University of Adelaide post-graduate students, aided the research of Ph.D. candidates Ms S-L. Hew and Ms L. Yu, enabling these young researchers to produce the following research publications:

1. Hew, S-L. and L.B. White, **Optimal Integrated Call Admission Control and Dynamic Pricing with Handoffs and Price-Affected Arrivals**, *Asia-Pacific Conference on Communications, Perth, Australia, Oct. 2-5, 2005*.
2. Yu, L. and L.B. White, **Broadband Doppler compensation for rational wavelet-based UWA communication systems**, *Asia-Pacific Conference on Communications, Perth, Australia, Oct. 2-5, 2005*.

These conference visits, although not funded through ACoRN, represent the culmination of the ongoing research-focused interaction that underscores the ACoRN Schools. The ACoRN School Series are a triumph of the collaborative efforts of ACoRN members to provide a forum at which Australian and international telecommunications researchers can be brought together to share knowledge and determine new research directions for the future. The excellence and superior quality of the ACoRN Schools, which is directly translated into tangible outcomes such as research publications, has prompted a continuing interest by The University of Adelaide to fund attendance by postgraduate students **and** academic staff members in 2006.

Researcher Mobility and Other Activities

Aside from producing research publications, The University of Adelaide-based ACoRN members have also been actively mobile throughout 2005. A summary of activities is given below:

- **February 2005:** Professor Langford B. White spent 4 weeks at ENST (France) in what has been a tradition of an ongoing international research collaborative effort. A direct outcome of Professor White's 2005 visit will be a return visit in 2007 during Professor White's sabbatical;
- **February 2005:** Dr B.A. Chiera and Professor L.B. White's conference paper at WITSP 2004, entitled "**LQG Congestion Control for TCP**", was selected for publication in the special issue of the **Journal of Telecommunications and Information Technology**(to appear 2006);
- **May-June 2005:** Dr Belinda A. Chiera spent 2 weeks on a research visit with Dr D. Kurowicka at the Delft Institute of Applied Mathematics, Delft University of Technology, The Netherlands, and Professor M.A. Remiche at the Université Libre de Bruxelles, Méthodes Algorithmiques et Probabilité, Département d'Informatique.

The outcomes of this visit were twofold. First, Dr Chiera was able to initiate research links with pioneering leaders in her selected field of research, paving the way for future collaborative potential. Second, as a direct result of her visit with Professor Remiche, Dr Chiera was made aware of leading-edge research being conducted by Professor Remiche's research group, which directly contributed to Dr Chiera's publication at WITSP'2005 (see the above publication list);

- **May-June 2005:** Ph.D. candidate Ms S-L. Hew attended the IEEE 61st Semiannual Vehicular Technology Conference (VTC), in Stockholm, Sweden, to present her paper (co-authored with L.B. White) "Interference-based Dynamic Pricing and Radio Resource Management for WCDMA Networks". Given the high-profile attendance of the VTC, it was crucial to Ms Hew's candidature that she was able to maintain an established research portfolio, which given the cost of overseas travel, was ultimately achievable only through ACoRN funding;
- **August 2005:** Dr Sanjeev Naguleswaran spent 3 weeks visiting fellow ACoRN member, Professor Michael Nielsen, in the Quantum Information Science Group (QIS), in the School of Physics, at The University of Queensland.

Outcomes of this visit included the potential for further collaboration between Dr Naguleswaran and Professor Nielsen, as well as the transfer of knowledge between two complementary facets of Quantum Information research with the unification of a practical application in planning with theoretical quantum computation. As a direct result of this visit, Dr Naguleswaran was able to write the paper “**Automated Planning Using Quantum Computation**”, accepted by the International Conference on Automated Planning (ICAPs) to be presented in June 2006.

A further outcome of Dr Naguleswaran’s visit was that he was successful in further enhancing his existing research knowledge to apply for an ARC Discovery Grant entitled “**Quantum Walks: Properties and Applications to Large Scale Structured Search Problems**”, which represents a potential collaborative research effort between Professor L.B. White (The University of Adelaide) & Professor I. Fuss (Chief Scientist of Information Sciences Laboratory, DSTO).

While these visits were funded by sources other than ACoRN, they aided in raising the profile and awareness of the ACoRN network to the local and international research community. In the case of Dr Naguleswaran’s visit to QIS, this represented a particular instance of a successful collaborative effort between ACoRN members. Further, Dr Naguleswaran’s mobility efforts have since caused him to become an invited speaker at the Australian Communications Theory Workshop (AusCTW) in early 2006. This visit was funded by an ACoRN Domestic Workshop Attendance Grant and directly culminated in inter-disciplinary discussions resulting in raising the possibility of applying powerful quantum computing algorithms for communications purposes. Follow-up discussions that could potentially lead to collaboration will continue throughout 2006.

Research Development Track for 2006

Overall, a solid start with ACoRN funded research opportunities has been made in 2005, with plans to capitalise on these newly laid foundations to further enhance existing research connections and capabilities as well as initiating new ones. For example, as a direct result of Professor White’s ongoing international collaboration (documented in researcher mobility), he has since received ACoRN support for a return trip to France in February 2006, from which a joint research paper is in the final stages of preparation for submission. Professor White has further plans to return in 2007 with the possibility of also taking at least one of his ACoRN postgraduate students with him, which is now achievable through the ACoRN International Student Travel Scholarship grant.

In a coup for ACoRN, the success of the ACoRN program has prompted the application and acceptance of a new, high-profile researcher in early 2006. Specifically, ACoRN has had the pleasure to welcome Dr Matthew Roughan, who has previously worked at AT&T Research (New Jersey, USA) and is now situated in the School of Applied Mathematics. This exciting new membership forms a vital component of the research development track for the ACoRN group over the next few years. Originating from a moderate-sized research group at the School of Electrical and Electronic Engineering, the acceptance of Dr Roughan’s application has enabled The University of Adelaide’s ACoRN team to take its first steps towards inter-disciplinary research collaboration. Dr Roughan is one of the foremost recognised experts of Border Gateway Protocols (BGP) and Network Routing in Australia and will provide a new dimensionality to the ACoRN profile. A further exciting outcome stemming directly from Dr Roughan’s membership will be the development of a locally-based BGP research group which will include further new memberships with at least two post-doctoral staff and one postgraduate student. Through various ACoRN grants, international research links between Dr Roughan’s BGP group and the highly prominent Professor Anja Feldman at the Network Architectures Unit (Computer Science Department), at the Technical University of Munich will continue to be strengthened over the next few years. Tentatively established research links with Dr Steve Uhlig at Université catholique de Louvain will also continue to grow. Plans are already underway to invite key members of Professor Feldman’s group to the University of

Adelaide for at least one research visit in 2006, paving the way to a future of united excellence in network-related research in 2006 and beyond.

On a final note, this report would not have been possible without the co-operation of the University of Adelaide ACoRN team and Professor Langford B. White, who was the local representative in 2005. Special thanks must also be given to Christine Thursby (ITR, University of South Australia), whose willing accessibility and support was detrimental to overseeing a smooth transition between Local Representatives in early 2006. An expression of appreciation must also be made to Professor Lars K. Rasmussen, whose pursuit of excellence for ACoRN has unfailingly striven to provide a series of unequalled research opportunities to the ACoRN community. The underlying spirit of co-operation between inter-institutional ACoRN members has made the inaugural ACoRN year a resounding success, which we at The University of Adelaide are confident will continue to grow in the years to come.

B.8 University of Melbourne

Local ACoRN Representative: Dr Brian Krongold

ACoRN directly supported conference and workshop attendance with 18 travel grants for postgraduate students in 2005. \$7000 in total funds was used to send students to the following venues: Wireless Winter School, Cross-layer Workshop, International Symposium on Information Theory (ISIT), ACoRN Spring School on Coding and Information Theory, and the Australian Communications Theory Workshop (AusCTW).

A CUBIN/ACoRN Information Theory Workshop took place 1st and 2nd September and featured 13 extended talks from some of the top researchers in the world, including Schlomo Shamai from Technion (Israel), Robert Calderbank from Princeton (USA), David Tse from UC-Berkeley (USA), and David MacKay from Cambridge (UK). Topics included network coding, fountain codes, relaying, and capacity of MIMO systems. This workshop was excellent for the education, inspiration, and development of postgraduate students at the University of Melbourne.

Jayant Baliga, a top electrical engineering student at the University of Melbourne, won an Agere Internship in 2005. In helping his travel expenses, \$400 of ACoRN funds were provided to him.

John Papandriopoulos, who is in the final year of his PhD candidature with CUBIN, was awarded a prestigious Victoria Fellowship in 2005 from the Victorian Government. Established eight years ago by the Victorian Government, these fellowships recognise young researchers with leadership potential. John's fellowship supplied \$18,000 in funding to work with top researchers at Princeton, Caltech, Stanford, and UC-Berkeley on cross-layer optimisation of wireless sensor networks. In addition to the Victoria Fellowship, John was also awarded an AFAS FEAST-France Fellowship that will take him to Sophia Antipolis to visit the leading French research institutions Eurocom and Inria.

A/Prof Stephen Hanly was awarded a Edward Dyson Universitas 21 Fellowship to help support his sabbatical visit to NUS in Singapore. In 2005, Hanly joined the editorial board for the IEEE Transactions on Wireless Communications, and A/Prof Subhrakanti Dey joined the editorial board for the IEEE Transactions on Automatic Control.

International Visitors in 2005 to the University of Melbourne on ACoRN-related activities included Ms. Brooke Shrader (University of Maryland, USA), Professor Rudolf Mathar (Aachen University, Germany), Ms. Anke Feiten (Aachen University, Germany), and Professor Douglas Jones (University of Illinois at Urbana-Champaign, USA).

B.9 University of Newcastle

Local ACoRN Representative: Dr Sarah Johnson

2005 saw the establishment of the ACoRN network at the University of Newcastle. This process took a little longer than expected due to the unfamiliarity of all concerned with the newly established ARC Research Networks program. Nevertheless, thanks to the assistance of many in the University and within the Faculty Engineering and Built Environment (FEBE),

the scheme is now up and running successfully. The matched funding contribution of the University has been shared between central University funds and the FEBE research budget. Administrative and accounting systems are now all up and running, leading to a more streamlined process for accessing ACoRN funding in 2006.

2005 also saw the expansion of ACoRN at the University of Newcastle with the addition of five new members, to join the four founding members. The new ACoRN members are: Dale Bates, John Dalton, Ian Griffiths, Alan Murray, and Dr Peter Schreier. These new members have increased the size of the ACoRN group at Newcastle to three DEST-funded academics (Ninness, Schreier and Weller), two post-doctoral fellows (Johnson and Knagge), and four postgraduate students (Bates, Dalton, Griffiths, and Murray).

ACoRN funding supported a number of very important schemes in 2005. Most successful were the Postgraduate Education initiatives, with all four ACoRN postgraduates at the University of Newcastle receiving at least one ACoRN travel Scholarship. ACoRN funding was used to support the attendance of Dale Bates at AusCTW in Brisbane in February 2005. Dale and John Dalton also attended the ACoRN NICTA Wireless Winter School which was a very successful ACoRN sponsored event. John was also fortunate to attend The Coding & Information Theory ACoRN Spring School in Adelaide thanks to ACoRN support. Finally Dale, John, Alan Murray, and Ian Griffiths have all received ACoRN support to attend the AusCTW conference in Perth in February 2006. Due to ACoRN support, all four Newcastle University communications postgraduate students have therefore been able to attend important Australian research conferences very early in their academic careers.

The University of Newcastle has also received ACoRN support for Researcher Mobility programs. Dr Pascal Vontobel from the Massachusetts Institute of Technology (MIT) was hosted by the University of Newcastle in August/September, thanks to support from ACoRN. ACoRN also supported a Newcastle ACoRN member (Sarah Johnson) on a research visit to NICTA's Wireless Signal Processing Program in Canberra.

National and International collaboration plays an important part in the research activities of Newcastle University ACoRN members. ACoRN members traveled both within Australia and overseas to the USA, Norway, and the Czech Republic in 2005. ACoRN members also hosted International visitors from Ireland, Sweden and the USA during 2005.

B.10 University of New South Wales

Local ACoRN Representatives: Dr Jinho Choi and Dr Jinhong Yuan

A summary of ACoRN activities at UNSW are detailed below:

Conference/workshop attendance

Five research students, Tao Yang, Judy Chu, Dongning Feng, Kuanlun Huang, and Ido Nevat, attended ACoRN Information Theory Workshop which was held in Adelaide in September 2005. One student Kuanlun Huang and two researchers Dr Jun Ning and Dr Jinhong Yuan attended the tutorials of the ISIT2005.

Schools

Dr Jinhong Yuan attended the ACoRN-NICTA Wireless Winter School, which was held in Canberra. Dr Yuan presented a talk on pre-coder designs for MIMO broadcast channels.

Domestic visits and visitors

Dr Zhenning Shi from NICTA Wireless Signal Processing (WSP) programme Canberra visited Dr Jinhong Yuan at UNSW for one week and worked jointly on iterative MIMO receivers.

International visits and visitors

Prof Li Ping from City University of Hong Kong visited UNSW and presented a tutorial on interleaving division multiple access schemes and the applications for wireless communication systems.

B.11 University of Queensland

Local ACoRN Representative: Dr John Homer

The ACoRN - University of Queensland group, during 2005, consisted of 15 members; being made up of three researchers from the School of Physics, and the remaining twelve (including eight postgraduate students) from the School of Information Technology and Electrical Engineering. The biggest event involving the group was the hosting of AusCTW'05 in February. This 2.5 day workshop attracted over 100 delegates from the communications field and provided a forum for lively discussion and presentations. The group, though Dr Raphael Cendrillon, was also involved in the running of the 2005 ACoRN-NICTA Winter Wireless School at ANU in July. Other conference/workshop related activities are listed below.

Conference	No. attendees	No. student travel grants
AusCTW'05	6	0
Winter Wireless Schl '05	2	2
Crosslayer Workshop '05	1	1
ICC'05	1	0
ISIT'05	1	0
APCC'05	2	1
DSPCS'05	7	5

The group hosted three international visitors during 2005, including: Prof Wei Yu (Digital Subscriber Line Technology) from the Univ. of Toronto, 31/8/05-2/9/05 (for whom ACoRN provided an international visitor travel grant); Dr Geert Van Meerbergen (Coding and Information theory) from the Katholieke Universiteit Leuven, Belgium, 12-14/9/05; and Prof Jorn Justesen (Coding and Information theory) from the Technical University of Denmark, 14/9/05.

Two members of the UQ-ACoRN group paid extended visits to overseas research institutions, including: Dr Vaughan Clarkson, who visited Prof Vikram Krishnamurthy (Hidden Markov Modelling of Communication Systems), at the Univ. of British Columbia between January-December 2005; and Dr Raphael Cendrillon, who visited Prof Mung Chiang (Optimization and Communications theory) at Princeton University during November 2005.

The UQ-ACoRN group received a number of awards during 2005, including: Qld Smart Women Award 2005, Ms Wai Yie Leong (PhD student), Winner in Postgraduate studies category; UQ 2005 Trailblazer Innovation Competition, Ms Wai Yie Leong, Winner of Highly Recommended Prize; UQ 2005 Trailblazer Innovation Competition, Dr Raphael Cendrillon, Winner of Highly Recommended Prize; and ICASSP2005 Best paper presentation award, Ms Wai Yie Leong.

Over the course of 2005, the UQ-ACoRN group published, within the communications field, 11 refereed international journal papers, 24 refereed international conference papers, and 16 refereed national conference papers.

B.12 University of South Australia

Local ACoRN Representative: Dr Steven Gordon

ACoRN members at the University of South Australia (UniSA) were very active in 2005. Out of \$35,000 of funds requested for ACoRN supported activities, \$25,000 was granted during

the year. In addition, UniSA members were involved in the organisation of two local ACoRN Workshops, heavily involved in the ACoRN-sponsored International Symposium on Information Theory held in Adelaide, as well as active in many other communications research activities in Australia and overseas. A summary of the grants awarded is shown in the table below.

Activity	Applications	Granted
<i>Researcher Mobility</i>		
International Travel Fellowship	2	\$6,030.00
Domestic Travel Fellowship	0	\$0.00
International Visitors Fellowship	2	\$1,700.00
<i>National & International Workshops</i>		
Domestic Workshop Attendance Grant	17	\$9,095.00
International Workshop Attendance Grant	2	\$4,075.00
ACoRN Workshop Attendance	5	\$600.00
<i>Postgraduate Education</i>		
International Student Travel Scholarship	1	\$1,000.00
Domestic Student Travel Scholarship	0	\$0.00
Summer/Winter Schools	11	\$2,500.00
TOTAL	40	\$25,000.00

Researcher Mobility

Within the ACoRN *Researcher Mobility* program UniSA granted two International Travel Fellowships, allowing ACoRN members to undertake visits overseas, and one International Visitors Fellowship. For the Travel Fellowships, **Dr Albert Guillen i Fabregas**, a Research Fellow at UniSA, travelled to Paris, spending three weeks at Ecole Nationale Supérieure des Telecommunications as a guest of Prof Joseph Boutros. From the visit Albert produced results that significantly improve the understanding of code design for the block-fading channel, which is a channel model which finds a wide range of practical applications. The outcomes of this study bring a complete picture of efficient communication in such non-ergodic channels, implying that higher data rates will be communicated more reliably. Tangible outcomes include:

- Published and submitted papers:
 1. J. Boutros, A. Guillén i Fàbregas and E. Calvanese Strinati, "Binary Codes in the Block-Fading Channel", to be submitted to the IEEE Trans. on Information Theory, March 2006.
 2. J. Boutros, A. Guillén i Fàbregas and E. Calvanese Strinati, "Binary Codes in the Block-Fading Channel", in Proc. 2006 Australian Communications Theory Workshop, Perth, February 2006.
 3. J. Boutros, A. Guillén i Fàbregas and E. Calvanese Strinati, "Analysis of coding on non-ergodic channels", in Proc. 43rd Annual Allerton Conference on Communication, Control and Computing, Allerton, IL, Sept. 2005.
- Grant application: L. Cottatellucci, A. Grant, A. Guillen i Fabregas, J. Boutros, M. Debbah, E. Altman, Grant application to the Franco-Australian FAST program.
- Visit to Prof Boutros for 3 days following the Allerton Conference in Sept 2005.
- A plan to visit Prof Boutros again for three weeks in June 2006 (an ACoRN application has been submitted in 2006).

The second visit was by **Dr Yi Hong**, a Research Fellow at UniSA, who travelled to both France and Italy for a total of four weeks. In France, Yi was a guest of Prof Jean-Claude Belfiore, at the École Nationale Supérieure des Télécommunications, and Prof Emanuele Viterbo, at the Dipartimento di Elettronica del Politecnico di Torino. Yi worked with both professors on two topics:

- A Space-time block coded Multiuser MIMO Downlink Transmission Scheme. In this work they showed how to use threaded algebraic space-time block codes and perfect space-time block codes in the downlink of a space time block coded multiuser multiple-input multiple-output (MIMO) system in order to achieve the maximum data rate and diversity gain.
- High Rate Space-Time Trellis Coded Modulation. In this work, they present a concatenated scheme for a 2x2 multiple-input multiple-output (MIMO) system over slow fading channels, using simulations to show that performance gains can be achieved over uncoded Golden code.

Tangible outcomes from Yi Hong's visit include:

- An invited seminar: "New Space-time trellis codes for Slow Fading Channels", at Polito Torino, Italy, 8th Dec. 2005.
- Submitted papers:
 1. Y. Hong, E. Viterbo, and J.-C. Belfiore, "A Space-time block coded Multiuser MIMO Downlink Trnasmission Scheme", submitted to *IEEE International Symposium on Information Theory*, Jan. 2006.
 2. J.-C. Belfiore, Y. Hong, and E. Viterbo, "High data rate trellis coded modulations", prepare for submission to *IEEE Trans. on Inform. Theory*.
 3. J.-C. Belfiore, Y. Hong and E. Viterbo, "High data rate trellis coded modulations", prepare for submission to *IEEE Information Theory Workshop'06*.
 4. Y. Hong, E. Viterbo, and J-C. Belfiore, "A space-time block coded multiuser MIMO downlink transmission scheme", submitted to *IEEE Commun. Lett.*, Feb. 2006.
- Application for ARC Discovery Project, entitled by "Multiple antennas Downlink Techniques for Next Generation Wireless Communications", seeking funding for APD for Dr Hong in 2007-2010, where Prof Viterbo and Prof Belfiore are Partner Investigators.
- A potential visit by Prof Emanuele Viterbo to UniSA for up to 7 weeks in 2006 (an ACoRN application has been submitted for 2006).

The third activity was a visit to UniSA by **Alexandre Graell i Amat** from Universitat Pompeu Fabra, Departament de Tecnologia, Barcelona, Spain for two weeks in September 2005. Dr Amat's visit was part of the collaboration between ACoRN and NEWCOM and was hosted by Prof Lars Rasmussen. The visit involved the collaboration among several UniSA and Australian researchers on the analysis and design of rate-compatible serial concatenated convolutional codes for high-speed applications. They combined the methods of upper bounds to the error probability based on uniform interleavers with the convergence method based on Extrinsic Transfer (EXIT) charts to optimize the constituent encoders and the puncturing patterns.

Tangible outcomes from Dr Amat's visit include:

- Papers accepted and submitted:
 1. A. Graell i Amat, F. Brannstrom, and L. K. Rasmussen, "Design of rate-compatible serially concatenated convolutional codes," to appear at International Symposium on Turbo Codes and Related Topics, Munich, Germany, Apr. 2006.

2. F. Brannstrom, A. Graell i Amat, and L. K. Rasmussen, "Analysis and design of concatenated codes," submitted to IEEE International Symposium on Information Theory (ISIT '06), Seattle, WA, July 2006.
- Grant application submitted to the French-Australian Science and Technology (FAST) Program entitled "Performance analysis and design of concatenated coding systems".
 - A visit to Alexandre Graell and Frederick Brannstrom in Sweden in November 2005 by Prof Rasmussen to follow up the joint work.

Postgraduate Education

Within the ACoRN *Postgraduate Education* program UniSA supported eleven applications for members to attend the ACoRN Spring School on Coding and Information Theory in Adelaide (described later) and granted one International Student Travel Scholarship.

The travel scholarship was awarded to **Gilles Gorlier**, a UniSA PhD candidate who spent 11 weeks at the University of Cergy-Pontoise in Paris, working on his PhD thesis with his associate supervisor Dr Inbar Fijalkow. Gilles visit was also supported by the French Embassy. This was also part of collaboration with NEWCOM, of which Dr Fijalkow is an active member. During the time Gilles advanced his work on turbo equalisation and symbol detection and achieved the following tangible outcomes:

- Paper accepted: G. Gorlier, S. Perreau, I. Fijalkow "Dependency between error variance of the a priori information and a modified channel noise variance in turbo-equalisation" accepted at the International Conference on Acoustics, Speech and Signal Processing 2006 Toulouse.
- Attended the NEWCOM Autumn School on Estimation Theory for Wireless Communications held at Ecole Nationale Supérieure des Telecommunications (ENST), Paris, France.

National and International Workshops

Within the ACoRN *National and International Workshops* program UniSA supported 22 grants for researchers to attend domestic conferences and workshops, five of which were for ACoRN Workshops, and three grants for attending international conferences.

Quang-My Tran, a PhD candidate at UniSA, was a recipient of an International Workshop Attendance Grant allowing him to the 5th Workshop on Applications and Services in Wireless Networks in France. Quang-My was also supported by the IEEE South Australia Section. The workshop focused on the impact of newly emerging technologies, such as sensor networks, embedded systems, system on chip, and nanotechnologies, in wireless applications and services. Quang-My presented a metric to capture the dynamics present in mobile ad hoc networks, which can be used to analyse and optimise the performance of various routing protocols, in a peer-reviewed paper titled "Characterising Mobility in Ad Hoc Networks: A Generalised Approach".

In August 2005, **Albert Guillen i Fabregas** followed up his visit to France (described above) to present joint research results on code designs for block fading channels at the 43rd Annual Allerton Conference on Communication, Control and Computing in the US.

The third International Workshop Attendance Grant was awarded to **Yong Liaw**, a PhD candidate at UniSA. Yong attended IEEE Globecom in December 2005 to present a paper titled "Evaluation of Rate-based Adaptive Flow Control Mechanisms in Multihop Wireless Networks". This reported results on the performance of a newly designed flow control mechanism for mobile ad hoc networks that utilises a novel approach at estimating the throughput of a network without active probing.

The domestic conferences attended by members included:

- Australian Communications Theory Workshop (AusCTW) in Brisbane in February.

- Asia Pacific Communications Conference in Perth in October.
- International Symposium on Information Theory in Adelaide in September.
- The CUBIN/ACoRN Information Theory Workshop in Melbourne in September.
- IEEE Region 10 Conference, TENCON, in Melbourne in November.
- International Conference on DSP for Communication Systems and the Workshop on the Internet, Telecommunications and Signal Processing in Noosa in December.

In most cases, the attendees were postgraduate students that presented peer-reviewed papers, giving them the opportunity to present research results to a national and international audience. To date there have been follow-up conference papers published by the awardees, as well as several papers submitted to journals.

Attending and presenting results at conferences is an important part of research in telecommunications. Given the high cost of attending conferences overseas, we have strongly supported local conferences, in particular the regular conferences that are aimed directly at ACoRN members, e.g. AusCTW, ATNAC (held as part of TENCON this year) and WITSP. Providing 22 grants for UniSA members to attend domestic conferences is a very significant step towards further increasing the research network amongst Australian telecommunications researchers.

ACoRN Events

UniSA ACoRN members were actively involved in the organisation of three ACoRN supported events held in Adelaide. Each of these was very successful in bringing together Australian and international telecommunications researchers.

In addition to these three events, several UniSA members were active in other ACoRN events, including:

- **Professor Lars Rasmussen** presented a seminar on Multi-User Detection at the ACoRN/NICTA Wireless Winter School in Canberra in July.
- Several members attended the CUBIN/ACoRN Information Theory Workshop in Melbourne in September.

ACoRN Workshop on Cross-Layer Design

23-24 June 2005, Adelaide

Organised by Professor Lars Rasmussen, ITR, UniSA

The first fully ACoRN organised workshop event was a great success with more than fifty researchers and students meeting up at the Institute for Telecommunications Research (UniSA) in Adelaide. Eight one-hour, tutorial-style presentations were featured within the area of cross-layer design. The presentations covered a wide range of topic areas and problems, spanning over virtually all layers in a wireless network. Topics included network coding, control protocols in wireless networks, UMTS packet data evolution, and top-down/bottom-up design approaches. The tutorial level of the presentations ensured a high level of interaction with the audience, providing a good foundation for future cross-disciplinary collaboration.

The eight speakers represent research groups from New South Wales, Victoria and South Australia, working on cross-layer issues. The attending delegates were from all ACoRN member states with a majority from South Australia.

The event was low budget, only requiring \$20 registration fee to cover morning/afternoon teas. Lunches and workshop dinner were organised for the delegates but not included in the registration. A closing wine tasting event (externally sponsored) concluded a successful workshop, where many new links and contacts were made.

The feedback from delegates regarding the workshop has been very positive. The delegates found the workshop very useful for getting up to speed with the cross-layer research activities in Australia, and for identifying opportunities for future collaboration across ACoRN organisations. The success is very encouraging and will hopefully inspire many more such workshop across Australia.

Further information about the workshop, including material for download, is available at the ACoRN website.

ACoRN Spring School on Coding and Information Theory

12-16 September 2005, Adelaide

Organised by Dr Albert Guillen i Fabregas, ITR, UniSA

The ACoRN Spring School was a big success with more than 65 students and researchers from across Australia attending. Exploiting the opportunity of having ISIT in Adelaide in September, Albert Guillen i Fabregas (UniSA) organised a memorable event featuring Prof David Tse, A/Prof Emanuelle Viterbo, and Dr Gerhard Kramer.

Prof Tse (University of California, Berkeley) presented a two-day tutorial in wireless communications. The tutorial covered a wide range of useful topics in wireless communications, such as diversity, multiple access and interference management, multiuser diversity, and spatial multiplexing. The tutorial was organised around his recently published book, "Fundamentals of Wireless Communications".

A/Prof Emanuelle Viterbo (Politecnico di Torino) presented a one-day tutorial on algebraic number theory and its applications to code design for Rayleigh fading channels. The tutorial provided the algebraic background required for code construction for fading channels based on lattice theory.

The school was concluded with a two-day tutorial on multiuser information theory presented by Dr Gerhard Kramer (Bell Labs Innovations). The tutorial gave a comprehensive background in the fundamentals of information theory, before venturing into the more complicated multiuser results. The tutorial inspired many questions, leading to interesting discussions. Dr Kramers presentation of the challenging material allowed the audience to take with them a thorough understanding of multiuser information theory.

The ACoRN Spring School is another one of the success stories of ACoRN. It has received very positive feedback from attending students, and ACoRN will make sure to organise similar events in connection with future prominent International conferences held in Australia. Plans are already in the making for a ACoRN Fall School in connection with VTC in Melbourne.

IEEE International Symposium on Information Theory

4-9 September 2005, Adelaide

Sponsored by ACoRN; General Co-chairs were Alex Grant (ITR, UniSA) and Rod Kennedy (NICTA)

The IEEE International Symposium on Information Theory (ISIT) was held in the Adelaide Convention Centre on September 4-9. The General Co-Chairs were Alex Grant (UniSA) and Rod Kennedy (NICTA), supported by a team of ACoRN Members. The Technical Program Co-Chairs were Stephen Hanly (Uni Melbourne) and Christian Schlegel (Uni Alberta, Canada).

It was the first time the ISIT was held in the southern hemisphere and it was a great success with close to 650 of the top researchers in information and communications theory from around the world attending. A significant change was introduced at ISIT this year, extending the Symposium proceedings to include five-page manuscripts distributed on CDROM and available online on IEEEExplorer. A total of 798 papers were submitted for review from 47 countries, with an acceptance rate of 62%. An inspiring program, featuring 500 paper pres-

entations organised into seven parallel sessions was put together by the technical program chairs.

There were also four world-class plenary speakers to complement the 2005 Shannon Lecturer, Prof Richard Blahut (Uni. Illinois, USA). In addition to the Shannon Lecturer, the plenary speakers were Prof Benjamin Schumacher (Kenyon College, USA) lecturing on quantum and information theory, Prof David Mackay (Cambridge University, UK) lecturing on hands-free writing, Prof P. R. Kumar (Uni. Illinois, USA) lecturing on theoretical foundations for wireless and sensor networks, and finally, Prof Terry Speed (U.C. Berkeley, USA and Eliza Hall Inst. Medical Research, Melbourne) lecturing on information theory and bioinformatics.

The attendees at the ISIT had only good things to say about the venue and the organisation. The technical quality was high and the social events exposed the international visitors to some Australian experiences, such as koalas and Australian snakes at the welcome reception and aboriginal music and dancing at the banquet. Insights into some of the Australian initiatives in the ICT area were provided by the Honourable Karlene Maywald (MP in South Australia, among other portfolio - Minister for Science and Information Economy) as the awards luncheon speaker and by Prof Bob Williamson (National ICT Australia) as the banquet speaker.

In summary, the ISIT in Adelaide was a memorable event, promoting Australia and Australian research. ACoRN was a proud major sponsor of the ISIT and enjoyed significant exposure to the international community. General Co-Chair Alex Grant is to be congratulated on his hard work which made the ISIT in Adelaide the great success that it was.

Other Research Activities

On top of the activities reported above, UniSA ACoRN members were active in advancing communications research in Australia in 2005. This includes postgraduate student completions, promotions, attending and presenting at international conferences, journal publications, membership of conference program committees and so on. Some of the more notable activities and achievements include (in no particular order):

- **Albert Guillen i Fabregas** was awarded the 2004 Nokia Best Doctoral Thesis Award in Mobile Internet and 3rd Generation Mobile Solutions from the Spanish Institute of Telecommunications Engineers.
- **Arek Dadej** was co-editor of the book "Advanced Wired and Wireless Networks" (edited by T.A.Wysocki, A.Dadej, B.A.Wysocki), Springer (ISBN 0-387-22781-4).
- At the "Telecommunications Society of Australia Innovation Address" in Melbourne in 2005, **Paul Alexander**, CTO Cohda Wireless (and ITR, UniSA alumnus) was announced as winner of the 2005 John & Yvonne Almgren TSA Innovation Encouragement Award. The purpose of the Award is to recognise innovation in the field of Telecommunications, and through that recognition, to encourage further innovation both by the recipient of the award and by others.
- **Kutluyil Dogancay** was awarded a South Australian Tall Poppy Science Award, one of 8 state winners of this award which is to recognise the achievements of outstanding young researchers in the sciences including physical, biomedical and applied sciences and biotechnology, and their community engagement in promoting science.
- **Alex Grant** was awarded an ARC Discovery project for \$423,000 titled "Information theory for networks with uncertain topologies".
- **Lars Rasmussen** and Iain Collings were awarded an ARC Discovery project for \$222,000 titled "Quality-of-service-based adaptive coding for wireless communications networks"
- **Nick Letzepis** was awarded the Best Paper prize at the 6th Australian Communications Theory Workshop held in February 2005, for his paper on Information Capacity

of Multiple Spot Beam Satellite Channels. The award is judged by the workshop's technical program committee, based on review scores and individual reading of the papers.

- **Nimrod Lilith** (with **Kutluyil Dogancay** was a co-author) won the Best Student Paper award at TENCON 2005 with the paper titled "Using Reinforcement Learning for Call Admission Control in Cellular Environments Featuring Self-similar Traffic".
- **Lars Rasmussen** won the best paper award at the Asia-Pacific Conference on Communications (APCC) jointly with Dr Elisabeth Uhlemann for the paper "Analytical Approach for Maximizing the Average Code Rate of Incremental Redundancy Schemes".
- Several members were actively involved in the IEEE, including: **Arek Dadej** as IEEE South Australia Section Vice Chair; **Steven Gordon** as IEEE South Australia Section Secretary; **Lars Rasmussen** as Chair of the IEEE Joint ACT/SA/Vic/NSW Information Theory Chapter; **Alex Grant** as Treasurer of the IEEE Joint ACT/SA/Vic/NSW Information Theory Chapter; **Mark Ho** as Treasurer of the IEEE Communications and Signal Processing Chapter.
- **Albert Guillen i Fabregas**, with **Alex Grant** and **Lars Rasmussen** as advisers, was awarded a UniSA Australian Competitive Grant Developing Scheme Early Career Researcher Program for the project "Coding for Wireless Broadband Mobile Networks".
- **Quang-My Tran** was awarded an IEEE South Australia Section Travel Grant to attend ASWN in France.

Plans for 2006

The inaugural year for ACoRN was very successful at UniSA, with about 40 grants awarded to the total value of \$25,000. This has enabled a number of research activities to take place that would not normally have been possible. On top of some of the tangible outcomes illustrated in this report, such as follow up publications, visits and grant applications, there have also been many other benefits such as exposure of Australian communications research to international audiences and networking amongst researchers both within Australia and overseas. It is our ambitious goal to improve upon these achievements in 2006 and beyond. Some of the activities and approaches we will consider include:

- *Promoting and supporting visits within Australia.* We have had strong demand and success from UniSA researchers visiting institutions overseas and visitors coming to UniSA. In 2006 we will aim to increase the number of researchers that undertake medium to long term visits (e.g. 4 to 10 weeks) within Australia.
- *Attracting International visitors to multiple organisations.* Although we inviting visitors have been successful for UniSA, it will be more beneficial and cost-effective if a stronger program is in place for all visitors that involves spending several weeks at several ACoRN organisations. We will also aim to hold events and visitors by piggy-backing off international conferences held in Australia, as was done with ISIT'2005.
- *Continuing to enable local, informal workshops.* UniSA was quite successful in 2005 by holding two workshops in Adelaide. We will try to continue this success, as these informal, low costs workshops are very attractive to domestic researchers.

Thanks to all researchers (and of course the ACoRN Administrative Team) who have contributed to ACoRN's success in 2005. The contribution of all members is needed for this success to continue into 2006 and beyond.

B.13 University of University of Sydney

Local ACoRN Representative: A/Prof Abbas Jamalipour

ACoRN membership in 2005 at the University of Sydney consisted of 13 members, including three permanent members of staff and 10 students all belong to the telecommunications laboratory at the School of Electrical and Information Engineering:

In July 2005, Dr Iain Collings has left the University to take up the newly created Science Leader position at CSIRO, in Marsfield, NSW. Mr. Matthew Peacock has also finished his PhD studies and granted an Early Career Development fellowship working at the same department. These members are involved in a variety of research activities on wireless communications including mobile cellular radio, mobile Internet, fixed and mobile satellite, wireless systems, and telephony networks.

The Telecommunications Laboratory also perform research on cellular and wireless networking, including traffic management, quality of service management, mobility and location management, TCP protocol enhancement for wireless networks, and novel network architecture design for future wireless cellular and IP networks, mainly under the supervision of Prof Jamalipour.

Another focus in the Laboratory is on optimum modulation codes for fading channels, optimum soft output detection and decoding algorithms, channel models for satellite mobile channels and adaptive receivers for code division multiple access (CDMA). These are mainly performed under the supervision of Prof Vucetic.

The Telecommunications Laboratory is also involved in close collaboration with industry, both in Australia and internationally. Currently there are several projects involving with Sing-Tel Optus, DEST, EU partners, and ARC on the above topics.

In 2005, with the assistance of ACoRN, several students could participate in ACoRN schools and obtain up-to-date knowledge in the field and expanding the research network among Australian and overseas universities. A total of almost \$20,000 has been paid to cover the cost of trips domestically and internationally as listed below:

- Matthew Peacock, \$500.00, to attend IEEE - ISIT on 5th -9th September 2005
- Allen Chuang, \$500.00, to attend Cross Layer Design Problems for Wireless Communications 23 & 24 June
- Wibowo Hardjawana, \$500.00, to attend Cross Layer Design Problems for Wireless Communications 23 & 24 June
- Matthew McKay, \$500.00, to attend IEEE - ISIT on 5th -9th September 2005
- Zhanjiang Chi, \$309.20, to attend the CUBIN/ACoRN Information Theory Workshop on 1st & 2nd September 2005
- Allen Chuang, \$1,740.00, to visit Prof Lars Rasmussen at UniSA from 17th September to 4th October 2005
- Allen Chuang, \$500.00, to attend The Coding & Information Theory ACoRN Spring School in Adelaide from 12th – 16th September
- Matthew McKay, \$500.00, to attend CUBIN/ACoRN Information Theory Workshop on 1st & 2nd September 2005
- Matthew McKay, \$2,000.00, to attend IEEE Int Symp on Personal Indoor & Mobile Radio Communication in Berlin from 11th – 14th September 2005
- Allen Chaung, \$500.00, to attend IEEE - ISIT on 5th -9th September 2005
- Daniel Ryan, \$500.00, to attend CUBIN/ACoRN Information Theory Workshop on 1st & 2nd September 2005
- Daniel Ryan, \$500.00, to attend IEEE - ISIT on 5th -9th September 2005

- Yang Tang, \$500.00, to attend The Coding & Information Theory ACoRN Spring School in Adelaide from 12th – 16th September
- Rubaiyat Kibria, \$2,575.00, to attend the First International Conference on Next Generation Wireless Systems January 2-4,2006 and to visit the university in Dhaka
- Ehssan Sakhaee, 18/10/2005 \$4,300.00 to visit of Professor Kato at the Graduate School of Information Sciences, Tohoku University
- Matthew McKay, \$770.00, to visit Assoc Prof Peter Smith at the University of Canterbury from 27th November to 4th December 2005
- Daniel Ryan, \$1,000, to attend AusCTW in Perth on 1st - 3rd February 2006
- Matthew Peacock, \$1,000, to attend AusCTW in Perth on 1st - 3rd February 2006
- Matthew McKay, \$1,000, to attend AusCTW in Perth on 1st - 3rd February 2006
- Allen Chuang, \$1,000, to attend AusCTW in Perth on 1st - 3rd February 2006

In addition to the experiences and knowledge the students could achieve during their visits, they could establish further collaborations with other ACoRN partner institutions. For example, following Mr Allen Chuang's visit to the University of South Australia, there has been regular contact and an interesting research project has been formulated based on fundamental information theoretic results for ARQ systems in multi-terminal systems. The ongoing work in this direction is subject to a longer visit by Allen to UniSA in 2006.

There are several individual achievements during 2005 for ACoRN member at the University of Sydney including the appointment of Abbas Jamalipour as the new Editor-in-Chief of the IEEE Wireless Communications. This is for the first time that an IEEE Communications Society publication finds its EiC in Australia. He has also appointed as the new Technical Editor of the Journal of Communications and Networks (JCN) and the International Journal of Sensor Networks in addition to his ongoing editorship for the IEEE Communications, the Wiley International Journal of Communication Systems. He has organized three special issues on topics related to the Mobile Internet in 2005 in the IEEE Wireless Communications (June, October, December) and one in the International Journal of Computer and Telecommunications Networking (Elsevier) in February 2005. He was the Symposium chair at IEEE WCNC2005, IEEE ICC2005, and IEEE Globecom2005. As an IEEE Distinguished Lecturer, Dr Jamalipour has organized several lecture tour around the world in 2005.

Matthew Robert McKay a PhD student at the Telecommunications Lab and an ACoRN Member has received a travel grant to support a research visit to Prof Peter Smith at the University of Canterbury, NZ, in Dec 2005. So far this work has resulted in one IEEE international conference paper. He has also received financial support from ACoRN to attend the ACoRN/Cubin Information Theory Workshop in Melbourne, Sept 2005, to attend and present papers at IEEE Int. Conf. on Personal, Indoor, Mobile, and Radio Communications (PIMRC) in Berlin, and IEEE Int. Symp. on Information Theory (ISIT) in Adelaide, both in Sept 2005. He was awarded the prize for the Best Student Poster Presentation at the Australian Communication Theory Workshop (AusCTW), Feb 2005.

Daniel Ryan, another PhD student at the Telecommunications Lab and ACoRN Member, has received support to attend ACoRN Cubin Workshop/ISIT 2005 Adelaide/ACoRN Spring School. He says that this was a rare opportunity to see and meet the world's best researchers in information and communications theory in Australia. He gave an oral presentation with paper in proceedings at ISIT. He won the WATRI prize for best student poster for the poster "Noncoherent Lattice Decoding" co-authored by Ryan, Iain Collings and Vaughan Clarkson (UQ). He was able to generate some offers of collaboration to extend the work.

Ehssan Sakhaee, a PhD student and an ACoRN member, has received the IEEE Student Travel Grant to present his paper at the IEEE Wireless Communications and Networking Conference (IEEE WCNC), New Orleans, LA, USA, in March 2005. He has also spent 8 weeks at Tohoku University, through ACoRN support, and could establish a good collaboration there with other researchers and enhance his research project and future works.

Another PhD student, Yang Tang who has attended the ACoRN Spring School 2005 Coding and Information Theory said, "It was a very informative short course and has broaden my knowledge in the area of information theory."

The University of Sydney and Telecommunications Lab is getting much closer to the telecommunications research community in Australia as a result of the ARC ACoRN initiative, something that has not been a case before the introduction of ACoRN. The mobility of researchers in 2005 through the support of ACoRN, ARC, and the University of Sydney contribution has been extremely improved. While in 2005 most funds were allocated to the students, with the increase of collaborative activities and more participation from permanent staff, we expect to have a much wider collaboration and mobility of researchers in 2006. This includes further collaboration in organizing conferences and workshops that can further close the relation among researchers at the University of Sydney and other researchers in Australia.

B.14 University of Wollongong

Local ACoRN Representative: Dr Beata Wysocki

Membership

There has been a significant increase in the number of UoW staff and postgraduate research students being members of ACoRN throughout 2005. This has to be attributed to the funding opportunities (conference travels, participation in ACoRN co-sponsored training, etc.). At the beginning of 2005, there were just 5 members: Prof Jennifer Seberry, Assoc. Prof Tadeusz Wysocki, Dr Beata Wysocki, Mr Peter Vial, and Mr Le Chung Tran. By the end of 2005, the following members joined ACoRN: Mr Kenneth A. Finlanlyson, Dr Mehran Abolhasan, Mrs Ying Elaine Zhao, Mr Keni Popovski.

School and Conference attendance sponsored by ACoRN

- ACoRN-NICTA Wireless Winter School. The School was attended by two PhD students from the Group, Mr Peter Vial and Mr Keni Popovski.
- Dr Mehran Abolhasan attended Asia Pacific Communications Conference, APCC'2005, where he presented an invited talk: "Performance Investigation on three-classes of MANET Routing Protocols" by Mehran Abolhasan, Tadeusz Wysocki and Justin Lipman.
- Mr Keni Popovski attended 8th International symposium on DSP and Communication Systems combined with 4th Workshop on the Internet, Telecommunications, and Signal Processing DSPCS/WITSP'2005, where he presented a paper: "Background Radio Frequency Interference Measurements for Wireless Devices in the Electricity Supply Industry" by D. Robinson, T. Wysocki, V. Smith, and K. Popovski.
- Mr Peter Vial attended 8th International symposium on DSP and Communication Systems combined with 4th Workshop on the Internet, Telecommunications, and Signal Processing DSPCS/WITSP'2005, where he presented a paper: "An Ultra Wide Band Simulator Using MATLAB/Simulink" by Peter James Vial, Beata Wysocki and Tad Wysocki.
- Dr Mehran Abolhasan attended 8th International symposium on DSP and Communication Systems combined with 4th Workshop on the Internet, Telecommunications, and Signal Processing DSPCS/WITSP'2005, where he presented a paper: "Satellite DVB Multicast for Remote Desert Community Messaging" by Tony Eyers and Mehran Abolhasan.

Overseas visitors hosted by the WRG:

Prof Leandro de Haro stayed at the University of Wollongong within the School of Electrical, Computer, and Telecommunications Engineering from 29 June till 14 August 2005. During

that time he was engaged in research into channel capacity of MIMO systems taking into account antenna coupling and correlation among the MIMO channels. While staying in Wollongong he presented a seminar on his own research and research carried out at the Madrid Technical University. He also visited the National ICT Australia (NICTA) Laboratories in Canberra where he presented a seminar and held talks with researchers of the Wireless Signal Processing Program. In addition, he visited the CSIRO ICT Centre in Sydney-Marsfield, which is the prime centre of antenna research activities in Australia, and gave a seminar at the University of Technology, Sydney. The visit enabled strengthening the existing collaboration to the point that Prof de Haro became a Partner Investigator on the ARC Discovery grant submitted for the 2007.

Mr Michal Pietrzyk, PhD student at the Delft University of Technology came to Wollongong under the ACoRN – NEWCOM agreement covering exchange of postgraduate students. During his visit (7/11/2005 – 30/01/2006), Mr Pietrzyk was involved in research activities related to performance improvement of ultra-wide band (UWB) communication systems. In particular, he investigated application of orthogonal polarity and time-hopping (TH) sequences in UWB-IR systems with interleaved coding-modulation and polarity randomization. At first, he studied the single-user scenarios examining performance of the system employing different classes of randomization sequences. Based on those investigations, he performed an initial selection of the sequences, which allowed for better system performance in the presence of significant inter-symbol interference (ISI). Then, he considered the more complicated multi-user case where, apart from the ISI, a very strong multi-access interference (MAI) is present. This part of research will be continued after his return to Delft, and it is expected that the results will be published in a form of a journal paper. Mr Pietrzyk actively collaborated with other PhD students and research staff working in the WRG on related projects. In particular, he collaborated very closely with Mr Keni Popovski and Mr Peter Vial, and it seems that all the parties benefited strongly from that research collaboration. At the time of writing this letter, a joint publication is being prepared. While staying in Australia, Mr Pietrzyk presented two research seminars at the University of Wollongong and one at NICTA Wireless Signal Processing Labs in Canberra. He also participated at the 8th International Symposium on DSP and Communication Systems (DSPCS'2006) organized jointly with the 4th Workshop on the Internet Telecommunications and Signal Processing (WITSP'2006) in Noosa on Sunshine Coast, where he had his paper published.

Visit by **Prof Minkyu Song** of Dongguk University, Seoul Korea. Albeit approved in 2005, this visit started in January 2006 and will last till the end of 2006. During that time Prof Song will be involved in designing of a transceiver chip for a UWB system utilizing the concept of 'reverse-time communications'.

Overseas visits:

In January 2006 (visit approved in 2005), Dr Mehran Abolhasan Traveled to University of Delft in Netherlands. The aim of this visit was to strengthen collaborative research between the University of Wollongong (UoW) and Delft University of Technology (TUDelft). Having made initial contact with Delft and inviting one of their researchers to Wollongong in the area of Ultra-Wide Band (UWB), the aim of Dr Abolhasan's visit to Delft was to show-case our research and build a stronger bond between the two Universities. During his visit to Delft, Dr Abolhasan gave a presentation to the wireless research team. Additionally, he discussed possible areas of collaboration with a number of researchers at Delft, which resulted in the identification of similar areas of interests. One such area of interest was in the area of routing and medium access control for ad hoc and personal area networks. The Wireless team at Delft is amongst the leading researchers in Europe investigating these areas and they are currently developing a number of prototypes based on Ad hoc and personal area networks. These areas of research are also currently being pursued by the Wireless Research Group at the UoW. Therefore, we envisage that our newly build research link with TUDelft will further enhance our research in this area.

Other Research Activities

The 8th International Symposium on DSP and Communication Systems combined with the 4th Workshop on the Internet, Telecommunications and Signal Processing was held between 19th and 21st December 2005 at Noosa Blue Resort, Noosa Heads, at Queensland's Sunshine Coast. The combined Symposium and Workshop were sponsored by: DSTO, AT-CRC, ACoRN, and supported by the SA Section of IEEE. The response to the original call for papers has exceeded the expectations of an Organizing Committee, with 164 full paper submissions. All submitted papers have been peer reviewed, and each paper received at least two but mostly three peer reviews. Based on those reviews, 80 papers have been accepted, and finally, 77 included in the program - 50 for oral and 27 for poster presentations. In addition, there were two invited keynote presentations delivered by Prof Bahram Honary of the University of Lancaster and Prof Michael Steer of North Carolina State University. The titles of their respective presentations were "Recent Results on Construction of Structured LDPC codes" and "The Interplay of Signal Processing, Communication Technologies and RF Circuit Design with Perspectives on the Future of RF and Microwave Engineering". The event was very well attended by delegates from both Australia and overseas with the total number of attendees reaching 75.

Achievements:

Assoc. Prof Tad Wysocki has been appointed as an Associate Editor of the IEEE Transactions on Microwave Theory and Techniques to handle papers in areas of Coding, Communications Theory, Networks, and DSP. He became the first Associate Editor of the Transactions on MTT from the southern hemisphere.

Former PhD student of Assoc. Prof Tad Wysocki, Mr Le Chung Tran (he will receive his PhD degree after the next University Committee meeting) has been awarded a prestigious Alexander von Humboldt Research Fellowship to spend a year in Germany, at the University of Oldenburg.

Prof Jennifer Seberry received an ARC Discovery grant: "Secure Multi-Party Computation" for 2006 – 2008.

Publications by members of ACoRN on the related activities (numbers only):

Research book – 1
Refereed book chapters – 5
Edited volumes – 2
Fully refereed journal papers – 21
Fully refereed conference papers – 14

B.15 Victoria University

Local ACoRN Representative: Dr Aaron Reid

Membership

There has been a significant increase in the number of Victoria University staff and postgraduate research students becoming members of ACoRN throughout 2005. At the beginning of 2005, there were just 4 members:

Prof Michael Faulkner, Prof Jack Singh, Assoc. Prof Fu-Chun Zheng, and
Dr Aaron Reid.

At the completion of 2005, Victoria University has a total of 12 active researchers as members of ACoRN whose additional members are:

Dr Alex Stojcevski, Dr Xun Yi, Dr Ying Tan, Mr. VenkatKumar VenkataSubramanian, Mr. Matthew Williamson, Mr. Mohammed Alamgir,

Mr. Leon Gor, and Mr. Kevin Tom,

Summary of Activities 2005

A summary of the grants awarded is shown in the table below.

Activity	Applications	Granted
<u>National & International Workshops</u>		
Domestic Workshop Attendance Grant		
AusCTW 2005 (Brisbane)	2	\$750.00
Cross-Layer Desn Workshop (Adel.)	2	\$500.00
CUBIN Workshop (Melbourne)	8	\$550.00
International Workshop Attendance Grant		
IEEE VTC Spring (Stockholm)	1	\$1,000.00
IEEE VTC Fall (Dallas)	1	\$1,000.00
<u>Education</u>		
Summer/Winter Schools		
Winter Wireless School (Canberra)	4	\$1000.00
Info. Theory Spring School (Adel.)	1	\$250.00
<u>Sponsorship</u>		
Sponsorship of IEEE VTC 2006 (Melb.)	1	\$10,000.00
TOTAL	20	\$15,050.00

Postgraduate Education

Within the *Postgraduate Education* program ACoRN supported one application for a member to attend the ACoRN Spring School on Coding and Information Theory in Adelaide, and 4 members were granted support to attend the Winter Wireless School in Canberra.

National and International Workshops

Within the ACoRN *National and International Workshops* program VU supported 15 grants for researchers to attend domestic conferences and workshops, ten of which were for ACoRN Workshops, two for the AusCTW 2005 conference and three grants for attending international conferences.

Assoc. Prof Zheng attended IEEE VTC Fall (Dallas) where he presented two co-written papers, "*Double Diagonalisation: an improved zero-forcing detector for orthogonal STBC over time-selective fading channels*", and (on behalf of fellow ACoRN member Mr. VenkataSubramanian), "*On the Performance of Constellation Rotated NO-STBC over Correlated Fading Channels*". Assoc. Prof Zheng also attended the IEEE VTC Spring (Stockholm) to sit in the preparation meeting for IEEE VTC May 2006 which is to be held in Melbourne.

GlobeCom 2005 (St. Louis) was attended by Prof Michael Faulkner.

The domestic conferences/workshops attended by members included:

- Australian Communications Theory Workshop (AusCTW) in Brisbane in February.
- The CUBIN/ACoRN Information Theory Workshop in Melbourne in September.

- The Cross-Layer Design Workshop held in Adelaide in June.

In most cases, the attendees were postgraduate students who had the opportunity to learn of the newest efforts in telecommunications research from a plethora of leading national and international researchers. This opportunity has broadened the knowledge of all attendees and has given rise to new strains of thought for researchers who are looking to study in newly developed areas of research.

By providing the possibility for VU ACoRN members to attend domestic and international conferences has further increased the research network that VU ACoRN members have had in the past.

Achievements:

- Matthew Williamson received best poster prize at the final ATcrc Conference held in Melbourne for his research on "SVD Based Adaptive Duplexer with Spread Spectrum Pilot".

Plans for 2006

The inaugural year for Victoria University's involvement with ACoRN was very successful with about 20 grants and sponsorship awarded to the total value of \$15,050. This has allowed many VU ACoRN members the opportunity to be actively involved in numerous research activities that normally would not have been possible. The response from researchers has been enthusiastic with people feeling that the telecommunications research network is more widely available and all are impressed with the exposure that is now possible for Australian researchers.

ACoRN plans for 2006 at Victoria University cover the areas of furthering our research contacts on both a national and global scale. Some of the incentives which are currently being considered include:

- *Promoting and supporting visits within Australia.* We have built a strong collaboration with industry and research academia via VU researchers visiting institutions overseas and also visitors coming to Victoria University. In 2006 we will aim to increase the number of researchers that undertake medium to long term visits within Australia. The first such people include Geoffrey Li (*Georgia Institute of Technology*) who will be visiting Assoc. Prof Zheng and will also be presenting a talk at the ACoRN MIMO workshop organised by VU in May 2006. Thomas Haustein (*Heinrich-Hertz Institute, Berlin*) will also be visiting Victoria University as part of the ACoRN MIMO workshop.
- *Local workshops.* VU is currently organising the next workshop in the ACoRN workshop itinerary. The workshop entitled "MIMO: From Theory to Practice" will showcase researchers and industry representatives presenting the latest movements and understanding related to the use of MIMO in upcoming technologies. The workshop aims at attracting domestic researchers to attend by offering low cost registration fees whilst providing leading technology in the MIMO/OFDM area.

Victoria University would like to thank ACoRN and the Administrative Team who have contributed to ACoRN's success in 2005 and who have greatly assisted VU with the opportunity to attend many workshops/conferences.

B.16 Western Australian Telecommunications Research Institute

Local ACoRN Representative: Prof Sven Nordholm

The activities at WATRI supported by ACoRN in 2005 are as follows:

- AusCTW 2005 - Brisbane in January 2005 - Ian Holland - Student Workshop Attendance Grant (SWAG) - \$250
- Cross-Layer Design Problems for Wireless Communications - ACoRN Workshop in Adelaide during 23-24 June 2005 - Ian Holland - \$250.
- ACoRN-NICTA Wireless Winter School - Canberra during 1-15 July 2005 - Asri Shaheem and Anna Lim - \$250 each (\$500)
- ACoRN Spring School on Coding and Information Theory - Adelaide during 11-16 Sep. 2005 - Wayne Griffiths and Greg Cresp - \$250 each (\$500)

Prof S. Nordholm was technical program chair for APCC 2005. Dr Manora Caldera, Dr Ian Holland and Dr Z. Zang served on the technical program committee for APCC 2005. Prof Nordholm also served on the technical program for VTC 2006 (spring) in Melbourne.

Watri organized the AUSCTW 2006. Local organization Chairman Dr Hai Huyen (Heidi) Dam from WATRI.

Prof Sven Nordholm is associate editor for Eurasip Journal on Applied Signal Processing.

C. Register of Participants

The following table shows the full ACoRN Members as described in section 3 of this document. The institution is the ACoRN Organisation Member, and the Department is shown if appropriate.

Register of Participants (Members)						
No.	Title	First name	Last name	Department	Institution	State
1	Mr	Khaizuran	Abdullah	Department of Electrical and Computer Systems Engineering	Monash University	VIC
2	Dr	Thushara	Abhayapala	Research School of Information Sciences & Engineering	Australian National University	ACT
3	Dr	Mehran	Abolhasan		University of Wollongong	NSW
4	Mr	Shoba	Akula	Department of Electrical and Computer Systems Engineering	Monash University	VIC
5	Mr	Amin	Al-Ka'bi	School of Information Technology & Electrical Engineering	University of Queensland	QLD
6	Mr	Ravi Varma	Angiras		University of Melbourne	VIC
7	Assoc. Professor	Jean	Armstrong	Department of Electrical and Computer Systems Engineering	Monash University	VIC
8	Mr	Muhammad	Bacha	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
9	Dr	Sorin	Barbulescu	Institute for Telecommunications Research	University of South Australia	SA
10	Dr	Stephen	Bartlett		University of Sydney	NSW
11	Mr	Dale	Bates	School of Electrical Engineering and Computer Science	University of Newcastle	NSW
12	Mr	Ahmad	Belhoul	Department of Electrical and Computer Systems Engineering	Monash University	VIC
13	Mr	Konstanty	Bialkowski	School of Information Technology & Electrical Engineering	University of Queensland	QLD
14	Dr	John	Bunton	ICT Centre	CSIRO	NSW
15		Craig	Burnet	Institute for Telecommunications Research	University of South Australia	SA
16	Professor	Antonio	Cantoni		Western Australian Telecommunications Research Institute	WA
17	Mr	Ching-Yoong	Chang	School of Electrical and Electronic Engineering	University of Adelaide	SA

Register of Participants (Members)						
No.	Title	First name	Last name	Department	Institution	State
18	Miss	Chia-Yin	Che	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
19	Mr	Tommy	Chee	School of Electrical and Electronic Engineering	University of Adelaide	SA
20	Mr	Liang	Chen	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
21	Ms	Wei	Chen	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
22	Mr	Zhanjiang	Chi	School of Electrical and Information Engineering	University of Sydney	NSW
23	Dr	Belinda	Chiera		University of Adelaide	SA
24	Dr	Jinho	Choi	School of Electrical Engineering and Telecommunications	University of New South Wales	NSW
25	Mr	Allen	Chuang	School of Electrical and Information Engineering	University of Sydney	NSW
26	Dr	I. Vaughan	Clarkson	School of Information Technology & Electrical Engineering	University of Queensland	QLD
27	Dr	Iain	Collings	ICT Centre	CSIRO	NSW
28	Dr	Laura	Cottatellucci	Institute for Telecommunications Research	University of South Australia	SA
29	Professor	William	Cowley	Institute for Telecommunications Research	University of South Australia	SA
30	Mr	Gregory	Cresp		Western Australian Telecommunications Research Institute	WA
31	Mr	Tony	CUI	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
32	Assoc. Professor	Arkadiusz (Arek)	Dadej	Institute for Telecommunications Research	University of South Australia	SA
33	Mr	John	Dalton	School of Electrical Engineering and Computer Science	University of Newcastle	NSW
34	Dr	Hai	Dam		Western Australian Telecommunications Research Institute	WA
35	Mr	Graham	Daniels	ICT Centre	CSIRO	NSW
36	Assoc. Professor	Linda	Davis	Agere Research	Agere Systems Australia	NSW
37	Assoc. Pro-	Subhrakanti	Dey	Department of Electrical and Electronic Engi-	University of Melbourne	VIC

Register of Participants (Members)						
No.	Title	First name	Last name	Department	Institution	State
	fessor			neering		
38	Mr	Glenn	Dickins	Research School of Information Sciences & Engineering	Australian National University	ACT
39	Mr	Shuo	Ding	Institute for Telecommunications Research	University of South Australia	SA
40	Dr	Kutluyil	Dogancay	School of Electrical and Information Engineering	University of South Australia	SA
41	Assoc. Professor	Andrew	Doherty	Department of Physics	University of Queensland	QLD
42	Mr	Hoang Ha	Duong	Institute for Telecommunications Research	University of South Australia	SA
43	Dr	Jamie	Evans	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
44	Assoc. Professor	Peter	Farrell	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
45	Professor	Mike	Faulkner	Centre for Telecommunication and Microelectronics	Victoria University	VIC
46	Mr	Kenneth	Finlayson		University of Wollongong	NSW
47	Mr	Ashley	Flavel		University of Adelaide	SA
48	Dr	Alexei	Gilchrist	Department of Physics	University of Queensland	QLD
49	Dr	Steven	Gordon	Institute for Telecommunications Research	University of South Australia	SA
50	Mr	Gilles	Gorlier	Institute for Telecommunications Research	University of South Australia	SA
51	Dr	Munish	Goyal		University of Melbourne	VIC
52	Professor	Alex	Grant	Institute for Telecommunications Research	University of South Australia	SA
53	Mr	Ian	Griffiths	School of Electrical Engineering and Computer Science	University of Newcastle	NSW
54	Dr	Albert	Guillen i Fabregas	Institute for Telecommunications Research	University of South Australia	SA
55	Mr	MANDAR	GUJRATHI	School of Information Technology & Electrical Engineering	University of Queensland	QLD
56	Mr	Yinghua	Guo	Institute for Telecommunications Research	University of South Australia	SA
57	Ms	Malka	Halgamuge		University of Melbourne	VIC
58	Dr	Bing	Han	School of Electrical and Information Engineering	University of South Australia	SA

Register of Participants (Members)						
No.	Title	First name	Last name	Department	Institution	State
				ing		
59	Dr	Leif	Hanlen	Wireless Signal Processing	National ICT Australia	ACT
60	Dr	Stephen	Hanly	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
61	Dr	Mark	Hedley	ICT Centre	CSIRO	NSW
62	Ms	Siew-Lee	Hew	School of Electrical and Electronic Engineering	University of Adelaide	SA
63	Dr	Mark	Ho	Institute for Telecommunications Research	University of South Australia	SA
64	Dr	Tsun Yue	Ho	Department of Electrical and Computer Systems Engineering	Monash University	VIC
65	Dr	Ian	Holland	Institute for Telecommunications Research	University of South Australia	SA
66	Dr	John	Homer	School of Information Technology & Electrical Engineering	University of Queensland	QLD
67	Dr	Yi	Hong	Institute for Telecommunications Research	University of South Australia	SA
68	Dr	Colin	Jacka	ICT Centre	CSIRO	NSW
69	Professor	Abbas	Jamalipour	School of Electrical and Information Engineering	University of Sydney	NSW
70	Dr	Dhammika	Jayalath	Research School of Information Sciences & Engineering	Australian National University	ACT
71	Dr	Aruna	Jayasuriya	Institute for Telecommunications Research	University of South Australia	SA
72	Mr	Shamim	Joarder	Institute for Telecommunications Research	University of South Australia	SA
73	Dr	Sarah	Johnson	School of Electrical Engineering and Computer Science	University of Newcastle	NSW
74	Dr	Haley	Jones	Research School of Information Sciences & Engineering	Australian National University	ACT
75	Dr	Nemai	Karmakar	Department of Electrical and Computer Systems Engineering	Monash University	VIC
76	Mr	Sridhar	Karuppasami	Institute for Telecommunications Research	University of South Australia	SA
77	Professor	Rodney	Kennedy	Research School of Information Sciences & Engineering	Australian National University	ACT
78	Mr	M. Rubaiyat	Kibria	School of Electrical and Information Engineering	University of Sydney	NSW

Register of Participants (Members)						
No.	Title	First name	Last name	Department	Institution	State
79	Mr	Geoff	Knagge	School of Electrical Engineering and Computer Science	University of Newcastle	NSW
80	Dr	Brian	Krongold	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
81	Dr	Margreta	Kuijper	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
82	Mr	Gopakumar	Kurup	Department of Electrical and Computer Systems Engineering	Monash University	VIC
83	Mr	Manus	Kwan	School of Electrical and Information Engineering	University of South Australia	SA
84	Mr	Tharaka	Lamahewa	Research School of Information Sciences & Engineering	Australian National University	ACT
85	Mr	Stefan	Lehmann	School of Information Technology & Electrical Engineering	University of Queensland	QLD
86	Mr	Alex	Leong	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
87	Mr	Nicholas	Letzepis	Institute for Telecommunications Research	University of South Australia	SA
88	Mr	Charles	Li	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
89	Mr	David	Li	School of Computer and Information Science	University of South Australia	SA
90	Mr	Feng	Li	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
91	Mr	James	Li	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
92	Mr	Ji	Li	Department of Electrical and Electronic Engineering	University of Melbourne	VIC
93	Mr	Yong	Liaw	Institute for Telecommunications Research	University of South Australia	SA
94	Dr	Lavy	Libman	Networks and Pervasive Computing Program	National ICT Australia	NSW
95	Mr	Nimrod	Lilith	School of Electrical and Information Engineering	University of South Australia	SA
96	Ms	Anadonnah	Lim		Western Australian Telecommunications Research Institute	WA
97	Mr	Zhi Hui (David)	Lim	Institute for Telecommunications Research	University of South Australia	SA

Register of Participants (Members)						
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				neering		
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127	Mr	A.T.M.	Rahman	Institute for Telecommunications Research	University of South Australia	SA
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165	Professor	Langford	White	School of Electrical and Electronic Engineering	University of Adelaide	SA
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D. 2005 Budgets and Actual Expenditure

Income	Initial 2005 Budget			Revised 2005 Budget			Actual 2005 Expenditure		
	ARC	ACoRN Partners	Total	ARC	ACoRN Partners	Total	ARC	ACoRN Partners	Total
2004	150,000	0	150,000	150,000	0	150,000	150,000	0	150,000
2005	300,000	243,000	543,000	300,000	233,000	533,000	306,000	233,000	533,000
Events*	0	0	0	0	0	0	0	4,000	4,000
Total	450,000	243,000	693,000	450,000	233,000	683,000	456,000	237,000	693,000
Expenditure									
Governance	100,000	35,000	135,000	77,000	30,000	107,000	73,000	10,000	83,000
Researcher Mobility	48,000	83,000	131,000	20,000	34,000	54,000	14,000	23,000	37,000
Nat. and Int. Conf. & Workshops	56,000	71,000	127,000	58,000	34,000	92,000	69,000	67,000	136,000
Postgraduate Education	34,000	52,000	86,000	19,000	33,000	52,000	14,000	19,000	33,000
Knowledge Management	60,000	0	60,000	53,000	0	53,000	52,000	0	52,000
Contingency	2,000	2,000	4,000	16,000	0	16,000	0	0	0
Programs total	300,000	243,000	543,000	243,000	131,000	374,000	222,000	119,000	341,000
Rollover 2004	150,000	0	150,000	150,000	0	150,000	150,000	0	150,000
Rollover 2005	0	0	0	57,000	102,000	159,000	84,000	118,000	202,000
Total	450,000	243,000	693,000	450,000	233,000	683,000	456,000	237,000	693,000

Table 19: Overview of the initial 2005 budget, the revised 2005 budget and the actual 2005 expenditure. “Events” denotes surplus generated from ACoRN events.

E. 2006 Budget

<i>Income</i>	ARC	ACoRN Partners	Total
Rollover	234,000	118,000	352,000
2006	300,000	223,000	523,000
Total	534,000	341,000	875,000
<i>Expenditure</i>			
Governance	86,000	20,000	106,000
Researcher Mobility	48,000	80,000	128,000
Nat. and Int. Conf. & Workshops	170,000	80,000	250,000
Postgraduate Education	46,000	80,000	126,000
Knowledge Management	21,000	0	21,000
Contingency	13,000	0	13,000
Programs total	384,000	260,000	644,000
Rollover	150,000	81,000	231,000
Total	534,000	341,000	875,000

Table 20: 2006 Budget.