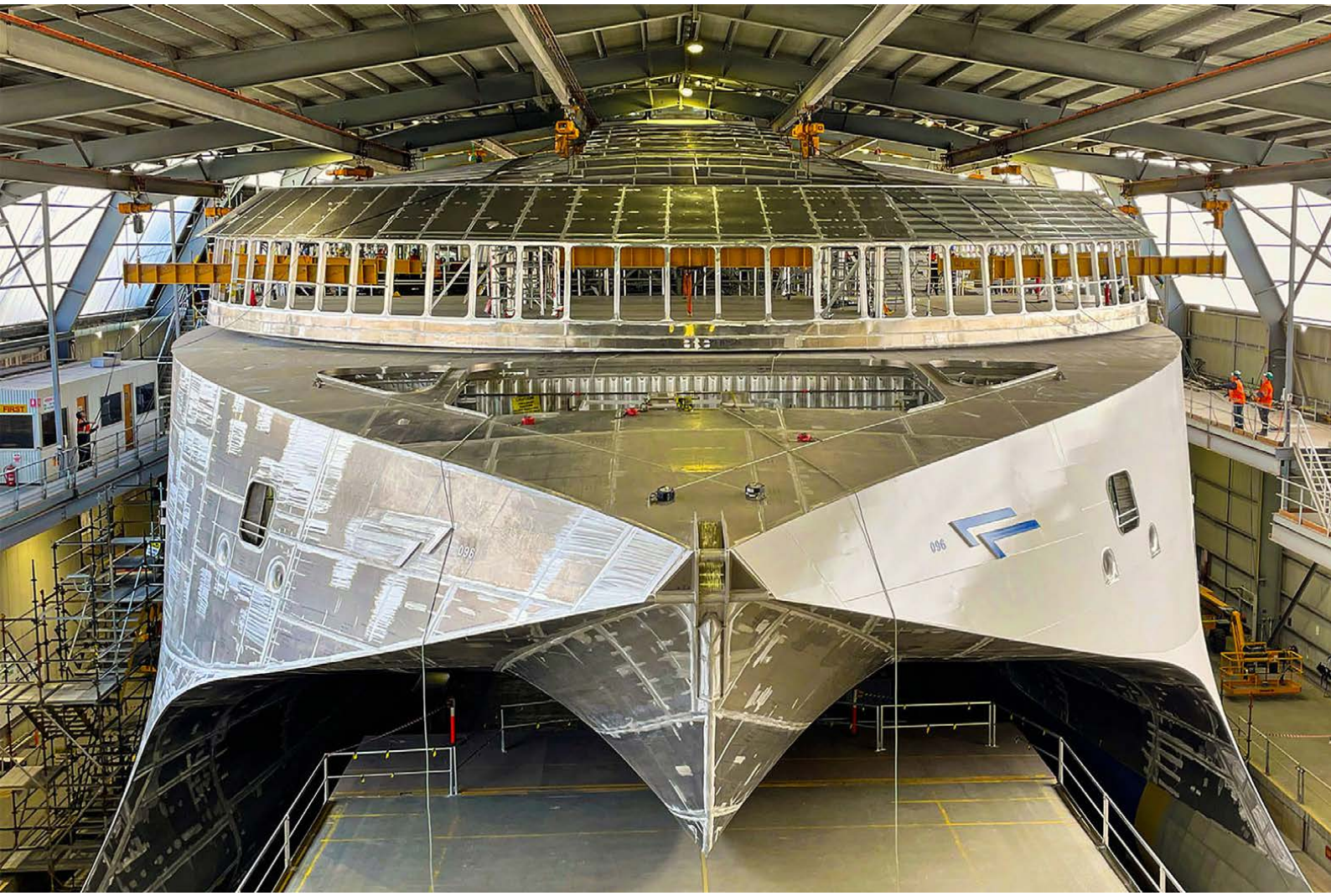
THE AUSTRALIAN NAVAL ARCHITECT



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NOVEMBER 2024

A combined Royal Australian Navy and Australian Army fly-over during the Fleet Review in Sydney Harbour by Their Majesties King Charles III and Queen Camilla on Tuesday 22 October 2024
(RAAF photograph)

THE AUSTRALIAN NAVAL ARCHITECT

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Cover Photo:

Progress at Incat Tasmania with the construction of the world's largest electric ferry
(Photo courtesy Incat Tasmania)

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RINA Australian Division
on the
World Wide Web
www.rina.org.uk/publications

From the Division President

To all our Australian RINA members and everyone reading this freely-distributed journal, welcome to the November edition of your favourite, informative and most-relevant publication on naval architecture in Australia.

Since August, technical presentations have included:

- *Naval Crew Size and Habitability: Where is the Future?*, by Michael O'Connor, Taylor Bros, online and at the Australian Maritime College in Launceston and in person at Taylor Bros in Hobart.
- *Docking James Craig on the Floating Dock*, by Sean Langman, MD of Noakes Group, and John Butler, Principal, John Butler Design, online and in person at the Royal Prince Edward Yacht Club in Sydney.
- *The Story of Sagan: Building a 36ft Huon Pine Yacht by Hand in the 1980s*, by Derek Shields, online only.
- *Hydrogen Powering of Vessels,* by Andrew Harris, Lead for the Hydrogen Powering of Vessels Project, Blue Ecomomy CRC, in person only at the University of Adelaide.
- *Ship Electrification: a Viable Pathway for Decarbonisation*, by Ashar Khan, Manager New Builds Marine, Wärtsilä Australia, online and in person at the Sydney Mechanics School of Arts.
- *How will Shipping Meet its Zero Target of Decarbonising by 2050,* byProf. Stephen Turnock, Head, School of Engineering, University of Southampton, online and at Taylor Bros in Hobart and in person at the Australian Maritime College in Launceston.
- *Digital Twins*, by Lars Holterud Aarsnes, Head of Maritime Advisory for South East Asia, Pacific and India, DNV, online and in person at Navantia offices in Docklands, Melbourne.
- *Autonomous Surface Vessel Design Considerations*, by Allen Stotz, Torsten Lau, Eliah Cameron and Michael Reilly, Gibbs & Cox Australia, online and in person at the Sydney Mechanics School of Arts.
- *Antarctic Expedition Programs*, by Graeme Elphinstone, Principal, Elphinstone Engineering, online and at the Australian Maritime College in Launceston and in person at Taylor Bros in Hobart.
- *Measured and Modelled Flow around Container Ships in Shallow Water,* by Dr Tm Gourlay, Principal, Perth Hydro, in person only at the Flying Angel Club in Fremantle.
- *Composite Ingenuity,* by representatives from Fuze Solutions, in person only at the Flying Angel Club in Fremantle.
- *Adversarial Machine Learning: The Maritime Context,* by Dr Yee Wei Law, Senior Lecturer, University of South Australia, in person only at the University of Adelaide.
- *Structural Integrity and Safety of Older Ships in a Seaway*, by Martin Renilson, Adjunct Professor, Australian Maritime College, University of Tasmania, in person only at the University of Adelaide.

Jonathan Binns

These offer an amazing way to find out what naval architects are doing around Australia and to increase your CPD. They were all publicised through your local secretaries; you can attend in person if you're in the state at the time and meet up with other professionals just like you!

As we speed towards the end of another huge year for the maritime industry in Australia, I know of two great end-of-year catchups coming up, but I'm sure there are more! In the lead up, please do take the time to say a festive 'hi' to your colleagues. The two I know of are on 15 November in Melbourne and 5 December in Sydney—these are wonderful chances to see current colleagues and a chance to meet new ones for the new year. Do get in touch with your local committee to check in on these dates if you're in Melbourne or Sydney, but also get in touch with your local committee in other states to see if it's possible to have a set or informal catchup.

Coming up later in the new year is Indo Pacific 2025 on 4–6 November 2025, 373 days, 16 hours, 20 minutes and 7 seconds to go (when I wrote that sentence); by the time of the next issue of *The ANA* we could see announcements and call for abstracts for IMC2025.

We mentioned the Warship 2024 conference in the last issue of *The ANA*; before the conference hall got cold on the last day, plans were already being made for the next, and I've been reliably told that RADM Durbin, Head Navy Engineering, did mention to RINA representatives to send her an invite to one next in Australia, as she was sure it would be equally as successful. The next such conferences are in June 2025 in Glasgow, and the following year we have a booking for June 2026 in Australia. Our biggest problem at the moment is to make sure that this doesn't interfere with the Indo Pacific IMC to be held in November 2025—perhaps we're becoming "victims of our own success"!

Earlier in the year, Rob Gehling and I met with the Chief Systems Engineer from the Capability, Acquistion and Sustainment Group (CASG), discussing the sponsoring of the Department of Defence (DoD) for RINA membership right through to Chartered Engineer status. DoD has a big drive on at the moment for more suitably qualified and experienced members to obtain Chartered Status, and RINA is specifically listed as one of four societies which can be used to obtain sponsored status. This is across all Australian Defence Force and Australian Public Service employees. If you do work within ADF or APS, then ask your boss about Defgram 488/2023 and upgrade yourself to chartered status.

Members of the Australian Division Council. with support from RINA HQ in London, continue to provide advice to senate hearings and committees; ably led by Rob Gehling, these initiatives put the needs of naval architects at the front of mind for these inquiries. The latest was the Joint Standing Committee on Treaties, held on 24 October and looking at the agreements between Australia, UK and the USA for the purpose of future submarine developments. This was a direct follow on from Rob leading the submission to the standing committee on Foreign Affairs, Defence and Trade in February. During these engagements the role of naval architects in the shipbuilding enterprise was explained on a number of levels, highlighting the critical shortage of supply of naval architects we are experiencing now, and how it is set to get worse in coming years.

Our government interactions have also extended to discussing skills competency frameworks for naval architects working on submarine projects. This discussion highlighted the connections between disciplines which naval architects form and how critical those connections are. It also highlights the way in which naval architects simply can't be stove-piped along with other professions when classifying skill sets.

Finally, along with the RINA Improvement Working Group, I will be hosting a workshop in Melbourne on 29 November to discuss and develop realisable and effective plans to help make the Australian Division of RINA be more for members and more for the entire maritime industry, perhaps even more for the Australian community. We have sent save-the-dates and invites out, but if you do want to come to Melbourne on 29 November to imagine what we could do, do get in touch with me directly (email and phone—leave a message!—below).

Signing off, please do join your local committee, please do contribute to the activities of your local Section and, indeed, those of the Division and the wider Institution; our members are what have made and continue to make us.

Jonathan Binns

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Editorial

As the nations of the world struggle to meet emissions targets in an effort to ward off the worst of global warming, pressure is mounting on the shipping sector to reduce its greenhouse gas emissions. Some change is evident today as ship owners adopt alternative power sources. It seems likely that a range of solutions may be adopted, including wind (everything old is new again), hybrid diesel/electric, all electric, and fuels such as LNG, methanol, ammonia and hydrogen. Chosen options will, no doubt, depend on many factors including ship sizes and routes.

All the options for emission reduction have infrastructure implications. All electric ships will need shore supply facilities for recharging. The alternatives to oil as fuel in internal combustion engines are all challenging as the fuels are volatile and potentially dangerous. It may take many years for port infrastructure to keep up with the changing demand for fuels and one might wonder how much progress is being made to provide the fuels which will be needed by the ships of the future.

Another option has also arisen—nuclear. The use of nuclear power for warships, submarines and ice-capable ships is now decades old. Studies into the use of nuclear propulsion for LNG carriers and container ships raise the possibility that large, nuclear-powered commercial vessels may appear on the world's oceans in coming decades. If this does occur, noting that it is now over fifty years since the first nuclear-powered merchant ship, *Savannah*, was taken out of service, there will be an enormous demand for suitably qualified people to build, crew and operate these ships, and for nations to develop the standards and infrastructure to manage nuclear ships in their ports.

Australia has always been reluctant to adopt nuclear energy. Perhaps this is not surprising given our abundant and relatively cheap fossil fuel resources. The AUKUS alliance and the decision to equip the Royal Australian Navy with nuclear-propelled submarines have begun to drive change, particularly for the Navy and its supporting industry. There is much to do before the first nuclear submarine is commissioned into the RAN. The possibility that we may need to contemplate the arrival at our ports of nuclear-powered container ships adds to the challenges we may face, possibly sooner than most might expect.

Nuclear-powered vessels have been safely visiting Australian ports for over six decades. Of course, these ships have been submarines, surface combatants and the world's largest aircraft carriers, not commercial vessels. Today the number of Australian ports able to host a nuclear visitor is limited. That may need to change in a hurry if nuclear-powered ships begin carrying our trade.

John Jeremy

An early nuclear visitor—USS *Sculpin* (SSN590) entering Sydney Harbour on 2 May 1964 (Photo John Jeremy)

COMING EVENTS

Tasmanian Model Solar Boat Challenge

The Tasmanian Model Solar Boat Challenge 2024 will be held on Monday 2 December from 10 am to 1pm at Friends' Bell Street Grounds, Queen's Walk, New Town. The event is organised by Marc Iseli from the University of Tasmania, with some input from RINA's Chris Davies, and is open to school-age students.

The event encourages many aspiring concepts of naval architecture and engineering; teamwork, original design, competition, use of recycled materials and troubleshooting on the day, with prizes awarded accordingly.

There is expected to be stiff competition. Sorry, but adults are not allowed to enter; perhaps if there is significant demand an "open" class could be considered by the event organisers. It is clear from past competitions that there has been significant evidence of "input" from mums, dads and grandparents in naval architecture, aspiring to hydrofoil and swath designs but, to date, these have all been unsuccessful on the day!

Details of construction materials allowed will be forthcoming. Initial rumors are that Huon pine may be more favourable than treated pine or polystyrene.

The December competition is a lead-up to the Australian Wooden Boat Festival, where a similar event will be held on the lawns of Parliament House during the festival from 7 to 10 February 2025.

For more information on the Tasmanian Model Solar Challenge see https://www.tassolarchallenge.org/ and

https://www.facebook.com/tassolarchallenge/.

NSW Section

The twenty-fourth SMIX (Sydney Marine Industry Christmas) Bash will be held on Thursday 5 December aboard the beautifully-restored *James Craig* alongside Wharf 7, Darling Harbour, from 1730 to 2130. This party for the whole marine industry is organised jointly by RINA (NSW Section) and IMarEST (ACT & NSW Branch). Join your colleagues in the maritime industry and their partners for drinks and a delicious buffet meal on board the unique 19th century iron barque. Cost is $65 per head for RINA/IMarEST members, and $80 for non-members. Dress is smart casual, but no stiletto heels on the timber decks!

Those wishing to attend this Sydney Maritime Industry Christmas Party should purchase their tickets through www.trybooking.com. Search for SMIX and follow the prompts. Payment only accepted by Visa and Mastercard.

There is a limit of 225 attendees on the James Craig and we have had to turn away members and friends in previous years, so you are urged to book early.

NSW Section Technical Presentations 2025

Technical presentations are generally combined with the ACT & NSW Branch of the Institute of Marine Engineering, Science and Technology and held on the first Wednesday of the month (February through October) at the Sydney Mechanics School of Arts, 280 Pitt St, Sydney, or at a yacht club, and recorded for webcasting, starting at 18:00 for refreshments and 18:30 for the presentation, and finishing by 20:00. Guests are welcome.

The program of meetings for 2025 (with exceptions noted) is as follows:

5 Feb	Ben Webster, Operations Director, Chillflow Solutions *Marine HVAC and Refrigeration Engineering Solutions*
5 Mar	Warren "Skip" Miller, Senior Engineer, Composites Consulting Group *From Naval Architecture Dreams to Composite Engineering Reality* Royal Sydney Yacht Squadron
5 Mar	RINA NSW Section Annual General Meeting
2 Apr	IMarEST
7 May	Nigel Mathews, Managing Director, Oceans Rivers Lakes *Stability Assessment of a Catamaran using High-throughput Testing and Sea Trials*
4 Jun	Drew Shannon, Managing Director/Salvage Master, United Salvage *Salvage and Emergency Response*
2 Jul	David Payne, Honorary Research Associate and former Curator of Historic Vessels, Australian National Maritime Museum *Walter Reeks, Naval Architect, Yachtsman and Entrepreneur, and the Vessels he Designed*
6 Aug	IMarEST
3 Sep	Alan Steber, General Manager, Steber International *Steber 43 Hybrid Diesel-Electric Workboat* Royal Prince Edward Yacht Club
1 Oct	IMarEST
4 Dec	SMIX Bash 2025

EXA 2025

For over 40 years Energy Exchange Australia (EXA), previously known as AOG Energy, has cemented itself as a critical event in the oil, gas and energy market. Held annually in Perth, EXA builds on the strong legacy AOG Energy has established but with a modern outlook and new opportunities.

EXA is dynamic and immersive, with improved experiences to connect, inspire, and exchange initiatives. It tackles key industry challenges, encourages disruptive conversations, and showcases prominent influential industry figures who are making a difference in the energy transition, accelerating us to a decarbonised future.

EXA 2025 will be held on 11–13 March 2025 at the Perth Convention and Exhibition Centre.

For further information, contact <exa@divcom.net.au>.

Warship 2025

Warship 2025 *The Future Fleet: Smart Technology, Sustainability and Autonomy* will take place on 16–17 June 2025, with additional optional workshops and activities on 18 June 2025, in Glasgow, UK.

Warship 2025 will build on the momentum from this

year's successful event in Adelaide, which saw over 230 delegates join us for an inspiring two days of naval defence collaboration and knowledge-sharing. With keynotes from prominent figures like RADM Rachel Durbin and Austal Limited's Glenn Callow, the event covered cutting-edge topics from autonomous vessel design to disruptive technologies, and welcomed attendees from across the UK, Australia, Canada, the USA, and Europe.

Returning to the UK, Warship 2025 is set to be RINA's most ambitious conference yet. This year's theme *The Future Fleet: Smart Technology, Sustainability, and Autonomy,* will set the stage for a packed agenda of thought-provoking presentations, interactive panels, and hands-on workshops.

The sessions will dive into core topics that are shaping the future of modern fleets:

- Technology to improve availability
- Glide path to Level 4 autonomy
- Drive toward net zero
- Blend of crewed/uncrewed — Do future platforms need crews?
- Lean crewing
- Tech advancement
- More sustainable build techniques

At Warship 2025, you will have the chance to collaborate with industry leaders, participate in hands-on activities, and contribute to the evolving landscape of naval defence. Don't miss this opportunity to be part of an event that's shaping the future of warship technology.

Submit Your Abstract

For those interested in presenting, please submit your abstract by 16 December 2024 at https://rina.org.uk/events/events-programme/warship-2025-the-future-fleet-smart-technology-sustainability-and-autonomy/.

Registration and Sponsorship Opportunities

If you would like to join as an attendee, you can book your ticket or register your interest at https://rina.org.uk/events/events-programme/warship-2025-the-future-fleet-smart-technology-sustainability-and-autonomy/.

Sponsoring and Exhibiting

Special thanks to BMT, RINA's returning sponsor! RINA has a few additional sponsorship and exhibiting opportunities available, offering an excellent platform to build brand awareness in the warship industry and to engage directly with our targeted audience. Sponsorship opportunities are limited, so if this is of interest, please contact Rusne Ramonaite at RINA HQ < rramonaite@rina.org.uk>to discuss the available options.

Indo Pacific 2025—IMC2025

The Indo Pacific International Maritime Exposition is the region's premier commercial maritime and naval defence exposition, connecting Australian and international defence, industry, government, academia and technology leaders, in the national interest. The three-day event is a platform for engagement and incorporates an international industry exhibition, specialist conference program featuring presentations and symposia from leading maritime institutions and networking opportunities. Indo Pacific is strongly supported by the Royal Australian Navy, the Australian Department of Defence and the NSW State Government.

AMDA Foundation in conjunction with the Royal Australian Navy has committed to the future dates of the Indo Pacific International Maritime Expositions. Indo Pacific is a critical platform for engagement where customer and industry connect and commercial maritime and naval defence suppliers promote their capabilities to decision-makers from around the world.

Planning has begun for the International Maritime Conference 2025, organised by the Royal Institution of Naval Architects, the Institute of Marine Engineering, Science and Technology and Engineers Australia, and will be held at the International Convention Centre Sydney on 4–6 November.

Indo Pacific 2027 is also planned for early November in that year. Put these dates in your diary now and plan to be there!

NEWS FROM THE SECTIONS

Western Australia

Measured and Modelled Flow around Container Ships in Shallow Water

Dr Tm Gourlay, Principal of Perth Hydro, gave a presentation on *Measured and Modelled Flow around Container Ships in Shallow Water* to a meeting at the Flying Angel Club in Fremantle on 9 October. The presentation was attended by 22.

Container ships are the racehorses of the cargo shipping world, with fine lines designed to travel at high speed. This presentation discussed a linear method (SlenderFlow) and a nonlinear method (phFlow) for calculating flow around container ships at moderate-to-high speeds in shallow water. Wave patterns and dynamic sinkage and trim were discussed, and results were compared with full-scale measurements on container ships in the Fremantle shipping channels, and model-scale measurements on container ships in the Duisburg towing tank.

The presentation was not streamed live but was recorded and is available on the Perth Hydro website at www.perthhydro.com/archive.html.

The Presenter

Dr Tim Gourlay MRINA is a mathematician specialising in ship hydrodynamics. Through his company, Perth Hydro, Tim undertakes ship motion modelling and measurements, locally and internationally. Tim's experience with container ships includes conducting full-scale measurements on over 40 container ships in Hong Kong, the Torres Strait, Fremantle and Napier, as well as coordinating international benchmarking exercises on container ship motions in shallow water.

Composite Ingenuity

Jason Lecoultre, Managing Director, Fuze Solutions also gave a presentation on *Composite Ingenuity* to the meeting at the Flying Angel Club in Fremantle on 9 October. The presentation was attended by 22.

This presentation gave an overview of the current capabilities of composites to provide cost-effective temporary and permanent repairs to ships and maritime structures, both above and below the waterline. Steel repair and replacement solutions which extend asset life, reduce maintenance downtime and increase revenue were presented.

The presentation was not streamed live or recorded.

The Presenter

Fuze Solutions ensure the reliable and continued operation of critical assets by combining sophisticated composite technology with complex engineering-style thinking, from simple fixes to sophisticated and extensive repairs.

RINA WA at Fremantle Maritime Day

This year's Fremantle Maritime Day was held on Saturday 2 November 2024 at the Fremantle Passenger Terminal with more than 90 displays, free harbour boat rides, tours of tugs and emergency-response vessels, Border Force display, Royal Australian Navy interactive displays, kids dress-ups as a mermaid, pirate or fish, free entertainment, music, train rides, face painting, art, etc., visits to the WA Maritime Museum, and historic and modern photography displays.

The RINA Stand at this year's Fremantle Maritime Day was an outstanding success, thanks to all WA members who assisted and, particularly, to Ken Goh who supplied the student-pleasing Lego models (*Nuyina* with *Millenium Falcon* on her aft deck, and *Titanic*), the practical stability challenge, and the virtual reality headset—how could anyone not be interested in an engineering career after all that?

About 9000 people attended the event, roamed the stands and visited the ships berthed alongside. The Australian Maritime College also had a stand there and reported real interest from potential students—we shared brochures and information with them, and also with IMarEST who shared our stand—and we look forward to a surge in student naval architects!

Jim Black

RINA's stand at the Fremantle Maritime Day
(Photo courtesy Jim Black)

South Australia and Northern Territory

Hydrogen Powering of Vessels

Andrew Harris, Lead for the Hydrogen Powering of Vessels Project, Blue Economy CRC, gave a presentation on *Hydrogen Powering of Vessels* to a meeting in the Napier Building at the University of Adelaide on 28 August.

The Blue Economy Cooperative Research Centre is a 10-year multi-participant academic and industry research program, looking at the future of the oceans to provide Australian energy, food and decarbonisation of seaborne transport in a sustainable future.

One of the Blue Energy CRC's research projects currently being undertaken is an investigation into the future of hydrogen as a fuel for ships and boats in Australian waters. This presentation covered the research to date, including a review of global technology demonstrator vessels past, present and future. Work to study the redesign of conventional vessels to contain a hydrogen propulsion system was described, as well as case studies which modelled some of the key performance risks of hydrogen-powered vessels. Finally, a review of some of the technology options now entering the market was given.

The Presenter

Andrew Harris graduated with a Bachelor of Ship Science degree from the University of Southampton, UK. He joined BMT's UK defence company as a naval

architect in 1996, spending over 20 years working in naval submarine sustainment, surface warship design and, finally, superyacht concept design. Having emigrated to Australia in 2019, he remains with BMT, working in Adelaide on a diverse portfolio of defence, commercial shipping and marine renewable energy projects. Andrew is a Chartered Engineer and a Member of RINA. A passionate advocate for sustainable development of Australia's blue economy, Andrew is the Blue Economy CRC's lead for the Hydrogen Powering of Vessels Project.

Adversarial Machine Learning: The Maritime Context

Dr Yee Wei Law, Senior Lecturer, University of South Australia, gave a presentation on *Adversarial Machine Learning: The Maritime Context* to a joint meeting with the Institute of Marine Engineering Science and Technology in the Engineering South Building at the University of Adelaide on 16 October.

Adversarial machine learning (ML) is the study of the capabilities of attackers and their goals, as well as the design of attack methods which exploit the vulnerabilities of ML during the ML life cycle. Since the discovery of the adversarial vulnerabilities of deep neural networks by Google Deepmind in 2014, the field of adversarial ML has been experiencing exponential growth. Last year, the Australian Signals Directorate published *Guidelines for Secure AI System Development*, which include precautions against adversarial ML, highlighting the impact of adversarial ML. Together with the Australian Institute for Machine Learning, we have been investigating adversarial ML in the space context. This presentation covered the work we have done in the space context, and extend the lessons learnt to the maritime context, as well as discussing what other adversarial ML researchers have done in the maritime context, and highlight some implications which maybe of interest to the maritime community.

The Presenter

Dr Law received his BEng, MEng and PhD degrees from the University of Southampton, Nanyang Technological University, and University of Twente respectively. Before joining the University of South Australia, Dr Law was a Research Fellow at the Department of Electrical and Electronic Engineering at the University of Melbourne. Dr Law's research interests are diverse, but he is currently focussing on funded projects in the areas of adversarial machine learning, hypersonic vehicle detection, and machine prognostics. Dr Law has been involved with numerous European projects on sensor networks, including EYES, SENSEI, Internet of Things Initiative, SmartSantander and SocIoTal; being a Chief Investigator in the last three projects.

Structural Integrity and Safety of Older Ships in a Seaway

Martin Renilson, Adjunct Professor, Australian Maritime College, University of Tasmania, gave a presentation on *Structural Integrity and Safety of Older Ships in a Seaway* to a meeting in the Engineering South Building at the University of Adelaide on 13 November.

Structural maintenance is a large cost driver in ship operations, and the desire to minimise these costs can risk degradation in a ship's structural material state. Older ships have been lost due to global structural failure in waves, sometimes with catastrophic consequences.

This presentation described how the sea environment is characterised, the derivation of ship responses for global motions and stresses, and the influences of fatigue and corrosion. Methods of modelling were discussed with particular focus on the use of Smooth Particle Hydrodynamics and how the modelling technique can be used in combination with Finite Element Analysis.

The Presenter

Prof. Renilson moved to Tasmania in 1983 to work at the Australian Maritime College, where he established the Ship Hydrodynamics Centre in 1985, and the Department of Naval Architecture and Ocean Engineering in 1996, with the first naval architecture and then ocean engineering degrees at AMC. In 2001 he moved to the UK to work at QinetiQ as Technical Manager, Maritime Platforms and Equipment. In this role he was responsible for all hydrodynamic research for the UK Ministry of Defence. In 2007 he returned to Australia where he now has a position as Adjunct Professor at AMC/UTas.

He has recently been involved in a research project on the numerical modelling of ship response under corrosion, fatigue and complex sea-state environments which was funded by the Australian Research Council.

Andrew Harris

Victoria

The Story of *Sagan*

Derek Shields gave a presentation on *The Story of* Sagan*: Building a 36 ft Huon Pine Yacht by Hand in the 1980s* as a webinar (i.e. streamed live only) on 28 August. The presentation was attended by 11 online.

This presentation covered Derek's building of a 36 ft (11.0 m) Huon Pine yacht from 1983 to 1985 and a highlight of its voyage across the Southern Ocean. These were the days of designing boats by eye. No calculations; dimensions and curves were "a bit tighter or fuller than on this boat or that". Building was by hand, eye and feel, offering up and trimming, nailing and roving, planing and sanding.

After deciding that the only way he could afford to go world cruising on his own boat was to build it, Derek spent three years learning and applying the art of building a timber yacht as he constructed *Sagan*, a beautiful carvel planked, splined, laid-deck cruising yacht. In the subsequent 39 years, *Sagan* has carried Derek, his family and his friends on many adventures over many thousands of miles, and sails proudly to this day, ready for more adventures.

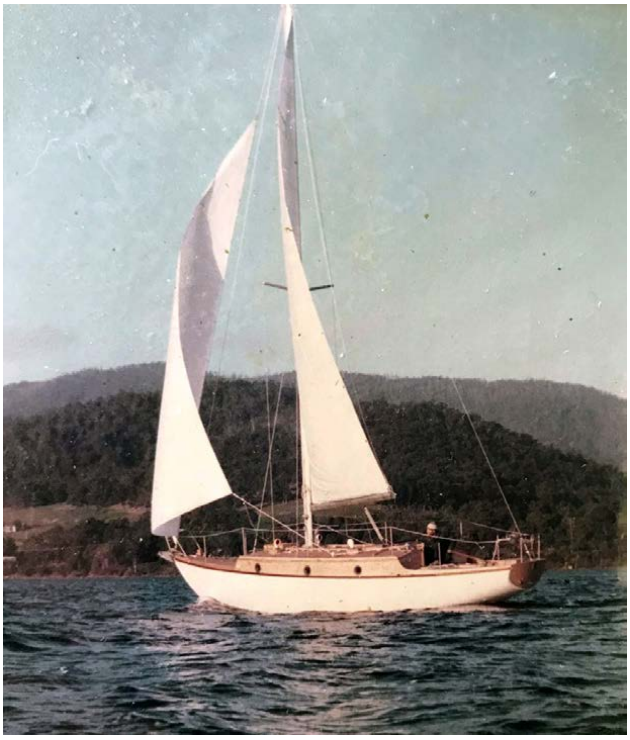
Derek went into some detail of the design drawings and techniques involved in building a timber boat, with participants gaining an insight into the many thousands of parts which are shaped and hammered and bolted in many ways to complete the construction of a boat as small as 36 ft.

Sagan's maiden voyage was across Bass Strait, around Australia to Darwin and then Africa via many islands and anchorages, down to Durban and then across the Southern Ocean back to Tasmania. To finish up, Derek showed a selection of photos from his voyage to Amsterdam and the

St Paul Islands which are halfway between Durban and Hobart and a long way from everywhere else.

The presentation was not recorded.

Sagan under construction
(Photo courtesy Derek Shields)



Sagan sailing
(Photo courtesy Derek Shields)

The Presenter

Derek Shields grew up on a farm where he learned to build whatever was needed and to fix whatever broke down. He gained a Bachelor of Science in a mixed degree at Flinders University, then worked on a cray boat on Tasmania's west coast and down the mines at Rosebery to save for a trip around the world. That trip lasted 15 years and morphed into working on oil rigs as a geological engineer in many countries.

His love of the sea, boats and adventure eventually resulted him building his own yacht and sailing with Mary, his wife to-be, for four years around Australia and the southern Indian Ocean. He then settled in Tasmania and ran a geological engineering business for three years. With two friends, he founded a marine biological business to monitor the impacts of salmon farming and conduct environmental impact assessments in Tasmanian coastal waterways. Along the way he built two family homes.

Since retiring he has worked as a volunteer skipper for a marine research organisation, Reef Life Survey, sailing and maintaining ocean-going sailing catamarans throughout the coastal and near-oceanic waters of Australia. A classic jack of all trades, master of none.

Digital Twins

Lars Holterud Aarsnes, Head, Maritime Advisory, South East Asia, Pacific and India, DNV Singapore, gave a presentation on *Digital Twins* via Zoom to a meeting at Navantia Australia in the Aquavista Tower, Docklands, and streamed live on 25 September. The presentation was attended by 7 with a further 15 participating online.

This presentation provided an introduction to digital twins and their role in the maritime industry, with a focus on structural condition monitoring.

Using DNV's 'Nerves of Steel' technology as a framework, Lars explored the four levels of digital twins: Indicator, Numerical Twin, Sensor-based Twin, and Hybrid Twin.

The presentation covered the practical applications of digital twins for naval architects, highlighting how they optimise asset management and enhance safety. He also addressed the process of building and maintaining a digital twin, while discussing the current state and future developments in this field.

The presentation was recorded and is expected to be available soon on the RINA YouTube channel.

The Presenter

Lars Holterud Aarsnes currently heads DNV's Maritime Advisory for South East Asia, Pacific and India, based in Singapore. Prior to this role, he led the Structures Unit within Maritime Advisory and has served as Global Head of the Structures Practice since 2022. He has been the product owner and lead developer for DNV's digital twin technology, Nerves of Steel, a cutting-edge solution used for structural condition monitoring of ships and offshore assets. With nine years of experience at DNV, Lars has provided a wide range of technical advisory services, specialising in structural analysis, lifetime extension, programming, and hull condition monitoring. He holds a master's degree in Marine Technology (Naval Architecture) from NTNU, Norway, with a focus on hydrodynamics and structures.

Luke Shields

Tasmania

Naval Crew Size and Habitability—Where is the Future?

Michael O'Connor, Design Manager, Taylor Bros Marine, gave a presentation on *Naval Crew Size and Habitability—Where is the Future?* to a meeting at Taylor Bros Marine in Hobart, Zoomed to the Australian Maritime College in Launceston, and streamed live to the wider fraternity on 13 August. The presentation was attended by 11 in Hobart, 3 in Launceston, and a further 14 participating online.

What is the optimum crew size for a modern surface combatant? Habitability standards on surface ships have changed over the years with an increased focus on crew welfare, space and well-being. These standards potentially drive a reduction in crew size. This is not often reflected in reality, however, as major warships are increasing capability on the same platform, with warships becoming more multi-functional. On warships the increased capability on a single platform has driven an increase in crew size and crew are still, in general, divided by competencies and functional departments.

The commercial shipping industry has halved its crew size over the last 20–30 years with increased focus on automation and crew becoming more multi-skilled. Naval crewing policy, on the other hand, has not changed in the same manner as the commercial shipping industry with the introduction of more automated equipment. Crew sizes have been maintained with vessel size, and vessel capability has increased with the focus being on multi-functional platforms.

Taylor Bros has been involved in numerous installations and studies where modern crew habitability standards have been applied (or attempted to be applied) to installations and the increased vessel capability has driven a crew increase. A compromise needs to be made and some clear direction from Navy would be appreciated.

The devil is often in the details, but any crew increase has a flow-on effect to other ship's auxiliary systems, while any crew decrease will have the same flow-on effect but in the reverse direction. Such an effect can have some major impacts on ship capability such as ship displacement, range and, particularly, endurance.

Michael discussed Australian naval vessels, in particular the AWD's increasing crew complement. His research has shown that increasing crew sizes on existing ships means that they failed the navy's own habitability standards, and reduced the vessels operational duration due to additional stores consumption. He also looked at potable water, black and grey water capacities, amongst other considerations.

Michael made comparisons with commercial and merchant shipping, where the opposite trend is taking place, reducing manning to reduce costs. This is also due to more automated systems and commercial shipping moving towards autonomy.

The presentation was recorded and is now available on the RINA YouTube channel.

Michael's presentation came from his paper on this topic jointly authored with Dean Bong and presented at the Warship 2024 conference in Adelaide. The full conference paper is reproduced elsewhere in this issue.

The Presenter

Michael graduated from UNSW Sydney in Naval Architecture with Honours in 2001 and obtained a double master's degree in *Integrated Advance Ship Design* in 2012 from the University of Liège, Belgium, and Ecole Central de Nantes, France. He is currently the Design Manager at Taylor Bros Marine, and is responsible for oversight in all marine engineering and naval architecture related tasks within Taylor Bros. Taylor Bros have designed, manufactured and installed the entire accommodation facilities for the Hobart-class Destroyers and Sea 1180 Offshore Patrol Vessels. Michael has over 20 years of marine-based design experience, with expertise in the design and upgrade of naval amphibious vessels, patrol vessels and surface combatants.

Michael O'Connor (R) mid presentation and Nipuna Rajapaksha listening intently
(Photo courtesy Richard Boult)

How will Shipping Meet its Zero Target of Decarbonising by 2050

Prof. Stephen Turnock, Head, School of Engineering, University of Southampton, gave a presentation on *How will Shipping Meet its Zero Target of Decarbonising by 2050* to a meeting at the Australian Maritime College in Launceston, Zoomed to Taylor Bros in Derwent Park, Hobart, and streamed live to the wider fraternity on 17 September. The presentation was attended by 22 in Launceston, 5 in Hobart, and a further 11 participating online.

Stephen discussed various fuels and propulsion methods to minimise the environmental impact of shipping and reduce shipping carbon emissions to zero by 2050. His presentation proposed a number of net zero solutions, noting the importance of reducing carbon and other emissions as more than 90% of the world's trade travels by sea!

In 2023 the IMO confirmed significantly more-stringent targets for achieving net zero by 2050 and with intermediate goals by 2030 and by 2040. Along with aviation, shipping is late to the efforts to decarbonise and, as a result, will need to act with pace. The aim of this presentation was to review the barriers to the adoption of zero-carbon future fuels and how that transition process can be accelerated.

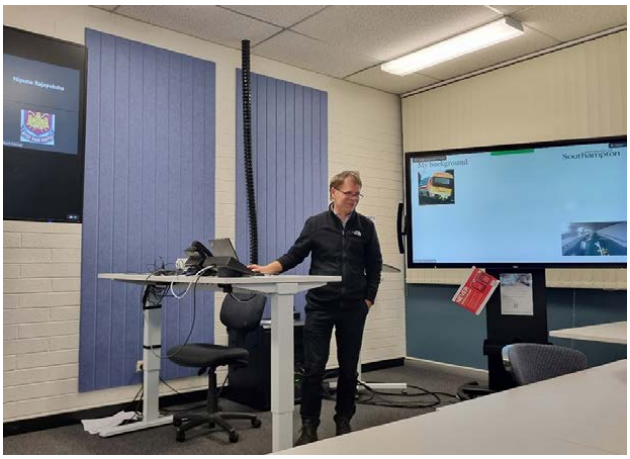
There is still much uncertainty as to what option will be best. Is that hydrogen, ammonia, methanol, nuclear, or batteries? Whatever option is adopted, it is clear that the future fuel cost will increase. This puts pressure on ship designers to generate ships which are as efficient as possible and minimise other costs by using autonomous systems to

reduce the number of crew. The presentation will focus on the use of time-domain analysis of ship performance data to investigate how well alternative power trains and fuels will perform for future ship designs. Simulations of future ship designs using this voyage data allows for the impact of energy-saving systems such as wind assist or air lubrication as well as alternative propulsion systems to be benchmarked against each other. By 2030, if shipping is to meet its targets, a significant proportion of new builds will need to be zero-carbon so naval architects need to be confident that they are making the right choices around fuel choice, which includes all of the potential greenhouse gas and other emissions. At present, many proponents are making cost-based predictions around future fuels which always has great uncertainty. Work at Southampton suggests that an evaluation of the wind-to-wake (WtW) ratio for a given ship provides an objective measure which will remove much of this uncertainty.

Stephen presented a case study of an Anemos 136 m cruise ferry, proposing various solutions for short-, medium- and long-term emission reductions.

The vote of thanks was proposed by Michael Woodward, and carried with acclamation.

The presentation was recorded and is now available on the RINA YouTube channel.



Prof. Stephen Turnock making his presentation
(Photo courtesy Martin Renilson)

The audience for Prof. Stephen Turnock's presentation
(Photo courtesy Martin Renilson)

The Presenter

Prof. Stephen Turnock is Head of the School of Engineering at the University of Southampton and has been part of the maritime engineering group there since 1988. His research interests are in hydrodynamics, energy efficiency and future fuels for ships, renewable energy, maritime robotics and performance sport. He led the development of the 138 × 6 × 3.5 m Boldrewood towing tank at the University of Southampton, the first new towing tank built in the UK for 50 years and the largest university towing tank in the UK. He led the performance sports engineering team which was awarded a Queen's Anniversary prize in 2012. The work reported in the presentation has primarily been funded through UK's Clean Maritime Demonstration competitions.

Richard Boult

Antarctic Expedition Programs

Graeme Elphinstone, Principal of Elphinstone Engineering, gave a presentation on *Antarctic Expedition Programs* to a meeting at Taylor Bros Marine in Hobart, Zoomed to the Australian Maritime College in Launceston, and streamed live to the wider fraternity on 8 October. The presentation was attended by 4 in Hobart, 10 in Launceston, and a further 5 participating online.

Graeme's presentation essentially covered two topics: the engineering aspects and development in the design of logging and weighing systems revolutionising the industry, and Graeme's personal exploits and journey with the French Antarctic Expedition across the ice.

Elphinstone Engineering has supplied the Korean, French and Australian scientific expeditions with heavy-lift sleds backed by four decades of innovation in heavy logging equipment.

A significant point that amazed our audience was that the French Antarctic expedition initially approached Graeme to build their sleds. How often does a company get such an opportunity totally left field of their core business?

Graeme included in his presentation a personal insight into the importance of embracing change and being innovative in business without being too ahead of the game. He invited any keen members at the presentation, including engineering students at the AMC, to inspect the Elphinstone facilities at Triabunna.

The presentation was recorded and is now available on the RINA YouTube channel.

A "thank you" bottle of red wine was presented in appreciation of Graeme's talk, and he answered many more questions offline after the presentation.

One of Elphinstone Engineering's many Antarctic heavy-lift sleds
(Photo courtesy Graeme Elphinstone)

(L to R) Chris Davies, Nipuna Rajapaksha, Michael O'Connor and Graeme Elphinstone
(Photo courtesy Chris Davies)

The Presenter

Graeme Elphinstone has spent a lifetime in engineering, heavy lifting and logging equipment, and is now the principal of his own company, Elphinstone Engineering, with head office and manufacturing facilities in Triabunna, Tasmania, and regional offices in Melbourne (Vic), Hervey Bay (Qld), and Manjimup (WA).

Chris Davies

New South Wales

Committee Meetings

The NSW Section Committee met on 10 September and, other than routine matters, discussed:

- SMIX Bash: Organisation has been completed and everything is in place; however, we are still requesting sponsors.
- TM Program 2025: Program almost two-thirds complete with slots to fill by RINA in September and IMarEST in April, August and October.
- Signatories to Bank Account: One additional signature required for backup and is to be arranged.
- Members' Contact Details: Spreadsheet of NSW Members contact details received from London has been set up on a Google drive and, since this is password protected, we have been advised by London that it meets the RINA requirements for *Security of Membership Personal Data Issued to, and Held by Divisions, Sections, Branches and Joint Branches*. This allows our Secretaries and Treasurer to access, and update, the spreadsheet in the one location.

This meeting goes down in history as the shortest-ever meeting of the NSW Section Committee at 17 min, beating the previous record by 1 min! For the statistically-minded, the longest-ever was 2 h 13 min on 5 February 2004.

The NSW Section Committee also met on 5 November and, other than routine matters, discussed:

- SMIX Bash: Still requesting sponsors; bookings slow, but sometimes have a late rush; there are ways to trim the budget if necessary.
- TM Program 2025: Presentation secured for September, so we now have four RINA presentations filled; IMarEST have two of their five filled.
- Signatories to NSW Section Bank Account: Date and time for verification of additional signature to be decided.
- Australian Division Improvement Committee Workshop: NSW Committee members have other commitments on 29 November; non-members to be sought from NSW industry.
- Format for Future Technical Meetings: In-person attendances at recent technical meetings have been around six, well below the minimum for our caterer of 10. WA has recently had an in-person only meeting with much improved attendance. Decided to try (with IMarEST concurrence) holding the first few TMs in 2025 as in-person meetings with no streaming, but recording for placing on the web (usually within two weeks of the meeting), and then review.
- RINA Bi-Annual Branch Meeting: Committee member volunteered to attend on 18 or 25 November 2024.

The next meeting of the NSW Section Committee is scheduled for 11 February 2025.

Docking *James* Craig on the Floating Dock

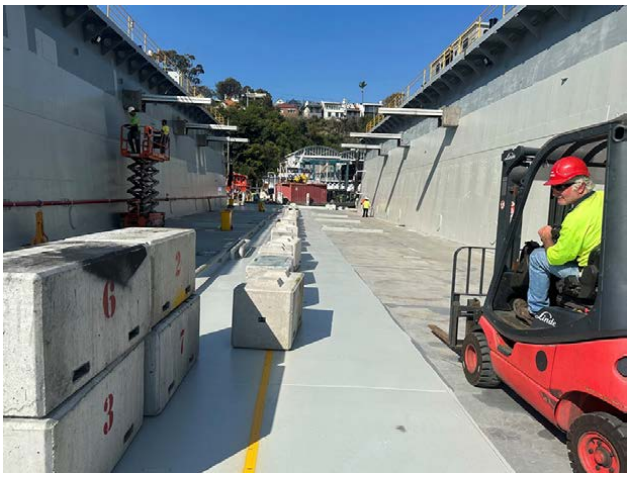
Sean Langman, Managing Director, Noakes Group, and John Butler, Principal, John Butler Design, gave a presentation on *Docking* James Craig *on the Floating Dock* to a joint meeting with the IMarEST at the Royal Prince Edward Yacht Club, Point Piper, and streamed live on 14 August. The presentation was attended by 17 with a further 17 participating online.

Sean began the presentation, saying that *James Craig* is required by AMSA to have an out-of-water survey every five years. Her last docking was in the Captain Cook Dock (CCD) at Garden Island. However, for vessels like *James Craig, Young Endeavour, et al.,* the CCD is overkill in size and expense, and not always available when required. The Sydney Heritage Fleet (SHF) therefore approached Noakes Group and asked whether they could dock *James Craig* on the floating dry dock (FDD), to which Noakes Group readily agreed [*The background of the FDD and its restoration for Noakes by Harwood Marine at Yamba, NSW, is written up in the May 2018 issue of* The ANA—Ed.] However, NSW Land and Environment specified that Noakes must have an environment protection licence for the docking operation, which meant doing it in Commonwealth waters, i.e. at Garden Island, Cockatoo Island, or Woolwich Dock. Sean was so keen that he contacted Thales and said that, if they could do the operation at Garden Island, then Noakes would do the docking for free! Thales agreed. Of course, to do the docking, they would need a docking plan and stability analysis.

The next hurdle was that, in order to minimise time alongside at Garden Island, they needed permission from the Environmental Protection Authority to move the floating dock from her mooring in Snails Bay to Noakes Yard in Berrys Bay so that they could set up the dock for *James Craig.* That licence cost them $4000 for three weeks. Noakes letterboxed their neighbours to advise them of what was happening. The EPA turned up to monitor the setup, and North Sydney Council did too and slapped an environment order on them which Sean is still fighting in court. Noakes then invited the neighbours on board to show them what they were doing. As well as the setup, they did some maintenance work on the dock. In order to do the setup, they had to have

infrastructure on board, such as forklifts, etc, and this all had to be removed for the docking. They painted the dock floor and a yellow centreline on it (which Garden Island had never done). They also installed a plumb bob at the bow and stern of *James Craig* to align the vessel with this centreline. The wooden dock block caps were fastened down to the concrete bilge blocks with tie rods through a channel in the forklift holes in the concrete bases.

The FDD coming in to berth at Berrys Bay
(Photo courtesy Sean Langman)



Setting up the keel blocks on the centreline of the FDD
(Photo courtesy Sean Langman)

John Butler then took up the story, saying that *James Craig* was undergoing refurbishment by the Sydney Heritage Fleet at the same time, with the aft mast off the vessel, along with the anchors and anchor chain. The jib boom was also retracted to reduce the overhang from *James Craig* and allow easier manoeuvring within Garden Island waters. The first step was to undertake a lightship measurement check so that they could determine the displacement and centre of gravity in the docking condition and the drafts of the vessel. They contacted Brad Lovegrove, Dockmaster at Garden Island, and he gave them a copy of the Thales docking plan for *James Craig* showing the configuration of the dock blocks in the CCD. The first challenge was to overlay this Thales setup with the structure in the FDD. The next one was that work was required to be undertaken on the rudder, necessitating removal of the rudder and stock. The easiest way to do that was to overhang the rudder and stock aft of the deck of the FDD. This meant that *James Craig* herself would be well aft of midships on the FDD, and so would require ballasting forward to maintain a level condition.

In a traditional dry dock, the dock blocks are level, and this can lead to a large sueing load if the vessel comes in to dock with a significant trim. However, a floating dry dock can be ballasted to suit the trim of the vessel being docked and minimise the sueing load. As a result of the lightship measurement check, calculations showed that *James Craig* in the docking condition would come in with a trim of 28 cm by the stern.

A cross section of the FDD and *James Craig* showed the centreline blocks and bilge blocks, as well as side shores built into the dock. They had to take account of possible overturning forces, including wind, dynamic, and transverse forces due to a possible heel angle. For a floating dry dock they don't have to consider seismic forces, but they did take into account lateral accelerations due to vessel motion. The shores on each side of the vessel can take up to 20 t each. However, they did not want to place side loads on the hull of *James Craig* due to her age, and did not include the side shores in resisting the overturning moment, and relied solely on the bilge blocks.

Unlike for a traditional dry dock, the stability analysis for a floating dry dock is much more comprehensive, as it needs to consider the stability of each vessel separately and then combined at each stage of the docking. They set the FDD up for 23 cm of trim by the stern (i.e. up to 5 cm different to *James Craig*) and then considered five stages of the docking:

- FDD fully ballasted down to drafts for 23 cm trim;
- aft end of keel of *James Craig* landed and some mass on the dock blocks;
- half mass of *James Craig* on the dock blocks;
- water level at the level of the dock floor; and
- FDD fully unballasted.

John Butler Design compiled a report for the Department of Defence for approval before going ahead with the docking.

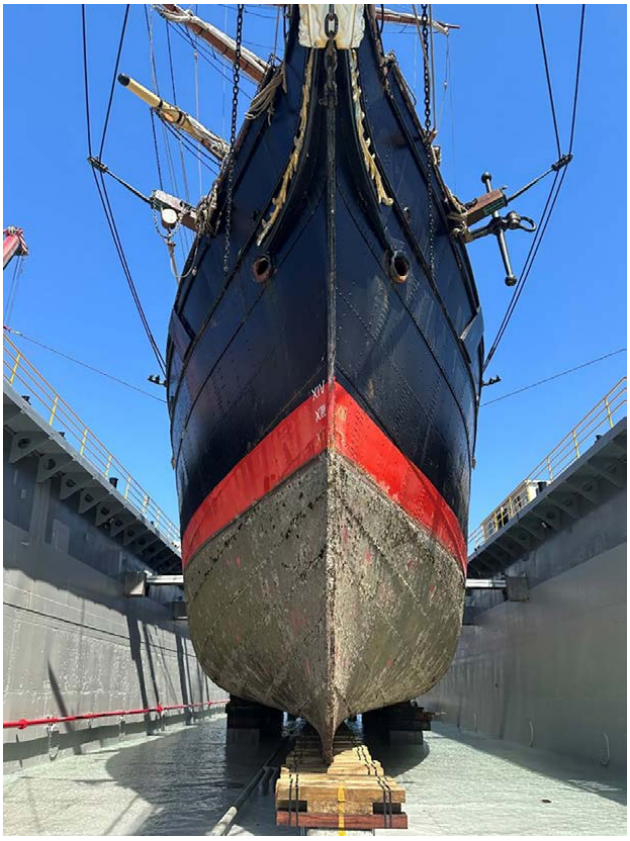
Sean then continued the story. For the docking, he decided that they needed a dockmaster (himself) to direct operations, and a pumpmaster to keep the heel and trim correct throughout. The FDD has its own power for pumping, lighting, etc., and the required backup would be provided by shore power from Garden Island. Before the FDD left the berth at Berrys Bay, they had set up Tirfors so that they could position *James Craig* exactly on the centreline of the FDD. The docking operation was done at the FBE 7 wharf (where the LHDs usually berth). The SHF provided their tugs *Bronzewing* and *Currawong* to keep the FDD a sufficient distance off the wharf while the docking was in progress so that the side shores in the open position did not foul the wharf. Docking down (they do not refer to "sinking"!) the FDD the first time took 8 h; however, they can now do it in 1.25 h. When the FDD was being refurbished at Yamba, they removed the cross-ship walkways from the ends, and the cranes from on top of the wingwalls, all of which significantly lowered the VCG. In total they removed 600 t, and so there is now a limit to the maximum draft which can be achieved with all ballast tanks full.

For the docking operation, it was critical to wait for night time for the ferries on Sydney Harbour to stop creating waves and wash. Undocking they could do in daylight. They had

two divers in the water to check the positioning of the keel and bilges in relation to the dock blocks. The operation is most unstable when the deck of the FDD is just below the water surface.

James Craig entering the FDD at night
(Photo courtesy Sean Langman)

Completing unflooding in daylight
(Photo courtesy Sean Langman)



Jeames Craig docked down
(Photo courtesy Sean Langman)

Aft overhang for removal of rudder
(Photo courtesy Sean Langman)

When they had *James Craig* docked, they were told that they had to move the FDD and *James Craig* away from FBE 7. They had never done a previous cold move of the dock plus ship, so they were flying somewhat blind here! They provided additional sea lashing and tripod shores which were good for 3 t each. They were to move the dock plus ship from FBE 7 to the East Dock Wall of the CCD (FBE 9), i.e. in front of the Dock Office. For the cold move they used two Ausbarge tugs. What they didn't realise until after the move was that their new mooring was in front of the discharge of the pumps which ran intermittently to keep the CCD dry and, of course, played havoc with the mooring of the FDD. The dock blocks have a concrete base, then hardwood

Tripod shores for sea lashing for the cold move
(Photo courtesy Sean Langman)

Outflow from the CCD pumps
(Photo courtesy Sean Langman)

Keel block
(Photo courtesy Sean Langman)

Line of keel blocks
(Photo courtesy Sean Langman)

Bilge block
(Photo courtesy Sean Langman)

blocks, plywood, softwood blocks and sacrificial softwood caps. The deck of the FDD is flat on the centreline, but the sides have camber; that's great for drainage, but then the bilge blocks have to have the same camber to level them up. They consulted Brad Lovegrove about the operation, and

Brad Lovegrove (L) and Sean Langman
(Photo courtesy Sean Langman)

his advice was that for vessels up to 1000 t, it was much easier and cheaper to dock them in the FDD than the CCD. Then they had another cold move back to where they started on FBE 7. The undocking can be undertaken during the day, which occurred for *James Craig* at FBE 7, following the cold move. Rollers on the corners of the FDD fendered the vessel as it was removed from the dock.

Undocking
(Photo courtesy Sean Langman)

Since the docking of *James Craig*, they have done two more dockings on the FDD at Garden Island, one for *Young Endeavour,* and one for a USV (unmanned surface vessel) for the US Navy. The State Government currently needs to dock the Freshwater-class ferries, and needs local government and EPA approvals. The FDD is clearly needed for vessels up to 1000 t. And the FDD herself is coming up for a five-year survey and, for that, she will go to Harwood Marine at Yamba.

The presentation was not recorded.

The Presenters

Sean Langman is the owner and Managing Director of Noakes Group, Australia's leading general marine company, with shipyards at North Sydney, and Port Huon in Tasmania. Sean has spent his life around boats and, starting out as a rigger, has sailed all manner of boats from 49er dinghies to piloting *Wot Rocket* for an attempt on the World Sailing Speed Record. He is one of the country's most-recognised yachtsmen and has competed in 32 Rolex Sydney–Hobart Yacht Races. His *Team Australia* ORMA 60 crew holds the record for the fastest passage times from Sydney to Hobart and Sydney to Auckland. Sean can often be seen on the water as master of one of the Rosman ferries, at the helm of the Noakes-sponsored 18 ft skiff, racing his Ranger 24, *Vagrant*, on Sydney Harbour, or sailing *Maluka* to two wins in her class in the Sydney–Hobart and a win in her class in the 2023 Fastnet Race in the UK.

John Butler is a naval architect and AMSA-accredited marine surveyor. Completing his naval architecture degree at the Australian Maritime College in 2001, John went on to work for Ocean Innovations, Incat Designs and Burness Corlett Three Quays before starting his own business, John Butler Design, in 2014. John Butler Design works in the Defence, cruise ship and commercial vessel survey industries, specialising in stability, plan approval, machinery and structural design aspects of new and existing vessels. John Butler Design also values the heritage aspect of the marine industry, assisting Sydney Heritage Fleet with the ongoing restoration of their vessels *John Oxley* and *Kanangra*, including the stability analysis during the dock-swap of the two vessels. John Butler Design recognises the importance of additional docking facilities within the Sydney area and has worked closely with Noakes Group to re-attain accreditation of their Floating Dry Dock for Defence and Commercial use.

The vote of thanks was proposed, and the "thank you" bottles of wine presented, by John Jeremy.

(L to R) John Butler, John Jeremy and Sean Langman
(Photo Phil Helmore)

Ship Electrification: A Viable Pathway for Decarbonisation

Ashar Khan, Manager New Builds Marine, Wärtsilä Australia, gave a presentation on *Ship Electrification: A Viable Pathway for Decarbonisation* to a joint meeting with the IMarEST on 4 September in the Henry Carmichael Theatre at the Sydney Mechanics School of Arts in the Sydney CBD and streamed live. The presentation was attended by 8 with a further 7 participating online.

This presentation covered various electrification options available now, touched on reference cases, focussed in on the ferry segment, went through considerations for full-battery electric propulsion, discussed current available from lithium-ion battery technology, and considered safety aspects of the batteries.

The presentation was recorded and is now available on the RINA YouTube channel.

The vote of thanks was proposed, and the "thank you" bottle of wine presented, by Steve Morant.

The Presenter

Ashar Khan has a bachelor's degree in mechanical engineering and a post-graduate diploma in business management. He has 20 years of experience in the marine industry in various roles and in the South Asia, Middle East, and Oceania regions. His area of expertise is technical sales and developing tailor-made solutions in collaboration with the customers. Currently he's responsible for New Build Projects in Australia and the Pacific, driving new concepts and solutions supporting decarbonisation.

Steve Morant (L) and Ashar Khan
(Photo courtesy Adrian Broadbent)

Autonomous Surface Vessel Design Considerations

Allen Stotz, Torsten Lau, Eliah Cameron and Michael Reilly, Gibbs & Cox Australia, gave a presentation on *Autonomous Surface Vessel Design Considerations* to a joint meeting with the IMarEST on 2 October in the Henry Carmichael Theatre at the Sydney Mechanics School of Arts in the Sydney CBD and streamed live. The presentation was attended by 11 with a further 16 participating online.

The Environmentally-powered Modular Autonomous Platform System (EMAPS) was designed around a set of fixed parameters. The design was limited by road safety limits associated with trailer width, length and maximum weight, and the ability to move two EMAPS stacked in a 20 ft high-cube ISO container. These design constraints and the need for stability, payload capacity and modularity, power regeneration, autonomous operation and the need to operate in shallow waters and inshore currents led to a number of design decisions which are reflected in the EMAPS prototype.

This presentation discussed the lessons learned during design, build and set-to-work of the EMAPS Uncrewed Surface Vessel (USV). In particular, they discussed the design constraints, the lessons learned and applied in the first and second builds; design impacts recognised due to the nature of the EMAPS autonomous USV, such as trading off habitation space for payload, and power and control systems required for remote and autonomous operation. They also discussed the systems required to implement an autonomous system in a marine environment and the challenges involved.

The topics were covered as follows:

Allen Stotz:	Overview
Torsten Lau	EMAPS lessons identified as related to design constraints
Eliah Cameron	Weight allocations and differences from crewed vessels
Michael Reilly	Autonomous mechanisms and control systems

The presentation was recorded and is now available on the RINA YouTube channel.

The vote of thanks was proposed, and the "thank you" bottles of wine presented, by Steve Morant.

The Presenters

Allen Stotz has both BSc in mathematics and MBA degrees from St Mary's University, and has worked for the Canadian Department of National Defence, Lockheed Martin, MDA Systems, and Irving Shipbuilding. He has been the Director, Maritime Autonomy, with Gibbs & Cox Australia since 2022. In this role he is responsible for maritime autonomous systems research and development, aligning with and supporting introduction of autonomous systems technology in Australia, development of the EMAPS autonomous surface vehicle, developing pre-production prototypes, developing production-ready product, participation in customer demonstrations and trials, and sales to defence and commercial end-users.

Torsten Lau is a naval architecture graduate of the Australian Maritime College, has been working in industry with Gibbs & Cox Australia since 2021 and is a naval architect on the EMAPS team. He has been responsible for the naval architecture platform design, performance predictions, procurement and set-to-work production activities in the EMAPS project, designing and building a 5.85 m environmentally-powered autonomous catamaran workboat.

Eliah Cameron is a naval architect who is new to the industry, graduating from the Australian Maritime College in 2023. After conducting an internship with Gibbs & Cox Australia between his third and fourth year of university, working

on the early stages of the EMAPS project, he has now been employed and is working alongside Torsten and the autonomy team. He has been involved with the progression of the design and build of the EMAPS platform.

Michael Reilly is an electrical engineering graduate of the University of Newcastle and has been working in industry since 2017. Michael previously worked for Thales Australia as a lead electrical engineer for design changes on the naval Minehunter Program and has been working for Gibbs & Cox Australia since 2023 in the position of Senior Electrical Engineer in the EMAPS team. Michael has been responsible for electrical design, procurement and set-to-work as well as autonomy development on the EMAPS project.

Phil Helmore

(L to R) Adrian Broadbent, Allen Stotz, Eliah Cameron, Michael Reilly and Torsten Lau
(Photo courtesy Steve Morant)

CLASSIFICATION SOCIETY NEWS

DNV Strengthens Cyber Security in Shipping

DNV has acquired CyberOwl, a global expert in cyber risk monitoring and threat management onboard maritime vessels. The two companies have joined forces to strengthen the cyber defences of the shipping industry by forming one of the world's largest specialists in maritime systems cyber security. The partnership comes at a time when the sector must comply with a wealth of new cyber-security regulation and invest in incident detection, response and recovery as increasing implementation of digitally-connected systems onboard vessels creates new vulnerabilities. A typical fleet of 30 cargo vessels now experiences an average of 80 cyber incidents per year.

"Digital technologies must continue to scale for a safer, more efficient and greener maritime industry. But the benefits of digitalisation and automation cannot be realised without a robust approach to cyber security. That's why DNV has placed cyber security at the heart of its growth strategy. Together, DNV and CyberOwl will reduce cyber risks and strengthen compliance across the maritime supply chain with services that support all aspects of an organisation's cyber-security needs and manage risk at every stage of a vessel's lifecycle," said Remi Eriksen, Group President and CEO, DNV.

New unified requirements from the International Association of Classification Societies' (IACS) this year are placing tougher rules on measures which maritime organisations must take to govern, identify, protect, detect, respond to, and recover from cyber incidents. This follows International Maritime Organization (IMO) requirements already in place for vessel owners, operators and managers to establish cyber-security management systems. Only just over half (56%) of maritime professionals are confident in their ability to meet cyber security regulatory requirements.

CyberOwl provides vessel operators with analytics to identify, monitor and manage cyber threats, and evidence regulatory compliance. The company's Medulla platform and managed security services helps owners and operators of hundreds of vessels to discover and maintain asset inventories, monitor for escalating cyber risks, know when crew are behaving insecurely, and evaluate the effectiveness of security controls and cyber security policies.

"DNV and CyberOwl are on a mission to help the shipping industry boost its security posture by combining cyber-security expertise with long-standing experience in the industry's technical, operational and commercial realities. DNV has 160 years of maritime heritage, strong engineering expertise and a growing portfolio of cyber-security services. These, coupled with CyberOwl's deep expertise in threat monitoring and incident management, provide a powerhouse for advancing cyber-physical safety, sustainability and resilience in the sector" said Daniel Ng, CEO, CyberOwl.

The acquisition strengthens DNV's maritime cyber security and emergency response services portfolio. It creates one of the world's largest specialists in maritime cyber security with a presence in five global shipping hubs—Oslo, London, Singapore, Hamburg and Piraeus.

CyberOwl will team up with DNV's global network of 3500 maritime risk experts and 500 cyber-security specialists. Together, the two companies will address all aspects of a maritime organisation's cyber-security needs, safeguarding demanding IT and industrial control-system environments in the sector.

DNV's acquisition of CyberOwl is the latest step in the independent assurance and risk management provider's cyber-security growth strategy. Earlier this year, DNV created one of Europe's fastest-growing cyber-security service businesses—DNV Cyber—by merging its existing cyber-security business with two recently-acquired companies, Nixu and Applied Risk.

CyberOwl will be operated separately to DNV's ship classification business.

DNV News, 25 September 2024

LR Benchmarks Digital Maturity

Lloyd's Register (LR) has announced the launch of its Digital Maturity Framework and Index, a pioneering tool designed to help companies assess and benchmark their digital maturity. The need for greater clarity and transparency in maritime digitalisation efforts has become increasingly evident. In response, LR commissioned Thetius to develop *The Benchmark* report, which outlines LR's detailed digital maturity model. The model is a starting point for understanding where an organisation sits on the maritime

digital transformation spectrum—from foundational stages, with little or no digital infrastructure, to mature advanced data-driven decision-making.

LR's Digital Maturity Index (DMI), a free, web-based platform based on real maritime use cases, allows shipping companies to self-assess their digital readiness, compare themselves against industry competitors, and identify potential areas for investment in technology and skills. In the pilot phase, five leading tanker and bulker companies participated and examined digital maturity across all aspects of their operations, from digital infrastructure to cultural integration.

Mark Warner, LR's Global Content and Communications Director, said "The LR Digital Maturity Index has been developed in collaboration with our pilot clients and gone through a rigorous and robust discovery process. It is unique in the maritime industry and incorporates close to 50 digital use cases. Our aim is to continue the pilot phase with more clients, primarily from the tanker and bulker segments, and then widen into other segments. The preliminary results highlight that, although companies are showing higher levels of maturity around the core enablers of connectivity, cloud computing and cyber security, there is far less maturity around the implementation of digital culture, skills, training and data standardisation. This reinforces the need for clear digital strategy adoption and a uniform approach to data standards."

Thetius' report's findings, presented during the Smart Maritime Network event in Copenhagen, emphasise the importance of a comprehensive digital strategy orchestrated at board or C-Suite level, resource allocation both in technology and staff skills, willingness to take risks and experiment with new technologies and leveraging support from external expertise.

In alignment with the Digital Maturity Index, LR will also launch a new digital transformation advisory service designed to assist clients with overcoming the challenges of maritime digitalisation.

James Frew, Business Consultancy Director, Lloyd's Register, said "The Digital Maturity Index provides a useful framework for shipowners to assess their digital maturity, also allowing them to explore advisory support/services tailored to their needs. We are already supporting some of the largest vessel charterers around the digitalisation of their maritime businesses, and now we are able to offer trusted advice to owners as to how they can reap the real benefits of digitalisation."

The Benchmark report may be downloaded from

https://www.lr.org/en/knowledge/research-reports/2024/the-benchmark/

LR News, 1 October 2024

ABS Expands Presence in Western Australia

ABS is expanding its footprint in Western Australia, establishing a physical presence in Port Hedland, a key trading zone for dry bulk minerals in the eastern hemisphere. The new site joins other ABS locations in Perth, Cairns, Brisbane, Sydney and Melbourne.

Port Hedland, the world's largest iron ore export port, is located within the Pilbara region in northwestern Australia. The area is making substantial investments to support the energy transition to meet net-zero emissions goals. Projects include a multi-million-dollar hydrogen hub, port infrastructure expansion and improvement along with clean energy job training programs.

"The Pilbara region has been a long-standing key international trading zone and, to date, we have serviced our clients' vessels by travelling from other offices to Port Hedland. Activity at the port is booming and the government is investing in supporting growth not only in iron ore exports but also clean energy facilities and renewable-energy supply chains to support alternative fuels, offshore wind, and battery manufacturing. So, we are investing as well and making our presence permanent," said John McDonald, ABS President and COO.

With bulk carriers representing a significant portion of the ABS-classed fleet, ABS is the industry leader in providing sound technical knowledge and extensive practical experience for the safe operation and efficient performance of bulk carriers.

ABS News, 2 September 2022

ABS Launches Industry's First Comprehensive Rules for Floating Nuclear Power

The industry's first comprehensive rules for floating nuclear power plants have been unveiled by American Bureau of Shipping (ABS) at a forum for nuclear industry leaders held jointly with Idaho National Laboratory (INL).

Held at ABS' world headquarters in Texas, the event saw presentations on the latest reactor technologies from leading companies and publication of a detailed study from ABS and Herbert Engineering modelling the design, operation and emissions of a floating nuclear power plant.

"We demonstrated today that nuclear's potential in the maritime domain is so much more than a reactor on a ship. Nuclear energy can link energy demands across the electric, industrial and shipping transportation sectors to optimise energy generation and use, maintain grid reliability, and support decarbonisation of shipping and industry. Not to mention its vast potential for the production of clean fuels such as e-ammonia and e-hydrogen," said Christopher J. Wiernicki, ABS Chairman and CEO. "It is clear that nuclear energy has the potential to be a disruptor for the maritime industry. This is why we are proud to produce the first comprehensive rule set for the industry as an important step forward for the adoption of the technology."

The ABS *Requirements for Nuclear Power Systems for Marine and Offshore Applications* provides the first classification notation for nuclear-power service assets such as floating nuclear power plants or nuclear-powered floating production, offloading and storage units. Uniquely, the requirements allow designers to consider any type of reactor technology and propose a framework for nuclear regulators to collaborate with flag administrations and ABS for complete regulatory oversight and license.

The regulatory landscape around nuclear power plants was another key feature of the event, followed by workshops with offshore industry leaders to explore their requirements and understand operational challenges floating nuclear power plant technology will have to overcome.

"This is an exciting time for nuclear energy. Idaho National Laboratory is growing and working with industry partners like ABS to test and demonstrate advanced reactor technologies," said Brad Tomer, COO of the National Reactor Innovation Center headquartered at INL. "Collaboration and discussions like these will be critical as we move forward in delivering the low-carbon affordable and reliable power which nuclear energy provides."

ABS is playing a leading role in helping government and industry work towards the adoption of advanced nuclear technology in commercial maritime, including key research with the US Department of Energy and multiple New Technology Qualification and Approval-in-Principle projects with industry.

The ABS *Requirements for Nuclear Power Systems for Marine and Offshore Applications* are available to download at https://pub-rm20.apps.eagle.org/r/1/2024-10-01/Foreword.

ABS News, 3 October 2022

FROM THE CROWS NEST

WSR Spirit 2

On 8 October 1978, Ken Warby blasted across Blowering Dam to set his second (and current) Unlimited World Water Speed Record of 317.6 mph (511.1 km/h), now 46 years ago!

Sign at The Pines campground with a tribute to Ken Warby
(Photo courtesy Martin Grimm)

Dave Warby of Warby Motorsport is attempting to break his father Ken's Water Speed Record in their latest vessel, *Spirit of Australia 2*. The Warby Motorsport team was back on the water at Blowering Dam for the third time this year on the weekend of 19–20 October to continue testing and ramping up the speed towards the record.

David completed three sets of runs in *SoA2* each day, with the boat lowered into the water using a mobile crane at The Pines campground. David typically completes a southbound and northbound run, then makes one or two fast passes to please the crowd gathered at the launching area. The boat is then recovered to its trailer for refuelling on shore. Water surface conditions were ideal at the northern end of the course for portions of both days, although it remained rougher at the southern end. The highest peak speed reported for the weekend was 267 mph (430 km/h).

Lowering *SoA2* into almost mirror-calm water at The Pines
(Photo courtesy Martin Grimm)

David Warby makes a fast pass in *SoA2* for the crowd gathered at The Pines
(Photo courtesy Martin Grimm)

Refuelling *SoA2* on shore
(Photo courtesy Martin Grimm)

Attention remains focussed on achieving predictable handling of the boat and, consequently, several rudder configurations had already been tested in the past. The solid high-tensile steel NC-milled rudder currently fitted was previously tested in August and proved to perform satisfactorily. However, for the latest trials, adjustable-friction and viscous-damping systems have been incorporated in the rudder quadrant to improve the feel of the helm at higher speeds.

Rudder with damper fitted
(Photo courtesy Martin Grimm)

Attending the trials was Rosco McGlashan OAM, the current Australian land speed record holder. He has had a long association with the Warby family. McGlashan is pursuing the land speed record with his Aussie Invader 5R which is to be rocket powered.

(L to R) Rosco McGlashan, David Warby and Crew Chief, Phillip Frawley
(Photo courtesy Martin Grimm)

The Warby team hopes to return to Blowering in February 2025, leaving the reservoir free for other users over the summer-holiday period. Conducting the high-speed trials safely requires the reservoir to be cleared of other watercraft aside from safety boats, so NSW Roads and Maritime Services declares an exclusion zone well in advance of each trial period.

Martin Grimm

WSR *Longbow*

Britain has re-entered the contest for the Water Speed Record with a new vessel, *Longbow*, having commenced construction in April 2018.

However, there does not appear to be a more-recent update on the website than July 2024. In the meantime, keep an eye on https://www.jet-hydroplane.uk/.

WSR ThrustWSH

The Thrust team currently hold the world land speed record, set by Andy Green in *ThrustSSC* at 760.3 mph (1223 km/h) on 15 October 1997 in the Black Rock Desert, Utah and, incidentally, being the first to exceed the speed of sound!

The team turned their attention to the world water speed record in 2020 and, according to their website, are now researching the use of super-cavitating micro foils instead of planing points. They are carrying out research using CFD in association with QinetiQ to see if it is possible.

There are, of course, pros and cons to the use of foils for such a project, and these are being actively discussed in the wider fraternity by hydrofoil enthusiasts and hydrodynamicists.

You can check out their website for (infrequent) updates at https://thrustwsh.com/.

Phil Helmore

SP80 Aims for World Sailing Speed Record

The world sailing speed record is currently held by Australian Paul Larsen in *Vestas Sailrocket 2* at an average speed of 65.45 kn (121.1 km/h) over the 500 m track.

SP80 is the vessel being designed and built by engineering students from the Swiss engineering school École Polytechnique Fédérale de Lausanne (EPFL) to attempt the world sailing speed record and take it back to Europe. They are aiming for a speed of 80 kn (148 km/h) using a boat with shaped hulls, propelled by the usual kite wing, while the overall stability is achieved via super-ventilating hydrofoils.

SP80 at 35 kn
(Photo from SP80 website)

The team started out with a 10 m^2 kite; they now have 25 and 40 m^2 kites, and are planning a 55 m^2 kite for the final assault. They are also currently sailing with a training foil, which is designed to withstand a maximum speed of about 40 kn (74 km/h), and they will change the foil for higher speeds.

Back on the water in Leucate, France, in late July, they had a run with the 25 m^2 kite, and achieved a new top speed of 35 kn (65 km/h), with an average speed of 30 kn (56 km/h) over the 500 m course. Since then in August they have had both the 40 m^2 and 55 m^2 kites in action, and are able to achieve the 35 kn (56 km/h) speeds consistently in lighter winds on the training foil.

The crew went for a safety training course in Lorient, France, in September. Back on the water in October, they have been pushing the speed, gaining new data, and learning how to control the boat and kite as they go. They have now achieved a new top speed of 43 kn (79 kph).

The new record-breaking foil has arrived in their workshop and should be mounted on the boat in the coming weeks.

For more details, visit the SP80 website at https://sp80.ch/.

SP80 website

Sail GP

The Australia SailGP Team has now won the coveted SailGP Trophy three times, winning it in Seasons 1, 2 and 3, and came second to Spain in the most-recent Series 4.

Season 5 starts in Dubai, UAE, on 23–24 November 2024, and will feature new events in Brazil, Germany, Switzerland and Auckland, as well as a return to Great Britain and New York. Unfolding over a 12-month period, beginning and ending in November (2024–25), the season will be the league's most expansive to date, with 14 events across an increased five continents.

For more details, visit the Sail GP website at https://sailgp.com.

America's Cup 2024

The 37th America's Cup took place in Barcelona, Spain, in August–October 024, with five teams competing in the Louis Vuitton Cup for the right to challenge the Defender of the Cup, Emirates Team New Zealand.

The Louis Vuitton Cup challenger selection series, sailed between 29 August and 7 October, entailed a double round-robin in which all teams raced each other twice in match races, with the top four qualifying and the top scorer choosing the opponent. The round robin included the Defender, Emirates Team New Zealand, the Challenger of Record, Ineos Britannia (GB), Alinghi Red Bull Racing (Switzerland), Luna Ross Prada Pirelli Team (Italy), NYCC American Magic (USA) and Orient Express Racing Team (France). This was followed by the semi-final, with the winner being the first to score 5 points. The final, between Ineos Team Britannia and Luna Ross Prada Pirelli Team was won by Ineos Team Britannia, being the first to score 7 points.

The Louis Vuitton 37th America's Cup, sailed between 12 and 27 October between Emirates Team New Zealand and Ineos Team Britannia, was a set of match races with the winner of each race scoring one point and the loser scoring no points, and the overall winner being the first to score seven points. NZL quickly won four races, but then GB won the next two, taking the score to 4–2. NZ got back into their stride, winning the next two and taking it to 6–2 and match point. The ninth race had a delayed start due to insufficient wind and increasing the tension, but NZ were too strong and came in with the win. The winner of the 37th America's Cup and, hence, the Defender of the 38th America's Cup, is Emirates Team New Zealand. This is a record three America's Cup wins in a row for New Zealand!

All the results, and replays of each of the final match races between NZ and GB can be seen on the 37th America's Cup website https://www.americascup.com/.

Phil Helmore

Ineos Britannia at speed
(Photo from America's Cup website)

New Defence Precinct at Henderson

On 16 October, the Commonwealth Government announced the establishment of a consolidated Commonwealth-owned Defence Precinct at Western Australia's Henderson shipyard to underpin tens of billions of dollars of investment in defence capabilities in the West over the next two decades and support in the order of 10 000 well-paid, high-skilled local jobs.

The establishment of a consolidated Defence Precinct at Henderson is the critical next step in delivering continuous naval shipbuilding in Western Australia. This builds on the Government's announcement last year of a strategic partnership between Defence and Austal Limited at Henderson. It also represents a major milestone on the AUKUS pathway as Australia develops the capability to safely and securely own, operate and sustain conventionally-armed nuclear-powered submarines.

The Defence Precinct will support the build of new landing craft for the Australian Army and new general purpose frigates for the Navy, with requisite large vessel infrastructure to form part of the Precinct. These capabilities are vital to transforming the Defence Force's ability to meet Australia's complex strategic circumstances.

The Government has also determined that the Defence Precinct at Henderson will be the home of depot-level maintenance and contingency docking for Australia's future conventionally-armed nuclear-powered submarines. These vital maintenance capabilities will be established at Henderson in accordance with domestic processes and regulatory requirements, and consistent with Australia's international obligations to maintaining the highest standards for nuclear safety, security and safeguards.

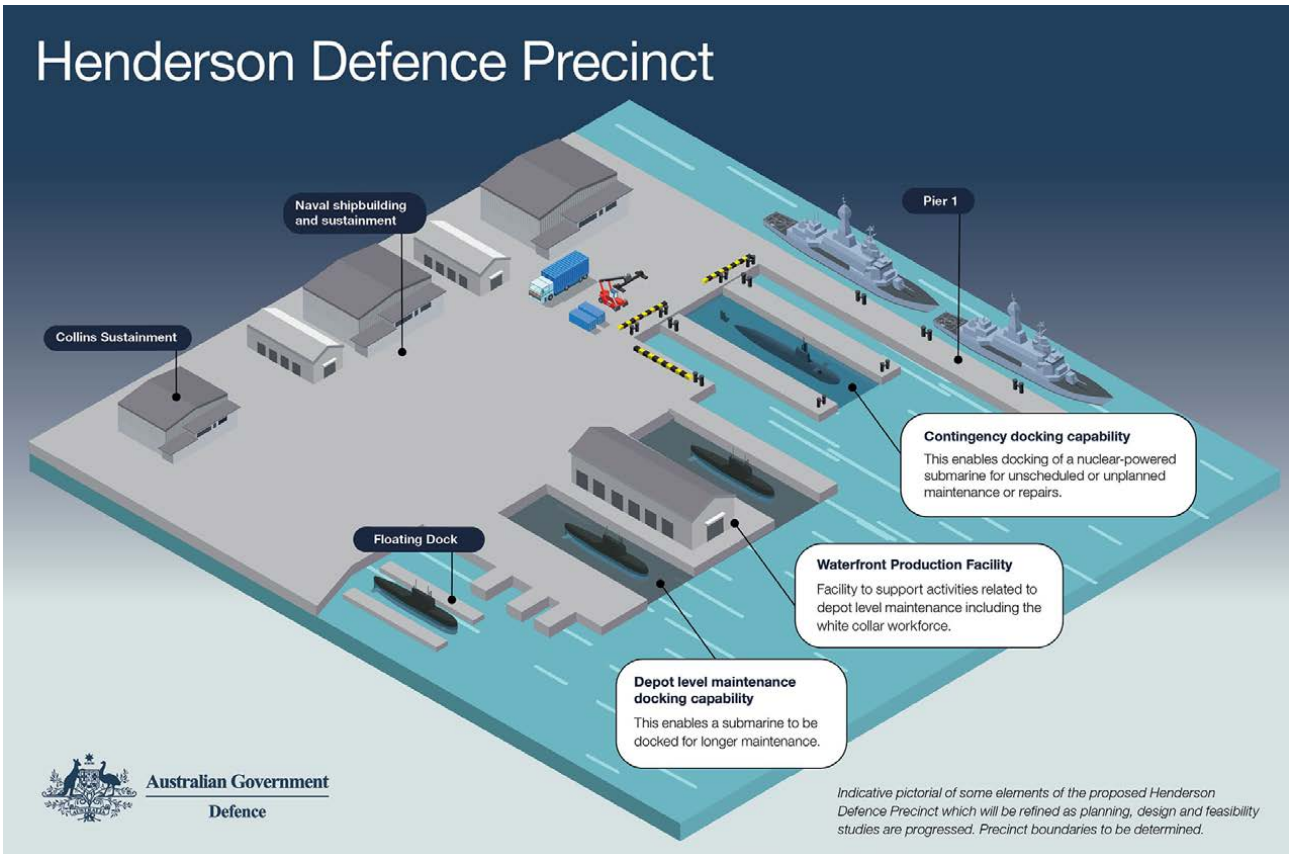
Contingency and depot-level maintenance alone will create around 3 000 jobs in Western Australia. This is in addition to the thousands of jobs which will be supported through construction of the Defence Precinct, delivery of continuous naval shipbuilding in the West, and the establishment and operation of Submarine Rotational Force-West at HMAS *Stirling*.

Coupled with the $8 billion the Government has already committed to expand HMAS *Stirling*, these investments and capability programs in Western Australia will be worth tens of billions of dollars over the next two decades.

Cooperation Agreement

To deliver this ambitious long-term program, the Albanese and Cook Governments have signed a Cooperation Agreement, which provides a foundation for collaboration to deliver the Defence Precinct and related activities. This will include:

- Developing a dedicated joint forum to deliver the skilled workforce required to deliver and sustain critical Defence capabilities.
- Establishing the necessary infrastructure, including common-user facilities, to support industry across the Defence Precinct at Henderson.
- Ensuring effective engagement across Federal, State and Local governments and communities.



An impression of the Defence Precinct to be developed at Henderson, WA
(Department of Defence image)

The site of the planned Henderson Defence Precinct
(Department of Defence photograph)

The Commonwealth Government will make an initial investment of $127 million over three years to progress planning, consultations, preliminary design and feasibility studies as well as enabling works for the Defence Precinct at Henderson. This work will inform future decisions on delivery options and models for the Defence Precinct at Henderson.

First AUKUS Nuclear-Powered Submarine Maintenance Activity in Australia

In August, personnel from the Royal Australian Navy and Australian industry began an historic Submarine Tendered Maintenance Period (STMP) at HMAS *Stirling* in Western Australia alongside their United States (US) counterparts.

USS *Hawaii* (SSN 776), a US Virginia-class submarine, arrived at HMAS *Stirling*, joining the USS *Emory S. Land* (AS 39), a US service ship with equipment and crew dedicated to providing significant maintenance work for US submarines.

During World War II, the US Navy routinely conducted maintenance on US, UK, and Dutch submarines in Fremantle. The STMP marked the first time Australian personnel directly participated in the maintenance of a nuclear-powered submarine in Australia.

In preparation for the STMP, over 30 Navy officers and sailors had been embedded as part of the crew of USS *Emory S. Land* since January 2024 to build the skills, knowledge and experience in nuclear-powered submarine maintenance.

In addition to the Australian personnel as part of the crew of the USS *Emory S. Land*, one of the Royal Australian Navy officers to graduate from the Submarine Officer Basic Course and naval nuclear training in the US, was part of the crew of USS *Hawaii*.

Workers from ASC Pty Ltd were involved in providing support services, and also utilised the STMP to continue learning about SSN maintenance. The first cohort of ASC workers commenced direct training on the maintenance of Virginia-class submarines in June and will provide maintenance work in the future.

Port visits by US and UK SSNs, such as the STMP, are a vital part of building Australia's capability and capacity to support maintenance on nuclear-powered submarines in the lead up to Submarine Rotational Force–West (SRF-West) commencing in 2027.

The rotational presence of one UK Astute-class and up to four US Virginia-class submarines at HMAS *Stirling* as part of SRF-West will further accelerate Australia's ability to be sovereign ready to safely and securely own, operate and maintain Australia's future fleet of conventionally-armed, nuclear-powered submarines from the early 2030s.

The STMP is also an important opportunity to measure the progress Australia and our AUKUS partners are making as we develop not just our workforce, but also our infrastructure, our stewardship capabilities, and our supply chain."

Ferries to Lay-up in Scotland?

Whilst the two new ferries for the Melbourne to Devonport service are well advanced, their berth in Devonport Tasmania might not be available until February 2027.

Spirit of Tasmania IV has been handed over by her builders and *Spirit of Tasmania V* is approaching completion. With no berth at Devonport, and a lack of suitable facilities in Australia, it seems likely that *Spirit of Tasmania IV* will be laid up in Leith, Scotland, until the Devonport berth is available. The new ships are 18 m longer, 5 m wider and have a draft 0.5 m greater than the existing ships.

Tenders Sought for Commercial Vessels for Strategic Fleet

In September the Australian Government issued a request for tender for vessels to participate in its Strategic Fleet Pilot program, a five-year initiative aimed at strengthening the

nation's maritime capabilities and resilience.

The pilot will involve three privately-owned vessels operating commercially but available for government requisition during crises or national emergencies. The vessels will be selected through a competitive process and are expected to provide training opportunities for Australian seafarers.

"This is a major step towards fulfilling our commitment to establish a Strategic Fleet of up to 12 Australian flagged and crewed vessels to strengthen our sovereign maritime capabilities while supporting our maritime workforce," said the Hon. Catherine King MP, Minister for Infrastructure, Transport, Regional Development and Local Government.

The program aims to address recent supply-chain disruptions and geopolitical challenges by bolstering Australia's domestic maritime sector. It will also support industries reliant on shipping, such as heavy manufacturing, and provide assistance during natural disasters or conflicts.

The tender process closes on 29 November 2024.

New Wharf for Port of Hobart

It was announced on 16 October 2024 that the Commonwealth Government has secured Hobart's future as the home port of Australia's icebreaker, RSV *Nuyina*, and the long-term future of the Australian Antarctic Program in Tasmania.

An agreement between the Federal and Tasmanian Governments for a new, fit-for-purpose Macquarie Wharf 6 has been reached, locking in Tasmania as Australia's Antarctic and Southern Ocean Gateway.

The Commonwealth Government will contribute $188 million over four years to construct a new Macquarie Wharf 6 in the Port of Hobart.

The Tasmanian Government will provide priority access to Macquarie Wharf 6 as the home port for RSV *Nuyina* for the next 30 years, continued access to existing portside facilities during the construction period, access to shoreside power, and a refuelling solution for RSV *Nuyina* in the Port of Hobart.

RSV *Nuyina* is the main lifeline to Australia's Antarctic and sub-Antarctic research stations and the central platform of Australia's Antarctic and Southern Ocean scientific research. Wharf construction will be managed by the Tasmanian Government and will begin next year.

Young Endeavour II Progress

Construction of the new sail training ship STS *Young Endeavour II* is making impressive strides at the Birdon Shipyard in Port Macquarie, New South Wales.

Young Endeavour II under construction
(Photo courtesy Young Endeavour Youth Scheme)

Recently, CMDR Gavin Dawe OAM, RAN, Young Endeavour Youth Scheme Project Manager, and CPO Matthew Jarvis, STS *Young Endeavour* Chief Bosun, visited the site to check out progress on the replacement vessel and provide operator insights into development of the masts and safety aloft system.

RSV *Nuyina* alongside Macquarie Wharf 3 in the Port of Hobart
(Photo courtesy Tasmanian Government)

The Naval Shipbuilding and Sustainment Group, Australian shipbuilder Birdon, and Dutch designer Dykstra Naval Architects, have been working hard to bring the state-of-the-art barquentine sailing vessel to life. The keel laying in July 2023 marked the start of this exciting journey, with construction of the hull and structural framework now well underway.

CMDR Dawe and CPO Jarvis shared expertise gained during multiple postings to STS *Young Endeavour*, providing invaluable feedback from an end-user's perspective on some of the key aspects of the design. Their insights help to make the ship more functional and user-friendly.

This collaboration—one of many planned visits—demonstrates continued co-operation between Defence and industry stakeholders working together to get the best possible end product. Introduction into service of the larger, more-advanced sail-training platform will provide incredible opportunities for young Australians for many years to come.

Echo Yachts starts Construction of Sail-equipped Catamaran Yacht

Australia-based custom superyacht builder Echo Yachts has commenced construction of a new sail catamaran vessel at its superyacht building facility in the Australian Marine Complex in Western Australia.

The aluminium-hulled vessel was developed in partnership with Dutch sailing yacht designer Dykstra Naval Architects and Australia's One2Three Naval Architects. Echo Yachts said that the 57 m long vessel will be the world's largest sailing catamaran to date.

The sailing yacht will feature similar luxury accommodation as Echo Yachts' 2023-built motor yacht *Charley 2*. The new vessel will also feature a vast array of water toys and helicopter landing capabilities as well as a twin-rig sail system by Southern Spars.

Echo Yachts said that, as a result of the addition of sail power, a regenerative power system will be installed, utilising twin shaft generators and a battery storage system to allow for silent running under sail.

With a CPP driveline, this system also allows the vessel to utilise the main engines without the need to run separate generators to power the vessel more efficiently when motoring.

Baird Maritime

Austal Australia Delivers 21st Guardian-class Patrol Boat

On 16 October 2024 Austal Australia delivered the 21st Guardian-class patrol boat (GCPB) to the Australian Department of Defence.

The vessel, *Te Mataili III,* was officially accepted for the Commonwealth of Australia by The Hon. Matt Keogh MP, Minister for Defence Personnel and Veterans Affairs, and then gifted to the Pacific Island nation of Tuvalu, represented by Prime Minister, The Hon. Feleti Teo, at a handover ceremony held at HMAS *Stirling* in Western Australia on 16 October 2024.

Te Mataili III replaces *Te Mataili II,* a Guardian-class Patrol Boat which was gifted to Tuvalu in 2019 and operated successfully until damaged beyond economic repair during twin cyclones that hit Vanuatu in 2023.

The 84 m trimaran superyacht *White Rabbit*, built by Echo Yachts in 2018 and designed by One2Three Naval Architects, recently visited Sydney berthing at the Jones Bay Marina in Pyrmont
(Photo John Jeremy)

Austal Australia has delivered the 21st Guardian-class Patrol Boat *Te Mataili III* to the Department of Defence under the Pacific Patrol Boat Replacement Project SEA3036-1
(Photo courtesy Austal)

Austal Australia has delivered the eighth Evolved Cape-class patrol boat, ADV *Cape Schanck*, to the Royal Australian Navy
(Photo courtesy Austal)

Austal's Chief Executive Officer, Paddy Gregg, said that the delivery of the patrol boat continued to highlight the efficiency of the Austal Australia team, delivering the Pacific Patrol Boat Replacement Project for the Commonwealth of Australia.

"Austal Australia has now delivered 21 Guardian-class patrol boats in just five years, which is a fantastic achievement and great demonstration of the capability and efficiency of the Western Australian naval shipbuilding industry," Mr Gregg said.

"For five years now, we have been collaborating successfully with our supply chain and project partners (including the Department of Defence), industry stakeholders and Royal Australian Navy to deliver this important, sovereign capability-building project for Australia and our Pacific Island neighbours.

"Our thanks yet again to everyone who has contributed and continues to contribute to the success of the Pacific Patrol Boat Replacement Project," Mr Gregg added.

The Pacific Patrol Boat Replacement Project was awarded to Austal Australia in May 2016, with subsequent, contract options awarded in April 2018, November 2022 and June 2024, taking the project to 24 vessels, valued at more than $400 million, in total.

Evolved Cape-class Patrol Boat Delivered to the RAN

On 1 November 2024 Austal Australia announced the delivery of the eighth of ten Evolved Cape-class patrol boats (ECCPBs) under construction for the Royal Australian Navy. The vessel, ADV *Cape Schanck,* is the eighth ECCPB to be constructed at Austal's Henderson, Western Australia, shipyard in four-and-a-half years.

Austal's Chief Executive Officer, Paddy Gregg, said that *Cape Schanck* highlights Western Australia's naval shipbuilding capability, productivity and reliability, and Austal Australia's successful collaboration with industry and project partners to deliver eight patrol boats in four-and-a-half years.

"Austal Australia, with the help of our valued supply chain, industry and project partners, have now delivered eight Evolved Capes to the Royal Australian Navy in just four-and-a-half years. That's an outstanding track record of productivity, with one 58 mm patrol boat delivered (on average) every 6 to 7 months, Mr Gregg said.

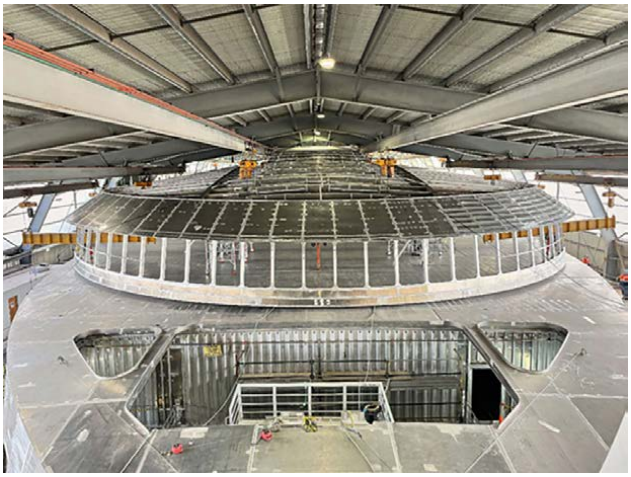
"We were awarded the Evolved Capes contract in May 2020 and now, less than five years later, we have delivered eight boats, despite the challenges of the COVID pandemic and in addition to the (now) 24 Guardian-class patrol boats we're also delivering to the Commonwealth of Australia.

The SEA1445-1 Evolved Cape-class Patrol Boat project, initially to construct six 58 m aluminium monohull patrol boats for the Royal Australian Navy from May 2020, was extended by two vessels in April 2022 and a further two vessels in February 2024, bringing the total to ten vessels. Two ECCPB's have now been delivered in 2024 and two remain under construction at Austal's Henderson, Western Australia shipyard.

Incat Tasmania's Hull 096 Reaches Structural Completion

A significant milestone in the construction of Incat Hull 096 was achieved on 23 September when the final passenger deck module was lifted into place, signalling the structural completion of the vessel.

The successful placement of the front superstructure, the largest and most technically challenging module Incat has ever lifted, was a pivotal moment in the journey toward launching the world's largest electric ferry.



Progress on the construction of Incat's Hull 096, the world's largest electric ferry
(Photo courtesy Incat Tasmania)

"This achievement represents more than just the physical completion of the structure—it's a testament to the innovation, expertise, and vision which define Incat's leadership in the maritime industry," said Incat CEO Stephen Casey.

"Spanning 130 m in length, and capable of carrying 2100 passengers and 225 vehicles, Hull 096 sets a new global standard for sustainable maritime transportation.

With its structure now complete, the project moves into the next critical phase: the internal fit-out. Our highly-skilled teams are already hard at work on outfitting passenger amenities and preparing the duty-free shopping deck, which spans more than 2300 m^2. In the coming months, major machinery will begin to arrive at the shipyard for installation, continuing to bring this ground-breaking vessel to life."

Incat Chairman, Robert Clifford, added: "While the industry anticipates the launch of Hull 096 next year, Incat is planning for the future and undergoing a significant expansion to ensure that we can build many more electric ferries to meet the growing demand."

Hull 096 remains firmly on schedule for delivery in late 2025.

Austal USA Breaks Ground on Facility for Submarine Modules

On 23 October Austal USA celebrated the start of construction for a new manufacturing facility for submarine modules. The new building, scheduled to be fully operational in late 2026, will significantly increase Austal USA's capacity to support the US Navy Submarine Industrial Base.

The new building will provide 34 337 m^2 of indoor manufacturing space, purpose-built to manufacture submarine modules. The production from this building will support the US Navy's goal of delivering one Columbia-class and two Virginia-class submarines annually. It will include a material storage area, machine shop, assembly area, and waterfront improvements to support the shipment of the completed modules via barge.

This project, combined with the recent ground-breaking for another manufacturing building, represent over $US750 million in expansion of Austal USA's Mobile facility, further solidifying Austal USA's role as a major contributor to Alabama's economy. The two buildings, when fully operational, will add over 2000 new jobs. In 2023, Austal USA's contracts were supported by 259 Alabama-based suppliers accounting for over $US115 million of business. This includes 185 small businesses; over 50 percent of the cost.

In July Austal USA started construction on a new assembly building to enable the erection of large steel modules for Navy and Coast Guard ships, including the Offshore Patrol Cutter (OPC) and TAGOS-25 programs. The building will occupy 1.82 ha providing over 17 837 m^2 of new indoor manufacturing space. This project will include a shiplift system which features an articulated lifting platform approximately 136 m long by 38 m wide. The shiplift will provide a safe and reliable system to launch ships as they are completed in the assembly buildings and will also enable bringing ships back on the land-side facility for repair and maintenance.

Upon completion of these buildings, Austal USA' s Mobile ship manufacturing facility will include a 1579 m^2 steel panel line, two module manufacturing facilities totalling over 92 900 m^2 of covered manufacturing space optimised for serial production, and seven assembly bays providing over 37 161 m^2 of indoor erection space. In all, the Mobile facility covers 72.84 ha and, when this project is complete, over 139 355 m^2 of indoor manufacturing space.

John Nutt from Incat Crowther

The second of seven vessels in the new fleet of next-generation Parramatta-class ferries designed by Incat Crowther has arrived in Sydney and entered service in just a fortnight. The new vessel, *John Nutt*, completed its maiden landing at the iconic Man O'War steps of the Sydney Opera House in late June following a successful three-day voyage from Tasmania where it was built by Richardson Devine Marine. Named in honour of Dr John Nutt, known for his lead role in the construction of the Sydney Opera House, the ferry's arrival paid tribute to his significant contributions to Sydney's maritime heritage.

Following final checks by operator Transdev, *John Nutt* has now entered service, predominantly serving the busy commuter route between Parramatta, Sydney Olympic Park and Circular Quay.

John Nutt was constructed using Incat Crowther's Digital Shipbuilding service, with a multitude of stakeholders contributing to the design and delivery of the vessel.

CEO of Incat Crowther, Brett Crowther, said that the vessel entering service so quickly demonstrates digital shipbuilding's ability to produce accurate, repeatable, and operation-ready ships. "Incat Crowther has a proven track record of partnering with governments and mass-transit operators around the world to deliver tailored passenger ferries, efficiently and at pace. We are excited to see the second Parramatta-class ferry now servicing Sydney commuters and passengers so quickly."

The innovative future-focused design of the new Parramatta-class vessels includes full air-conditioning, floor-to-ceiling views, and a 200-person capacity. The ferries are expected to have a 25–30 year working life and are future-proofed for conversion to electric propulsion when network infrastructure is ready.

Incat Crowther worked closely with Transport for NSW and operator Transdev on the digital design of the new commuter ferry fleet, utilising augmented reality headset technology

Port bow of *John Nott*
(Photo courtesy Incat Crowther)

Main cabin on *John Nott*
(Photo courtesy Incat Crowther)

to enable efficient collaboration via the digital model of the ship throughout the process.

To learn more about the design of the new fleet of Parramatta-class ferries visit

www.incatcrowther.com/ships/ferries/commuter/ic22088.

Principal particulars of the new vessels are

Length overall		26.40 m
Length waterline		24.95 m
Length measured		23.98 m
Beam overall		7.2 m
Draft	(SDL)	1.55 m
	(departure)	1.48 m
Passengers		200
Crew		3
Fuel oil		2600 L
Fresh water		780 L
Black water		780 L
Main engines		2×Scania DI 13 070M each 405 kW @ 1800 rpm
Propulsion		2×propellers
Generators		1×Cummins Onan QD 8 kW
Speed	(service)	23 kn
	(maximum)	26 kn
Construction		Marine-grade aluminium
Class/Survey		NSCV Class 1D

Resilience from Incat Crowther

RV *Resilience*, a new state-of-the-art hybrid research vessel, designed by Incat Crowther and built by Snow & Company in Seattle, USA, has been delivered to the US Department of Energy's Pacific Northwest National Laboratory (PNNL). In an important milestone, RV *Resilience* is the Department of Energy's very first hybrid electric-diesel research vessel. Ushering in a new era for research for the Department of Energy, the 15 m hybrid catamaran research vessel will help PNNL sustainably expand its research activities in the Sequim Bay region of Washington state.

The vessel's innovative design has also been recognised by *Workboat* magazine, being listed in their *Ten Significant Boats of 2024*.

Offering exceptional capability for a vessel of its size, RV *Resilience*'s 28 m² main deck is equipped with an A-frame, boom crane and movable davit, in addition to a foldable swim platform. Designed to support the work of six scientists, RV *Resilience* also features multiple research

Port bow of *Resilience*
(Photo courtesy Incat Crowther)

workstations and convertible sleeping arrangements for multi-day assignments.

Sustainability and operational flexibility have been enhanced via the vessel's advanced parallel hybrid-electric propulsion system. While RV *Resilience* can travel at speeds of up to 23 kn on its two main diesel engines, it can quickly transition to a silent all-electric mode capable of speeds of up to 7 kn. This silent, all-electric mode will allow the PNNL researchers to conduct their activities with minimal noise pollution, allowing for enhanced research capabilities when taking sensitive acoustic measurements.

"This first-in-class electric-hybrid vessel will greatly expand our R&D and testing capabilities and help us build new partnerships," said Christian Meinig, Division Director for PNNL's Coastal Sciences Division. "The large working deck and heavy-lift capability will allow us to deploy and recover larger instruments and uncrewed vehicles to rapidly develop technology and deliver impact to our sponsors."

"RV *Resilience* opens up a whole new set of research possibilities and potential collaborations which we're excited to share with the world," said T.J. Heibel, Renewable Energy Lead for PNNL.

Grant Pecoraro, Incat Crowther's US Managing Director, said "The successful delivery of RV *Resilience* adds to Incat Crowther's growing track record of working with our partners to design, construct and deliver state-of-the-art, low- and zero-emission vessels. RV *Resilience* is a truly bespoke vessel, designed specifically to the PNNL's operational requirements and was a true collaboration between our team of digital shipbuilders and our partners at Snow & Company as well as the team at PNNL."

Port quarter of *Resilience*
(Photo courtesy Incat Crowther)

Principal particulars of RV *Resilience* are

Length OA	15.24 m
Length WL	15.15 m
Beam OA	4.86 m
Depth	2.30 m
Draft (hull)	0.85 m
Scientific staff	6
Crew	2
Fuel oil	1586 L
Fresh water	300 L
Sullage	300 L
Main engines	2×Volvo Penta D8-510 each 374 kW @ 2850 rpm
Gearboxes	2×Twin Disc MGX-5075 SC
Batteries	Spear Trident 113 kWh
Propulsion	2×propellers
Generators	2×Danfoss EM-PMI375-T200-2600
Speed (maximum)	23 kn
(electric)	7 kn
Construction	Marine-grade aluminium
Flag	USA
Class	USCG Subchapter T

42 m Catamaran Ferries from Incat Crowther

The fleet of Incat Crowther-designed vessels for Singapore's Majestic Fast Ferry has continued to expand with the delivery of two new state-of-the-art second-generation 42 m ferries. Further sisterships are under construction by Indonesian shipbuilder PT Cahaya Samudra and will contribute to a growing number of second-generation Incat Crowther vessels now in Majestic Fast Ferry's fleet.

These new, second-generation vessels, *Unity of Majestic* and *Ethos of Majestic,* will replace some of Majestic Fast Ferry's first-generation Incat Crowther / PT Cahaya Samudra vessels, eleven of which have now been sold to operators in Europe, Asia, the Middle East and the South Pacific with further vessels currently available on the market.

Port Bow of *Unity of Majestic*
(Photo courtesy Incat Crowther)

The new 42 m vessels represent an evolution in operational efficiency and customer experience, building on the success of the first-generation models. Passenger capacity has increased to transport up to 343 passengers at a maximum speed of 39 kn and at a cruising speed of 36 kn. The vessel's main deck has spacious seating for 295 passengers, five bathrooms (including one handicaped accessible), and ample luggage storage space. The vessel's upper deck can accommodate 48 passengers and includes a large bathroom and luggage holds as well as the vessel's elevated wheelhouse.

The customer experience has been advanced with a sleek design including updated aesthetics and more spacious seating. The operational efficiency has increased via the inclusion of a revised hullform capable of increased deadweight, while operational sea condition limits and passenger numbers are also enhanced.

Commenting on the delivery of the two new 42 m vessels, Max Tan, Managing Director at Majestic Fast Ferry, said "Incat Crowther's deep understanding of our operational requirements has delivered vessels which offer both high performance and long-term value. We're confident that this fleet will support the expansion of our services and provide

Starboard quarter of *Unity of Majestic*
(Photo courtesy Incat Crowther)

a reliable choice for passengers, while our first-generation ferries designed by Incat Crowther continue to hold their value on the used vessel market," said Mr Tan.

In addition to the two new 42 m vessels, several more Incat Crowther 42s are under construction while thirteen second-generation Incat Crowther-designed and PT Cahaya Samudra-built 39 m vessels are also either already in service for Majestic Fast Ferry or under construction.

Principal particulars of the new vessels are

Length OA	42.3 m
Length WL	40.0 m
Beam OA	10.0 m
Depth	3.40 m
Draft (hull)	1.40 m
Passengers	343
Crew	9
Fuel oil	16 600 L
Fresh water	5200 L
Sullage	1200 L
Main engines	4×MTU 12V 2000 M72 each 1080 kW @ 2250 rpm
Gearboxes	4×ZF 3050D
Waterjets	4×Rolls Royce 56A3
Generators	2×Perkins 99 kW
Speed (service)	36 kn
(maximum)	39 kn
Construction	Marine-grade aluminium
Flag	Singapore
Class/Survey	BV I ✠Hull ✠Mach, High Speed Craft, Cat A, Sea Area 3

Stewart Marler

Kanangra Restoration

Sydney's iconic ferry *Kanangra* was built by Morts Dock at the Woolwich yard and plied the inner Harbour until her retirement in 1985. *Kanangra* was one of five 1000-passenger vessels built for Sydney Ferries Ltd between 1910 and 1912 for the busy Cremorne and Mosman routes. The other four were the near-identical steel-hulled sister *Kirawa* and the three timber-hulled, but otherwise similar ferries, namely *Kirrule* (1910), *Kiandra* (1911), and *Kubu* (1912). All had timber decks and superstructures .

Kanangra on the *Sea Heritage Dock* in Rozelle Bay
(Photo courtesy Alex Byrne)

Kanangra is 47.2 m in length and has a beam of 9.5 m. Her original triple-expansion steam engines were replaced with a single direct-coupled eight-cylinder Crossley diesel engine driving fore-and-aft propellers, the last of the Sydney Harbour steam ferries to be converted to diesel. Her tall smoke stack was replaced with a smaller exhaust funnel, losing some of her distinctive appearance.

Kanangra was donated to the Sydney Heritage Fleet in 1987, and was placed on the Australian Register of Historic Vessels in 2009.

Kanangra is the last of the K-class ferries, and the Sydney Heritage Fleet is restoring her to her 1960s period, retaining the diesel configuration. She is now on board the *Sea Heritage Dock* at the SHF yard in Rozelle Bay, having replaced *John Oxley* there in April 2022. The SHF is committed to restoring her to her 1960s splendour with the aim of having her sail under the Sydney Harbour Bridge on the Bridge's centenary in 2032, which will also be the 120th anniversary of *Kanangra'*s construction at Mort's Dock.

Cruising in NSW

The winter quiet saw *Carnival Splendor* and *Pacific Adventure* working out of Sydney, the decreased number from six vessels pre-pandemic being indicative of the reduced demand for winter cruises.

The arrival of *Diamond Princess* on 26 September signalled the start of the next summer season. She was followed in October by *The World, Carnival Luminosa, Quen Elizabeth, Disney Wonder, Celebrity Solstice, Celebrity Edge, Crown Princess,* and *Royal Princess.*

November moved into a slightly higher gear, with return visits by these vessels plus *Ovation of the Seas.* Vessels berthing regularly at the Overseas Passenger Terminal at Circular Quay is a sure sign that the summer cruise season is under way.

Cruise vessels continue to call at Eden, with 27 visits scheduled over the coming summer season and *Disney Wonder* opening the berthing on 5 November. She made a return visit and was followed by *Royal Princess* up to mid-November.

Phil Helmore

Disney Wonder berthed at the Eden cruise-ship wharf on 5 November 2024
(Photo courtesy Robert Whiter)

Carnival Luminosa departing Sydney on 30 October 2024
(Photo John Jeremy)

HMAS *Hobart* dressed overall during the Fleet Review in Sydney Harbour
by Their Majesties King Charles III and Queen Camilla on 22 October 2024.
Junior sailors from the Royal Sydney Yacht Squadron in the foreground
(Photo John Jeremy)

NAVAL CREW SIZE AND HABITABILITY–WHERE IS THE FUTURE?

M O'Connor and D Bong
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SUMMARY

Habitability standards on naval surface ships have changed over the years with an increased focus on crew welfare, space and well-being. These standards drive a reduction in crew size. Naval crewing policy however has not changed in the same manner as the commercial shipping industry with the introduction of more automated equipment. Crew sizes have been maintained and, on certain vessels, have increased. Taylor Bros has been involved in numerous installations and studies where modern crew habitability standards have been applied while the increased vessel capability has driven a crew increase rendering crew habitability standards impossible to meet. Any crew increase has a flow-on effect to other ships, auxiliary systems and design aspects, while any crew decrease will have the same flow-on effect but in the reverse direction. Such an effect can have some major impacts on ship capability such as ship displacement, range and, particularly, endurance.

1. INTRODUCTION

Naval habitability standards have changed substantially over the last 20 to 30 years with an increased focus on crew welfare. These standards quantitively provide increased space for crew members in berthing, recreational and working areas. However, such space is not often available as the naval surface combatant design footprint has not changed. Thus, to meet habitability standards, either the crew berthing spaces needs to increase which will provide the adverse effect of reducing vessel capability in other areas, or crew numbers need to decrease.

Based on real experience, however, neither vessel capability nor crew numbers are reduced. Instead, crew habitability standards are compromised. It is worth viewing the evolution in the commercial shipping world, as due to vessel equipment automation, neither crew habitability standards or vessel capability are compromised. Crew numbers are reduced.

2. HABITABILITY AND ACCOMMODATION RULES

The Royal Australian Navy (RAN) has two major habitability standards relevant to the fleet. These are:

- **Def (Aust)5000 Vol. 08 Part 01**: *Accommodation Requirements*
- **DST-Group-TR-3550**: *A Revised Maritime Physical Accommodation Guidance for the Royal Australian Navy*

As the majority of Australia's fleet is designed outside of Australia, these standards are rarely adhered to or in compliance for newly-designed vessels. However, for any modifications or work done during operation of the vessels, these standards are referenced.

Taylor Bros has a lot of experience in (and ongoing attempts in) retrofitting existing designs to meet these standards, and understands the implications which these standards have on vessel design and capability.

Commencing with the Def (Aust)5000 Vol. 08 Part 01 as being the specified standard for habitability across the fleet, some important context and citations of the standard are included below:

General: 'The RAN's primary mission is to be prepared to fight and win in the maritime environment either alone or as an element of a joint or combined force. The Navy is dependent upon its shipboard personnel to accomplish this mission. Navy shipboard life contains a number of elements that may have a considerable bearing on the physical and psychological wellbeing of the ship's crew. These include separation from family and friends, intermittent danger, boredom, forced contact with others, and the unpredictable nature of the sea. The RAN recognises the positive impact that appropriate habitability criteria and design practices can have on mitigating these factors.'

Capability Aspects: 'Good habitability standards are essential in ensuring that a ship's crew performs at its maximum potential. It can be shown from research and anecdotal evidence that a ship's crew that is happy with their living conditions will be more motivated, productive, proactive and perform their duties to a higher standard for a longer period.'

Safety: 'Safety is of paramount importance and should be considered at all times in the design and implementation of surface ship habitability. Habitability directly and indirectly influences the safety of the crew and the platform. A ship that is well designed from a habitability viewpoint will minimise the crew's exposure to hazards such as excessive noise and vibration, falls, motion-induced interruptions, exposure to large variations in climatic conditions. Good habitability standards will directly lead to increased motivation and awareness which will in turn have a positive effect on safety.'

Consequences of Poor Performance or Hazard: 'Poorly designed and outfitted habitability spaces will lead to a crew that is unhappy with their quality of life. This will have several short-and long-term impacts. This will directly impact on crew safety, quality of life, recruitment and retention, crew performance and morale.'

From the above overview, direct from the navy's primary standard on ship habitability, habitability is not only important from a crew morale and quality-of life-perspective, but it is intertwined deeply in ship capability and crew safety.
The overarching rules in the Def (Aust) 5000 standard which dictates the number of crew is the berthing requirements per cabin. These are summarised below for each rank of crew member.

Captain/Commanding Officer suites shall comprise:

- a combined day/dining cabin of 19 m^2 (approx.);

- A sleeping cabin of 7 to 9 m^2 (approx.); and
- An ensuite compartment.
- The combined day/office, dining cabin, sleeping cabin, and ensuite ablution facilities shall be fitted out to the same requirements as the corresponding Flag Officer's apartment.

Cabin — Head of Department (HOD):

- HOD cabins shall have 8 to 9 m^2 deck area. These cabins are for use by Heads of Departments and should be suitable for interviews, meetings, and office work.

Officer Cabins — Single Berth:

- Officer cabins shall have 6 to 7 m^2 deck area depending on the user's rank and responsibility.

Officer Cabins — Double Berth:

- Officer double-berth cabins shall have 8 to 10 m^2 deck area. The allowances for furniture shall be one outfit for each occupant with the exception of washbasins, which are provided on the basis of one per two occupants.

Senior Sailors Accommodation — Warrant Officers:

- Warrant Officers are entitled to a single-berth cabin of between 5 to 6 m^2 deck area. Single cabins should be the designer's aim.

Chief Petty Officers:

- Chief Petty Officers shall be provided with multi-berth sleeping cabins. Two-berth cabins should be the designer's aim.
- Two-tier bed berths shall be provided, aligned in the fore and aft direction.

Petty Officers:

- Petty Officers shall be provided with multi-berth sleeping cabins. Four-berth cabins should be the designer's aim.
- Two-tier bed berths shall be provided, aligned in the fore and aft direction.

Junior Sailors:

- Deck area for Junior Sailors sleeping spaces shall be based on 1.6 m^2 per person messed, not including bunk/locker area. The maximum number of Junior Sailors located in each sleeping cabin shall be twelve. The minimum number shall be six.
- Two-tier bunks shall be provided, aligned in the fore and aft direction. The sleeping cabin shall be fitted with ensuite compartments.

The Defence Science and Technology (DST) Group provided guidance in 2015 regarding navy habitability standards in the stipulated documents below:

- **DST-Group-TR-3550:** *A Revised Maritime Physical Accommodation Guidance for the Royal Australian Navy*
- **DST-Group-TR-3564:** *Revised Anthropometry Guidance for the Royal Australian Navy*

In 2015 an Anthropometric Survey of the Royal Australian Navy (ASRAN) was conducted, providing comprehensive female and male body size and shape data of the Royal Australian Navy operational workforce. Details of this study can be found in document DST-Group-TR-3564.

The RAN's anthropometric data is essential for accurately aligning and designing the physical dimensions of compartments, workspaces, systems, or equipment with those of the users. This ensures precise fitting to the diverse range of individuals within the RAN population. The RAN anthropometric data in DST-Group-TR-3564 serves as the basis for evidence-based human factors engineering design guidance, as outlined in DST-Group-TR-3550. This document was developed to tailor design solutions to optimise the fit between the RAN population and HMA surface ships and submarines, and their systems, subsystems, and facilities. The main purpose of this guidance is to provide future and modified naval vessels with physical habitability requirements which reflect the physical and social needs of the personnel who use it. The end goal is to optimise performance, health and safety, quality of life, and satisfaction.

Key areas addressed in the document with regard to naval habitability design include:

- General body space requirements
- Workstation requirements
- Bunk requirements
- Passageway requirements
- Mess seating requirements
- Water closets and showers

All of the above areas of study provide design guidance for acceptable size and space requirements for ship's berthing areas and bunks, ship's passageways, ship's offices, workstations and consoles, mess seating and water closet and shower requirements.

Further details of the methodology and application examples of these DST standards can be found in Annex 1.

When considering the broader context of ship design, particularly for RAN's fleet, it becomes evident that many design elements are brought or influenced by international standards and practices. This is as seen in the case of the Hobart-class destroyers being based on the Spanish F100 design and the SEA5000 Hunter-class frigates, which are based on designs from Type 26 frigate and the Royal Navy's anthropometric data. While drawing from these external sources can offer valuable insights and best practices, there is a clear imperative to prioritise the collection and utilisation of anthropometric data specific to the RAN's operational workforce. This data provides invaluable insights into the physical dimensions and requirements of RAN personnel, ensuring that ship designs are optimised for the individuals who will be using them. By incorporating this data into the design process, naval engineers and architects can better tailor accommodations, workspaces, and equipment to suit the needs of RAN personnel, ultimately enhancing safety, performance, and overall operational efficiency.

3. CREW SIZES AND EXAMPLES OF INCREASED CREW SIZE

Table 1 provides an overview of the crew size for a range of RAN current and future surface combatant vessels. Specifically, Taylor Bros' experience has been with the Hobart-class destroyer where a crew size increase of 30 additional personnel over the baseline design was specified.

Also, but not specifically related to surface combatants, Taylor Bros has been recently involved in an increase in crew size on the AOR vessels of an additional 10 personnel and the Armidale-class patrol vessels of an additional 8 personnel.

The rationale behind the increased crew size of the destroyers was an increase of training capacity for personnel, particularly during helicopter operations as this already utilised the maximum capacity of the ship's crew.

Table 1 indicates the crew size for a range of RAN surface combatants. The overall number of crew has not drastically changed over the last 20 to 30 years. The table also shows the proposed increase in bunks for the Hobart-class destroyers to accommodate an additional 30 personnel.

Table 1: Crew size overview by RAN surface combatant ship class.

	ANZAC-class Frigate	Hobart-class Destroyer	Proposed Increase Hobart-class Destroyer	Hunter-class Frigate
CO	1	1	1	1
Officers	21	22	22	30
CPOs	25	29	29	30
POs	50	62	62	30
Junior Sailors	65	72	72	117
Total	163	186	186	180
Spare Staff				
CO		1	1	
Officers	5	11	11	5
CPOs	5	17	32	5
POs	5	10	25	8
Junior Sailors	1	9	9	10
Total	16	48	78	28
Total Berths	**178**	**234**	**264**	**208**

4. IMPACT OF CREW SIZE ON SHIP DESIGN AND AUXILIARY SYSTEMS

The impact that crew size has on other ship systems and the total ship design and vessel capability is certainly not negligible.

By adding 30 extra personal to the Hobart-class destroyer the following direct influences on the ship capability and ship auxiliary systems occured:

- The endurance of the vessel was reduced from 34 to 30 days.
- The time taken for the slowest group to embark the vessel from working stations to embarkation stations increased by 31 seconds.
- An additional two life rafts were needed.
- Additional washer and dryer capacity was needed in both the communal laundry and self-service laundries. Self-service washer and dryer demand increased by approx. 1.5 kg per berthing zone (changing the size of each stacked washer and dryer from 6 kg capacity to 8 kg capacity) and communal dryer capacity increased to 13 kg.
- Potable water storage capacity had to increase by approx. 1400 L to achieve a required storage capacity of 1.5 days.
- The ship's HVAC system did not meet ISO standards for the stipulated amount of fresh air entering certain cabins due to the increase in the number of berths.
- Recreational space (mess area and facilities) did not meet the minimum requirements for seating needed for the number of crew.
- The number of toilets, showers and wash basins in junior and senior sailors berthing did not meet the minimum requirement for numbers per berth.

- The stowage capacity for senior sailor's cabins does not meet the minimum amount of 0.75 m^3 per person.
- Galley size and capacity does not meet the minimum requirements.
- Food stowage capacity does not meet the requirements for the stipulated crew size and vessel endurance. Thus, the vessel endurance is compromised.

Berthing arrangement was one major area where the current baseline design does not meet the Def (Aust) 5000 habitability requirements. However, by increasing the number of berths in certain compartments, the habitability of the crew has moved further away from acceptable standards. This is shown in Table 2 with the berthing area analysis of the baseline design and the proposed upgraded design for the Hobart-class destroyers.

The deck area requirement is a minimum of 1.6 m^2 per person messed, not including bunk and locker area.

It should also be noted that, to comply with the need to increase crew capacity, three-tier bunks have been specified over two-tier bunks. This is in direct contradiction to the Def (Aust)5000 standard and the DST-Group-TR-3550 standard. These documents both recommend two-tier bunks to be used rather than three-tier bunks.

Table 2: Berthing area analysis Hobart-class Destroyer.

Cabin	Cabin Name	Initial Arrangements				Design Arrangements				No. of Bunks Increase
		Deck Area, Excluding Furniture (m^2)	No. of Bunks	Deck Area per person (m^2)	Compliant to DEF (AUST)	Deck Area, Excluding Furniture (m^2)	No. of Bunks	Deck Area per person (m^2)	Compliant to DEF (AUST)	
3-172-0-L	Junior Sailor's Berthing N-2	7.44	9	0.83	NO	-	9		-	0
3-173-2-L	Junior Sailor's Berthing N-1	7.62	9	0.85	NO	-	9		-	0
3-164-3-L	PO's Berthing N-1 (F)	8.83	8	1.10	NO	9.16	10	0.92	NO	2
3-156-1-L	PO's Berthing N-4 (M/F)	7.61	8	0.95	NO	7.10	10	0.71	NO	2
3-158-2-L	PO's Berthing N-3	7.98	8	1	NO	7.72	9	0.86	NO	1
3-164-2-L	PO's Berthing N-2	5.78	4	1.45	NO	5.52	6	0.92	NO	2
3-50-1-L	Ratings Berthing N-9 (M/F)	6.71	9	0.75	NO	6.74	9	0.75	NO	0
3-57-1-L	Ratings Berthing N-6 (F)	6.87	9	0.76	NO	6.91	9	0.77	NO	0
3-51-2-L	Ratings Berthing N-8	6.67	9	0.74	NO	6.96	9	0.77	NO	0
3-58-2-L	Ratings Berthing N-7	6.14	9	0.68	NO	6.41	9	0.71	NO	0
2-50-3-L	CPO's Cabin N-5	5.75	4	1.44	NO	5.57	6	0.93	NO	2
2-50-4-L	CPO's Cabin N-6	5.79	4	1.45	NO	5.68	6	0.95	NO	2
2-57-2-L	CPO's Cabin N-4 (F)	5.72	4	1.43	NO	5.56	6	0.93	NO	2
3-36-2-L	PO's Berthing N-11	7.90	6	1.32	NO	6.94	9	0.77	NO	3
3-44-4-L	PO's Berthing N-9	8.05	6	1.34	NO	7.30	7	1.04	NO	1
3-44-1-L	PO's Berthing N-7	6.19	4	1.55	NO	5.70	6	0.95	NO	2
3-37-1-L	PO's Berthing N-10	8.90	8	1.11	NO	8.64	9	0.96	NO	1
2-44-0-L	CPO's Cabin N-9	5.30	4	1.33	NO	5.82	6	0.97	NO	2
2-44-1-L	CPO's Cabin N-8	5.30	4	1.33	NO	5.82	6	0.97	NO	2
2-172-6-L	CPO's Cabin N-3	5.50	4	1.38	NO	5.82	6	0.97	NO	2
2-172-0-L	CPO's Cabin N-2	5.50	4	1.38	NO	5.87	5	1.17	NO	1
2-172-1-L	CPO's Cabin N-1	5.50	4	1.38	NO	5.87	6	0.98	NO	2
3-44-2-L	PO's Berthing N-8	5.10	6	0.85	NO	5.09	7	0.73	NO	1
		TOTAL	144			TOTAL	174		TOTAL	30

5. CREW SIZES IN THE COMMERCIAL SECTOR

An analysis and overview of current crew sizes in the commercial shipping sector is worth noting. It is acknowledged that commercial ships have a very different mission than navy vessels, but the influence of equipment automation and crew size over the years should not be discounted.

It is fair to say that, in the commercial sector, crew size has halved over the last 30 years by the increased use of automation and the common use of unmanned machinery spaces. Studies are being conducted to further reduce crew size but, as of today, the commercial sector has minimum manning requirements dictated by both the IMO and flag state authorities.

Many commercial ships are single-mission non-complex ships with little in common with a navy vessel's multi-role capability and complex ship systems. Some vessels, however, provide a closer comparison where commercial vessels are multi-role with various complex ship systems employed which require some specialised crew competence to operate.

One such vessel is RSV *Nuyina*, a new icebreaking research and supply vessel owned by the Australian Antarctic Division. This vessel has various specialised ship missions from carrying specialised equipment and scientists to Antarctica as well as conducting scientific research.

The vessel's principal particulars are shown in Table 3.

Table 3: RSV *Nuyina* principal particulars.

Length OA	160.3 m
Beam Moulded	25.6 m
Depth to Main Deck	19.2 m
Draught	9.2 m
Displacement (Full load)	25 500 t
Speed Max	16+ kn
Range @ 12 kn	16 000+ n miles
Icebreaking @ 3 kn	1.65+ m
Silent Operation	8 kn
Endurance	90+ days
Crew	32
Passengers	117

RSV *Nuyina* has over 20 different modes of operation for its complex hybrid twin-screw propulsion system. The propulsion system can be used in electric mode, mechanical mode, or a combination of both in either booster mode for increased speed or power for icebreaking, or increased power generation where the PTO electric motors can be used as generators. The vessel also has three stern thrusters and three bow thrusters with a DP3-rated dynamic-positioning system providing excellent maneuverability.

Her equipment is designed to function in the extreme weather of Antarctica and tropical summer conditions of 45° air temperature. This necessitates a complex HVAC system on the vessel. The vessel has two chilled-water systems supplying 11 air-handling units and 47 fan-coil units on board to control the air temperature of various specialised compartments throughout the vessel.

The vessel has a doctor and medical facility, fitness centre, theatre and various specialised scientific equipment which can be deployed to conduct scientific research. These can be deployed via the use of an aft A-frame, moon-pool handling system, forward deployment boom and drop keels.

The crew size of RSV *Nuyina* is 32, as set out in Table 4:

Table 4. RSV *Nuyina* crew size.

RSV *Nuyina* Crew Size	
Master	1
Deck officers	6
Engineering officers	7
Integrated Ratings	12
Stewards/cooks	6
Total	**32**

RSV *Nuyina* does have berthing capacity for 116 additional personnel and one doctor but these are not considered part of the crew to operate the vessel.

In determining the appropriate crew size for a commercial vessel, generally the ship owner undergoes a crewing evaluation. For international vessels this is outlined in IMO Resolution A.1047(27) *Principles of Minimum Manning*. For Australian-flagged vessels Marine orders 504, Schedule 1 Clause 6(4) lists the factors which must be considered when undergoing a crewing evaluation.

It is important to state that, based on the well-developed IMO convention for the Standards for Training Certification and Watchkeeping (STCW), crew competence is standardised and the level of competence needed by the crew for shipborne tasks and levels of responsibilities is stipulated. This makes the important task of calculating crew numbers in the vessel crewing evaluation much easier.

The Australian Maritime Safety Authority (AMSA) has developed some guidance for performing a crewing evaluation with an overview of the factors which affect crewing numbers below.

AMSA Overview of crewing evaluation: The owner of the vessel must determine the level of appropriate crewing through a process referred to as 'crewing evaluation'. Appropriate crewing may change depending on the tasks and the kind of operation being carried out.

Marine order 504, Schedule 1 clause 6 (4) lists the factors which must be considered when carrying out a crewing evaluation:

- Tasks and activities performed in addition to the safe navigation of the vessel, and the demands they impose on the master and crew.
- Risk of fatigue of the master and crew.
- Number of people to be carried on the vessel and the effectiveness and timeliness of arrangements for passenger monitoring, taking into account that the master of the vessel must be able to find out the number of passengers on board the vessel at any time.
- Design characteristics of the vessel, including its general arrangements, machinery and equipment.
- Qualifications and competencies of the master and crew, including circumstances where only the master holds mandated engineering qualifications.
- Competency needed to use technological aids to safety and navigation fitted, in addition to the mandatory requirements (e.g. fire-safety systems, remote engineering monitoring and diagnostics, electronic communication and navigation equipment, closed-circuit TV).
- Area of operation of the vessel and expected conditions, for example weather, climate, and water temperatures.
- Duration of the voyage.
- Requirements for the vessel's emergency preparedness, including the vessel's emergency plan and evacuation arrangements.
- Maintenance requirements of the vessel, and its machinery and equipment.
- External support available to the vessel.

6. SHIP OPERATION IN THE COMMERCIAL SECTOR AND CULTURAL DIFFERENCES

The large cultural differences between the navy and commercial ship operators should be noted and explained. Commercial ship operators have managed to successfully streamline technical and commercial roles and responsibilities of ship management as well as ship-side and shore-side management into one organisation.

The naval structure is bureaucratic in nature where there are clear lines of management and organisational roles and responsibilities. Multiple organisations manage a naval vessel from ship's crew to shore-side staff and repair and maintenance personnel. These roles and responsibilities can be more centralised in the commercial world where one organisation is responsible for multiple functions, allowing a far greater level of efficiency in operations. Only certain specialised tasks would be sub-contracted out to a third-party organisation giving the ship manager far greater autonomy in the ship's operation. This also allows the crew to perform more maintenance tasks on vessel equipment with only major equipment breakdowns or maintenance tasks being sub-contracted out. Navy crew are performing far fewer maintenance tasks than commercial ships with most of the equipment maintenance being sub-contracted out to equipment manufacturers or representatives.

Bureaucracy is evident in the breakdown of a navy vessel crew compared with a commercial vessel. A navy vessel has clear lines of management and roles and responsibilities which have not greatly changed over the years with the change in equipment technology. Commercial ships' lines of management have become much flatter with greater roles and responsibilities placed on fewer personnel.

In summary, a commercial ship's crew has far greater levels of responsibility and autonomy than in the naval sector. Commercial ship's crews have become more multi-functional and ship's crew perform a greater level of maintenance tasks.

A breakdown of both a typical naval surface combatant crew organisation chart is shown below compared with a typical commercial ship breakdown. What is not shown on the naval chart is the further breakdown of ship's crew into Chief Petty Officers, Petty Officers and Able Seaman. What is strikingly different is that the levels of management are much less on a commercial vessel. Also, the number of personal for each level is much less on a commercial ship.

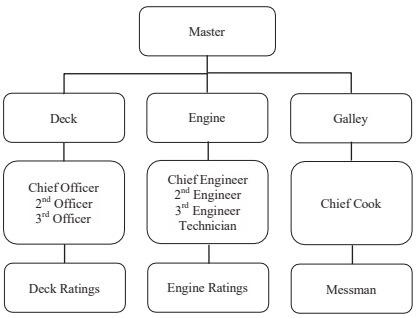

Figure 1: Typical merchant ship crew breakdown.

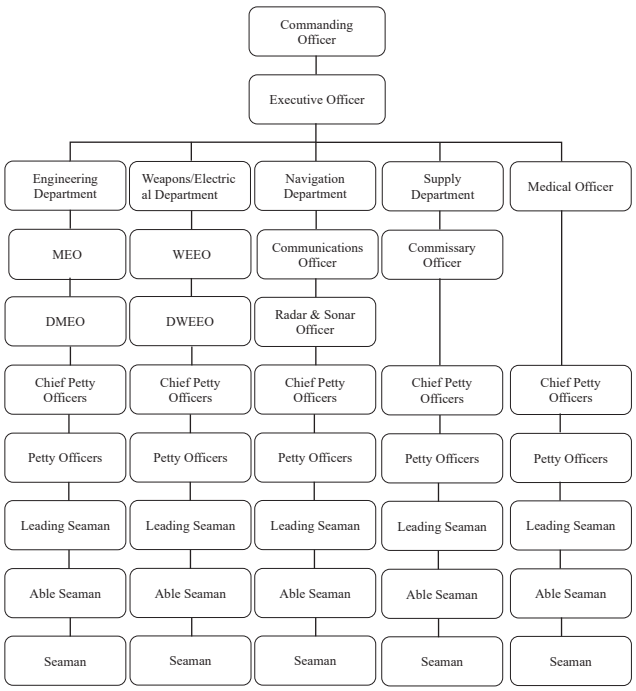

Figure 2. Typical RAN surface combatant crew breakdown. (Indicative)

Figure 2: Typical RAN surface combatant crew breakdown. (Indicative)

7. DESIGN DIFFERENCES BETWEEN THE COMMERCIAL SECTOR AND WARSHIPS

There are some major ship-mission philosophical differences when designing commercial ships compared with navy ships. A naval vessel and, in particular, a surface combatant, is a nation's means of defence and the crew, damage control systems and procedures onboard are oriented towards saving the ship, rather than in the commercial world where the loss of life is the priority rather than the loss of the ship.

Thus, crew on a naval vessel takes greater responsibility in damage control activities. This includes firefighting, damage control from flooding and chemical, biological, radiological and nuclear defence (CBRND) and general preparation for warfare.

A naval vessel will have a greater level of communication equipment onboard and a surface combatant has a command centre where it can be part of a fleet of ships and exercise some form of command and control. This function requires a high level of specialised communication equipment to communicate within a battle fleet and home to the flag state nation. Top-side design is also very important for a surface combatant as various sensors and weapons systems for both defence and attack as well as specialised radars and communications equipment need to be carefully placed on the upper deck to ensure that there is no interference.

Specialised communications and warfare officers and crew are therefore needed on naval vessels and this aspect of the vessel design requires a higher manpower than a commercial crew.

Accordingly a warship's crew size is often seen as an enhancement of the vessel capability as the crew have not been replaced in their ability to save the ship in a wartime or damage-control scenario and fight a battle.

No doubt damage-control activities have become more automated over the years, such as the use of automated watertight doors, centralised and fixed firefighting systems, IPMS Systems where ship control as well as damage control activities can be controlled from multiple work stations and compartments throughout the ship.

If naval warfare and damage-control activities can be performed as effectivly with less personnel than currently used, then this is an aspect of naval ship design which needs further consideration. It is unclear whether this is an area which has been greatly studied, but it certainly needs further examination of the risk-benefit of moving naval habitability in line with modern standards and its effect on the ability of a warship to better defend itself in a number of damage-control circumstances.

In summary, ship's functions such as vessel navigation and operation are unchanged between naval and commercial vessels. However, command and control, damage control and warfare specifics of a naval vessel require a larger crew. It is not clear, however, whether this need for a larger crew has been quantified in the context of today's modern and automated onboard equipment.

Also, when designing a new surface combatant and integrating habitability standards into the vessel requirements from the outset, some interesting characteristics are evident.

8. REALISTIC CHANGE PROPOSALS AND IMPACT ON SHIP CAPABILITY

This study does not propose a reduction in crew size based on any crewing evaluation. It does recommend that a crewing evaluation be conducted which better reflects the needs of a modern naval surface combatant.

This study proposes a surface combatant configuration which meets current naval habitability standards and highlights the influence which this has on the vessel's capability and the design aspects of the vessel and its auxiliary systems.

Working within the confines of the as-built cabins in the Hobart-class destroyer, Table 5 sets out the number of berths per cabin which would meet the navy standards for habitability.

Table 5: Hobart-class destroyer berthing in compliance with Def (Aust) 5000

Compartment	Compartment Name	Initial Arrangements				Design Arrangement in compliance with Def (Aust) 5000			
		Deck Area, Excluding Furniture's (m^2)	No. of Bunks	Deck Area per person (m^2)	Compliant to DEF (AUST)	Deck Area, Excluding Furniture's (m^2)	No. of Bunks	Deck Area per person (m^2)	Compliant to DEF (AUST)
3-172-0-L	Junior Sailor's Berthing N-2	7.44	9	0.83	NO	7.44	4	1.86	YES
3-173-2-L	Junior Sailor's Berthing N-1	7.62	9	0.85	NO	7.62	4	1.90	YES
3-164-3-L	PO's Berthing N-1 (F)	8.83	8	1.10	NO	8.83	4	2.21	YES
3-156-1-L	PO's Berthing N-4 (M/F)	7.61	8	0.95	NO	7.61	4	1.90	YES
3-158-2-L	PO's Berthing N-3	7.98	8	1	NO	7.98	4	1.99	YES
3-164-2-L	PO's Berthing N-2	5.78	4	1.45	NO	5.78	4	1.45	YES
3-155-2-L	PO's Berthing N-5	4.18	6	0.70	NO	4.18	2	2.09	YES
3-50-1-L	Ratings Berthing N-9 (M/F)	6.71	9	0.75	NO	6.71	4	1.68	YES
3-57-1-L	Ratings Berthing N-6 (F)	6.87	9	0.76	NO	6.87	4	1.72	YES
3-51-2-L	Ratings Berthing N-8	6.67	9	0.74	NO	6.67	4	1.67	YES
3-58-2-L	Ratings Berthing N-7	6.14	9	0.68	NO	6.14	2	3.07	YES
3-63-0-L	Junior Sailor's Berthing N-3	4.53	9	0.50	NO	4.53	2	2.27	YES
3-63-2-L	Junior Sailor's Berthing N-4	4.56	9	0.51	NO	4.56	2	2.28	YES
3-63-4-L	Junior Sailor's Berthing N-5	7.23	9	0.80	NO	7.23	2	3.61	YES
2-50-3-L	CPO's Cabin N-5	5.75	4	1.44	NO	5.75	2	2.87	YES
2-50-4-L	CPO's Cabin N-6	5.79	4	1.45	NO	5.79	2	2.90	YES
2-57-2-L	CPO's Cabin N-4 (F)	5.72	4	1.43	NO	5.72	2	2.86	YES
3-36-2-L	PO's Berthing N-11	7.90	6	1.32	NO	7.90	4	1.98	YES
3-44-4-L	PO's Berthing N-9	8.05	6	1.34	NO	8.05	4	2.01	YES
3-44-3-L	PO's Berthing N-6	7.41	8	0.93	NO	7.41	4	1.85	YES
3-44-1-L	PO's Berthing N-7	6.19	4	1.55	NO	6.19	4	1.55	YES
3-37-1-L	PO's Berthing N-10	8.90	8	1.11	NO	8.90	4	2.23	YES
2-44-0-L	CPO's Cabin N-9	5.30	4	1.33	NO	5.30	2	2.65	YES
2-44-1-L	CPO's Cabin N-8	5.30	4	1.33	NO	5.30	2	2.65	YES
2-44-3-L	CPO's Cabin N-7	5.30	4	1.33	NO	5.30	2	2.65	YES
2-44-2-L	CPO's Cabin N-10	5.49	4	1.37	NO	5.49	2	2.74	YES

Compartment	Compartment Name	Initial Arrangements				Design Arrangement in compliance with Def (Aust) 5000			
		Deck Area, Excluding Furniture's (m^2)	No. of Bunks	Deck Area per person (m^2)	Compliant to DEF (AUST)	Deck Area, Excluding Furniture's (m^2)	No. of Bunks	Deck Area per person (m^2)	Compliant to DEF (AUST)
2-35-0-L	CPO's Cabin N-11	5.30	4	1.33	NO	5.30	2	2.65	YES
2-35-6-L	CPO's Cabin N-12	5.40	4	1.35	NO	5.40	2	2.70	YES
2-172-6-L	CPO's Cabin N-3	5.50	4	1.38	NO	5.50	2	2.75	YES
2-172-0-L	CPO's Cabin N-2	5.50	4	1.38	NO	5.50	2	2.75	YES
2-172-1-L	CPO's Cabin N-1	5.50	4	1.38	NO	5.50	2	2.75	YES
3-44-2-L	PO's Berthing N-8	5.10	6	0.85	NO	5.10	2	2.55	YES
		TOTAL	201			TOTAL	92		

This is an over 50% reduction in crew size for senior sailors and below. As all officer's accommodation meets the naval standards this was not examined and kept as per the baseline design.

Total crew numbers have reduced from 234 to 125 personnel in order to meet the navy habitability standards. What does this crew reduction do for other ship systems and the general design and capability of the vessel? A summary is contained below:

- The endurance of the vessels increases from 33 to 62 days, or the food storage capacity needed to meet the current endurance reduces from 117 m^3 to 65 m^3.
- The potable water-storage capacity needed and water-making capacity reduces by a factor of two.
- Domestic hot water consumption reduces by a factor of two, reducing hotel load by approximately 180 kW.
- The grey-water capacity and storage tanks reduces by a factor of two.
- The ships sewage-treatment plant can be reduced by a factor of two.
- The HVAC system can be simplified with the capacity of air-handling units and fan-coil units reduced and the capacity of supply fans reduced.
- The laundry capacity can be reduced by a factor of two for both communal laundries and self-service laundries.
- Galley size and capacity is reduced by a factor of two.
- Messed area and dining area space requirements are reduced.

It has not been quantified, but the vessel's lightship displacement will certainly also be reduced. This can lead to reduced running costs with less fuel and provisions needed to meet the vessel mission, or vessel range and capability can be increased with capacity for increased fuel and payload (in the form of combat systems) due to the reduced lightship displacement.

Crew numbers certainly have a vast impact on the surface combatant design.

With less crew, vessel capability can be greatly increased on the same platform or, for the same capability, the vessel size being both displacement and/or dimensions can be greatly reduced. This can also allow navies to better optimise their fleets by providing the same capability with either more ships or less ships than currently utilised.

Also, it's worth noting the operating costs of a vessel are greatly influenced by crew size, and any major change will have a substantial effect on vessel running costs.

9. CONCLUSION

The RAN habitability standards for surface ships are modern, well detailed and specific to RAN personnel. These standards are the Def (Aust)5000 Vol.8 Part 01: *Accommodation Requirements* and DST-Group-TR-3550: *A Revised Maritime Physical Accommodation Guidance for the Royal Australian Navy*.

However, any attempt to meet these standards involves a compromise.

If these standards are intended to be met then they need to be incorporated into the design from the outset and, any attempt to retrofit such standards into existing designs based on experience is not possible without major ship-wide design implications.

Naval crewing policy is currently not aligned with such standards and they seem to have diametrically opposed objectives which need major design compromises for successful integration.

A comparison with commercial ships and crewing policy provides valuable insight. Although the major design differences and objectives of naval and commercial vessels is noted, it is unclear whether is truly reflective of the vast difference in crew numbers between the two. Due mainly to vessel automation and an increase in crew autonomy with fewer layers of management, the commercial shipping world has managed to reduce crew size without compromising vessel capability and maintaining high crew-habitability standards.

This is an area whre the RAN has not progressed and it is unclear whether any major studies into crewing policy have contemplated the reduction of crew size of its surface combatants in an attempt to provide compliance with modern habitability standards.

A reduction in crew size can certainly provide both ship-wide and fleet-wide capability increases if incorporated in the design from the outset. Ship auxiliary services are greatly reduced and vessel range, endurance and combat system capability can be increased on the same platform, while providing crew a safer environment with a higher standard of living, giving them a better opportunity to perform at their maximum potential.

10. REFERENCES

1. Australian Government Department of Defence, Def (Aust)5000 Vol. 08 Part 01: Accommodation Requirements. *Defence DRN Maritime Materiel Requirements Set*, 4 March 2008
2. Ponton, K., *A Revised Maritime Physical Accommodation Guidance for the Royal Australian Navy*, Maritime Division Defence Science and Technology Group, October 2018.
3. Ponton, K., Huf, S.,Gamble, D., Coleman, J., Furnell, A., Cockshell, S. and Fletcher, K., *Revised Anthropometry Guidance for the Royal Australian Navy*, Maritime Division, Land Division and Weapons and Combat Systems Division, Defence Science and Technology Group, January 2019.

ANNEX 1

AN ERGONOMIC STUDY IN ACCORDANCE WITH DST GROUP STANDARDS

As outlined in DST-Group-TR-3550, the default accommodation target range is 5th percentile female to 95th percentile male (or central 90%) population. This target range also aligns with international standards such as MIL-STD-1472G (US standard) and Def Standard 00-251 (UK standard) and serves as the benchmark for the SEA1180 offshore patrol vessels and SEA5000 Hunter-class frigates. While in most cases, the 5th percentile female will capture the 5th percentile male, and the 95th percentile male will capture the 95th percentile female, there are a few anthropometric dimensions for design where females are larger and males are smaller. In such instances, female and male data shall be examined and used separately for precision and accuracy.

Percentile data is most effectively used when one dimension needs to be considered for a single design point. For example, when determining the height of a structure which has no other constraints, stature is the dimension to consider, and reference to the percentile data can be made. When multiple dimensions are relevant to a design point, the percentile data should not be used or added together, instead a multivariate approach to design is required. For example, if designing a doorway, both stature and width (bideltoid breadth or forearm-forearm breadth) are necessary to consider simultaneously. Using 95th percentile male data for both stature and bideltoid breadth would only accommodate 90% of that male population. As more dimensions are included, the level of accommodation decreases when using 95th percentile data. Therefore, a multivariate data is to be used where multiple anthropometric body dimensions are considered key and are interrelated in the design point. An overview of the assessment process of using univariate or multivariate data is illustrated in Figure 3.

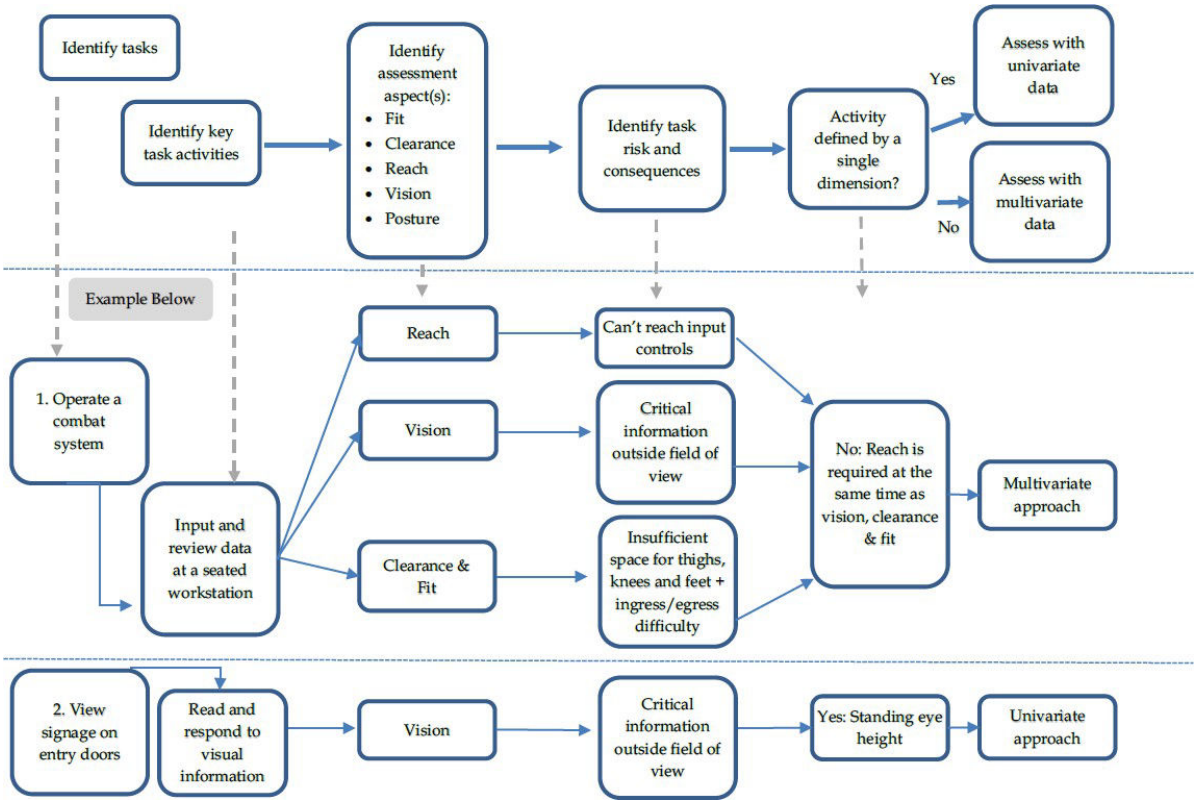

Figure 3: Assessment process of using univariate or multivariate data as per DST-Group-3564

Anthropometric data is typically collected on semi-nude participants, as is the case with the 2015 ASRAN data. Consequently, it is essential to consider additional allowances including:

- Secular trend—refers to the generational changes in dimensions which can occur over time.
- Personal equipment and clothing correction factors—refers to the additional volume which clothing and equipment or other encumbrance normally worn add to a dimension.
- Dynamic movement—refers to the additional space required for normal posture and movement when performing a task.
- General allowances and clearances—includes physical and psychological comfort measures, as well as facilitating efficient ingress and egress.
- Subtractions—to account for cases such as the compression of the seat cushion and postural slump in individuals.

There are four key principles of applied anthropometric design requirements:

- Design for the smallest—applies primarily to the application of physical force and reach distances.
- Design for the largest—applies primarily to clearances.
- Design for the average—applies when adjustability is not feasible in the design.
- Design for the range—applies when determining the amount of adjustability required, ideal for accommodating a range of users.

Taylor Bros was engaged by Luerssen to conduct an ergonomic study on the workstations on the SEA1180 offshore patrol vessel (OPV). Workstations include those on the bridge, operations room, and machinery-control room. The study focused on verifying that specified workstations complied with the design guidance and criteria outlined in DST-Group-3550, identifying any system design issues, and recommended design alternatives. The assessment of each workstation's physical habitability considered five physical aspects; fit, reach, clearance, vision and posture. This assessment was guided by the four principles mentioned above, utilising the anthropometric (univariate and multivariate) data alongside the allowances.

The findings revealed significant non-compliance with DST-Group-3550, particularly concerning the fit within the target accommodation range. Issues included chairs not meeting height and width requirements, inadequate forward and backward pan, improper positioning of chairs in relation to the desks or consoles, and inability to reach the far end of the console while seated. In several workstations, insufficient clearance hindered the rotation of chairs, impeding user ingress and egress. Of the most notable and crucial concern is the helmsman's console on the bridge, failing to meet SOLAS Regulation 22 regarding the visibility of the bow and horizon while seated.

The study made recommendations to optimise workstation ergonomics in line with DST-Group-3550 and to accommodate the target population as far as reasonably practical, with allowances for size increase over time for future crew (secular trend), clothing, cushion compression and dynamic movement. The recommendations involved implementing an alternative chair model which is better suited to the target accommodation range, modifying chair height adjustability, adjusting console height, installing deck rails for chair clearance, and optimising desk dimensions for improved reach and ergonomics. While these recommendations were implemented, the goal of accommodating the target range of the population was hindered by the limited availability of commercial off-the-shelf chairs. Furthermore, constraints related to economic feasibility restricted the feasibility of custom-made chairs and significant alterations to workstation design, such as console height adjustability.

It is apparent that the crew sizes are evolving, and this has a number of implications on the compliance with navy habitability standards. Upon examination (in accordance with DST-Group-3550) of the proposed addition of crew in the Hobart-class destroyer, it was also found that three-berth bunks do not meet the vertical separation requirement, leading to a recommendation for two-berth bunks instead. This recommendation contrasts with the standard practice across all fleet surface ships, where three-berth bunks are commonly used in junior sailor cabins and even in some senior sailor cabins.

This paper was first presented at the Warship 2024 Conference in Adelaide.

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Without such support the International Maritime Conferences and the publication of *The Australian Naval Architect* would not be possible.

Incat Tasmania to Double Capacity with New Site and Shipbuilding Facility

Incat Tasmania's expansion plans took a major step forward in August with the Tasmanian shipbuilder acquiring a portion of the Norske Skog Boyer Mill site at Boyer.

The acquisition of the 12 ha site in the Derwent Valley, located north-west of Hobart, will allow Incat to double its current shipbuilding capacity and workforce.

The expansion plan for the site includes the construction of a 240 × 120 m production facility, with capacity to construct three large ships at one time.

Incat's CEO, Stephen Casey, said that the new site is an exciting prospect for the future of the Tasmanian shipbuilder.

"Incat is leading the industry by building the world's largest electric ferry, and our goal over the next 5–10 years is to build on that success and produce multiple electric ships for the global market while expanding our workforce. The new production facility is vital for us to achieve that," Mr Casey said.

"The new site, which already has the appropriate industrial zoning, will allow us to construct hulls and decks for our vessels at Boyer and then transport the structure down the River Derwent to our existing Prince of Wales Bay shipyard to be completed. This will streamline our vessel construction process and enhance our ability to produce multiple ships per year for the market."

"Incat has the vision and the shipbuilding expertise to lead the world in the design and construction of these new eco-friendly electric ships, and we are positioning ourselves as the shipyard of choice for major ferry operators who want to minimise their environmental footprint with vessels of the highest quality."

"New Norfolk is a growing area, and this will give Incat the opportunity to provide training and employment opportunities for people across the greater Derwent Valley. We are thrilled with the prospect of employing more Tasmanians."

The site of Incat Tasmania's new shipbuilding facility in the Derwent Valley, Tasmania
(Illustration courtesy Incat Tasmania)

Incat's Chairman, Robert Clifford, said that the maritime industry's need for environmentally-friendly electric vessels is increasing rapidly and the shipbuilder needs to be ready to meet demand.

"Incat has been at the forefront of maritime innovation for more than four decades and the purchase of this site marks a new period of significant growth for the company," Mr Clifford said.

"I predict that more than 1000 new sustainable ships will be needed to satisfy the global market over the next decade. Domestically there will be a need for more vessels in locations such as Sydney Harbour, and in Europe there will be a need for much larger vessels of up to 170 m in length with the capacity to carry up to 1000 passengers. Incat is one of the few shipyards in the world capable of constructing large, lightweight, electric ships to meet that demand."

"The new production facility will feature nearly 30 000 m^2 of undercover production area, bringing our total undercover production space across both Incat sites to around 100 000 m^2, equivalent to 10 ha."

General Manager of the Norske Skog Boyer Mill, Patrick Dooley, welcomed the announcement.

"The Boyer site comprises some 565 ha, with around 10% used for the manufacture of publication paper including newsprint and magazine grades," Mr Dooley said.

"Our vision is to see the site become a major economic hub in Southern Tasmania incorporating new industries such as renewable energy and advanced manufacturing, together with the support businesses that service these industries. Incat's decision to establish its new facility at Boyer is an important step towards that goal and we wish them every success."

The site will be prepared for construction of the new production facility in the coming months, with vessel construction set to begin at the facility in 2026.

Babcock Facility in SA Opened

Babcock Australasia (Babcock) has opened a new cutting-edge facility which will see its Adelaide maintenance, manufacturing and repair footprint double in support of critical sovereign army and navy programs.

The $31 million Defence-accredited building will be home to more than 100 Babcock engineers and technical experts working across nationally-significant Defence programs including:

- Collins-class submarine in-service sustainment and future Life of Type Extension (LOTE) support.
- Systems on the Hunter-class frigates.
- Counter Chemical, Biological, Radiological, Nuclear and Explosive (C-CBRNE) asset management.
- Future AUKUS endeavours.

The Woodville North facility features a 4000 m^2 custom-built manufacturing workshop and warehouse, equipped with state-of-the-art technology to increase operational throughput, along with an additional 2000 m^2 of office space.

The environmentally-green building, which replaces Babcock's operations at Osborne, has been flexibly designed to expand so that it can easily cater for the future needs of Australia's submarine program, along with a broader pipeline of activities including, for example, the substantial work required to successfully execute AUKUS Pillar 1 and 2.

The opening of the high-tech facility signals a significant uplift in capability for Babcock and its defence operations in South Australia, by providing additional space to engineer, assemble and test equipment under simulated conditions as well as deliver a full suite of high-quality asset management services.

Babcock's Collins-class delivery team will conduct deep maintenance on several of the fleet's key systems from the new specialist facility, along with future LOTE modernisation packages as part of its partnership with ASC.

The move to the new facility is well-timed for engineers and graduates working on the Hunter-class frigate program, as it presents them with hands-on opportunities to perform detailed design work and apply their STEM skills in the creation and optimisation of mechanical systems.

Babcock has successfully recruited a strong engineering and trades base in recent years, and this new facility will further enhance its ability to attract local, national and international talent to South Australia, and develop precise technical skills amongst its workforce in support of the State's growing defence manufacturing ambitions.

Bringing staff from different Defence programs together on a single open-plan floorplate will encourage knowledge sharing and the exchange of new ideas, plus create fresh avenues for career advancement.

The building—owned and constructed by Commercial & General and leased to Babcock under a long-term arrangement—is designed to be carbon neutral in operation and features a 99 kW rooftop solar array, ground-water harvesting, electric vehicle charging stations, energy-saving lighting and end-of-trip facilities.

Babcock Australasia's new Woodville North Facility
(Photo courtesy Babcock)

Babcock and SMP sign MoU to Explore Capability

Babcock Australasia (Babcock) and Submarine Manufacturing & Products Ltd (SMP) have joined forces to explore new underwater technology and equipment which will provide next-generation sovereign capability to Australia and New Zealand's defence operations.

The two organisations have signed a Memorandum of Understanding (MoU) focussed on providing capability uplift in the undersea support space for navy activity and sustainment.

The strategic partnership will combine Babcock's comprehensive engineering, sustainment, asset-management and supply-chain experience, with SMP's expertise in specialised military diving, underwater maintenance, decompression systems, submarine escape and rescue, and all systems relating to sustaining a breathable atmosphere for personnel deployed subsea.

Strengthening these critical capabilities in Australia will be done in concert with local SMEs creating manufacturing and export opportunities which will build industry depth and develop long-term supply-chain resilience.

Babcock Australasia's Executive Director AUKUS and Strategic Growth, Andy Davis, said that broadening the navy's access to sovereign industrial resources was a critical outcome for the strategic partnership.

"The recent Defence Industry Development Strategy requires greater sovereign access to critical technology, through innovation, system integration, local upskilling and a resilient supply chain of support which delivers long-lasting quality to the customer," Mr Davis said.

"The MoU between Babcock and SMP is the first step in establishing this enhanced domain capability into our sovereign industrial base."

SMP's Managing Director, Ben Sharples, said "With maritime activities increasing and the underwater battle space evolving, a broader range of underwater equipment will be required by local and visiting navies."

"As a leading expert in manned subsea engineering and operations, SMP is well placed to work with Babcock as it continues to provide equipment maintenance and support to both current and future navy assets deployed in the region."

PMB Defence Engineering awarded major UK Nuclear Submarine Contract

PMB Defence Engineering (PMB) has signed a contract with the UK Ministry of Defence (MoD) valued at over £13 million ($A25 million) to test and qualify their cutting-edge battery system for the UK's nuclear submarines.

This contract marks a continuation of PMB's successful partnership with the UK Ministry of Defence, following an initial contract awarded in May 2019.

This advanced technology, incorporating PMB's nickel zinc battery design, has been developed and tested in collaboration with the UK MoD to suit the unique needs of nuclear submarine operations. Over the next 20 months, the upcoming phase will finalise the design and culminate in a qualified battery module and land-based trials to verify the battery system's operational performance.

"We are extremely pleased to continue this innovative work for the United Kingdom Ministry of Defence for their nuclear submarines," Mike Hartas, General Manager of New Technologies at PMB Defence, stated. "Our team in Australia and the United Kingdom has worked tirelessly since 2019 to get to this stage, and to finally see our technology mature to this state positions us well to support future AUKUS contracts in Australia and the US."

Since its establishment in 1988 as Pacific Marine Batteries, PMB Defence has been a key supplier to the Royal Australian Navy's Collins-class submarines, providing main storage batteries and associated services.

In recent years, PMB has expanded its expertise to design and supply advanced technology submarine batteries for many international customers, reinforcing its reputation as a leading provider of innovative and reliable solutions in the defence sector.

Austal Australia and Greenroom Robotics Strategic Partnership Agreement

Austal Australia and Greenroom Robotics have announced the establishment of a strategic commercial partnership, following the successful completion of the Patrol Boat Autonomy Trial (PBAT) for the Royal Australian Navy.

The Strategic Partnership Agreement (SPA) will see Austal Australia and Greenroom Robotics collaborate further on developing watercraft-based products, services and technologies which may reduce crewing, increase safety, and enable remote and autonomous operation of vessels designed and constructed by Austal Australia.

The SPA continues the highly-successful working relationship developed between Austal Australia and Greenroom Robotics during PBAT which saw both platform and navigation autonomy solutions developed for a decommissioned Armidale-class patrol boat.

Austal Australia's Chief Technology Officer, Dr Glenn Callow said that the Agreement reflects both companies' growing capabilities and demonstrated commitment to developing industry-leading remote and autonomous technologies, aligned with AUKUS Pillar 2 objectives.

"The Patrol Boat Autonomy Trial highlighted Austal and Greenroom Robotics' respective expertise in naval platform integration, and navigation and situational awareness systems technology to demonstrate a reliable, remote and autonomous-capable vessel," Dr Callow said.

"This Agreement enables Austal and Greenroom Robotics to continue working together, build upon the valuable lessons learned from PBAT and develop practical remote and autonomous solutions which may be applied to any watercraft designed or built by Austal.

"Further, this Agreement aligns directly with the AUKUS Pillar 2 objective to develop advanced military capabilities, including autonomy and both Austal and Greenroom Robotics are ready to pursue opportunities that we hope one day, will be integral features of future Australian, UK and US naval vessels."

Greenroom Robotics Chief Technology Officer, Harry Hubbert, said that both teams were looking forward to further developing systems that were tested and proven during the Patrol Boat Autonomy Trial and may be considered for future optionally crewed naval vessel programs.

"PBAT allowed us to install, test and operate our Greenroom Robotics Advanced Maritime Autonomy (GAMA) software, to successfully navigate the de-commissioned Armidale-class patrol boat, *Sentinel*, in a series of remote and autonomous tests off the coast of Western Australia.

"GAMA worked seamlessly with Austal's proven platform management system, MARINELINK, to offer reliable and safe operation of the 57 m patrol boat, including collision-avoidance exercises which demonstrated the capability of the platform.

"We're excited to be continuing our close collaboration with Austal to further develop fully integrated remote and autonomous technologies and explore new opportunities for optionally-crewed vessels which ultimately may contribute to meeting AUKUS Pillar 2 objectives," Mr Hubbert added.

Civmec to Acquire Luerssen Australia

Civmec Limited (Civmec) and NVL BV & Co. KG (Naval Vessels Lürssen) of Bremen, Germany, have entered into a non-binding Heads of Agreement detailing the framework for the transfer of ownership of Luerssen Australia Pty Ltd to Civmec Limited, it was announced on 15 October 2024.

Luerssen Australia's sole business is the building of six Arafura-class offshore patrol vessels for the Royal Australian Navy under the existing SEA1180 contract with the Australian Department of Defence. Upon completion of the potential transaction, NVL will transfer all its shareholding in Luerssen Australia Pty Ltd to Civmec Limited, including all assets, employees, and licences. This ensures the uninterrupted design and build of the Arafura-class offshore patrol vessels at the Osborne South shipyard in South Australia and the Civmec-owned facility in Henderson, Western Australia.

The proposed change of ownership and control of Luerssen Australia is subject to the Commonwealth granting its consent. In order to obtain such consent as soon as is possible, Luerssen Australia and Civmec will immediately begin engaging with the Commonwealth in the required administrative approval process, with the parties working towards a target date of 31 December 2024

The non-binding Heads of Agreement is subject to satisfactory due diligence and meeting Conditions Precedent. In parallel with the Commonwealth consent process, an effective date in the coming months will allow the parties to conduct necessary due diligence and detailed planning. The immediate priority is to agree on a framework for the interim period in which Luerssen Australia and Civmec will closely cooperate in managing the SEA1180 project, ensuring that Defence, the Royal Australian Navy and industry all benefit from the efficiencies and advantages of the agreement.

Civmec's Executive Chairman, Jim Fitzgerald, said "The acquisition of Luerssen Australia is a natural step for Civmec as a sovereign Australian shipbuilder with world-class shipbuilding facilities and an experienced shipbuilding workforce. Having worked on the project since 2018 we're confident in our ability to execute the remaining work scope and ensure a smooth transition for all stakeholders.*"*

Luerssen Australia's Chairman (and CEO of NVL), Tim Wagner, said "We're very confident in Civmec's ability to finish the remaining works on the SEA1180 project and NVL will ensure that they are supported by us until Civmec's successful completion of the project. We appreciate that there are many details to work through and we look forward to engaging with all stakeholders, including the Commonwealth, Luerssen Australia employees and suppliers to ensure a smooth and successful transition."

The lead ship in the SEA1180 project, NUSHIP *Arafura*, recently completed sea trials in South Australia.

EDUCATION NEWS

UNSW Canberra

Since the last report, Semester 2 has been peppered with presentations from guest lecturers. All who have participated are thanked for their contribution and expression of passion for their roles as naval architects and for the education of our students. They were:

Author and affiliation	Topic
Matt Solon (DNE)	Survivability and vulnerability
Joe Cole (DNE)	Concept design
Molly McManus (DNE)	Ship structures
Richard Milne (DNE)	Hydrodynamics
Rob Gehling (AMSA Rtd)	IMO and commercial shipping
Martin Renilson (AMC)	Submarine hydrodynamics and design
Paul O'Connor (BV)	Ship design and structures
Richard Duffield (NSSG)	NSSG and ship construction (see photo next page)

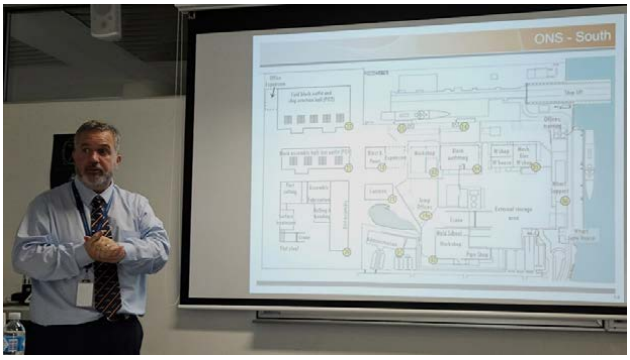
Ship Design presentations for the final-year students were held on 24 October with attendance in the audience featuring a range of invitees coming from Defence, industry and interested retirees. Some of the Year 3 cohort also attended as part of their own learning journey, projecting themselves into a similar event in 2025 when they will be centre stage (see photo of attendees). The presentations made were by:

Author	Topic
SBLT Scarlett Locker	Design of an air-independent propulsion (AIP) SSG submarine for the RAN
SBLT Thandi Murada	Design of an uncrewed autonomous surface vessel (AUSV) for the RAN
SBLT James Scotson	Design of a next-generation multi-role logistics ship for the RAN.

As we seek to grow the awareness of our program in the broader community, it is encouraging that a significant number of students have expressed preferences for our 2025 program via the Universities Admissions Centre (UAC). There have been nominations of five first preferences from Defence students, presumably midshipmen, and six first preferences from civilian students. Another 16 have identified us as their second-to-fifth preference as they explore their university options. The applicants' achievements of suitable ATAR scores will lead to offers and hopefully acceptances. It is an interesting waiting game for us to see who will populate our future classes. It will also be interesting to see whether any of them are taking advantage of the nature of our degree with its 2 + 2 structure; one which facilitates students transferring to UNSW Canberra to pursue naval architecture, having undertaken the first two years of an accredited mechanical or aeronautical engineering four-year degree program at another Australian or New Zealand tertiary institution. Time will tell. This level of interest through UAC is up on the numbers from 2023 for 2024 entry.

As this year ends and another begins, let me on behalf of my colleagues and, in particular, David Lyons and Sean McCracken, wish you well, and invite you to consult with us

Attendees and presenters at the 2024 final-year Ship Design presentations
(Back L to R) Richard Milne, Rob Gehling, Martin Grimm, Alistair Smith, Lachlan Maloney, Joe Cole, Peter Blackwood, MIDN Archie Gumley, MIDN Kelvin Hepburn (part-obscured), (Front L to R) Warren Smith, SBLT Scarlett Lockyer, David Lyons (on Scarlett's laptop, participated online) SBLT Thandi Murada, SBLT James Scotson, CAPT Andrew Wright, MIDN Rian Klinger; Missing from photo: Levi Catton and Sean McCracken
(Photo courtesy Sean McCracken)



Guest lecturer Roger Duffield of NSSG, describing the Osborne Naval Shipyard
(Photo courtesy Warren Smith)

to support your workforce planning and naval architectural growth needs. Supply is not in equilibrium with expected national demand. We are keen to engage and explore the opportunity for provision of education pathways to deliver on sovereignty, continuous naval shipbuilding, AUKUS and other maritime objectives, including partnering in research and targeted studies. If you know of scholarship, cadetship, and internship opportunities, or would like to create some, we would also like to have discussions.

A/Prof. Warren Smith
Naval Architecture Program Coordinator
School of Engineering and Technology
UNSW Canberra at ADFA

Australian Maritime College

AMC to Host New Naval Research Centre

The University of Tasmania's Australian Maritime College (AMC) will soon be home to a new Naval Research Centre in Launceston, consolidating Tasmania's position at the forefront of maritime research and innovation.

An agreement signed in Launceston on 23 October between AMC and Navantia Australia marked a significant step forward in the establishment of the Centre, which will offer unique opportunities for students and researchers working at the cutting edge of innovation in shipbuilding and design.

The partnership brings together AMC's world-class research capabilities and Navantia Australia's industry leadership in naval design capability. It will foster industry collaboration with AMC's academics and students, contribute to creating and keeping high-tech jobs in Australia and help to secure Australia's sovereignty in the naval domain. Areas of priority in shipbuilding and design research include innovations to keep Australian vessels and sailors safe during naval operations and improvements to the efficiency and environmental footprint of vessels.

Malcolm Wise, Principal of the Australian Maritime College, said that this collaboration, underpinned by specialist research capability and advanced facilities, positioned the AMC at the forefront of naval research. "These specialist research areas include underwater acoustics, hydrodynamic optimisation, model-based simulation, and underwater shock and vibration," Mr Wise said.

AMC's state-of-the-art hydrodynamic facilities, including a 100 m towing tank and Australia's only cavitation laboratory, will be critical to the Centre's operations.

Navantia Australia Managing Director, Israel Lozano, said that he was excited to be collaborating with the AMC on innovative technological solutions. "By combining AMC's cutting-edge research capabilities with Navantia's 400 years of experience in naval ship design, we are creating this innovation hub for the future of the Australian naval industry. This collaboration will advance critical research needed for the Royal Australian Navy in niche areas such as platform signatures, hullform optimisation, ship system optimisation, and model-based simulations for digital twins. It will also reinforce Tasmania's role as a leader in naval research. Together, we look forward to developing solutions which will enhance Australia's naval capabilities for years to come."

Navantia Australia, which has played a major role in the delivery and sustainment of over 60 per cent of the Royal Australian Navy's surface fleet, is committed to growing Australia's naval shipbuilding and sustainment industry.

The Naval Research Centre will officially begin operations in early 2025

Signing the agreement at the AMC Towing Tank are (L to R) Navantia Australia Managing Director, Israel Lozano, the Premier of Tasmania Jeremy Rockliff, and University of Tasmania Deputy Vice-Chancellor (Research), Professor Anthony Koutoulis
(Photo courtesy Navantia Australia)

30th ITTC Hosted by AMC in Hobart

The 30th International Towing Tank Conference (ITTC) was hosted by the Australian Maritime College at the Hotel Grand Chancellor in Hobart on 22–27 September 2024

The ITTC has long been recognised as a global leader in the field of hydrodynamic experimentation. This voluntary association of worldwide organisations, responsible for predicting the hydrodynamic performance of ships and marine installations through physical and numerical experiments, holds NGO status with observer privileges at the International Maritime Organisation (IMO). Every three years, the ITTC brings together the brightest minds and leading institutions in this field and, in 2024, Australia had the honour of hosting the prestigious 30th Conference in Hobart.

A Global Gathering in the Southern Hemisphere

Hosted by the Australian Maritime College (AMC), the 30th ITTC Conference welcomed 160 delegates, 140 of whom made the journey from the northern hemisphere to participate in this landmark event. For only the second time in the ITTC's history, the Conference was held in the southern hemisphere. Previously, the 26th ITTC was hosted in Rio

de Janeiro, Brazil, making this year's event particularly significant for Australia.

The Structure of the ITTC: Driving Innovation

Comprising more than 100 member organisations from around the world, the ITTC stands as a leading authority on hydrodynamic research. The conference brings together representatives from all member organisations, with technical committees working between conferences to address critical issues in ship resistance, propulsion, seakeeping, manoeuvring, ocean engineering, stability in waves, cavitation, wind-powered ships, and more.

Each committee member can serve up to three terms, ensuring that fresh perspectives and innovative thinking remain at the forefront of the organisation. The rotational nature of the conference venue, which shifts between six key regions, reflects the truly global nature of this body.

An Executive Committee oversees daily operations, while an Advisory Council manages the technical matters.

Australia's Moment in the Spotlight

Hosting the 30th ITTC was not only a prestigious milestone for AMC and Australia, but also an invaluable opportunity to showcase the nation's expertise in hydrodynamics. More importantly, it has created lasting benefits for the country's maritime engineers.

For early- and mid-career professionals, the opportunity to collaborate with the world's top engineers in the field of hydrodynamics is transformative. By working closely with these global experts over the years, young engineers gain foundational knowledge, develop contemporary procedures, and acquire hands-on experience at some of the world's most advanced facilities.

Networking at the ITTC also builds career-defining friendships and opens doors to lifelong professional relationships.

A Memorable 6-day Program

The 30th ITTC in Hobart offered a rich program of technical sessions, group discussions, networking opportunities, and social events. Delegates explored cutting-edge developments in hydrodynamic research while enjoying the unique experience of Tasmania's maritime history and natural beauty.

Several technical committees presented the application of novel predictive methods, such as machine-learning and artificial intelligence-based methods, including for the prediction of seakeeping motions and loads.

As a result, the ITTC Advisory Council has assigned a general task on all technical committees in the 31st term to monitor the impact of AI on their area.

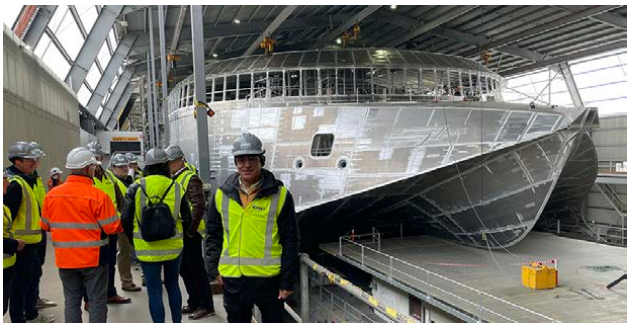
The general assembly of the full conference voted to accept approximately 70 updated and 7 new guidelines and procedures. Of particular interest to the operations of the AMC Towing Tank are the updated procedures for High-Speed Marine Vehicle Resistance Tests (7.5-02-05-01) and Seakeeping Tests (7.5-02-05-04).

The organising team, led by Michael Woodward and Gregor Macfarlane from AMC, along with Estelle Hudson (AMC Search) and Helene Stewart (Leishman Associates), delivered a well-executed event which further cemented Australia's position as a key player in maritime innovation.

As the ITTC looks to the future, the successes of this year's conference have left an indelible mark on the international maritime community, with Australia at the heart of its progress.

The next full conference, for the 31st ITTC term, will be hosted by Flanders Hydraulics in Ghent, Belgium on 12—17 September 2027.

30th ITTC official group photo including 144 of the 160 delegates
(Photo courtesy Gregor Macfarlane)



The Chair of the ITTC Executive Committee, Professor Kourosh Koushan from Sintef Ocean, Norway,
during the technical tour of the Incat International shipyard
(Photo courtesy Gregor Macfarlane)

Some of the AMC personnel who attended the 30th ITTC
(L to R) Dr Chris Chin, Dr Nick Johnson, A/Prof. Gregor Macfarlane, Dr Eric Gubesch,
A/Prof. Jonathan Duffy, Dr Shaun Denehy, Mr Michael Sokialis (Year 4 NA student),
and A/Prof Michael Woodward
(Photo courtesy Gregor Macfarlane)

AMC students, some external assessors and AMC staff
together for the 2024 Maritime Engineering Research Project Presentations
(Photo courtesy AMC)

AMC Maritime Engineering Student Research Projects 2024

Final-year Bachelor and Master of Engineering students have honed their presentation skills and gained invaluable industry feedback on their thesis projects at the Australian Maritime College's annual Maritime Engineering Research Conference on Friday 1 November 2024. The annual conference marks the culmination of countless hours of hard work during the last year of their maritime engineering degrees, with students required to deliver a 15 minute presentation and 5 minute Q&A session which is judged by industry assessors.

Winners of the Best Presentation Awards
Ryan Stanaway (L) and Cameron Skeggs
(Photo courtesy AMC)

A total of 36 presentations were delivered to a panel of external assessors, AMC staff and fellow students. Twenty-one external assessors from industry attended the presentations (three via Zoom). Of the 18 assessors from industry, 14 travelled from outside Tasmania to attend in person, making the event an excellent opportunity to network with fellow industry representatives, AMC staff and soon-to-be graduates of maritime engineering degrees.

Two awards for Best Presentation were on offer, with each recipient receiving a certificate and $750 from OMC International, presented by Dr Mohammadreza Javanmardi. The recipients of each award and their research thesis titles were:

Prize No.1 Winner	Ryan Stanaway, *Live sampling platform (LSP) performance investigation—Empirical and experimental study of mass flowrate through towed-model inlet*
Prize No.2 Winner	Cameron Skeggs, *Sensitivity of numerical simulations of air-backed collision tests to cold work hardening and impact energy*

A/Prof. Gregor Macfarlane
Manager, Towing Tank and Model Test Basin
Australian Maritime College

AMSA

Survey Matters

Survey Matters is AMSA's e-Newsletter relating to domestic commercial vessel (DCV) survey and is published approximately six times per year. You can request placement on the mailing list by emailing DCV Survey <dcvsurvey@amsa.gov.au>. The e-Newsletters are now also available online at

https://www.amsa.gov.au/news-community/newsletters#collapseArea612

Items included in the September 2024 e-Newsletter included:

- Marine Surveyor Accreditation Guidance Manual—Part 2
- Case Study—Compliance action on an AMS's accreditation
- Domestic Commercial Vessels—Decks
- Understanding conflict of interest provisions for accredited surveyors under the National Law Regulations
- Temporary operations permits—Division 5 and 6—Ongoing issues
- Instructions to Surveyors (DCV-ITS-022)
- Surveyor Workshop—October 2024
- Alternate survey approvals—Surveyors must conduct surveys in accordance with prescribed standards
- Have your say on the new Accommodation, Arrangement & Personal Safety form
- 10-year surveys must be completed
- Survey Matters suggestions

The article on *Instructions to Surveyors (DCV-ITS-022)* is reproduced below.

Phil Helmore

Instructions to Surveyors (DCV-ITS-022)

The long-awaited *Instruction to Surveyors (ITS)* for the inspection of foam buoyancy, hull voids and fuel tank compartments at 10 yearly surveys is now live on the AMSA website,

https://www.amsa.gov.au/vessels-operators/domestic-commercial-vessels/instructions-surveyors

This ITS was created on the back on the discussions and ideas of accredited marine surveyors at the 2022 surveyor workshop. The initial draft was then released in *Survey Matters* and further refined based on feedback received. AMSA is very appreciative of the discussion and feedback provided by the surveyor community to create a useful tool for reference.

Surveyor judgment and experience on the ground is fundamental to the practical implementation of the ITS. Ultimately it is for the surveyor to provide technical justification of the approach taken to establish the condition of the items being surveyed. The ITS provides a defendable framework for establishing this justification.

Guidance is also provided for builders and plan-approval surveyors for design details which should be included at the design and construction stage. This will facilitate the survey of the vessel in the future, without the need for costly and potentially destructive works in the future. These represent a very tangible and marketable saving in cost of ownership and require minimal additional effort at the design and construction stages.

We strive for continual improvement in the resources provided to surveyors and welcome any feedback or suggestions for this ITS, others already available or those to be created.

Survey Matters, September 2024

AMSA Rewards UoW Students for Academic Excellence

The Australian Maritime Safety Authority (AMSA) has awarded Glenn Hanson and Dan Probert from the University of Wollongong with its Academic Excellence Scholarship for 2024. Awarded annually, the $10 000 scholarship is provided to students who demonstrates academic excellence while studying a Master of Maritime Policy or Graduate Certificate in Maritime Studies Programs. Glenn and Dan are two of seven students who AMSA is supporting this year as part of its annual scholarship program which promotes the development of skills and knowledge in the maritime industry.

AMSA Chief Executive Officer, Mick Kinley, said that having skilled professionals in maritime policy is critical to supporting the growth and development of Australia's maritime industry, and AMSA as its safety regulator. "Policy, both domestic and international, informs the way the maritime industry operates and is regulated," Mr Kinley said. "Our Academic Excellence Scholarship is one way in which we are supporting a steady stream of skilled and experienced professionals in this area of the maritime sector."

Director of the Australian National Centre for Ocean Resources and Security (ANCORS) at the University of Wollongong, Prof. Stuart Kaye, said that the university is grateful for the assistance provided by AMSA and for its long-standing relationship with the maritime regulator. "We are proud of the strong relationship we have with AMSA and thankful for the financial assistance provided to our students, enabling them to critically analyse and explore the factors which contribute to the development of the law of the sea and maritime policy."

AMSA Media Release, 8 August 2024

MEMBERSHIP

Australian Division Council

The Council of the Australian Division of RINA met on the afternoon of Tuesday 10 March 2024 by zoom-conference under the chairmanship of our President, Prof. Jonathan Binns in Melbourne with links to Gold Coast, Sydney, Canberra, Melbourne, Hobart, Launceston, Adelaide and Perth. Prof. Martin Renilson, a member of the Institution's Council and nominee as Pacific Region Vice-President, attended as an observer.

Among the items discussed were:

Filling Council Vacancies

Council noted that no nominations had been received for the vacancy resulting from the resignation of Omar Hostia Sotil and indicated it would welcome any suggestions for appointment to the vacancy. Prof. Martin Renilson will continue to be invited to observe Council meetings.

***Subs in Schools* Program**

Council was advised with regret that the Program had been discontinued through lack of funding.

Annual Grant from RINA HQ

Subject to receiving answers to some questions, Council reluctantly agreed in-principle to forego the annual grant for the current year to assist in the Board's efforts to re-build the Institution's financial base following COVID and the digital transition.

Improvement Working Group

Council cleared the way for the Group to hold a face-to-face workshop in the coming months to further develop the services provided to Division members.

GP Frigate Acquisition

Council agreed to communicate with the Minister on the connection between the "no design changes" policy applied to these frigates' foreign design and the construction in Australia of most of these vessels.

Walter Atkinson Award 2024

Selection of the winner of this Award is still underway and would be resolved before Council meets in December.

Australian Division Handbook and Alignment of Section Rules

Council noted a number of developments at RINA HQ which would need to be resolved before finalisation of the Division Handbook and amended Section Rules.

Victorian Engineer Registration

Further to the report on this matter in the August edition of *The ANA*, the next step in this matter remains in the hands of RINA HQ. The previous advice for Victorian members to register with BPEQ remains current

The draft minutes of the meeting have been circulated to Council members and are available to other members by request. The next meeting was tentatively scheduled for Wednesday 11 December.

Division Members should note that the terms of elected Council Members expire at the Division Annual General Meeting early in 2025. Accordingly, a call for nominations is published in this edition of *The ANA*.

Rob Gehling AO
Secretary
rinaaustraliandivision@gmail.com
0403 221 631

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

NOMINATIONS FOR DIVISION COUNCIL

Nominations are invited from Corporate Members (MRINA or FRINA) and Associate Members (AMRINA) for election to Division Council for a term of two years from March 2025. The majority of these elected members must be Corporate Members. Nominations, which must be in writing and include the signatures of the proposer, seconder and nominee, should be received by the Secretary no later than Saturday 31 December 2024.

Rob Gehling
Secretary, Australian Division
PO Box 462, Jamison Centre, ACT 2614
rinaaustraliandivision@gmail.com
0403 221 631

Changed contact Details?

Have you changed your contact details within the last three months? If so, then now would be a good time to advise RINA of the change, so that you don't miss out on any of the Head Office publications, *The Australian Naval Architect*, or Section notices.

Please advise RINA London, *and* the Australian Division, *and* your local section:

RINA London	hq@rina.org.uk
Australian Div. Section	rinaaustraliandivision@gmail.com
ACT	rinaact@gmail.com
NSW	rinansw@gmail.com
Qld	rinaqlddiv@gmail.com
SA&NT	rina.santdiv@gmail.com
Tas	tassec@rina.org.uk
Vic	vicsec@rina.org.uk
WA	wa@rina.org.uk

Phil Helmore

NAVAL ARCHITECTS ON THE MOVE

The recent moves of which we are aware are as follows:

Nick Bentley has moved on from BLA Marine and has taken up the position of Senior Naval Architect with Oceanic Design & Survey in Coomera, Qld.

Lee Fennell continues consulting and has added the position of Account Manager with CDP, an international non-profit organisation which helps companies, cities, and regions disclose their environmental impact and risks, in London.

Nigel Finnerty has moved on from Rio Tinto Alcan and is now the Principal of his own consultancy, Finnscon, in Invercargill, New Zealand.

David Firth has moved on within the Department of Defence and has taken up the position of Engineering Manager with the Capability Acquisition and Sustainment Group in Canberra.

Steve Fitzsimmons has moved on from Neptune Marine Services and has taken up the position of Lead Engineer with Icon Engineering in Perth.

Dean Feltcher has moved on from MMD Naval Architects and has taken up the position of Project Engineer with Subsea 7 in Perth.

Andrew Forbes has moved on from BCI Minerals and has taken up the position of Project Manager with Infinite Green Energy in Perth.

Stuart Friezer relocated his consultancy, Stuart Friezer Marine to Aarhus, Denmark, in 2010, and SFM now encompasses Stuart Friezer Consulting DK, the local business entity.

Nathan Gale has moved on within KPMG Australia and has taken up the position of Director in Sydney.

Elettra Ganoulis has moved on within One2three Naval Architects and has taken up the position of Naval Architect and Project Manager in Sydney.

Zijian Gao has moved on from Austal and has taken up the position of Marine Surveyor with ClassNK (Nippon Kaiji Kyokai) in Fremantle.

Fergus Hudson has moved on within Austal and has taken up the position of R&D Defence Technology Analyst in Henderson, WA.

Zoran Jaksic has moved on from Navantia Australia and has taken up the position of Director with Horizon Maritime in Sydney.

Cengizhan Uluduz continues as the naval architect with Diab Korea in Busan, South Korea, servicing Diab customers in South Korea and Japan on commercial and military projects, and Taiwan on military projects, providing support, qualifications and supplying Diab materials.

Dominic Worthington has moved on from Maersk Drilling and has now taken up the position of Chief Engineer on Australian merchant vessels, based in NSW.

Konrad Zurcher has moved on within the Australian Maritime College and has taken up the position of part-time Lecturer in Launceston.

This column is intended to keep everyone (and, in particular, the friends you only see occasionally) updated on where you have moved to. It consequently relies on input from everyone. Please advise the editors when you up-anchor and move on to bigger, better or brighter things, or if you know of a move anyone else has made in the last three months. It would also help if you would advise Robin Gehling when your mailing address changes.

Phil Helmore

THE INTERNET

RINA Webcasts

RINA has set up a YouTube channel and RINA webcasts can be viewed there. The RINA YouTube channel is at

https://www.youtube.com/channel/UChb1sfHbWfQmG-iwpp_QGJg

Bookmark this website and keep your eye on it!

Video recordings of Australian section presentations should be sent to Klaudia Rogala-Haracz <krogalaharacz@rina.org.uk> at RINA HQ for uploading. Recording files are usually too large to be sent as email attachments; a preferable solution is to load the presentation to Dropbox (or similar) and send the URL to Klaudia.

To find a recording of an Australian section presentation, look under Branch and Section Presentations (usually the top line of presentations). If it doesn't show up there or in the next screen to the right, then click on Playlists in the menu bar. Scroll down and across, and click on *View full playlist* under Branch and Section Presentations.

If you know the name of the presentation, then click in the search icon in the menu bar, type the title of the presentation you are looking for (or at least the first few words thereof) and press Enter.

NSW Section Webcasts

The NSW Section webcasts recorded and uploaded within the last three months are:

- *Ship Electrification: A Viable Pathway for*

Decarbonisation presented by Ashar Khan, Manager New Builds Marine, Wärtsilä Australia, to a joint meeting with the IMarEST on 4 September in the Henry Carmichael Theatre at the Sydney Mechanics School of Arts in the Sydney CBD and streamed live.

- *Autonomous Surface Vessel Design Considerations* presented by Allen Stotz, Torsten Lau, Eliah Cameron and Michael Reilly, Gibbs & Cox Australia, to a joint meeting with the IMarEST on 2 October in the Henry Carmichael Theatre at the Sydney Mechanics School of Arts in the Sydney CBD and streamed live.

Phil Helmore

Tasmania Section Webcasts

The Tasmania Section webcasts recorded and uploaded within the last three months are:

- *Naval Crew Size and Habitability—Where is the Future?* by Michael O'Connor, Design Manager, Taylor Bros Marine to a meeting on 13 August at Taylor Bros Marine in Hobart, Zoomed to the Australian Maritime College in Launceston, and streamed live to the wider fraternity.
- *How will Shipping Meet its Zero Target of Decarbonising by 2050* by Prof. Stephen Turnock, Head, School of Engineering, University of Southampton, to a meeting on 17 September at the Australian Maritime College in Launceston, Zoomed to Taylor Bros in Derwent Park, Hobart, and streamed live to the wider fraternity.

Nipuna Rajapaksha

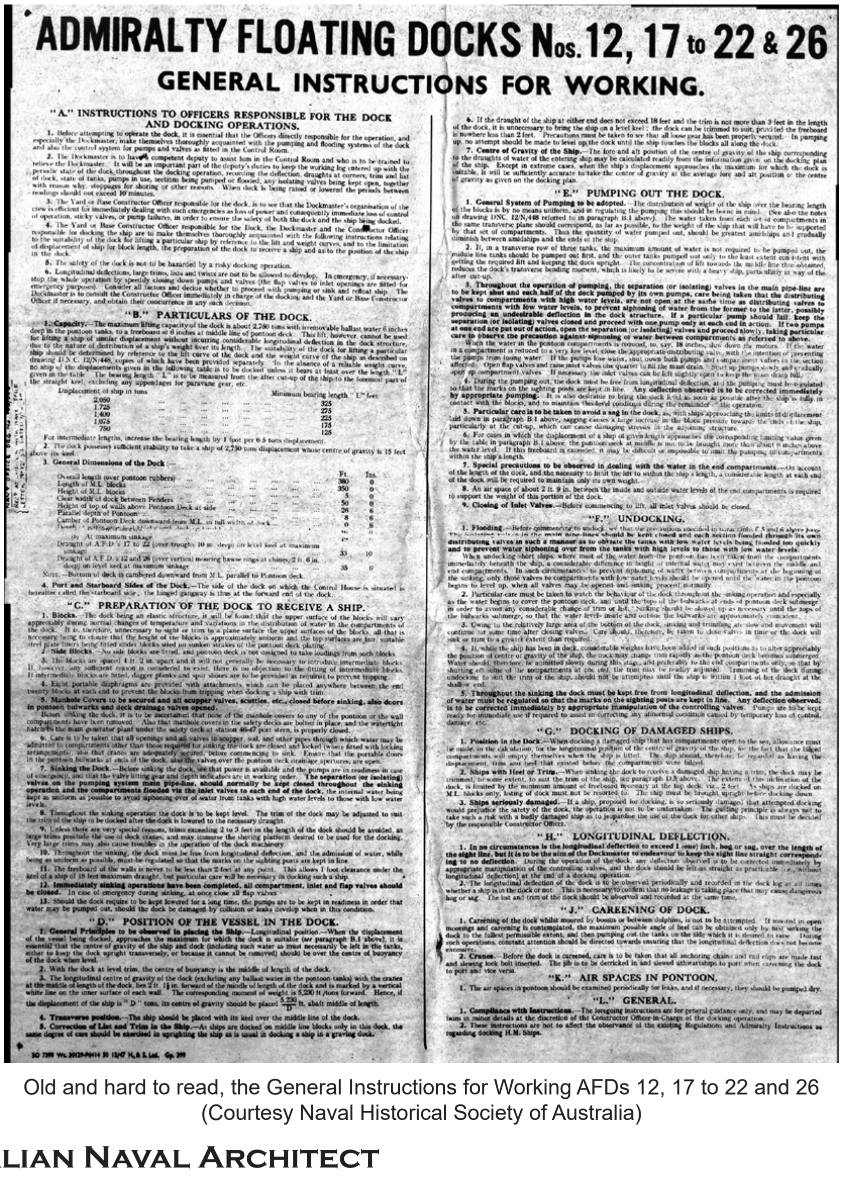
Further recordings will be added to the RINA YouTube channel as they occur.

FROM THE ARCHIVES

A MUCH TRAVELLED FLOATING DOCK

John Jeremy

An old Photostat copy of a document was recently found in a box of papers donated to the Naval Historical Society of Australia which stirred memories of one of Sydney's floating docks. It provided the instructions for operating Admiralty Floating Docks 12, 17 to 22 and 26. AFD 17 was operated in Sydney for nearly two decades.



ADMIRALTY FLOATING DOCKS Nos. 12, 17 to 22 & 26

GENERAL INSTRUCTIONS FOR WORKING.

"A." INSTRUCTIONS TO OFFICERS RESPONSIBLE FOR THE DOCK AND DOCKING OPERATIONS.

1. Before attempting to operate the dock, it is essential that the Officers directly responsible for the operation, and especially the Dockmaster, make themselves thoroughly acquainted with the pumping and flooding systems of the dock and also the control system for pumps and valves as fitted in the Control Room.

2. The Dockmaster is to have a competent deputy to assist him in the Control Room and who is to be trained to relieve the Dockmaster. It will be an important part of the deputy's duties to keep the working log entered up with the periodic state of the dock throughout the docking operation, recording the deflection, draughts at corners, trim and list of dock, state of tanks, pumps in use, sections being pumped or flooded, any isolating valves being kept open, together with reason why, stoppages for shoring or other reasons. When dock is being raised or lowered the periods between readings should not exceed 10 minutes.

3. The Yard or Base Constructor Officer responsible for the dock, is to see that the Dockmaster's organisation of the crew is efficient for immediately dealing with such emergencies as loss of power and consequently immediate loss of control of operation, sticky valves, or pump failures, in order to ensure the safety of both the dock and the ship being docked.

4. The Yard or Base Constructor Officer responsible for the Dock, the Dockmaster and the Constructor Officer responsible for docking the ship are to make themselves thoroughly acquainted with the following instructions relating to the suitability of the dock for lifting a particular ship by reference to the lift and weight curves, and to the limitation of displacement of ship for block length, the preparation of the dock to receive a ship and as to the position of the ship in the dock.

5. The safety of the dock is not to be hazarded by a risky docking operation.

6. Longitudinal deflections, large trims, lists and twists are not to be allowed to develop. In emergency, if necessary stop the whole operation by speedily closing down pumps and valves (the flap valves to inlet openings are fitted for emergency purposes). Consider all factors and decide whether to proceed with pumping or sink and refloat ship. The Dockmaster is to consult the Constructor Officer immediately in charge of the docking and the Yard or Base Constructor Officer if necessary, and obtain their concurrence in any such decision.

"B." PARTICULARS OF THE DOCK.

1. Capacity.—The maximum lifting capacity of the dock is about 2,750 tons with irremovable ballast water 6 inches deep in the pontoon tanks, to a freeboard of 6 inches at middle line of pontoon deck. This lift, however, cannot be used for lifting a ship of similar displacement without incurring considerable longitudinal deflection in the dock structure, due to the nature of distribution of a ship's weight over its length. The suitability of the dock for lifting a particular ship should be determined by reference to the lift curve of the dock and the weight curve of the ship as described on drawing D.N.C. 12/N/448, copies of which have been provided separately. In the absence of a reliable weight curve, no ship of the displacements given in the following table is to be docked unless it bears at least over the length "L" given in the table. The bearing length "L" is to be measured from the after cut-up of the ship to the foremost part of the straight keel, excluding any appendages for paravane gear, etc.

"C." PREPARATION OF THE DOCK TO RECEIVE A SHIP.

"D." POSITION OF THE VESSEL IN THE DOCK.

"E." PUMPING OUT THE DOCK.

"F." UNDOCKING.

"G." DOCKING OF DAMAGED SHIPS.

"H." LONGITUDINAL DEFLECTION.

"J." CAREENING OF DOCK.

"K." AIR SPACES IN PONTOON.

"L." GENERAL.

Old and hard to read, the General Instructions for Working AFDs 12, 17 to 22 and 26
(Courtesy Naval Historical Society of Australia)

Admiralty Floating Dock No. 17 (AFD17) was built in 1942 by the Devonport Naval Dockyard, Plymouth, UK to a Clark and Stanfield design. As built, the dock had a lifting capacity of 2750 tons (2800 t), a pontoon length of 350 feet (106 m) and a width between fenders of 50 feet (15.2 m). On completion in September 1942 AFD17 was towed to Reykjavik, Iceland, where it remained until September 1944 when it was reassigned for duty with the British Pacific Fleet. The dock began what was then the longest ocean tow in history, Reykjavik to Sydney, arriving in Sydney in late June 1945. The dock had been slightly damaged during the long voyage but was repaired by Morts Dock and Cockatoo Dockyard, with a docking in the new Captain Cook Graving Dock at Garden Island in January 1946. It was then placed in service at the Fitzroy Wharf at Cockatoo Island.

With the war over, the British Admiralty tried to dispose of AFD 17 in that year, initially for a sum of £205,000, although the asking price was later reduced to £150,000. All State Governments were approached, but none were interested in acquiring the dock. Even though the RAN decided it had no peacetime need for it, and could see only limited wartime use, the dock was finally bought by the navy for £75,000 in 1948 as part of an overall settlement for Royal Navy wartime assets remaining in Australia.

Whilst the RAN considered AFD17 too small for the newer combat ships then being built, AFD 17 was quite busy during its 18 years of service in Australia. The first docking was of the tug *Lindfield* on 17 December 1946 and by the time the last docking, of the Royal Navy submarine HMS *Taciturn*, was completed on 24 March 1964, the dock had been used on 641 occasions. Most of the dockings were of small vessels like tugs and ferries, but many were also of RAN and RN ships and submarines.

The RAN was reluctant to see large sums of money spent on the dock, but AFD17 was periodically surveyed afloat, and it was docked in 1952. By 1956 the condition of the dock had deteriorated to the point that the cost of repairs (about £250,000) was not considered justified, and in 1957 the RAN decided to dispose of the dock as scrap. Following representations from Cockatoo Dockyard, it was agreed that it should be retained but given minimum maintenance, recognising that it had a limited life.

By 1964 AFD17 was clearly in very poor condition, and it was docked in the Captain Cook Dock at Garden Island for a further survey. The dock had come to the end of its useful life and was condemned. AFD17 was subsequently sold and broken up for scrap in Sydney. Parts of AFD17 were to continue to serve for many years—its two five ton (5.1 t) electric travelling cranes were refitted with longer jibs and were used at the Fitzroy Dock until Cockatoo Dockyard closed at the end of 1992. The cranes survive there today, substantially restored by Sydney Harbour Federation Trust volunteers.

The ferry *Lady Denman* in AFD 17 in 1959
(Photo courtesy Bill Allen)

HMAS *Queenborough* in AFD17 at Cockatoo Island near the end of her conversion to a Type 15 anti-submarine frigate
(Photo John Jeremy collection)

The Mexican Navy's sail training ship *Cuauhtémoc* at Fleet Base East, Sydney, during her recent visit to Australia (Photo John Jeremy)