

## ASA Message for SmP

### **National Benefit of Astronomy - the benefits to the tax payer**

Australia has a long and proud tradition in astronomy. For the past 50 years, Australian astronomers have been at the forefront of their field. Today, it is one of the nations highest impact sciences. The Australian Government recognizes astronomy as a flagship Super Science and there has been significant financial investment for new facilities, particularly over the past 5 years. Australia's investment in astronomy has translated to world leading science and subsequent national and international recognition.

Australian astronomers have pioneered some of the most important technological advances in astronomy over the past two decades, including the use of fibre optics and robotics in astronomy and advanced signal processing techniques. Most recently the work lead by Dr John O'Sullivan from CSIRO in the search for exploding black holes led to the patented technology used for Wi-Fi networks.

Astronomy plays a crucial role in inspiring young people. Astronomy is seen by educators as offering an attractive context within which students can be taught a range of scientific subjects.

### **The top priorities set in the Mid Term Review of the Australian Astronomy Decadal Plan:**

1. The astronomical community must ensure that Australia is in the best possible position to participate in and host the international SKA. This includes continued development and operations of ASKAP, protection of the radio quiet zone in Murchison, Western Australia, and a re-baselined operation of the existing national facilities for radio astronomy.
2. Australian astronomy needs to secure long-term access to a portfolio of astronomical facilities including access to 20 per cent of an 8-metre telescope. The community believes this best done via membership in the European Southern Observatory (ESO) but it could be alternatively pursued through a revitalized partnership with the Gemini and/or Magellan telescopes coupled to a long-term investment plan for operational and capital expenditure on next generation facilities.
3. Australian astronomy also benefits enormously from the breadth of astronomical discovery through investment in the areas of theoretical astrophysics, Antarctic astronomy and ground-based high-energy astrophysics, as well as through university-based research facilities. It is important that funding programs remain in place to support this scale of investment.

### **Current Issues:**

Many of the strategic issues currently faced in astronomy are also relevant to other areas of the wider research and innovation sector. They include:

- The need for stable, long-term operational funding for major national and international research facilities.
- The low level of basic research grant funding available through the ARC.

- The need to build on the Super Science initiative and provide longer-term career paths for young scientists.
- There needs to be more part-time and job share opportunities in research.
- High childcare costs and limited vacancies in childcare centres inhibit scientists to return to the work place after maternity/paternity breaks.
- The “Publish or Perish” landscape discourages participation in additional outreach/educational activities.
- Women are under-represented in astronomy. The current fraction of astronomy positions held by women is only 22 per cent and yet at the PhD level the fraction is closer to 50%. Why are so many women leaving research in the early-to-mid career stage?
- Career breaks have a significant impact on publication records, which are a primary marker of success for ARC grant assessments. What is the best way to measure research relative to opportunity?

ASA participants should use (but not be limited to) this list when formulating the key issues they wish to discuss with the Parliamentarians they meet during the SmP event. It is important to have a few ideas on how one could solve these issues (don't simply have a whinge.) Talk with your colleagues and think outside the box to come up with new initiatives to propose.

#### ESO Proposal Plan:

The AAL/National Committee for Astronomy ESO Working Group will continue to develop a business case in 2011, and AAL will continue discussions with Government about the feasibility and timing of Australian membership in ESO in the 2015 time frame.

#### Cut to Access to Major Research Facilities Program (AMRFP):

AMRFP is funded via the International Science Linkages (ISL) program (<https://grants.innovation.gov.au/ISL/Pages/Home.aspx>). The ISL Program is scheduled to finish on 30 June 2011 and AMRFP will also finish. In the Federal budget that was delivered on Tuesday 10 May there was no announcement of an extension to the ISL program or a successor program. As such the AMRF program will finish on 30 June 2011 and there will not be international travel support for researchers after June 30 2011. AMRFP is managed by ANSTO and is the primary means for support for astronomers and students to travel overseas to observe with telescopes such as Gemini and the VLT.

The SKA is one of the largest scientific projects undertaken anywhere in the world, with the international SKA project community expecting to make a decision on its location (Australia - New Zealand or southern Africa) in 2012.

## High Profile Astronomy Projects

Sourced from the flyer produced by AAL for the IAU General Assembly in 2009

### Facilities and Engineering

#### *WIGGLEZ*

The WiggleZ Dark Energy Survey at the Anglo-Australian Telescope, operated by the Anglo-Australian Observatory, is creating unprecedented maps of the high-redshift galaxy distribution in order to measure the imprint of cosmic sound waves from the early Universe

#### *HERMES*

The Anglo-Australian Observatory is building the HERMES multi-object high-resolution spectrograph for the Anglo-Australian Telescope to study the stellar fossil record and determine how the Galaxy was formed.

#### *PARKES PULSAR TIMING*

The Parkes radio telescope has been the main site for Australian efforts to detect a gravitational wave background using millisecond pulsar timing. Continuing improvements in timing precision have been achieved through a suite of digital instrumentation projects from CSIRO and Swinburne University.

### Infrastructure for the Future

#### *GIANT MAGELLAN TELESCOPE*

The Australian Government has committed A\$88.4 million to partner in the construction phase of the 25-metre Giant Magellan Telescope (GMT), through the Australian National University. GMT is a collaboration between institutions in the United States, Australia and Korea to build a next generation optical telescope to answer fundamental questions on the nature of life, matter and energy in the Universe.

#### *SKYMAPPER*

The Australian National University (ANU) SkyMapper telescope will provide the world's first deep digital map of the southern sky. This will allow astronomers to study everything from nearby solar system objects to the most distant objects in the Universe. The collected data will be shared with astronomers around the world via the Virtual Observatory

### Square Kilometre Array - Australia•New Zealand

#### *AUSTRALIAN SKA PATHFINDER (ASKAP)*

CSIRO Astronomy and Space Science is building the world's leading radio telescope incorporating an innovation phased array feed design and leading edge ICT systems.

- 36 x 12m dishes
- 30 sq degree field of view
- 700 MHz – 1.8GHZ frequency coverage
- 300 MHz instantaneous bandwidth

#### *MURCHISON RADIO-ASTRONOMY OBSERVATORY*

The Murchison Radio-astronomy Observatory (MRO) is Australia's candidate SKA core site as well as the location of ASKAP and other international projects – including the Murchison Wide-Field Array. The MRO provides pristine radio-quietness, superb observing conditions and has long-term government protection.

*ICRAR AND SKA COMPUTING CENTRE*

The \$60million International Centre for Radio Astronomy Research (ICRAR), has been established in Perth, Western Australia to make a major contribution to scientific and technical programs supporting ASKAP and the SKA. In addition a new \$80 million centre providing advanced computing infrastructure to support SKA science and operations in Australia is being built.

## AAL's \$10M EIF grant

On 14th December 2009 the projects listed below were selected for consideration as part of a \$10.2M Education Investment Fund (EIF) Investment Plan.

### *Murchison Widefield Array (\$3,070,000)*

The Murchison Widefield Array (MWA) is a low frequency wide field-of-view interferometer located at the Murchison Radioastronomy Observatory. The project has been underway since 2005 as an international collaboration between partners in Australia, India and the USA. EIF funds have been requested to augment NCRIS funds allocated to the project and funds to be requested from the US National Science Foundation to complete the proposed 512 antenna array.

### *HERMES 4th channel (\$1,670,000)*

The HERMES (High Efficiency and Resolution Multi-Element Spectrograph) is currently under development at the AAO. HERMES will allow the simultaneous spectroscopic observation of nearly 400 targets at a spectral resolving power of about 30,000, over 3 separate wavelength regions. EIF funding has been requested for a 4th near-infrared channel to increase the wavelength coverage and allow all the major objectives of the Galactic Archaeology survey to be pursued.

### *AAOmega detectors upgrade (\$710,000)*

A proposal was submitted to AAL to upgrade the existing AAOmega spectrograph with new CCDs. A new blue CCD from E2V will significantly increase efficiency at near-UV wavelengths (370 - 400 nm), critical to many stellar observing programs, and remove the cosmetic flaws that currently limit such investigations. A new red CCD from LBNL will increase the quantum efficiency in the Z and Y bands (800-1100 nm) by factors of 2 - 3, enabling a whole new class of science projects to be undertaken. AAL is not able to fund the full cost of this proposal and will work with the AAO to determine if the detectors can be upgraded with the \$710,000 of available EIF funding.

### *C/X upgrade to the Australia Telescope Compact Array (\$1,471,000)*

This project proposes to increase the maximum accessible instantaneous bandwidth of the 6cm and 3cm receivers of the ATCA to take advantage of the increased correlator capacity made available by the recently completed Compact Array Broadband Backend upgrade. The project will merge the 6 and 3 cm bands from the current (4.4-6.9 GHz & 8.0-9.2 GHz) bands to provide continuous coverage of approximately 4-12 GHz.

### *GPU Supercomputer for Theoretical Astrophysics Research (\$1,040,000)*

The project proposes to construct a next generation GPU-based computing cluster for computational astrophysics, that will be hosted by the Swinburne Center for Astrophysics and Supercomputing. The cluster is expected to achieve ~600 Teraflop performance, with 200 Terabytes of storage, to tackle next-generation computational problems not possible with existing CPU-only architectures.

*Site qualification and exploratory science from Antarctica (\$1,330,000)*

The aim of this project is to build three robotic astronomical observatories, in collaboration with China, Japan and the US, for deployment on the Antarctic plateau at Dome A, Dome F and Ridge A, and to collaborate with these countries in pathfinder facilities at optical and THz wavelengths. \$330,000 of this proposal is expected to be funded by the NCRIS grant.

*Upgrade of GMOS-S CCDs to modern E2V parts (\$690,000)*

The CCDs in the GMOS-S instrument on the 8m Gemini South telescope, are nearly a decade old, and suffer from several defects relative to new generation detectors, including poor quantum efficiency and severe fringing beyond 750nm, and subtle cosmetic defects that make nod-and-shuffle observations difficult over large fields-of-view. The project proposes to replace these with modern E2V devices that have identical footprints, and exceed their performance at all wavelengths.

*Replacement cloud monitoring infrastructure, Pierre Auger Observatory (\$50,840)*

The Pierre Auger Observatory is investigating the origin of the highest energy cosmic rays with a detector array covering 3000 square kilometres in western Argentina. As a partner in this international facility, one of Australia's responsibilities has been to provide and maintain the infrastructure required to monitor the night-time cloud conditions over the Observatory. This proposal aims to provide replacement cloud monitoring equipment for the Observatory in the form of infra-red cloud detectors using single-pixel infrared radiometers.

*AAL management fee (\$500,000)*

## Astronomy NCRIS

Through the National Collaborative Research Infrastructure Strategy (NCRIS) the Government is providing \$542 million over 2005-2011 to provide researchers with major research facilities, supporting infrastructure and networks necessary for world-class research. The astronomy NCRIS includes a forty-five million dollar grant from the Australian Government announced in November 2006. The astronomy NCRIS runs until June 2011, and aims to deliver facilities for Australian astronomers to use now, while also investing in the next generation of facilities.

The projects are:

AAT upgrade and instrument	\$10.0M
ASKAP	\$14.6M
Gemini and Magellan	\$10.1M
GMT DDP	\$4.8M
MWA	\$4.6M
PILOT Design Study	\$1.0M

Approximately 2.5% is used for the running of Astronomy Australia Ltd

## Astronomy Outlook

Sourced from the Decadal Plan 2006

Astronomy is a profound expression of humanity's need to understand how the Universe works. We are living through a remarkable era of discovery in astronomy. For the first time we have found clear evidence for planets orbiting other stars, for massive black holes occupying the centres of our own Galaxy and many other galaxies, and for a dark energy component to the Universe whose origin and nature we have yet to fully understand. As the full complexity of the cosmos becomes apparent, today's astronomers require cross-disciplinary skills in fields as diverse as computer modeling, chemistry, fluid dynamics, statistics and even biology.

Over the coming decade astronomers in Australia and around the world will undertake fundamental research into the laws of physics on scales and in realms too extreme to examine in any laboratory. The questions that astronomers seek to answer are amongst the biggest that is possible to ask.

What is the nature of dark energy and dark matter?  
How and when did the first stars form in the early Universe?  
How are galaxies assembled and how do they evolve?  
Is our understanding of gravity correct?  
How do super-massive black holes in the cores of galaxies work?  
What is the origin of evolution of cosmic magnetism?  
How do stars and planetary systems form?  
How common are planetary systems and conditions suitable for life?  
How do stars produce and recycle the elemental building-blocks of life?

Australia has a long and proud tradition in astronomy. For the past 50 years, Australian astronomers have been at the forefront of their field. Today, it is one of the nations highest impact sciences. Australian astronomers have pioneered some of the most important technological advances in astronomy over the past two decades, including the use of fibre optics and robotics in astronomy and advanced signal processing techniques.

Astronomy plays a crucial role in inspiring young people. Astronomy is seen by educators as offering an attractive context within which students can be taught a range of scientific subjects.

Astronomy has always received the strong support of the general public. Fundamental research at the frontiers of science is an essential cultural element of any technologically advanced nation and is an important expression of our identity. Australians are justifiably proud of our positions as one of the world's most successful nations in astronomy.

## Australian Astronomy Statistics

Sourced from the Decadal Plan & Mid Term Review

- An estimated A\$60M is invested annually by Australia in astronomy-related activities. Around 60% is used to fund university activities. Just over 30% is used to fund the AAO and the ATNF, both as providers of national astronomy facilities and a further 5% funds Australian 8-m telescope access and SKA.
- The five-year period between 2005-2010 has seen a major investment in new astronomy infrastructure and facilities with a total capital expenditure of \$230 million over the decade 2006-2015. This includes \$130 million for radio astronomy facilities and support (mainly for ASKAP, but also including the MWA and a 25 per cent share of the Pawsey Centre), and \$100 million for optical astronomy (mainly for GMT but also including some additional funding for the AAO)
- Australia's key observational strengths lie in the radio and the optical/infrared domains. Optical and radio astronomy account for over three quarters of the total citations gathered by Australian astronomers of the last decade.
- The total number of people involved in astronomical research in Australia has increased by more than 25 per cent since 2005. In mid 2010 there were 542 full-time-equivalent people working in technical, instrumentation, support and administrative roles.
- The fraction of astronomy positions held by women in astronomy has increased slightly to 22 per cent.
- Twelve Australian universities offer honours degrees in astrophysics.
- About 20 doctorates in astronomy are awarded per year. About one sixth of PhD graduates go on to careers outside astronomy. The number of astronomy PhD students enrolled in Australian universities increased by at least 50 per cent from 2005. In 2010 there were 237 enrolled students.

## Various Australian Science Organisations

*The Astronomical Society of Australia (ASA)*

<http://asa.astronomy.org.au/>

The Astronomical Society of Australia (ASA) was formed in 1966 as the organisation of professional astronomers in Australia. Membership of the ASA is open to anyone contributing to the advancement of Australian astronomy or a closely related field. This means that the members are mostly active professional astronomers and postgraduate students. However some retired astronomers and distinguished amateur astronomers are also members, and several organisations are corporate members of the Society. The Society currently has almost 500 members.

Current President: Prof. Lister Stavelly Smith

*Astronomy Australia Limited (AAL)*

<http://astronomyaustralia.org.au/>

Astronomy Australia Limited is a not-for-profit company limited by guarantee whose members are a range of Australian universities and research organisations. Its core business is to manage programmes that provide astronomers with access to national optical/infrared and radio astronomy infrastructure.

Current Board of Directors Chair: Prof. Warrick Couch

*National Committee for Astronomy (NCA)*

<http://www.aao.gov.au/nca/>

The National Committee for Astronomy (NCA) is one of the National Committees of the Australian Academy of Science (AAS). The National Committee for Astronomy exists to foster astronomy in Australia, to liaise with international scientific bodies, and to advise the Council of the Australian Academy of Science on relevant matters. The NCA acts as a peak body for astronomy in Australia, with the aims of promoting the national value and benefits of the astronomical sciences, facilitating community-wide strategic planning initiatives, and managing relations between Australian astronomers and the International Astronomical Union.

Current Chair: Prof. Elaine Sadler

*Australian Academy of Science (AAS)*

<http://www.science.org.au/academy/>

The Academy was founded in 1954 and receives government grants towards its activities but has no statutory obligation to government. The objectives of the Academy are to promote science through a range of activities. The Fellowship of the Academy is made up of over 400 of Australia's top scientists. The Academy has published many reports on public issues such as national research policy setting, stem cell research, human cloning, pesticides, ecological reserves, food quality, genetic engineering, space science and climate change. The Academy also makes submissions to government ministers and parliamentary inquiries. The President of the Academy is, by virtue of that position, a

member of the Prime Minister's Science, Engineering and Innovation Council. The Fellows of the Academy elect the Council, which manages the business of the Academy. The Council advises the Prime Minister on important scientific issues. The Academy is Australia's representative on the International Council for Science (ICSU) and many of its constituent organisations. There are 21 National Committees of the Academy

Current President: Prof. Suzanne Cory, Professor of Medical Biology, University of Melbourne.

*Federation of Scientific and Technological Societies (FASTS)*

<http://www.fast.org/>

FASTS is the peak body for science and technology in Australia. FASTS represent the interests of some 60,000 Australian scientists and technologists. FASTS works to influence science and technology policy for the economic, environmental and social benefit of Australia. The FASTS President is a non-ministerial member of the Prime Minister's Science, Innovation and Engineering Council (PMSEIC), and this allows FASTS to contribute to discussions at the highest levels in policy-making in Australia.

Current President: Dr Catherine Foley, Chief CSIRO Materials Science and Engineering

*Department of Innovation, Industry, Science & Research (IISR)*

<http://www.innovation.gov.au>

The Department of Innovation, Industry, Science and Research strives as a key priority to encourage the sustainable growth of Australian industries by developing a national innovation system that drives knowledge creation, cutting-edge science and research, international competitiveness and greater productivity. The department is committed to developing policies and delivering programs, in partnership with stakeholders, to provide lasting economic benefits ensuring Australia's competitive future. The department also works to boost innovation by Australian industry and improve social and economic benefits for the Australian community.

The department is structured into a number of divisions including the Australian Astronomical Observatory and Questacon.

Minister for Innovation, Industry, Science and Research: Senator the Hon Kim Carr

*The Australian Research Council (ARC)*

<http://www.arc.gov.au/>

The ARC is a statutory authority within the Australian Government's Innovation, Industry, Science and Research (IISR) portfolio. Its mission is to deliver policy and programs that advance Australian research and innovation globally and benefit the community. In seeking to achieve its mission, the ARC provides advice to the Government on research matters and manages the National Competitive Grants Program (NCGP), a significant component of Australia's investment in research and development.

Chief Executive Officer: Prof. Margaret Sheil

*Office of the Chief Scientist*

<http://www.chiefscientist.gov.au>

The Office of the Chief Scientist supports the Chief Scientist for Australia in their role of providing independent advice to Government on a wide range of scientific and technological issues and her engagement with the science, research and industry communities, learned societies and other governments. The Chief Scientist provides high-level independent advice to the Prime Minister and other Ministers on matters relating to science, technology and innovation. The Chief Scientist is the Executive Officer of the Prime Minister's Science, Engineering and Innovation Council and report directly to the Minister for Innovation, Industry, Science and Research, the Hon Senator Kim Carr.

Current Australia Chief Scientist: Prof. Ian Chubb

*The Prime Minister's Science, Engineering and Innovation Council (PMSEIC)*

<http://www.innovation.gov.au/Science/PMSEIC/>

The Prime Minister's Science, Engineering and Innovation Council (PMSEIC) was established in 1997 as the Government's principal source of independent advice on issues in science, engineering and innovation and relevant aspects of education and training. The council is made up of Ministerial members and non-ministerial members. The non-ministerial members constitute the Standing Committee of the Council, and oversee and contribute to studies and research aimed at improving understanding of the major, science, engineering and innovation issues.

Chair: The Prime Minister

*CSIRO*

<http://www.csiro.au>

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is Australia's national science agency. CSIRO is an Australian Government statutory authority constituted and operating under the provisions of the Science and Industry Research Act 1949. CSIRO's primary functions under the Act are to carry out scientific research to benefit Australian industry and the community, and to contribute to the achievement of national objectives. CSIRO is accountable to the Minister for Innovation, Industry, Science and Research and is part of the Innovation, Industry, Science and Research portfolio.

Chief Executive Officer: Dr Megan Clark

## Various Australian Astronomy Hubs

### *The Australia Telescope National Facility (ATNF)*

<http://www.atnf.csiro.au>

The Australia Telescope National Facility (ATNF) sits within the CSIRO Astronomy and Space Science (CASS) division of CSIRO and supports Australia's research in radio astronomy. The ATNF operates the Australia Telescope, which consists of the Compact Array at Narrabri and the Parkes and Mopra radio telescopes. These telescopes can be used together as a long baseline array for use in Very Long Baseline Interferometry.

Director of CASS and ATNF: Prof. Phil Diamond

### *Australian Astronomical Observatory (AAO)*

<http://www.aao.gov.au/>

The Australian Astronomical Observatory is within the Australian Government's Innovation, Industry, Science and Research (IISR) portfolio. The AAO operates the Anglo-Australian and UK Schmidt telescopes and supports Australian access to Gemini and Magellan. It also builds instruments for all these telescopes.

Director: Prof. Matthew Colless

### *International Centre for Radio Astronomy Research (ICRAR)*

<http://www.icrar.org/>

The International Centre for Radio Astronomy Research (ICRAR) is a joint venture between the University of Western Australia and Curtin University of Technology. ICRAR has been established in Perth to make a major contribution to scientific and technical programs supporting ASKAP and the SKA.

Director: Prof. Peter Quinn

### *ARC Centre of Excellence for All-Sky Astrophysics (CAASTRO)*

<http://www.caastro.org/>

By bringing Australia's top astronomers together into a focused collaboration, CAASTRO aims to cement Australia's reputation as an international leader in astrophysical research, and to build unique expertise in wide-field radio and optical astronomy. CAASTRO also aims to position Australia to lead the science programmes planned for the SKA, a radio telescope for the 21st century that will answer fundamental questions about the origin and evolution of the Universe.

Centre Director: Prof. Bryan Gaensler

### *Murchison Radio-astronomy Observatory (MRO)*

<http://www.atnf.csiro.au/SKA/site.html>

The MRO is Australia's candidate SKA core site as well as the location of ASKAP and other international projects – including the Murchison Wide-Field Array. The MRO is

approximately 315km north east of Geraldton and is ideal for radio astronomy as it exhibits excellent sky coverage, superb radio quietness, ionospheric stability and benign tropospheric conditions. The extremely low levels of radio-frequency interference will allow highly sensitive instruments such as ASKAP, MWA and potentially the SKA, to conduct ground-breaking astronomy research. The MRO will be protected from developments that may cause radio interference through a combination of special WA State legislation and existing Federal legislation administered by the Australian Communications and Media Authority.

We acknowledge the Wajarri Yamatji people as the traditional owners of the MRO site.

*Pawsey Supercomputing Centre*

<http://www.ivec.org/super-computing/pawsey-hpc-centre>

In 2009 the Australian Government, as part of its Super Science initiative, allocated \$80 million towards the establishment of the Pawsey Centre Project with the primary aim of hosting new supercomputing facilities and expertise to support SKA (Square Kilometre Array) research and other high-end science. The secondary goal of the Project is to demonstrate Australia's ability to deliver and support world-class advanced ICT infrastructure and therefore strengthen Australia's bid to host the SKA, which is critically dependent on advanced ICT.

The Pawsey Centre Project will have the capacity to host new supercomputing facilities and other expertise to provide immediate support to the Australian SKA Pathfinder and Murchison Widefield Array radio astronomy telescopes as well as other high-end research areas of computational and data-intensive science, particularly nanotechnology, biotechnology and geosciences. The Pawsey Centre will comprise a purpose-built building, housing a petascale supercomputing system and associated works at Kensington, Western Australia.

## Some Shakers and Makers on Capital Hill

Current as of May 2011

The Prime Minister, The Hon **Julia Gillard** MP

The Deputy PM and Treasurer, The Hon **Wayne Swan** MP

The Minister for Innovation, Industry, Science and Research, Senator the Hon **Kim Carr**

The Minister for Agriculture, Fisheries and Forestry, Senator the Hon **Joe Ludwig**

The Minister for Infrastructure and Transport, The Hon **Anthony Albanese** MP

The Minister for Trade, The Hon Dr **Craig Emerson**

The Minister for Broadband, Communications and the Digital Economy, Senator the Hon **Stephen Conroy**

The Minister for Climate Change and Energy Efficiency, The Hon **Greg Combet** AM MP

The Minister for Health and Ageing, The Hon **Nicola Roxon** MP

The Minister for Resources and Energy and Tourism, The Hon **Martin Ferguson** AM MP

The Minister for Sustainability, Environment, Water, Population and Communities, The Hon **Tony Burke** MP

The Minister for the Arts; Minister for Regional Australia, Regional Development and Local Government, The Hon **Simon Crean** MP

The Minister for Tertiary Education, Skills, Jobs and Workplace Relations, Senator the Hon **Chris Evans**

The Minister for School Education, Early Childhood and Youth, The Hon **Peter Garrett** AM MP

The Chief Scientist for Australia, Prof **Ian Chubbs**

The President of the Australian Academy of Science, **Professor Suzanne Cory**

The President of the Australian Academy of Technological Sciences and Engineering, **Professor Robin Batterham** AO

The Chair of Universities Australia, Professor **Peter Coaldrake**

The President of the Federation of Australian Scientific and Technological Societies, **Dr Cathy Foley**

The Chief Executive of CSIRO, **Dr Megan Clark**

The Chief Executive Officer of the Australian Research Council, **Professor Margaret Sheil**

The Chair of the National Health and Medical Research Council, **Professor Michael Good** AO

The President of Engineers Australia, represented by **Mr Peter Cockbain**

The Chair of the Innovation Australia Board, **Mr David Miles** AM

The Chief Defence Scientist, Defence Science and Technology Organisation, **Professor Robert Clark**