

**STRATEGIC RESEARCH, NATIONAL INFRASTRUCTURE
AND INTERNATIONAL ENGAGEMENT**

A SUBMISSION TO THE INNOVATION REVIEW

by

**THE RESEARCH SCHOOL OF PHYSICAL SCIENCES AND ENGINEERING,
AUSTRALIAN NATIONAL UNIVERSITY**

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This document presents the submission to the Innovation Review on behalf of the Research School of Physical Sciences and Engineering at the Australian National University (ANU). Please note that this document represents the views of the School and not necessarily those of the ANU.

The School is the recipient of grants from a wide range of government research funding programmes, as well as research funding from private enterprise in specific areas. Consequently, the School has a keen interest in the effective use of research funding in the national interest.

In this submission, we restrict our contribution to those issues which provide a key national research focus. We can summarise our key ideas in the following three points:

- **a review/oversight body is needed that determines priority areas for strategic research in the national interest, funding for which needs to be provided over a range of government portfolios and not concentrated in one body (such as the ARC/NHMRC);**
- **a new mechanism for research infrastructure (facility and equipment) funding is required to succeed the NCRIS programme; and**
- **a separate funding process is needed to support global research engagement.**

We outline the reasoning behind these ideas in the sections below.

STRATEGIC RESEARCH

Currently in Australia the primary responsibility for undertaking coordinated strategic research of national benefit lies in the publicly funded research agencies (PFRAs) – CSIRO, ANSTO, AIMS and DSTO. It is appropriate that strategic research is funded by these agencies, but research in the national interest is also increasingly performed by universities and other institutions.

For example, given the key role of energy research to combat climate change, research and research training in energy sources is an area of strategic importance to Australia. However, while this research is undertaken both within and outside the PFRAs, there is very little dedicated funding for strategic research outside the PFRAs. The Australian Research Council provides competitive funding for all research disciplines, but not on a scale which can support the large research facilities needed for such endeavours. In addition, the ARC does not specifically target areas of national strategic importance.

The Research School of Physical Sciences and Engineering at ANU is a case in point where we undertake large scale research in the national interest in the following two areas.

1. *Preparing for Australia's energy future:*

- Nuclear Science: Our School is the only research and training facility in the country in the field of nuclear science. Our research is based around the Heavy Ion Accelerator Facility which provides research capability and training for the following nationally and internationally significant research programmes:
 - isotopic indicators of climate change;
 - tracers for the study of environmental flows;
 - materials development and characterisation; and
 - fundamental nuclear science.

Against this backdrop of world leading research, we are able to provide postgraduate education in nuclear science which underpins not only the strategic research undertaken by ANSTO, but provides trained graduates for our international obligations in nuclear weapons proliferation and nuclear monitoring. Indeed, it also provides human capacity for any future investment by the nation in nuclear energy based on nuclear fission.

- Fusion Research: The School also houses another large experiment – the H-1 Major National Research Facility – which is aimed at understanding the scientific issues underpinning the harnessing of fusion energy (the source which powers the sun). With a long-standing international reputation in fusion research, Australia has an expertise niche in this field, which is an important leveraging tool for involvement in the International Thermonuclear Experimental Reactor or ITER – the world's largest multinational experiment aimed at producing potentially unlimited power. The ANU activity is part of the Australian ITER Forum which includes other university researchers as well as ANSTO, and whose aim is to engage with ITER to ensure that Australia is well-placed to take advantage of this potential future energy source.

Continued funding for both of these programs and the major facilities that underpin them will be beyond the resources of the University and the School, particularly following the end of the Major National Research Facility funding after 2010. In a flat or declining funding environment, and with depreciating equipment and infrastructure, these facilities cannot be maintained or operated by the School without a stable external source of strategic research funding.

2. *Nanoscience, nanofabrication and advanced materials*

This important area for the future of Australia's manufacturing industry requires substantial, integrated research facilities and infrastructure. These research programmes in the School have achieved a critical mass of large, sophisticated diagnostic and research equipment, and involve around 100 research scientists, which collectively represent a coordinated activity of strategic benefit to the Nation. The School's capabilities and expertise are foremost in the Nation, but the scale of the programme (personnel as well as capital costs) and its long-term coordination cannot be adequately supported with sufficient continuity by a collection of small research grants. A national strategy is needed in this important area with appropriate strategic funding.

In the light of the above, it is therefore essential that a body be established to identify the areas of strategic research which are essential for the nation. We believe that energy research and nanotechnology – particularly based around major national facilities or coordinated clusters of facilities which cannot be funded by other mechanisms – are two such strategic areas, as well as other fields outside our School's area of expertise.

Necessarily, this approach will require funding outside the traditional PFRA framework. It is instructive to look at overseas models such as the Department of Energy in the US which funds strategic research programmes. Given that strategic research is important to a number of government portfolios, we see a role for strategic research funding to be provided by a range of departments, including - but not limited to - DIISR.

NATIONAL INFRASTRUCTURE

Given our large research facilities outlined above, we also have a strong interest in future funding of major research infrastructure. To this we can add infrastructure associated with large critical research mass. As noted above, our School has a suite of such facilities that support materials and nanotechnology research – clean rooms, materials preparation and processing, diagnostics and high resolution microscopes.

The continued operation, maintenance and upgrading of these expensive large facilities cannot be sustained through the usual competitive grants process. It requires a new funding mechanism to replace NCRIS, which no longer has any funding allocation. This is a critical need around the country, and cannot be delayed without halting our internationally competitive fundamental and nationally important strategic research in its tracks.

Neither can major national research infrastructure be supported by the HEEF fund, which is severely oversubscribed for the replacement of the higher education sector's decaying building stock. An entirely separate funding source is required to replace NCRIS, and to produce a concrete roadmap for infrastructure establishment, operation and renewal.

INTERNATIONAL ENGAGEMENT

Modern research is highly collaborative to maximize resources (expertise and facilities) and therefore outcomes. Hence global research engagement is essential. Australia has had programs to support our access to major international facilities (and these have worked well), but there are areas where lack of national support for international research collaboration is limiting our international engagement.

The various types of engagement include:

1. *Operation of key Australian facilities for international access.* While it is accepted international practice not to charge for access to major facilities (Australia does not pay for access to international facilities – foreign governments support operations), there is no reciprocal scheme whereby the Australian government supports a proportion of operation costs for Australia's international facilities (e.g. the Heavy Ion Accelerator facility at ANU).

2. *Access to major global programs.* These include, for example, ITER, CERN, major telescopes, synchrotrons, and gravitational wave observatories such as LIGO. Although access for travel support to major facilities is sometimes covered by existing schemes, funding for portable experimental equipment from the Australian end does not necessarily follow the award of access.
3. *Large bilateral and multilateral programs which need funding sources in the partner countries.* Australia does not currently have a separate scheme to support its contribution to such programs (except for some very specific cases). As an example, Australian groups wishing to partner with individual 7th Framework initiatives in the European Union do not have a mechanism to leverage funding from these major overseas research programmes. Australian partners are increasingly required to cobble together funds from ARC and other sources - and without a mechanism to establish a reciprocal agreement - which has severely limited our engagement.

We strongly recommend that these three areas of research significance - strategic research, national infrastructure and international engagement – are given appropriate consideration in the report of the Innovation Review.

Yours sincerely

A handwritten signature in cursive script that reads "Jim Williams".

Professor Jim Williams
Director
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ANU