Under the Microscope – Exploring Science Heritage

Australia ICOMOS
Science Heritage Symposium Proceedings

Hobart, Tasmania
12th November 2018

AUSTRALIA ICOMOS
International Council on Monuments and Sites

Australia ICOMOS, 2020

Proceedings of the Australia ICOMOS Science Heritage Symposium: Under the Microscope – Exploring Science Heritage, Hobart, Tasmania, 12th November 2018

Publisher: Australia ICOMOS

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Contributed Papers: All papers included in these Proceedings were delivered as presentations by authors at the *Australia ICOMOS Science Heritage Symposium: Under the Microscope – Exploring Science Heritage* in Hobart, Tasmania, on the 12th November 2018. All papers have been peer reviewed by appropriately qualified academic or other heritage professionals.

Opinions: Opinions expressed by contributors to these Proceedings are not necessarily those of the Editor, Australia ICOMOS or employees, or contributors.

Erratum: Page 76 – 'Edwardian case' has been corrected to 'Wardian case' (20/5/2020)

Cover Images

Top Recherche Bay, southern Tasmania, recognised as an associative cultural landscape of national heritage significance in relation to the interactions between the local indigenous people, the *Ilyluequonny*, and the 1792-3 French D'Entrecasteaux scientific expedition. (Photo: Anne McConnell, 2018).

Lower LH Scientific instruments and other objects used to support Australian research in Antarctica, which are part of the Australian Antarctic Division heritage collection. (Photo: courtesy of the Tasmanian Museum and Art Gallery).

Lower RH The Molonglo Radio Telescope east-west arm. The Molonglo Radio Telescope (originally the 1965 Mills Cross Telescope) was designed to be a broad-spectrum radio telescope to scan large areas. It has a distinguished history of contributions to astronomy and is still involved in cutting edge science. (Photo: Alison Wain, 2018).

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Proceedings of the Australia ICOMOS Science Heritage Symposium: Under the Microscope – Exploring Science Heritage, Hobart, Tasmania, 12th November 2018

The Molonglo Radio Telescope – a science, heritage and education partnership

Alison Wain

Abstract

The Molonglo Radio Telescope near Hoskinstown in New South Wales is both heritage and a working research instrument. A large cross-shaped array designed by prominent Australian radio astronomer Bernard Mills, the telescope has been a test bed for new technology and ground-breaking science for over 50 years and is currently being used to study Fast Radio Bursts. The advent of remote data acquisition, however, has reduced the number of people visiting and forming personal connections with the instrument, leading to perceptions that it is ageing and unfashionable, and making it vulnerable to decommissioning and disposal. To make this significant piece of heritage sustainable it is necessary to ensure that more people are aware of it and feel that they value it and are connected to it. This should not be limited to scientists, but should include the general public and especially the local communities, for whom it can be a source of inspiration and opportunity.

This paper looks at a project undertaken to explore ways to generate public interaction with the telescope, drawing not just on its astronomical significance but on the stories of social, political and technological changes reflected in its history; embodied experiences of the site; interest in the mechanical design; interest in the on-site animal communities; and creative responses to site experiences. These activities allow people to find bridging values to connect their existing lives and interests with the sometimes unfamiliar world of professional science.

Introduction

A significant number of both optical and radio telescopes exist along the eastern side of Australia. They include smaller, private telescopes, large university and government installations, current working telescopes and the remains of historic telescopes. Some are both of these last things: telescopes that are still involved in cutting edge science, but which have long and distinguished histories of contributions to astronomy.

One of these "double-dippers" is the Molonglo Radio Telescope (MRT). Officially known as the Molonglo Observatory Synthesis Telescope (MOST), and owned and operated by the University of Sydney, the telescope sits in a wide, shallow valley near the small town of Hoskinstown in New South Wales (NSW), just outside Canberra (refer Figure 1). The MRT was designed by iconic Australian radio astronomer Bernard Mills and opened as the Mills Cross Telescope in 1965. Constructed as an array, rather than a dish, with East-West and North-South arms of a mile (about 1.6 km) in length each, it was designed to be a broad-spectrum radio telescope able to scan large areas of the sky (McAdam 2005; Mills 1991). In 1978 it closed for three years for a major reconfiguration, reopening in 1981 as the MOST using just the East-West arm of its design (Mills 1991). More recently it has been reconfigured again and the North-South arm brought back into play with new antennae to allow Swinburne University of Technology (Swinburne University) to search for Fast Radio

Bursts, one of the hottest topics today in radio astronomy (Swinburne University, n.d.). MRT is managed by a close-knit team of site staff who maintain the telescope, prototype new components, install upgrades and new experimental equipment on the telescope, and provide data to off-site researchers.

Figure 1 The East-West arm of the Molonglo Radio Telescope. (Photo: Alison Wain, 2018).

The telescope has a continuous history of scientific use dating back 50 years, which makes it one of the first generation of radio telescopes to emerge out of the work done on radar in WWII (Wild 1987). It was, and still is, an innovative instrument which has made fundamental contributions to the development of the discipline of radio astronomy at an international level, and it is representative of Australia's leading international role in radio astronomy over many decades (Mills 1991). Its initial identity as the Mills Cross was recognised, not just by scientists, but by a broad cross-section of the public (at least in the Sydney-Canberra region) and was linked in the public's mind with its creator Bernard Mills. Mills' widow, Crys Mills, said that "it was very well known, and [when] I'd go into a shop some of [the shopkeepers] would see my credit card and say 'Oh! Are you Mrs Mills? Are you married to Professor Mills?'" (Crys Mills interview, 03/03/2019). This level of significance, recognition and persistence in the landscape as a physical embodiment of the processes of radio astronomy make the telescope a significant piece of cultural heritage.

But that is not how people mostly thought about it. When I first became acquainted with it in the early 2000s, its identity – its "branding" – centred on its being a scientific instrument and in that context it was considered old, somewhat run down and a bit unfashionable. As Crys Mills noted, it had faded from view (Crys Mills interview, 03/03/2019). Ironically, the fact that it had kept pace with digital advances actually contributed to its fading from view. In the 1960s and 70s researchers would typically come to the site in person for days at a time, living in the small accommodation block and physically working with the instrument

(Richard Hunstead interview, 17/10/2017). As quicker digital connections became available however, researchers were able to request data from the on-site staff, and even operate the telescope and receive data remotely. Most researchers, therefore, had no incentive to actually visit the site, and certainly not to stay there for extended periods. This was efficient in terms of time management, and utilised the site staff's intimate knowledge of the instrument to get the best out of it, but the reduction in people actively working at the site meant that a decreasing number of people were aware of the instrument's true potential or were thinking creatively about how to extend its capabilities. Duncan Campbell-Wilson, Officer-in-Charge at the site from 1975-2016, has commented on the insight and creativity that result from an intimate understanding of both the physical nature of the instrument and the digital data that it produces (Duncan Campbell-Wilson interviews, 2016), and that without personal experience of the physical instrument, fewer and fewer researchers were having the opportunity to develop this insight.

As well as limiting creativity, a lack of personal engagement was reducing the community of scientists who felt personally invested in the telescope. This is important because radio astronomers are, first and foremost, human, and like all humans they grow to love the things they spend time with, that they have a personal investment in, and that are woven into their personal stories and identities.

Richard (Dick) Hunstead, who helped to commission and test the telescope, used the telescope for his Ph.D. work in the 1960s and is currently the director of the telescope, remarked on the vivid memories he had of a community, forming social bonds with colleagues. They drove together from Sydney to Hoskinstown, bought food and ate together and spent long days and nights in both the hot summer and often freezing winter weather (Richard Hunstead interview, 17/10/2017). Anne Green remembers sleeping in the control room to keep warm in the winter: "…every morning when the staff would come in they would bang the door open and I would levitate and they thought it was very funny" (Anne Green interview, 30/01/2019). These people were young scholars when they first visited the telescope, and their experiences there helped to form their identities, both as scholars and as people. Without a stream of enthusiastic and, particularly, young people visiting and coming to know the site, the pool of people who loved the telescope, who felt a personal investment in it, or who even knew it existed, was dwindling rapidly. This made it increasingly vulnerable to being seen as a liability rather than an asset, and to be at risk of decommissioning and disposal.

New perspectives

As a member of the local community, and as a heritage professional rather than a scientist, I came to know the telescope in a different context. I came to know it through social contacts within the community and through an interest in the opportunities the telescope could provide for the community. This meant that, for me, the identity of the telescope was not centred around its role as a professional scientific instrument, but around its intricate and beautiful engineering, its connection with an earlier time in the Canberra region, and the way it contextualised science as part of the world around us.

I and my husband came to know Duncan Campbell-Wilson, who ran the telescope, through the Rural Fire Service in Bungendore, a village close to the telescope, where we all lived. My husband has a background in maths, physics and computer science, so he and Duncan had an immediate connection. I was a heritage conservator with a passion for preserving

large old machinery, so I was fascinated by the age and history of this big machine. Visiting the telescope with Duncan was an inspiring experience not only because of the instrument itself, but because we had the opportunity to experience it through Duncan's eyes – to hear the inside stories, to see his passion for it, and to have him tell us its story and how it had changed over the years.

When my children joined Scouts, I became a Scout Leader. Scouting is strongly focused on doing outdoor things that involve practical skills and finding out about the world, and I believed that the telescope would be a perfect place to take my Scouts to talk about science – not just the specific scientific work that was done at the telescope, but related topics such as identifying compass directions, identifying objects in the sky, and taking accurate measurements. I also believed that the telescope could present science as part of the world around us, not as something separate and 'hard', to make children feel that being interested in science could be part of their identities and senses of self.

Initially I took Joey Scouts, who are 6-7 years old, and we thought about the idea that you could 'listen' to the stars as well as see them. Duncan spoke to them in age appropriate language about the sorts of things he had found out from listening to stars. He also told them about the birds that tried to nest in the mesh of the reflector, and the frogs that got into the receiver boxes. They were able to run around, and look at the sheep that 'mowed' the grass. Being so young meant that they were interested in the things about the telescope that they could relate to their own lives. However, their age did not prevent them from appreciating the telescope. Meeting the person involved, Duncan, was an important part of the experience.

Later I took Cub Scouts (8-10 year olds) and 'Scout' Scouts (11-14 year olds). Each time we varied the language and program to suit the age group, and each time we had a great day out. We also hosted a Scout JOTA/JOTI event (Jamboree of the Air and Internet) at the MRT site, an overnight camp with opportunities to try ham radio, soldering, and taking computers apart to see what was inside. None of these things were radio astronomy, but they all reflected tangents of life and work at the telescope – understanding more about how radio waves work, opening up the 'black box' of electrical equipment, and seeing how easy it is to wire up and test electronics. Duncan was an integral part of all these activities, and for the JOTA/JOTI event we also had a ham radio enthusiast, an electrician and some tertiary level work experience students to help with the activities (refer Figure 2). I will also mention that Scouts these days includes both girls and boys, and we did not experience any obvious gender-based differences in interest levels for the activities. It is perhaps worth noting, though, that the electrician and I were both female and therefore providing identity models of females who were interested in science and engineering.

These first-hand experiences consolidated my perception of the telescope as a place where people of many different ages, interests and personalities could go and have a good time, with the opportunity to pick up new information and experience as they went. This is a process known as "informal learning", which is a fundamental part of experiences in institutions such as museums, zoos and experiential science centres and which research shows is becoming an increasingly important part of science learning (Dierking, 2005).

In 2016, as Duncan was approaching retirement, I decided to capture some of his understanding of the telescope through a series of oral history interviews. These turned out to be not so much about the details of the science done at the telescope – much of which is

Figure 2 Duncan Campbell-Wilson teaching a Scout to solder at the MRT. (Photo: Alison Wain, 2012).

published in formal papers – but about the telescope's role in social and political life. Duncan spoke about the people and politics that surrounded its inception, funding and design, and made it clear how much science is dependent on relationships between powerful players and vested interests. He spoke of the increasing cost and technical challenges of signal filtration as mobile phones and the myriad other electronic devices of the modern age began to produce radio interference that swamped the delicate signals from space. He spoke of the importance of merging analogue and digital information to develop a really accurate understanding of the data the telescope produced, with creativity and clarity born out of moving between these realms. Duncan also spoke of the MRT's role in the integration of women into mainstream science. These are not just those women who were so talented that their gift could not be ignored, but women who, like most of their male counterparts, were just regular scientists who could marry and have babies and STILL do a good day's science as an ordinary day job. It is nice to note in this context that Professor Anne Green, who was the first young woman to do Ph.D. research at the MRT, eventually became Director of the telescope, and Head of the School of Physics at the University of Sydney.

As Duncan spoke I began to see the physical telescope both as a symbol of the achievements of the past, and as a big analogue and digital playground, with tendrils of meaning snaking out of the world of academic science and into the world of everyday life.

The benefits of getting involved

As well as the telescope itself, the MRT site is home to an important archive. There are boxes of paper records and a range of other objects that preserve a record of the technical development of the telescope, its scientific observations (some of which have never been fully published) (Mills, 1991), the lives and work of its personnel and its participation in the sometimes collaborative, sometimes combative world of international astronomy.

Lack of space, time and funding meant that the archive had been stored in an uninsulated shipping container on the MRT site. Boxes were piled on top of one another, leading to the deformation and partial collapse of some boxes and crumpling of the materials inside them. In time, the shipping container began leaking, placing the archives at serious risk. Every cloud has a silver lining, though, and the plight of the MRT archive made a perfect opportunity for heritage and conservation students from the University of Canberra, where I teach heritage and conservation, to practice their collection salvage skills on a real collection.

Getting heritage students on-site to move and document the archives began larger shifts in perceptions of what the telescope was and what it meant. The students loved it, but they were not scientists, so they saw different things in it to the on-site staff. The students loved that fact that it was not a dish – for them that was unexpected and quirky. They found it fun (refer Figure 3). They loved the beauty of the site, its sense of wide open space, and that they shared it with a complex community of wild and domestic animals. They loved the handwritten calculations and the old analogue recording formats in the records, the historical glimpses of science that emerged with every box they opened. Through their enthusiasm the site staff, too, began to see the telescope in a different light. They started to see it not just as a scientific instrument, but as something people loved for its age and history, its beauty and its environment, and as something non-scientists could be interested in and feel a personal connection with.

Figure 3 University of Canberra heritage conservation students seeing a less serious side to dusty boxes of radio astronomy heritage. (Photo: Alison Wain, 2017).

This sharing of viewpoints catalysed a search for ways to help other people discover the riches of the telescope, and in 2017, in collaboration with The School of Physics at the University of Sydney and various academic and community stakeholders, I applied for funding from the Heritage Near Me (HNM) program of the NSW Office of Heritage and the Environment. To our excitement, the administrators of this funding program were interested in the telescope, perhaps mostly because it was not another historic house. It was very different in form, associations and meanings from other heritage properties they had funded.

This brought its own challenges, though, as along with being different and unusual, it is less convenient as heritage than a house. It is further removed from most people's daily experience, which makes it more challenging to interpret; it is a large piece of engineering which makes it potentially dangerous; and it is still in operation, which means that its role as heritage must not interrupt or impair its current scientific work. The MRT is also not a static physical structure – its very reason for being is to facilitate creativity, innovation and experimentation, so preserving the historic essence of the telescope means prioritising not its physical fabric, but its intangible traditions.

Intangible heritage is not conserved by recording people doing things; it is preserved by having people actually do things (Smith 2006), thereby preserving the lived experience of the tradition and the embodied and tacit knowledge required to continue it. Interestingly, this may not mean using the same materials and techniques as in earlier times so much as aiming for the same outcomes. This is akin to artistic activities, where creativity is considered essential – a dance company that performed only the same works with the same sets and costumes as in the past would be considered to be creatively sterile, but a dance company that continues a long-held tradition of developing and mounting new works is considered to be preserving the spirit and essence of a living tradition. This theory, or definition of intangible heritage, means that while the MRT remains an operating research telescope, its authenticity is arguably grounded in intangible traditions of creativity, experimentation and innovation, and the changes to the physical fabric of the telescope that result from that innovation should be embraced. If the telescope should cease to operate, or cease to be actively involved in research, then the preservation of the existing physical fabric would assume a greater role, in recognition of the fact that the intangible heritage was no longer living, or had morphed into the more common heritage approach of people re-enacting skills rather than reinventing them.

HNM allocated a facilitator, Gary Estcourt, to the project. This gave the project team access to someone with extensive experience in heritage who could, not being familiar with the site himself, see the telescope with fresh eyes. Not being a scientist, Gary could also see what non-scientists might relate to and find interesting about the site and the instrument, without being constrained by the expectations of someone involved in the radio astronomy discipline. Gary encouraged us to find and be guided by the stories at the site – not just the headline-grabbing tales of major discoveries, but the 'ordinary' stories of life working at the telescope, such as getting up every hour to move the telescope on long, cold nights; chasing down the one faulty part in the 1.6 km length of the East-West arm that was stopping the telescope moving; and observing the birds that nested in the receiver mesh. These are stories of effort, perseverance, surprise and pleasure that anyone can feel a personal connection with, without feeling alienated because they do not have a science background or feel they are 'not good at maths'.

Gary's input was important because information about primarily technical concepts, presented in technical language with symbols and references that require prior knowledge to decode, is a barrier for people who do not possess the knowledge to interpret it. A study of audience reactions to large technology heritage, including much industrial and transport heritage, found that a focus on machinery specifications and achievements is perceived by lay audiences as making the displays inaccessible, threatening, and relevant only to the initiated. Most importantly it makes them feel inadequate (Wain 2012), and people generally dislike doing things that make them feel inadequate. If, therefore, we wanted to help non-scientists engage with the telescope and its work, we would have to find ways of

making it relevant and accessible to a broader public, overcoming feelings of strangeness and alienation, and bringing the telescope 'down to earth'.

Gary also urged the team to think about a sustainable future for the heritage of the telescope, to look for community engagement and public program ideas, and a funding and management structure that would support those activities into the future. He encouraged the group to identify a wide range of stakeholders – not just the universities that operate and use the telescope, but people who run heritage places and science communication activities and engagement programs that have similar aims or challenges, and people with a personal interest in making the telescope more accessible. He also encouraged the group to do studies of the feasibility of what we wanted to do and the opportunities of which we could take advantage.

The team identified a broad group of stakeholders and held a co-design meeting to brainstorm ideas. The site's distance from Canberra (about 40 km from the CBD), coupled with the dangers and delicacy of active scientific machinery, meant that the telescope was never going to be a traditional open visitor site. However, we already knew it could provide great informal educational experiences. In addition to the Scout experiences, the site staff over the years had hosted a small number of work experience and placement students at both secondary and tertiary levels, focusing on skills as diverse as aerospace engineering and mechanical maintenance (refer Figure 4). We therefore decided to explore whether we could build on this educational aspect.

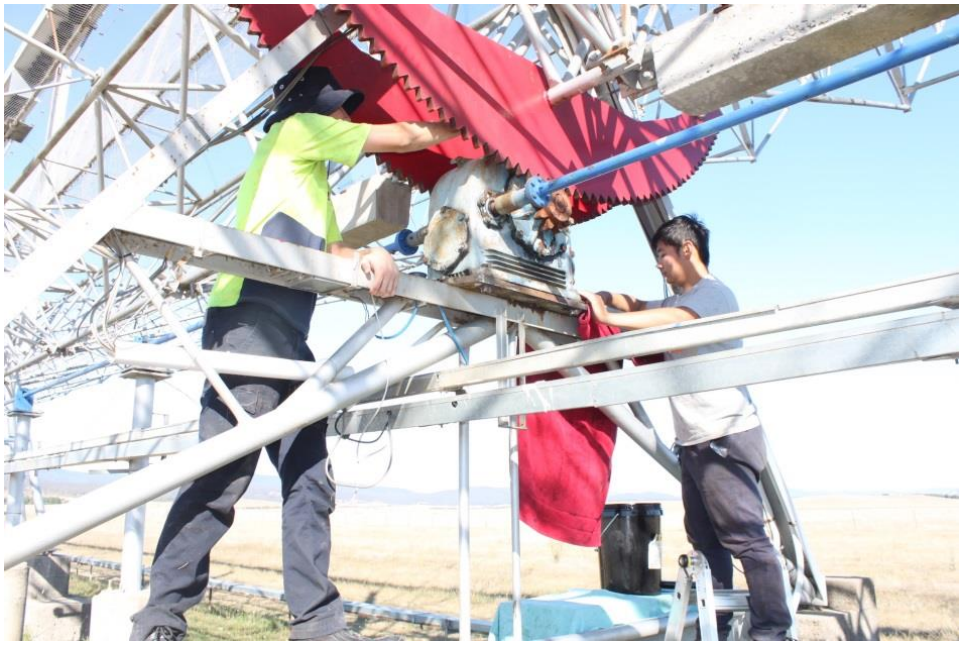

Figure 4 Tertiary engineering students getting hands-on maintenance experience at the MRT. (Photo: Alison Wain, 2017).

The MRT is relatively close to Canberra and a number of rural communities, all with their respective schools, TAFEs and universities. There are several complementary programs in the region focused on science education and optical astronomy that we could potentially partner with, and the MRT can be used to tell stories and support activities not just in science, but in the humanities and the arts, which gives it the potential to be used in a variety of curriculum areas. We hoped this would increase sustainability for the telescope as

it aged by giving it more strings to its bow; by creating a wider audience that was aware of it and valued it; and by providing a resource for Canberra and the local Queanbeyan-Palerang shire in which the telescope is situated. As a proof of concept we also framed the project to involve University of Canberra students from areas such as heritage and conservation, architecture, education and marketing; bringing new perspectives and skills to the project and widening the perception of what the telescope is and can do.

Realigning expectations

The HNM funded project started in mid-2018 and finished in November 2019, and comprised a Collections Significance Assessment and Management Plan, the production and transcription of a series of oral histories, an Interpretation Plan, a Communication and Engagement Plan, an Education Plan, and a Business Plan. This work improved the project team's understanding of the options and opportunities available, but did it deliver the outcomes we wanted?

Most people we spoke to loved the idea of the project – the concept of engaging the public with science through the varied interpretive options the MRT could support. Primary and secondary educational programs were enthusiastically received by the students who helped us to pilot them (refer Figure 5), and two public tours of the site were booked out within days. Displays of information and artefacts from the MRT at local libraries and events attracted a steady stream of interest. Enthusiasm ran high. Unfortunately, so did the logistical challenges.

The site is 45 minutes' drive from the centre of Canberra, which contributes to its beauty and low levels of radio interference, but worked against our heritage and educational plans. The site is too distant to fit comfortably into the time or financial budget for a typical Canberra school excursion, and it is not on any tourist routes that would make it an obvious stopover for interstate school tours or private tourists. This means that, while some teachers were eager to bring students out for specific project work, the volume of school visits would be likely to be too low to support a commercially viable schools program.

The University of Sydney concluded that having large volumes of students on-site was an unacceptable risk, both from a safety point of view and in terms of interrupting the work being undertaken at the site. The University of Sydney also noted that it currently expects the MRT to close in about 2030, at which point it will be required to decommission and dispose of the telescope and its site. This is an issue also faced by many industrial heritage sites, where companies often face a legal requirement to remove remnants of the industrial activity and rehabilitate the site when it ceases to be operational. While this requirement has the positive aim of mitigating environmental damage to a site, it has the unintended consequence of making it hard to preserve elements of the site as heritage assets.

Having significant numbers of students at the site would also require a facility for them to shelter, work, eat and meet hygiene needs, as well as to insulate the site staff from constant interruptions. The options for such a facility all turned out to be more expensive than anticipated, and more importantly to add to the University of Sydney's reluctance to invest in the site given its anticipated life span, or to accept the risks associated with having regular groups of students on-site.

Figure 5 Students from Queanbeyan Primary School at the MRT site using a small solar dish to track radio signals from the sun. (Photo: Lyndal de Ligt, 2019).

So, the members of the project team have had to rethink their expectations. Perhaps we were, in our hearts, still thinking along the lines of an historic house model, with commercial volumes of visitors. We have learnt that we will have to be more nuanced, and to grow our vision from the ground up. We are now planning to change our approach to focus on a series of smaller community collaborations, using the MRT to provide added value to existing programs and events and drawing on in-kind support and relatively small amounts of activity-specific funding. We will work with the local Council to assess the feasibility of a roadside pull-in bay with interpretive signage recording the identity and presence of the MRT, to provide an attraction for both locals and tourists interested in exploring the history of the Queanbeyan-Palerang shire. We will pursue online engagement and off-site community outreach events to generate awareness of the MRT and its activities without physical access to the site. We will explore the possibility of developing trusted relationships between local schools and the MRT, building its history, people and work into both science and humanities curricula and preparing selected students for access to the site itself for project and work placement experiences. We will continue to take University of Canberra heritage students to the site to work on the archive, and we will continue to develop collaborative relationships with other organisations that have similar aims.

In particular, we will continue to partner with the Inland Astro-Trail (IAT) project – an "astro-tourism, cultural heritage, STEAM (Science, Technology, Engineering, Arts and Mathematics) outreach and sustainable development initiative to link, promote, utilise and conserve sites of astronomical significance in southeastern Australia's rural inland for the benefit of rural and remote communities" (Findlay, 2019). Rather than concentrating on visits to one site, mandating an educational focus, or focusing on the science, the Inland Astro-Trail project is encouraging people to engage with a variety of astronomical observatories; to experience multiple cultural understandings of the sky; and to respond to

their experiences artistically through activities such as creative writing, weaving and dance. Dr Merrill Findlay, who runs the Inland Astro-Trail project, is first and foremost a creative arts person, and her comfort in this space is reflected in the emphasis she has given it in her project. While we initially aimed to do similar arts and humanities activities at the MRT, the MRT project team allowed itself to be pulled back from these ideals toward an emphasis on western scientific traditions as the central mode of understanding the MRT. This is a powerful reminder of the influence of prior personal experience on people's choices, and it should remind us that the audiences we wish to reach are affected by similar desires for feelings of personal connection, familiarity and confidence.

Conclusion

Is it important to cater to the interests of people who are not scientists? I believe the answer has to be yes. Science, above all, is a process of asking questions, not taking things for granted, and not acting on hearsay. It relies on a mindset of independence, personal initiative and the willingness to find out information for yourself rather than relying on what other people tell you. Independence requires role models, inspiration, and a self-identification as the sort of person who does ask questions and the belief that it is right to do so. If science seems to be out of your reach, walled off by barriers of unfamiliar language and symbols and devoid of people with whom you feel a connection, you are unlikely to engage with it. This means that an important route to developing habits of critical and analytical thought will be denied to you. If, however, you are already interested in history or biography, or love a good detective story, or a tale of effort pitted against the odds, finding these human interests reflected in a scientific context may provide you with a way into the subject that you can then explore with your existing skill set, and that can form a bridge to further engagement.

There are more directly practical reasons for wanting to engage people who are not scientists. Young people still searching for their path in life may be inspired to become scientists, providing a source of future students for the universities that own and use the MRT. Politicians are generally not scientists, yet they are often responsible for decisions about whether to provide the money to support science. And politicians are guided by the interests of the public whose votes they are trying to attract, so if there are votes in science, there will be money in science. Most of these people have the potential to be interested in science, and very often the bridge to that interest will be through elements that professional scientists see as peripheral, or even irrelevant, to the dissemination of their work. These elements are not trivial, though, they are essential. They are the bridges that allow us to see a new realm through a familiar lens and thereby gain the confidence to explore further.

Acknowledgements

I would like to thank the NSW Office of Environment and Heritage for supporting the Molonglo Radio Telescope Heritage and Education Partnership and Plan through the Heritage Near Me funding program.

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SYMPOSIUM DISCUSSION SESSION NOTES

Science Heritage and the Next Five Years?

The following summarises the comment and discussion from the Discussion Session, which was the final session of the Australia ICOMOS Science Heritage Symposium.

The Discussion Session was open to all Symposium participants and the comment reflects participant views based on a round table invitation to comment. Given the participants were largely Australian scientists and/or heritage practitioners, the views apply to the Australian arena. These views arise out of the real-world experiences of the participants as scientists, researchers and heritage professionals. The collected views however should not be considered as comprehensive given the Discussion Session time constraints and the fact that this was a brand new discussion topic in the Australian context.

The views presented in the Discussion Session indicate a clearly perceived, urgent need for active promotion and conservation of Australia's science heritage, as well as further discourse on the nature of science heritage and the strengthening of linkages across science, technology, engineering and industry. The most important strategies for conserving Australia's science heritage were considered to be research, good communication, and proaction, in particular in relation to inventorying science heritage.

And there was a unanimous view that science heritage is multifacetted – including documentary records, objects (including prototypes), sites, landscapes, viewscapes, and places and objects of memory and scientific, historical and social meaning and associations.

The comment (see below) has been ordered into a small number of topic areas. The summary attempts to report the individual comment, and the nuances of the comment, as faithfully as possible. As a result, there is some overlap of comment:

1 Defining Science Heritage

1. We need to explore, and come to a decision about, what 'science heritage' encompasses. Particularly important is whether it should be considered with engineering heritage.
2. We need to be inclusive in terminology – e.g., science, technology, engineering heritage, or STEM.
3. Science heritage needs to encompass lines of sight/viewscapes.
4. There is so much scope in considering science heritage, but this carries a risk that if the scope is too large science heritage conservation might become unmanageable.

2 Important Issues for Science Heritage Recognition and Conservation

1. There is limited promotion/public information about science heritage. This limits the community's engagement with science heritage, and also results in science

heritage having a low profile when arguing for its preservation or resourcing for its conservation.

2. There seems to be a lack of pride within the scientific community which inhibits science heritage conservation.
3. There is a disjunct/separation between categories of heritage and how it is treated which needs to be looked at and addressed. Particular disjuncts/separations noted were sites/places and moveable heritage (it was suggested that Victoria might be looked at as a model for how to treat objects), and tangible and intangible heritage.
4. There is a lot of 'potential science heritage' (i.e., as yet unidentified science heritage as it is still seen as part of current science). It is therefore important to identify potential heritage values before they are lost. This requires proactive inventorying.
5. A particular issue in relation to science heritage is that scientific objects are lost/disposed of as their heritage value is not recognised.
6. Objects of science heritage significance are often not recognised as heritage or 'potential heritage' and so are not curated or archived; and in many cases are simply disposed of at the rubbish tip. This requires proactive inventorying and assessment.
7. There are a lot of 'big things' generated through science and these pose major problems for storage and curation. We need to think about how we preserve these as heritage.
8. There has been a loss of science heritage sites, with such places being sold off (with intact heritage or after demolition), usually for redevelopment of the place. An example of this are Bureau of Meteorology sites, some of which in Tasmania have been sold to private owners and then redeveloped without regard for the heritage values (although there are some which have not).
9. Rehabilitation is an issue, including with respect to cleaning up ('rubbish collection') after scientific work. As with present day rehabilitation of mining sites, the science industry and researchers should be required to assess and protect heritage values as part of the clean up process. This requires a change in established processes.
10. Redundancy is a real issue and there are significant challenges for adaptive re-use of science heritage places.
11. Listing on a register does not guarantee protection, but if heritage is not listed it is an uphill battle to protect it. A sad reality!
12. Science heritage is threatened by the poor level of resourcing of heritage agencies/organisations. There are also limited resources in scientific organisations which make it hard for them to inventory and conserve their own science heritage.
13. Science heritage is threatened by political interests.

3 Suggested Approaches and Actions for Recognising, Celebrating, Promoting and Educating about Science Heritage

1. Hold meetings such as conferences, symposia and field trips to continue to explore science heritage. These should be broad based and include the full science – engineering – technology – industry spectrum.

2. Hold another meeting to explore the scope of science heritage. A specific suggestion was to hold a meeting in about in about two years' time, perhaps jointly with engineering heritage, with the aim of looking at connections and synergies between the different areas.
3. Look at how different types of science heritage knowledge and heritage can be linked and made visible. For example, can the *Encyclopaedia of Australian Science* be used to document and link up science heritage place and collections knowledge and historical data with the existing archives and publications knowledge.
4. We need to engage with young people to create and use opportunities to raise awareness about science heritage amongst younger people. This is important as:
    - Students are not as 'connected' with the way things were done in past, but this very history, showing how we have come to where we are now helps students to see where we are heading and to put our current knowledge into context. The 'whole story' paves the way for the future.
    - Making kids/students audiences for science heritage will provide for its protection in the future.
5. Use science heritage as pathway to inspire youth. It will be important to train teachers, and hands-on activities and stories will be needed.
6. Produce educational materials about science heritage for school age teachers. This material should include why this heritage and particular places are important.
7. More teaching about science heritage should be encouraged in universities, as university students are the scientists of the future.
8. Science heritage, particularly sites and 'big stuff', are important carriers of 'stories' - we need to work out how to communicate these stories to new generations and audiences, including through the science itself and through "bridging" stories and activities that relate science to other aspects of life and endeavour, including artistic creativity.
9. Install commemorative signs at science heritage places, particularly where there is a view over the place of interest and, where possible, using photos of past scientific activities relevant to those places. There should also be public tourist signs/information to draw attention to these places.
10. As science is more accessible to some people, science can also be used to tell the heritage story better.
11. Explore use of National Science Week funding for annual promotion.

4 Suggested Approaches for the Improved Protection and Management of Science Heritage

1. Key general strategic actions that are needed are:
    - identify gaps in research/knowledge;
    - baseline research on places – done by historians;
    - establish a framework for communication (possibly through the eScholarship Research Centre website);
    - develop a strategic approach for future science heritage conservation.

2. Develop the history of science. Some ways of doing this might be scholarships to libraries for young researchers or pairing young researchers with late career scientists.
3. Establish a scholarship for late career scientists to collate and document science heritage in their field.
4. Encourage specific disciplines to take on advocacy for the science heritage of their areas/fields.
5. Share information between disciplines, and improve the accessibility of material.
6. Deal with 'potential heritage' issues. Approaches include:
    - 'Benign neglect' – which is a powerful preservation strategy. It can mean that objects/records can survive the 'it's rubbish' short term view to be re-evaluated a generation later as important. Paradoxical but true!
    - Collect now for the future (Sweden was noted as a good example of this).
7. The technology of science is often about prototypes and one-offs made to fit particular requirements. Prioritise these for preservation and connect them to the records/archives of the experimental work they were part of.
8. Make and maintain connections between institutions and collections.
9. Encourage collaboration between organisations that produce science heritage material and collecting institutions that have the resources to care for and interpret it.
10. Ensure areas of government with major science initiatives and other science organisations have science heritage object collection policies that ensure significant objects are kept. Such policies should align with the collecting policies of collecting institutions, or provide for their own collection management.
11. Require governments with major science initiatives, and other science organisations, to assess places of potential science heritage prior to proposed disposal to ensure that significant places, sites and features are protected.
12. Work to achieve government intervention to prevent important science heritage sites from being ignored or destroyed. (The Flagstaff view in Melbourne was cited as a clear example of why this is needed).
13. Establish a national database of science heritage (or science/engineering/technology heritage).
14. There is a need for a proactive programme of listing on local, state, national or other heritage lists to provide better protection (engineering heritage is ahead in this). The programme should be based on identified science heritage themes and, where available, thematic studies.
15. Thematic and regional surveys will be important approaches to identifying science heritage places and sites. A thematic approach requires a science heritage thematic review to establish appropriate themes followed by Australia-wide science heritage thematic studies.
16. Review national and state historical thematic frameworks to ensure relevant science heritage themes are included. This should be preceded by articulating what the science heritage themes are.

17. Reassessment of existing place listings is needed to ensure their science heritage value is recognised in the listing as there are places that are already listed but which are unlikely to have had their science heritage values assessed.
18. More research is required on how to protect science heritage landscapes, such as geologically significant landscapes.

Suggested Important Foundational / Guiding Documents

- *The Archaeology of Science: Studying the Creation of Useful Knowledge* (M.B. Schiffer 2012, Springer).
- *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance* (Australia ICOMOS, 2013).
- *Dublin Principles – Joint ICOMOS–TICCIH Principles for the Conservation of Industrial Heritage Sites, Structures, Areas and Landscapes* (adopted by ICOMOS 2011).
- *The Conservation Plan, the 7th edition: A guide to the preparation of conservation plans for places of European cultural significance* (James Semple Kerr, 2013, *Australia ICOMOS).*
- *Significance 2.0: a guide to assessing the significance of collections* (Roslyn Russell and Kylie Winkworth, 2009, Collections Council of Australia).

Science Heritage Conservation Aims for the Next Five Years (2018 – 2023)

1. Publish a Proceedings of this Symposium as a visible starting point for science heritage conservation and promotion in Australia.
2. Hold at least one further conference in the next five years to build on the 2018 Symposium, that aims to have broader participation and scope.
3. Establish an Australian 'Science Heritage Working Group' to progress this area in the short-medium term. (This could sit within Australia ICOMOS if there is no other logical home).
4. Establish a national database of science heritage (or science/engineering/technology heritage).
5. Establish a programme to identify and document significant science heritage (or science/engineering/ technology heritage) and list this heritage on relevant statutory (protective) lists/registers.
6. Work to develop support at the political level (all levels of government) for assistance with the recognition and conservation of science heritage, including funding/grants, scholarships, etc., for this.

A LIST OF AUSTRALIAN SCIENCE HERITAGE PLACES INCLUDED ON THE STATE AND NATIONAL HERITAGE REGISTERS

The following is a list of all science heritage sites that have been identified as being listed on an Australian national or state heritage register. It can be considered as an initial listing of recognised Australian science heritage, current as at February 2020.

The places were identified by searching the various Australian national and state heritage registers for places that are acknowledged in the listing as having significance in relation to science. (Archival documentary and object collections were not included). An indication of the type of science or technology that the place has significance in relation to is also provided for each listing based on the place data sheets.

There are however likely to be more science heritage places listed than appear in this list. This is because the search of the heritage registers and lists was by necessity done using keyword searches (mainly using – science, scientific, technology, innovation, experiment) with the resultant place datasheets then being checked to ensure the places could be considered science heritage (rather than, for example, places that were representative, unusual, or had 'scientific value' (i.e., the ability to yield information)). The list has also not included engineering heritage unless such a place resulted from the keyword search and was found to represent a significant on-site technological development. The list is also largely of historic heritage places, with Aboriginal and natural heritage places not being considered unless the place was included in an historic heritage register or a combined values register.

The list starts with the two national heritage lists. This is followed by the state heritage registers in state alphabetical order.

National – National Heritage List

- Australian Academy of Science Building, Canberra, ACT (science – general)
- City of Broken Hill, NSW (chemistry - metallurgy)
- Dinosaur Stampede National Monument, Winton, QLD (geology – palaeontology)
- Dirk Hartog Landing Site 1616 - Cape Inscription Area, Dirk Hartog Island, WA (geodesy - surveying, botany)
- Ediacara Fossil Site, Nilpena, SA (geology)
- Flora Fossil Site, Yea, Vic (botany)
- Kamay Botany Bay botanical collection sites & Kurnell Peninsula), Sydney, NSW (botany)
- Koonalda Cave, SA (archaeology)
- Mawsons Huts and Mawsons Huts Historic Site, Antarctica (science – various, incl. geology)
- Recherche Bay (North East Peninsula) Area, Tas, (botany, geophysics – geomagnetism, astronomy, ethnography)

- Snowy Mountains Scheme, NSW (energy generation technology)
- The Goldfields Water Supply Scheme (hydraulic technology)
- Wilgie Mia Aboriginal Ochre Mine, WA (mining technology)
- Willandra Lakes Region, NSW (Quaternary sciences)

National - Commonwealth Heritage List

- Australian Forestry School (former), Banks St, Yarralumla, ACT (silviculture)
- Australian National Botanic Gardens, Acton, ACT (botany)
- CSIRO Forestry Precinct, Yarralumla, ACT (silviculture, botany)
- CSIRO Main Entomology Building, Acton, ACT (biology – entomology and weed control)
- Defence Explosive Factory Maribyrnong, VIC (chemistry, defence science)
- Jervis Bay Botanic Gardens, ACT (botany)
- Marine Biological Station (former), Watsons Bay, NSW (marine biology)
- Mawsons Huts Historic Site, Antarctica (polar science) (*also listed on the NHL*)
- Mount Stromlo Observatory Precinct, Mt Stromlo, ACT (astronomy, astrophysics)
- North Base Trig Station, Richmond, NSW (geodesy – surveying)
- Ningaloo Marine Area, WA (marine biology and ecology, oceanography)
- Phytotron, Acton, ACT (botany, horticulture)
- Redwood Plantation, Pialligo, ACT (silviculture)

Australian Capital Territory – ACT Heritage Register

- Becker House, Civic (science – general)
- Bendora Arboretum, Namadji (silviculture)
- Cotter Caves and Surrounds, Paddys River (geology)
- Honeysuckle Creek Tracking Station (space science, communication science)
- Lower Molonglo Geological Site, Stromlo (geology)
- Orroral Valley Tracking Station (space science, communication science)
- Orroral Geodetic Observatory (geodesy)
- Weston Park, Canberra (horticulture)
- Westbourne Woods, Canberra (silviculture, horticulture)
- Yarralumla Nursery, Canberra (horticulture)

New South Wales – State Heritage Register

- Australian Museum, Sydney (science – general)
- Bella Vista (agricultural science)
- Bombo Headland Quarry Geological Site (geology)

- The Cronulla Fisheries Centre (aquaculture)
- Elizabeth Bay House (science - general)
- Fossil Collection, Penrith (geology)
- Grantham Poultry Research Station, Seven Hills (agricultural science)
- Jenolan Caves Reserve (geomorphology)
- Linden Observatory Complex (astronomy)
- Parramatta Park and Old Government House (botany, astronomy)
- Penders, Tanja (architectural science)
- Science House, Sydney (science – general)
- Seaham Quarry (geology)
- Sydney Observatory (communications; astronomy, meteorology and time keeping)
- The Rock Bolting Development Site, Cooma (technology – construction)
- The Royal Botanic Gardens and Domain, Sydney (botany)
- WWII RAAF Radar Station 208 (former), Lake Macquarie (physics, defence science)

Northern Territory – NT Heritage Register

- 1869 Virginia Townsite Survey Markers (geodesy - surveying)
- Alice Springs Telegraph Station (communications technology, anthropology)
- Adelaide House, Town of Alice Springs (communications technology)
- Bullock Creek Fossil Site (geology - palaeontology)
- ELDO Rocket Shelters Marqua* (space science, defence science)
- Chain Calibration Site Alice Springs (geodesy - surveying)
- Charlotte Waters Telegraph Station (communications technology, anthropology)
- George Brown Botanic Gardens (botany, horticulture)
- Henbury Meteorite Craters (astronomy)
- John Veal Electronic Distance Measurement Baseline (geodesy - surveying)

* The NT HR search suggests there are approximately 11 separate listed European Launcher Development Organisation (ELDO) rocket launching sites (and also that one ELDO site, the ELDO Tracking Station, was nominated but refused for listing).

Queensland - Queensland Heritage Register

- Animal Research Institute (former), Yeerongpilly (agricultural science, entomology, parasitology)
- Bowen Park, Bowen Hills (horticulture)
- Brisbane Botanic Gardens (horticulture)
- Brisbane Dental Hospital and College (medical (dental) science)
- Brisbane General Hospital Precinct (medical science)

- Cameron's 1 Ton Survey Post (geodesy - surveying)
- Cleveland Lighthouse (former), Cleveland Point (architectural science)
- Commissioner Bidwill's Grave, Tinana (botany)
- Commonwealth Acetate of Lime Factory, Morningside (chemistry)
- Cook's Landing Place, Town of Seventeen Seventy (science - various)
- Crohamhurst Observatory (meteorology)
- Doctor Ludwig Becker's Grave, Thargomindah (zoology, ornithology, geology)
- Dr EA Koch Memorial, Cairns (medical science)
- Gallop Botanic Reserve, incorporating the Cooktown Botanical Gardens (botany)
- Hydrographic Survey Bench Mark at Bessie Point (1878), East Trinity (oceanography)
- James Cook University Department of Public Health and Tropical Medicine Building (former Australian Institute of Tropical Medicine), Townsville (medical science)
- Meringa Sugar Experiment Station, Gordonvale (agricultural science)
- Mount Elliott Mining Complex (chemistry - metallurgy)
- Pechey Forestry Arboretum (silviculture)
- Poeppel Corner (1880) (geodesy - surveying)
- Queen's Park, Maryborough (botany)
- Queen's Park, Ipswich (botany)
- Rockhampton Botanic Gardens (botany)
- Sherwood Arboretum (silviculture, botany)
- Thomas Park Bougainvillea Gardens, Brisbane (horticulture)
- Toowoomba Queens Park and Botanic Gardens (botany)
- Townsville Astronomical Trigonometrical Station (geodesy - surveying)
- University of Queensland Gatton Campus, Lawes (agricultural science)
- Wairuna Homestead and Cemetery (agricultural science)

South Australia – SA Heritage Register

- Adelaide High School and Observatory Site (astronomy, communications science)
- Arkaroola (geology)
- Blanche and Victoria Fossil Caves, Naracoorte Caves (biology)
- Border Cairn (Todd's Obelisk) (astronomy, geodesy - surveying)
- Bragg Laboratories, The University of Adelaide (mathematics, physics)
- Buildings Nos 29 and 33 Smithfield Magazine Area, Macdonald Park (defence science)
- Christmas Cove, Penneshaw (science – general)
- CSIR/CSIRO Field Research Station (former), Robe (biology, biochemistry, agricultural science)

- David Shearer's former Dwelling & Observatory, Mannum (astronomy, transport science)
- Dingley Dell, Robe (agricultural science)
- DSTO/Salisbury Explosives Factory (former) (defence science)
- Glenthorne CSIRO Field Station (former), O'Halloran Hill (agricultural science)
- 'Holland House' (Turretfield Research Centre), Rosedale (agricultural science)
- Lake Harry Date Plantation Site, Maree (horticulture)
- Main Building Waite Agricultural Research Institute, Urrbrae (agricultural science)
- Maslin Bay to Aldinga Bay Coastal Cliff Section Geological Site (geology)
- Myponga Beach Coastline Geological Site (geology)
- Naracoorte Caves Complex (geology, geomorphology)
- Priors Court Ostrich Farm, Seaford Heights (agricultural science)
- Residence of William and Lawrence Bragg, Adelaide (physics)
- Semaphore Timeball Tower, Semaphore (time keeping)
- Silvicultural Reserves Kuitpo Forest (silviculture)
- 'Struan House', Struan (agricultural science)
- The Crescent, part of DSTO (former Salisbury Explosives Factory) Site (defence science)
- Waite Arboretum, Urrbrae (silvicultural science)

Tasmania – Tasmanian Heritage Register

- Antarctic Division (polar science - various)
- Cambridge Railway Tunnel (atmospheric physics).
- Former Richardson's Motor and Cycle Garage (aeronautics)
- Lempriere's Tidal Benchmark, Port Arthur Historic Site (oceanography)
- Recherche Bay (d'Entrecasteaux Expedition Observatory Sites) (geophysics - geomagnetism)
- Royal Society Building, TMAG (science - general)
- Sprent's Cairn, Mt Laperouse (geodesy - surveying)
- Victoria Powder Magazine (geology, space science)
- Waterworth Building/Optical Annexe (optical science, defence science).

Victoria – Victorian Heritage Register

- Baldwin Spencer Building (Old Zoology, University of Melbourne) (biology, anthropology)
- Ballarat Botanic Gardens (botany, zoology)
- Ballarat Municipal Observatory, Melbourne (astronomy, geophysics - geomagnetism, meteorology)

- Burnham Beeches, Sassafras (medical and vetinary science)
- Castlemaine Botanic Gardens (botany)
- CSIRAC (Commonwealth Scientific and Industrial Research Organisation Computer) (computer science)
- Daylesford Botanic Gardens (botany)
- Domain Parklands, Melbourne (botany, horticulture, astronomy)
- Essendon Incinerator Complex (waste disposal technology)
- Flagstaff Gardens, Melbourne (geophysics - geomagnetism, meteorology, botany)
- Former Australian Beam Wireless Receiving Station, Melton (communications technology)
- Former Australian Beam Wireless Receiving Station, Fiskville (communications technology)
- Former Horticultural Research Station, Mildura (horticulture)
- Former Melbourne Veterinary College (vetinary science)
- Glenormiston (Homestead and Former Agricultural College) (agricultural science)
- Hamilton Botanic Gardens (botany, zoology)
- Jennerian Building, Melbourne (medical science)
- MacKenzie Cottage, Healesville (medical science)
- Old Pathology, University of Melbourne (medical science)
- Old Physics Building, University of Melbourne (physics, medical science)
- Royal Australasian College of Surgeons (medical science)
- Royal Botanic Gardens, Melbourne (botany)
- Royal Melbourne Zoological Gardens (biology -zoology)
- Rutherglen Research Institute, Rutherglen (horticulture – viticulture)
- Spotswood Sewerage Pumping Station (waste disposal technology, bacteriology)
- Solar House, Templestowe (energy generation technology)
- State Research Farm, Werribee (agricultural science)
- The Royal Society of Victoria, Melbourne (science – general)
- Thologolong Homestead, Thologolong (biology – genetics (breeding))
- Thomas Smith's Good Bed Fossil Quarry, Werona (geology – palaeontology)
- Tide Gauge House, Williamstown (oceanography)
- Westerfield, Frankston (chemistry – pharmaceutics)
- Williamstown Botanic Gardens (botany)

NB: There are another 12 heritage listed botanic gardens, however these do not appear to have specific science heritage significance.

Western Australia – State Register of Heritage Places

- ABC Sound Broadcasting and Television Studios, Perth (communications technology)
- ABC Transmission Station, Minding (communications technology)
- Avondale Research Station, Beverly (agricultural science)
- Boundary Tree (Stirling Tree), Baskerville (geodesy - surveying)
- Broome Coastal Wireless Station, OTC Building (communications technology)
- Broome Court House (Cable Station) (communications technology)
- Chemistry Centre (former), Perth (chemistry)
- CY O'Connor Memorial, Fremantle (hydraulic technology)
- Eyre Bird Observatory, Cocklebiddy (communications technology, meteorology, ornithology)
- Frank Wise Institute of Tropical Agriculture, Kununurra (agricultural science)
- Gascoyne Research Station, Carnarvon (agricultural science)
- Goldfields Water Supply Scheme (hydraulic technology)
- Heathcote Hospital, Perth (botany, soil science)
- Merredin State Farm (Merredin Research Station) (agricultural science)
- Old Cable Station, Cottesloe (communications technology)
- Old Observatory, Perth (astronomy, meteorology)
- Overseas Telecommunications Satellite Earth Station, Brown Range (space science, communications technology)
- Park Avenue Building, University of Western Australia (biology, zoology, geology)
- Perth Observatory (WA State Govt Observatory) (astronomy)
- Round House, Mount Barker (architectural science)
- Salmon Gums Research Station (agricultural science)
- Wireless Hill Park, Perth (communications technology)
- Wirra Willa Gardens, Mt Nasura (botany)

SYMPOSIUM PROGRAM

Australia ICOMOS Symposium, 12th November 2018, Hobart, Tasmania

Under the Microscope – Exploring Science Heritage



PROGRAMME

VENUE

The venue for the *Under the Microscope – Exploring Science Heritage Symposium* is the CSIRO Oceans & Atmosphere Auditorium, CSIRO, Castray Esplanade, Battery Point. The venue is located in Sullivans Cove beyond Salamanca Place. The CSIRO Oceans & Atmosphere Auditorium is accessed via the main entrance of the CSIRO buildings off Castray Esplanade.

PROGRAMME

Time	Session
9:00 am	**Opening Session** Symposium welcome - Anne McConnell (Symposium Coordinator) Housekeeping (CSIRO Staff) Welcome to Country Opening Remarks – Anne McConnell
9:20 am	**Keynote Paper** Dr Alice Gorman - *The black swan of trespass: Technological heritage and Australian identity*.
9:50 am	**Session 1** *Chair – Elspeth Wishart* ***Defining & Recognising Science Heritage*** Gavan McCarthy - *Find and Remember: Sixty years of tracking down Australia's scientific documentary heritage.* Eric Colhoun & Kevin Kiernan - *Does Scientific Knowledge Enhance the Heritage Value of the Environment? The Example of Tasmanian Pleistocene Glacial Landscapes.* Keith Baker - *Where Scientific and Engineering Heritage Intersect.*
11:00	**Morning Tea**
11:25	**Session 1 (continued)** *Chair – Elspeth Wishart* Anne McConnell - *Hidden in Plain Sight: The Unobtrusiveness of Science Heritage and its Implications.*

11:45	**Session 2** *Chair – Gavan McCarthy* ***Illustrating Science Heritage*** Martin George - *Tasmania's Very Low Frequency Radio Astronomy Sites.* Ken McInnes - *Time, Tides and Flagstaffs* (snapshot). Eddy de Jong - *Dashing and dotting our way to the future – how electric telegraphy was one of the first disruptive technologies* (snapshot). Paul Johnston - *Waterworth Building, Hobart* (snapshot).
12:30	**Session 3** *Chair – Gavan McCarthy* ***Interrogating the Scientific Documentary Heritage*** Liz Daniels - *Documenting the History of Scientific Societies in Van Diemen's Land and early Tasmania* (10-15mins) Caitlin Vertigan & Richard Tuffin - *Shoot, Catalogue, Eat*
1:10	**Lunch**
2:00	**Session 4** *Chair – Alison Wain* ***Experiences in Managing Science Heritage*** Ailie Smith - *Records of the Fellows and the archives of the Australian Academy of Science.* Elspeth Wishart - *Ensuring Antarctic science heritage collections are here for the future.* Mark Fountain & Natalie Tapson - *Managing Science Heritage at the Royal Tasmanian Botanical Garden.* Ken McInnes - *Engineering Heritage and Science Heritage – Can the lessons learnt from one apply to the other?*
3:25	**Afternoon Tea**
3:50	**Session 4 continued** *Chair – Alice Gorman* ***Experiences in Managing Science Heritage*** Alison Wain - *Molonglo Radio Telescope: A Heritage and Education Partnership.*
4:15	**Session 5** *Co-Chairs – Alice Gorman and Anne McConnell* ***Science Heritage and the Next 5 Years?*** *)* (1:00 hr) Symposium participant discussion
Close 5:15	Close & Thank you – Anne McConnell (5 mins)

FIELD EXCURSION PROGRAMME (SUNDAY 11TH NOVEMBER 2018)




ABOUT AUSTRALIA ICOMOS

Australia ICOMOS (International Council on Monuments and Sites) is a non-government, not-for-profit organisation of cultural heritage professionals, which formed as a national committee of ICOMOS in 1976. Australia ICOMOS' mission is to lead cultural heritage conservation in Australia by raising standards, encouraging debate and generating innovative ideas. Australia ICOMOS has an Australia-wide membership base and encourages heritage professionals and others with an interest in the conservation of cultural heritage to join. More information is available at https://australia.icomos.org/.

Image this page

Grote Reber working at the eastern end of the ‘far north antenna’ of his two-arm dipole antenna array at Kempton (erected 1956) for his low-frequency radio research. (Source: courtesy of the Archives, National Radio Astronomy Observatory/Associated Universities, Inc., USA).

Images Rear Cover – clockwise from top LH

1. The 74" Telescope Dome, Mt Stromlo Observatory, Canberra, ACT. The Observatory, established in 1924, is significant for its outstanding optical astronomy and astrophysics research. (Photo: Tim Vines, 2017. Source: Wikimedia Commons (https://commons.wikimedia.org/wiki/File:74%22_Telescope_Dome,_Mt_Stromlo_Observatory.png).
2. Part of the mid-1800s Tasmanian collection of fish at the Natural History Museum, London, understood to have been collected by, or on behalf of, Thomas Lempriere, at the time commissariat officer at Port Arthur. (Photo: Richard Tuffin, 2018).
3. The Rossbank ‘Hexagon Pavilion’, Hobart, Tasmania, constructed to house magnetometers. Rossbank was established in 1840 to be used as part of a chain of British colonial observatories established to study terrestrial magnetism. Rossbank was set up for Captain James Clark Ross’ naval expedition to find the South Magnetic Pole (c.1840-1842). (Photo: Anne McConnell, 2018).
4. A significant sequence of glacial sediments overlain by slope deposits exposed in a road cutting of the Lyell Highway at the King River, Tasmania. This section has been examined over several decades by earth scientists, including luminaries such as Sam Carey and Eric Colhoun. (Photo: Kevin Kiernan).