

2016 National Research Infrastructure Roadmap Capability Issues Paper

Submission No: <i>(to be completed by Departmental staff)</i>	
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EXECUTIVE SUMMARY

The [Council of Australasian Museum Directors](#) (CAMD) congratulates the authors of the *National Research Infrastructure Capability Issues Paper* on the breadth of the capability areas encompassed by the paper. CAMD is particularly supportive of the continuing acknowledgement of cultural and scientific collections as nationally significant research infrastructure and the extent to which the paper includes and integrates humanities, arts and social science research into infrastructure determinations.

Australia's collections are nationally distributed and can be found in the older, larger state collections, the smaller, regional collections as well as in the more recently established Canberra-based national collections. It should be noted that there is no one national science museum/collection in Australia but that this role is filled by a variety of state museums and other state and federal research institutions. The collections held by museums in Australia provide a rich resource for evidence-based research of national and international significance **in all fields of knowledge**. Utilisation of this data across disciplines provides an opportunity for innovation and new approaches.

Overall in relation to the Issues Paper, CAMD:

- endorses the continued support and enhancement of the [Atlas of Living Australia](#) (ALA). The ALA provides a truly world-leading access platform and tools to Australia's biodiversity data (both object-based and observational data). Globally, the ALA is recognised as leading research infrastructure;

- supports **international linkages** through nationally coordinated membership of key international initiatives such as the [Global Biodiversity Information Facility](#) (GBIF), [Scientific Collections International](#) (SciColl) and the [Consortium for the Barcode of Life](#) (CBOL). In addition, Australian access to international infrastructure such as [CERN](#) is critical to our scientific and cultural heritage materials research. With a new HASS digital access capability (see below), this would also create the opportunity to link into international HASS platforms and initiatives such as [Europeana](#);
- supports the development of a new/enhanced **digital access capability** to the HASS collections. This needs to be two-fold:
 - a **national digitisation capability** – technology and expertise to deliver mobile high volume and/or high resolution digitisation; and
 - a **digital access and discoverability platform** suitable for the Humanities, Arts and Social Sciences (HASS) collections. We would suggest that this may be an opportunity to expand/build upon the ALA platform, perhaps bringing this together with other existing (currently non-national) platforms such as [TROVE](#), to create integrated data harvesting and sharing, with tools specifically designed to ensure that national and international researchers have visibility of, and access to, the distributed national collections and the knowledge associated with them.

Crucial to this will be ensuring international interoperability so that Australian data can be meshed with internationally held data, for research outcomes. (For historical reasons, a significant quantum of Australia's cultural heritage is held in international collections. Currently, there is no mechanism for Australian or international researchers to link this data). The ability to link data on a global scale could result in a paradigm shift in HASS sector research capability, and allow links to be made to international initiatives such as Europeana.

CAMD

CAMD members are the leaders of the major national, state/territory and regional museums in Australia and New Zealand. Together, the CAMD museums in Australia hold close to 50 million natural science and geoscience specimens and cultural, technological and heritage objects which form part of the wider distributed national collection.

Museums contribute to the national research effort in the following key ways:

- museums generate ground-breaking research in a wide range of fields in their own right, through research partnerships with university researchers and in collaboration with the private sector; and
- this research in natural history, cultural heritage, humanities and social sciences fields is informed by vast and deep museum collections which traverse all subject areas and media.

RESPONSES TO SPECIFIC QUESTIONS & COMMENTS ON CAPABILITY AREAS

CAMD has chosen to comment on the following questions and capability areas:

Question 3: Should national research infrastructure investment assist with access to international facilities?

Yes. Membership of and participation in key international initiatives should be centrally coordinated and funded through the National Research Infrastructure. Membership of GBIF, SciColl and CBol is critical in both ensuring that Australia has access to, and interoperability with, linked global data and in ensuring that Australian data is discoverable and accessible to international researchers.

CAMD natural history museums partner with the ALA, which also serves as a gateway for data sharing between Australian projects and other international biodiversity informatics programmes, including the [Encyclopedia of Life](#) (EO), the [Biodiversity Heritage Library](#) (BHL), the [Barcode of Life Database](#) (BOLD) and [Morphbank](#). The ALA is being used by 10 countries around the world to support national biodiversity portals. National research infrastructure investment should be strategically aligned with and linked to key international infrastructure.

Existing global links are strong within the biodiversity, genomics and geosciences fields. However, a significant opportunity exists to link into global data networks and open cloud data for the HASS collections. Much of Australia's cultural heritage is still held in overseas institutions (for historical reasons). There is currently a complete disconnect between the fragmented HASS collections data held in Australian Institutions and the data and collections held internationally (eg Europeana).

Question 5: Should research workforce skills be considered a research infrastructure issue?

Skills should form an integral part of National Research Infrastructure. From software engineers to expertise in species discovery, core skills must be maintained and grown to support the very best return on investment in research infrastructure. This need is growing exponentially as research tools are enhanced and new ways to generate and manage 'big data' are developed.

ENVIRONMENT AND NATURAL RESOURCE MANAGEMENT

Museum natural science collections provide a series through time and space which are vital to understanding the changing dynamics of our continent and the vast challenges it faces now and in the future. The series allows base line studies of change and covers the ongoing collection of material, through fieldwork and acquisition, for research supporting state, national and global priorities. The value of these collections has grown alongside advances in imaging and characterisation in recent years.

Question 18: Are the identified emerging directions and research infrastructure capabilities for Environment and Natural Resource Management right? Are there any missing or additional needed?

The important role of the biological collections held in museums, herbaria, universities, the CSIRO and other Government departments in providing essential research infrastructure has already been identified in earlier iterations of the Roadmap and, subsequently, through the NCRIS funding of the online Atlas of Living Australia (ALA). CAMD strongly supports the continued funding and enhancement of the ALA and its associated tools.

CAMD museums incorporate a range of facilities which utilise collections to foster research in-house and with external groups in this field. These include the:

- [Australian Museum Research Institute](#) which uses its natural history and geological collections to underpin research in areas such as wildlife genomics, climate change impacts on biodiversity and the detection and biology of pest species;
- the country's first [Australian Wildlife Biobank](#), which was launched last month at the Melbourne Museum, which houses the museum's existing collection of more than 44,000 tissue, feather and fur samples including include parasites, fungal infections and bacteria;
- the [Australian Biological Tissue Collection](#) at the South Australian Museum which is one of the largest wildlife tissue collections in the world containing nearly 125,000 samples of animal and plant samples collected from terrestrial and marine animals;
- the [Queensland Centre for Biodiversity](#) (QCB) at the Queensland Museum which uses research on the natural history collections for applied topics. This includes the emerging DNA and chemical technologies (biodiscovery) that contribute to advancements in human and veterinary medicine; environmental assessment and monitoring; genetic diagnostics and other fields;
- the Western Australian Museum's [Molecular Systematics Laboratory](#) which investigates the use of DNA and DNA barcoding in cataloguing species; and
- the Western Australian Museum's [Marine Bioresources Library](#) - a frozen library of samples taken from sponges and other marine species, which will be available for use by State, national and international organisations to provide new research opportunities for industry research into cures for cancer and other diseases.

CAMD supports the further integration and coordination of existing museum facilities in plant and animal biological sciences into wider research activities in order to address key issues raised under this capability.

CAMD would also suggest that museum geological and paleontological collections will also be critical inputs to this capability as they have the capacity to assist in research seeking to understand past climate patterns and the current use of earth resources. Investment in digital infrastructure is needed to improve access to these important collections and their linkage with existing data.

Taxonomy

CAMD also agrees that support is needed to continue building on existing taxonomy capability to ensure that National Research Infrastructure, such as the ALA, continues to hold the global lead in biodiversity data discoverability and accessibility. The focus of systematics and taxonomic funding in Australia could be shifted from small, often one-researcher research projects to major, national, multi-team and multidisciplinary approaches.

Approaches adopted in Europe (eg the EU funded project [European Distributed Institute of Taxonomy](#) (2006 – 2011) and the United States of America (eg the National Science Foundation's [Partnerships Enhancing Expertise in Taxonomy](#) (PEET) program) have been highly successful in establishing major national and international efforts that include taxonomic training.

Question 19: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

Yes. As noted above GBIF, SciColl, CBOL and Europeana. The following programs have also been recommended by member museums:

- the [Encyclopedia of Life](#) (EOL) - a free, online collaborative encyclopaedia intended to document all of the 1.9 million living species known to science. It is compiled from existing databases and from contributions by experts and non-experts throughout the world.
- the [Biodiversity Heritage Library](#) - which works collaboratively to make biodiversity literature openly available to the world as part of a global biodiversity community.
- the [Catalogue of Life](#) – the most comprehensive and authoritative global index of species currently available. It consists of a single integrated species checklist and taxonomic hierarchy.
- [Integrated Digitized Biocollections](#) (iDigBio) –funded by the National Science Foundation for Advancing Digitization of Biodiversity Collections (ADBC). Through iDigBio, data and images for millions of biological specimens are being curated, connected and made available in electronic format for the biological research community, government agencies, students, educators, and the general public.

Question 20: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Environment and Natural Resource Management capability area?

Greater collaboration between Australian NCRIS facilities, and with international research infrastructure facilities, would significantly enhance existing capability and maximise use of resources.

UNDERSTANDING CULTURES AND COMMUNITIES

CAMD was strongly supportive of a similar community and cultures capability advanced initially during the 2011-12 roadmap process and the concomitant recognition of cultural collections in Australia as a highly significant form of research infrastructure in their own right. CAMD also agrees strongly with the designation of online discoverability of these collections as a key action associated with the cultures and communities capability.

At the time, CAMD emphasised the following:

- the importance of utilising the vast research resource available in Australian public collections in which the Government, at both Federal and State levels, has made significant, long-term investment;
- the importance of museum collections as significant research infrastructure which in turn provides the basis for ongoing, unique research by museum research staff and other academic researchers;
- that the history, heritage, cultural and humanities collections held in museums and other collections hold information which informs and fosters research not only in the humanities, arts and social sciences but across a wide range of disciplines;
- the collections are particularly vital in relation to Indigenous cultural studies and for historical and social science studies which focus on national identity, adaptability and change. They also have the capacity to generate novel research solutions to further gaps in our knowledge base eg the [Indigenous hair sample collection in the South Australian Museum](#), which will help map Australia's ancient genetic history;
- that the lack of consistent cultural mapping for Indigenous Australia, including both urban and rural areas, means that the remains of the oldest continuous culture in the world are at risk, as is our potential to learn from 30,000 years of land management and climate change;
- the humanities, arts and social sciences can provide critical input not only to immediately recognisable social and cultural issues but across the sciences to encourage new thinking about the conceptualisation of problems and the implementation of workable solutions. They also contribute to the development of solutions for contemporary challenges in areas such health, education, sustainability and tolerance; and
- the analysis of material culture/moveable objects can reveal much additional context about history and diverse cultural groups that may otherwise not be detected through the more traditional approaches to inquiry (ie in history correspondence, oral histories and archives).

Recent developments

Since the 2011-12 road map process, a number of events and initiatives have highlighted the need for research infrastructure which would enhance the online access and discoverability of Australia's history, humanities and arts collections:

- the enhancement of online access to natural science collections through the **Atlas of Living Australia (ALA)** which now holds over 63m records and has demonstrated its full worth having passed the 7th billion download mark. It should be noted that the success of the Atlas has been grounded in its access to secure national funding;
- the potential for this type of investment in humanities research infrastructure was seen in the pilot [Museum Metadata Exchange](#) (MME) which was initiated by CAMD member museums in association with [Museums Australia](#) (MA) and the Australian National Data Service (ANDS) and has made data on close to 1,000 collections accessible to research academics through [Research Data Australia](#);
- **TROVE**, which provides a single access point for over 471 million online resources from libraries, archives and museums across Australia, has been [hailed by humanities researchers](#) for its nation-building contribution to research infrastructure development. The more than 20m unique users each year demonstrates the enormous appetite for cultural content;
- Australia's national and state/territory museums have greatly advanced access to sections of their collections utilising digital innovations, different portals and in partnership with external bodies such as [the Google Cultural Institute](#);
- the 2015 *National Arts and Culture Accord: Digital Technology survey*, commissioned by the [Meeting of Cultural Ministers](#), reported on the need for national, cross-domain collaboration in the collection sector to implement national digital strategies and standardise technical and skills areas in relation to online access;
- in 2016, peak organisations from the Galleries, Libraries, Archives and Museums (**GLAM peak**), including CAMD, and a representative from the Academy of Humanities, were successful in obtaining Catalyst funding enhancing digital access to collections. The project will:
 - prepare a draft national framework for digital access to collections;
 - endorse principles and common standards to assist small to medium institutions to prioritise digitisation and adopt best practice approaches to digital access; and
 - produce an accompanying case study-based prototype toolkit to support capacity building in the collecting sector.

The GLAM peak digital access project has seen an unparalleled level of collaboration across the collections sector. It will bring coherence to collaborations in this area, streamline further partnerships with other sectors and also build capacity amongst a range of small to medium collections across Australia.

Question 24: Are the identified emerging directions and research infrastructure capabilities for Understanding Cultures and Communities right? Are there any missing or additional needed?

CAMD agrees with the issues paper's acknowledgement that HASS sector research enhances our understanding of, and provides new frameworks for the analysis of humanity, and its history, ideas, cultures, languages and social structures. HASS research plays a particularly important part in developing interdisciplinary solutions to complex challenges such as climate change, resource management, health and welfare. It should also be noted that HASS sector researchers' needs are met in the main by the information held in collecting institutions and not by universities and other research institutions.

CAMD supports the comments made in this section on the nature of the national and state cultural collections as a key set of national research infrastructure and that access to this data is core to the 'Understanding Cultures and Communities' capability.

CAMD would further suggest that **all disciplines**, not only those from the HASS sector, would benefit from digital access to collection data. Furthermore, this data underpins and traverses all disciplines not only those relating to the HASS sector.

Question 26: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Understanding Cultures and Communities capability area?

CAMD strongly supports the development of a **National Cultural Heritage Digital capability** which operates in the Cultures and Communities sphere but goes beyond that to allow collections data to be researched as one entity by a wide range of disciplines; an opportunity which may well produce innovative and valuable research outcomes not yet even envisaged.

CAMD proposes a National Cultural Heritage Digital Capability which would be:

- free to users, as is the case with the ALA and provide seamless online access from researchers' desktops;
- delivering prioritised digitised research content to researchers;
- able to link individuals and groups of researchers with virtual research communities nationally and internationally;
- able to refine results and develop content linkages with filters such as date, theme, collection and location. The geospatial capacity in particular is missing from existing models;
- capable of addressing ethical and legal issues around copyright, ownership and access;
- able to deal with and provide online access to 3 dimensional objects;
- set up to capture born-digital material;
- able to address digital literacy and workflow, have access to existing national facilities and federated authorisation systems, and hold tools and expertise to address concerns of integration and scalability;
- able to manage access and discoverability, data harvesting and coordination;

- informed by the current GLAMpeak project to explore available models nationally and internationally;
- enhanced by a nationally coordinated digital imaging expertise (both high-volume and high-resolution solutions). It could also include a national mobile digitisation capability; and
- accessible for the development of different apps utilising data and metadata.

CAMD suggests that a National Cultural Heritage Digital Capability could be combined with the Atlas of Living Australia and possibly TROVE to bridge natural and HASS sector data and disciplines. This sort of combined data, hardware and expertise in a national digital capability would cut across all discipline boundaries and build upon and leverage the existing investment in the ALA.

CAMD also believes that funding for research infrastructure of this type should cover all aspects of research including capital costs, skilled technical support staff, operations, maintenance, preservation of data, training and skills development and effective governance of facilities.

Digital Repatriation (8.1.2)

CAMD also supports the concept of digital repatriation noting that approaches to providing access to data on communities and to community artefacts needs to proceed on a carefully determined ethical basis and to ensure that the community has the training and other digital infrastructure to allow their full access to digitally repatriated material.

A national digitisation capability could take the lead on standards and ethical protocols, to ensure that digital repatriation is culturally and technically appropriate.

Materials conservation (8.3.4)

CAMD agrees on the need for further identification of the gaps in material conservation and the need for a capability to ensure that information, techniques and instruments leading to best practice materials conservation are shared.

One particular gap relates to plastics. Further conservation research infrastructure and capability development is required given the move to 3D printing and the use of unusual/new forms of plastics with this work. This could be done on an international level to ensure best practice at a high standard.

NATIONAL SECURITY

Biosecurity

CAMD member museums make a contribution to national security chiefly through their collections, biobanks and facilities which are utilised for biosecurity purposes (9.1.1). Particular areas of application and research relate to identification of insect pests, plant diseases, marine pests, zoonoses and exotic animal diseases as well as changes in these organisms over time.

Given the known importance of this work to the environment, industry and human health, CAMD supports the need for the development of a virtual laboratory network to enhance research and response times in this area and further expansion of biocontainment facilities.

UNDERPINNING RESEARCH INFRASTRUCTURE

Question 30: Are the identified emerging directions and research infrastructure capabilities for Underpinning Research Infrastructure right? Are there any missing or additional needed?

CAMD members have been active in digitisation efforts over recent years but have found progress in this area obstructed by the cost and resources required. In 2014-15 CAMD museums held close to 50m items in their collections but the majority had less than 5% of the collection on display. Around half of those museums had less than 25% of the collection accessible online. Despite this gap, there are many examples of successful large-scale digitisation efforts carried out by CAMD museums in the region and by museum networks in other countries.¹

CAMD strongly supports the identification in the Issues Papers of the need for national coordination of work to digitise collections and agrees that this process would benefit from national coordination and funding.

Question 31: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

In relation to digitisation, developments in this area would also benefit from capital input to purchase large scale equipment for high volume digitisation and for high-resolution 3d imaging which is mobile and accessible to a range of collections. Training and specialised assistance would be required to enable application of new technology. CAMD supports the development of a National Digitisation Capability to support multi-disciplinary access to Australia's distributed national collection. The capability would work across all disciplines - sciences and HASS.

Question 32: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Underpinning Research Infrastructure capability area?

Exhibition programs to better communicate the outputs of research in Australia could be considered as necessary infrastructure. Research has little value to the society that pays for it if the outputs are not visible to the public at large. One approach to this issue could be to extend, for example, Questacon, Australia's National Science and Technology Centre, to provide such a research showcase to tell Australia's stories of research and innovation to national and international audiences. This would allow the production of touring exhibitions to engage and inspire a sense of pride in national endeavours across the country.

¹ For example, see [Museum Victoria Collections](#) which featured over 1.15 million records at launch in 2015, accompanied by over 150,000 images and the [Auckland War Memorial Museum Collections Online](#) which was launched in July 2015 and nearly one year on, has over three quarters of a million objects freely accessible online with 2,000 new objects being added every month. The [British Museum collections online](#) now has over 2.29m records available and at the [Smithsonian Collections](#) you can search 10 million records of museum objects, archives and library materials including more than 1.6 million online media files.

CAMD would be happy to elaborate on any of the points raised above in our submission. Please direct your initial enquiries to Dr Meredith Foley (0438 890 902; eo@camd.org.au).

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5 September 2016