ANTARCTIC CLIMATE & ECOSYSTEMS CRC

Antarctic Climate & Ecosystems Cooperative Research Centre
Location 20 Castray Esplanade, Hobart, Tasmania, 7000
Postal Private Bag 80, Hobart Tasmania 7001, Australia

www.acecrc.org.au

23rd June 2016

Australian Academy of Science
Ian Potter House
Gordon Street,
Canberra, ACT 2601

Attention: Prof Trevor McDougall

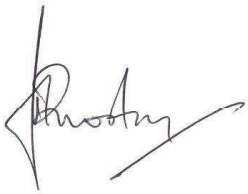
Re: Climate Science Capability Review

Dear Trevor,

Please find attached the ACE CRC's response to the Academy's Climate Science Capability Review.

Should you require any additional information, or clarification on any points, please don't hesitate to contact me.

Yours Sincerely,



Prof Tony Worby
Chief Executive Officer

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Australian Climate Science Capability Review – Input from the ACE CRC

1. Basic Information

Prof Anthony Worby

CEO, Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC)

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2. Sensitivity

None of the material presented in this submission is sensitive.

3. ACE CRC's climate science activities

The ACE CRC is a collaboration of 5 national core partners, 2 international core partners, and 14 other participants. The national core partners include the CSIRO Oceans and Atmosphere Flagship, the Australian Antarctic Division, University of Tasmania, Bureau of Meteorology and the Federal Department of Environment. The CRC is funded through the Department of Industry, Innovation and Science.

The CRC model relies on collaboration between our partner organisations to deliver on our research, education and utilisation milestones that are set out in our contract with the Commonwealth. The CRC directly employs approx. 40 staff, 34 of whom are directly involved in climate research or the support of that research (see below) across our 7 project areas. Additionally, the CRC relies on approx. 100 FTE of in kind support from scientists across our 21 partner institutions. To avoid double counting the staff at our partner agencies, given I expect each of those agencies will also have made a submission to this capability review, I will focus my responses only on the staff directly employed by the ACE CRC.

The CRC has 7 project areas, 5 of which align with your specified Areas 1 through 5.

1.1 The Southern Ocean in a Changing Climate

1.2 Ocean-forced evolution of the Antarctic ice sheet

1.3 Sea ice process and change

1.4 Antarctic Climate Variability of the past 2000 years

2.1 Carbon uptake and Chemical Change

Additionally, we have 2 project areas that are climate-related but have a biological focus. I have captured these below in response to Area 6 "other activities not specified elsewhere".

2.2 Biological responses to environmental change

2.3 Status and trends in habitats, key species and ecosystems

At 31st March 2016, the ACE CRC position can be summarised as follows.

The CRC is two years into a five-year funding round. Our present funding of $5M per annum will end on 30th June 2019. Beyond that date it is unclear whether there will be a mechanism to continue funding the work presently done by the ACE CRC. The CRC was first established, as the Antarctic CRC, in 1991 and we are in our fifth round of funding. New CRC guidelines introduced in 2015 after the Miles review[1] preclude any further CRC Programme funding for this work. Early discussions are underway across government to address the issue of where funds for public-good research will be sourced, given the strong policy shift towards industry-led and commercially-focussed research.

Area 1: Climate Observations

The ACE CRC has no staff in this category. It is worth noting that the ACE CRC does a lot of work on palaeoclimate using ice cores, but our two Postdocs working in this area are more closely aligned with Area 3 below. The ice cores are collected primarily by AAD staff who are not included here.

Area 2: Climate Processes

We have 19 FTE across programs 1.1, 1.2, 1.3 and 2.1. These include 3 mid-career researchers, 7 postdocs and 9 technical staff. The mid-career researchers are on 5 year contracts, the postdocs are on 3 year contracts and the technical staff are on a range of 3 month to 5 year contracts. Four of the technical staff were employed specifically to undertake field work on short-term contracts but were on our books at 31st March 2016.

Area 3: Climate Understanding

We have 4 FTE (1 mid-career and 3 postdoc level) working in this area, 2 on understanding detection and attribution of changes observed in the Southern Ocean (1.1) and 2 studying palaeoclimate from ice cores (1.4) to reconstruct past drought and flood events across mainland Australia over the past millennia. The mid-career scientist is on a 5 year contract, two of the postdocs are on 3 year contracts, the other is on a 2 year contract.

Area 4: Climate model development

We have 3 FTE (postdoc level) working in this area, 2 of whom are working on different aspects of ice shelf/ocean modelling (1.2) and 1 working on regional sea ice modelling (1.3). All are on three year contracts.

Area 5: Links to economic/social systems.

We have 2 FTE (postdoc level) working in this area. Both rely predominantly on soft money and are aligned with our Climate Futures program. Their focus has been on using downscaled modelling products to assess the likely impacts of climate change on different sectors of the economy, such as agriculture, emergency management response, and infrastructure exposure.

[1] Growth through Innovation and Collaboration. A review of the Cooperative Research Centres Programme, March 2015. ISBN 978-1-925092-53-0.

Area 6: Other climate science activities not specified elsewhere.

We have 6 staff (1 mid-career scientist and 5 postdocs) working across programs 2.2 and 2.3. These staff are not engaged directly in climate observations or process studies, but are looking at the likely impacts of climatic changes on Southern Ocean ecosystems, including some laboratory studies. All staff are employed on 3 year contracts.

4. Changes in the past 10 years

As a CRC we have a mandate to deliver research outputs to end users, and this has always been an important focus of our work. Over the past decade however, our focus has moved from SME engagement and efforts to develop commercial applications of our IP, to a much stronger focus on the end-users of climate information, and providing that information in a way that is targeted and useful. End-users of ACE CRC research include the agriculture sector in Tasmania which benefited from the Climate Futures for Tasmania project, the Alpine Resorts Coordinating Council, and the Tasmanian Fire Service and other Emergency management agencies that factor future climate change into their strategic and operational planning.

From a science perspective, we focus much more today on ice shelf / ocean interaction, given this is a key gap identified in the IPCC reports. We know much more now than we did a decade ago about how the physical properties of the ocean have changed, and have now turned our attention to the impacts of this on the margins of Antarctica, and the impacts on ice shelf processes and stability. Our focus has shifted in palaeoclimate too, with a stronger focus on building up a 2000 year climate history from multiple locations in Antarctica and coupling those records with other palaeoclimate proxies from marine and terrestrial locations, and working to develop a better understanding of Australia's climate history from this work.

5. Dependencies

As described above the ACE CRC relies heavily on our partner institutions for both staff, and non-staff, in kind support. Scientific leadership of our 7 project areas comes primarily from senior staff in our partner organisations, while the ACE CRC predominantly employs early-career researchers and technical staff to undertake the work.

The CRC relies on access to research vessels and Antarctic stations via competitive grants. In Australia this is through the Australian Antarctic Science (AAS) program and the Marine National Facility; however we also leverage ship-time and access to Antarctica through our international partners and it is common for our staff to participate on research voyages funded by other national programs.

The Integrated Marine Observing System (IMOS), which is funded through the NCRIS program, is integral to the success of the ACE CRC. The CRC co-invests approx. $1.5M in cash over 5 years in IMOS, particularly in the ARGO Facility and the Deepwater Mooring Facility. We also have a strong interest in data collected through the Ship of Opportunity Facility and Animal Tracking Facility.

The CRC is a formal partner in the National Computing Infrastructure and relies on NCI to provide high level computing facilities for some of our modelling activities. We use only 0.5% of the available CPU but it is critical infrastructure for our work, and I expect demand will only grow.

Some CRC staff rely heavily on the output of CMIP experiments, particularly for some of the Detection and Attribution work described above. Obviously there is also a great deal of model development underpinning the CMIP runs, so there is a strong dependency on the national long-term investment through CSIRO and BoM to develop and run the models.

The University of Tasmania provides accommodation (offices and specialised laboratories) for ACE CRC-funded staff as part of their role as the CRC's Centre Agent, and in return derives block grant funding on the CRC grant, and has access to ACE staff for student supervision and teaching.

6. External dependencies

All the work done by the ACE CRC takes place in a highly leveraged environment and there are a significant number of external dependencies.

Already mentioned above is the cash contribution the ACE CRC makes to IMOS, of approx. $1.5M over 5 years. This investment is leveraged by IMOS to attract further investment into its facilities. The ACE CRC projects also use data streams from other IMOS Facilities, and this uptake of data supports the investment made by IMOS in collecting the data. So, this is a very synergistic relationship.

The ACE CRC has funded a considerable amount of technical support, including sea-going staff and laboratory technicians. Much of this has value-added considerably to other national investments. Staff at CSIRO, for example, who received funding from the ACCSP program would not have delivered as much as they did on their ACCSP contract without the support provided through the ACE CRC.

The ACE CRC has a mandate to deliver research outcomes to end-users through the development of translational products. We have done this through the publication of a series of "Position Analyses" on topical areas of climate research, and these have been widely circulated through federal government agencies. The ACE CRC has developed a number of online tools, such as the Canute Sea Level Rise tool, that provides SLR estimates to interested users at high resolution around the Australian coast for different IPCC climate change scenarios. The ClimateAsyst tool and Tasmarc project also deliver information about climate change, and in particular beach erosion, to local communities and councils around Tasmania.

Much of the ACE CRC's Climate Future's research and delivery to end-users has been done in conjunction with CSIRO staff with expertise in dynamical downscaling. Again this is a highly synergistic relationship that has delivered significant benefits to both organisations, and to the end-users of that research including agriculture, aquaculture, emergency management, infrastructure owners, town planners and the like.

7. Collaboration with other organisations

As mentioned above the ACE CRC has formal institutional partnerships with 21 national and international partners. These are listed here in more detail:

Australian Core Partners: CSIRO, BoM, AAD, University of Tasmania, Dept Environment
International Core Partners: Alfred Wegener Institute (Germany), NIWA (NZ)
Other domestic participants: Curtin University, SGS Economics and Planning, Tasmanian Government

Other international participants: Hokkaido University, National Institute of Polar Research, Tokyo University of Marine Science and Technology (Japan); First Institution of Oceanography, Chinese Academy of Meteorological Science (China); Old Dominion University, University of Texas San Antonio, University of Texas Austin (USA); LEGOS (France); University College London (UK); Vrije University (Brussels).

The CRC's core partners are mission enabling inasmuch as they provide core capabilities in the form of staff contributions and/or research infrastructure that are essential for the ACE CRC to deliver on its contractual milestones with the Commonwealth. All of the work of the ACE CRC is focused on Antarctic and Southern Ocean research.

The nature of the collaborations varies by partner. We have a formal visitor exchange program with AWI and active (but less formal) visitor exchanges with our Japanese and Chinese partners. Staff from the ACE CRC participate in a field teaching program with the University of Hokkaido, and we have multiple jointly-supervised students. With our University of Texas colleagues we have access to valuable research infrastructure and aircraft time for making airborne measurements over Antarctica that has led to a much greater understanding of the thickness of the East Antarctic continent and the bedrock below. We have had staff participate on marine and Antarctic research voyages aboard vessels operated by Germany, the USA, and Japan.

In addition to these formal partnerships we have a number of MoUs or less formal collaborations with other institutions. These include Shanghai Ocean University in China, where we collaborate on Southern Ocean ecosystem research, Woods Hole Oceanographic Institution which provides us with access to an Autonomous Underwater Vehicle for making measurements beneath sea ice.

We collaborate with the Tasmanian State Government primarily through our Climate Futures projects, which deliver high-resolution climate projections for the state targeted at different sectors of the economy.

8. Support to other organisations

The ACE CRC provides policy-relevant advice to a number of government agencies at the federal, state and local level, as described in the sections above. A significant number of our staff have contributed to IPCC Assessment reports, both as authors of work cited in the reports and as contributing authors on specific IPCC AR chapters. A number of our staff hold leadership positions with various Academy national committees and with national and international organisations such as the World Climate Research Program and Scientific Committee on Antarctic Research.

9. Is our work critical to understanding Australian and regional climate, for responding to climate change, or otherwise essential for the national interest?

Yes. The work we do underpins our understanding of the role played by Antarctica and the Southern Ocean in the global climate system. The observations we make have provided evidence of significant changes over time and the work we are doing now is focussed on understanding the impacts of those changes, for example the impacts of warmer ocean waters on Antarctic ice shelves and on the long-term stability of the Antarctic ice sheet. This is essential for understanding future sea level rise and the possible impacts on communities, infrastructure and our economy, and should underpin

government policy making. Our work on understanding palaeoclimate provides context for present-day changes. I can't think of a single element of our research portfolio that is not in the national interest. The work also underpins Australia's strategic interests in the Antarctic, and our region more broadly, and our influence in international treaty systems.

10. Resourcing

The ACE CRC receives $5M pa for the 5 years from 1st July 2014 – 30 June 2019.

Additional research funding, which is separate to our Commonwealth Grant, comes from a number of sources. This additional funding may enhance the delivery of our milestones to the Commonweatlh or focus on new additional work. These include:

- State and Federal contracts, and funding from peak bodies such as Wine Australia, which is essential for our Climate Futures projects
- ARC Discovery and/or Linkage Grants, where we are able to free up a small percentage of an ACE-funded staff members time to contribute to a larger grant aligned with ACE CRC deliverables.

As described above the ACE CRC relies heavily on the in kind support of staff from our partner organisations.

11. Adequacy of resourcing

The $5M pa we receive in CRC Program funding is the minimum required to deliver on our 7 project areas. The Climate Futures work can only be delivered with additional external income. The other resourcing that is essential is the availability of ship time, and access to Antarctica, through competitive grants. Hence, we are exposed to any cuts in funding to the agencies that operate national research infrastructure such as ships.

A 30% reduction in our budget would see significant cuts to both our research activities, availability of technical support, and ability to develop translational products for end-users to the point that the CRC model would not be an appropriate vehicle for delivering the work.

A 30% increase in funding would enable us to scale up to a genuine critical mass in some key areas of research, such as ice shelf/ocean modelling. We would have additional capacity to invest in key measurement programs that deliver to our in-house projects, and co-invest more into national and global observing programs. We could invest more in technology development.

12. Frequency of resourcing

The ACE CRC is funded for 5 years, and we are in our fifth round of funding. It is unlikely, given recent changes to the CRC Program guidelines, that we will receive further funding from the CRC program. This fact is well known and I'm sure is factoring into the thinking of our staff, all of whom are on contracts that end between mid 2017 and mid 2019. It is almost certain that we will lose staff as they look for employment certainty elsewhere in the second half of their contract periods.

The 5 year funding cycle has resulted in significant turnover of ACE CRC staff. As an example, of the 40 staff we currently employ, less than 25% were employed in the last round of funding. Hence a very large proportion of our first year was spent recruiting. Of course there are pros and cons to refreshing your staff pool, but a >75% turnover is less than ideal and does result in a significant drop in productivity and continuity from one funding round to the next.

Antarctic and Southern Ocean research also requires long lead times. The Australian Antarctic grants program, which we rely on for logistics support, only opens every two years. A successful proposal may then take a number of successive seasons to complete, before time is allocated to the analysis, write up and publication of results. This is inconsistent with staff being employed on 3 year contracts.

13. Functions and Capabilities of our organisation

The ACE CRC drives collaboration across our partner institutions. We are, in effect, a very high performing matrix model that draws capability from multiple sources to build project teams to tackle large, multi-disciplinary research projects that no single institution alone has the capacity to undertake. In this way we drive efficiency in the innovation system because we remove the need to duplicate capability across institutions and provide an effective, nimble mechanism to partner.

There are very few mechanisms by which Publicly Funded Research Agencies and Universities can effectively collaborate. The CRC Program is one example that has stood the test of time, but for public good research this vehicle is being taken away. All of the partners in the ACE CRC have different business models, different funding streams, different relationships to government, and different stakeholder groups. The CRC Program recognises these differences and works across and within them to facilitate collaboration. To achieve a similar outcome through multiple bilateral relationships would be administratively unworkable.

14. State of Climate Workforce in Australia

(a) Is the workforce currently adequately equipped? No. Obviously the cuts at CSIRO have seriously impacted on our national capacity to deliver an appropriate level of information to the government and community on climate change. Our climate modelling capability was already underdone and is now substantially reduced. I don't think anyone yet has a clear line of sight on just what the impacts will be in terms of our national climate modelling capability but it is not clear to me that we can maintain the level of climate model development and contribution to CMIP that has previously existed. Unfortunately, morale in the community is also presently at a low ebb, and this exacerbates the flight risk of remaining staff. Our capacity to teach and supervise student projects is reduced as a result, and Australia has suffered considerable reputational damage.

(b) Is there a critical mass of scientists? In some areas we have critical mass, but in other areas we are sub-critical or at risk of being sub-critical. In many cases, we face generational change with limited depth to the talent pool coming through. Australia's glaciology expertise may be a good example - it is largely based at AAD but with a significant university footprint scattered around the country. There are a number of high-profile scientists reaching retirement age but a limited number of emerging leaders. Recruiting from overseas is an

option to fill the gap but we need to be able to attract the world's best, and that is more difficult than it was because of (a) above.

(c) Where are the major gaps in capabilities? I don't have any statistics to hand, but it appears to me we teach a lot of PhD students. The ACE CRC, as an example, has more than 60 PhD students working on projects related to our research portfolio. I think many people pursuing a career in science find it challenging to go from early-career to mid-career, inasmuch as they might land one or two postdoc positions, but then struggle to find something more permanent. DECRAs and Future Fellowships are extremely competitive, with outstanding candidates frequently missing out, and the situation overseas is no easier. Addressing the lack of opportunity for mid-career scientists, and in particular for young women in science, is critical. Addressing the issue of generally poor numerical skills in students coming out of under-graduate training into PhD programs is also essential.