

## **Serving the scientific program into the future**

- 5.1 Australia's Antarctic science program has been an enduring feature of Australia's engagement on the continent. The nation's leadership and engagement in Antarctic science underpins Australia's presence. As highlighted in this report, Antarctic science is a focus of many national Antarctic programs and, for Australia to remain at the forefront of science and engagement on the continent, a renewed focus on its own program is required.
- 5.2 This chapter considers a range of matters including:
- Australia's Antarctic science framework including Australia's leadership in Antarctic science and the *Australian Antarctic Science Strategic Plan 2011-12 to 2020-21*;
  - Australia's particular areas of Antarctic science expertise;
  - how Australian Antarctic science is resourced including the future of the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC), the development and maintenance of a scientific workforce, improved training opportunities and how data is stored, managed and used;
  - consideration of scientific collaboration agreements and intellectual property issues; and
  - some of the wider applications for which Antarctic science may be utilised.

## Antarctic science framework

- 5.3 Science is the currency of influence in Antarctica, and Australia's expertise in Antarctic science is globally renowned. As such Australia's Antarctic science capabilities are a major strand of Australian engagement and influence on the continent.<sup>1</sup>
- 5.4 Australia's scientific effort is led by the Department of the Environment and Energy's Australian Antarctic Division (AAD). The AAD is responsible for the delivery of the Australian Antarctic Program (AAP), including one third of the projects undertaken under the auspices of the Australian Antarctic Science Program. The remainder are undertaken by Australian research institutions, and in some cases in partnership with international collaborators.<sup>2</sup>
- 5.5 Australia's Antarctic science framework is underpinned by the Australian Government's commitments as part of the *Australian Antarctic Strategy and 20 Year Action Plan*. The Plan outlines the Australian Government's commitment to delivering a revitalised science program.<sup>3</sup>
- 5.6 In particular, the Plan provides for a coordinated and effective approach to the funding of Antarctic science. It also considers opportunities for public-private partnerships to conduct new and iconic scientific research endeavours, through an Antarctic Foundation. The Plan also provides for a review of the *Australian Antarctic Science Strategic Plan 2011-12 to 2020-21* to be completed, revising and extending the Plan for a further five years.<sup>4</sup>

## Australian science leadership in Antarctica

- 5.7 Australia has played a leadership role in Antarctic affairs since the inception of the Antarctic Treaty System (ATS). As outlined in chapter 3, Australia has an extensive record in international leadership and collaboration in Antarctica.
- 5.8 With respect to Australia's leadership in the field of Antarctic science, the Department of Environment and Energy advised the Committee that Australia works closely with a range of government agencies and research

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1 Department of the Environment and Energy, *Submission 13*, p. 12.

2 Department of the Environment and Energy, *Submission 13*, p. 12.

3 Department of the Environment and Energy, *Australian Antarctic Strategy and 20 Year Action Plan*, 2016, p. 3.

4 Department of the Environment and Energy, *Submission 13*, p. 1.

establishments in supporting 'Australia's reputation as a science leader in Antarctica.'<sup>5</sup>

5.9 The Institute of Marine and Antarctic Studies (IMAS) noted that Australia has shown its leadership credentials through its active participation – and in some cases chairing – a range of international Antarctic forums.<sup>6</sup> The Institute noted that Australia's unique Antarctic scientific research program which links the AAD with other cooperative research partnerships sets it apart from the scientific efforts of other 'long-established Antarctic nations and [has been] materially responsible for the significant scientific contribution Australia has made to the ATS.'<sup>7</sup>

5.10 The Institute, however, highlighted its concern that Australia's leading role in Antarctica was at risk:

Fundamentally Australia will lose its scientific capability for Antarctic science if it cannot maintain critical mass of scientific expertise and an ability to provide the necessary logistical support to undertake Antarctic science programs, especially deep-field science, ice shelf and ice sheet observations, and a maintained presence for Southern Ocean observations (physical, chemical and biological).<sup>8</sup>

5.11 This sentiment was echoed by a number of inquiry participants. In particular, concerns were raised about a perceived decline in Australia's standing as a scientific leader on the continent. Commentary also focussed on how Australia's relative position in the field could be impacted by the recent work of other Antarctic nations.

5.12 The Australian Academy of Science, for example, submitted that Australia's 'ability to influence affairs in the region is dependent on its scientific credibility and noted that those:

... countries that are not original signatories to the Treaty only achieve decision-making status by conducting substantial research activity in the region.<sup>9</sup>

5.13 The Academy also submitted that, while Australia has a strong record in the production of scientific papers,<sup>10</sup> Australia's 'scientific activity and output have declined substantially.'<sup>11</sup>

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5 Department of the Environment and Energy, *Submission 13*, p. 10.

6 Institute for Marine and Antarctic Studies (IMAS) University of Tasmania, *Submission 8*, p. 1.

7 IMAS University of Tasmania, *Submission 8*, p. 2.

8 IMAS University of Tasmania, *Submission 8*, p. 2.

9 Australian Academy of Science, *Submission 4*, p. 2.

## ***Australian Antarctic Science Strategic Plan 2011–12 to 2020–21***

- 5.14 The *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21* was launched in 2010 and is intended to guide the Australian Antarctic Science Program over the period of a decade.<sup>12</sup> The Department of the Environment and Energy advised that Australia's research program covers physical and life sciences in the terrestrial, marine and atmospheric domains built around four themes:
- Climate processes and change;
  - Terrestrial and nearshore ecosystems: environmental change and conservation;
  - Southern Ocean ecosystems: environmental change and conservation; and
  - Frontier science.<sup>13</sup>
- 5.15 The *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21* establishes the framework under which Australian entities contribute to Australia's Antarctic science effort. The Plan notes that there are 'logistical and budgetary limits on the amount of science that can be supported by the Australian Government in the Southern Ocean and Antarctica, which will vary from time to time in line with government priorities.'<sup>14</sup> As such, there will be a need to prioritise across and within these themes.<sup>15</sup>
- 5.16 The Department of the Environment and Energy advised that the *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21* was currently being evaluated to 'identify new and emerging strategic drivers for Antarctic science'.<sup>16</sup> The Department advised that this evaluation will include assessing the progress made toward achieving the Plan's goals since its launch. The evaluation will inform the revision and extension of the Plan consistent with the commitments under the *Antarctic Strategy and*

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10 Australian Academy of Science, *Submission 4*, p. 4.

11 Australian Academy of Science, *Submission 4*, p. 4. See also Professor Steven Chown, Chair, National Committee for Antarctic Research, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 5.

12 Department of Sustainability, Environment, Water, Population and Communities, *Australian Antarctic science strategic plan 2011–12 to 2020–21*.

13 Department of the Environment and Energy, *Submission 13*, p. 5.

14 Department of Sustainability, Environment, Water, Population and Communities, *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21*, p. 2.

15 Department of Sustainability, Environment, Water, Population and Communities, *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21*, p. 2.

16 Department of the Environment and Energy, *Submission 13*, p. 12.

*20 Year Action Plan*.<sup>17</sup> Following evaluation, a revised Plan will be made available for public consultation.

## Australian expertise

- 5.17 Australia's Antarctic scientists are producing world class research. Through the AAP and other international and domestic scientific collaborations, there are abundant examples of Australian scientific expertise at work. While it is beyond the scope of this report to provide a complete assessment of the entire scientific endeavour being undertaken by Australians, the Committee's inquiry uncovered a vast array of scientific projects being undertaken by Australians or by Australian Antarctic entities.
- 5.18 For example, evidence to the Committee highlighted Australian scientists' contributions to global Antarctic science efforts through a broad range of projects including:
- A joint initiative between the Commonwealth and Tasmanian governments to develop a virtual centre for Antarctic remote and maritime medicine based on Australia's particular strength in remote medicine in Antarctica.<sup>18</sup>
  - CSIRO collaborative research into the Antarctic atmosphere through observations of greenhouse gases and related tracers at Casey, Mawson, and Macquarie Island,<sup>19</sup> as well as the management of a number of major research projects through the Integrated Marine Observing System.<sup>20</sup>
  - A broad range of accelerator-based programs linked to Australia's Antarctic activities and conducted by the Australian Nuclear Science and Technology Organisation, such as 'paleo-climate studies based on the characterisation of naturally occurring cosmogenic isotopes in rock,

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17 Department of the Environment and Energy, *Submission 13*, p. 12. See also Mr Mark Kelleher, Chief Executive Officer, Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC), *Committee Hansard*, Hobart, 10 November 2017, p. 22.

18 Ms Karen Rees, Director, Antarctic Tasmania and Maritime Industries, Tasmanian Department of State Growth, *Committee Hansard*, Hobart, 10 November 2017, p. 17.

19 Department of Industry, Innovation and Science, *Submission 16*, p. 4.

20 Dr Anthony Worby, Director, Oceans and Atmosphere, Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Committee Hansard*, Hobart, 10 November 2017, p. 26.

ice, firn (old snow), firn air and ice core bubbles samples from Antarctica.<sup>21</sup>

- A broad range of scientific activity conducted under the auspices of Geoscience Australia including geophysical monitoring, marine and terrestrial geoscience (research and mapping), Earth observations from space, and geospatial information and advice.<sup>22</sup>

- 5.19 Perspectives during the inquiry differed on whether Australia had a particular Antarctic science strength. Mr Mark Kelleher, Chief Executive Officer of ACE CRC, suggested that, rather than individual countries holding particular types of expertise, these skills were held by individuals as part of various collaborations. Scientific results derived through the expertise of individual researchers were then shared between collaborators.<sup>23</sup>
- 5.20 In contrast, some contributors suggested that Australia did possess a range of expertise in Antarctic science. For example, it was suggested that Australia held specialisations in Antarctic medicine,<sup>24</sup> biogeochemistry (such as understanding the effects of ocean acidification), astronomy,<sup>25</sup> and marine geo-engineering.<sup>26</sup>
- 5.21 The Department of the Environment and Energy was supportive of the emphasis that the *Australian Antarctic Strategy and 20 Year Action Plan* placed on the management of krill and the strengthening of ice core science.
- 5.22 Antarctic krill is the main food source of numerous Antarctic vertebrates<sup>27</sup> and sustainable harvesting is critical to ensure that large predators can continue to rely on krill as their main source of food.<sup>28</sup> As part of the *Australian Antarctic Strategy and 20 Year Action Plan*, the Australian Government has committed to build research infrastructure in Hobart to

21 Australian Nuclear Science and Technology Organisation (ANSTO), *Submission 28*, p. 3.

22 Geoscience Australia, *Submission 6*, p. 5.

23 Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, p. 21.

24 Ms Rees, Tasmanian Department of State Growth, *Committee Hansard*, Hobart, 10 November 2017, p. 17.

25 Dr Worby, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 28.

26 Dr Jeffrey McGee, Senior Lecturer in Climate Change, Marine and Antarctic Law, IMAS and Faculty of Law University of Tasmania, *Committee Hansard*, 10 November 2017, p. 38.

27 IMAS University of Tasmania, 'Antarctic & Marine Plankton', 30 October 2015, <<http://www.imas.utas.edu.au/research/ecology-and-biodiversity/antarctic-and-marine-plankton>>, viewed 1 August 2017.

28 Department of Sustainability, Environment, Water, Population and Communities, *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21*, p. 47.

strengthen these capabilities to better contribute to the sustainable harvesting of krill.<sup>29</sup>

- 5.23 Another of the Australian Government's key scientific endeavours under the Plan focusses on its ice core research capability. The Department of the Environment and Energy advised that the *Australian Antarctic Strategy and 20 Year Action Plan* included a \$45 million commitment to re-establish an overland science traverse capability to enable research in all parts of the Australian Antarctic Territory, and assist in locating and drilling a million year ice core.<sup>30</sup>
- 5.24 The Department of Industry, Innovation and Science submitted that CSIRO maintains an ice core 'library'. These ice cores:
- ... contain climate and atmospheric composition information over the past three centuries with unparalleled resolution and precision. There are also air samples in tanks filled directly from the upper 'firn layer' of the Antarctic and Greenland ice sheets.<sup>31</sup>
- 5.25 The Department of Industry, Innovation and Science advised that data from the ice core records produced by CSIRO 'have appeared in all Intergovernmental Panel on Climate Change (IPCC) scientific assessments and numerous other scientific and policy documents by CSIRO ...'<sup>32</sup>

## Resourcing Australian Antarctic science

- 5.26 Conducting Antarctic science requires a broad range of supports in addition to the core scientific assets and infrastructure maintained and operated by the Department of the Environment and Energy.<sup>33</sup> In particular, the inquiry was told that there is a need to maintain capabilities including a skilled scientific workforce. Scope also existed to further expand Australia's international education sector with respect to Antarctic science as well as improve communications, data, and information technology capacity. These issues are considered below.

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29 Department of the Environment and Energy, *Australian Antarctic Strategy and 20 Year Action Plan*, 2016, p. 24.

30 Department of the Environment and Energy, *Submission 13*, pp. 2 and 9.

31 Department of Industry, Innovation and Science, *Submission 16*, p. 2. See also Dr Worby, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 26.

32 Department of Industry, Innovation and Science, *Submission 16*, p. 3.

33 Department of the Environment and Energy, *Submission 13*, p. 6.

## Funding and support for Australian Antarctic science

- 5.27 The manner in which Antarctic science is both funded and prioritised was an important theme of the Committee's inquiry, with inquiry participants commenting on the issue and proposing improvements.
- 5.28 The Committee heard that the AAD provides support for scientific research through logistical support and direct grants.<sup>34</sup> Approximately \$1.05 million per year is allocated to scientists that are from organisations not funded by the Commonwealth.<sup>35</sup>
- 5.29 The Australian Academy of Science suggested that, while this direct grant initiative has provided excellent support for scientists in the past, there are signs that the overall support has declined.<sup>36</sup> In particular, the Academy noted that such grants:
- ... often remain insufficient to cover employing research staff nor the running expenses of the kinds of high-end scientific research that is required to stay competitive in the Antarctic science arena, let alone maintain Australian leadership in world-class, high-priority Antarctic science.<sup>37</sup>
- 5.30 While some scientists have sought additional funding from entities such as the Australian Research Council, the Academy noted that there is no ability to coordinate different types of funding for research and logistical support.<sup>38</sup> It is hoped that the newly announced Antarctic Foundation under the *Australian Antarctic Strategy and 20 Year Action Plan* may alleviate part of this issue.<sup>39</sup>
- 5.31 Inquiry participants also commented on how Antarctic science is prioritised. As previously noted under the *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21*, Antarctic science needs to be prioritised based on logistical and budgetary limits imposed by the priorities of the government of the day.<sup>40</sup>
- 5.32 Mr Mark Kelleher, ACE CRC, advised that '... within the Antarctic Division, there is a process to prioritise the proposals that come through

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34 Australian Academy of Science, *Submission 4*, p. 3.

35 Australian Academy of Science, *Submission 4*, p. 3.

36 Australian Academy of Science, *Submission 4*, p. 3.

37 Australian Academy of Science, *Submission 4*, p. 6.

38 Australian Academy of Science, *Submission 4*, p. 6.

39 Australian Academy of Science, *Submission 4*, p. 6; University of Queensland, *Submission 32*, p. 6.

40 Department of Sustainability, Environment, Water, Population and Communities, *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21*, p. 2.

and how closely they align ...' to the *Australian Antarctic Strategy and 20 Year Action Plan*.<sup>41</sup>

- 5.33 The Australian Academy of Science proposed further direct funding of science and larger total grants to enable complex projects to be conducted. It also recommended that an enhanced formal collaboration between the Academy's National Committee on Antarctic Research and the AAD would help 'facilitate coordination of national scientific interests in the Antarctic region and help inform the Australian Antarctic Program of new scientific developments in the region.'<sup>42</sup>
- 5.34 Dr Tony Press, a former Director of the AAD, submitted that the Australian Government should maintain the 'hybrid system' of science delivery that involves government agencies and the non-government research sector. He recommended that 'priorities be set from time to time and regularly reviewed to ensure that the Antarctic science program is relevant to Government.'<sup>43</sup>
- 5.35 Geoscience Australia told the Committee that in terms of its own work, it both competes on merit against other scientific researchers during 'open calls for scientific research' and also collaborates with the AAD, where strategic projects such as mapping could be prioritised and used to enable other scientific activity.<sup>44</sup>

## Future of ACE CRC funding

- 5.36 One of the areas of concern during the inquiry was in relation to the future funding of the ACE CRC. The ACE CRC, which was established in 1991 and is based in Hobart,<sup>45</sup> conducts multidisciplinary research in Antarctica and the Southern Ocean that delivers directly against Australia's national research priorities and *Australia's Antarctic Science Strategy 2011-12 to 2020-21*.<sup>46</sup>
- 5.37 According to the Department of Industry, Innovation and Science, the ACE CRC is '... currently in its fifth round of CRC Programme funding with a commitment of Australian Government funding of \$25 million over

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41 Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, p. 24.

42 Australian Academy of Science, *Submission 4*, pp. 6-7.

43 Dr Tony Press, *Submission 5*, p. 2.

44 Dr Stuart Minchin, Chief, Environmental Geoscience Division, Geoscience Australia, *Committee Hansard*, Canberra, 19 October 2017, p. 14.

45 Department of Industry, Innovation and Science, *Submission 16*, p. 1.

46 ACE CRC, *Submission 11*, p. 1; Department of Industry, Innovation and Science, *Submission 16*, p. 1; Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, p. 25.

the period 2014–19.<sup>47</sup> The Committee heard that in June 2019, Australian Government funding for the ACE CRC would cease.

- 5.38 Mr Mark Kelleher of the ACE CRC, explained that its funding would cease for two reasons. Firstly, under changes to the guidelines underpinning cooperative research centres ‘organisations that had been in the CRC program for more than 10 years would no longer be eligible ...’<sup>48</sup> Secondly, the guidelines now directed funding to organisations that are ‘more about business-led and more direct commercial outcomes than long-term public benefit or national interest science’.<sup>49</sup> Given this ineligibility, for its work to continue, Mr Kelleher advised the Committee that ‘we need an alternative funding source and pathway for that funding which has not been identified at this stage.’<sup>50</sup>
- 5.39 Mr Kelleher told the Committee that Australia had made significant investment in its Antarctic infrastructure and assets. This however was not matched by science funding and he told the Committee that scientific activity in Antarctica was required to ensure Australia’s Antarctic presence was optimised.<sup>51</sup>
- 5.40 Mr Kelleher advised the Committee the value of his organisation’s funding over a five year period – about \$25 million – could be translated into about \$160 million worth of scientific activity once leveraging from its collaborative engagement was accounted for.<sup>52</sup> The cessation of funding would also impact staff at ACE CRC. Mr Kelleher advised that while the employment of some staff was funded from the direct allocation provided by the Australian Government, other staff are provided on an ‘in-kind’ basis by joint-venture partner entities.<sup>53</sup>
- 5.41 Inquiry contributors impressed on the Committee the impact that ACE CRC’s closure would have. The Australian Academy of Science submitted its concerns to the Committee; noting that the loss of ACE CRC would result in a significant erosion of Antarctic science capability.<sup>54</sup>

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47 Department of Industry, Innovation and Science, *Submission 16*, p. 1; Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, pp. 21–22.

48 Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, p. 23.

49 Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, p. 23.

50 Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, p. 22.

51 Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, p. 23.

52 Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, p. 23.

53 Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, pp. 21–22; Dr Worby, Director, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 33; CSIRO, *Submission 29.1*, p. 1.

54 Australian Academy of Science, *Submission 4*, p. 5.

Dr Anthony Worby from CSIRO, told the Committee that the CRC was one of CSIRO's collaborative partners and that the 'loss of that funding stream would be a significant hit to CSIRO and the work that we do in that space.'<sup>55</sup>

5.42 Some inquiry contributors called for the Australian Government to consider how ACE CRC's funding could continue.<sup>56</sup> In response, the Department of Industry, Innovation and Science advised the Committee that it is working with ACE CRC and the Department of the Environment and Energy to explore options post 2019 for the Government's support of Antarctic research.<sup>57</sup>

5.43 Mr Richard Fader, Chairman of the Tasmanian Polar Network, told the Committee that the Network views the ACE CRC as an important part of the Antarctic science collaborative effort, particularly given its links to other Antarctic programs and industry.<sup>58</sup> With respect to the programs being run by ACE CRC, Mr Fader noted that:

They're not something we can stop at the end of that period of funding without doing some significant damage to our standing in the science community. That's why we believe that the continued funding is essential. It brings together a lot of different disciplines into one spot.<sup>59</sup>

5.44 Mrs Lara Hendriks, of the Tasmanian Department of State Growth, also said that the Tasmanian Government called upon the Australian Government to provide funding certainty to ensure that the work of the ACE CRC could continue.<sup>60</sup>

5.45 It should also be noted that, in 2014, the Senate Standing Committee on Foreign Affairs, Defence and Trade also recommended that the Australian Government commit to the extension of funding for existing

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55 Dr Worby, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 32.

56 Department of Industry, Innovation and Science, *Submission 16*, p. 2; Mr Fader, Tasmanian Polar Network, *Committee Hansard*, Hobart, 10 November 2017, p. 10.

57 Department of Industry, Innovation and Science, *Submission 16*, p. 1; Dr Nicholas Gales, Director, AAD, Department of the Environment and Energy, *Committee Hansard*, Canberra, 15 February 2018, p. 10.

58 Mr Richard Fader, Chairman, Tasmanian Polar Network, *Committee Hansard*, Hobart, 10 November 2017, p. 10.

59 Mr Fader, Tasmanian Polar Network, *Committee Hansard*, Hobart, 10 November 2017, p. 10.

60 Mrs Lara Hendriks, Acting General Manager, Tasmanian Department of State Growth, *Committee Hansard*, Hobart, 10 November 2017, p. 13.

collaborative initiatives that support Antarctic and Southern Ocean scientific research.<sup>61</sup>

## Australian science workforce

5.46 Two key concerns were raised regarding the state of Australia's Antarctic science workforce.

5.47 Firstly, despite the improvement to Australia's Antarctic infrastructure, such as the new icebreaker, the Australian Academy of Science submitted to the Committee that:

... staff capability to make scientific use of these assets has not kept pace with the developments. Indeed, the numbers of research scientists capable of making full use of the assets has declined ...<sup>62</sup>

5.48 Geoscience Australia shared a similar view, noting that the operation of multibeam sonar equipment, which will be used for the collection of 'unprecedented amounts of...data' on board the new icebreaker, will require skilled staff at sea to:

... operate the systems, oversee the data collection process and manage the data. Further, processing the data in real time maximises the value of the equipment. Experience with multibeam sonar systems to date shows that the processing of data after the survey requires 10 times as long as during acquisition.<sup>63</sup>

5.49 Secondly, some concerns were also raised about the ability of Australian government agencies to staff their Antarctic science programs effectively. In particular, the Australian Academy of Science cited staff reductions at the AAD and CSIRO, and reduced funding through the national competitive grants process, as contributing to the declining scientific workforce.<sup>64</sup> In some cases, full time positions had been replaced with short term contract work.<sup>65</sup> CSIRO submitted that its Antarctic science workforce had been reduced as a result of a restructure of programs.<sup>66</sup>

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61 Senate Foreign Affairs, Defence and Trade References Committee, *Australia's future activities and responsibilities in the Southern Ocean and Antarctic waters*, 29 October 2014, p. 61.

62 Australian Academy of Science, *Submission 4*, p. 4; Professor Chown, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 5.

63 Geoscience Australia, *Submission 6*, p. 16; ACE CRC, *Submission 11*, p. 2.

64 Australian Academy of Science, *Submission 4*, p. 4.

65 Australian Academy of Science, *Submission 4*, p. 4.

66 CSIRO, *Submission 29*, p. 2.

- 5.50 The Committee heard that the impacts of reduced staff had been felt across the Antarctic science community. For example, the Australian Academy of Science highlighted that some Australian Antarctic scientists had either redirected their skills to other research areas or ‘transferred their efforts to collaborations led by other countries.’<sup>67</sup> CSIRO noted that its collaboration with the AAD was mainly through projects conducted by ACE CRC, and the loss of staff at the AAD had had limited impact on CSIRO in terms of its Antarctic and Southern Ocean research.<sup>68</sup>
- 5.51 The Community and Public Sector Union also highlighted significant reductions to Australia’s Antarctic science staffing levels in recent years. In particular, it cited reductions to scientific staff levels at the AAD which had disproportionately affected areas involved in science and data collection.<sup>69</sup> The Union submitted that these reductions had meant ‘significant increased workloads for the remaining staff.’<sup>70</sup> Evidence to the Committee also suggested that scientific research staff at collaborative organisations, such as the ACE CRC, would be affected by an impending loss of funding.<sup>71</sup>

## Antarctic science education and training

- 5.52 Education, research and training are further areas of significant opportunity for Australia, both economically and in the development of its Antarctic science workforce.
- 5.53 IMAS told the Committee of its own degree program that partners with a university in China to deliver a joint program, and its outreach education programs which run in countries such as Iceland and Iran.<sup>72</sup> As part of this and other international programs, Australian Antarctic researchers are involved in teaching.<sup>73</sup>
- 5.54 In Australia, there is a range of educational opportunities for domestic and international students to participate in Antarctic science programs in

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67 Australian Academy of Science, *Submission 4*, p. 5.

68 Dr Worby, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 33.

69 Community and Public Sector Union (CPSU), *Submission 7*, p. 2.

70 CPSU, *Submission 7*, p. 2.

71 ACE CRC, *Submission 11*, p. 2.

72 IMAS University of Tasmania, *Submission 8*, p. 3.

73 Dr McGee, IMAS and Faculty of Law, University of Tasmania, *Committee Hansard*, 10 November 2017, p. 36 and 38.

Hobart, adding to the city's multicultural diversity.<sup>74</sup> The Institute stated that it works with partners such as the Australian Research Council in:

... providing significant opportunities for young scientists at postdoctoral and junior research level to undertake really amazing research and innovative science with new technologies that also links with the Australian Maritime College and the University of Tasmania ...<sup>75</sup>

- 5.55 Mr Mark Kelleher advised that, in addition to undertaking its scientific work, the ACE CRC was a critical pathway for new graduates and postdoctoral staff who are supervised by more experienced researchers. Early career researchers, he said, build up:

... expertise, capability, confidence and networks across the world move on from us over time into other organisations both in Australia – partners and otherwise – and internationally.<sup>76</sup>

- 5.56 The Committee heard that additional opportunities exist for Australian expertise to be used in providing technical training, such as through training courses on the International Maritime Organization's International Code for Ships Operating in Polar Waters in January 2017.<sup>77</sup>

## Data storage, management and use

- 5.57 As Antarctic science is not 'owned' by any nation, it requires a collaborative approach to data storage and management. Geoscience Australia suggested that there was a need to both develop a data acquisition and data management plan for the new icebreaker,<sup>78</sup> and develop digital infrastructure capabilities which will enable scientists to store, manage, discover, share and use Antarctic data.<sup>79</sup> This was supported by other inquiry contributors.<sup>80</sup>
- 5.58 Geoscience Australia submitted that, in order to provide comprehensive seabed mapping, Antarctic research vessels need to be equipped with

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74 Professor Marcus Haward, Professor, Ocean and Antarctic Governance, IMAS, University of Tasmania, *Committee Hansard*, Hobart, 10 November 2017, p. 35.

75 Professor Haward, IMAS, University of Tasmania, *Committee Hansard*, Hobart, 10 November 2017, p. 34.

76 Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, pp. 21–22.

77 IMAS, University of Tasmania, *Submission 8*, p. 3.

78 Geoscience Australia, *Submission 6*, p. 4.

79 Geoscience Australia, *Submission 6*, p. 4.

80 See for example: Professor Chown, ACE CRC, *Committee Hansard*, Canberra, 19 October 2017, p. 5.

suitable equipment such as multibeam echosounders.<sup>81</sup> The data produced by such devices can have multiple applications including the production of full-bottom coverage maps of seafloor topography and seafloor composition and texture, providing an improved understanding of broad-scale physical interpretation and marine biodiversity.<sup>82</sup>

- 5.59 As such, Geoscience Australia advised the Committee that the current icebreaker, *RV Aurora Australis*, has limited capacity to undertake these activities but that such facilities are available on CSIRO's *RV Investigator* vessel with support also available through smaller vessels operated by the AAD and Royal Australian Navy.<sup>83</sup>
- 5.60 Geoscience Australia added that the new icebreaker will have 'the capability, equipment and technology needed to map and sample the seafloor primarily along the Australian Antarctic Territory continental shelf and slope as well as the adjacent deep ocean abyssal basins.'<sup>84</sup> There will also be increased capability through a new tender vessel that is part of the new icebreaker specifications.<sup>85</sup>
- 5.61 It is clear that Australia's new Antarctic capabilities will produce large amounts of data. Geoscience Australia advises that while it currently operates some digital infrastructure to store, manage and share marine geoscience datasets,<sup>86</sup> there is a need for additional data management capacity that also requires 'enhanced storage and management systems to avoid loss of data ...'<sup>87</sup> This was a concept that was also supported by the University of Queensland.<sup>88</sup>
- 5.62 Geoscience Australia also commented on the steps it is taking to expand the capacity of its own digital infrastructure for its Antarctic scientists:

Geoscience Australia is expanding the capability of its digital infrastructure in support of the National Collaborative Research Infrastructure Strategy and the Government's National Innovation and Science Agenda and Digital Transformation Agenda.<sup>89</sup>

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81 Geoscience Australia, *Submission 6*, p. 14.

82 Geoscience Australia, *Submission 6*, pp. 14–15.

83 Geoscience Australia, *Submission 6*, p. 15.

84 Geoscience Australia, *Submission 6*, p. 15.

85 Geoscience Australia, *Submission 6*, p. 15.

86 Geoscience Australia, *Submission 6*, p. 15.

87 Geoscience Australia, *Submission 6*, p. 16.

88 University of Queensland, *Submission 32*, p. 7.

89 Geoscience Australia, *Submission 6*, p. 9.

- 5.63 Geoscience Australia highlighted the Australian Government's Digital Earth Australia initiative, a platform for satellite imagery and other Earth-related observations which will provide a 'unique capability to process, interrogate, and present Earth observation satellite data ...'<sup>90</sup> Geoscience Australia advised that this system will allow for 'rapid answers to environmental policy issues such as water quality, biomass, and habitat mapping.'<sup>91</sup>

### Antarctic telecommunications

- 5.64 Given the Antarctic working environment, telecommunications infrastructure is necessary so that staff can both be in contact with counterparts outside of the continent and transmit scientific data.
- 5.65 The AAD maintains a range of telecommunications systems that include a network that links Australia's Antarctic research stations, summer stations, field bases, ships, and aircraft, and its headquarters in Kingston, Tasmania. It includes the broad spectrum of satellite systems, HF and VHF radio systems, computer networks and telephone systems which are maintained and operated by dedicated telecommunications personnel.<sup>92</sup>
- 5.66 The Department of the Environment and Energy advised that its assets included '648 ICT telecommunications and IT assets totalling \$16.2 million.'<sup>93</sup> During the course of the inquiry, the Department entered into a contract with Australian telecommunications company Speedcast, to provide improved satellite communications infrastructure between its facilities.<sup>94</sup>
- 5.67 A number of inquiry participants commented on the communications infrastructure in Antarctica and how it could be improved. The Bureau of Meteorology advised the Committee that it uses the limited bandwidth provided by the AAD to transmit its data back to mainland Australia from

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90 Geoscience Australia, 'Digital Earth Australia', <<http://www.ga.gov.au/about/projects/geographic/digital-earth-australia>>, viewed 22 February 2018.

91 Geoscience Australia, *Submission 6*, p. 9.

92 AAD, Department of the Environment and Energy, 'Telecommunications', 12 August 2010, <<http://www.antarctica.gov.au/living-and-working/station-life-and-activities/telecommunications>>, viewed 22 February 2018.

93 Department of the Environment and Energy, *Submission 13*, p. 6.

94 N Arboleda, 'Speedcast ousts Telstra with \$4 million satellite deal in Australian Antarctic', 12 January 2018, <<https://www.crn.com.au/news/speedcast-ousts-telstra-with-4-million-satellite-deal-in-australian-antarctic-480917>>, viewed 16 January 2018.

its collecting facilities in Antarctica.<sup>95</sup> Dr Sue Barrell of the Bureau suggested that better communications infrastructure would improve the Bureau's use of data.<sup>96</sup>

- 5.68 Geoscience Australia submitted that improved telecommunications capacity could provide an economic opportunity for Australia. Earth observation satellites pass over Antarctica each day and collect a variety of information about the continent. According to Geoscience Australia, developing the capacity to 'up-link' scientific data between a satellite ground station in either Antarctica or Australia to orbiting satellites as they pass over Antarctica would provide Australia with an opportunity to 'make Australia the focus of attention for southern hemisphere remote sensing, a sought-after co-operator in international agreements, and provide new economic opportunities.'<sup>97</sup>
- 5.69 Such capacity would be attractive given Australia's time zone relative to Europe and North America.<sup>98</sup> Additionally, the development of an undersea communications cable to transmit such data from the ground station site would reduce operating costs providing value for many international satellite operators. Geoscience Australia proposed that data from this remote sensing capability could be stored in an 'Antarctic Geoscience Data Cube' which would attract scientists from around the world and be of interest to international space agencies.<sup>99</sup> Geoscience Australia advised that this could be included in an expanded version of the Digital Earth Australia program, which currently covers information about continental Australia's changing landscape and coastline.<sup>100</sup>

### Data sharing and intellectual property

- 5.70 The ATS specifies that information collected from Antarctic research should be open and shareable.<sup>101</sup> Evidence to the Committee supported this, with participants advising that intellectual property stemming from Antarctic Research is usually deemed to be in the 'global public benefit'.<sup>102</sup>

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95 Dr Sue Barrell, Group Executive Science and Innovation, Bureau of Meteorology, *Committee Hansard*, Canberra, 19 October 2017, p. 22.

96 Dr Sue Barrell, Bureau of Meteorology, *Committee Hansard*, Canberra, 19 October 2017, p. 22.

97 Geoscience Australia, *Submission 6*, p. 18.

98 Geoscience Australia, *Submission 6*, p. 18.

99 Geoscience Australia, *Submission 6*, p. 25.

100 Geoscience Australia, *Submission 6*, p. 18.

101 Professor Chown, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 8.

102 Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, p. 21.

The Committee was interested to hear whether in practice data was being shared openly and if any concerns existed regarding intellectual property.

5.71 The AAD noted that, while Antarctic science data was often available to all researchers, in some circumstances data was embargoed for a period to allow researchers to write and publish their work.<sup>103</sup>

Professor Steven Chown from the Australian Academy of Science noted that countries such as Australia and the United Kingdom take very seriously the obligation to share data.<sup>104</sup> However, evidence to the Committee suggested that data is not always available on an open and shareable basis.<sup>105</sup> Professor Chown suggested that, in some cases, countries are limited in their ability to share data as they do not necessarily have the requisite capability.<sup>106</sup> He also highlighted that the AAD often assists countries to gain this capability.<sup>107</sup> Evidence to the Committee also suggested that issues concerning the sharing of data could often be resolved between individual researchers.<sup>108</sup>

5.72 Some inquiry contributors also highlighted that intellectual property ownership of scientific research would be dependent on the nature of the research and exact funding arrangements.<sup>109</sup> Professor Chown cited an example of a research expedition which was privately funded by a philanthropist and not associated with an academic or governmental organisation.<sup>110</sup> The intellectual property from the research conducted is owned formally by Switzerland but the Australian researchers who participated in the expedition 'have a non-exclusive world-wide guarantee

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103 Dr Gales, AAD, Department of the Environment and Energy, *Committee Hansard*, Canberra, 15 February 2018, p. 19.

104 Professor Chown, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 8.

105 Professor Chown, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 8.

106 Professor Chown, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 8.

107 Professor Chown, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 8.

108 Professor Chown, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 8.

109 See for example: Dr Minchin, Geoscience Australia, *Committee Hansard*, Canberra, 19 October 2017, p. 18; and Dr Worby, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 29.

110 Australian Academy of Science, *Submission 4.1*, p. 6.

to use the information.’<sup>111</sup> As such, the relevant intellectual property is ‘co-owned’.<sup>112</sup>

## Collaboration

- 5.73 Antarctic science is underpinned by a global collaborative effort. The Committee took evidence that highlighted the nature of collaborative science in Antarctica including its international focus and governance.
- 5.74 A number of inquiry participants commented on the nature of the collaborative science undertaken in Antarctica. Mr Mark Kelleher, of ACE CRC, advised that Antarctic research and related protocols are unique, relying on soft diplomacy and scientific collaboration.<sup>113</sup> He suggested that Antarctic science was very much occurring collaboratively between nation states, rather than independently. Similarly, Dr Andreas Schiller of CSIRO, noted that most Antarctic science occurs on an international level and is coordinated through international networks to ‘minimise overlap but to optimise the benefits’.<sup>114</sup>
- 5.75 This section explores some of the agreements on cooperation, and considers matters such as intellectual property.

## Agreements on cooperation

- 5.76 The Committee was advised of memorandums of understanding between Australian and international Antarctic entities which underpin much of the scientific work undertaken in Antarctica.
- 5.77 As outlined in this report, agreements exist between the Department of the Environment and Energy and the Department of Defence for the latter to provide niche support to the Antarctic program. This includes geospatial, hydrographical and meteorological support as well as the

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111 Professor Chown, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 7.

112 Professor Chown, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 7.

113 Mr Kelleher, ACE CRC, *Committee Hansard*, Hobart, 10 November 2017, p. 21.

114 Dr Andreas Schiller, Science and Deputy Director, Oceans and Atmosphere, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 28; Dr Gales, AAD, Department of the Environment and Energy, *Committee Hansard*, Canberra, 15 February 2018, pp. 18-19.

sharing of expertise in extreme climate, remote, maritime and airborne medicine.<sup>115</sup>

- 5.78 The AAP also has agreements with the Bureau of Meteorology which provides it with services and information in Antarctica. This includes providing weather services to Australians operating in the AAT, as well as mariners, aviators, and for search and rescue operators working in close proximity to Antarctica. The Bureau outlined its role in supporting this mandate. This includes operating a range of meteorological assets, and conducting observations and climate computer modelling, and research and development.<sup>116</sup>
- 5.79 Internationally, the Committee was advised that the AAP and other Australian Government entities have entered into memorandums of understanding and other agreements with Antarctic nations with respect to collaborative Antarctic science activities.
- 5.80 One such agreement is the China–Australia memorandum of understanding on Cooperation in the Field of Antarctic and Southern Ocean Affairs was established in 2014.<sup>117</sup> Discussions under this agreement included ‘those on ICECAP, of which both countries are part. ICECAP is a multination project to map the thickness and underlying bedrock topography of the East Antarctic Ice Sheet.’<sup>118</sup>
- 5.81 CSIRO noted that Australia also has deep relationships with a range of international Antarctic partners, similar to the manner of Australia’s defence partners. China and France were both cited as examples of this type of enduring partnership.<sup>119</sup> Both nations have a range of projects undertaken in conjunction with Australian scientists.
- 5.82 One of these key partnerships with China is through the Centre for Southern Hemisphere Oceans Research (CSHOR) which brings together Antarctic scientists from CSIRO, Australian universities, the University of Tasmania, and the University of New South Wales, as well as the Qingdao National Laboratory for Marine Science and Technology.<sup>120</sup> Dr Worby from CSIRO noted that the partnership provided a mechanism by which Chinese financial investment could be coupled with in-kind

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115 Department of Defence, *Submission 14*, p. 2.

116 Bureau of Meteorology, *Submission 25*, p. 2.

117 Australian Academy of Science, *Submission 4.1*, p. 5.

118 Australian Academy of Science, *Submission 4.1*, p. 5.

119 For example: Dr Worby, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 29; Dr Schiller, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 29.

120 Dr Schiller, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 29.

support from CSIRO to collaborate on Southern Oceans-focussed research based in Australia.<sup>121</sup>

- 5.83 The Bureau of Meteorology highlighted its own memorandum of understanding with the Chinese Meteorological Administration, advising the Committee that it works collaboratively on a number of research topics including weekly stratospheric ozonesonde flights.<sup>122</sup>
- 5.84 The Bureau of Meteorology told the Committee of its membership of the World Meteorological Organisation which ensures that the Bureau's observations, including those made in Antarctica, are shared openly with other members. In exchange, according to Dr Sue Barrell of the Bureau:

... we have access to the observations of the 190 other countries that are made by their met services and other agencies and, importantly, by space programs. In simple terms, we get access to all of the satellite data and surface based observations collected, which is roughly valued at between \$5 billion to \$10 billion per year ... We have access to that for basically what the bureau spends on providing those observations. It's roughly 100-to-one leveraging.<sup>123</sup>

## Applications of Antarctic science

- 5.85 The vast majority of Antarctic science conducted, at least in the East Antarctic, is government supported or funded, with limited commercial interest.<sup>124</sup> However, a range of inquiry participants demonstrated that aspects of their work have commercial or economic applications.
- 5.86 Geoscience Australia highlighted that its own geophysical observatories support a range of purposes besides its work in Antarctica. For example, the agency's work supports drivers of economic activity such as global positioning system signals for Australia.<sup>125</sup>
- 5.87 CSIRO also advised that its Southern Ocean research projects – such as detailed measurements of ocean properties, temperature and salinity –

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121 Dr Worby, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, pp. 29–30.

122 Dr Barrell, Bureau of Meteorology, *Committee Hansard*, Canberra, 19 October 2017, p. 21.

123 Dr Barrell, Bureau of Meteorology, *Committee Hansard*, Canberra, 19 October 2017, p. 20.

124 Mr Fader, Chairman, Tasmanian Polar Network, *Committee Hansard*, Hobart, 10 November 2017, p. 6.

125 Dr Minchin, Geoscience Australia, *Committee Hansard*, Canberra, 19 October 2017, p. 14.

have underpinned its collaboration with the Department of Defence and the Bureau of Meteorology, particularly in relation to Defence's strategic planning.<sup>126</sup> Other aspects of its work examine the impacts of ocean acidification on food security, such as the management of fisheries.<sup>127</sup>

5.88 The Committee was also interested in the concept of bioprospecting which involves, according to Professor Chown:

... looking for natural products in plants and animals for medical uses; it also includes uses such as antifreeze products that might be used in foodstuffs.<sup>128</sup>

5.89 Dr Press told the Committee that some scientists have worked with industry to identify genetic resources in Antarctica.<sup>129</sup> Professor Chown gave an example of how bioprospecting in Antarctica has been used in the food industry to prevent the recrystallisation of ice cream.<sup>130</sup> Dr Anthony Worby of CSIRO also cited several examples of scientific work that has commercial applications including a fish with antifreeze in its blood and another with sunscreen properties.<sup>131</sup>

5.90 CSIRO was asked whether the requirement to share intellectual property would be a hindrance to private sector investment in Antarctic science. Dr Worby advised the Committee that, quite often 'research will be done as part of a publicly funded research program, but the commercialisation of it may actually be done by a private company under some IP agreement.'<sup>132</sup>

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126 Dr Worby, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, pp. 27, 30.

127 Dr Worby, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 27.

128 Professor Chown, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 9.

129 Dr Press, private capacity, *Committee Hansard*, Hobart, 10 November 2017, p. 43.

130 Professor Chown, Chair, Australian Academy of Science, *Committee Hansard*, Canberra, 19 October 2017, p. 9.

131 Dr Worby, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 27.

132 Dr Worby, CSIRO, *Committee Hansard*, Hobart, 10 November 2017, p. 27.

**Figure 5.1** Members of the Committee receiving a briefing at the Australian Antarctic Division in Hobart



Source Supplied

## Committee comment

- 5.91 Australia's Antarctic science capabilities are amongst the best in the world and, as has been evident throughout this inquiry, these capabilities are supported by a skilled Antarctic science workforce. Antarctic science has, however, become an internationally competitive and crowded field. As such, to maintain Australia's standing as a leading Antarctic science nation, it is imperative that the Australian Government and Australia's Antarctic community increase investment and foster growth in this area.
- 5.92 As highlighted previously, the Committee was pleased to visit Hobart and Antarctica to meet with and hear the perspectives of the dedicated staff that comprise some of Australia's Antarctic science community. The Committee also had the opportunity to inspect a range of facilities that facilitate Australia's Antarctic science capacity – in particular, the AAD in

Kingston, the University of Tasmania's Institute of Marine and Antarctic Studies, and Casey station in Antarctica. The close knit Antarctic science community were welcoming of the Committee and provided valuable insights.

## Australian science framework

- 5.93 The Australian Antarctic science framework is undergoing a period of renewal. From the *Australian Antarctic Strategy and 20 Year Action Plan* to the *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21*, an effort is being made to position Australian Antarctic science at the forefront of international efforts on the continent. In the Committee's view, this is a welcome development, however, the inquiry was an opportunity to enhance these efforts.
- 5.94 Evidence to the inquiry suggested that Australia's leadership in Antarctic science is declining, demonstrated by diminishing publication output in recent years. Despite the perceived decline, it is imperative that Australia continue to engage with, and where appropriate, seek to lead the various international scientific forums of which it is a member.
- 5.95 As Australia's Antarctic science program aligns itself further with the objectives of both the *Australian Antarctic Strategy and 20 Year Action Plan* and the *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21*, the Australian Government should consider ways to bolster its scientific publication output. In particular, increased funding to research areas deemed to be scientific priority and an improved effort to coordinate Antarctic science research are required.
- 5.96 The Committee is aware of the review into the governance of Antarctic science currently being undertaken by former senior public servant Mr Drew Clarke AO PSM. The Committee understands that the Australian Government intends to soon release this review. While the Committee does not wish to pre-empt the review's findings, there is a need to consider improved funding and coordination of Antarctic science, in line with established governance structures.

### **Recommendation 11**

**The Committee recommends that the Australian Government release the review into Antarctic science governance as soon as practicable and provide a public response to its findings and recommendations in a timely manner.**

## **Resourcing Australian Antarctic science**

- 5.97 Antarctic science is expensive due to the type of logistical support required. In line with commitments under the *Australian Antarctic Strategy and 20 Year Action Plan*, the Committee believes that additional Australian Government funding aimed at improving research support is required. This should be supplemented by the provision of further clarity on scientific project priorities and guidance on the use of public funds.
- 5.98 The Committee is concerned by commentary suggesting that the sum of Australian Government grants for Antarctic science is not sufficient. It is clear that, there is a need to ensure funding for ancillary expenditure associated with the high cost of conducting research in Antarctica. Additionally, consideration must be given to clear guidelines that outline the manner in which funds from all Australian Government sources can be used, particularly when seeking research support. Understandably, such considerations can only be determined as the Australian Government considers its budgetary position each year.

### **Recommendation 12**

**The Committee recommends that the Australian Government provide clarity on how different sources of Australian Government Antarctic science funding can be utilised by funding recipients including whether such sources can be used for project or ancillary research support purposes.**

- 5.99 To provide clarity for Antarctic researchers, the Australian Government must consider how science is prioritised and coordinated. A body comprising representatives from key Antarctic science stakeholders, such as that suggested by the Australian Academy of Science, may provide an avenue to establish scientific project priorities, consistent with the *Australian Science Strategic Plan 2011–12 to 2020–21*. Such a body may also be tasked with coordinating Australia's scientific research projects in conjunction with stakeholders to limit overlap and maximise valuable research capacity.

### **Recommendation 13**

**The Committee recommends that the Australian Government consider the establishment of a body to determine both Antarctic science project priorities consistent with the *Australian Science Strategic Plan 2011–12 to 2020–21* and to provide a forum for overseeing the coordination of projects.**

- 5.100 The Committee notes with concern that Australian Government funding for ACE CRC is due to cease in June 2019. The Committee also notes that the continued operation of ACE CRC beyond that date would not be consistent with the updated Australian Government guidelines for the funding of cooperative research centres.
- 5.101 The Committee received significant evidence as part of the inquiry that highlighted the important ongoing contribution that ACE CRC has made to Antarctic science. It would appear to be a successful model for collaborative Antarctic science. Many inquiry participants also commented on the impact on Antarctic science that the loss of ACE CRC's funding will have.
- 5.102 In the Committee's view, the loss of such a capacity would cause a significant gap in Antarctic science conducted out of Hobart and collaborative efforts in the field. As such, there may be opportunities for the Australian Government to work with ACE CRC and the Tasmanian Government to consider available options for its continued operation.

**Recommendation 14**

**The Committee recommends that the Australian Government consider mechanisms by which the Antarctic Climate and Ecosystems Cooperative Research Centre can continue its operations in collaborative Antarctic science beyond June 2019. The Australian Government may consider opportunities to work with the Tasmanian Government to consider how the work of the Antarctic Climate and Ecosystems Cooperative Research Centre can continue.**

- 5.103 The development of Australia's Antarctic science workforce is vital and inextricably linked to the strategic objectives under both the *Australian Antarctic Strategy and 20 Year Action Plan* and *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21*. Australia's push to increase its Antarctic infrastructure stock will require skilled staff to operate equipment, such as the multibeam sonar equipment on board the new icebreaker. The growth of Australia's Antarctic science workforce is also linked to the capacity for Antarctic science entities such as the AAD and CSIRO to employ research staff and train the next crop of researchers – a capacity which has diminished due to funding reductions.
- 5.104 While additional funding support is one answer, the development of critical skills is not a short term goal. The Committee is concerned that the Antarctic science workforce is becoming a less viable long-term career choice for young scientists, and that this will eventually have an impact on Australian Antarctic science. The Australian Government should consider innovative ways to meet the need for a skilled Antarctic science workforce in order to achieve its longer terms objectives in Antarctica. This could include leveraging cooperation from commercial and philanthropic entities, as well as continuing to strengthen learning experiences through international cooperation.

## Recommendation 15

**The Committee recommends that the Australian Government assess how Australia can retain and further develop its Antarctic science workforce to ensure long term objectives under the *Australian Antarctic Science Strategic Plan 2011–12 to 2020–21* can be met. Such an assessment should consider opportunities to leverage cooperation from commercial and philanthropic entities, as well as jointly funded international ventures. The results of this assessment should be incorporated into future iterations of the *Australian Antarctic Science Strategic Plan*.**

### Data storage, management and use

- 5.105 As technology advances, so does the amount of data that is generated. The Committee has heard that Australia's new icebreaker will be fitted with a multitude of advanced scientific capability that will require an efficient means to capture, store and access scientific data for analysis.
- 5.106 While the Committee notes and welcomes the recent announcement of improved satellite communication facilities available to the AAD, it is not clear that a strategic plan exists for the management of the vast scientific data generated through Antarctic research. While entities such as the AAD and Geoscience Australia each have mechanisms to manage vast amounts of scientific data, there does not appear to be a coordinated approach to data management including capacity to readily share and disseminate that information.
- 5.107 Furthermore, the Committee is concerned that the Australian Government does not have sufficient visibility of the data being gathered by other countries, especially in East Antarctica. The Committee notes with concern that technological shortcomings may be compromising Australia's capacity to engage in important opportunities to collaborate with Antarctic partners.
- 5.108 The Australian Government should consider a coordinated approach to the management of its Antarctic data. One suggestion that merits further investigation is the data cube as proposed by Geoscience Australia. In the Committee's view, such a concept could provide a central data repository and enable increased collaboration with international Antarctic partners.

## Recommendation 16

**The Committee recommends that the Australian Government, through the Department of the Environment and Energy, consider a whole of government data management strategy to manage its store of Antarctic data as a matter of priority. In the short term, the Committee recommends that Geoscience Australia and the Australian Antarctic Division put forward a business case for an ‘Antarctic Geoscience Data Cube’ that could be included in an expanded version of the Digital Earth Australia program, and any other necessary data management infrastructure – including the tools Australia requires to access, read, and use data from other countries’ Antarctic research.**

- 5.109 The Committee also notes the suggestion by Geoscience Australia to improve its capacity in remote sensing technology. While the Committee believes this may be a meritorious suggestion, particularly given its attractiveness to international space agencies, the Australian Government may wish to conduct further analysis on the viability of this project.
- 5.110 Whilst the Committee notes that the ATS specifies that information collected from Antarctic research should be open and shareable, evidence suggested that this was not always the case. Both during site inspections in Antarctica and through public hearings, the Committee observed that some countries were sharing data more readily than others. The Committee accepts that this may be due to a lack of capability of some countries, and the Committee is therefore pleased to hear that the AAD has made efforts to assist countries to develop this capability. However, the Committee is concerned that more may need to be done to ensure that data remains open and shareable. The Committee considers that any future memorandums of understanding Australia enters into, relating to Antarctica, include clear provisions requiring data sharing. This should also apply to reviews of existing MOUs.

## Collaboration

- 5.111 Collaboration is at the heart of Antarctic science. The Committee heard about an array of projects being worked on by Australia’s talented Antarctic scientists in collaboration with Australian and international colleagues. The Committee is also pleased to see that Australian scientists have developed expertise across a range of fields.

- 5.112 The Committee was interested in the range of agreements on cooperation struck between Australian and international entities with respect to Antarctic science. It was also interested in the manner in which intellectual property rights are allocated under such agreements. Given the various agreements in force, it would be beneficial for the Australian Government to consider whether these agreements should be centrally coordinated. Such a repository would ensure visibility for the Australian Antarctic science community so that valuable efforts are not duplicated. The Australian Government may also wish to consider how such a mechanism would also capture the registration of any relevant intellectual property rights.
- 5.113 The Committee also received some evidence that considered the economic or commercial use of Australian Antarctic science discoveries. In the Committee's view, economic or commercial imperatives are linked to the cooperative agreements and intellectual property considerations underpinning these agreements.

### **Recommendation 17**

**The Committee recommends that the Australian Government, through the Department of the Environment and Energy develop a centrally coordinated repository of Antarctic science agreements which also capture the registration of any relevant intellectual property rights.**