International Specialised Skills Institute

PRATT FOUNDATION

# IRON HULLED HERITAGE VESSEL RESTORATION


**Matthew Gurn**

The Pratt Foundation/ISS Institute Overseas Fellowship

Fellowship supported by The Pratt Foundation

ISS Institute Inc

International Specialised Skills Institute

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# Executive Summary

This Fellowship has been undertaken to further the understanding, in Australia, of the conservation and restoration options for iron hulled heritage vessels that are being implemented in the United Kingdom (UK) and Germany and to address the various skill deficiencies apparent here. The large number and type of heritage vessels that are being conserved or restored in Europe offer a diverse range of procedures and practices. It was the Fellow's intention to view and discuss with as many experts as time and funding permitted the pros and cons of each option and to assess the outcomes for application in Australia.

As noted by the Fellow, not all of the vessels/objects being conserved or restored come under a national system of standard practices. The outcomes observed by the Fellow seem to depend on the particular skill sets and relative experience of the people involved with each specific project, as well as by the funding available and the directions given by individual curators, conservators, institute directors and CEOs. In the UK, funding comes from a wide range of sources, e.g. the Heritage Lottery Fund, the Government (the Department of Defense [DoD]), museums, local councils, trusts set up for particular vessels (the Cutty Sark Trust), interested and wealthy patrons, and special interest groups. This has allowed a large range of methods and approaches to be used, with no coordination or collation at a national level of effective procedures or elimination of ineffective procedures.

Only the final result seems to count, and this seems to be mainly assessed in the short term by the cost of the particular conservation/restoration method, visitor numbers, and the operating revenue raised for a particular vessel or site.

From a curator's or conservator's perspective this is far from ideal. Focusing on short-term outcomes often means bypassing conservation measures that would ensure the longevity of the vessel and reduce maintenance budgets. These problems are becoming more prevalent in Australia and need to be addressed appropriately and at the earliest opportunity. It is the Fellow's intention to disseminate these options to the broader museum community and to encourage a national dialogue aimed at establishing a set of standard guidelines in this field.

By visiting a wide range of vessels and sites as part of the Fellowship, the Fellow was able to quantify and document the various skill deficiencies and gaps that exist overseas and their relevance to Australia.

The scope of this Fellowship included:

- Studying new methods and techniques in use in the UK and Germany for conserving and restoring large heritage iron objects and their application in an Australian context.
- Exploring how to combine the skills of museum conservators and commercial tradespeople to ensure the best outcome for a particular project.
- Investigating the latest technologies available to treat salt-impregnated iron and the success rates associated with these methods.
- Observing and assessing the outcomes of the various sealing systems and surface coatings in use on heritage iron vessels and metal objects.
- Examining the latest environmental control processes in use on these vessels and sites and their application to Australian conditions.
- Quantifying the available options and assessing their suitability for preserving iron heritage objects in Australia.
- Disseminating this research to relevant bodies in Australia with the long-term goal of developing national guidelines for preserving large iron objects.
- Identifying the necessary steps for formulating a successful conservation project in relation to a large heritage iron object.

By observing procedures and discussing these issues at as many maritime sites as possible the Fellow has been able to bring valuable insights back to Australia and make them available to all interested parties.

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# Abbreviations/Acronyms

| | |
|---|---|
| ACR | Accredited Conservator-Restorer |
| AMMC | Australian Maritime Museums Council |
| ANMM | Australian National Maritime Museum |
| CEO | Chief Executive Officer |
| CRINA | Companion Royal Institution of Naval Architects |
| DoD | Department of Defence |
| ft | Feet |
| HMS | His or Her Majesty's Ship (UK Naval ship) |
| IBSA | Innovation & Business Skills Australia |
| ICOMOS | International Council on Monuments and Sites |
| ISS Institute | International Specialised Skills Institute |
| MIMechE | Member of the Institution of Mechanical Engineer |
| MMM | Merseyside Maritime Museum |
| MRINA | Member of the Royal Institution of Naval Architects |
| NHS | National Historic Ships |
| OHS&W | Occupational Health Safety and Welfare |
| RINA | Royal Institution of Naval Architects |
| RH | Relative Humidity |
| SAMM | South Australian Maritime Museum |
| SMM | Scottish Maritime Museum |
| SS | Steam Ship |
| SSGB | *SS Great Britain* |
| UK | United Kingdom |

# Definitions

**Accredited Conservator-Restorer**

ACR is a professional qualification in the UK.

**bar**

The bar is a measurement unit of pressure, equal to 1,000,000 dynes per square centimetre (baryes), or 100,000 newtons per square metre (pascals). The word bar is of Greek origin, báros meaning weight. Its official symbol is ‘bar’; the earlier ‘b’ is now deprecated, but still often seen especially as ‘mb’ rather than the proper ‘mbar’ for millibars.

**Barque**

A sailing ship of three or more masts having the foremasts rigged square and the aftermast rigged fore-and-aft.

**Burra Charter**

The Burra Charter provides guidance for the conservation and management of places of cultural significance (cultural heritage places), and is based on the knowledge and experience of Australia ICOMOS members.

**Design**

Design is problem setting and problem solving.

Design is a fundamental economic and business tool. It is embedded in every aspect of commerce and industry and adds high value to any service or product—in business, government, education and training, and the community in general.

Reference: ‘Sustainable Policies for a Dynamic Future’, Carolynne Bourne AM, ISS Institute 2007.

**Innovation**

Creating and meeting new needs with new technical and design styles. (New realities of lifestyle). Reference: ‘Sustainable Policies for a Dynamic Future’, Carolynne Bourne AM, ISS Institute 2007.

**Member of the Institution of Mechanical Engineer**

MIMechE is a professional qualification in the UK.

**Member of the Royal Institution of Naval Architects**

MRINA is a professional qualification in the UK.

**Skill deficiency**

A skill deficiency is where a demand for labour has not been recognised and training is unavailable in Australian education institutions. This arises where skills are acquired on-the-job, gleaned from published material or from working and/or studying overseas.

Reference: ‘Directory of Opportunities. Specialised Courses with Italy. Part 1: Veneto Region’, ISS Institute, 1991.

There may be individuals or individual firms that have these capabilities. However, individuals in the main do not share their capabilities, but rather keep the intellectual property to themselves. Over time these individuals retire and pass away. Firms likewise come and go.

# Acknowledgements

Matthew Gurn would like to thank the following individuals and organisations who gave generously of their time and their expertise to assist, advise and guide him throughout the Fellowship program.

## Awarding Body – International Specialised Skills Institute (ISS Institute)

In particular, Gurn would like to thank Carolynne Bourne, former CEO, Paul Sumner, Fellowship Coordinator, and Ken Greenhill, Reports Coordinator, for their support during and after the Fellowship trip.

The International Specialised Skills Institute Inc is an independent, national organisation that for over two decades has worked with Australian governments, industry and education institutions to enable individuals to gain enhanced skills and experience in traditional trades, professions and leading-edge technologies.

At the heart of the ISS Institute are our Fellows. Under the **Overseas Applied Research Fellowship Program** the Fellows travel overseas. Upon their return, they are required to pass on what they have learnt by:

1. Preparing a detailed report for distribution to government departments, industry and educational institutions.
2. Recommending improvements to accredited educational courses.
3. Delivering training activities including workshops, conferences and forums.

Over 200 Australians have received Fellowships, across many industry sectors. In addition, recognised experts from overseas conduct training activities and events. To date, 22 leaders in their field have shared their expertise in Australia.

According to Skills Australia's 'Australian Workforce Futures: A National Workforce Development Strategy 2010':

> Australia requires a highly skilled population to maintain and improve our economic position in the face of increasing global competition, and to have the skills to adapt to the introduction of new technology and rapid change.
>
> International and Australian research indicates we need a deeper level of skills than currently exists in the Australian labour market to lift productivity. We need a workforce in which more people have skills, but also multiple and higher level skills and qualifications. Deepening skills across all occupations is crucial to achieving long-term productivity growth. It also reflects the recent trend for jobs to become more complex and the consequent increased demand for higher level skills. This trend is projected to continue regardless of whether we experience strong or weak economic growth in the future. Future environmental challenges will also create demand for more sustainability related skills across a range of industries and occupations.[1]

In this context, the ISS Institute works with Fellows, industry and government to identify specific skills in Australia that require enhancing, where accredited courses are not available through Australian higher education institutions or other Registered Training Organisations. The Fellows' overseas experience sees them broadening and deepening their own professional practice, which they then share with their peers, industry and government upon their return. This is the focus of the ISS Institute's work.

For further information on our Fellows and our work see www.issinstitute.org.au.



[1] Skills Australia's 'Australian Workforce Futures: A National Workforce Development Strategy 2010', pp. 1-2 http://www.skillsaustralia.gov.au/PDFs_RTFs/WWF_strategy.pdf

## Fellowship Supporter

The Pratt Foundation was established in 1978 by Richard and Jeanne Pratt with the shared vision of supporting charitable enterprises and adding value to philanthropy. The Foundation is now one of the largest private sources of philanthropy in Australia. In the words of its mission statement, it aims *"to enrich the lives of our community"* and, in the words of Jeremiah, it works to fulfil this aim in a spirit of *"kindness, justice and equity"*. Gurn would like to thank them for providing funding support for this Fellowship.

## Supporters

Gurn would like to thank the following people for their advice, support and assistance:

### In Australia

- Alan Edenborough, Sydney Heritage Fleet
- Kevin Jones, Director, South Australian Maritime Museum (SAMM), Chair, Australian Maritime Museums Council (AMMC)
- Lindl Lawton, Senior Curator, SAMM
- Peter Rout, Assistant Director, Australian National Maritime Museum
- Joan Simpson, Operations Manager, South Australian Maritime Museum
- Innovation & Business Skills Australia

### In the UK

- David Baynes, Volunteer Co-ordinator, Friends of Portsmouth Historic Dockyard
- Laurence Birnie, National Maritime Museum (NMM), Head Conservator of Metals
- Jonathon Carr, Ship Keeping Department, Merseyside Maritime Museum (MMM)
- Ian Clark, Ian Clark Restoration, consultant to the NHS (National Historic Ships)
- Bob Daubeney, Head Shipwright, *HMS Warrior*
- Richard Doughty, Chief Executive Officer, Cutty Sark Conservation Project
- Eamonn Farrel, Ship Keeping Department, MMM
- Martyn Heighton, Director, National Historic Ships
- Richard Holdsworth, Museum and Heritage Director, The Historic Dockyard, Chatham
- David Iggo, Head Ship Keeper, Scottish Maritime Museum (SMM)
- Ken Jones, Captain, *HMS Warrior*
- Dr Mark Jones, Head of Collections, The Mary Rose Trading Ltd.
- John Kearon, Project Manager and Lead Conservator, Asgard Conservation Project, and Master Shipwright
- Tim Parr, Heritage Lottery Fund and National Historic Ships
- Linda Ross, Senior Curator, SMM
- Ivan Steele, Chairman of the Trustees of the *Steam Pinnace 199*
- Matthew Tanner MBE, Director, Brunel's ss Great Britain Trust
- Paul Woodward, Guide and volunteer, Portsmouth Historic Dockyard





### In Germany

- Svenja Manz, International Maritime Museum, Hamburg

### Mentors

Industry Mentor

- Kevin Jones, Director, SAMM, and Chair of the Australian Maritime Museums Council

Workplace and Report Writing Mentor:

- Lindl Lawton, Senior Curator, SAMM

## Employer Support

- Kevin Jones, Director, SAMM, and Chair of the Australian Maritime Museums Council

### South Australian Maritime Museum (SAMM)

The SAMM is a museum of HISTORY South Australia, a statutory authority that oversees museums and advises historical societies throughout the State. The SAMM is administered to by Arts SA, which, in turn, is responsible to the Minister for the Arts.

The SAMM is located in Port Adelaide, the State's first heritage precinct and the historic centre of its maritime industries. Its Bond Store exhibition galleries, lighthouse, floating vessels, administration building, stores, and workshop are spread over a number of sites. The SAMM opened in 1986 but its origins stem from over 130 years of various organisations' activities. It cares for the oldest nautical collection in Australia, a collection begun in the 1870s.

The SAMM Vision

A museum that excels in its engagement with the community, building on the significance of its location in an historic port and its legacy as custodian of a collection that has grown over 130 years.

The SAMM Mission

Engage the broadest audience by finding new ways to interpret maritime history that show its continuing relevance and by presenting programs that are inclusive, innovative, and enriching.

## Organisations Impacted by the Fellowship

### Industry

Australian Maritime Museums Council (AMMC)

AMMC facilitates communication, exchange of information and mutual support among Australian maritime museums, individuals and associated organisations.

The members of the AMMC are maritime museums and museums with maritime exhibitions that are specified under the Museums Australia definition and other organisations and institutions that have an interest in maritime matters. The AMMC was formed in 1990.

Australian National Maritime Museum (ANMM)

The ANMM, on the western shore of Sydney's Darling Harbour, is in a lively heritage precinct with many attractions. The main building houses exhibitions that:

- explore Australia's links with the sea
- consider how maritime activities and issues have shaped the lives of people in Australia.

## *Acknowledgements*

Docked at the ANMM's wharves is one of the largest fleets of any museum in the world, currently 14 vessels. Officially opened in 1991, the museum is relatively new. Its collection, however, already comprises more than 40,000 objects.

The museum's outreach programs connect it to regional Australia, through travelling exhibitions, voyages on the *Endeavour* replica and its online Australian Register of Historic Vessels. The Vaughan Evans Library is a valuable research resource. The Welcome Wall honours Australian immigrants, wherever they live.

The ANMM's audience comprises families and others who enjoy the exhibitions and activities: schools, researchers and historians, other cultural, heritage and commercial organisations, community groups, museum members, sponsors, and those who use the function venues and other services.

It represents Australia internationally and welcomes many overseas visitors.

Innovation & Business Skills Australia (IBSA)

IBSA is one of 11 Industry Skills Councils recognised and funded by the Australian Government to fulfil workforce skills development roles and functions. Museum Services is one of the IBSA's six industry sectors.



# About the Fellow

**Name:** Matthew Gurn

**Employment**

- Fleet Manager and Volunteer Coordinator, South Australian Maritime Museum (SAMM)

**Qualifications**

- Plant Operator Certificate, Newfishing Australia Pty. Ltd., Karumba, 1987
- Qualified Marine Engine Driver, Western Australian College of TAFE, 1985
- Qualified Fitter and Turner, Queensland Education Department, 1981

**Brief Biography**

- Gurn worked for various manufacturing/construction companies and government departments as a Maintenance Fitter and Welder from 1981 to 1987.
- He was employed as a Marine Engineer and Plant Operator for Newfishing Australia Pty. Ltd., based in Karumba (Queensland) and Darwin (Northern Territory) from 1987 to 1993.

  After obtaining a Plant Operator's Certificate, he was responsible for running the company's cold store and fuel depot in Karumba. He also worked at sea as a Marine Engineer onboard prawn trawlers and mother ships, as well as assisting in vessel dry docks during the season closures.

  A highlight of his employment with Newfishing was crewing a 30-metre prawn trawler, as the Marine Engineer onboard, for a delivery trip to Buenos Aries, Argentina, a journey totalling 76 days.
- Employed by Perry Engineering Ship Repair (Adelaide), as a Marine Fitter, Special Class Leading Hand, a position that entailed conducting repair work on all types of vessels from tugs to container ships in the Port of Adelaide from 1993 to 1997.
- The Fellow worked for various companies based at the Port of Adelaide as a Maintenance Marine Fitter from 1997 to 2002.
- Employed by Adsteam Marine (now Svitzer) as a Marine Fitter specialising in the support, maintenance, and repair of the company's fleet of tugboats around the South Australian coast from 2002 to 2007.
- The Fellow commenced with the SAMM in his present position of managing the museum's historic vessels and large objects in 2007. He is also responsible for coordinating the recruitment and activities of the museum's team of 57 volunteers.

  An accomplishment of which Gurn is very pleased has been his work returning the Steam Tug *Yelta* back into commercial survey after a major dry docking that took three months to complete and entailed countless hours work by the vessel's volunteer crew. *Yelta* was built at Cockatoo Dock in 1949 and is the only working steam tug in South Australia.

  The Fellow's qualifications as a marine engineer and marine fitter and turner, and a background in the maintenance of vessels including tugs and commercial fishing vessels, along with the experience gained managing the historic vessels at the SAMM, enables him to work with the museum's curators and director to learn new approaches to restoring vessels. These approaches respect the importance of maintaining their historic integrity and as much of their original fabric as possible.

  Gurn's main interests include computers, fishing, gardening, and spending quality time with his family.

# Aims of the Fellowship Program

The aims of the Fellowship Program are to:

- Expand the knowledge and address the identified skills that are required to preserve iron vessels and objects in Australian maritime museums.
- Identify and record the conservation plans, policies, new technologies, and procedures demonstrated in the United Kingdom (UK) and Germany regarding iron and metal heritage projects.
- Increase the skill and knowledge base available to all parties concerned with heritage vessel conservation in Australia including tradespeople, curators, designers, and directors.
- Promote the dissemination of such skills and knowledge by various methods such as site visits, online databases, presentations to the media, forums and conferences.

# The Australian Context

## The Industry in Australia

There are significant skill deficiencies in the conservation of historic iron ships and metal objects in Australia. The conservation of heritage metals falls between the skill sets of museum conservators and commercial tradespeople. This skill deficiency is a global one and is the focus of ongoing discussion amongst maritime museums at a national and international level.

Maritime museums in the UK and Europe have been extremely proactive in identifying and addressing these skill deficiencies. By learning from their experiences and challenges, and their successes and failures, the Australian heritage sector can begin to develop its own strategy for conserving the large metal objects in its collections.

The conservation of historic ships and objects falls between the skills of museum conservators, who usually focus on treating small artefacts, and commercial shipwrights, marine engineers and tradespeople, who maintain large objects. In the past, Australian institutions approached conserving large heritage objects by first consulting commercial shipwrights and tradespeople. Project outcomes were not researched, articulated, or documented. Subsequently, the outcome would generally be an unsatisfactory mix of what the conservators and curators wanted and what the commercial metal trades could achieve or supply. Constant changes to project plans inevitably led to delays in completion and project cost overruns. The result has been a focus on the cheapest alternative for conserving a vessel or object at the expense of the integrity of the original fabric.

Through sharing knowledge and leading by example the IBSA council aim to boost the innovative capacity of the Australian workforce, including the capabilities of organisations, leaders, educators and individual workers. Their vision is for progress on three interrelated goals:

- Inspiring a culture of innovation
- Developing leaders
- Building workforce capability

The new approach in Europe, particularly in the UK and Germany, has been to research and clearly articulate the desired conservation outcome from the outset of a project and to engage all practitioners—tradespeople, professional curators and conservators—in achieving that goal within the available resources.

The main aim of the Fellowship is to investigate the new methods and approaches available overseas that bridge the gap between the skills of museum conservators and the ones of commercial tradespeople. The research project will aim to combine the attributes of both these skill bases to develop a best-practice approach for conserving large iron objects and vessels in Australian collections.

## Background to the Fellowship

To develop Gurn's skills and knowledge of conservation practices for iron vessels and objects the Fellow intends to acquire as much information as possible by visiting the maritime museums in Europe that are acknowledged as exemplifying world's best practice.

These include Brunel's ss Great Britain Trust. The *SS Great Britain* was built by Isambard Kingdom Brunel in 1843. He was the foremost engineer of his day in the UK and was responsible for a large number of iconic engineering feats that still exist today. One example is the famous Clifton Suspension Bridge spanning the Avon Gorge in Bristol.

The conservation treatment of the *SS Great Britain* over the past decade has received a number of awards including the prestigious Gulbenkian Prize for Museum of the Year, the largest single art prize awarded annually to a museum or gallery in the UK.

The conservation of the *SS Great Britain* was supported by Britain's Heritage Lottery Fund to provide a model for new methods of conservation for historic vessels. Previous projects conserving historic ships had been based on the methods of commercial dockyards. Those methods were developed to keep contemporary ships working and were in conflict with many of the heritage values of museum conservation.

The conservation of the *SS Great Britain* broke new ground in giving absolute priority to the retention of as much original fabric as possible and using methods that were reversible. In doing so, it treated the ship as an archaeological artefact.

Also included in the Fellowship itinerary was the Cutty Sark Conservation Project in London, the Merseyside Maritime Museum in Liverpool, the Portsmouth Historic Dockyard, The Historic Dockyard in Chatham, the German Maritime Museum in Bremerhaven and the Hamburg Maritime Museum.

## Benefits to Australia

The key benefit to Australia of the Fellow's research trip to European maritime museums is that it has the potential to improve the way in which Australia's historic vessels are conserved and managed.

There are over 70 maritime museums in Australia ranging from large state and national institutions to small local museums. Some of our most important historic ships are made of iron. One example is Melbourne's barque *Polly Woodside*, built in 1885, another is Sydney's *James Craig*, built in 1874.

Gurn will disseminate his knowledge of the skills he has acquired in a number of ways.

He will apply them to the preservation of an iron ship that is in the collection of the SAMM and in need of urgent conservation treatment—the coastal trader *Nelcebee* that was constructed in 1883. Today, *Nelcebee* is the oldest ship in South Australia and the oldest powered ship in Australia.

Preserving the *Nelcebee* presents a complex conservation challenge. Through its 125-year life it has undergone many changes. It has been converted from a steam tug to a sailing ship. Its iron hull has been patched with welded steel and it bears the marks of many accidents. One challenge of restoring this vessel will be to apply the methods learnt in the UK and Europe in order to preserve the ship. Another is to stabilise corrosion while retaining the original fabric that shows the repairs and the changes of the *Nelcebee's* long life. Restoring this ship will break new ground in preserving iron vessels and large objects in Australia.

The Fellow will also publicise knowledge of the skills acquired through the network of maritime museums in Australia. He will do this through the AMMC by presenting workshops at its conferences and by inviting its members to visit the restoration project. Along with other concerned museums, he will help establish a national knowledge base online that will be accessible to all interested parties whether they are large institutions, small local community museums or concerned private individuals.

## SWOT Analysis

Conservation and restoration practices for heritage metal vessels and large objects at the South Australian Maritime Museum:

### Strengths

- Well-known and respected maritime museum both domestically and internationally
- Supported by HISTORY South Australia and the Government of South Australia
- Large range of services in support of local community maritime museums and historical societies
- Enormous range of objects in its collection





- Redeveloping web-based access portals and sites to ensure easier access and interactivity
- Increasing local interest due to the redevelopment of Port Adelaide and the resulting loss of maritime heritage
- Strong and active volunteer base
- Experienced and well qualified staff

### Weakness

- Lack of adequate funds
- Absence of slipway and workshop facilities
- Shortage of required trade skills and marine certificates
- Indecision by planning authorities in establishing a dedicated marine precinct
- High cost of materials and contracted labour
- Need to develop procedures for large object conservation
- Inexperience with new methods for treating salt-impregnated metals

### Opportunities

- Online knowledge base in progress
- Dissemination of knowledge Australia wide
- Increase sponsorship, financial, and in-kind support
- Establish a dedicated maritime precinct
- Access to a slipway and suitable workshops
- Increase the skilled volunteer base by active recruitment
- Raise public awareness of threats to maritime heritage

### Threats

- Loss of traditional skills
- Lack of required marine qualifications
- Reduction or withdrawal of government funding
- Loss of volunteer base through age
- Loss of corporate sponsorship
- Lack of public awareness of the loss of maritime heritage

# Identifying the Skills Deficiencies

1. **Record and investigate the new procedures and techniques available in the UK and Europe for the conservation and preservation of iron vessels and objects:**

- Identify and assess the relevant methods of current best-practice restoration as opposed to traditional methods of restoration for iron ships and large objects.
- Interpret the results to achieve the most appropriate outcome for each individual object on a case-by-case basis.
- Learn new methods that bridge the gaps between the skills of museum conservators and commercial shipwrights.

  *Action: document the new methods of restoration and conservation for large metal objects in European collections. The use of modern technology to combine the skills of modern day conservators with the traditional skills of metalworkers can help achieve these outcomes.*

  *Action: based on this research, develop a draft list of recommendations for conserving large iron objects in Australian collections.*

2. **Treat salt-impregnated iron and other metals:**

- Document and evaluate the various methods available for the treatment of salt-impregnated iron and other metals.
- Investigate ways to give absolute priority to the retention of as much of the original fabric of the object as possible.
- Determine which of these treatments is most suitable—they are varied and include sensitive cleaning using dry closed circuit air abrasion, moist air abrasion, and extreme high-pressure water washing.

  *Action: use the evaluation of these techniques to reach a better understanding of the chemical processes of salt impregnation.*

  *Action: formulate recommendations for applying these techniques to relevant objects in Australian collections.*

3. **Clarify the suitability of the available surface coatings and sealing systems for conserving iron vessels and other large metal objects:**

- Appraise and differentiate between the various methods of surface coating and resealing of iron (along with other metals), after treatment.
- Compare and analyse the results from various institutions that have been obtained over the long term.
- Ensure that these processes are completely reversible if deemed necessary.

  *Action: observe first-hand, assess, and document the results of different methods of surface coating and resealing large metal objects in European collections.*

  *Action: Based on this research develop a draft list of recommendations for best practice in regards to sealing large metal objects in Australian collections.*

4. **Investigate the different processes available for the implementation of environmental control measures used in preserving iron and other metals:**

- Analyse and record the differences between the available environmental control measures and determine their overall success rate.
- Identify which of these techniques would have the best practical application for Australia. These techniques are cutting edge and all Australian maritime museums need to learn how to apply environmental controls to preserve their vessels while meeting the needs of the visiting public and keeping a realistic, practical maintenance and operating budget.

- Evaluate their effectiveness, especially in their application to the remaining iron vessels and heritage objects in Australia.

  *Action: identify best-practice measures in terms of implementing environmental controls in the conservation of metal objects.*

  *Action: develop draft recommendations on how these could be implemented given potential resource and financial restraints in Australian heritage institutions.*

**5. Interpret and define the most suitable methods of preserving vessels and large objects:**

- Understand the differences and review the processes necessary to preserve vessels on dry land, as opposed to keeping them in operational survey, while observing the framework of the Barcelona Charter.
- Investigate different methods for exhibiting a vessel on dry land taking into account the ongoing maintenance issues and the vessel's ability to raise revenue as a public display.
- Ensure the associated scale of economics is taken into account.

  *Action: Provide those involved in heritage conservation projects with a comprehensive overview of the drawbacks and advantages of different conservation methods and their associated costs.*

**6. Formulate a successful, large Conservation Project Plan:**

- Identify the correct approach to conservation project management.
- Consider what each associated trade, profession and skill can contribute and how they can all be brought together and assimilated into a best-practice environment.
- Assess the pitfalls and hazards associated with the project and how to manage them.
- Study the varying ways the plan can be programmed so that the object can be conserved while still allowing public access.
- Learn new ways in which the project can be managed so that all documentation and photography work, to preserve the original information about the object, is completed while the project is underway.
- Evaluate the intervention processes and procedures available when differing types of metal have degraded or been damaged beyond repair.
- Investigate the best ways to interpret the content of the Burra Charter with regard to its application for large heritage objects.
- Document and distinguish between the different approaches available to ensure a successful, large conservation project outcome
- Identify the range of techniques used to preserve, conserve, and interpret the decorative and functional elements of different types of metal objects (hinges, locks, latches, bolts, fittings, etc.) while finding new methods of attaching them to the parent material to ensure the minimum intervention and disruption to the original material.
- Identify the unknown skill deficiencies revealed while a project of this nature is in progress so that they can be assessed and rectified according to world best practice.

  *Action: the formulation of a successful large conservation project is critically dependent on identifying and assessing all available options at the draft stage. This approach, while novel in Australia, has been widely adopted in recent heritage projects in the UK and Europe. Australia heritage bodies still pursue large conservation projects in an ad hoc manner and subsequently often run over deadlines and budgets. Identifying conservation options, articulating risks and advantages linked to these options and publicising this information on an accessible national database will lead to better planned and best-practice conservation projects in Australia.*

  *Action: Develop draft recommendations on how best to identify and assess all available options, potential resources and financial restraints, in Australian heritage institutions.*



# The International Experience

## Overview

The Fellow investigated the following sites and projects:

- NMM and the *Cutty Sark* in Greenwich, London. The Fellow met with Laurence Burnie (Head of Metal Conservation for the NMM), and, Richard Doughty (Chief Executive of the Cutty Sark Trust) who gave the Fellow a hard hat tour of the vessel.
- Albert Dock in Bristol, where a new build reconstruction of the historic iron paddle steamer *Medway Queen* is taking place.
- Brunel's ss Great Britain Trust in Bristol, where the Fellow met with Matthew Tanner (Director and Chief Executive of the Trust) who showed him around the site and highlighted the problems encountered and the solutions implemented with this seminal conservation project. The Fellow also met with Martyn Heighton, Director, National Historic Ships; Tim Parr, C.Eng. MRINA, from the National Historic Ships; and Ian Clark, ACR, EngTech MIMechE, of Ian Clark Restoration, one of the leading conservation consultants in this field in the UK.
- Portsmouth Historic Dockyard, which includes the Mary Rose Museum, and the vessels *HMS Victory* and *HMS Warrior* and the last surviving naval steam pinnace, *Steam Pinnace 199*. The Volunteer Co-ordinator of the Friends of Portsmouth Historic Dockyard, David Baynes, introduced the Fellow to Dr Mark Jones (Head of the Mary Rose Collection and lead conservator), Ken Jones, Captain of the *HMS Warrior* and Bob Daubeney, Head Shipwright of the *Warrior*. He also had the opportunity to meet Ivan Steele, Chairman of the Trustees of the *Steam Pinnace 199* and to tour the vessel itself. Through these meetings the Fellow gained a comprehensive overview of the vessels and site.
- The Historic Dockyard, Chatham, where the Fellow toured the site and met with Richard Holdsworth who discussed various aspects of Conservation Project Management and outlined funding opportunities that could be explored in Australia.
- Merseyside Maritime Museum (MMM), Liverpool where the Fellow met with Jonathon Carr and Eamonn Farrell of the MMM Ship Keeping Department who are responsible for the *Edmund Gardner* (pilot cutter) and the *De Wadden* (schooner) heritage vessels.
- The National Museum of Ireland, where the Fellow met with John Kearon, CRINA, Project Manager and Lead Conservator of the Asgard Conservation Project and Master Shipwright—one of the foremost vessel conservators in the UK.
- The Scottish Maritime Museum (SMM) site at Irvine, Scotland, where the historic tall ship *City of Adelaide* is slipped and other heritage iron vessels are berthed and maintained. A large collection of historic shipbuilding machinery is also housed in a ship construction shed nearby.
- The International Maritime Museum in Hamburg, Germany. The Fellow toured this impressive maritime museum and also observed the results of a large number of European vessel and large iron object conservation/restoration projects, both on water and on dry land, during the Hamburg Port Festival.

## National Maritime Museum, Greenwich, London

Gurn met with Laurence Birnie, Head of Metals Conservation for the NMM. He showed the Fellow around the Metal Conservation workshop and discussed the options for conserving small, easily handled objects like fittings and fixtures. This involves intensive and time-consuming conservation work, a lot of it performed under a microscope or magnifying glass.

Consequently, the NMM avoids using traditional metal tradecraft processes, e.g. sandpaper, wet or dry blasting, varnishing, and phosphoric acid cleaning.

Its approach places a strong emphasis on processes like cleaning by hand and soft cloth using tannic acid, which are non-aggressive, and then coating/sealing, then cleaning with a substance called Renaissance Wax, which is a ph neutral micro-crystalline man-made wax that is blended from refined crude oil. Renaissance Wax has different characteristics from natural waxes like beeswax or carnauba wax. These waxes contain acids that can eventually damage the parent material beneath.

It is suitable for all metals, wood, leather, glass, and stone, both in and outdoors and is the sealing substance of choice for many major UK institutions.

The majority of large outdoor objects, made of wood or any metal that corrodes, are usually high-pressure water blasted then sealed with a 2-pack paint system with various types of application depending on the manufacturer. Relatively inert metals like gunmetal, bronze and copper are usually left to patina naturally and, depending on the institution and available workforce, sealed with the wax or a proprietary varnish.

*17th century bronze cannon at the NMM—showing the natural patina with a wax coating and cast iron display carriage (circa early 1800s) coated in a 2-pack paint system*

## The Cutty Sark Conservation Project, Greenwich, London

The Fellow met with Richard Doughty, Chief Executive of the Cutty Sark Trust and was shown around this historic composite (iron and timber) clipper ship that is currently undergoing major conservation/ restoration work.

The approach here has been governed largely by the way the Trust wants to display the vessel to the public and the need to increase the revenue streams available for the vessel's long-term conservation. The Trust wants to suspend the vessel three metres above the bottom of its dry dock so visitors can observe the graceful lines of its hull and the space beneath can be utilised for functions.





The *Cutty Sark's* conservation challenges include:

- The large amount of corrosion damage to the original iron frames and plating, and the effect this has had on the ability of the structure as a whole to support itself safely and without distortion.
- The ineffective results of previous conservation work, i.e. using concrete to try and add support and corrosion protection in the bilge spaces along the keel.

The previous conservation work has actually accelerated the corrosion by trapping moisture between the concrete and the iron. The moisture has promoted wood rot in the hull timbers, as well as corrosion of the iron.

A major structural strengthening of the original fabric of the vessel has to be accomplished for this restoration approach to be successful. New steel sister frames painted a different colour to the original iron frames are being added alongside the old, some of this work was started in the 1970s, and the keel has had to be strengthened in the same way. Some new plates and diagonals are being added alongside the old.

The design for suspension has required some additional strengthening at various other places around the vessel's hull.

*An example of an original frame of the* Cutty Sark *showing the extent of corrosion and wastage, with a view of a new addition alongside*

An attempt had been made to remove the chloride-induced corrosion products of various smaller sections of the vessel by using the impressed current electrolysis method. This method entailed submerging sections in specially designed tanks which hold the electrolyte (tap water containing one part per million of sodium carbonate) and adding anodes and an electric current. Impressed current electrolysis has the potential to remove all chlorides and corrosion products from the ship's material but in reality it is only practical with small objects.

Consequently, the corrosion removal/sealing method had to be modified in the context of the *Cutty Sark* and they have opted to totally encapsulate the original iron framework within a polyurethane paint envelope as is normal practice in current shipyards.

The original iron work has since been wet blasted, dry blasted, and finally sweep blasted to remove any remaining visible chloride spots. A red oxide zinc phosphate primer was then applied, followed by a white polyurethane paint in two coats.

The main objective of this conservation approach is to increase the life of the vessel for up to 50 years. The outcome of this approach remains to be seen and will have to be assessed over the long term.

*Another view of the original iron frames of the* Cutty Sark *showing the oxy-acetylene burn damage to the paint envelope. This damage was caused by modifications to fit the strengthening system. This will have to be addressed when all the modifications are completed.*

## Albert Dock, Bristol, UK

The Fellow met with Martyn Heighton, Tim Parr, and Ian Clark and was shown around the Albert Dock site. The Fellow was specifically shown the riveted iron paddle steamer *Medway Queen* that rescued 7,000 Allied soldiers at Dunkirk during the Second World War.

This vessel's hull had almost completely rusted away when funding was found to preserve it. The decision was made to keep this vessel afloat once the reconstruction work was finished. This meant that full compliance with current marine survey requirements had to be incorporated into the design and construction stages for it to be fit for purpose, i.e. be able to carry paying passengers on short journeys in enclosed waters.





The deplorable condition of this vessel meant that a new hull had to be fabricated from scratch and it was decided to rivet this new hull together to reflect the vessel's original configuration/construction. As no new riveted ship's hull fabrication work has been attempted in the UK for approximately 50 years it has been a process of trial and error.

Current OHS&W legislative requirements prohibit shipbuilders handling red-hot rivets as they did in the past. This has led to alternative methods being trialled and tested. These results of these trials were still under assessment while the Fellow was visiting Bristol. There was some disagreement amongst the various parties about the correct procedures and the tolerances that should be allowed.

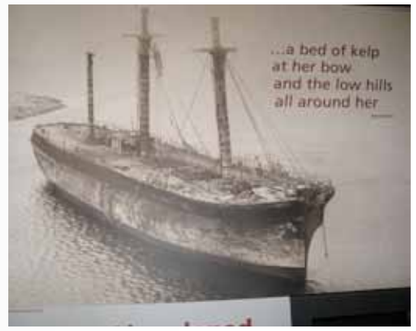
*Bow section of the* Medway Queen *showing new fabrication work*

*Close up of a watertight bulkhead of the* Medway Queen *showing new riveting work*

The results of this vessel's reconstruction can only be assessed after the vessel has been in service for a number of years.

## Brunel's ss Great Britain Trust, Bristol, UK

The Fellow met with Matthew Tanner, Director and CEO of the Trust, and spent two days on an in-depth tour of this major maritime conservation success story.




*The* SS Great Britain *bandoned in Sparrow Cove, Falklands (Brunel's ss Great Britain Trust)*

### Background on the *SS Great Britain* (SSGB)

The SSGB, launched in 1843, was constructed at the purpose-built dry dock that it is now conserved in. At the time it was the most technically advanced and the largest iron vessel of its type in the world.

It had a varied career, which at one stage included transporting hundreds of immigrants to Australia from the UK and Europe over a period of 20 years. After suffering storm damage in 1886, the vessel limped into Port Stanley and was purchased by the Falkland Islands Company. It was then used as a floating storage hulk for coal and wool. In 1933 it was deemed too unsafe for this purpose and was scuttled at remote Sparrow Cove.

*Hull section of the* SS Great Britain *showing previous repair work and the present stabilised condition, as seen by the Fellow*

The ship was rescued and brought back to Bristol for conservation in 1970. Since then it has been in the dry dock that was specially designed and built for its construction.

There had been several attempts at conserving the vessel. For various reasons the projects were never completed successfully and the iron hull continued to corrode, actually at a faster rate than when it was lying in shallow seawater in Sparrow Cove. This was because salt chlorides, a result of its long immersion in salt water, had impregnated the iron and once out of that environment, the relative humidity (RH) of the dock accelerated the corrosion process.

The vessel had been treated by modern shipyard cleaning processes during this time, i.e. high-pressure water blasting (back to bare metal, if possible) followed by a coating of zinc phosphate, an undercoat and then several final coats.

This paint specification was designed to last five years (normal time between ship dry docks) and then the process would begin again.

*View from the bow of the* SS Great Britain *looking aft showing the 'glass sea' and the ducting for the dehumidified air*

In 1997, all conservation work was halted pending a thorough review of the conservation plan. This found that much more of the hull's original fabric was under threat from corrosion than had been estimated.

A comprehensive condition report revealed that as much as 17% of what was left of the original fabric of the hull would disappear and another 43% would be damaged beyond repair at the next programmed cleaning. This was deemed unacceptable by Brunel's ss Great Britain Trust and means were put in place to find and assess alternate methods of conservation. The Trust's stated aim is to conserve the vessel in perpetuity.

After extensive research it was found that the most secure way to conserve as much of the original fabric of the vessel's hull as possible was to eliminate one of the four main contributors to corrosion (water, salt, air and iron).

On an object of this size, water was deemed the most appropriate element for removal. In fact, this was the only one as the salt chlorides had penetrated the porous wrought iron and there is no known way, at present, to extract the chlorides completely from the iron.





If all the chlorides are not removed (this is also extremely difficult, if not impossible, to test for) and the other three contributors are still present, corrosion will continue. Testing revealed that if the amount of RH present was kept below approximately 20%, corrosion would be halted, or, at the very least slowed down to a negligible rate.

The Trust decided to encapsulate the hull exterior in a 'glass sea', sealing the interior of the vessel from the atmosphere, and de-humidifying the exterior and interior of the vessel from the waterline down.

Research confirmed that the hull above the waterline and the topsides were in much better condition than those below, so a traditional ship cleaning and coating system was applied in these areas. This coating system was then reviewed in consultation with the preferred paint supplier and professional conservators. The final coating system applied to areas above the waterline comprised high-pressure wet blasting to 2,500 bar. This was then coated with a 2-pack zinc-rich wet application epoxy primer. The mid coat is a 2-pack epoxy, which is then top coated with a 2-pack conservation grade urethane sheen finish. The chemical resistance of epoxy resins is combined with the UV resistance of polyurethanes.

The hull below the waterline was high-pressure water blasted and cleaned inside and out and basically left as is. The dehumidifying system had been operational for five years when the Fellow visited. Continuous monitoring of RH levels have confirmed the outstanding success of this method.

Interestingly, the largest moisture load on the dehumidifying plant comes from the number of visitors below deck and in the dry dock itself.

*View from the bow of the* SS Great Britain, *above the waterline, showing the completed topside coating system and the 'glass sea'.*

Brunel's ss Great Britain Trust is still, however, addressing some major issues. These include:

- Cost of running and maintaining the dehumidification plant.
- Amount of water penetrating the walls of the historic dry dock. This is increasing as time goes by, with a subsequent increase in the load on the dehumidification plant.
- Trouble with the timber weather deck planking that is exposed to the atmosphere. The timber swells and shrinks according to the seasons, the caulking splits and allows moisture through to the steel, isolating the weather deck underneath and risking corrosion.

The conservation process has been thoroughly researched and documented and numerous papers are available on the web.

## Portsmouth Historic Dockyard, Portsmouth

In 1848 the Portsmouth Historic Dockyard site was the largest and most modern naval base in the world. At that time the age of the great wooden sailing ships was coming to an end and the age of steam and iron shipbuilding was coming into its own.

The Dockyard is home to the following:

- Mary Rose Trust (King Henry VIII's flagship, raised off Portsmouth in 1982)
- Portsmouth Naval Base Property Trust
- Royal Naval Museum
- Warrior Preservation Trust
- *HMS Victory* (Lord Nelson's Flagship during the Battle of Trafalgar)
- *Steam Pinnace 199*

All of these entities are separate business concerns and have approached their individual conservation requirements in different ways.

The HMS Warrior, *moored at its berth in Portsmouth Harbour (part of the Historic Dockyard Precinct)*

### Background on the *HMS Warrior*

In 1858 the British Admiralty was deeply concerned by the threat posed by Napoleon III's proposed fleet of steam powered, wooden hulled, armour plated warships (ironclads). To counter this threat it approved the construction, in Portsmouth, of the first iron hulled, steam powered, armour plated battleship in the world—*HMS Warrior.* Its keel was laid in May 1859 and it was launched in December 1860.

The vessel incorporated the best of Victorian Britain's naval technological expertise and it instantly rendered all other battleships in the world obsolete. Described by Napoleon III as *"a black snake amongst rabbits",* the *Warrior* never had to fire a shot in anger, such was the threat it posed. Technological advances in the mid- to late 1800s meant that by 1875 the vessel had been superseded.





The Fellow met with Ken Jones, Captain of the *Warrior*; Bob Daubeney, Head Shipwright of the *Warrior* and Dr Mark Jones (Head of the Mary Rose Collection and lead conservator), on board the *Warrior.* After this productive meeting the Fellow was escorted around the *Warrior* by Bob Daubeney and visited parts of the vessel that are normally inaccessible to the public.

As the *Warrior* is still in the water, its iron hull conservation has proceeded along the lines of normal shipyard practice. It had recently been dry docked and a paint system had been applied that was typical of current coating procedures. The Warrior Preservation Trust is hoping to increase the time between slippings to 15 or, hopefully, 20 years (previously five to 10 years). This may be feasible with the new 2-pack painting processes that are under trial and development at present. The painting system will be monitored over time.

Most of the conservation projects visited by the Fellow have stopped dry blasting and are now using wet blasting as the preferred method for cleaning hulls. This method is less invasive, retaining more of the hull's original fabric. The wet blasting process is relatively new to Australian maritime institutions and has yet to be adopted on a broad basis. In terms of the requirements of the Burra Charter, this cleaning method has obvious advantages.

The *Warrior* has played different roles during its lifespan. After being relegated to the First Reserve (the Coastguard) in 1875, it was laid up in Portsmouth in 1883 for 20 years before becoming the HMS Vernon torpedo school in 1904. In 1929 it was used as a floating oil and fuel depot in Milford Haven, Wales, and in 1979 it was towed to Hartlepool for restoration.

The hull is in extremely good condition for its age, due to the superior quality of the iron used and the fact that it has always been afloat and working. The Navy or its sub-contractors have always maintained the vessel. Navy divers still regularly inspect and clean the underwater section of the hull and use it for training purposes.

*View of the* Warrior's *bilges showing the untreated iron ballast*

*View of the* Warrior's *deck head in an area inaccessible to the public*

The inboard parts of the vessel, which are inaccessible to the public, have not been maintained to the same extent as the exposed sections due to budgetary constraints. These will require substantial conservation work as time progresses. The lower sections of the bilge contain large amounts of iron ballast that is currently rusting away and contributing to the hull's deterioration from the inside out. In addition, coatings are failing on the deck heads and hull sides in the same areas.

Most of the vessel's topsides have been completely reconstructed as not much was saved during its various conversions while in naval service. This is typical of vessels that have changed roles during their working life.

### Background on the *Steam Pinnace 199*

Completed in 1911, the *Steam Pinnace 199* is a wooden-hulled, steam powered vessel of approximately 50 ft. Pinnaces were seconded to battleships and used to protect them from torpedo attacks while at anchor. They were also used to ferry officers, crew, mail, and stores around the fleet. The *Steam Pinnace 199* is the last functioning pinnace from the 634 listed by the Royal Navy in 1913.

The Navy sold it in 1950 and it was transferred from Portsmouth to a location on the Thames. Attempts were made to convert and conserve it, including replacing the steam machinery with a petrol engine. It was rescued by the Royal Naval Museum, Portsmouth, in 1979.

During the initial restoration the original steam auxiliaries were discovered in a shipyard in Belgium, the period steam engine and boiler were donated from another naval vessel and more recently, the three pound 1887 Hotchkiss gun was retrieved from a trawler's net in the North Sea. Despite being submerged for so long, the Hotchkiss was in remarkably good condition. It only required cleaning and a small amount of repair work to become 'like new'.

The *Steam Pinnace 199* is fully self-funded by a Board of Trustees, crewed by volunteers, and maintenance work is carried out at a special-purpose workshop set up inside the Historic Naval Base. This workshop employs some traditional shipyard tradespeople, such as shipwrights and boilermakers, and is being used to train young apprentices in these fast disappearing skills. Funding comes from contract work on site and around the country for various heritage organisations.

*The* Steam Pinnace 199 *at its summer berth in Gosport*

At its next slipping the pinnace will require the replacement of a substantial amount of wooden planking below the waterline due to wood rot. Some of the iron nails and various other iron fittings are suffering chloride damage to a degree yet to be established, and will be replaced with stainless steel during this process.

Like-for-like replacement with stainless steel is the accepted method in the UK of renewing iron in wooden hulls, as it's not as reactive with existing elements, materials and substances.





## The Historic Dockyard, Chatham

Elizabeth I established Chatham as a Royal Dockyard in 1568. Initially a refitting base, it became a shipbuilding yard; from then until the late 19th century the yard expanded. In its heyday, thousands of people were employed there. This historic dockyard provides a fascinating window into the history of British shipbuilding.

### Background on the *HMS Gannet*

This is a composite screw sloop similar in age and construction to the *Cutty Sark*. The primary purpose of ships of the *Gannet's* class was to maintain British naval dominance through trade protection, anti-slavery, and long-term surveying. The conservation and restoration approach undertaken is similar to the ex-Navy vessels in Portsmouth.

The exterior of *Gannet's* hull is in remarkably good condition because the vessel is laid up in a dry dock that can be emptied for slipping purposes. The interior iron frames show evidence of corrosion.

Unfortunately, the Fellow was not granted access to the lower decks of the vessel and could not evaluate their condition. The *Gannet* has been painted in a traditional shipyard manner.

*View of the* Gannet *from dockside*

The *Gannet* underwent major changes during its commissioned life and as a result much of the upper deck and superstructure have been restored to the time when it was a working naval vessel. This construction is new and, again, because it's not in service, the materials used are modern, e.g. galvanised sheet metal, made to look like riveted iron; foam and plywood, painted to resemble old materials.

*The* Gannet's *frames showing signs of corrosion*

*Replica funnel constructed from galvanised sheet metal*

## The Dockyard

One of the many buildings on site is the ropery, an original building dating back to the late 1700s. Hemp rope has been made on this site since 1618. It is still commercially making rope today, providing one of the revenue streams that fund the site. It is the last hemp ropery still operating in the UK and uses machinery dating back to 1811. Most of the hemp rope that is required for the world's heritage vessels is sourced from here. The ropery, which is a quarter of a mile long, continues to train people in the craft of traditional hemp ropemaking.

The rope required to re-rig the *HMB Endeavour* (the ANMM-owned replica of Captain Cook's vessel) was made here and while the Fellow was on site the replacement rigging was being dispatched to Australia.

Heritage shipbuilding machinery is stored and displayed here—either left as is under cover or coated with a 2-pack painting system if outdoors.

*The interior of the dockyard fitting out shed showing the old shipbuilding machinery*





The museum has a vast collection of traditional hand tools that are used in the shipbuilding trades on display. The library has a large collection of engineering trade manuals used by all sections of the marine industry and this valuable resource is available to the public for research purposes. It also keeps alive the knowledge and experience gained from generations of shipbuilders.

*A selection of the shipwright's hand tools on display*

Funded, in part, by commercial enterprise (including the ropery) and residential and business properties on site, the dockyard is used extensively as a period film set, e.g. for the movie Sherlock Holmes, 2009.

The exhibition Wooden Walls provides a snapshot of the life of an apprentice shipwright during the age of sail, from the first day of his indenture to the completion of his first ship.

The main focus is on exploring the life and times of dockyard workers through the ages, including all aspects of the this through the pipe-bending floor, blacksmith shop, fitting out shop, ropery and the giant fitting out sheds, these are also heritage listed.

The Dockyard covers an impressive area that would require a week to thoroughly explore.

## Merseyside Maritime Museum (MMM), Liverpool

The MMM has two vessels displayed in dry dock, described as follows.

### *Edmund Gardner*

This is a riveted steel pilot cutter, built in 1953. It is a diesel electric vessel and was used by the Liverpool Pilotage Service until 1980. Although it had a specialised function, the interiors, including the dining saloon, are typical of much larger cargo liners. The conservation approach adopted here incorporates a modern ship painting system except for the replica antifouling.

Constructed from steel rather than iron, the *Edmund Gardner* does not have a problem with chlorides. The relatively young age of this vessel means that the steel has not had a chance to corrode very much and the outside of the hull appears to be in very good condition. The paintwork also seems to be holding up well.


Edmund Gardner *(pilot cutter) in dry dock*

*The* Edmund Gardner *chain locker shown after treatment (note the good condition of the steel and rivets)*

Internally there is some corrosion and it is only lack of funds and human resources that prevents the completion of the conservation project. The areas that have been treated are holding up quite well.

The *Edmund Gardner* was transferred directly to the Museum after being decommissioned by the Pilot Service. The vessel is intact and the Ship Keeping Department, with the help of volunteers, is slowly working at restoring discrete sections.

### *De Wadden*

The *De Wadden* is a three-masted schooner launched in Holland in 1917. It is the last of the trading schooners that sailed between Ireland and the UK. It is now permanently dry docked and has only had minimal conservation work—mainly to stabilise the vessel until sufficient funding can be found to conserve it properly.

After ultrasonic thickness testing the vessel, it was found that 80% of the metal would require replacement prior to the vessel putting to sea again. This goes against the accepted philosophy of retaining as much of the original material as possible and it was decided to dry dock the vessel.

One of the major problems facing the Ship Keeping Department is the composition of the iron hull. Metallurgical testing revealed the existence of arsenic, which is released as a gas during welding. This raises serious OHS&W issues that will have to be addressed before conservation can begin on a larger scale.

The wasting away of material has left the vessel's structure unable to support itself both internally and externally. While there has been some internal strengthening carried out, mainly around the steps for the masts, major supporting work needs to be carried out at the earliest opportunity.

*View along the* De Wadden's *hull showing distortion due to internal corrosion of the vessel's frames*





## The *Asgard*, National Museum of Ireland

### Background on the *Asgard*

The *Asgard* was designed and built in 1905 by noted yacht designer Colin Archer, in Norway. It was commissioned as a wedding present for Erskine Childers (author and significant figure in the struggle for Irish Independence) and his wife, Molly, by her parents. In 1903 Childers wrote what is now regarded as one of the world's first spy novels, 'The Riddle of the Sands'. He was also a gifted yachtsman and the book's portrayal of sailing has made this novel a must read for any serious yachtsman.

The *Asgard* has a special place in Irish history, as it was used in 1914 by Childers and his wife to bring a load of guns and ammunition to Ireland in support of the Rising of 1916. This was their last trip in the vessel as the First World War broke out soon after. Childers served with distinction in British Naval Intelligence during the war and he was against a treaty when civil war broke out in Ireland. He was executed in 1922 for his role in the struggle for Irish independence. The Irish Government purchased the vessel in 1961 and it became Ireland's first National Sail Training vessel.

John Kearon was contracted to complete the initial survey by the Irish Government before the vessel was purchased and has had a close association with it ever since. He was contracted to restore and exhibit the *Asgard* at Collins Barracks in Dublin and, after five years, this project is now nearing completion. Iron fastenings in the vessel had seriously corroded, and whole sections of the hull were removed bit-by-bit and reassembled with stainless steel fittings (nails, bolts, brackets, etc.). Rotten timber has been replaced with the same types of timber.

*The bottom of the rudder post showing the original copper sheathing, new copper roves and new brass strengthening strips. Also note the new rudder timbers alongside the original.*

*Inside the hull near the stern showing new stainless steel fixtures and fittings*

This conservation project has been meticulously and thoroughly researched, and executed with an attention to detail that makes it stand out from all the other projects the Fellow observed while overseas. Correspondence between Colin Archer and Erskine Childers during the *Asgard's* construction has been unearthed and this has helped enormously with the conservation process. A professional film crew is on call to document the entire process.

Wherever feasible original material is being used to restore the vessel. The project has sourced the exact types of timber used in the initial construction. For example the original oak tree nails have been replaced with new oak tree nails. The team is even reusing the old oakum and cotton caulking where possible.

Once completed, this project will be one of the finest examples of a combined conservation/restoration project in the entire UK. It should become the benchmark conservation project to which Australian institutions aspire.


*The iron butts that have suffered chloride damage are then replaced with stainless steel*

*An example of a very badly corroded keel bolt. These keel bolts had to be removed and replaced with stainless steel ones*

## Scottish Maritime Museum (SMM), Irvine, Scotland

This Maritime Museum occupies three sites around Scotland but the Fellow only had the resources to visit the site at Irvine. This is where the historic *City of Adelaide*, built 1864, is slipped. The *City of Adelaide* is the oldest of only three composite clipper ships left in the world. This vessel's future is currently under debate and as the Fellow was not allowed access to the privately owned slipway he could only make observations from outside the fencing.

The vessel appears to be in a very neglected state. A covering has been fitted over the decks in an attempt to offer it some protection from the elements.

*The* City of Adelaide *at its present site in Irvine*





The SMM site at Irvine is home to a range of historic ship construction machinery from all over Scotland and most of this is housed in an original building called the Linthouse. The majority of the ship construction machinery is in original condition with conservation work ongoing. Some of the objects displayed outside have been coated with the traditional marine painting system described previously.

*The superstructure of the* Garnock

The vessels of interest to the Fellow were the steam yacht *Carola*, the puffer *Spartan* and the tug *Garnock*, which are maintained by a small group of volunteers under the supervision of the SMM Head Ship Keeper, David Iggo, who has a commercial marine background.

The *Spartan* appeared to be in the best condition of the fleet. Both the other vessels are in need of funding to conserve or restore them, with decisions still pending on their future. They both suffer from corrosion problems with evidence of chlorides in the riveted iron hulls. They are currently being conserved with the traditional shipyard practices of rust removal by hand using needle guns, chipping hammers, etc., followed by spot priming and painting. This process is unable to keep up with the acceleration of corrosion due to the weather conditions.

It appears that the SMM suffers from the same range of problems that most of the Australian maritime institutions experience, i.e. lack of funding and the need for a skilled volunteer work force.

## International Maritime Museum, Hamburg

The Fellow was in Hamburg during the Hafen City Port Festival. Heritage vessels from all over Europe gather in Hamburg to celebrate the removal of customs fees and charges between the Port of Hafen and the North Sea. This took place in 1189 and was the event that allowed the port to become one of the biggest and busiest in the world and that cemented Hamburg's status as one of the richest City States in Germany.

The Fellow was able to observe a wide range of conservation and restoration outcomes. The majority of the vessels were actively working during this festival ferrying large numbers of sightseers around this busy waterway. Keeping vessels working in this way significantly increases the funding available for their long-term future. Most of the local vessels are run by volunteer associations set up to oversee a particular vessel. Each organisation has their own agendas regarding the restoration and conservation of their vessels.

There are also many wrought iron riveted bridges and machinery that have been conserved throughout the re-development of the inner port. It was inspiring to see such a concerted effort being taken to preserve this maritime heritage and integrate it all into the new port.

*An example of a riveted wrought iron bridge, restored and incorporated into the Hamburg Port Redevelopment.*

*Propeller and stern drive casing of a mini-sub (note the corrosion effects).*

The effort and funding available for these types of large-scale conservation approaches needs to be found and implemented early in the overall plan because the trade skills and techniques required are in danger of disappearing. The International Maritime Museum is a privately owned museum of the highest standard. It has a wide range of exhibits and small vessels on display ranging from U-boat propellers and mini submarines through to industrial-scale objects from all over the world, which have been brought back to Hamburg

*Various metal objects on display at the International Maritime Museum.*





## Summary

All major work on heritage vessels that has secured Heritage Lottery Funding in the UK is carried out by contractors with volunteers assisting where they can. This introduces a very significant cost factor into the conservation equation, one that very few maritime institutions in Australia would be able to meet with their current funding.

Ways to increase funding opportunities need to thoroughly investigated and reviewed on a site-by-site, object-by-object, and case-by-case basis.

The Fellow's research suggests that the only way to successfully stabilise and conserve large wrought iron objects suffering chloride damage is by removing one of the contributors to the corrosion process—either water, iron, salt or air. With the need to allow public access, at this stage, the only practical solution seems to be to keep the relative humidity of the object below approximately 20% RH.

Keeping vessels operational so as to increase their public profile, access, and, subsequently, opportunities for funding, results in further dilapidation of the vessel and the replacement of the object's original fabric. These needs must be carefully weighed up with the object's historical significance and the desire to conserve it in perpetuity for future generations.

The research has indicated that the process of conserving/restoring heritage wrought iron large objects in an open all-weather environment is extremely complicated. The methodology used has to be well researched and must continue to be evaluated and modified throughout the life of the object by the curators and conservators. Changes in conservation technology must be brought to bear on this equation as well.


*The* Hendrika Bartelds, *one of the historic vessels cruising the Elbe River during the Hamburg Port Festival*

# Knowledge Transfer: Applying the Outcomes

The information, knowledge, and skills obtained during the Fellowship will be accessible to interested parties in Australia in a wide variety of formats. The Australian Maritime Museums Council and their website will be the primary repository for information, with the Fellow also disseminating his findings through site visits, presentations, and workshops.

## Australian Maritime Museums Council (AMMC) Website

The main repository for the knowledge gained during the Fellowship project will be this report and associated photographs, which will be available on the ISS Institute's and the AMMC's website. For information on the contacts developed during the Fellowship please contact ISS Institute. This information will be available to all members of the AMMC and other interested parties.

A list of recommendations and guidelines will be drafted and these will be discussed at the next AMMC Conference. The AMMC have an annual conference and the Fellow will present a paper at the 2011 conference.

The work practices and recommendations in the Fellow's paper will be highlighted as world's best practice and will help direct the guidelines to be established by the AMMC. Most of the maritime museums and institutions in Australia are members of the AMMC.

There is substantial knowledge and experience available in Australia (mainly held by people now retired from the industry) and it is hoped that once this report has been publicised it will act as the catalyst for an increased dialogue between professionals and tradespeople in the field. It will become a focal point for discussions on the way forward for historic iron vessel restoration and conservation.

# Recommendations

## State Government

Most of the slipways and docks in Port Adelaide's historic inner harbor have been removed during the Port's re-development. With the current economic forecast making it unlikely that these industries will return to the inner harbor it is crucial to document and, if possible, re-energise the skills and trades that are disappearing. This could be achieved through TAFE courses, the apprenticeship system, and government-sponsored welfare programs.

## Education

In the current secondary school curriculum there is little emphasis placed on the value of traditional maritime trades and skills and potential careers in this field. Educators need to be provided with more information on these trades and skills so they can help generate interest in their students and highlight this as a viable career path.

Curators and conservators who intend to work at maritime institutions should, during their training, be exposed to the relevant trades so as to further their understanding of what processes are required.

## Training

With the onset of modern technology and increasing mechanisation in the ship repair field and associated trades, a federally endorsed and recognised module in the further education system for conserving and repairing historic iron vessels and objects should be established among the relevant trades. This will help conserve these traditional maritime trades and also attract a new generation to the field.

## Maritime Museums and Institutions

Maritime museums and institutions need to educate the wider public about the negative consequences to our maritime heritage of letting traditional maritime skills and trades disappear. They also need to be the custodian and guardian for these skills and trades and strive to document and record as much of this information as possible.

# References

## Australian

- AMMC: http://ammcouncil.ning.com
- ANMM: http://www.anmm.gov.au
- SAMM: http://www.history.sa.gov.au/maritime/maritime.htm

## International

- Asgard Conservation Project: http://www.museum.ie/en/list/asgard-studio.aspx
- The Historic Dockyard, Chatham: http://www.thedockyard.co.uk/
- *Cutty Sark*: http://www.cuttysark.org.uk
- International Maritime Museum: http://www.internationales-maritimes-museum.de/
- *Medway Queen*: http://www.medwayqueen.co.uk
- Merseyside Maritime Museum: http://www.liverpoolmuseums.org.uk/maritime/
- NMM: http://www.nmm.ac.uk
- Portsmouth Historic Dock: http://www.historicdockyard.co.uk/
- Brunel's ss Great Britain Trust: http://www.ssgreatbritain.org
- Scottish Maritime Museum: http://www.scottishmaritimemuseum.org
- Measurement Unit Conversion: http://www.convertunits.com/info/bar
- The Free Dictionary: http://www.thefreedictionary.com/barque