

Leading Australian Antarctic Science

Independent Expert Review of Australian Antarctic Division Science Branch

November 2021

Recommendations of the O’Kane Review

Recommendation 1: Science at the centre of the AAD

That the Division adopt as its core value that science is at the centre of all its activities; and that it further adopt:

- a narrative underpinning its work in accordance with this value
- funding and logistics allocation processes that reinforce this value.

Recommendation 2: Decadal plan to drive science priorities and programs

2.1 That the Australian Antarctic Science Council develop a 10-year Australian Antarctic science plan (Decadal Plan) to implement the Strategic Plan (which should be updated), including:

- programs to deliver the science priorities and outcomes, as per the Strategic Plan
- science programs to support geopolitical priorities, as per Recommendation 2.2
- consideration of the SCAR horizon scans, taking into account that the cornerstone of all major and successful national Antarctic programs is excellence in science in a global sense.

The work of preparing and drafting this Plan will be led by the Chief Scientist who is Executive Officer of the Council. [See Recommendation 6 also.]

- 2.2 That the Division develop recommendations to Government on the science programs that might best support Australia’s geopolitical interests in Antarctica, including those relating to the Antarctic Treaty System. This process may identify science programs that are additional to the Strategic Plan priorities, addressing Australia’s physical and virtual presence across the Australian Antarctic Territory.
- 2.3 That the Division explicitly consider and advise the Council on the opportunity for more cost-efficient, high impact science which enables Australia to demonstrate its presence across a larger component of the Australian Antarctic Territory. This might include, but would not be limited to, the potential benefit and use of remote sensing technology and data coordination and analysis across national and international Antarctic programs. This will include ongoing familiarity with international as well as Australian research being carried out concerning East Antarctica and the data being produced through that research. [See Recommendation 5 also.]
- 2.4 Within the Decadal Plan, and in consultation with the Council, AAPP and SRIs, that the Science Branch identify the specific critical programs that it will lead, consistent with the recommendations on the role of the Science Branch.

2.5 That reporting against the Decadal Plan be done on an annual basis and that the Plan be updated at least every three years.

Recommendation 3: Role of Science Branch

3.1 That the Science Branch *policy* roles be formalised as:

- principal Antarctic (and Southern Ocean) science adviser to the Australian Government, through the Division, including the synthesis of relevant science undertaken by other Australian and international science bodies
- secretariat to the Australian Antarctic Science Council (the Council)
- manager of the science capability program (refer Recommendation 7)
- custodian of the long-term monitoring program (refer Recommendation 4)
- custodian of the Australian Antarctic data model
- facilitator of Australia's national and international Antarctic science collaboration (refer Recommendation 6).

3.2 That the Science Branch *delivery* roles be formalised as:

- leading [a small number of] critical programs to support Australian Government policy priorities, provided these programs are part of a well-defined challenge science program in the Decadal Plan and satisfy one or more of the following principles:
 - to support the Branch's commissioning, coordination and science policy advisory functions to the Government including for treaty or other international obligations (e.g. fishing limits mandated through CCAMLR)
 - to support the assimilation and synthesis of science and research undertaken by parties outside the Australian Antarctic Division
 - for reasons of national security
 - to minimise human impact on sensitive Antarctic terrestrial and marine ecosystems
 - to support custodianship of the Australian Antarctic data model programs
 - to ensure ecologically sustainable use
- filling any critical capability gaps, or helping partner organisations fill critical capability gaps, in the Australian Antarctic science program, where necessary using a 'secondment-in' model where senior researchers in a particular field work in AAD for a short period
- undertaking long-term monitoring that underpins the Australian Antarctic science priorities and programs
- leveraging the data model and driving the development of a digital twin in support of Australia's science and geopolitical interests, including through a program of data development, access, analysis and publication (this should include a refreshed mapping program over the Australian Antarctic Territory – possibly in collaboration with Geoscience Australia).

3.3 In general, that the Science Branch:

- not deliver sub-scale science programs, or programs not aligned with the needs described under 3.2

- minimise duplication of capabilities and programs across Australian Antarctic science, working with the other relevant Australian agencies and universities to review the range of programs in parallel with the cycle of reviews of Science Branch science delivery
- maximise efficiencies in the use of scientific infrastructure and data for Antarctic and related science.

Recommendation 4: East Antarctic Monitoring Program (EAMP)

That Science Branch, with the support of the Australian Antarctic Data Centre, create, manage and be the custodian of a formal, long-term monitoring program (the East Antarctic Monitoring Program – EAMP), building on and extending monitoring done over decades by AAD and partners and ensuring maximum use of technological developments in data science, low-cost sensors, spaceborne sensors, and autonomous vehicles.

Establishing the EAMP will involve:

- determining the essential physical, biological and chemical variables to be measured, guided by relevance, feasibility and effectiveness
- determining the frequency and duration of measurements and the preferred data collection methods to be used in designing and/or continuing long-term monitoring through wide consultation with end-users
- ensuring the use of intercalibrated, state-of-the-art standardised methodologies for data collection
- implementation of quality assurance/quality control procedures to ensure the integrity and comparability of data over timeframes consistent with natural and human- induced change
- ensuring easy access to data and robust archival storage methods for timeframes that will span decades
- curating all past data collections including forensic investigations to rescue long-term datasets/records and other information in all forms; assessing and documenting the quality and value of archived data; and transferring all data to modern storage and preservation technologies to promote wide access by end-users.

The resulting data will be open access and formally curated, stored and quality controlled for the purposes of understanding long-term change and providing data streams of known quality to predictive systems such as large-scale models and digital twins. This dynamic data collection and appropriate software tools will together constitute the AAT Virtual Observatory, presenting all the monitoring material online in an accessible format, including real-time where possible. The proposed EAMP will work closely with related national bodies such as IMOS, international programs such as the Southern Ocean observing System (SOOS), and data products curated by SCAR (e.g. BEDMAP3,² Biodiversity.aq,³ the International Iceberg⁴, and the Seismic Data Library System⁵).

² www.scar.org/science/bedmap3/home/

³ <https://www.biodiversity.aq>

⁴ <https://www.scar.org/resources/iceberg-database/>

⁵ <https://www.scar.org/sdls/>

Recommendation 5: Integrated Digital East Antarctica (IDEA)

- 5.1 That the Science Branch initiate and lead a new and ongoing 'Integrated Digital East Antarctica' (IDEA) program as a fundamental component of the Australian Antarctic Program. The IDEA program will integrate and leverage:
- the new AADC and AAPP digital capabilities
 - Australia's expertise in other application areas in data science, remote sensing, large robotics, smart sensors, and modelling
 - historic and future Australian data from the AAP, including from the AAPP, SRIs, GA, BoM, CSIRO, MNF, IMOS (including its Ships of Opportunity Facility) and the new icebreaker and field platforms
 - international data, from SCAR programs and remote sensing platforms
 - initiatives including the ACCESS NRI's leadership in simulation such that next generation simulation capabilities inform the development of a digital twin for East Antarctica.
- 5.2 That the geographic extent of IDEA be the whole of East Antarctica and the surrounding ocean, which fully incorporates the AAT and Australia's Exclusive Economic Zone claim; and its objectives be to:
- build and maintain the globally authoritative digital model (or twin) of East Antarctica with input from at least CSIRO, GA, BoM and the university sector
 - enable integrated research programs (building from the data architecture noted above to include modelling, scenarios, and prediction) by all AAP participants.

These objectives have both geopolitical and scientific dimensions. The IDEA will be a modern (digital) expression of Australia's AAT sovereignty claim⁶⁶ (our digital footprint on the ice), facilitate collaboration with other national Antarctic programs including through SCAR, and enable more ambitious multi-disciplinary 'big data' science. The IDEA will initiate and enable new science programs, by current and new researchers, without the cost of field work. IDEA could even be positioned as an Australian-led SCAR initiative.

Critical initial steps in developing the IDEA include:

- identify the research questions in the Decadal Plan which can only be addressed by developing the IDEA (this is an iterative process; the Decadal Plan should generate other science and geopolitical use-cases for the IDEA, including in the Antarctic Treaty System)
- review current Australian and international data holdings and monitoring programs against the science and policy user needs, to identify data gaps

⁶⁶ Following the passing of the 1933 Australian Antarctic Territory Act, the Australian Government decided that production of a comprehensive map of Antarctica would assist the consolidation of its territorial claims. The resulting map, published in 1939 (Bayliss and Cumpston, Department of the Interior) was recognised as 'the world's first reliable map of Antarctica'. A digital twin of East Antarctica, incorporating topographic, bathymetric and other spatially-referenced historic and current scientific data, would be the 21st Century equivalent.

- examine and assess existing digital twin initiatives to establish strategies that can be adopted by the Division
 - develop programs to fill those gaps (including via international collaboration and remote sensing, where possible).
- 5.3 That these science and policy-driven applications and programs be led by Science Branch, in collaboration with the AAD's Technology & Innovation and Policy & International Branches. The technical architecture for the IDEA should be developed in consultation with members, noting that several other Commonwealth agencies and universities have significant digital capabilities and experience.

Recommendation 6: Science collaboration

- 6.1 To maximise collaboration in Australian Antarctic science, that the Chief Scientist convene an advisory group to help her draft the Decadal Plan. Ideally, this group should include the leaders of the AAPP and the SRIs, and appropriate leaders from the other entities carrying out major Antarctic research, CSIRO, BoM and GA, as well as Science Branch itself.
- 6.2 That the Chief Scientist, with input from the advisory group, develop a collaboration program to deliver the Decadal Plan, including logistics support, data sharing and science symposia.
- 6.3 That, in developing the Decadal Plan, the Chief Scientist pursue opportunities for Australian leadership and participation in SCAR programs that are aligned with the Plan. In particular, that the focus be on regional and continental data analytics and remote sensing programs that would link to the Australian data model but not require new logistics support. More generally, the Chief Scientist should examine possibilities for maximising collaboration with other polar programs, with a view to increasing science impact significantly and sharing expensive facilities.
- 6.4 That the Chief Scientist examine and report on the short and long-term research opportunities and collaboration which could be realised and strengthened through co- location of Hobart-based elements of the Australian Antarctic science community as a key element in the broader program of work by the Australian and Tasmanian Governments to develop a business case for the creation of a state-of-the-art Antarctic and Science Precinct at Macquarie Point.
- 6.5 That the Chief Scientist, in collaboration with the Council, develop a plan for further strengthening the Australian Antarctic science institutional model. This should include consideration of unimplemented recommendations from the Clarke Review and a submission to Government (through the Division and Department) for ongoing science funding following cessation of the AAPP and SRI programs. It should also include processes to second or otherwise engage high quality research groups from other institutions as required.

Recommendation 7: Science capability

- 7.1 That the Chief Scientist, in collaboration with the Council, AAPP and SRIs, determine the future Australian capabilities (people, technology, science) that will be required to deliver the Decadal Plan, map current capabilities against those needs, and initiate a program to fill any gaps. This process should be repeated every three years.
- 7.2 That the Chief Scientist develop a program of secondments from other Australian and international science bodies to strengthen Science Branch capabilities in strategic areas. (This program should be based on win-win-win principles – for the Branch, the home institution and for individual career development).

- 7.3 That a regular review cycle of research programs across the AAP, aligned to the three- year capability review, be encouraged.
- 7.4 That the Chief Scientist, in collaboration with the Council, AAPP and the SRIs, develop an integrated, cost-effective and best-practice program, with five and 10 year targets, to support development of future Australian Antarctic science leaders, at all levels (postgraduate, postdoctoral, early-mid career, principal investigator, Future Fellow). This program to include co-supervision, funding and international linkage arrangements.

Recommendation 8: Science infrastructure and logistics support

- 8.1 That the Decadal Plan be informed by a coordinated overview of available national (and potentially international) science infrastructure and logistics support to ensure the expression of priorities and investment in research is matched by available operational support, particularly on ice.
- 8.2 That future decisions on the allocation of the available support be made by the Director, AAD, with advice from the Council and the Chief Scientist and other appropriate branch heads, in consultation with the heads of the AAPP and the SRIs, to help mitigate the potential for perceptions of conflict of interest.

Recommendation 9: Communication

That the AAD, informed by the Chief Scientist and the heads of the Policy & International and Strategy & Communications branches, develop an appropriate ongoing Government communication strategy that covers the continuing AAD science/policy nexus, in the context of the proposed AAP Decadal Plan.

Recommendation 10: Leveraging capability in Tasmania

That the Chief Scientist foster a culture of intra-Tasmania cooperation in AAD and look for opportunities for strengthening cooperation with other Tasmanian entities which engage in Antarctic and Southern Ocean research.

Recommendation 11: Getting there from here

- 11.1 That, under the guidance of the Science Council, the Science Branch move rapidly to do the work needed to develop the Decadal Plan. This will involve:
- developing with the help of Policy & International Branch a sophisticated understanding of how Antarctic and Southern Ocean science can serve Australia's needs and articulating these needs in a clear statement that spells out customer agencies and timeframes and by when these needs have to be met
 - auditing what is available already to help deliver on these needs including: current projects carried out by all organisations in the AAP, noting delivery responsibilities and timeframes; international Antarctic science collaborations between Australia and other nations; and data collections (historical and recent; national and international) of aspects of East Antarctica and the surrounding ocean
 - identifying the capabilities (people, technology, science) required for delivery of the Decadal Plan, mapping them against current capabilities, and developing a program to fill the gaps – for Science Branch, this should include high quality secondments to build its own capability
 - consulting all relevant agencies and research organisations

- drafting the Plan with a view to having full consultation finished and Ministerial sign off by the end of June 2022.

11.2 That new structures needed to implement the policy and delivery roles for Science Branch be implemented quickly, with the aim of being in place by the end of June 2022. Significant support and training will be needed to help staff transit to new roles and take on new responsibilities.

11.3 That Science Branch work with Technology & Innovation Branch to implement the Antarctic Monitoring Program and to scope the Integrated Digital East Antarctic program with a view to having funding support for IDEA by the end of 2022.