

Annual Report 2011 - 2012

CELEBRATING

10 YEARS



AMSI

AUSTRALIAN MATHEMATICAL
SCIENCES INSTITUTE

2002 - 2012

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CELEBRATING 10 YEARS 2002 - 2012

AMSI's 10th Birthday

2012 marks the tenth year since AMSI's establishment, an appropriate time to reflect on the Institute's successes and to recognise the achievements of key individuals who have guided AMSI towards realising its vision. The AMSI Board has introduced the AMSI Medal for Distinguished Service, to be awarded to those who have demonstrated both sustained and exceptional service to AMSI and leadership in one or more of AMSI's portfolio areas of Research and Higher Education, School Education, Industry engagement, or in advocacy for the broad discipline. The awards were presented on 28 June 2012 at a celebratory function held at the AMSI offices.

The inaugural medallists are:



Dr Jim Lewis



Professor Garth Gaudry



Ms Jan Thomas



Professor Tony Guttman



Professor Peter Hall



Professor Peter Taylor

The Australian mathematical sciences community owes a considerable debt of gratitude to these far-sighted and dedicated individuals. Without them AMSI would not have reached its tenth anniversary or its track record of achievement and influence.



About AMSI

The Australian Mathematical Sciences Institute (AMSI) is a national, collaborative venture of 33 universities and organisations around Australia. AMSI has a high profile in the mathematical sciences both nationally and internationally.

Membership

FULL MEMBERS

La Trobe University
 Monash University
 RMIT University
 The Australian National University
 The University of Adelaide
 The University of Melbourne
 The University of Queensland
 The University of Sydney
 The University of Western Australia
 University of New South Wales

ASSOCIATE MEMBERS

Australian Bureau of Statistics
 Australian Mathematics Trust
 Bureau of Meteorology
 Charles Sturt University
 CSIRO
 Curtin University of Technology
 Deakin University
 Flinders University
 James Cook University
 Macquarie University Sydney
 Queensland University Technology
 Swinburne University of Technology
 University of Ballarat
 University of Canberra
 The University of New England
 The University of Newcastle
 University of South Australia
 University of Southern Queensland
 University of Technology Sydney
 University of Western Sydney
 University of Wollongong

SOCIETY MEMBERS

AustMS
 ANZIAM



Mission statement

AMSI's mission is the radical improvement of mathematical sciences' capacity and capability in the Australian community through:

- The support of high quality mathematics education for all young Australians.
- Improving the supply of mathematically well-prepared students entering tertiary education by direct involvement with schools.
- The support of mathematical sciences research and its applications including cross-disciplinary areas and public and private sectors.
- The enhancement of the undergraduate and postgraduate experience of students in the mathematical sciences and related disciplines.

From the Chair

As I write this report it is almost twelve months since I took over from Jim Lewis as Chair of the AMSI Board. In his role as Chair, Jim was inspirational in his unflagging efforts on behalf of AMSI. Among his many contributions were appointing and mentoring a series of AMSI Directors, negotiating complex contracts such as BlueScope Steel's involvement in the ICE-EM outreach program, taking a hands-on leadership role when there was no director, and direct involvement in negotiations to bring significant funding to AMSI. As the AMSI review report stated: "The Panel salutes this massive contribution without which AMSI's survival would have been jeopardised."



So in my first report as Chair I would like to reiterate my gratitude to Jim for the health of AMSI as I took the baton from him. I would also like to say how refreshing it is to have seen the previous Board's reaction to the numerous recommendations made by the review panel, almost all of which have been put into place.

It was gratifying in my first weeks as Chair to hear from Vice Chancellor Glyn Davis of the strong support of The University of Melbourne, our Lead Agent, for the mission of AMSI.

The first big AMSI event in which I was able to participate was the forum held in Canberra in February of 2012. In some ways, this was an event in which AMSI came of age. The review panel was of the view that AMSI's primary role was as an advocate for the mathematical sciences in Australia (and there is much to advocate for!) One of the highlights of this forum was the speech by the Chief Scientist, Professor Ian Chubb, whose support for the mathematical sciences is enormously encouraging.

Joining Ian Chubb in advocating the criticality of mathematical education was Professor Celia Hoyles, whose position in the United Kingdom as the UK Government's "Maths Tsar" was able to pave the way for a sea change in the way mathematics education is thought of in Britain. And the results have been truly spectacular, with mathematics enrolments across the country increasing dramatically.

Celia made it clear that the “mathematics issue” is a system level problem that begins very early in a child’s mathematical education. Mathematics is a cumulative discipline with many students losing the plot early through inadequate teaching and, as a consequence of its cumulative nature, never regaining it. That is why AMSI’s focus on the system and, in particular, education, is so important. It is where our political leaders have the greatest chance of understanding the issues and it is where the future intellectual giants of our discipline will be nurtured. It is incredibly rare for a mathematician not to have had an inspiring teacher along the way. My teacher John Robson’s inspiration and encouragement is probably why I’m writing these words today.

The after-dinner speaker at the forum was Professor Brian Schmidt, Physics Nobel Laureate, who spoke powerfully of the role mathematics had played not just in his career in astrophysics, but also in his wife’s daily work as an economist, his father’s work in fisheries population dynamics, his uncle’s work in micro-farming and drainage (sic!) respectively.

The Director will give a number of examples of how AMSI’s advocacy has borne fruit over the past year in his report. Professor Prince’s leadership in this area has been outstanding.

The ability to hold such an event as the forum with so many influential stakeholders present is a tribute to the very high calibre of staff AMSI has been able to recruit and retain. It is this professionalism that will, in the fullness of time, result in the whole of AMSI’s vision being realised. But it is only by increasing the level of understanding by policy-makers of the systemic value a mathematically-educated society can add to national productivity that our longer-term, never-forgotten dream of a national research institute in the mathematical sciences will become a reality.

In seeking to build national support for the mathematical sciences it is imperative that the Australian mathematical community should speak with a single voice. It has been my experience working with the Board (which is shortly to be increased by the addition of a number of highly talented external members) that there is strong commitment to AMSI’s national agenda, and a very positive spirit of collaboration to achieve AMSI’s goals.

It has been a privilege to take up the reins as AMSI’s Board Chair, and I look forward to the years ahead with increasing confidence and excitement.

In seeking to build national support for the mathematical sciences it is imperative that the Australian mathematical community should speak with a single voice.



Dr Ron Sandland AM FTSE
CHAIR

Director's report

The period covered by this report, 2011–2012, has been a particularly exciting one, with the introduction of new faces, the Maths for the Future forum, significant funding, and culminating in the celebration of AMSI's 10th year of operation.

Dr Ron Sandland took on the role of Board Chair from Dr Jim Lewis, AMSI's foundation chair. Ron was an obvious choice, having led the external review of the Institute the previous year and in the process getting fully immersed in the workings of the organisation.



Other new faces at AMSI include:

- Cate Ballard, who joined us in September 2011 to head AMSI Intern
- Rod Birch, who joined us in October 2011 as AMSI's Business Manager
- Kally Yuen, who took over as the AMSI Statistician in September 2011 and works on various projects for Parks Victoria
- Stéphanie Pradier, who joined us in June 2012 as part of AMSI's media and communications effort.

We have been progressively implementing the recommendations of the 2010 review, such as the changes to AMSI's membership fee structure and the update of the Joint Venture Agreement, both of which are now complete. Whilst some of these recommendations have proved to be lengthy and complex to enact, others have been straightforward.

The forum *Maths for the future: Keep Australia competitive* in February 2012 in Canberra was an innovative outreach and advocacy activity that was sorely needed to bring issues facing the mathematical sciences to an audience with the ability to take action. We had an excellent array of speakers, including Professor Celia Hoyles, who had spearheaded initiatives to benefit mathematics education in the UK, and Professor Ian Chubb, Australia's Chief Scientist.

The forum *Maths for the Future: Keep Australia Competitive* was an innovative outreach and advocacy activity that was sorely needed to bring issues facing the mathematical sciences to an audience with the ability to take action.

The forum concluded with two recommendations to Government: a mathematics awareness campaign, and a national mathematics advisor. The awareness campaign is yet to be funded and is still on the top of our agenda, while the federal budget allocated \$4.3M for a National Mathematics and Science Education and Industry Adviser. Although this is not quite the position envisioned by the forum, it is certainly a positive step.

A piece on the forum appears later in this report, but I must emphasise that it was absolutely critical in increasing the media exposure of mathematics and statistics and in building our relationship with the Chief Scientist, Professor Ian Chubb, and government staff. The forum undoubtedly led to much-needed funding for AMSI's Research and Higher Education program in the 2012 Commonwealth budget.

This new Commonwealth grant has secured our flagship programs—Summer School, Winter School, BioInfoSummer and Vacation Research Scholarships. It also gives us the opportunity to grow and refresh these events and to look for new opportunities to enhance the undergraduate and postgraduate experience of our students. Lifting the vacation scholarship numbers from 20 to 50 is an immediate and exciting consequence of the grant! Our next challenge is to increase the support of the program by Australian business.

The second edition of the ICE-EM Mathematics textbooks, written for the new Australian Curriculum, has been published by Cambridge University Press. The new edition has enjoyed strong sales in its first year, and we can look forward to further growth as the new curriculum is implemented across the country over the coming years.

Our strong credentials in the school education sector has led to a \$750,000, one-year contract with Education Services Australia for digital support of the Australian Curriculum for both students and teachers. AMSI looks forward to further work on the Year 11 and 12 curriculums to support Australia's teachers.

A strong feature of this support is the provision of context to the mathematical content itself. This context is designed to give the school community a much clearer idea of both the utility of the mathematical sciences and the professional identity of working specialists.

AMSI's internship program underwent a dramatic facelift in the middle of 2011, with a rebranding strategy put in place which saw a new, dedicated website and logo under a new name, AMSI Intern.

AMSI Intern has also experienced a period of significant growth, going from 28 interns placed from 2008–2011 under the first internship scheme to 11 interns placed under the current Enterprise Connect scheme in the year July 2011 to June 2012. Although the Enterprise Connect scheme will come to its end in the first half of 2013, I believe a solid foundation has been put in place to see accelerating growth.

I would finally like to extend my thanks to Ron for his encouragement and support, and to the AMSI staff, who pursue AMSI's mission and vision on a day to day basis and who are largely responsible for our growing reputation and influence.



Professor Geoff Prince
DIRECTOR



Advocacy and Outreach

Introduction

One of AMSI's most important functions is that of advocacy on behalf of the mathematical sciences. AMSI has built a reputation as a central voice on a number of issues, representing the views of the university mathematics and statistics departments and government agencies that form its membership.

Higher Education Base Funding

AMSI continues to be consulted as a representative body of the mathematical sciences, attending a meeting by invitation in February 2012 with the Australian Government and other stakeholders from the higher education sector following the release of the Final Report of the Higher Education Base Funding Review.

AMSI made a submission on behalf of the mathematical sciences for the Higher Education Base Funding review in 2011, in which members of the ACHMS were invited to submit contributions to provide a view truly representative of the discipline. The Government has yet to give its formal response to the recommendations of the review.

Productivity Commission: Schools Workforce Enquiry

AMSI made a submission to the Productivity Commission Schools Workforce enquiry in August 2011 on behalf of its membership. The submission discussed the undersupply of qualified mathematics teachers in schools and the flow-on effects of this shortage. AMSI recommended the creation of a nationally-coordinated scholarship scheme for undergraduates intending to become secondary mathematics teachers, as well as a scheme to assist teachers currently teaching mathematics out-of-field to become fully qualified. The submission also recommended a nationally-agreed minimum standard for mathematics content knowledge in the pre-placement training of primary school teachers.

Productivity Commission: Impacts and benefits of COAG reforms

AMSI made a submission to the Productivity Commission's Study into the Impacts and Benefits of COAG Reforms in October 2011. The submission draws attention to the need for a coordinated national program to deliver on national priorities.

The submission also details the strong track record of AMSI's School Education Program to contribute in areas relating to national partnerships, mathematics teacher training and development, and the promotion of career options available through the study of mathematics.



Australian Council of Heads of Mathematical Sciences

The Australian Council of Heads of Mathematical Sciences is an annual forum for Heads of Schools and Departments of Mathematics, Statistics and Econometrics to meet with each other and with Presidents of major professional societies in the Mathematical Sciences such as the Australian Mathematical Society, ANZIAM, Statistical Society of Australia inc, AAMT, MERGA, Australian Society for Operations Research, Combinatorial Mathematics Society of Australia and representatives of the Australian Mathematics Trust, ABS, CSIRO, the National Committee for the Mathematical Sciences (NCMS) and Science and Technology Australia. These meetings allow for the exchange of ideas and the discussion of issues impacting on the mathematical sciences.

The meeting in February received a report on the 2012 Excellence in Research for Australia (ERA) exercise from Professor Peter Taylor. A letter to Minister Carr, endorsed by AMSI, NCMS and ACHMS, expressing the concerns raised at the 2011 ACHMS meeting about the 2010 ERA exercise was acknowledged by the Minister but did not provide any specific responses from the Government.

Professor Geoff Prince reported on the implications of the Government's Base Funding Review for the Mathematical Sciences and Dr Michael Evans gave an update on the implementation of the F-10 National Mathematics Curriculum and the development of the Senior Secondary Mathematics Curriculums. Consultation on the senior draft curriculums will continue during 2012 and the final version should be ready for release at the end of the year.

The meeting received reports on Inspiring Australia, the Knight Report on changes to student visas, plans for Mathematics of Planet Earth 2013, updates from Professor Nalini Joshi on NCMS, Professor Geoff Prince on AMSI and Professor Merrilyn Goos on Science and Technology Australia (previously known as FASTS).

The Heads discussion session focused on first year mathematics (advanced stream structures, different ways to cater for increasing numbers of students entering without calculus, bridging courses), external evaluation of assessments and different ways of defining 'research active'.

Professor Jim Denier completed his term on the ACHMS Executive as Deputy Chair in 2012. Jim was a very active member of the Council and we thank him for his many contributions and wish him well in New Zealand. Joe Grotowski was appointed as Deputy Chair and Donald Taylor as Executive Officer. The members of the ACHMS Executive for 2012 are Jerzy Filar, Merrilyn Goos, Joe Grotowski, Kerrie Mengersen and Neville Weber.

Thanks go to AMSI for their ongoing sponsorship of ACHMS and I would also like to thank the 13 organisations that contributed to help cover the costs of the ANU meeting.



Neville Weber
Chair, ACHMS

AMSI in the Media

A selection of media exposure from July 2011-June 2012

Newspaper Articles

- Tarica, E. 2011, 'Top maths man fears for its future', *The Age*, 18 July.
- Trouson, A. 2011, 'Search for a solution as maths fees double', *The Australian*, 30 Nov.
- Mather, J. 2011, 'Figuring out maths problem', *The Australian Financial Review*, 5 Dec.
- McDougall, B. 2011, 'Why we're getting dumb and dumber', *Herald Sun*, 10 Dec.
- Rowbotham, J. 2012, 'In the maths realm, good timing counts', *The Australian*, 18 Jan.
- Rowbotham, J. 2012, 'UK expert adds impetus to solve the maths divide', *The Australian*, 1 Feb.
- Macdonald, E. 2012, 'Nobel winner says maths counts', *The Canberra Times*, 7 Feb.
- Hall, B. 2012, 'Quest to make maths and science cool', *The Canberra Times*, 8 Feb.
- Hall, B. 2012, 'Figuring how to make maths and science cool', *Sydney Morning Herald*, 8 Feb.
- Rowbotham, J. 2012, 'Nobel winner's plea for maths', *The Australian*, 8 Feb.
- Hilton, D. 2012, 'Medical research doesn't have the numbers', *Australian Life Scientist*, 9 Feb.
- Editorial. 2012, 'Remedying our skills shortage', *The Australian*, 10 Feb.
- Hall, B. 2012, 'Chief scientist's mission: spicing up maths and science', *The Age*, 13 Feb.
- Schmidt, B. 2012, 'Brian Schmidt's mathematical argument', *The Australian*, 9 Feb.
- Arlington, K. 2012, 'Follow Brits and do the maths, says top adviser', *Sydney Morning Herald*, 15 Feb.
- Arlington, K. 2012, 'Push to multiply positive points of maths in minds of students', *Sydney Morning Herald*, 20 Feb.
- Hall, B. 2012, 'Science seeks better set of numbers', *The Age*, 6 Mar.
- 'Numbering up', (2012, April), *Industry*, vol. 56, p.38-39.
- Tarica, E. 2012, 'It figures: lack of specialists grips the school system', *The Age*, 14 May.

Media releases

Evans, C. (Minister for Tertiary Education, Skills, Science and Research) 2012, *Mathematical Sciences essential for Australian prosperity*, media release, Canberra, 8 Feb.

Radio interviews

Prince, Geoff. Interview with Nick Rheinberger. Morning. ABC Illawarra, NSW. 30 Nov 2011
Topic: Scrapping of the HECS discount for undergraduate mathematics and science subjects.

Hoyles, Celia. Interview with Adam Spencer. 702 ABC Sydney Breakfast, NSW. 7 Feb 2012
Topic: Maths for the Future national forum.

Hoyles, Celia. Interview with Geoff Hutchison. 720 ABC Mornings, Perth, WA. 7 Feb 2012.
Topic: Maths for the Future national forum.

Hoyles, Celia. Interview with Fran Kelly. ABC Radio National Breakfast Program. 8 Feb 2012.
Topic: Maths for the Future national forum.

Hoyles, Celia. Interview with Red Symons. 774 ABC Melbourne, VIC, 8 Feb 2012.
Topic: Maths for the Future national forum.

Afternoons, Genevieve Jacobs, 666 ABC Canberra, ACT. 13 Feb 2012

Topic: Entire 2-hour program dedicated to mathematics and mathematics education. Guests included **Prof. Celia Hoyles, Adam Spencer, Prof. Penny Sackett, Dr. Marty Ross, Prof. Peter Taylor** and **Prof. Michael Barnsley**

Hoyles, Celia. Interview with Margaret Throsby. Midday, ABC Classic FM. 15 Feb 2012.

Maths for the future: Keep Australia competitive

Canberra 7–8 February 2012

Maths for the future: Keep Australia competitive was conceived to influence policy makers as part of AMSI's role as an advocate for mathematics and statistics. The aim was to create new alliances with the corporate and government agency worlds to publicise both the state of the discipline and its importance to national productivity growth. It came at a time when AMSI believed that the HECS discount for mathematics, statistics and science would be replaced with more direct measures to encourage enrolments, however this did not eventuate. Further to this, Professor Ian Chubb, the Chief Scientist of Australia, was commissioned by the Prime Minister to advise on measures to replace the HECS discount scheme by the end of February 2012, so the timing of the forum proved impeccable. With an impressive line-up of speakers and extensive media coverage, our discipline's voice was heard loud and clear at a time when policy makers were keen to listen.

Professor Celia Hoyles, former mathematics advisor to the British Government, set the agenda when she spoke about initiatives employed in England that have improved standards, reversed teacher shortages and increased mathematics enrolments. It was Professor Hoyles' 2010 presentation to the Australian Council of Heads of Mathematical Sciences, and her work on the 2010 AMSI Review, that demonstrated that coordinated action on a number of fronts was needed in Australia.

Dr Ron Sandland, the chair of the AMSI Board, presented a profile of the mathematical sciences in Australia in a speech that focused on the indispensable contribution the discipline has made to Australian public, individual and commercial life. Professor Chubb further developed these ideas and made clear his deep concern for the quality of the schoolroom experience in mathematics and science.

Associate Professor Kim Beswick, President of the Australian Association of Mathematics Teachers, spoke at the end of the first day about the need to change the perception of mathematics for school students and the challenges that this brings to teachers. Her statement, 'What we do in classrooms needs to more closely resemble the work of mathematicians', resonated strongly amongst forum attendees.

The widely reported speech of recent Nobel Prize winner Professor Brian Schmidt at the forum dinner was a highlight of the event. Professor Schmidt discussed statistical uncertainty in climate change, his own mathematical work, and the mathematical core of many professions with examples from his extended family. Most importantly he reflected on education:

We are not there yet: too many of our kids leave school without a core numeracy. Too many of our kids, who are able and willing to excel at maths, are taught by teachers without the level of competency required for the subjects they teach. Solving this skills shortage has to be our highest priority. Our kids cannot afford to have the opportunities lost that result from having a poor mathematical education, and the nation can ill afford to lose talent which is in such short supply.

Three politicians spoke at the forum: Senator Chris Evans, Minister for Tertiary Education, Skills, Science and Research; Sophie Mirabella, Shadow Minister for Innovation, Industry and Science; and Christopher Pyne, Shadow Minister for Education, Apprenticeships and Training. In a speech informed by direct family experience, Senator Evans dwelt on the shortage of mathematics teachers, academics and researchers and the strategic importance of the discipline. A very strong statement about the discipline later appeared on his website. Sophie Mirabella also addressed the importance of mathematics and statistics but was cautious about the extent of future coalition financial support. Christopher Pyne spoke of the opposition's plans for school funding. Celia Hoyles and Geoff Prince attended a private meeting with Peter Garret, the School Education Minister, during the forum where he was briefed on aspects of the UK experience.

The forum concluded with a round-table discussion and the participants issued a communiqué. Rather than specify a comprehensive list of potential policies and actions for the various stakeholders, two major recommendations were made to underpin future measures: the appointment of a national adviser and the establishment of a five-year awareness campaign targeting school and university students, parents, career counsellors and mathematics teachers, the general public and Australian private and public enterprise. The first of these recommendations was recognised in the recent

'The Maths for the Future conference was the best event of its type that I have been involved in. I'd be surprised if the mathematical sciences community in this country has ever been able to line up such a list of speakers to concentrate on what needs to be done to nurture the discipline.'

Professor Peter Taylor, President,
Australian Mathematical Society

federal budget announcement, with \$4.3 million allocated towards the appointment of a National Mathematics and Science Education and Industry Adviser. This post will be located within the Office of the Chief Scientist to champion the role of mathematics, science and statistics across education and industry. The \$54 million Science and Maths Package also includes \$20 million for a partnerships program between universities, schools and other organisations to improve secondary students' engagement in mathematics and science. AMSI will continue the push to find avenues to support a five-year national awareness campaign in mathematics and statistics.

The speakers were all wonderfully generous with their time and AMSI thanks them for their commitment. Special thanks in particular to Celia Hoyles, who not only opened the forum and spoke tirelessly to the press, but also had private meetings with politicians and policy makers; and to Brian Schmidt, for the depth of his commitment at a very hectic time for him. The forum was sponsored by the Australian Bureau of Statistics, the Australian Council of Deans of Science, the Australian Mathematical Society, the Australian Mathematics Trust, CSIRO's Division of Mathematics, Informatics and Statistics, and Science and Technology Australia.

'The forum was a very positive event that I trust will pay dividends in initiating an ongoing conversation with government and policy makers.'

Associate Professor Kim Beswick,
President, Australian Association of
Mathematics Teachers

SPEAKERS

Celia Hoyles (Former Mathematics Adviser to the UK Government)

Ron Sandland (AMSI)

Ian Chubb (Chief Scientist for Australia)

Glenn Wightwick (IBM)

Rob Vertessy (Bureau of Meteorology)

Mike Manton (Academy of Technological Sciences and Engineering)

Kim Beswick (AAMT)

Christopher Pyne (Shadow Minister for Education, Apprenticeships and Training)

Paul Van Bergen (KPMG)

Chris Evans (Minister for Tertiary Education, Skills, Science and Research)

Doug Hilton (WEHI)

Len Sciacca (DSTO)

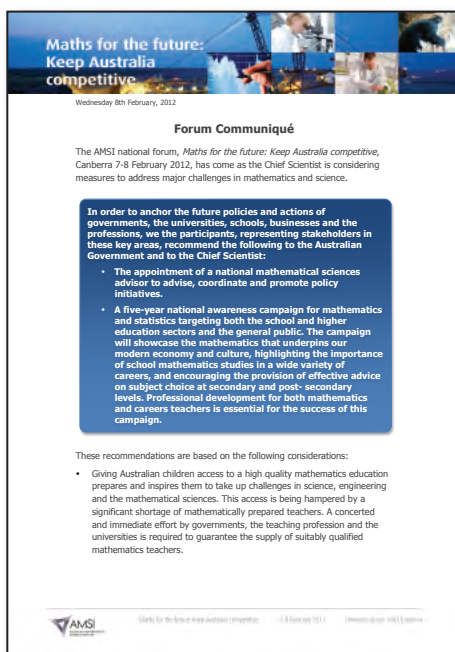
Louise Ryan (CSIRO)

Sophie Mirabella (Shadow Minister for Innovation, Industry and Science)

Steve Davies (APRA)

Attila Brungs (Deputy Vice Chancellor (Research), University of Technology Sydney)

John Rice (Australian Council of Deans of Science)



Maths for the future: Keep Australia competitive

Wednesday 8th February, 2012

Forum Communiqué

The AMSI national forum, *Maths for the future: Keep Australia competitive*, Canberra 7-8 February 2012, has come as the Chief Scientist is considering measures to address major challenges in mathematics and science.

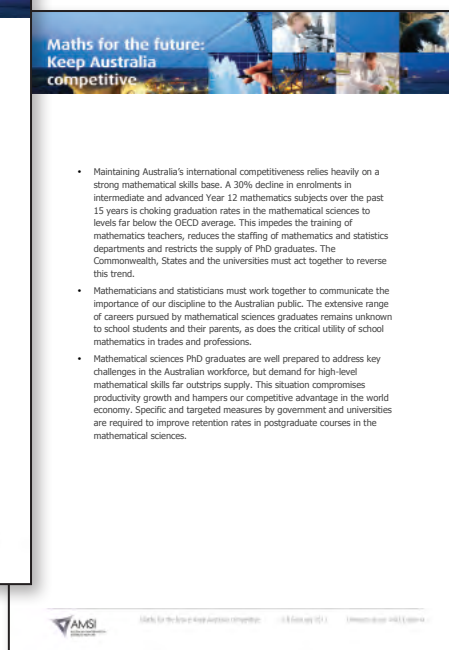
In order to anchor the future policies and actions of governments, the universities, schools, businesses and the professions, we the participants, representing stakeholders in these key areas, recommend the following to the Australian Government and to the Chief Scientist:

- The appointment of a national mathematical sciences advisor to advise, coordinate and promote policy initiatives.
- A five-year national awareness campaign for mathematics and statistics targeting both the school and higher education sectors and the general public. The campaign will showcase the mathematics that underpins our modern economy and culture, highlighting the importance of school mathematics studies in a wide variety of careers, and encouraging the provision of effective advice on subject choice at secondary and post-secondary levels. Professional development for both mathematics and careers teachers is essential for the success of this campaign.

These recommendations are based on the following considerations:

- Giving Australian children access to a high quality mathematics education prepares and inspires them to take up challenges in science, engineering and the mathematical sciences. This access is being hampered by a significant shortage of mathematically prepared teachers. A concerted and immediate effort by governments, the teaching profession and the universities is required to guarantee the supply of suitably qualified mathematics teachers.

AMSI
Maths for the future: keep Australia competitive



Maths for the future: Keep Australia competitive

- Maintaining Australia's international competitiveness relies heavily on a strong mathematical skills base. A 30% decline in enrolments in intermediate and advanced Year 12 mathematics subjects over the past 15 years is choking graduation rates in the mathematical sciences to levels far below the OECD average. This impedes the training of mathematics teachers, reduces the staffing of mathematics and statistics departments and restricts the supply of PhD graduates. The Commonwealth, States and the universities must act together to reverse this trend.
- Mathematicians and statisticians must work together to communicate the importance of our discipline to the Australian public. The extensive range of careers pursued by mathematical sciences graduates remains unknown to school students and their parents, as does the critical utility of school mathematics in trades and professions.
- Mathematical sciences PhD graduates are well prepared to address key challenges in the Australian workforce, but demand for high-level mathematical skills far outstrips supply. This situation compromises productivity growth and hampers our competitive advantage in the world economy. Specific and targeted measures by government and universities are required to improve retention rates in postgraduate courses in the mathematical sciences.

AMSI
Maths for the future: keep Australia competitive



Research and Higher Education



Summer School

The 10th annual AMSI Summer School was held at the University of New South Wales in January and February of 2012. The importance of the Summer School to the mathematical sciences community was evident from the start with strong enrolments, media attention and Australia's Chief Scientist, Professor Ian Chubb, officially opening the event.

Eight honours level courses covering a range of specialised and core topics in the mathematics and statistics were offered. Many students took courses that will count towards an honours or postgraduate degree at their home institution while others attended simply to improve their mathematical knowledge and skills. All, however, benefited from interaction with a lively mathematical community that many had not previously experienced. While most of the summer school was spent on the courses, the social activities, general interest lectures and the careers afternoon were a very valuable component of the summer school experience.



The AMSI Summer School was the result of much hard work and valuable input from many individuals. The foundation of a successful Summer School is an appealing program delivered by talented lecturers, and the program committee deserves thanks for their work in providing this. Guidance and support from the previous director, Finnur Lárusson, as well as from Geoff Prince, Simi Henderson and other AMSI staff was invaluable. Members of the School's administrative staff spent many hours helping with the organisation and day-to-day running of the event. Finally, all of this combined with the enthusiasm and commitment shown by the students ensured the summer school was a great success.

Jonathan Kress, 2012 Summer School Director



Hyamfest

Hyamfest, hosted by the University of Melbourne, consisted of two exciting weeks of lectures and workshops. The event brought together an impressive line-up of guests from Australia, the United States, Europe and Asia, and was attended by approximately 120 students and academics. Hyamfest was held in honour of Professor Hyam Rubinstein, and celebrated his contribution to topology and his long-standing role as an advocate for the mathematical sciences.

Elisabeth Tarica from The Age wrote about Hyamfest in an article published on 18 July 2011. The article drew attention to the parlous state of mathematics in Australia, and how some of the nation's best mathematical minds have been lost to overseas institutions. She wrote,

"They say that if Australia continues to slide backwards in maths education and the disciplines it supports, the shortage of workers with high-level mathematics and statistics capabilities could jeopardise the nation's economic and research capability."



AMSI hosted a free public lecture on 19 July 2011 in conjunction with the conference. Professor Danny Calegari, California Institute of Technology, delivered the lecture entitled *The Shape of the Internet*. Calegari's sense of humour was well received as he used various Australian animals as models for possible shapes of the Internet. He also touched on the 6 degrees of separation hypothesis and the mathematical modelling of social networks.

Mahler Lecturer

Professor Peter Sarnak, Princeton University, was the 2011 Mahler lecturer. Sarnak visited six capital cities from 9–26 August, presenting lectures on a variety of topics for public and specialist audiences.

Sarnak's lectures gave the public the opportunity to explore some of the hot topics in mathematics, including chaos in quantum mechanics and randomness in number theory. Many of the colloquium lectures were available over the Access Grid Network to reach a wider audience.

Peter Sarnak is an experienced lecturer, mentor and science communicator. He is widely known for his role in the documentary series, *Andrew Wiles and Fermat's Last Theorem*. He is a major figure in modern analytic number theory, with research interests also in analysis and mathematical physics. He has received many awards for his research including the Polya prize in 1998, the Ostrowski prize in 2001, the Conant prize in 2003 and the Cole prize in 2005.

The Mahler lectures are a biennial activity organised by the Australian Mathematical Society with support from AMSI.



Graduate Winter School

The sixth annual AMSI Graduate Winter School in the Mathematical Sciences, hosted by the University of Queensland, was attended by 25 postgraduate students and early-career researchers from 26 June to 8 July 2011.

Professor Margaret Sheil, CEO of the Australian Research Council, opened the Winter School. She talked about the importance of events such as this to the Australian science and research community, commenting that these events help to fill the serious demand for mathematical scientists identified in the Research Workforce Strategy. She congratulated AMSI on its commitment to research training in the mathematical sciences.

Dr Jean Lasserre, French National Centre for Scientific Research, and Professor Jerzy Filar, University of South Australia, delivered the courses on the theme, Global Optimisation: theory and applications. Students were exposed to a wide range of new concepts, modelling tools and algorithms, providing them with the tools to tackle complex challenges in a range of areas. Each student also presented a 30-minute talk on their own research, providing a valuable opportunity to obtain feedback from high-profile mathematical scientists.

Program

COURSE	LECTURER
Moments, Positive Polynomials and their Applications	Jean Lasserre (Laboratory of Analysis and Architecture of Systems, France)
Competitive Markov Decision Processes	Jerzy Filar (University of South Australia)

Thanks to Professor Mark Gould and Andree Philips for organising an excellent program.

Vacation Research Scholars

While many flocked to the beach this summer, AMSI's vacation scholars were getting a taste of what it's like doing mathematics and statistics research. 22 intending honours students from around Australia were awarded scholarships to complete a six-week supervised project at their home institution. At the end of the summer, the students presented their work at CSIRO's Big Day In, held at Macquarie University.

Megan Farquhar, Queensland University of Technology, had her chair in an upright position over the summer while she investigated different methods for boarding a passenger aircraft. Megan used MATLAB to compare six different ways to board a Boeing 737. Total boarding time depends on the passenger interarrival time—the amount of time between one passenger arriving to board the plane and the arrival of the next passenger. For low interarrival times, she found that allowing passengers to board the plane in a random order was one of the fastest methods, but she cautions that this may not be the most effective strategy if a bottleneck develops in the aisle. 'Future work can look at what happens when a luggage compartment is full, what to do when a passenger is running late, and the possibility of multiple door entry,' she said.

Meanwhile, Bradley O'Bree from RMIT University used his project as an opportunity to explore some of the statistics behind his favourite sport, golf. Brad used Bayesian inference to develop a model that predicts whether or not each player will qualify for the third round of a professional tournament, where half of the competitors are eliminated.

Brad's model uses historical data from professional tournaments to assign players to one of two groups—'qualifying' or 'non-qualifying'—and randomly assigns each player a score based on their group's distribution. At the end of each round, the model updates each player's score and re-evaluates the probability that they will qualify. 'Classifying players into groups means that we can randomly generate scores that are more relevant to that player,' Brad said.

This two-group classification system resulted in a large variability between the two scoring distributions. 'If a player got a score that fell between the two distributions, you couldn't really say whether they would qualify or not. To eliminate this ambiguity I introduced a 'maybe qualify' group. This allowed me to tighten up the distributions to generate more realistic scores,' he said.

The Cambridge University Press Book Prize for best student talk was awarded to James Kwiecinski, Monash University, for his excellent presentation on unsteady free surface flows. Congratulations also to Stuart Johnson, whose project led to a publication in Physical Review E, *Mean-field descriptions of collective migration with strong adhesion*.



THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

'The vacation scholarship experience has allowed me to get a taste of how life as a researcher is, allowing me to do the research and follow through with both a report and presentation on it.'

Megan Farquhar, Queensland University of Technology



CSIRO



CAMBRIDGE
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Bradley O'Bree

Teeing off a career in sports statistics

Bradley O'Bree, RMIT University, talks to Emma Bland about how he has combined two passions—sports and statistics—most recently through his AMSI vacation research project, Applications of Simulation and Bayesian Inference in Golf.

Your project on professional golf grew out of some previous work you have done at RMIT. What other sports have you looked at?

Last year I did some work that examined badminton serving strategies. In men's badminton, for example, about 95% of the time they'll do a low serve that just pops over the net, and then occasionally they'll hit it up over their opponent's head. What we wanted to do was optimise the timing of that, given that the receiver would be expecting a low serve. You want to throw your opponent off-balance to increase your chance of winning the point, so it is important to do that on the most critical points in the set. In badminton, and also in tennis, it's often a good idea to avoid your non-standard serves early on so that your opponent doesn't learn to watch out for them.

Tell me about the Big Day In...

Everyone at the Big Day In was there because they had done a project over the summer. We were all students of about the same age, and everyone felt a real sense of accomplishment from their work. We had respect for other students with motivations for research and it was really interesting to hear what people had to talk about. I think a lot of people found my topic quite interesting because I was talking about maths and sport, and they had never really put the two together before.

What are some of the general challenges in sports statistics?

We often have to make assumptions in sports statistics. We're modelling human behaviour, and what's more complex than someone's brain? People have motivations for doing things and respond differently to scenarios. It's too complex to know everything, so we have to generalise. What's great is that you can still obtain a nice result.

Is it difficult to obtain data?

Gathering data is very time-consuming. Unless someone will hand you data for free, which they won't normally do, you either have to pay for it or go out and get it yourself. You don't realise how quick some sports are until you have to press buttons to record what's going on! If you make a mistake or stop for a second, you've lost it.

It is good to get out and watch sports though, and this is one of the main reasons I've gone into sports statistics. I've always been strong in maths, and I've always loved sports; I'll play anything—any weather, any conditions—and being able to merge them together is ideal. I was lucky that Associate Professor Anthony Bedford, my supervisor, was at RMIT because he's a real figure in sports statistics. It's a great place to get experience and my love for this sort of work has really developed there.

BioInfoSummer

BioInfoSummer is an annual educational and outreach program aimed at increasing understanding and skill levels of bioinformatics among students and entry-level research staff. BioInfoSummer 2011 was hosted by the Walter Eliza Hall Institute of Medical Research, Melbourne, with the generous support of the European Molecular Biology Laboratory (EMBL) Australia and BioPlatforms Australia.

The symposium opened with a day of introductory lectures on fundamental concepts in biology and bioinformatics. The days that followed were designed to expose participants to cutting-edge bioinformatics research in the following areas:

- Introduction to Biology and Bioinformatics, 5 December
- Molecular Evolution, 6 December
- Genetic Variation and Massively Parallel Sequencing, 7 December
- Cancer Genomics and Massively Parallel Sequencing, 8 December
- Proteomics and Metabolomics, 9 December

Workshops held each afternoon gave participants the opportunity to consolidate their knowledge through hands-on activities, and each day concluded with a keynote lecture on state-of-the-art research relevant to the day's theme.

All speakers were leading researchers from Australia and overseas. International speakers included Professor Sohrab Shah (University of British Columbia), Dr Christina Boucher (University of California, San Diego), Dr Xiting Yan (Yale University), and Dr Anateresa Maia (Cambridge University).

The 2011 program also included a teachers' day, sponsored by AMSI and the Gene Technology Access Centre (GTAC). This new addition to the program was targeted at biology and mathematics teachers on the lookout for ideas to challenge talented students, and for resources relevant to the Year 12 Biology Curriculum.

Event feedback was very positive, particularly with regards to the quality of the keynote lectures. The keynote speakers were Dr Kathryn Holt (University of Melbourne), Professor Mellisa Southey (University of Melbourne), Professor Sohrab Shah (University of British Columbia), and Dr Wade Hines (Australian Wine Research Institute).

Arthur Hsu, Director, BioInfoSummer 2011

Careers Evening

Thursday 25 August 2011

The 2011 AMSI Careers Evening was held at The University of Melbourne on 25 August. Recent mathematics and statistics graduates spoke about their careers to over 150 students from Victorian AMSI member universities, showcasing the breadth of careers available in the mathematical sciences. Students were shown how to broaden their expertise whilst still at university, particularly through AMSI schemes such as Vacation Research Scholarships, Summer School and AMSI Intern. Students were also given advice on how to market their skills to potential employers as they prepare to enter the job market.

Speakers:

- Jarrod Tuck (Myer)
- David Innes (Mooroolbark College)
- Norman Do (University of Melbourne)
- Tristan Barnett (Strategic Games)
- Maya Muthaswamy (AGL Energy)
- Chris Green (CSIRO Earth Science and Resource Engineering)
- Nicholas Groves (The Boston Consulting Group)
- Geoff Prince (AMSI Director, speaking about AMSI Intern)

This annual event is hosted by AMSI and is sponsored by the Department of Mathematics and Statistics at the University of Melbourne. Opportunities for similar events at other member universities are available.



"Some very entertaining lecturers...very passionate people from all different careers who really enlightened me on the different prospects of where mathematics can take me."



\$2 million for AMSI Higher Education program

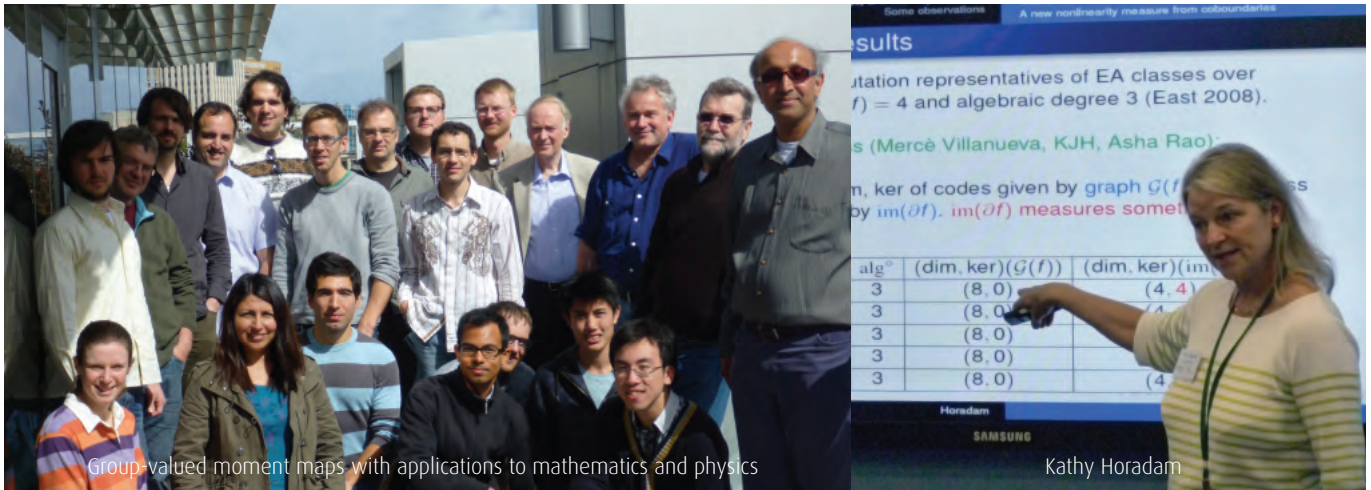
AMSI has received 4 years of funding at \$0.5 million per annum for its Research and Higher Education program, announced in the Commonwealth Budget in May 2012. The funding is an exciting opportunity for AMSI to grow its flagship higher-education program, including doubling the number of vacation research scholarships offered to intending honours students, additional places at BioinfoSummer and Summer School, and a revised format for the Winter School. These programs help to build Australia's research capacity and increase the work-readiness of our graduates.

On budget night the Government announced a total of \$54 million in response to the recommendations of the Chief Scientist presented in the report, Mathematics, Engineering and Science in the National Interest. This includes funding for a national Mathematics and Science Education and Industry Adviser, a key recommendation from the AMSI National Forum held in February 2012 (see page 16).

AGR Seminars

SEMINARS	DATE	HOST INSTITUTION
Estimating Burr XII distribution parameters using cross entropy method	08/07/11	La Trobe University
The Topology of Compact Groups	29/07/11	La Trobe University
Introduction to Yang-Baxter equation and quantum groups	05/08/11	La Trobe University
Mahler tour AGR event: Thin integer matrix groups and the affine sieve	12/08/11	University of Western Australia
Dirichlet analogues of q-series and some tiling patterns from quasicrystals	02/09/11	La Trobe University
How to reconstruct a metric by its unparameterised geodesics	26/09/11	La Trobe University
Geodesically equivalent metrics	26/09/11	La Trobe University
Forecasting model validation	07/10/11	La Trobe University
Crossings and colourings: beyond the 5 colour theorem	21/10/11	La Trobe University
Perturbed determinants, spectral theory and longest cycles on graphs	08/11/11	University of South Australia
$F_q[M_n]$, $F_q[G_n]$ and $F_q[S_n]$ as quantized hyperalgebras	21/11/11	Professor Zoran Rakić University of Newcastle
SigmaOpt talk: A finite element method for density estimation with Gaussian process priors	21/11/11	University of Newcastle
Osserman type problems in Riemannian and pseudo-Riemannian geometry	24/11/11	Professor Zoran Rakić
AMSI/CARMA workshop on experimental and analytical mathematics: Marking the occasion of Jonathan Borwein's 60th Birthday	29/11/11 – 01/12/11	University of Newcastle
SigmaOpt talk: The asymmetric sandwich theorem	09/12/11	University of Newcastle
The minimum coverage probability of confidence intervals in regression after a preliminary F test	24/02/12	La Trobe University
Dispersive Quantization—the Talbot Effect	13/03/12	La Trobe University
Metrical musings on Littlewood and friends	23/03/12	La Trobe University
SigmaOpt seminar: Selection theorems in optimization, Part II: Applications	29/03/12	The University of Newcastle
A tighten-and-branch ILP algorithm framework under generalized formulation	30/03/12	RMIT University
Splittings, commutators and the linear Schrödinger equation	30/03/12	La Trobe University
A new look at nonnegativity and polynomial optimization	03/04/12	The University of Newcastle
Planning and control of massive networks	04/04/12	IRMACS Canada / University of Sydney
Pathological maximal monotone operators	05/04/12	The University of Newcastle
Sublevel sets of positively homogeneous functions and non-Gaussian integrals	11/04/12	The University of Newcastle
A structure theorem for maximally monotone operators with points of continuity	19/04/12	The University of Newcastle
A tale of two G_2	22/04/12	La Trobe University
Strong convergence in Hilbert spaces via gamma-duality	26/04/12	University of South Australia
Residuated lattices for the working mathematician	27/04/12	La Trobe University
Revealed preference theory revisited	27/04/12	RMIT University
Optimal disturbance rejection	11/05/12	RMIT University
Indirect cross-validation for density estimation	31/05/12	La Trobe University
Snippets from soil-water infiltration: where approximate becomes exact	01/06/12	La Trobe University

Scientific Workshops



Group-valued moment maps with applications to mathematics and physics

Kathy Horadam

WORKSHOP

SUMMARY

Integer Programming Workshop

The University of Newcastle 6–8 July 2011 Attendees: 65
 Speakers: Natashia Boland (University of Newcastle)
 Martin Savelsbergh (CSIRO)
 Hamish Waterer (University of Newcastle)

The workshop covered a wide range of topics within integer programming, with particular emphasis placed upon applications within the mining industry. The scientific program was excellent, with a perfect balance of methodological and applied presentations, as well as a perfect balance of senior and junior researchers presenting.

9th EUROPT Workshop on Advances in Continuous Optimization

The University of Ballarat 8–9 July 2011 Attendees: 46
 Speakers: Adil Bagirov (University of Ballarat)
 John Yearwood (University of Ballarat)

This workshop aimed to bring together international and Australian experts in the area of continuous optimisation and applications to meet and exchange their recent research findings and to discuss possible joint projects. The workshop attracted a number of international participants, and was considered a great success.

Hyamfest: Geometry and Topology Down Under

The University of Melbourne 11–22 July 2011
 Attendees: 115
 Speakers: Stephan Tillmann (University of Queensland)
 James Carlson (Clay Mathematics Institute)
 Loretta Bartolini (Oklahoma State), Danny Calegari (CalTech)

This two-week event consisted of two exciting weeks of lectures and workshops. The event brought together an impressive line-up of guests from the United States, Europe and Asia, and was attended by 115 students and researchers. Hyamfest attracted experts and emerging researchers who reported on recent results and explored future directions in the field of geometry and topology. The conference was held in honour of Hyam Rubinstein, and celebrated his contributions to topology and his long-standing role as an advocate for the mathematical sciences.

Algebraic Cycles and Orbit Spaces

Australian National University 2–4 September 2011
 Attendees: 31
 Speakers: Bruno Kahn (Université de Paris)
 Amnon Neeman (ANU)

This conference was held to coincide with the 60th birthday of Peter O'Sullivan, and to bring this beautiful theory to the attention of the Australian mathematical community where it has been thus far widely ignored and unknown. This particular aim was accomplished to high satisfactory levels.

Group-valued moment maps with applications to mathematics and physics

University of Adelaide 5–9 September 2011
 Attendees: 30
 Speakers: Craig Westerland (The University of Melbourne)
 Mathai Varghese (University of Adelaide)
 Snigdhayan Mahanta (University of Adelaide)
 Pedram Hekmati (University of Adelaide)

Moment maps are central objects in Hamiltonian mechanics and are used to construct conserved quantities for actions of Lie groups on symplectic manifolds. Typically the moment map takes values in the Lie algebra. In order to treat certain infinite dimensional examples on an equal footing, Professor Eckhard Meinrenken and his collaborators developed a formalism of Lie group-valued moment maps with striking applications to problems in quantisation and symplectic reduction. In a series of lucid lectures (total time ten hours), Professor Meinrenken explained the theory of group-valued moment maps, starting from a very basic level and ending with some state-of-the-art results.

Geometry of Differential Equations

Australian National University 19–23 September 2011
 Attendees: 59
 Speakers: Michael Eastwood (ANU)
 Rod Gover (University of Auckland) Katharina Neusser (ANU)

The aim of this meeting was to gather some of the world leaders in these closely related areas and to bring the emerging and rapidly developing field of parabolic differential geometry to the attention of the Australian mathematical community. These topics all involve a rich blend of algebraic and differential techniques, and were widely enjoyed by attendees.

Early Career Workshop 2011 - 55th Annual AustMS Meeting

University of Wollongong 25–26 September 2011
 Attendees: 120

This year's workshop included advice talks and discussion sessions around the themes of collaboration and managing a career with a family (or other obligations) as well as more advice on working in industry. The workshop provides opportunities for networking among ECRs and PhDs.

International Workshop on Hadamard Matrices and their Applications In honour of the 60th birthday of Prof. Kathy Horadam

RMIT 28–30 November 2011
 Attendees: 70
 Speakers: Asha Rao (RMIT University)
 Victor Alvarez (University of Sevilla)
 Jennifer Seberry (University of Wollongong)

This workshop was designed to foster a resurgence of interest in Hadamard matrices and successfully brought together the varied researchers in design theory and combinatorics from Australia and overseas. The main aim of the workshop was to encourage students and early career researchers in Australia to look at these fascinating objects, and to be inspired by the experts. The workshop managed to achieve maximum effect and national benefit by strategically coinciding with the Australasian Conference in Combinatorial Mathematics and Combinatorial Computing (ACCMCC).

Scientific Workshops *continued*

International Number Theory Conference in Memory of Alf van der Poorten

WORKSHOP**SUMMARY*****Australia New Zealand Rotating Flow Workshop***

Auckland University 9–11 January 2012 Attendees: 21
 Speakers: Jim Denier (University of Adelaide)
 Richard Clarke (University of Auckland)
 Michael Page (Monash University)
 Andrew Bassom (University of Western Australia)

The workshop covered fluid mechanics of rotating flows, including topics on: instabilities and bifurcation structures, inertial waves, physiological flows, polar vortices, stratification and geothermal applications. The workshop brought together researchers in Australia and New Zealand with an interest in the dynamics of rotating flows together with a number of international keynote speakers.

Connecting finite and infinite mathematics through symmetry

University of Wollongong 1–3 February 2012
 Attendees: 30
 Speakers: Cheryl Praeger (University of Western Australia)
 Jacqui Rammage (University of Wollongong)
 Akos Seress (University of Western Australia)

The main purpose of the workshop was the establishment of connections among different branches of mathematics, especially finite and infinite areas, with symmetry as the guiding principle. Because of the ubiquity of symmetry, the talks necessarily covered a very wide spectrum. The workshop achieved its main objectives. A community of ‘symmetry people’ was established, and attendees started to develop a common language that is absolutely necessary for collaborations among the different areas. Major research themes were identified, and a ‘management group’ coordinating further activities was organized.

Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing

University of New South Wales 13–17 February 2012
 Attendees: 191
 Speakers: Ian H. Sloan, Frances Y. Kuo, Josef Dick, Gareth Peters

The Tenth International MCQMC Conference was by all accounts a highly successful event. With 191 participants, including nearly 130 from overseas, it featured a very strong scientific program and a number of outstanding invited plenary speakers from all parts of the world, with many special sessions made available to attendees. Run biennially since 1994, the MCQMC conference has become the major event for researchers in the Monte Carlo and Quasi-Monte Carlo community. The School of Mathematics and Statistics at UNSW was proud to host MCQMC in the Southern Hemisphere for the first time in its history.

The Mathematical Implications of Gauge-String Dualities (Part 1)

University of Adelaide 5–9 March 2012 Attendees: 30
 Speakers: Prof Mathai Varghese, Dr Snigdhasan Mahanta,
 Dr Pedram Hekmati, Prof Peter Bouwknegt

Several mathematicians and physicists in Australia are working directly on problems related to some of these questions. The conference has given them a golden opportunity to interact with like-minded researchers within Australia and promote collaborative research, as well as benefit from the outstanding lectures given by the principal lecturers.

International Number Theory Conference in Memory of Alf van der Poorten

University of Newcastle 12–16 March 2012 Attendees: 65
 Speakers: Jon Borwein, Wadim Zudilin

The meeting commemorated the research and influence of Alf van der Poorten in number theory and generally in mathematics giving a comprehensive account of recent achievements in theoretic and computational number theory and its applications to cryptography and theoretic computer science. The meeting attracted a large number of international participants (about 50% of the total number of participants) from all over the world.

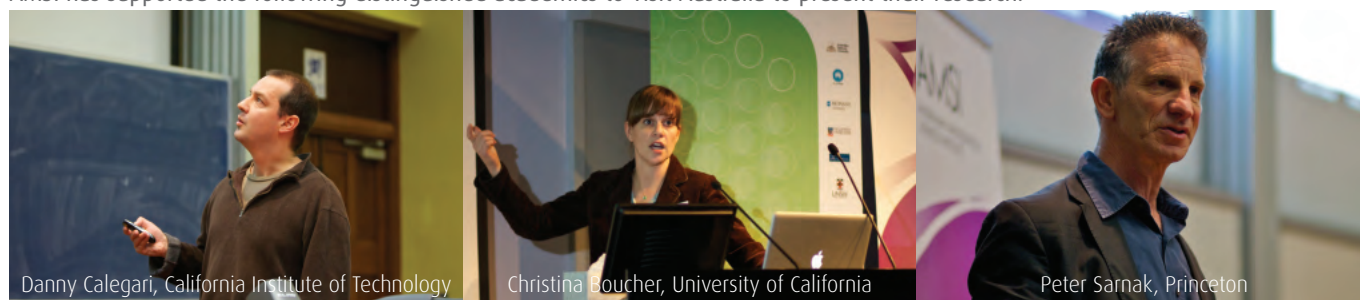
The Mathematical Implications of Gauge-String Dualities (Part 2)

University of Adelaide 19–23 March 2012 Attendees: 30
 Speakers: Peter Bouwknegt (Australian National University)
 Mathai Varghese, Snigdhasan Mahanta, and
 Pedram Hekmati (University of Adelaide)

String theory is a leading candidate for a grand unified theory of physics and has reinvigorated traditional research areas like topology, geometry, and representation theory by providing a fresh perspective. The second part of this workshop focused specifically on world renowned expert, Professor Jonathan M. Rosenberg, of the University of Maryland who is recognized for his extensive work in operator algebras and K-theory.

International Visitors

AMSI has supported the following distinguished academics to visit Australia to present their research.



Danny Calegari, California Institute of Technology

Christina Boucher, University of California

Peter Sarnak, Princeton

SPEAKER	UNIVERSITY	COUNTRY	RESEARCH INTERESTS
Integer Programming Workshop			
George Nemhauser	Georgia Tech	USA	Large-scale mixed-integer programming problems and their applications in maritime inventory routing
Matteo Fischetti	University of Padova	Venice	Mixed integer programming, combinatorial optimisation, vehicle routing and scheduling, graph theory, combinatorial algorithms, polyhedral combinatorics, 2D nesting problems.
Hyamfest: Geometry and Topology Down Under			
Mohammed Abouzaid	MIT	USA	Symplectic topology and its interactions with algebraic geometry and differential topology
Ian Agol	Berkeley	USA	Low-dimensional geometry
Michel Boileau	Toulouse	Europe	Proof of Thurston's Orbifold theorem and simplifications in Perelman's proof of Thurston's Geometrisation Conjecture
Danny Calegari	California Institute of Technology	USA	Geometry, dynamics and topology in low dimensions, geometric group theory
Marc Culler	UIC	USA	Geometric group theory and low-dimensional topology
Nathan Dunfield	University of Illinois	USA	Topology and geometry of 3-manifolds
David Gabai	Princeton	USA	low-dimensional topology and hyperbolic geometry
Cameron Gordon	UT Austin	USA	Geometric topology
Kazuo Habiro	Kyoto	Asia/Pacific	3-dimensional quantum topology
Joel Hass	UC Davis	USA	Topology and complexity theory, and applications of discrete geometry to biology
William Jaco	Oklahoma State University	USA	Low-dimensional topology, geometry, combinatorial and geometric group theory, and computational complexity
Thang Le	Georgia Institute of Technology	USA	Topological quantum field theory, knot invariants, and the Volume Conjecture
Feng Luo	Rutgers	USA	Differential geometry, analysis, triangulations, and normal surfaces
Darryl McCullough	University of Oklahoma	USA	Geometric topology
Yoav Moriah	Israel Institute of Technology	Asia/Pacific	Topology of 3-dimensional manifolds, particularly the theory of the Heegaard structure of these manifolds as a means of understanding their topology
Walter Neumann	Columbia University, Barnard College	USA	Algebraic geometry, group theory and topology
Yi Ni	California Institute of Technology	USA	3-dimensional topology and knot theory, specifically Heegaard Floer homology and its applications
Leonid Polterovich	Tel Aviv	Asia/Pacific	Symplectic geometry and topology
Martin Scharlemann	UC Santa Barbara	USA	Low-dimensional topology
Abigail Thompson	University of California at Davis	USA	Knot theory and 3-manifolds
Gang Tian	MIT/Zhejiang University	Asia/Pacific	Near surface geophysics, exploration seismology, marine geophysics
Genevieve Walsh	Tufts University	USA	Geometric topology and geometric group theory
Shicheng Wang	Peking University	Asia/Pacific	Broad geometric aspects of 3-manifold theory and knot theory, maps and automorphisms on manifolds of dimensions 2, 3 and 4
Algebraic Cycles and Orbit Spaces			
Yves André	École Normale Supérieure	Europe	Algebraic cycles
Bruno Kahn	Institute of Mathematics of Jussieu	Europe	Algebraic cycles
Shun-ichi Kimura	Hiroshima University	Asia/Pacific	Chow groups, especially Bloch's conjecture, bivariant intersection theory, Gröbner basis, toric varieties, non-commutative algebraic geometry
Chuck Weibel	Rutgers University	USA	Algebraic K-theory, motivic cohomology, Kahler differentials on singular varieties, algebraic geometry, homological algebra
Group-valued moment maps with applications to mathematics and physics			
Eckhard Meinrenken	University of Toronto	Canada	Symplectic geometry, Lie theory and mathematical physics
Maths for the future: Keep Australia competitive			
Celia Hoyles	University of London	UK	Mathematics education and policy development, including students' conceptions of proof, mathematical skills in modern workplaces, and computational environments for learning and sharing mathematics

Hosted Visitors *continued*

Algebraic cycles and Orbit Spaces workshop



Celia Hoyles, University of London



Robert Craigen, University of Manitoba

SPEAKER	UNIVERSITY	COUNTRY	RESEARCH INTERESTS
AMSI Graduate Winter school			
Jean Lasserre	Laboratory of Analysis and Architecture of Systems	France	Control theory, probability and production, planning and scheduling
Geometry of Differential Equations			
Willard Miller	University of Minnesota	USA	PDE's with a very large degree of symmetry, including superintegrable systems. The author of several standard monographs in the area.
Robert Bryant	Duke University	USA	Exterior differential systems
Lionel Mason	St Peter's College (Oxford)	Europe	Integrable systems and related approaches to PDEs of geometric origin
Peter Olver	University of Minnesota	USA	Applications of symmetry and Lie groups to differential equations
Jan Slovak	Masaryk University	Europe	Conformal geometry and parabolic geometries
Mahler Lecturer			
Peter Sarnak	Princeton	USA	Zeta functions and automorphic forms with applications to number theory, combinatorics, and mathematical physics
International Workshop on Hadamard Matrices and their Applications In honour of the 60th birthday of Prof. Kathy Horadam			
Dane Flannery	NUI Galway	Ireland	Theory and applications of Hadamard matrices
Robert Craigen	University of Manitoba	Canada	Theory and applications of Hadamard matrices
John Dillon	National Security Agency	USA	Theory and applications of Hadamard matrices
Jonfest: International Meeting to Celebrate the 60th Birthday of Jonathan Borwein			
Victor Moll	Tulane University	USA	Special functions, number theory, symbolic computation
Alejandro Jofre	Universidad de Chile	Chile	Optimisation and equilibrium
Neil Calkin	Clemson University	USA	Combinatorial and probabilistic methods, particularly in number theory
BioInfoSummer: AMSI Summer Symposium in Bioinformatics			
Sohrab Shah	UBC	Vancouver	Development and application of statistical models for inferring genomic abnormalities from high dimensional genomic measurements in tumour samples
Wade Hines	Australian Wlne Research Institute	USA	Biochemistry, molecular biology and pharmaceutical chemistry
Xiting Yan	Yale University	USA	Molecular biophysics and biochemistry
Christina Boucher	UCSD	USA	Design and implementation of algorithms that solve computational problems in genomics and transcriptomics
Australia New Zealand Rotating Flow Workshop			
Tom Mullin	The University of Manchester	UK	Bifurcation phenomena in viscous fluid flows
Jonathon Healey	Keele University	Europe	Hydrodynamic stability, particularly absolute/convective instability of rotating disk flows
Mike Foster	Rensselaer Polytechnic Institute	USA	Theoretical fluid dynamics
Connecting finite and infinite mathematics through symmetry			
Martin Liebeck	Imperial College, London	UK	Algebraic groups, finite simple groups, probabilistic group theory, permutation groups and algebraic combinatorics
Number Theory and Its Applications			
Rajesh Gopakumar	Harish-Chandra Research Institute	Asia/Pacific	Topological string theory
The Mathematical Implications of Gauge-String Dualities (Part 1)			
Jonathan Rosenberg	University of Maryland	USA	Operator algebras, geometry, topology and T-duality in string theory
International Number Theory Conference in Memory of Alf van der Poorten			
John Coates	Univ. of Cambridge	Europe	Cognitive and Behavioural Neuroscience
Frank Garvan	Univ. of Florida	USA	q-series, partitions, congruences for modular functions, symbolic computation
John Friedlander	Univ. of Toronto	Toronto	Analytic number theory
Roger Heath-Brown	Univ. of Oxford	UK	Analytic number theory
Carl Pomerance	Dartmouth College	USA	Number theory, cryptography, algorithms
Michel Waldschmidt	Paris 6 (UPMC)	Europe	Number theory and its applications



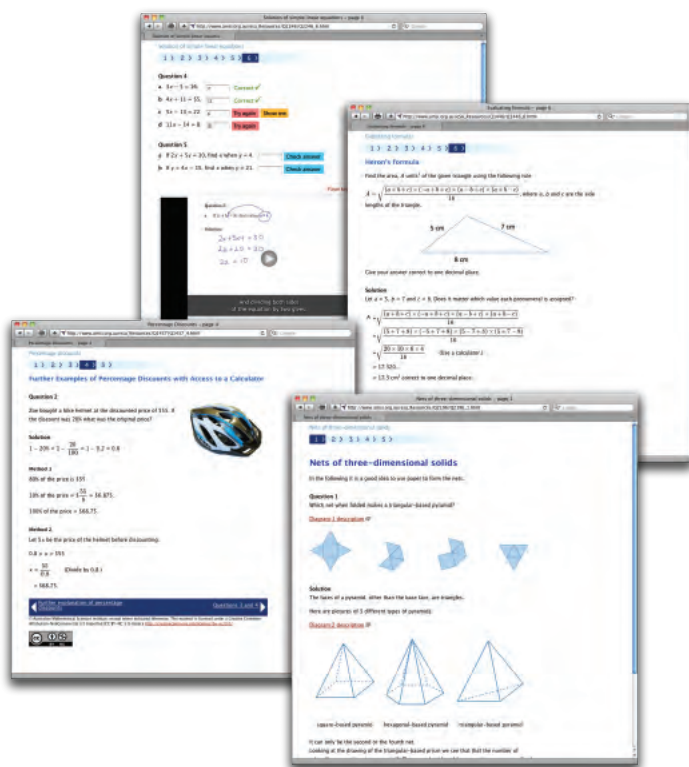
School Education

Improve Program

Michael Evans and Janine McIntosh are working with Education Services Australia (ESA) on the Improve program, which is designed to provide teachers and students with an online learning environment to prepare for NAPLAN tests. The program aims to guide students on their approach to NAPLAN-style questions, explaining the nature of each sample question and what the topic is about. The students will be able to answer a few questions and receive some feedback. They are then able to do some additional reading and exercises before attempting further questions. This process allows students to gain a deeper understanding of the expectations of the NAPLAN.

Australian Curriculum

AMSI has continued its work with the *Australian Curriculum, Assessment and Reporting Authority (ACARA)* this year. The work has included preparing drafts for the Australian Curriculum: Mathematics for Years 11 and 12, preparing extensive glossaries for the Specialist Mathematics course, and consulting with the mathematics community including state authorities, universities, professional associations and schools on matters relating to the Australian Curriculum.



ICE-EM Mathematics Textbooks

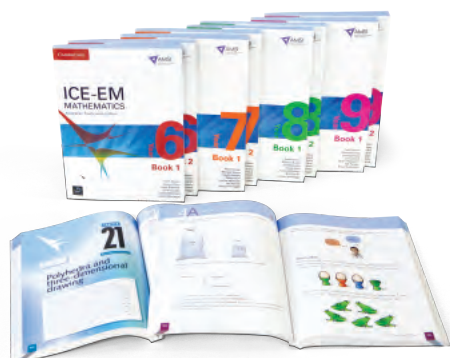
The ICE-EM Mathematics Australian Curriculum series is now available from Cambridge University Press. The twelve full-colour textbooks have been rewritten to meet the detailed requirements of the Australian Curriculum, while retaining the structure, depth and approach of the first edition. The series develops a clear understanding of mathematical ideas and concepts for students with a range of abilities, needs and levels of interest.

Sales of the Australian Curriculum edition stand at 32,000 as of 30 June 2012. Towards the end of 2012 and beginning of 2013, Michael Evans and Janine McIntosh will participate in professional development sessions for schools considering implementing the series in their schools.

Schools using the ICE-EM textbooks have the option to subscribe to Cambridge HOTmaths, a comprehensive online resource that has been customised for the Australian Curriculum. HOTmaths allows students to incorporate technology into their study of mathematics. The textbooks contain links to the online material including practice exercises, animations, interactive games, lessons and demonstrations. There is also a mathematics dictionary of terms and symbols embedded into the HOTmaths content. The resource allows teachers to review the progress of each student, and students receive immediate feedback as they work through questions, including hints when required.

The authors of the textbooks are:

- Years 5–6: Janine McIntosh, Garth Gaudry, Jacqui Ramagge, Colin Becker, Howard Cole and Andy Edwards.
- Years 7–8: Michael Evans, Peter Brown, Garth Gaudry, David Hunt, Bill Pender, Janine McIntosh, Garth Gaudry and Jacqui Ramagge.
- Years 9–10: Michael Evans, Peter Brown, Garth Gaudry, David Hunt, Robert McLaren, Bill Pender and Brian Woolcott.



Business Working with Education Foundation

AMSI is one of five not-for-profit organisations taking part in the Maths and Science Partnerships Project—Capacity Building of NFPs Initiative through the Victorian Government's Business Working with Education Foundation in 2012. Several AMSI staff members have attended training sessions covering general principles of marketing and public relations as they relate to fund raising, revenue generation and partnership development.

TIMES Project

The final report for the TIMES Project was approved by the Department of Employment, Education and Workplace Relations (DEEWR) on 21 July 2011. This completes AMSI's arrangement with DEEWR for TIMES.

The TIMES Project had four components: Outreach, Teacher Support, Careers Education, and a collaboration with CSIRO Education to produce Maths and Stats by Email. With the aid of additional funding, these four areas are still active and form part of AMSI's broader schools program.

The TIMES Project's four components:

Outreach

This year AMSI has continued its role in teacher training and support across Australia. Working with teachers face-to-face has proven to be very successful in helping them to develop high-quality, engaging mathematics programs for their students.

Since November 2011, Janine McIntosh has been contracted to the Townsville Catholic Education office in the Townsville–Mount Isa area. Over six one-week sessions, Janine worked with students, teachers and principals to assist schools in the diocese with implementing the new curriculum.

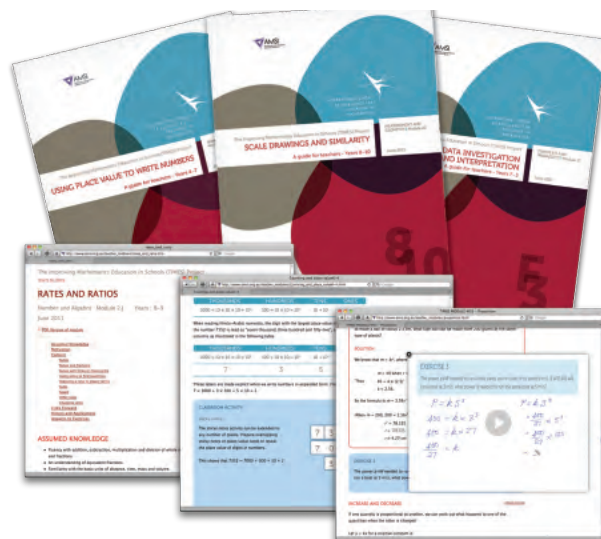
Janine also worked with a group of Year 7 teachers in the Geelong South-West region of the Victorian Department of Education and Early Childhood Development (DEECD). The ten-week program was designed to develop the teachers' content knowledge, focusing on decimals, fractions and percentages. Analysis of pre- and post-test results indicates that the program was successful, with all teachers demonstrating growth in understanding these key concepts and their implementation in the classroom.

Teacher Content Modules

AMSI's Teacher Content Modules are designed to support teachers by providing a resource to enhance their mathematics content knowledge. AMSI believes that a teacher with a sound understanding of the curriculum has a greater capacity to engage students with mathematics. The modules are organised under the strand titles of the Australian Curriculum:

- Number and Algebra
- Measurement and Geometry
- Statistics and Probability

The F–10 modules became publicly available in August 2011 and are linked to the SCOOTLE website of Educational Services Australia. Work has also commenced on modules for Years 11 and 12 in consultation with mathematicians, statisticians and mathematics educators.



The modules are available online at www.amsi.org.au/teachermodules

Posters



Careers Education

The Maths: Make Your Career Count campaign was launched in December 2010 with the aim of increasing students' awareness of the breadth of careers available to them if they pursue mathematics. Many young people and their parents are unaware that mathematical skills are highly valued in the Australian workforce, and that tertiary qualifications in mathematics or statistics often lead to very rewarding career opportunities.

The careers materials, funded by DEEWR through the TIMES Project, showcase a range of careers that involve the practical use of mathematics, presented in an attractive, accessible format appropriate for school students. Profiles include a meteorologist, zookeeper, chef, travel agent, and a football statistician, who all recognise the important role that mathematics plays in their profession.

The AMSI materials include:

- A set of 12 A2 posters.
- A booklet with 20 profiles of people in different careers explaining the importance of mathematics in their work.
- A DVD featuring 10 people using mathematics in their careers.

Every school in the country was provided with a set of the brand new careers materials completely free of charge in December 2010. The materials are a valuable resource for students, parents and teachers, and are distributed at careers exhibitions and on request. The careers campaign also includes a website, www.mathscareers.org.au, which currently receives 30-40 visitors per day.

The materials are available from www.mathscareers.org.au or email times@amsi.org.au.



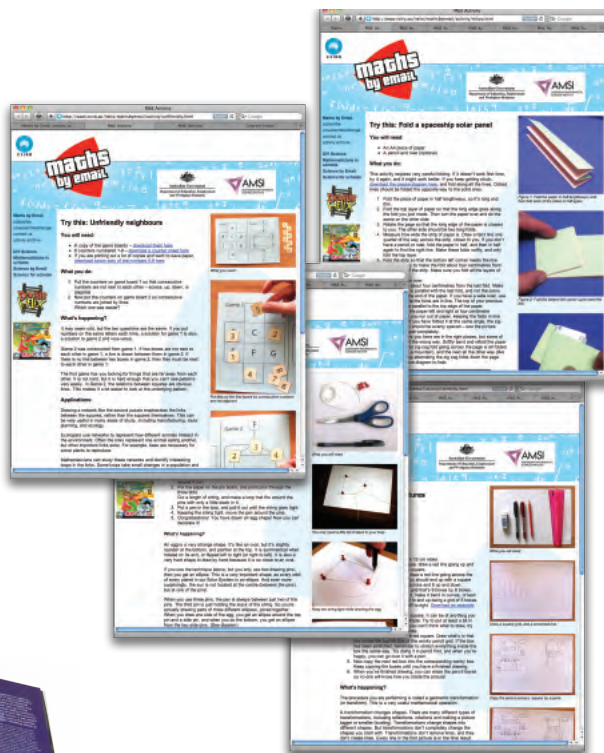
CSIRO Collaboration

CSIRO Education, AMSI and the ABS jointly produce a free fortnightly newsletter called Maths and Stats by Email, which is sent to student, teacher and parent subscribers.

Each newsletter features stories from the cutting-edge of mathematics, brainteasers, facts, links to interesting websites, and lively discussions about mathematics in the news. The newsletter is very popular and has over 10,000 subscribers.

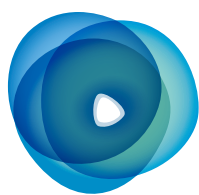
For more information visit: www.mathematiciansinschools.edu.au

To subscribe: www.csiro.edu.au/resources/Maths-by-Email.html





Business, Industry and Government



AMSI Intern

AMSI Intern is an innovative university and industry collaboration that connects business and other organisations to the vast research expertise in Australia's universities. Our aim is to provide postgraduate students with the opportunity to take part in paid, research-based internships, guided by an academic mentor at their home institution. Small-to-medium enterprises seeking high-end analytical expertise can take on an intern to address a specific research challenge or problem facing their business. Projects can cover any research area—not just mathematics and statistics—and typically last 4-5 months.

AMSI facilitates the delivery of the program, working with students, academics and industry partners nationally. The program is currently funded through the Commonwealth's Enterprise Connect, an Australian Government initiative within the Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE). The industry partner is required to pay the intern's stipend for the duration of the project, with all other costs covered by Enterprise Connect and AMSI.

AMSI Intern has developed significantly over the last 12 months. Cate Ballard, the Business Development Manager, is making regular visits to member universities and attending industry events to raise awareness of the program. Cate currently works onsite at Victorian full member universities one day per week to create an additional presence and build relationships with potential interns and academic mentors. These efforts have seen significant uplift in the number of student applications and enquiries regarding the program.

This year we have also been working closely with Mitacs in Canada to gain an in-depth understanding of key business development and marketing strategies that have been critical to the growth of Mitacs. This relationship has also been useful for improving our internal processes and procedures.

Future Growth

Securing ongoing funding remains a key long-term challenge for AMSI Intern. We are currently identifying avenues to obtain state level funding to underpin future development of the program. We are also investigating the benefits of embedding the program into some postgraduate courses, particularly masters by coursework programs. Early discussions are underway with three universities and we hope to have a program in place by 2013.

We are also negotiating with two universities to build the relationship for AMSI Intern from the Deputy Vice Chancellor (Research) offices. Advocacy from this level will provide the program with increased credibility and encourage more academics to engage with the program. This is of critical importance now that AMSI Intern has expanded to cover all disciplines, not just mathematics and statistics.

Enterprise Connect

AMSI's partnership with Enterprise Connect continued this year, and has allowed AMSI to expand its internships program significantly by funding 90 internships over a three-year period. Enterprise Connect is an Australian Government initiative in the Department of Innovation, Industry, Science and Research (DIISR). The program gives small to medium enterprises access to the analytical skills that support innovation and productivity, and provides valuable industry experience to interns.



ENTERPRISE CONNECT

Shaping Business, Transforming Industry

Recent projects

Bass Coast Shire Council

Intern: Hossein Pourali, RMIT University

Industry Partner: Paul Lennox, Bass Coast Shire Council

Academic Mentor: Associate Professor Colin Arrowsmith, School of Mathematical and Geospatial Sciences, RMIT University

Natural disasters seem to be on the rise, and the devastating nature of recent floods in Australia prompted Bass Coast Shire Council to enlist a mathematician. Changes in land usage—no matter how small—can be responsible for large changes in water drainage. PhD candidate Hossein Pourali worked with the council to develop a digital elevation model of the local area, which provides detailed information about water flow patterns. Hossein built on previous work by developing a model that incorporates natural surface drainage patterns, underground drainage pipeline networks, interconnecting drainage pits, buildings and impervious surfaces specific to the Bass Coast area. A major advantage of this model is its ability to be modified. Coastal areas all over the world will be able to use it as an initial planning tool for development and climate change adaptation.



"Hollie's area of expertise has provided Enware with a much needed skill set that has allowed us to customise our main database, increasing our productivity."

Tim Robinson, Enware Australia

Show Works Creative Solutions

Intern: Gauri Laud, RMIT University

Industry Partner: Tim Blaikie, Business Development Manager, Show Works Creative Solutions

Academic Mentor: Dr Raju Mulye, School of Economics, Finance and Marketing, RMIT University

Show Works Pty Ltd is a Melbourne-based company that designs and builds theatre scenery and force-reducing dance floors. The Sprung Floor by Show Works™ is a low-cost dance floor aimed primarily at young dance teachers setting up their first business. With high advertising and rental costs, many new dance teachers end up teaching on concrete slabs, increasing the risk of injury to themselves and their students. During her 5-month internship, PhD candidate Gauri Laud analysed the perception and market potential of Sprung Floor by Show Works™, and examined the company's capacity to enter the more competitive European market. The research process included a series of in-depth interviews with representatives from within and outside Show Works' current target market segments. Gauri identified ways that Show Works can improve their marketing strategy and expand the business to groups outside the dance industry. She also made recommendations about how to effectively approach the European market.



"AMSI Intern has provided us with the opportunity to enter into the world of market research at a fraction of the normal cost and I hope that this is just the beginning of our relationship with them."

Tim Blaikie, Show Works Creative Solutions

Enware Australia

Intern: Huiyuan 'Hollie' Zheng, Macquarie University

Industry Partner: Tim Robinson, Communications and Training Coordinator, Enware Australia

Academic Mentor: Professor Jian Yang, Department of Computing, Macquarie University

With environmental concerns motivating many businesses to go paper-free, demand for high-level databasing skills continues to grow. Successful software programs must be easy to use and encompass as many facets of the business as possible. Enware Australia is a leading manufacturer of commercial tapware and valves, and distributes a range of other water and gas related products. PhD candidate Huiyuan Zheng worked with Enware staff to upgrade the software the company uses to control its manufacturing processes, product and price management systems and accounting details. The new system is a highly customisable database that has led to a substantial increase in productivity throughout the company.



Partnership with Parks Victoria

In 2010, AMSI entered into a three-year collaboration with Parks Victoria to provide statistical and analytical support to Parks Victoria's environmental monitoring, evaluation and reporting processes. Parks Victoria is responsible for managing a diverse estate covering more than 4 million hectares, or about 17 percent of Victoria. This area includes national parks, urban parks, large wilderness areas and 70 percent of Victoria's coastline.

AMSI statistician Kally Yuen has analysed the data collected for some of their monitoring programs and provided statistical advice for a range of conservation projects within Victorian national parks.

English broom adaptive experimental management program in the Alpine National Park

The English broom adaptive experimental management program was established by Parks Victoria in 2003 to evaluate the effectiveness, efficiency and environmental outcomes of three best-practice herbicides used for controlling English broom following the 2003 bushfires in the Alpine National Park. This is Parks Victoria's longest-running pest-plant experimental management program, with data having been collected over the past seven years. Kally worked with Parks Victoria technical and field staff to analyse and interpret the results of this important work. A number of very useful findings have emerged that will greatly assist with the management of this highly-invasive weed into the future. For example, this work has demonstrated that once broom cover has been reduced to a minimal level following the application of herbicide, spraying once every two years may be sufficient to maintain low levels of weed cover. Parks Victoria is considering further study to formally evaluate the effectiveness of this strategy. If the biennial schedule is effective, huge cost saving and less damage to off-target species may result.

Koala abundance & tree condition in Great Otway National Park

In Great Otway National Park, over-abundant koala populations are impacting on coastal woodland vegetation. Over-browsing of highly-preferred feed tree species is contributing to defoliation and tree death which may cause potential risks to koala populations. Parks Victoria has commenced the development of a monitoring program to assess changes in both the condition of the vegetation and koala abundance over time.

The first phase is a pilot study designed with Kally's support to gain some information about koala abundance and tree condition in four areas in the national park. It is believed that the results will assist in designing a robust program for monitoring koala abundance and tree condition.

Goat monitoring program in the Alpine National Park

Feral goats are a significant environmental and agricultural pest. They can have a major effect on native vegetation through overgrazing of native herbs, grasses, shrubs and trees and preventing regeneration. Feral goats are responsible for damage to soil structure which can lead to erosion. They foul waterholes and can introduce weeds through seeds carried in their dung. Particularly during times of drought, feral goats can compete with native animals and domestic stock for food, water and shelter. Recently, goat abundance has increased in the Alpine National Park. To reduce goat abundance, Parks Victoria has conducted a series of controlled shooting operations in conjunction with the Sporting Shooters' Association of Australia (Upper Murray section). These operations commenced in May 2006 and are ongoing. Data have been collected during each operation to examine whether the abundance of goats as measured by the catch per unit effort indicator has decreased over time. Kally analysed the data and generated a statistical report for staff in Parks Victoria to aid in their evaluation of the program.

Many thanks to Dr John Wright, Dr Marie Keatley, Ms Lorraine Ludewigs and Mr Glen Jameson from Parks Victoria for their contribution to this section.



Figure 1a: Broom plants continued to thrive in one untreated site.



Figure 1b: Regeneration of native grasses, plants and trees after broom plants were sprayed by herbicide in one of the treated sites; these photos were taken at the time of site assessments in 2008.

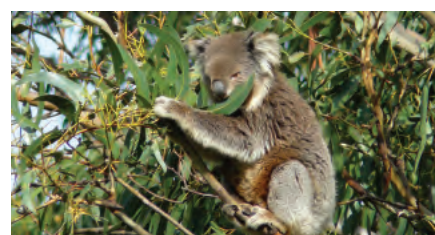


Figure 2a: A koala browsing at Kennett River in Great Otway National Park.



Figure 2b: Dead coastal woodland vegetation along Great Ocean Road near Kennett River; these photos were taken in 2011.

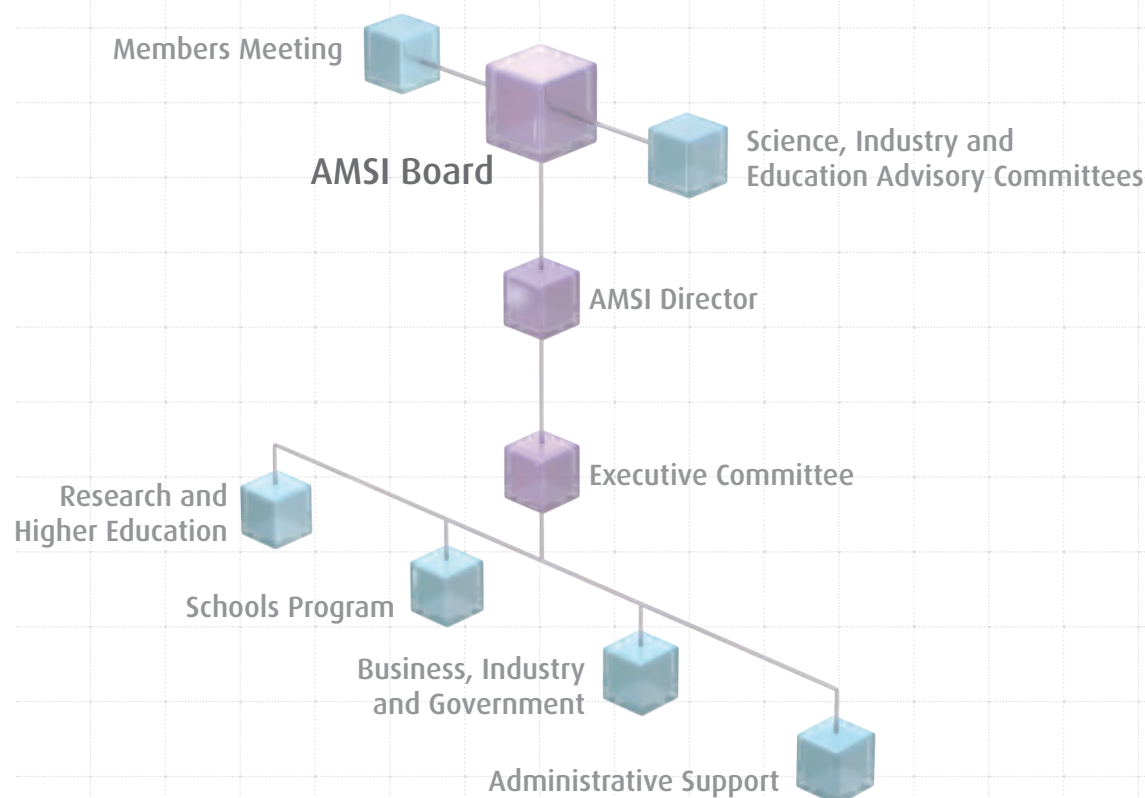


Figure 3: A Judas goat fitted with a radio collar and released back into the wild to rejoin its herd in the Alpine National Park. The tracking device then leads the shooters straight to their location. Shooters target the rest of the herd but spare the Judas goat.

AMSI Members Meeting



Organisational Structure



Structure of AMSI

AMSI is a collaborative unincorporated joint venture involving universities and other bodies related to the mathematical sciences. Six full member universities signed a Joint Venture Agreement (JVA) in 2002. Since then four additional universities have become full members. All Group of Eight universities are full members. A complete list of AMSI members appears on page 6 of this report.

Management of AMSI

The JVA empowers the AMSI Board to be responsible for the overall direction of the Institute, formulation of policies, and management of activities in AMSI's three portfolio areas:

- Research and Higher Education
- Business, Government and Industry
- Primary and Secondary School Education

External advice is provided by two high-profile advisory committees.

Activities are detailed in the Business Plan and Budget document, as authorised annually by the full members and the Board. Management of the Institute and its activities, as detailed in the Business Plan and Budget document, is the responsibility of the Executive Committee authorised to perform such functions by the Board. Members of the Executive Committee are listed on page 40.

The AMSI Board

Composition

The Board comprises up to 13 persons being:

- An independent Chair appointed by the full members
- The Institute Director
- The Deputy Director appointed by the full members
- One person representing The University of Melbourne
- Two people representing the full members appointed by mutual agreement of the full members
- Two people representing the associate members appointed by mutual agreement of the associate members
- Up to five independent members representing business and industry appointed by mutual agreement of the full members

No non-executive members of the Board are remunerated.

Term of Board members

The persons comprising the Board are appointed for terms of one year but are eligible to serve for one or more further terms if re-appointed in accordance with clause 19.2 of the Joint Venture Agreement. Board representatives for the full members and associate members will serve two-year terms.

Board Members 2011-2012



Dr James E. Lewis BE, BA, PhD, FIChemE
Independent member and Chairman
to September 2011

Jim is President of the Parkview Group Pty Ltd and Director of several other companies. He has had a long career in industry and for a significant period was responsible for the research effort of one of Australia's major corporations.



Dr Ron Sandland BSc (Hons), PhD, FTSE, AM
Independent Member and Chairman from
September 2011

Ron was Deputy Chief Executive of CSIRO from 1999 to 2007 and currently chairs the Steering Committee of the Australian National Data Service and the Advisory Board of the Australian Centre of Excellence in Risk Analysis. He is a member of the Council of the University of Technology Sydney and chairs its Commercial Activities Committee. He is a Fellow of the Australian Academy of Technological Sciences and Engineering, and was made a member of the Order of Australia in 2007.



Prof. Geoff Prince
BSc (Hons), DipEd, PhD, FAustMS
Director of AMSI

Prior to joining AMSI, Geoff was Head of the Department of Mathematics and Statistics at La Trobe University, sat on the board of the Australian Centre of Excellence for Risk Analysis (2006–2009) as AMSI's representative, and was Vice President of the Australian Mathematical Society (2008–2009). Geoff's involvement with AMSI dates to 2004–2006 when he was Deputy Director, Executive Director, Acting Director, and Access Grid Room coordinator. His research interests are in the field of applications of differential geometry to ordinary and partial differential equations, uncovering results in electrodynamics through to highway design.



Prof. Andrew Eberhard BSc, PhD
Deputy Director to 28 June 2012

Andrew Eberhard is a Professor of Mathematics at RMIT University in Melbourne (Victoria). He is the Discipline head of Mathematics and Statistics and an active member of the Platform Technologies Research Institute where he is head of the Network Modelling, Optimisation and Dynamics (NetMod) grouping. He has worked and published extensively in many areas of variational analysis and his interests include the theory of variational limits, monotone operator theory, nonsmooth optimisation, the theory of viscosity solutions of Hessian and curvature equations, robust control and systems theory. More recently he has worked on utility function approximation and the theory of revealed preferences, and has a growing interest in integer programming and algorithms.



Dr Eileen Doyle BMath, MMath, PhD, FAICD
Independent member
from 18 February 2010

Eileen has more than three decades of diverse business experience at both the executive and board level. She has held executive roles in the steel industry, the water and wastewater industry and the timber industry. Her non-executive director roles have covered a wide range of industries including research, financial services, business services, building and construction, steel, mining, logistics and export. Eileen is currently Chair of the Hunter Valley Research Foundation and the Hunter Founders Forum and Director of Bradken, CSIRO, Boral and GPT.



Prof. Aleks Owczarek BSc (Hons), PhD
Nominee of the University of Melbourne
from 18 February 2011

Aleks is Head of the Department of Mathematics and Statistics at the University of Melbourne. His research interests lie in the general field of statistical mechanics, in particular the area of phase transitions and critical phenomena especially pertaining to model polymer systems. He is part of a Statistical Mechanics and Combinatorics Group working on these topics and is also a Chief Investigator of the ARC Centre of Excellence in the Mathematics and Statistics of Complex Systems.



Prof. Tony Dooley BSc, PhD, FAICD
Representative of the Full Members
to 28 June 2012

Tony was Head of the School of Mathematics and Statistics at the University of New South Wales to April 2012. His research interests are in harmonic analysis on Lie groups: ergodic theory. He is a Member of the College of Experts EPSRC (United Kingdom), the MIST panel PBRF (New Zealand), sits on the board of the National Institute of Dramatic Art and sat on the ARC MICS Expert advisory panel (2001–2004).



Prof. Louis Caccettá
BSc, PhD, FTICA, FAustMS, MASOR
Representative of the Associate Members
to 28 June 2012

Louis has been Head of the Department of Mathematics & Statistics at Curtin University since December 2010, and was Head from 1994 to 2004. In October 1999, he formed the Western Australian Centre of Excellence in Industrial Optimisation (WACEIO) and has been its Director ever since. His research interests include combinatorics, graph factorisations, graph theory and its applications in network design and analysis, vehicle routing problems, open pit mining and network reliability.



A/Prof. David Easdown BA, PhD

Representative of the Full Members from 5 July 2011

David has wide interests in mathematics and mathematics education. He has published over 40 research papers and a successful undergraduate textbook, now in its third edition. He is Director of First Year Studies within the School of Mathematics and Statistics at the University of Sydney. He is participating, together with colleagues from the University of Melbourne, University of Adelaide and Curtin University, in a project funded by the Office of Learning and Teaching entitled, *Building leadership capacity in university first year learning and teaching in the mathematical sciences*.



Prof. Stan Miklavcic

BSc (Hons), PhD, FAustMS

Representative of the Associate Members from 5 July 2011

Stan is Director of the Phenomics and Bioinformatics Research Centre in the School of Mathematics and Statistics at the University of South Australia and formerly Head of School (2007–2012). He has published over 75 articles on his research in industrial and applied mathematics in international peer reviewed journals, conference proceedings and book chapters. Stan is a life member of the Swedish Mathematical Society and is a Fellow of the Australian Mathematical Society.

Board Observers

The Chairs of the Advisory Committees, President of the Australian Mathematical Society, Director of MASCOS and Chair of the National Committee for Mathematical Sciences are also invited on to the Board as observers.



Prof. Jon Borwein

BA (Hons), MSc, PhD, FRSC, FAAA, FAA

Chair of the Scientific Advisory Committee

Jon is Laureate Professor of mathematics at the University of Newcastle and Director of the Centre for Computer Assisted Research Mathematics and its Applications (CARMA). His research interests span pure mathematics (analysis), applied mathematics (optimisation), computational mathematics (numerical and computational analysis), and high performance computing. He has also worked at Carnegie-Melon, Dalhousie, Simon Fraser, and Waterloo Universities and has held two Canada Research Chairs. He is a past winner of the Chauvenet Prize (1993) and received an honorary degree from Limoges (1999). Jon is a Fellow of the Royal Society of Canada (1994), the American Association for the Advancement of Science (2002), and the Bulgarian Academy of Sciences (2003). In 2010 he was elected as a Fellow of the Australian Academy of Science.



Prof. Tony Guttman

MSc, PhD, FAustMS, FAA, FTSE, FSIAM

Director of MASCOS

Tony was Interim Director of AMSI upon its foundation and an organiser of the BHP Billiton/The University of Melbourne School Mathematics Competition. His research interests lie in mathematical models of phase transitions, enumerative combinatorics and critical phenomena in general. He currently holds an ARC Discovery Outstanding Researcher Award.

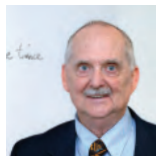


Prof. Peter G. Taylor BSc (Hons), PhD

President of the Australian Mathematical Society

Peter is internationally known for his research in applied probability and stochastic modelling. He is Editor-in-Chief of *Stochastic Models* and an associate editor of *Queueing Systems* and a member of the editorial board of the *Journal of Applied Probability/Advances in Applied Probability*. In 2008, Peter became one of the five trustees of the Applied Probability Trust. From February 2006 to February 2008, Peter was Chair of the Australia and New Zealand Division of Industrial and Applied Mathematics (ANZIAM).

Dr Bob Anderssen BSc, MSc, PhD, OAM



Chair of the Education Advisory Committee

Bob, due to his keen interest in the application of mathematics to real-world and industrial inverse problems, accepted a position in industrial and computational mathematics in the CSIRO Division of Mathematics and Statistics in 1979. He has been directly involved with the mathematics profession in Australia through various positions, including Chair of the Division of Applied Mathematics of the AustMS (now ANZIAM), President of the AustMS, Chair of the NCMS, and more recently as a regular contributor to the Australian Mathematics In Industry Study Group (MISG), CSIRO's Mathematicians in Schools initiative, and as advisor to the Editor of CSIRO's *Mathematics and Statistics by Email*. Bob was awarded the Order of Australia medal in 2010 for services to the mathematical and information sciences.



Prof. Nalini Joshi

BSc (Hons), MA, PhD, FAA

Chair of the National Committee for Mathematical Sciences

Nalini is Chair of Applied Mathematics and Director of the Centre for Mathematical Biology at the University of Sydney. Her research interests lie in integrable differential equations, difference equations, and extended versions of cellular automata. She was elected fellow of the Australian Academy of Science in 2008, President of the Australian Mathematical Society to September 2011 and has held visiting positions around the world.

Board Meetings

Board meetings were held on the 5th of July and 5th of October 2011, and on the 9th of February, 2nd of May, and 29th of June 2012.

Dr James E. Lewis (to September 2011) 1 of 1
 Dr Ron Sandland (from September 2011) 4 of 4
 Dr Eileen Doyle 3 of 5
 Prof. Geoff Prince 5 of 5
 Prof. Andrew Eberhard 5 of 5

Prof. Aleks Owczarek 5 of 5
 Prof. Tony Dooley (to 29 June 2012) 3 of 5
 Prof. Louis Caccetta (to 29 June 2012) 2 of 5
 Assoc. Prof. David Easdown (from 5 July 2011) 4 of 5
 Prof. Stan Miklavcic (from 5 July 2011) 4 of 5

Committee Membership

Scientific Advisory Committee

Prof. Jon Borwein (University of Newcastle) (Chair)
 Prof. Phil Broadbridge (La Trobe University)
 Prof. Darren Crowdy (Imperial College London)
 Prof. Ezra Getzler (Northwestern University, Chicago)
 Prof. Nalini Joshi (University of Sydney)
 Prof. Frances Kirwan (University of Oxford)
 Prof. Geoff Prince (Director, ex officio)
 Prof. Terry Speed (University of California, Berkeley; Walter and Eliza Hall Institute)
 Prof. Terence Tao (University of California, Los Angeles)
 Prof. Neil Trudinger (Australian National University)

Education Advisory Committee

Dr Bob Anderssen (CSIRO) (Chair)
 Mr Abdulmoeed Arayne (Brunswick Secondary College)
 Dr Frank Barrington (University of Melbourne)
 Mr Peter Brown (University of New South Wales)
 Prof. Jim Denier (University of Adelaide) – to October 2011
 Dr Michael Evans (AMSI)
 Ms Janine McIntosh (AMSI)
 Prof. Jacqui Ramagge (University of Wollongong)
 Ms Jan Thomas (AMSI)
 Mr David Treeby (Ivanhoe Girls' Grammar School)
 Dr Leigh Wood (Macquarie University)
 Dr Frank Yu (Australian Bureau of Statistics)
 Dr Philip Swedosh (St Leonard's College)
 A/Prof. Kim Beswick (AAMT President)

Executive Committee

Prof. Geoff Prince (AMSI Director)
 Prof. Andrew Eberhard (Deputy Director to 28 June 2012)
 Prof. Mark Gould (Deputy Director from 28 June 2012)
 Mr Rod Birch (Business Manager)
 Mrs Cate Ballard (Business Development Manager: Internships)
 Dr Michael Evans (Schools Project Manager)
 Ms Janine McIntosh (Schools Project Officer)
 Ms Simi Henderson (Program Manager: Research & Higher Education)

Stakeholders

Members

Full Members and Associate Members are listed on page 6. They meet as a group twice a year, normally in February and June or July.

In the 2010–11 year, the meetings were:

- 18 February 2011 at The University of Melbourne
- 5 July 2011 at The University of Melbourne

Other stakeholders

AMSI was established through a grant from the Victorian Government and with in-kind input by The University of Melbourne. Funding through this grant ceased on 30 June 2005. The following additional funding has been received since inception:

2004: AMSI won a tender from the Department of Education, Science and Training (DEST) for an International Centre of Excellence for Education in Mathematics (ICE-EM), the project was funded for four years until July 2008.

2007: AMSI received funding from the Department of Education Employment and Workplace Relations (DEEWR) under the Collaboration and Structural Reform Fund (CASR). The three-year National Collaboration in the Mathematical Sciences: integrating research, industry and education grant funded many of AMSI's flagship programs.

2009: AMSI received further funding from DEEWR for The Improving Mathematics Education in Schools (TIMES) project. The project was funded for one year and extended AMSI's education program.

2010: AMSI entered into a three-year partnership with Enterprise Connect, an initiative of the Department of Innovation, Industry, Science and Research (DIISR). The three-year partnership expands the AMSI Internship Program.

Comprehensive progress reports and updated business plans are presented in accordance with the Funding Agreements.

Communication with stakeholders

All Full and Associate Members of AMSI have nominated a person to be their representative to communicate with AMSI. In the case of member universities, this is usually the Head of the Department or School or Discipline of Mathematics and Statistics. These 'member representatives' or their proxies are invited to meet as a group every six months to hear reports of progress on current matters and to raise matters of common interest and concern.

The AMSI Director's monthly reports on activities are emailed to Board members, committee members and AMSI member representatives.

The Joint Venture Agreement members meet bimonthly to provide input on AMSI activities.

Employees

Policies and procedures

Staff members are employed on fixed term contracts through the University of Melbourne and its policies and procedures are followed.

AMSI staff



Professor Geoff Prince

BSc (Hons), DipEd, PhD, FAustMS

Director of AMSI

is profiled on page 38



Mr Rod Birch BComm

Business Manager

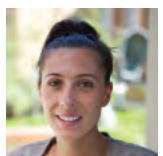
Rod joined AMSI as Business Manager in October 2011. Formerly with the Faculty of Medicine, Dentistry and Health Sciences at the University of Melbourne, his career has spanned work in Government, two major accounting firms and a major bank and has included consulting to the tertiary education sector.



Ms Simi Henderson BSc (Hons)

Program Manager (Research and Higher Ed)

Simi manages AMSI's Research and Higher Education program. The program comprises AMSI's flagship programs, workshop sponsorship, industry events and lecture tours. She also undertakes various project work within the Institute. During her time at AMSI, Simi has also worked as Research Assistant on the ALTC funded Mathematics for 21st Century Engineering Students project.



Cate Ballard BBus (Tourism & Communications)

Business Development Manager (AMSI Intern)

Cate is the Business Development Manager for AMSI Intern. Her role is to develop and grow the postgraduate internship business of AMSI. Students from a variety of disciplines are matched with private companies and public agencies, depending on their business needs. Before coming to AMSI, Cate worked at the International College of Management, Sydney, in a dual role as an Industry Training/Learning & Development Manager and Business Development Manager. She has also held two strategic sales and marketing roles in the corporate world.



Edwena Dixon BBus (Mktg), AdvDip Bus (Mktg)

Internships (AMSI Intern)

Edwena fosters collaboration between universities and industry for the AMSI Intern Program. With her background in Business (Marketing), Edwena ensures that AMSI sends the right message in the right way, to garner as much attention for the Mathematical Sciences as possible.



Emma Bland BSc, DipMathSc

Media and Communications

Emma joined AMSI in March 2011 to help communicate AMSI's vision and activity to government, members and the public. She writes press releases and edits AMSI publications including member bulletins and the annual report. Emma graduated from the University of Melbourne in 2011 and is currently undertaking her honours year with the Space Physics Group at La Trobe University.

Honorary staff



Ms Jan Thomas BSc (Hons), DipEd, BED (TESOL)

Senior Fellow

Jan was AMSI's Executive Officer until March 2011. She is now a Senior Fellow at the University of Melbourne and has an office at AMSI. Before coming to AMSI, Jan worked as a teacher, as a consultant in schools and as a lecturer in teacher education. Her research interests are concerned with the effect of language and culture on mathematics learning. She believes access to a good mathematics education, along with good communication skills, is fundamental to an equitable and socially just society.



Dr Michael Evans BSc (Hons), PhD, DipEd

ICE-EM Mathematics Manager

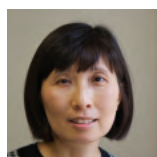
Before coming to ICE-EM, Michael was Head of Mathematics at Scotch College, Melbourne. He has worked with the Victorian Curriculum Assessment Authority (VCAA) in various capacities and over many years. He also has a continuing involvement with the Australian Curriculum. In 1999 he was awarded an honorary Doctor of Laws by Monash University for his contribution to mathematics education. In 2001 he received the Bernhard Neumann award for his contributions to mathematics enrichment in Australia.



Ms Janine McIntosh DipT

Schools Project Manager

Janine McIntosh is the Schools Project Manager. Her role is to develop school mathematics material and to work with teachers to enhance the mathematics experiences of the children they teach. Janine is an experienced primary teacher who has also worked as curriculum writer for the VCAA and the Australian Curriculum, Assessment and Reporting Authority (ACARA), in mathematics education at The University of Melbourne and serves on the Maths Challenge committee of the Australian Mathematics Trust.



Ms Kally Yuen HkY & Nut y / 2S Yi 2GYzgz

Statistician

Kally works as a statistical consultant to the research team at Parks Victoria, providing statistical advice on study designs and performing data analysis for Parks Victoria projects. Kally has worked for many years as a biostatistician at the Peter MacCallum Cancer Centre and the Centre for Youth Mental Health at the University of Melbourne. She is an accredited statistician, awarded by the Statistical Society of Australia in 2004.



Michael Shaw

BA (Hons), AdvDip (Electronic Design & Interactive Media)

Multimedia Manager

Michael is the resident designer for AMSI's marketing material and multimedia projects. He is also the in house photographer for print and special events. He assists staff in using multimedia technology which improves communication both inside and outside the organisation.



Anne Nuguid BBNSc

Administrative Assistant

Anne provides executive assistance to the Director, communicates with the AMSI Membership, performs administrative tasks for the Board, and coordinates ad-hoc events. She also provides administrative support for the ACHMS. Anne completed a Bachelor of Behavioural Neuroscience in 2005 with a second major in pharmacology, and is currently completing a Graduate Diploma in Management on a part-time basis.

WAVE = AMAS
JAM

Financial Statements

Commentary

AMSI's financial records are managed and administered by AMSI staff in conjunction with, and using the facilities of, The University of Melbourne.

All financial statements are reconciled to the University's integrated system Themis to ensure appropriate compliance and to confirm the amount of available cash reserves held by the University on behalf of AMSI.

During the year ended 30 June 2012, income remained consistent with prior years, although operating costs were significantly reduced, leaving the Institute in a sound financial position heading into 2012/2013.

The AMSI core operation, with financial support from Member subscriptions, commercial revenues and contributions from intern placements continues to be able to support key programs over the coming year.

Whilst not reflected in the financial statements as at 30 June 2012, the \$2m grant awarded to AMSI in July 2012 by the Federal Government will provide us with on-going funding over the next 4 years, for the Research and Higher Education Portfolio.

Our net revenues from our publishing activities continue to grow, and the intern program is on track to achieve budgeted financial outcomes.

Certification

The University of Melbourne undertakes to provide audited financial statements for all contractually funded activities but not for the overall AMSI Group. In the absence of such an overall audit statement, the following certification is provided.

We hereby certify that the funds received by the AMSI Group during 2011/12 and the expenditure incurred during that period were in accordance with the relevant funding agreements, with the AMSI Joint Venture Agreement, and with the approved Business Plan.

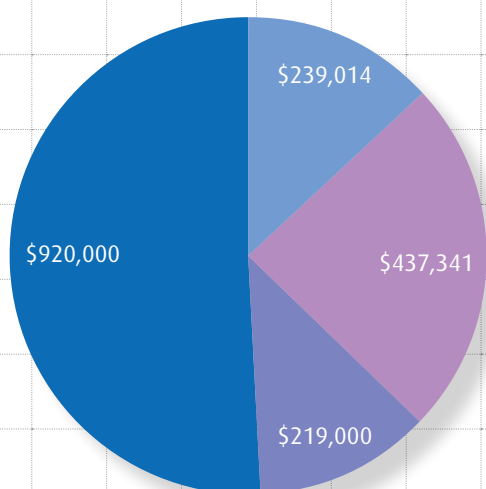
The balance of cash reserves as at 30th June 2012 of \$959,549, as described in the following financial statements is consistent with the records of The University of Melbourne as at 30 June 2012.



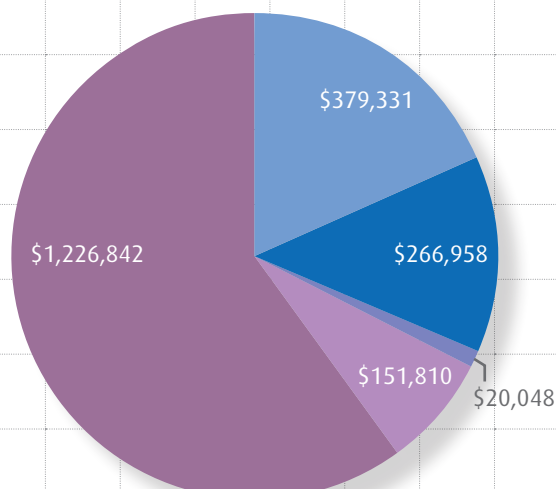
Geoff Prince
Director



Rod Birch
Business Manager



Group Income 2011-12		\$
Government Funding	239,014	
Commercial Incomes	437,341	
Internship Program	219,000	
AMSI Membership Subscriptions	920,000	
	1,815,355	



Group Expenditure 2011-12		\$
Research and higher Education	379,331	
Business, Industry and Government	266,958	
Schools Education	20,048	
Administration	151,810	
Staff Costs	1,226,842	
	2,044,989	

Financial Performance

	July 2011 to June 2012 \$	July 2010 to June 2011 \$
INCOME		
Funding:		
AMSI Member Subscriptions	920,000	760,000
DIISR - Enterprise Connect, Internships	239,014	292,700
DEEWR - Equity and Structural Reform Branch	0	95,800
Sponsorship and Other Income:		
AustMS - AMSI Summer School in Mathematics	0	15,000
EMBL Australia/Bio Platforms - BioInfoSummer	0	25,000
Geoscience Australia	10,000	0
Australian Scientific and Engineering Solutions	1,500	0
Maths for the Future Forum - sponsorship and registration income	25,877	0
Sale of publications	6,831	364,845
Copyright income	111,155	32,303
Contributions from CUP Agreement	172,937	36,000
Internships - industry contribution	201,000	122,000
VLSCI Internship Program	18,000	89,845
Consulting services	104,561	10,000
Contribution - Federation Fellowship Fund	0	-40,000
Other income - including advertising revenue	4,480	1,087
Total Income	1,815,355	1,804,580
EXPENDITURE - Personnel		
Salaries, permanent and casual	1,266,532	1,600,156
External salary support	39,690	-108,606
	1,226,842	1,491,550
EXPENDITURE by Program		
Research and Higher Education		
Research activities	59,497	104,125
Sponsorship:		
Summer and Winter Schools, Vacation scholarships		
Guest lecturers and visiting fellows		
Theme programs, AGRs, vacation scholarships, Delta Conference, 2012 February Forum	319,833	250,772
Business, Industry and Government		
Intern program, focused workshops, costs of consulting projects	266,958	259,771
Schools Education		
Schools - teacher PD, promotion of careers, schools materials for students and teachers	20,048	693,029
	666,337	1,307,697
Administration	151,810	183,841
Independent Review cost	0	29,665
	151,810	213,506
Total Expenditure	2,044,989	3,012,753
Net of Actual Income less Expenditure	-229,634	-1,208,173

Financial Position

	30 June 2012 \$	30 June 2011 \$
ASSETS		
Funds on Hand:		
AMSI Core Executive, commercial operations and administration of member contributions.	718,983	875,812
Projects 80028/30 Internship program. Funded by DIISRTE/Enterprise Connect.	240,566	313,372
	959,549	1,189,184
Net Assets	959,549	1,189,184
EQUITY		
Retained income brought forward	1,189,184	2,397,357
Net of income over expenditure:		
AMSI	-156,829	221,034
Books taken from stock	0	-93,463
Project 80005	0	-400,650
Project 80018	0	-1,049,781
Project 80027	0	-3,385
Projects 80028/30	-72,806	118,072
	-229,634	-1,208,173
Net Equity	959,550	1,189,184

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AMSI Annual Report 2011–2012
Designed by Michael Shaw
Compiled by Anne Nuguid
Edited by Emma Bland



CELEBRATING
10 YEARS
2002 - 2012

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