International
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Institute Inc

PRATT FOUNDATION

CONSERVATION AND RESTORATION OF HERITAGE TIMBER VESSELS

Matthew Dunn

The Pratt Foundation/ISS Institute Overseas Fellowship

Fellowship supported by The Pratt Foundation

ISS Institute Inc.
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Executive Summary

This Fellowship was undertaken in order to attain further understanding of restoration and conservation of heritage timber vessels, as well as addressing the related skills deficiencies within the industry in Australia. The necessity for best practice and understanding of timber heritage vessel conservation and restoration is necessary for maintaining and preserving Australia's maritime heritage. Neglecting to address skills gaps in this area will result in a significant loss of our cultural heritage.

Modern materials are fast overtaking traditional methods of construction and maintenance in the boat building industry. This is due to materials such as steel, aluminium and fibreglass being a more efficient and cost effective option. As a result many skills in relation to traditional practices are being lost and training in these methods are close to becoming non-existent.

With these trends in mind the following skills gaps have been identified:

- Restoration, conservation and replacement of timber in vessels
- Caulking of timber vessels
- General design aspects of fitting out of traditional vessels
- Maintenance scheduling
- Documentation of museum vessels
- Restoration procedures for heritage vessels
- Bronze casting for shipwrights

By investigating the policy and practice of maritime conservation in the US context, it was the Fellow's aim to enhance his own skills base and bring valuable insight and knowledge to his work practices here in Australia and, in turn, pass on these capabilities to others in the industry.

This was achieved by:

- Working with shipwrights and staff at the Mystic Sea Port: Museum of America and the Sea.
- Visiting and talking with staff about teaching and restoration practices at the International Yachting Restoration School in Rhode Island.
- Attending a bronze-casting course for shipwrights at the Wooden Boat School, Maine.
- Visiting maritime museums and meeting staff at the Herreshoff Marine Museum.
- Talking with timber boat restoration industry staff around New England.
- Attending the 17th annual Wooden Boat Show, where Dunn met with industry people and attended various related seminars.

Prior knowledge and personal experience was drawn on for comparative purposes when compiling this report. Knowledge and skills were gained with the purpose of transference to a wider base of specialist artisans and tradespeople. This will be achieved through workshops, seminars, public talks and education programs both within the Australian National Maritime Museum and elsewhere among the traditional and wooden boat community.

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Abbreviations and Acronyms

ANMM	Australian National Maritime Museum
ISS Institute	International Specialised Skills Institute
IYRS	International Yacht Restoration School
MED	Certificate Marine Engine Driver
TAFE	Technical and Further Education
WBS	Wooden Boat School, Maine

Acknowledgments

Matthew Dunn 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)

We know that Australia's economic future is reliant upon high level skills and knowledge, underpinned by design and innovation.

The International Specialised Skills Institute Inc (ISS Institute) is an independent, national organisation, which has a record of nearly twenty years of working with Australian industry and commerce to gain best-in-the-world skills and experience in traditional and leading-edge technology, design, innovation and management. The Institute has worked extensively with Government and non-Government organisations, firms, industry bodies, professional associations and education and training institutions.

The Patron in Chief is Sir James Gobbo AC, CVO. The ISS Institute Board of Management is Chaired by Noel Waite AO. The Board comprises Franco Fiorentini, John Iacovangelo, Lady Primrose Potter AC and David Wittner.

Through its CEO, Carolynne Bourne AM, the ISS Institute identifies and researches skill deficiencies and then meets the deficiency needs through its *Overseas Skill Acquisition Plan (Fellowship Program),* its education and training activities, professional development events and consultancy services.

Under the Overseas Skill Acquisition Plan (Fellowship Program) Australians travel overseas or international experts travel to Australia. Participants then pass on what they have learnt through reports, education and training activities such as workshops, conferences, lectures, forums, seminars and events, therein ensuring that for each Fellowship undertaken many benefit.

As an outcome of its work, ISS Institute has gained a deep understanding of the nature and scope of a number of issues. Four clearly defined economic forces have emerged out of our nearly twenty years of research. The drivers have arisen out of research that has been induced rather than deduced and innovative, practical solutions created - it is about thinking and working differently.

A Global Perspective. 'Skills Deficiencies' + 'Skills Shortages'

Skill deficiencies address future needs. Skill shortages replicate the past and are focused on immediate needs.

Skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the-job, gleaned from published material, or from working and/or study overseas. This is the focus of the work of ISS Institute.

There may be individuals or firms that have these capabilities. However, individuals in the main do not share their capabilities, but rather keep the IP to themselves; and over time they retire and pass way. Firms likewise come and go. If Australia is to create, build and sustain Industries, knowledge/skills/understandings must be accessible trans-generationally through nationally accredited courses and not be reliant on individuals.

Our international competitors have these capabilities as well as the education and training infrastructure to underpin them.

Addressing skill shortages, however, is merely delivering more of what we already know and can do to meet current market demands. Australia needs to address the ***dual*** challenge – skill deficiencies and skill shortages.

Acknowledgments

Identifying and closing skills deficiencies is vital to long-term economic prospects in order to sustain sectors that are at risk of disappearing, not being developed or leaving our shores to be taken up by our competitors. The only prudent option is to achieve a high skill, high value-added economy in order to build a significant future in the local and international marketplace.

The Trades

The ISS Institute views the trades as the backbone of our economy. Yet, they are often unseen and, in the main, have no direct voice as to issues which are in their domain of expertise. The trades are equal, but different to professions.

The ISS Institute has the way forward through its 'Master Artisan Framework for Excellence. A New Model for Skilling the Trades', December 2004. The Federal Government, DEEWR commissioned ISS Institute to write an Australian Master Artisan School, Feasibility Plan.

In 2006, ISS Institute Inc. set up a new ISS advisory body, the **Trades Advisory Council.** Members are Ivan Deveson AO; Martin Ferguson AM, MP, Federal Labor Member for Batman; Geoff Masters, CEO, Australian Council of Educational Research; Simon McKeon, Executive Chairman, Macquarie Bank, Melbourne Office; Richard Pratt, Chairman, Visy Industries and Julius Roe, National President Australian Manufacturing Workers' Union.

Think and Work in an Holistic Approach along the Supply Chain - Collaboration and Communication

Our experience has shown that most perceive that lack of skills is the principal factor related to quality and productivity. We believe that attitudes are often the constraint to turning ideas into product and a successful business; the ability to think laterally, to work and communicate across disciplines and industry sectors, to be able to take risks and think outside the familiar, to share – to turn competitors into partners.

Australia needs to change to thinking and working holistically along the entire Supply Chain; to collaborate and communicate across industries and occupations - designers with master artisans, trades men and women, Government agencies, manufacturers, engineers, farmers, retailers, suppliers to name a few in the Chain.

'Design' has to be seen as more than 'Art' discipline – it is a fundamental economic and business tool for the 21st Century

Design is crucial to the economic future of our nation. Australia needs to understand and learn the value of design, the benefits of good design and for it to become part of everyday language, decision making and choice.

Design is as important to the child exploring the possibilities of the world, as it is to the architect developing new concepts, and as it is to the electrician placing power points or the furniture designer working with a cabinet-maker and manufacturer. As such, design is vested in every member of our community and touches every aspect of our lives.

Our holistic approach takes us to working across occupations and industry sectors and building bridges along the way. The result has been highly effective in the creation of new business, the development of existing business and the return of lost skills and knowledge to our workforce, thus creating jobs - whereby individuals gain; industry and business gain; the Australian community gains economically, educationally and culturally.

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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"*. Dunn would like to thank them for providing funding support for this Fellowship.

Supporters

Dunn would like to thank the following people for their support and assistance.

- Carolynne Bourne AM, International Specialised Skills Institute
- Steven Adams, Fleet Manager, Australian National Maritime Museum
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- Dr Donald Elsmore, Heritage Conservation Services
- Mary-Louise Williams, Director, Australian National Maritime Museum
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- Walter Ansel, Boat Builder and lead Shipwright of Roann restoration project, Mystic Seaport: The Museum of America and the Sea
- Rob Whalen, Shipwright and Boat Builder, Mystic Seaport: The Museum of America and the Sea
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- Shannon McKenzie, Mystic Seaport: The Museum of America and the Sea
- Dana Hewson, Vice President, Vessels, Mystic Seaport: The Museum of America and the Sea
- Quentin Sneideker, Ship Yard Foreman, Mystic SeaportvThe Museum of America and the Sea
- Scott Noseworthy, Sawer, Mystic Seaport: The Museum of America and the Sea
- Peter Vermilya, Water Craft Collections, Mystic Seaport: The Museum of America and the Sea
- Wyatt Lawrence, Teacher, Wooden Boat School, Maine
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- Clark Poston, Program Director, International Yacht Restoration School
- Warren Baker, Senior Instructor, International Yacht Restoration School
- Lew Davies, Managing Instructor, International Yacht Restoration School

Employer Support: Australian National Maritime Museum

Dunn would like to thank the Australian National Maritime Museum.

The Australian National Maritime Museum is a statutory authority of the Australian Government (the National Government of the Commonwealth of Australia). The Museum is responsible to the Minister for the Environment, Heritage and the Arts (currently the Hon Peter Garrett AM MP). It is one of the national collecting institutions under the Department of the Environment, Water, Heritage and the Arts (others include the National Library of Australia, Australian National Gallery and National Museum of Australia). Its enabling legislation is the Australian National Maritime Museum Act 1990 (amended 1993).

In 1984 the New South Wales and Australian Governments jointly announced that a National Maritime Museum would be built as part of the redevelopment of Darling Harbour, Sydney, a cradle of Australian maritime commerce close to the site of Australia's first European settlement at Sydney Cove.

The prominent Australian architect Philip Cox was chosen to design the building, and construction and staff recruitment began in 1986. Collecting and exhibition development centred around five display themes – discovery, passengers, commerce, leisure and navy, with another added when the USA funded a gallery of US-Australian maritime links as its gift to the nation for the 1988 Bicentenary celebrations.

The nucleus of the National Maritime Collection was built over five years by purchase, transfer from other Commonwealth collections and gifts, including historic vessels which were New Zealand and Norway's Bicentennial gifts to Australia.

The museum was opened by Prime Minister Bob Hawke on 29 November 1991, with the USA gallery dedicated on 1 January 1992 by US President George Bush and Prime Minister Paul Keating.

The museum's duty statement clearly articulates the scope of activity. The museum aims to bring maritime heritage to life and preserve it for future generations via the following:

- Exhibitions, programs and events that are creative, inclusive, enjoyable and memorable
- Development and management of the National Maritime Collection
- Research, acquisition, conservation, interpretation, scholarships, publications, outreach and education
- National leadership and the provision of support and encouragement to local, regional and community museums which value maritime heritage
- National and international cooperation and collaboration with museums and other organisations
- Fostering traditional skills and practices

Acknowledgments

Mystic Seaport: The Museum of America and the Sea

Mystic Seaport: The Museum of America and the Sea is set in the small Connecticut town of Mystic. The museum was founded in 1930 and is a living history museum, consisting of a village, numerous historical vessels and 17 acres of exhibitions depicting coastal life in 19th-century New England. Mystic Seaport is home to a collection of over 500 vessels ranging from rowboats and kayaks to schooners and tall ships. The Museum is the leading maritime museum in the USA in timber vessel preservation.

Mission Statement: The mission of Mystic Seaport is to create a broad, public understanding of the relationship of America and the sea.

Website: http://www.mysticseaport.org

About the Fellow

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Employment

Shipwright, Australian National Maritime Museum

Qualifications

- Ship and Boat Builder, Shipwright Trade Certificate, NSW TAFE, 1992
- Coxswain, MED 2 Certificate, WA Maritime Training Centre Fremantle (Challenger TAFE WA), 2006
- Certificate I Transport and Distributions (Maritime Operations), NSW TAFE, 1996
- Marine Radio Operator's Certificate of Proficiency (MROCP), Australian Maritime College, 2006
- Square Rig Sailing (OTEN Maritime Studies), Open Training Education Network, NSW TAFE, 2004

Dunn has over 18 years experience in the ship and boat building industry; the majority of this time spent in the museum environment undertaking projects in the conservation and maintenance of historic vessels. Restoration projects he has worked on include vessels such as 172 *Epic Lass* (a 36ft timber naval officers' launch), *Lady Hopeton* (a 72ft timber steam launch), the *James Craig* (an 1874 iron barque), and at present, *Bareki*, a 45ft timber tug boat. Dunn has also successfully completed the Coxswain, MED 2 Certificate in order to further understand the use and behaviour of sea going vessels.

To obtain sea time and develop an understanding of timber vessels at sea, Dunn worked on a 145ft timber brigantine, the *Soren Larsen,* sailing the South Pacific as crew and ship's carpenter for five months. In those five months he gained experience in basic seamanship of rope and sail handling, navigation, time at the helm, anchoring, and safety at sea, eg: man overboard, abandon ship and fire drills. Dunn also experienced the diverse culture and natural beauty of the South Pacific, visiting many small island communities. He has also been involved in two major refits of the vessel.

Dunn is committed to keeping traditional boating skills and practices alive and preservation through use. The Fellow will continue working with boats in one form or another and considers it a lifestyle rather than a job.

Dunn's interests include sailing and boating, working with timber, maritime history, travel, music, fishing and surfing.

Aims of the Fellowship Program

The aims of the Fellowship program were to:

- Gain skills and knowledge to be used in the restoration and conservation of Australian heritage vessels.
- Enhance technical skills and attain further understanding of timber ship and boat building.
- Investigate the policy and practice of maritime conservation in the US context.
- Develop and support skills and knowledge transfer activities for other artisans and employees of the Australian National Maritime Museum and to apprentices through the heritage trade-training scheme.
- Disseminate knowledge and skills to a wider base of specialist artisans through workshops, seminars, public talks and education programs both within the museum and elsewhere through the traditional and wooden boat community.

The Australian Context

A Brief Description of the Industry

In Australia there remains the remnants of a bygone timber ship and boat building industry. Although timber vessels are still used for commercial transportation (ferries), tourism (whale watching tours, sail adventure and sight-seeing), fishing and charter. The majority of commercial and recreational vessels are now constructed from steel, aluminium or fibreglass. This is a result of the high cost of building and maintaining timber vessels along with increasing timber shortages. In the past, once a timber commercial or recreational vessel had reached the end of its life, an abundance of materials and skilled tradespeople meant that a vessel could readily be refitted or replaced. With the gradual transition from timber to modern construction materials in the last 20-30 years, and the decrease of skills in timber ship/boat building and shipwright work, these options are no longer practical or economically viable.

Australian National Maritime Museum

As the nation's foremost institution in the field of maritime heritage, this museum has pursued the development of a conceptual framework to guide historic ship conservation. Given the national significance of the fleet, the museum aims to achieve best practice status for vessel conservation.

Drawing from the conservation planning process for historic buildings in Australia, the museum's approach is based upon guidance provided by the Australia ICOMOS Charter for Places of Cultural Significance (The Burra Charter) and other heritage protocols promulgated by the Australian Heritage Commission and the Heritage Office of NSW. The conservation planning process provides a philosophical framework to underpin all conservation work. At the heart is the identification of significance – what is important about the vessel and how to ensure the sustainability of this significance in the face of constraints, to allow interpretation and access.

For some years, statements of significance, if not plans, existed for most vessels in the fleet, and though development had hardly progressed beyond this point, there was a clear understanding of the concept of significance and its intrinsic physical location. This has guided staff in the approach to be taken with any work required to identify those areas that were significant and vulnerable. The adoption of the conservation management plan model allowed a seamless link to develop between the established significance and the proposed conservation treatments and actions. This flow incorporated existing reporting systems, gave a documented basis for decision-making and provided an excellent didactic tool for training of staff in heritage management.

Activating the plans required the development, perpetuation and documentation of manual skills and techniques associated with traditional boat building, ship husbandry and the maintenance, where necessary, of redundant and superseded technologies.

Extensive documentation of all conservation procedures is maintained, posted to a share drive and is available for museum-wide use.

Facilities

Maintaining a fleet of museum vessels after the turn of the new millennium in Sydney is an increasingly insular activity. Where formerly the expertise needed to support traditional boat building resided in the commercial yards dotted around the harbour, the disappearance of these yards, coupled with changes in work practices and technology, have witnessed the demise of the skills base.

Additionally, the skills and approach required for vessel maintenance in a museum environment are different to those formerly found in the commercial area. The skills of existing fleet staff are diverse but complementary and focused on traditional technology. If the fleet is worth preserving, then as a museum, the challenge is now to be self-sufficient in order to survive in an environment of decreasing funds, increased public expectation and increasing shortage of skilled labour in traditional shipwright practices.

The Changing Waterfront of Sydney Harbour

The past decade has witnessed a massive reduction at the port of Sydney in the range and scope of marine facilities for supporting maintenance of the museum fleet. The trend of dockyard and slipway closures appears set to continue, with landowners relentlessly seeking to realise the maximum return on scarce waterfront land. The decline in ship repair facilities in Sydney seems inexorable, with uncertainty now over the future of most conventional slipways.

With the reduction in a labour force skilled in traditional technology and the increasing rates charges for contemporary trades in the remaining slipways, the ability of the museum to continue to pursue a policy of outsourcing significant amounts of work and engaging contractors to slip vessels is increasingly in doubt

A SWOT Analysis

Conservation and Restoration of Heritage Timber Vessels at the Australian National Maritime Museum

Strengths	Weaknesses
• Internationally and domestically recognised institute in maritime heritage • Large research library and knowledge base • Aim to foster traditional skills and practices • Maritime Museums of Australia Project Support Scheme – grants to non-profit maritime museums and historic societies • Location of museum in the CBD of Sydney which gives easy access to the public and tourists • Resurgence of the interest in classic and timber boats • Strength in the Australian economy, low cost of borrowing and consumer confidence • Increasing number of classic and timber boat festivals • Interest created by classic vessel regattas for public and tourist	• Lack of workshop facilities and slipway • Shortage of trained staff • Updating and modernisation of techniques and maintenance programs • Lack of infrastructure to support maintenance, slipping and moorings • Trained tradespeople shortage • Competing with modern ship and boat industry for tradespeople • Environmental regulation issues

The Australian Context

Opportunities	Threats
• Collaborate with research centres, TAFEs, universities and other cultural institutes • Consultation for other heritage industries • Raise international profile as a pre-eminent innovator in this field of expertise • The use of heritage vessel restoration on public display as tourist attraction • Obtain access to waterfront workshop facilities eg: Cockatoo Island • Build stockpile of structural materials eg: timber • To ensure that there is infrastructure in place for the future of slip and workshop facilities on the waterfront • The use of heritage vessel restoration on public display as tourist attraction • Public display of timber vessel construction as a tourist interest	• The loss of traditional skill and practices • The degeneration of historic vessels • Loss of maritime heritage • The disappearance of the working waterfront

Identifying the Skills Gap/s

Skills Deficiency – Definition

A skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutes. This demand is met where skills and knowledge are acquired on-the-job, gleaned from published material, or from working and/or study overseas. This is the key area targeted by the ISS Institute.

Recognising the Need for Additional Skills

The ever increasing tradespeople shortage across the board in Australia has also, inevitably effected the ship/boat building industry. Additionally, as the industry has moved towards modern materials, the training focus is on steel, aluminium and fibreglass vessel construction. With the focus on modern materials in construction, the lack of on the job training and traditional shipwright skills not being adequately taught at TAFE, a significant skills gap has evolved. With timber vessels still in commercial use (and the resurgence of the interest in classic timber motor and sailing boats for recreational use), the need for regular maintenance, restoration and conservation has led to a renewed demand for traditional shipwright skills.

Identifying and Defining the Skills Gaps

The skills gaps investigated were as follows.

Restoration, conservation and replacement of timber in vessels

Restoration and conservation:

- Isolation
- Consolidation
- Repair
- Treatment of rot and other damage

Replacing part of the timber by gluing or fastening a new piece of timber to the original is a traditional and widely accepted method. With this method there can be rot spore left in the original timber, which can go on causing damage. A method needs to be explored to stop and contain the rot spore.

Replacement:

- Laminating with modern glues and appropriate timbers
- Techniques in removing corroded fastenings
- Bending of replacement timber

Caulking of timber vessels

- Inspection and scheduling of caulked seams for replacement and hardening.

As caulking forms an integral part of a timber vessel's hull and deck, undertaking the correct process is imperative for maintaining watertight integrity. As most modern shipwrights and boat builders have little need for the technique, caulking is rarely covered in any great detail in trade certificate courses with the majority of skills learnt on the job.

Materials:

- Selection of oakum and cotton

Identifying the Skills Gap/s

Techniques:

- Picking, rolling, paying up techniques and materials
- Use of modern techniques on traditional vessels
- Use of tools.

General aspects of fitting out

Design: When traditional vessels are being restored, there is often the need for hatches, skylights and other deck fittings to be either refurbished or replaced. This can be done using traditional timber joinery or with the use of modern adhesives and fastenings. When undertaking this process it is important that the lines of the vessel match the deck superstructure and that the fittings be constructed correctly and remain watertight.

Investigate: Hatch, skylight and deck fitting design on traditional timber vessels, including consideration of materials, joinery and watertight integrity, keeping the aesthetical beauty of traditional timber vessels and the cultural significance of the vessel.

Maintenance scheduling

Preventative maintenance is an important part of the conservation process and it is vital to have a regularly reviewed maintenance schedule. This is best achieved using an electronic documenting system.

Documentation of museum vessels

Investigate:

- Systems for recording work undertaken.
- An economical way of documenting work carried out and ease of access to this information.

Restoration procedures for heritage vessels

- Develop a comprehensive understanding of restoration methods and philosophies of restoring timber boats for museums and private projects.
- Acquire knowledge on guidelines for timber vessel restoration.

Bronze casting for shipwrights

- Produce bronze cast hardware and fittings for traditional timber vessels.
- Further develop an understanding of pattern making and design for bronze casting.

Benefits in Obtaining Skills/the Threat of Not Obtaining Them

Maintaining skills relating to traditional boat building, as well as the integration of new technologies and conservation practices within the maritime heritage industry is vital for the preservation of Australian's maritime heritage. These skills need to be transferred to other artisans and apprentices through the Australian National Maritime Museum and to a wider base of specialist artisans through workshop seminars, public talks, TAFE and education programs, both within the museum and elsewhere through the traditional and wooden boat community.

If this does not occur, traditional trade practices and skills necessary for maintaining and preserving Australia's maritime heritage will be lost.

The International Experience

Mystic Seaport: The Museum of America and the Sea

The Mystic Seaport Museum is a living history museum, consisting of a village, ships and 17 acres of exhibitions depicting coastal life in New England in the 19th century. The Museum has a collection of 500+ vessels of all sizes, from rowboats to kayaks, from schooners to ships. The museum has a focus on preserving heritage vessels. It has staff and facilities dedicated for the sole purpose of restoration and conservation of traditional timber vessels. The Henry B duPont Preservation Ship yard encompasses a 500 tonne syncro-lift, which is a preferred method of slipping timber vessels, large workshops, a large array of woodworking machinery, its own sawmill and timber storage sheds.

Here Dunn worked for a period of three weeks with a team of shipwrights on the restoration of the 1947 New England eastern-rig dragger, *Roann*. In the three weeks he also meet and discussed with other museum and industry people relevant processes and techniques regarding timber vessel restoration and preservation. Working on *Roann* with a group of very experienced traditional shipwrights provided Dunn with the opportunity to observe, participate and learn about a variety of techniques, tools and products used at the museum.

The shipwright trade involves the use of both traditional and new technologies to undertake certain aspects of work. For example, when it is required that the wood finish be curved, a Spanish-made electronic compass plane is used to provide a fair line. While this work can still be undertaken using traditional techniques involving a hand compass plane or ‘adze’, the power compass plane is quicker and less labour intensive. When pouring pitch into deck seams after melting with heat, it is done with a traditional ladle in Australia, whereas in the USA, it was poured with a pitch cone, which is a more efficient and gives a neater pour.

Pitch cone used to apply pitch to seam

The International Experience

Restoration Documentation

Mystic Seaport Museum has a dedicated staff member who takes photos of the restoration projects in progress and then logs them with a short explanation. The computing system used is Windows based, easy to use and readily accessible for future reference. Having a staff member trained in photography and who understands timber vessel restoration work, enhances the quality of documentation.

Ships' Plan Collection

The Museum has a large catalogue of boat plans. These plans have been collected and also drafted from their boats in storage. These plans can be searched for on the museums web link (http://library.mysticseaport.org) and then bought from the museum if desired. The plans have been scanned onto computer to stop wear and tear on the original plans from the process of photocopying.

The boat plans are an archive of historic and classic vessel design and are artefacts in themselves.

In the context of restoration these plans are a useful tool and can be used for:

- Reconstruction of deckhouses, skylights and other fittings that could have been altered over time or are now missing.
- Restoring vessels to their original shape using the lines plan.
- Replacing of rigging and sails.
- Studying design for a certain era.

The plans could also be used in new boat construction, building of replicas and for design concept.

Small Boat Storage

Mystic Seaport Museum has a collection of 500+ small vessels from kayaks, guide boats, sailing dinghies and yachts. The vessels are in storage, where they are not subject to the elements of the weather. This storage area is not open to the public, though on occasion the museum will run tours. These vessels are in 'as acquired' condition. Some of these boats are restored for static displays and others may be used in certain museum programmes if needed.

Vessels that are not to be restored nor used for their intended purpose again are conserved and kept as artefacts for the use of the study of the boat history. Such history embodies the purpose and use of the design, technology in the era of the vessel, how and by who the vessel was used, construction methods and materials, and many other different questions that could be asked about the vessel in the future that may have not yet come to mind.

The museum has also built replicas of some of these vessels and through the building and use of these vessels, significant understandings can be developed regarding conservation and restoration of heritage timber vessels. This knowledge is enhanced by the museum's small boat building programme.

Plans of the boats in storage can be obtained from the ships' plan collection or lines plans may be taken off the original vessel in storage that also provide first hand insight into the vessels construction.

The International Experience

An example of the use of the boat plans collection and small boat storage in the wooden boat industry in the USA is the example of a local boat builder and restoration works Taylor and Snediker. Taylor and Snediker were asked to build three classic Herreshoff dinghies for tenders for larger Herreshoff yachts being restored at another yard. The museum has dinghy plans taken from the original Herreshoff built dinghy, which is in their small boat storage facility and is of the same era as the yachts being restored.

This example provides evidence of the value of:

- Adding value to larger vessel
- Co-operation between museum and private industry
- Appreciation of classic design
- Adding interest to historic vessels
- Traditional skills practised in construction
- Understanding traditional construction methods

Herreshoff dinghy in the Mystic Seaport Museum storage facility

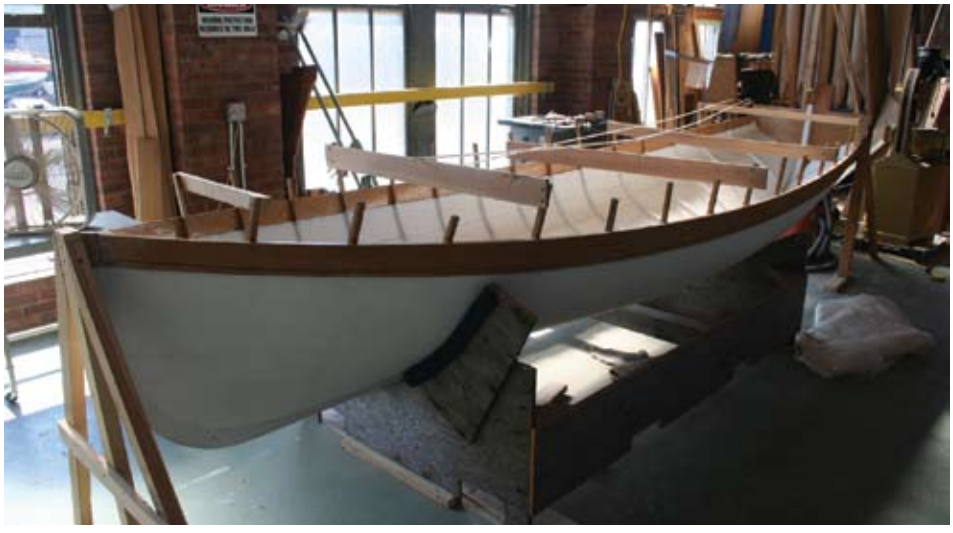
The International Experience

Taylor and Snediker built Herreshoff dinghy

The lines plans taken from a 15ft timber Whitehall rowing boat that Mystic Maritime Museum has in storage, along with the study of the original vessel, were used as a teaching aid for restoration students from International Yachting Restoration School (IYRS). The students and teachers built a replica of this vessel and discovered along the way some of the difficulties faced in building to the methods used in the original boat. The museum's Whitehall is, within the current knowledge of the museum, the only original true Whitehall from Manhattan still in existence, and as such this boat is a 'Rosetta Stone' for those doing research into Whitehalls. IYRS will sell the replica Whitehall they built for private use.

This provides a further example of the points listed on the previous page, as well as:

- Co-operation between museum and education institutes



Whitehall rowing boat replica at IYRS

The International Experience

Unique Whitehall rowing boat at the Mystic Maritime Museum storage facility

Roann

Roann is a 1947 timber New England east coast-rig dragger fishing vessel. In 2004 an extensive restoration of the vessel was started. Now near completion, the vessel is berthed alongside the museum wharf. Before the project was started there were considerations to be taken into account about whether to keep the vessel in the water or house it on land in a building. The option of keeping a large timber vessel like *Roann* on land within a building had conservation problems such as unnatural stress on the hull, loss of shape, drying out and warping of timber. The vessel's fastenings would continue to corrode and paint systems would eventually fail. On the other hand, if the vessel was preserved in the water it would be subjected to the elements and, due to this, would eventually lose more of its original fabric. In both cases land and water had their difficulties and drawbacks with the conservation of the vessel.

It was decided that *Roann* was to be preserved in the water, for importance of interpretation, so the public could see the vessel in its working state, adding to the story of the *Roann*. The museum has over 400,000 visitors per year.

The restoration started with the fishing gear on deck being removed, then the vessel was taken out of the water and moved into the large workshop area for an extensive restoration, involving replacement of steam bent timber, planking and the stem. Also replaced in the restoration was the deck planking and bulwarks. The vessel was pulled back into shape to her original lines and has been virtually given a new hull.

With only 25% of the vessels original fabric remaining, *Roann* remains an important object and example of the history of east coast fishing.

Roann berthed alongside the Mystic Seaport Museum Wharf

The Restoration Process

Timber Boat Restoration Methods and Philosophies for Museums and Private Projects

One of the considerations in restoring a timber vessel is to what extent the restoration will be carried out on the vessel. This decision has implications for cost, time, material and in the museum context, how much historic fabric will be kept. This is all governed by the condition of the boat, what it is going to be used for and where it is going to be kept or berthed.

In the restoration process there will be original fabric that will have to be replaced. The original fabric may have failed as a result of osmosis, unsuitable timber, cheaper choice of materials, varying work practices, attack by marine organisms, neglect, rot, or the material may have reached its anticipated working life expectancy.

It may be worthwhile considering the use of a material and preservation method that will ensure longevity. With a restoration where most or all-original fabric has been lost, it still retains significance with regard to the design and interpretation of historic vessels.

Timber Conservation

There are considerations to be taken into account when working with timber on heritage vessels. Maritime museums will try to preserve all of the original fabric, in this case timber on historic vessels. A primary objective is to maintain the authenticity of the artefact for educational purposes. As established previously, circumstances vary in conservation methods depending on what the vessel is used for, where and how the vessel is stored, (a controlled environment vs being subjected to all of the elements alongside a wharf). Additionally the vessel could be kept for its intended uses of sailing, motoring, rowing and paddling.

Treatment of Rot

With rot affected timber it needs to be ascertained as to why the timber was affected by rot in the first place to avoid repetition of the problem. Rot can be caused by design fault, osmosis, unsuitable timber, poor maintenance or an environment conducive for rot to inhabit and thrive, such as poor ventilation. The most common types of rot are dry or wet. This involves a fungus that attacks wood causing it to decay; it spreads via airborne spores that will grow when the right conditions occur.

In some cases it is not possible to treat rotten timber because the damage is too extensive; in such cases the affected timber has to be removed then replaced. After removal it is recommended that area around the affected area be treated with fungicide to kill any remaining spores. Applying such fungicides is a method used to treat rot-affected areas in timber when it only has been marginally affected by rot and still has its structural integrity and can be kept.

In the museum context, boron and ethanol glycol are the recommended fungicides; they are water based and this process is reversible which is in accordance with museum practice and policy. Once the timber has been treated to kill rot it may need consolidation with such products as epoxy resin, which stabilises and strengthens the timber. This usually is not a reversible method – primarily it is giving the ability to keep the timber instead of using replacement timber. There are some consolidating processes that are reversible.

One of the methods of conserving timber vessels is preventive maintenance. To stop the rot before it can occur the following should be observed:

- Ensure a non-conducive environment to stop fungal growth
- Use fungicides
- Salt water wash of decks on regular basis
- Good maintenance of decks to stop the ingress of fresh water

Replacement of Timber

If timber has failed due to rot it may be suitable to replace the timber. Best practice involves replacing like-with-like unless the timber failed due to poor selection or previous selection was based on what was at hand at the time or economical reasons. The reason for using the like-for-like method is that as boat timber expands and shrinks under different conditions. If it is the same species it is more likely to expand and shrink at the same rate causing less stress on the timber construction.

It should also be noted that consideration should be given to the varnishing of timber. Varnishing may need to be considered from an aesthetic point of view, and this can be extended to painted timber when the grain is visible through the paint.

Using timber that identifies with the region of the vessels origin can add monetary and historic value and this could apply to builders and designers who were known for their use of a timber species for such reasons as the quality of build, aesthetics, beauty and resilience to rot and marine organisms.

Steam Bending

Steam bending is one method used for bending timber around sharp bends. This may include fitting timber to a vessel's stem, timbers or thwart supports and for other applications such as mast hoops. The most successful method involves steaming the timber for one hour for each 25mm of thickness. If the timber is not steamed for a long enough time it may cause the timber to break in the bending process, or it may not bend. Over-steaming which dries the timber out too much will weaken it. Once applied, strapping is used around the outside surface of the bend. The strapping is metal and the timber has to be tight against it.

Ends remain on the strapping to hold the timber as it bends and it must be well secured to the strapping as there will be a lot of pressure put on them. This method relieves external and internal compression which decreases the likelihood of breakage; the strap bearing the outside tensile stress which would normally be taken by the outside curve of the timber.

Dunn attended a short seminar and demonstration on steam bending of timber for boats given by Wade Smith, a shipwright who specialises in timber boat restoration, at the 17th annual Wooden Boat Show that was held at Mystic Seaport Maritime Museum. The seminar and demonstration had useful hints and helped with the understanding of steam bending timber for the professional and the novice. This type of seminar could be run at public events ie: boat festivals in Australia, promoting Australian timbers and to educate about steam bending of timber.

Caulking

As caulking forms an integral part of a timber vessel's hull and deck, undertaking the correct process is imperative for maintaining watertight integrity. As most modern shipwrights and boat builders have little need for the technique, caulking is rarely covered in any great detail in trade certificate courses with the majority of skills learnt on the job.

Hull Caulking: Inspection and Scheduling of Caulked Seams for Replacement and Hardening

When a timber vessel is up for routine slipping, seams should have a general inspection. Obvious signs need to be investigated including:

- Wear and tear where putty is missing
- Loose strands of oakum and cotton
- Sites where caulking has squeezed out of the seam
- Areas of water seepage from the seams while on slipway
- Leaking through seams on the inboard side of hull planking

In these areas that need maintenance, the seam can be hardened after raking the seam compound out or replacing of caulking if needed. Note: seams should be dry before re-caulking.

As a general scheduling rule, butted seams should be re-caulked, inspected and hardened every three years. Butt joints are where two plank ends butt up together. Butt joints are more susceptible to failure because of the movement of the timber planking along the length of the vessel through use in seaways, causing the caulking to be ground away or loosen in the seam.

Hull Caulking: Paying up Techniques and Materials

Considerations for the selection of the appropriate materials include the:

- Amount of shrinkage and expansion of various timbers
- Elements the vessel is subjected to
- Amount of stress on the hull in a seaway
- Stress caused on the hull from the sailing rig
- Malleability of seam compound
- Protection from marine organisms denigration

Hull Caulking: Paying up Compounds

Paying up compound is the material that is knifed or squeezed into the seam that goes over the caulking. The compound needs to be supple and easily removed to maintain the caulking, this is where some modern materials fail. They tend to be rubberised and glued into the seam such as one part polyurethane sealants that have a high degree of mechanical strength. These products are hard to remove and if they fail on edge it is very difficult to find where the failure is located along the seam.

The main paying up compound used on traditional timber vessels under the water line at present is linseed putty mixed with either red lead, white lead or anti-foul. This is to stop marine organisms attacking and eating the putty. The advantages of using linseed-based compounds are ease of removal. They stay supple for a long period of time, are low cost and offer ease of application and maintenance.

Deck Caulking

A caulked deck on a traditional timber vessel keeps out sea water, the weather and also is an integral structure of a timber vessel. Maintaining the caulking and pitch is an important part of keeping the deck watertight and in good condition. Stopping fresh water ingress of deck seams and leaking through to deck beams, the hull and other vessel structures is essential. This is an important issue to stop the growth of rot, as rot needs 20% moisture content in timber to grow. A saltwater wash down of timber decks is a preventive maintenance procedure to stop rot and also helps stop timber decks drying out.

Deck caulking should be treated similarly to hull caulking, hardening up or replacement of caulking where leaks are found.

Butt ends of planks are susceptible to absorb water through their end grain and should have extra attention paid to them, especially around combings, bitts, margin boards and butted planks. Vessel movement also affects caulking in butt joints.

Use of Tools

The act of caulking and the proper use of caulking tools are very important to the life of a timber vessel and its watertight integrity. Caulking is ‘hands-on work’ that requires individual ‘adjustment’ with every timber vessel having its own characteristics. Common guidelines for all vessels include the following:

- Do not over caulk and split out back of planking.
- Do not over caulk, causing the seam to spread. Do not over fill seams with oakum or cotton; leave adequate space for paying up compound.
- Use good quality oakum and cotton.

Traditional caulking tools have developed over hundreds of years; the tools and techniques have not changed on the use of traditional timber vessels and it is important to understand these traditional methods.

Education and Training

There is a reasonable amount of information on caulking methods and materials available through the popular avenues such as books and the internet. To understand the skill and develop a feel for the technique requires ‘on the job’ training.

Dissemination of Knowledge and Skills

The following opportunities should be explored in regards to caulking methods:

- Dissemination of caulking knowledge and skills through workshops, seminars, public talks and education programs.
- A more in-depth study of caulking in the shipwright apprentice course at TAFEs could be given as an option.

Bronze Casting

Dunn attended a bronze casting course for shipwrights for six days in Brooklyn, Maine, at the Wooden Boat School. The school comprises a 60 acre salt water campus that accommodates 600 students each summer, who attend courses from skiff building, wood strip kayaks, blacksmithing, seamanship, navigation to wood carving for the novice and the professional boat builder. The school also publishes Wooden Boat Magazine, which has been published for 30 years. The bronze casting course for shipwrights involves pattern making, sand moulding, sand casting and setting up a small foundry. This included an efficient but inexpensive propane-powered furnace to produce bronze cast items such as rowlocks, nameplates, engine parts, tools and many more items for use in the boating industry. The ability and option of this skill can greatly add to the fitting out and improved design features of traditional timber boats.

Bronze casting: the Benefits

- Addresses the difficulty of acquiring off the shelf bronze fittings for traditional boats
- Ability to cast one off designs at a low cost
- Add value to product
- Produce replacement bronze fittings for restoration projects
- Provide unique bronze fittings to suit timber boats

Dissemination of Knowledge and Skills

The following opportunities in regards to bronze casting are:

- Dissemination of knowledge and skills of bronze casting through workshops, seminars, public talks and education programs.
- Demonstrations could be held at wooden boat shows across Australia to make people aware of the possibilities of being able to do their own bronze casting for the timber boat enthusiast and professionals in the industry.
- Courses could be run through TAFEs. Demonstration could be given to shipwright apprentices while they are attending TAFE courses.

Bronze being poured into a mould

Caulking iron pattern and bronze cast iron

Knowledge Transfer: Applying the Outcomes

The knowledge and skills that Dunn obtained through his Fellowship can be shared through the following.

Training and Transfer of Skills to Apprentices and Other Museum Colleagues at the ANMM

This knowledge transfer would be applied on a daily basis by working with apprentices and other tradespeople in a team environment. All work will be documented, giving details on individual situations and methods chosen. This information will be made accessible via the ANMM intranet.

Submit Articles for Publication to Industry Journals and Magazines

An article was written for the number 84 September-November 2008 edition of *Signals* magazine, outlining the purpose and aims of the Fellowship. *Signals* is the quarterly publication of the Australian National Maritime Museum and has a distribution of 6,500 including museum members, industry professionals and other cultural institutions.

Submitting articles to other such industry publications would not only provide a vehicle for information and knowledge transfer but also establishes the museum and its employees as an authority and knowledge base for the conservation and preservation of our maritime heritage.

Museum Website

The ANMM has recently established a blog on the museum website in order to inform, engage and encourage public dialogue. Written by staff from a range of areas across the museum, these entries will cover the day-to-day operations and functions of the museum, the progress of major projects, maritime industry developments and current events. Submitting blog entries on wooden boat conservation and preservation practices would not only provide information, but also create awareness and encourage public discourse around such practices. By utilising the online environment, this can provide a clear avenue of contact to Dunn and his colleagues and facilitate information exchange.

Demonstrations to TAFE Students in the Marine Craft Construction, Certificate III for Ship and Boat Building

Dunn is available for demonstrations of bronze casting, caulking timber vessels and steam bending of timber. Talks could be given on the subject of timber boat restoration and conservation methods and philosophies. As these skills are not often taught in any great detail this will provide an opportunity to increase the knowledge of emerging tradespeople and bring awareness to traditional methods and practices.

Courses and Demonstrations at Maritime Festivals and Boat Shows

Demonstrations could be run at festivals such as the Classic and Wooden Boat Festival in Sydney and other boat shows around Australia. This could be incorporated with promotional work of Dunn's employer, the Australian National Maritime Museum.

Conduct Talks for Members Program at ANMM

The ANMM members department could be approached, in order to give seminars and talks to the museum's members.

National Training

Dunn is available to discuss his findings with the Transport and Logistics Industry Skills Council to ascertain inclusion in the relevant National Training Package/s.

Recommendations

The following are recommendations to government, industry, professional associations, education and training providers, our community and the ISS Institute.

Government

For the Sydney maritime industry to be able to accommodate traditional vessels, it is essential for government to maintain the necessary infrastructure and resources. The Sydney waterfront has traditionally generated industries that support and maintain a varied maritime culture.

As the nature of the industry has changed from deep-sea vessels to harbour ferries and from commercial to recreational craft the waterfront has evolved to reflect these trends. This, coupled with the increasing value of waterfront land, changed government policies, the ascendancy of developers and the voracity of resident groups seeking access and open space in any redevelopment, has led to the demise of a number of major marine contractors and their facilities.

Industry

It is necessary for measures to be put in place in order to ensure that timber remains a renewable resource for future restoration and building projects. At present the industry is seeing a severe shortage of suitable timber for marine restoration work. This could be overcome by a more proactive approach in regards to plantation grown timber.

General guidelines should be set for timber vessel restoration projects. This would act as a guide for both the public and industry professionals. This guide should be developed in consultation with collecting institutions such as the ANMM and published online.

Professional Associations

The Fellow recommends the creation of a professional timber vessel restoration and conservation association. This association could involve networking and knowledge sharing. Information may include material sourcing as well as product and technical advancements. This association could be run in conjunction with other trade associations such as Boating Industry Australia.

Education and Training

A more in-depth study of traditional shipwright practices and methods is needed in the shipwright apprentice trade course at TAFE. This could be complemented by an international exchange programme for students or shipwrights in the industry.

Community

The Fellow recommends that local councils support and promote heritage vessel regattas, fairs and boat shows in order to raise awareness and involve the public in maritime heritage.

Recommendations

ISS Institute

The ISS Institute could work in partnership with TAFE and apprentice training companies as well State and Federal Governments in order to establish a specialised training program. Apprentices could be used for a restoration project of a vessel during their studies. The restoration of a prominent vessel would assist in attracting interest and sponsorship opportunities.

Further Skills Gaps

Skills gaps are likely to develop in traditional timber vessel slipping as more and more mariners prefer the use of travel lifts, which are not appropriate for traditional timber vessels. Shipwrights would also benefit from a specialised course in traditional conservation methods and practices aimed specifically for wooden vessels in their natural environment.

References

Australian National Maritime Museum
www.anmm.gov.au

Mystic Seaport: The Museum Of America and The Sea
www.mysticseaport.org

International Yacht Restoration School
www.iyrs.org

The Wooden Boat School
www.thewoodenboatschool.com