



**Submission on
International
Research Collaboration**

**The Australian Academy of
Technological Sciences and
Engineering**

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International Research Collaboration

The Academy of Technological Sciences and Engineering¹ (ATSE) welcomes this opportunity to express its views on the important issue of international research collaboration. ATSE considers that such collaboration is critical to Australia's technological development and economic growth. International research collaboration underpins the Government's innovation agenda.

Summary

The Academy of Technological Science and Engineering (ATSE) acknowledges the increased investment that the present Government has made in science, technology and innovation. International research collaboration funding is one area that remains to be addressed. This collaboration plays a key role in ensuring that Australia maximises the benefits from its investment in research and innovation. Citation data indicate that research undertaken in collaboration with Australia's overseas partners has a higher impact than other research.

ATSE's unique contribution to international research collaboration is in opening new, and enhancing existing pathways, for science and technology cooperation with priority countries, through our significant networks with research institutions and other academies. These pathways have led to tangible benefits for Australian research and business. ATSE contributes the time and resources of its Fellows to this effort, with financial support from the Government under the International Science Linkages Program (ISL). Funding for this Program expires in the near future. Further, lack of long term funding commitments by the Australian Government in the ISL-SAP program could jeopardise productive collaborative Science and Technology relationships that have been successfully established to date.

In ATSE's view, Australian participation in European Framework Programme research is valuable and needs to be better supported by the Government.

ATSE recommends that the Government significantly increase funding for collaboration under the bilateral agreements to give these agreements critical mass and allow the Department of Innovation, Industry, Science and Research to make a more rational allocation between these agreements— ATSE recommends overall funding for the ISL Program be increased to \$25m per annum.

¹ The Academy was established in 1975 and is one of Australia's four learned national Academies, which have complementary roles and work together both nationally and internationally. The Academy has about 800 elected Fellows comprising the leadership of applied science and engineering across the country.

International Research Collaboration

The Academy of Technological Sciences and Engineering (ATSE) welcomes this opportunity to contribute its views on the important issue of international research collaboration. ATSE considers that such collaboration is critical to Australia's technological development and economic growth. International research collaboration underpins the Government's innovation agenda.

ATSE is a unique organisation, with the objective of promoting the application of scientific and engineering knowledge to practical purposes for the benefit of the nation's well-being and economic development. ATSE's strong commitment to international research collaboration flows directly from this mission. ATSE recognises the importance of this activity through the commitment of its own resources together with support from other sources, most notably the Commonwealth Government's International Science Linkages – Science Academies Programme (ISL-SAP)².

In recognition of the synergistic relationship between international cooperation and innovation and research, ATSE focuses on applied research activities wherever possible in its ISL-SAP activities. We are able to draw on our membership base of Australia's outstanding academics, industrialists, engineers, technologists and entrepreneurs to add an applied commercial outcome aspect to the SAP program we administer on behalf of the Government.

ATSE contributes a unique strength in opening new, and enhancing existing pathways, for science and technology cooperation with priority countries, through our significant networks of other academies and research institutions. These pathways have led to tangible benefits for Australian research and business. We believe a further strengthening of such an approach is vital in future years of the ISL-SAP program.

ATSE delivers value through its extensive national and international networks coupled with our established track record in delivering well targeted, cost effective applied science and technology programs with prestigious participants and

Creating Linkages, Creating Results

Some years ago the Academy ran an international workshop with Indian participation on renewable energy. Almost immediately after this, DIISR began the first round of the Australia/India research fund allocations received only a very small number of applications. As part of the workshop the Academy initiated a "renewable energy forum" with over fifty participants participating by email. This has contributed to the increase in applications for renewable energy projects in the latest (fourth) round to 12, a significant increase.

² This program is administered by the Department of Innovation, Industry, Science and Research (DIISR).

guaranteed access to senior levels in leading universities, research institutions and companies. ATSE's international activities are based on a strategic plan, overseen by an advisory committee, and subject to reporting to the ATSE membership and DIISR. This assures high quality technological sciences and engineering policy advice and collaborative outcomes.

ATSE has strong collaborative and strategic linkages internationally through bodies such as the International Council of Academies of Engineering and Technological Sciences (CAETS) and formal bilateral arrangements with sister academies worldwide. ATSE has established long term, trusted relationships nationally and internationally and is recognised by the countries with which we work for our ability to harness excellence in science and technology within a framework of cultural understanding.

In relation to ISL-SAP, the value proposition provided by ATSE to Government is multi-faceted, beyond the enormous wealth of achievement and experience of our

Creating Linkages, Creating Investment

Improving the efficiency of photovoltaics and squeezing light into ever-smaller dimensions to enhance data storage densities are perhaps two of the most promising applications emerging from research into localized surface plasmons. Progress being made in both of these areas was the subject of presentations at the Nanophotonics Down Under 2009 Devices and Applications Conference. The Conference, part of the Sir Mark Oliphant International Frontiers of Science and Technology Conference series, took place in Melbourne. It attracted approximately 160 attendees, with 37 invited speakers from 15 countries and 83 contributed papers from 18 countries.

One outcome of the Conference was the establishment of international collaboration between Swinburne University of Technology and Suntech Power Holdings of China, one of the World's largest solar panel manufacturers. Suntech Power has agreed to invest \$3m to jointly establish the Victoria-Suntech Solar Facility with the Victorian Government.

Fellows. ATSE has a proven track record in being cooperative with government, capable, experienced, able to react quickly, well connected, apolitical and not conflicted. ATSE has access to some 800 of the brightest and best applied scientists, technologists and engineers in Australia—spanning academia, industry and government. This provides significant leverage as we can draw on the expertise and networks of our Fellows (often at low or no monetary cost) to ensure bilateral/multilateral activities involve appropriate participation with support at the highest level.

ATSE operates on the basis of recovery of costs (i.e. no profit margins apply).

Further, costs are low compared with commercial/market rates, as ATSE can leverage off existing infrastructure and the volunteer work of Fellows. In terms of

value for money, ATSE estimates the dollar leverage on the initial investments by DIISR in ISL-SAP to be in the order of six times, which is exceptional value for money.

ATSE's main activity in promoting international research collaboration is by organising international science and technology missions and workshops. It also supports Australian scientists, from both the public and private sectors, to collaborate with international partners on leading edge science and technology. Some details of ATSE's recent activities in promoting international research collaboration can be found in Appendix A.

The nature and extent of existing international research collaboration

International research collaboration can take a number of forms. Much of Australia's international research collaboration is informal, undertaken on the initiative of individual researchers as part of their job. Larger scale collaboration tends to involve more complex arrangements. For example, Australian participation in research at CERN³ involves domestic collaboration between Australian high energy physics researchers to manage the collaboration, and a formal agreement between the Australian Government and CERN.

While international research collaboration could be thought to involve Australian researchers working in overseas countries, some international collaboration actually takes place in Australia. Australian researchers regularly host visits from their overseas counterparts. A further example is provided by French graduate students working at Australian universities under "co-tutelle" arrangements. Other international research collaboration can involve contributing to and sharing scientific databases. Thus defining and measuring international research collaboration is not an easy task.

A December 2006 report⁴ to the Prime Minister's Science, Engineering and Innovation Council (PMSEIC) provides the most recent comprehensive information on Australian engagement in international science and technology. A number of changes have occurred since this report was prepared. Some of its recommendations have not yet been adopted.

The PMSEIC report lists a number of Commonwealth grants programs which support international collaboration. However it needs to be recognised that, for many of the grants programs discussed in the report, fostering international collaboration is not the primary objective. Thus it is possible for an ARC Discovery grant to include a small amount of funding for work with an international partner. Further, a Cooperative Research Centre may engage in some international collaboration, but that is incidental to its main objectives. Thus we believe that Table 1 of the PMSEIC report

³ CERN is the European Organization for Nuclear Research. It works in the field of fundamental physics. At CERN, the world's largest and most particle accelerators and detectors are used to study the basic constituents of matter.

⁴ PMSEIC 2006, Australia's Science and Technology Priorities for Global Engagement accessed at http://www.innovation.gov.au/ScienceAndResearch/prime_ministers_science_engineering_innovation_council/Documents/Global_Engagement_WG.pdf on 10 February 2010.

could give a somewhat misleading impression about the amounts of funding available to foster international collaboration. The presentation in Table 1 also reports funding for multiple years covering different periods. As a result it is very difficult to know from the data presented in the PMSEIC report the exact amount of *dedicated Government funding for international collaboration* per annum. We believe that this amount is quite small by OECD country standards, which is of particular concern given Australia's distance from our major research partners. Further, funding for these activities has either ended or will end in 2010-11. Renewal of this funding is urgently needed.

ATSE acknowledges that there have been significant increases in funding for science under the present Government. The Government has also addressed some long-standing problems with the structure of support for science and innovation. The Government's response⁵ to the Independent Review of Australia's National Innovation System⁶ has provided a strong basis for growing innovation in Australia over the next ten years. However general support for bilateral science collaboration is one of the very few areas of science funding not yet addressed by the Government.

Bilateral science agreements

Bilateral science agreements are an important basis for research collaboration, especially where there are barriers to collaboration such as language and culture. These agreements are particularly important for countries such as Japan, China and Indonesia. Under these agreements both countries contribute funds, which means that Australian investment is leveraged by the other country's contribution. For some countries, agreements are a prerequisite for any serious research collaboration—while in other cases individual researcher collaborations occur without any apparent need for an agreement.

⁵ Commonwealth Government 2009, *Powering Ideas: An Innovation Agenda for the 21st Century*, Canberra.

⁶ Cutler T *et al*, 2008, *Venturous Australia: Building strength in innovation*, Canberra.

When it comes to funding collaboration under bilateral agreements, Australian Government support is very uneven and, in some cases, embarrassingly small. Thus funding available for collaboration for India is now approximately \$10m per annum (through the Australia India Strategic Research Fund) while funding for collaboration with France has been only \$250,000 per annum (under the France Australia Science and Technology Program). A science and technology agreement in place with the Republic of Korea since 2000 relies entirely on annual appropriations by DIISR and DFAT (through the Australia Korea Foundation) to support research exchanges. Collaboration with China has been allocated approximately \$1.2m per annum in recent years. For a country which is emerging as a world leader in science and research, this funding is insufficient.

Creating Linkages, Creating Long-Term Value

The Early Career Research Program provides Young Korean and Australian scientists with opportunities to meet with their leading counterparts— gaining an appreciation of the outstanding quality research being undertaken in the host country. Integral to these exchanges, time is set aside for informal networking and cultural exchange— establishing lifelong friendships and enhancing relationships between Australian and Korean research institutions.

Direct outcomes of the Program have been:

- *initiation of the ongoing collaboration between institutions;*
- *formalisation of a Memorandum of Understanding between research groups that enables an exchange of students and researchers;*
- *publication of joint scientific and conference papers;*
- *grants to enhance transfer of knowledge;*
- *communication between Australian and Korean groups;*
- *and annual Korea-Australia symposia in the area of neuro-imaging.*

Apart from the uneven allocation of funds, there are a number of other problems with bilateral funding. There are differences in the funding rules between similar schemes, which is a source of confusion to applicants. Under some agreements, funding is currently available only to cover travel, which is not an adequate basis for supporting serious research collaboration. Funding is fragmented. DIISR does not appear to have the flexibility to move funds between agreements. The number of applications greatly exceeds the funds available.

This same problem arises with the element of the ISL Program⁷ which is intended to allow the Government to target countries and areas of science which would otherwise receive insufficient attention from researchers. The funding that is available and the success rates for some elements of the ISL Program are so low that they currently struggle to attract the numbers of major proposals that they have in the past. The Program lacks critical mass and DIISR appears unable to make more rational allocations of funds between agreements.

ATSE RECOMMENDS

- ***Government take a more strategic approach to bilateral science agreements.***
- ***Government significantly increase funding for bilateral and strategic collaboration.***
- ***Raising overall funding for the ISL Program to \$30m per annum.***

The benefits to Australia from engaging in research collaborations

The benefits of international collaboration in science and technology have been discussed in the 2006 PMSEIC report. Scientific research and technological development are, by their very nature, international activities. New research often builds on the results of previous work that has been undertaken in another country. Australia accounts for about two per cent of the World's research effort. So international research collaboration is important, in order to tap into the other 98 per cent.

As Jason Mitchell, a well-known Harvard neuroscientist has pointed out:

“The most dramatic innovation introduced with the roll-out of our species is not the prowess of individual minds but the ability to harness that prowess across many individuals”.

The relative citation impact of Australian research undertaken in collaboration with partners in other countries is significantly higher than research where such collaboration is not involved (see Figure 1 below). This provides yet another example of the importance of international research cooperation.

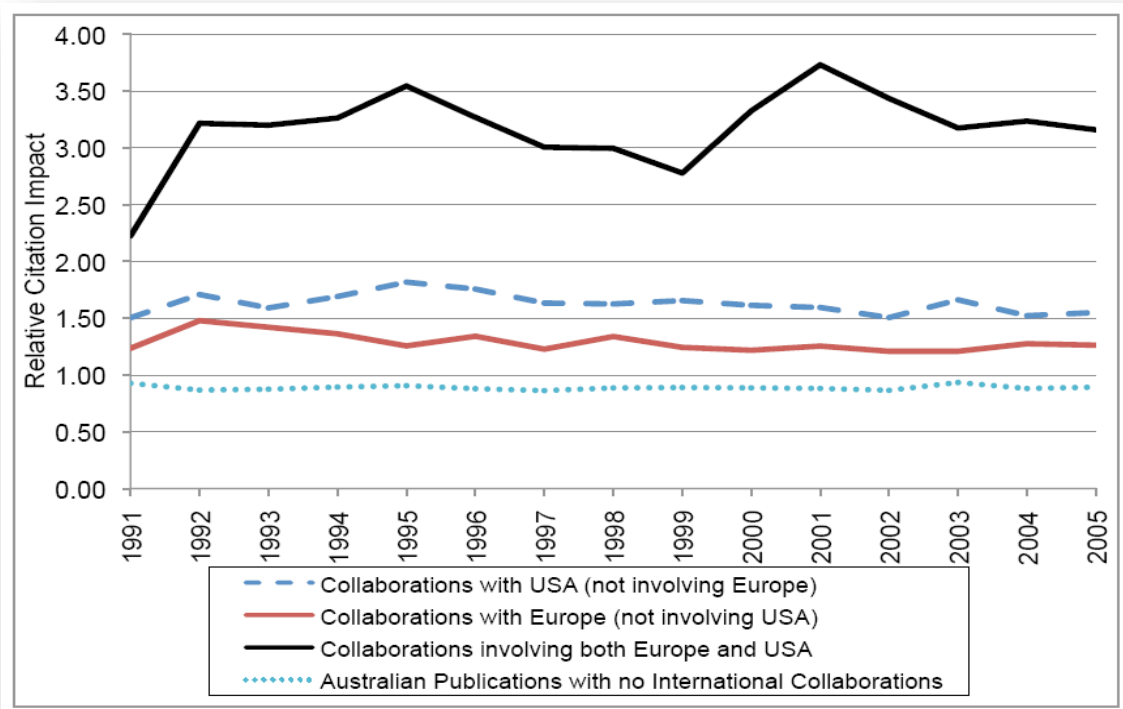
International research collaboration enables Australian researchers and their students to acquire new knowledge which may be applied in Australia. It also enables the application of Australian knowledge to the needs of other countries. This can create opportunities for the export of products and services.

Research equipment and techniques are constantly evolving. International research collaboration helps Australian researchers to keep up-to-date by accessing new

⁷ Funding for ISL, which includes support for bilateral activities and ISL-SAP has been \$94.5m over nine years.

techniques and equipment in other countries. Experience with new equipment in overseas laboratories helps our researchers to determine what is needed here. For example, Australia’s investment in a leading edge synchrotron was informed by a sizeable group of Australian researchers that had gained experience with synchrotrons in Japan, the USA, the UK and France.

Figure 1. Relative citation impact – science citation index publications 1991-2005



Source: FEAST 2009, *A Bibliometric Analysis of Australia’s International Research Collaboration in Science and Technology: Analytical Methods and Initial Finding*, Discussion Paper 1/09.

ATSE has the capability to facilitate international research collaboration which involves industry, or where the outcomes have the potential for application in industry.

As noted in *Powering Ideas*, Australia ranks last in the OECD for rates of collaboration between research organisations and business. The Government’s National Innovation Agenda, *Powering Ideas*, notes that:

“Australia has everything to gain from improving connections within the national innovation system and expanding its participation in international research and innovation networks”.

Creating Linkages, Accelerating Progress

The Global Carbon Capture and Storage Institute's main objective is to accelerate the commercial deployment of carbon capture and storage (CCS) projects to ensure their valuable contribution in reducing carbon dioxide emissions. It aims to accelerate the worldwide commercial deployment of CCS.

The Institute was formally launched in April 2009. The Australian Government has committed \$100m annual funding. The Institute has more than 20 national governments and over 80 leading corporations, non-government bodies and research organisations signing on as foundation members or collaborating participants.

The Institute will draw together information, knowledge and expertise to build a much-needed central base. It will play a pivotal role in facilitating the development and deployment of safe, economic and environmentally sustainable commercial-scale CCS projects.

The Institute will advise on the technologies that will capture, transport and store emissions, and provide expert insight on the costs and benefits of carbon solutions and the operational and legislative requirements needed to achieve success. It will work collaboratively with governments, non-government bodies and the private sector to build confidence in CCS and help drive the international momentum needed to provide a solution to the urgent problem of climate change.

ATSE agrees that the conversion of scientific research and ideas into real world applications is the ultimate aim in supporting and stimulating the science and technology sector in Australia. Improving the linkages between the various components in the innovation system, both nationally and internationally and through international collaboration serves to accelerate practical outcomes. There is ample evidence noting that high quality research involving collaboration with industry both domestically and internationally leads to high levels of innovation.

The participation of Australian researchers in major multi-country European "Framework Programme" projects sponsored by the European Commission is an important example of international research collaboration. This Programme supports large-scale consortia comprising leading researchers from across Europe. All participants in Framework Programme projects share the results. Competition for funding from this source is very strong, so when an Australian research team is a member of a successful application consortium, they will be collaborating with the best European researchers in their field. Unfortunately when Australian researchers

ATSE RECOMMENDS

- ***Australian participation in European Framework Programme research needs to be better supported by the Australian Government.***

are part of a consortium selected for Framework Programme funding they are not always able to gain Australian support for their participation.

On a still larger scale, research collaboration also gives Australian researchers access to megascience⁸ projects. These research projects involve expenditure even greater than that of the European Framework Programme. They are too expensive for any one country to undertake. Through international research collaboration, Australian researchers can participate in these projects and Australia can benefit from the knowledge and expertise generated. When Australia is a partner in some large-scale research projects there are valuable opportunities for Australian firms to win contracts to supply components of the research equipment – the notable example being large telescopes.

The key drivers of international research collaboration

Government

Government has a responsibility to ensure that Australian researchers, research teams and businesses can access world leading partners and equipment. One of the ways that the Government can achieve this objective is through support for international research collaboration. For example, postgraduate students whose supervisor involves them in international collaboration gain a number of benefits (knowledge, networks, etc) which they can take with them to a future employer.

International science collaboration has always had a role as a tool of Australian foreign policy. Government can use international research collaboration to build closer relations with other countries, particularly those in our region. One example of this is the dividend that Australia has gained through research collaboration with Indonesia, extending back to the period when Dr Habibie was Indonesian Minister for Research. A more current example is the goodwill that Chinese-Australian researchers are generating through research collaboration with the country from which they have emigrated.

ATSE has helped to build strong and productive relations between Australia and countries including Korea, Japan, India, Singapore, Taiwan, South Africa, France, and the EC. ATSE and AAS jointly administer an Early Career Researcher Program

⁸ The OECD Megascience Forum was created in 1992. The Forum identifies specific opportunities, challenges and obstacles in large-scale international scientific collaborations, and develops recommendations for action by governments.

worth \$60,000 per annum funded by the Australia Korea Foundation which involves exchanges with Korea.

Institutions

Universities measure their success in a number of ways including the Shanghai Jiao Tong University index and the Times Higher Education index. International research collaboration contributes to the recognition of the quality of Australia's science and technology capability and to the high recognition for research excellence, internationally, which Australia enjoys. This has also served to build our reputation as a valuable partner in international collaboration efforts.

Researchers

The relatively small size of Australia's research community means that, for some researchers, international collaboration provides a very important means of working with their peers. For the development of leading edge research capacity, working with peers is of critical importance.

International collaboration can also provide Australian researchers with opportunities to apply their expertise to problems in other countries. This source of challenges can, in turn, lead to new ideas that will result in economic and social benefits for Australia.

The impediments to Australian international research collaboration

From ATSE's perspective the major impediments to international research collaboration faced by Australian researchers are:

- Lack of an overseas science counsellor network; and
- Lack of adequate funding and longer term commitments for the ISL Program and related bilateral activities.

Science counsellors

Australian science counsellors located at overseas posts fulfil a vital role in international research collaboration. Under the previous Government, responsibility for these matters rested with the former Department of Education, Science and Training (DEST). That Department had inherited an overseas counsellor network from one of its predecessors. In the late 1990s the science counsellor network included full-time science positions in London, Washington, Tokyo, Seoul, Bonn, Brussels (EU), Jakarta and Paris (OECD). Positions in India, China and Taiwan were added subsequently. DEST changed the nature of some of these overseas positions to put greater emphasis on marketing Australia's education to overseas students and reducing their capacity to serve the needs of international science collaboration.

We understand that when the science responsibility was transferred to the present Department of Innovation, Industry Science and Research, most of these positions remained with the new Department of Education, Employment and Workplace Relations and ceased having a science function. Whatever the reasons for this change, Australia is now seriously under-represented overseas. Australia needs

science counsellors in our key embassies who understand the different elements of our national science and innovation system and can facilitate connections with counterparts in other countries.

As the PMSEIC report demonstrates, international science collaboration touches the interests of quite a number of government agencies. There is a need for one Department, and in our view it should be DIISR, to take a whole-of-government approach and address this problem. We understand that there are moves to re-establish the counsellor position in Washington and India and commend this move. The Washington position had existed for about four decades. However there are other locations where the presence of a full time science counsellor is also essential if Australia is to obtain optimum benefits from investment in international collaboration.

- The role of science counsellors is to meet the needs of Australian research funders and performers and well as those involved in science policy formulation;
- Facilitating Australia's engagement with science and research in the countries to which they are accredited;
- Ensuring that Australia is appropriately represented in science-related activities in these countries;
- Providing assistance to visiting Ministers, science and technology-related delegations, and other high level visitors;
- Assisting links between Australian research performing and funding agencies and their foreign counterparts;
- Representing Australia in various science-related activities including local science counsellor networks;
- Assisting Australian researchers to obtain funding and other support from foreign sources; and
- Supporting major Australian science projects such as the Square Kilometre Array and initiatives such as the Global Carbon Capture and Storage Institute.

ATSE RECOMMENDS

- ***Strong support of a science counsellor network— an essential component of Australia's international research collaboration effort***

ATSE RECOMMENDS

- ***ISL-SAP funding arrangements should be the subject of at least a three-year agreement, with a scheduled review period at the end of the second year to allow timely consideration of forward funding arrangements.***

ISL Program funding

ATSE recognises the extent to which the Government has increased funding for science and research. The major gap remaining is the funding of targeted bilateral science collaboration through the ISL Program, including ISL-SAP. As noted above, ATSE recommends that overall funding for the ISL program be increased to \$30m, per annum.

ATSE considers that the continuity of collaboration is a major driver in establishing stable bilateral relationships. The reversion to annual ISL-SAP funding in 2009-10 and 2010-11 could be interpreted by our partner countries as Australia weakening its commitment to international collaboration. This would be most unfortunate, occurring at a time when the Government has called for strengthened science and technology research and innovation, including through collaboration. Three year funding enhances the administrative efficiency in delivery as it allows for longer term planning and provides a “message“ of ongoing commitment to bilateral partners and their academies and research institutes.

ATSE RECOMMENDS

- ***An increase in base funding under the ISL-SAP and that this should be subject to an annual CPI adjustment.***

In addition, ATSE would like to see an additional funding element introduced into agreed activities specifically to support short-term follow-up initiatives that will leverage substantial outcomes for one-off modest investments. This would involve a modest cost of \$50,000 per annum. ATSE would facilitate follow up activities to workshops, missions and exchanges where joint research venture, and/or technology transfer/commercialisation is being pursued post earlier ISL-SAP activity. This adds a further opportunity for enhancing successful outcomes at a modest additional cost.

These recommendations are designed to enhance efficiency and effectiveness, build on existing arrangements but specifically targeted at practical outcomes of applying research and transferring technology into real world applications.

Appendix A

Outcomes from ATSE delivered ISL-SAP Activities

Quantity, quality and effectiveness activities

The extent of the reach that ATSE has been able to achieve in the ISL-SAP activities over the past decade is summarised in Tables 1 and 2. Our 132 workshops and missions and 85 bilateral/multilateral activities have enabled Australian researchers to form strong cooperative links with some thirty-three countries including APEC member States, as well as the European Commission.

Table 1. ATSE ISL-SAP activities – numbers of activities and (countries) ¹

Year	ATSE-foreign Academies meetings	Missions & Workshops ⁵	Bilateral/ Multilateral events
1998-99	1 (21)	6 (8)	14 (14) ²
1999-00	3 (21)	8 (6)	17(14) ²
2000-01		5 (3)	14 (13) ²
2001-02	1 (21)	13 (9*)	6 (7) ²
2002-03		15 (23) ³	-
2003-04	1 (21)	17 (22) ²	5 (5)
2004-05		18 (24)	6 (9)
2005-06	1 (18)	9 (6)	12(11) ⁴
2006-07		15 (16) ²	3(10)
2007-08		12 (14)	3 (19)
2008-09		14 (28)	5 (5)
TOTAL	7 (21 learned Academies)	132 (159) ⁵	85 (107)

- Notes:
1. A country may participate in more than one activity, each participation is counted.
 2. Indicates European Commission participation.
 3. Indicates APEC attendance.
 4. Indicates Western Europe attendance.
 5. In addition, 7 Sir Mark Oliphant Conferences have been held with 35 countries participating.
 6. For each entry, the number of events is followed, in parentheses by the number of countries involved.

Table 2. ATSE ISL-SAP activities- Country Participation in International S&T Linkages for Missions, Workshops and Delegates

Year		Total number	EU	Asia/Pacific	Americas	Other
1998-99	Mission	8	1	2	4	1
	Bilateral	12	1	9	1	1
1999-00	Mission	6	1	4		1
	Bilateral	14	5	7	2	
2000-01	Mission	3		3		
	Bilateral	13	3	7	3	
2001-02	Mission	9	2	5	2	
	Bilateral	7	1	3	3	
2002-03	Mission	23	6	11	3	3
	Bilateral					
2003-04	Mission	24	12	6	4	2
	Bilateral	5		4		1
2004-05	Mission	25	14	8	2	1
	Bilateral	6	2	4		
2005-06	Mission	6	1	4		1
	Bilateral	11	6	3	1	1
2006-07	Mission	16	5	8	1	2
	Bilateral	10	5	2	1	2
2007-08	Mission	14	6	4	2	2
	Bilateral	19	11	3	3	2
2008-09	Mission	27	10	6	5	6
	Bilateral	5	1	4		
TOTAL		263	93 (35.4%)	107 (40.7%)	37 (14%)	26 (9.9%)
(percent)						

Notes: 1. EU includes Belgium, the Czech Republic, Denmark, European Commission, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Spain, Switzerland, and UK.

2. Asia Pacific includes Japan, Hong Kong, Korea, Malaysia, Thailand, Indonesia, China, NZ, Taiwan, Philippines and Vietnam.

3. The Americas includes Argentina, Brazil, Chile, Canada, Mexico and the USA.

4. Other includes India, South Africa and Egypt.

The opportunity to have multiple activities over time with priority individual countries has allowed long term trusted relationships to be developed based on excellence in science and technology and cultural understanding. It is this investment over the longer term that value adds to the initial ISL-SAP funding investment — this is why ISL-SAP grants need to be for at least three year terms. ATSE's strong and productive relationships with science and technology academies world-wide has been a consistent element in leveraging benefit into the ISL-SAP activities through high level introduction into other countries national research and innovation systems.

The Australia China Young Scientist Exchange Program has proved to be highly effective model for introducing future science and technology leaders into the research and innovation systems of countries at very senior levels. ATSE proposes to use similar approaches for Singapore and Japan exchange activities.

The extent of the outreach ATSE contributes to awareness raising and opening up opportunities for exchange and collaboration is evident when considering that to date we have hosted 24 Chinese visiting scientists. Thus engagement on potential collaboration opportunities has occurred with more than 3,000 researchers, Australia-wide.

An example of outreach

Analysis of the recent Chinese exchange activity in August 2009 showed that for just one exchange scientist with an energy research interest, ATSE:

Raised the CV and research profile of the visiting scientist with 75 ATSE Fellows who were recognised leaders/leaders in their field;

Some 20 ATSE Fellow engaged;

ATSE Fellows provided a further 30 contacts of key researchers;

Overall some 15 Institutes/Universities/CSIRO were engaged in the visits plan and are aware of the linkage;

- 13 Host research units were engaged involving 10 lead scientists /host or a total of 130 research staff meeting directly with the Chinese visiting scientist;
- A further 75 researchers attended various talks and lectures given by the visiting scientist.

Thus, for one visiting scientist, the outreach was to 50 key researchers across Australia, with 13 host Institutes/key research units, direct contact and discussions on collaboration with 130 Australian scientists and a further 75 scientists being aware of the research capacity in China.

Outreach value

The ATSE exchange programs have a reputation for being well targeted and are seen as prestigious by participants as they open doors at very senior levels through the use of our strong relationships and influential networks with Australian research institutes, access to ATSE Fellows — Australia's leading science and technology experts — and our ability to leverage on our relationship with overseas science and technology Academies.

Australia Singapore Emerging Research Leaders Exchange Program

Australia's bilateral relationship with Singapore is based on long-standing Commonwealth, defence, education, political, trade and tourism links, as well as on the two countries' similar strategic outlook. Singapore is Australia's largest trade and investment partners in ASEAN and Australia's fifth largest trading partner overall.

The Australia Singapore Emerging Research Leaders Exchange Program (ASERLEP) provides opportunities for mid career researchers of both countries, who are emerging leaders in the Science and Technology community, to undertake two weeks of institutional placements in agreed-upon priority S&T areas. ATSE successfully administered a two week program in October 2009 for the first delegation of emerging research leaders from Singapore in the priority fields of biotechnology and energy.

ATSE Fellows with national and international reputations in relevant fields assisted in identifying and securing key Australian researchers to host visits, serving as a senior mentors to visitors, and providing access to the most senior levels of our universities and research Institutes. This initiative has proved highly strategic and has assisted in forging strategic and immediate to short term collaborative opportunities providing immediate returns on the investment costs of the program.

Joint initiative/Technology transfer

At least seven major joint ventures, funding and/or technology transfer outcomes have resulted directly from the ATSE ISL-SAP programs over the past five years (see Table 3). While directly illustrating the benefits of the program, it also highlights the value of the long term investment in building cooperative relationships with other countries. It is the work laid down over the past decade that has allowed the development of these recent joint collaborative research ventures.

Estimate of leveraged of government support by ATSE

ATSE estimates that the government investment in ISL-SAP grants to ATSE has seen, on average, a three-fold leveraging. Thus for activities covering the three year from 2006-07 to 2008-09, the ISL-SAP investment of \$1.6m has shown returns from ATSE in terms of an investment value in the order of \$4.8 m. This does not include the leverage achieved within participating research institutes, businesses and research units, but it would be reasonable to assume a similar leverage of 3-fold (\$4.8m). This means a ten-fold increase in value on the initial investment, excluding the value in any new collaborative initiatives arising from the program.

Table 3 Examples of Success

ISL activity	Outcome
Australia China Young Scientist Exchange Programme 2007-2009	Establishment of Australia-China Joint Centre on Stem Cells and Australia-China Joint Centre on Phenomics .
Re-assessment of the FecB mutation for prolificacy in sheep at Helen Newton Turner Memorial International Workshop on using the Booroola (FecB) Gene in Sheep Breeding Programs, November 2008	Prof. John Gibson, University of New England received a \$300,000 grant from the Bill Gates Foundation for a study on the role of animal breeding in poverty alleviation, based directly on the linkages and support he established at this Workshop.
Australia China ICT/Embedded Systems Workshop, August 2007	Establishment of Australia-China Research Centre for Wireless Communications . CSIRO Information and Communication Technologies Centre joined forces with the Beijing University of Post & Telecommunications with A\$2m total funding. Both countries now at the leading edge of future wireless communications technologies, including the development of 4G and 5G mobile networks.
Australia China Energy Symposium, November 2006	Establishment of Queensland-China Alliance on Nanomaterials for Clean Energy , which arose from regular participation in the Annual Australia China Symposium with CAS.
Australia China Water Workshop, 2006	Joint China Australia Water Centre on Water Resources Research Centre at University of Melbourne and Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences
Workshop on Innovation Research on Spatial Information, 2005	Workshop facilitated a visit to Australia by Dr Vincent Tao, VP of Microsoft's Virtual Earth Unit. Large funding grants and long term visits from senior researchers from Canada and USA resulted.
Workshop on Positron Applications from Atoms to Materials to Cells, 2005	Collaborations that arose from the Workshop led to the formation of an ARC Centre of Excellence in Antimatter Studies in 2006.
E-science Mission to UK, April 2004	This has led to strong relationships between Australian Government public service and its UK equivalent to further e-Research agenda in

both countries. Also **Victorian, South Australia and Queensland Governments and major research institutions established e-Research Strategic Initiatives** – providing investment in e-Research and in advanced high capacity e-Research infrastructure.

Efficiency

It is ATSE's experience that establishing our ISL-SAP funding as a three year grant and expanding it to the \$535,000 per annum level has given us with the ability to deliver a sufficient number of activities to deliver meaningful program outcomes. The provision of three year funding has allowed us to plan and establish longer term relationships, and hence confidence with our bilateral/multilateral partners. The current annual funding in 2009-10 and now 2010-11, whilst welcome to keep the program going, has limited our ability to commit to longer term planning activities and hence limits the scope and vision of the program.