THE AUSTRALIAN NAVAL ARCHITECT

Volume 27 Number 1
February 2023

Nothing says Summer in Sydney quite like the start of the Rolex Sydney-Hobart Yacht Race on Boxing Day. Whilst the big boats get most of the public's attention, there was plenty of action in the rest of the fleet. This is the start of the race on Start Line 4, well back from the glamourous maxis but plenty of keen competitors none the less
(Photo John Jeremy)

THE AUSTRALIAN NAVAL ARCHITECT

Journal of
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Volume 27 Number 1
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Cover Photo:

Hamilton Island Wild Oats and *Black Jack* overtaking the Sydney Heritage Fleet's *James Craig* at sea after the start of the 2022 Rolex Sydney-Hobart Yacht Race
(Photo courtesy David Michael)

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From the Division President

Welcome aboard, to the first 2023 edition of *The Australian Naval Architect*, and here's looking forward to a good year for us all. It's certainly a good start to the year for our hard-working Secretary, Rob Gehling: an Australia Day award of Officer (AO) in the General Division of the Order of Australia for "distinguished service to the maritime transport and safety industries, and to naval architecture" — well done Rob, and well deserved! And great to see naval architecture headlined nationally in this way. Full details of Rob's award are included in this issue.

It has become traditional for the President's notes in this issue to be substantially the President's Annual Report to the Australian Division AGM, and I will try to emulate that in the following paragraphs, but I am writing this in January, for a February publication date and, with an AGM scheduled for late March, a lot can happen in that interval, including the expected reporting from the Mead Nuclear Powered Submarine Taskforce and the Smith-Houston Defence Strategic Review, both of which can be expected to have significant medium- and long-term effects on many of us and our profession here in Australia. To add to the uncertainty, we have just heard that the Naval Shipbuilding College is closing; we certainly live in interesting times!

But back to my report:

Gordon MacDonald handed on the Presidency of the Australian Division to me at the 2022 AGM and I would like to thank him for his continuing interest and involvement during the past year. Similarly, I would like to thank all who have supported me during this time: the Secretary, Treasurer, Council Members, Section Committees, *The ANA* Editors, Indo Pacific IMC organisers, sub-committees, etc. — it is quite a list! I would particularly like to thank Belinda Tayler for agreeing to take on the Vice Presidency and heading up our Improvement Committee. I look forward to everyone's involvement again during the coming year — the support of all of you is essential to the success of the Australian Division and the whole of RINA as a respected worldwide professional organisation.

During the year our Division achieved the following:

- An extremely successful Indo Pacific International Maritime Conference in Sydney: well organised, good presenters, and a significant boost to our coffers — what more could we ask!
- A very successful visit around the country by our new Chief Executive, Chris Boyd — he was most impressed, thank you all.
- The reinstatement of the Walter Atkinson Award and the selection of a most worthy winner — I'm looking forward to some great papers in 2023 to be reviewed for this year's award.
- The achievement of some clarity on the Victorian engineering registration requirements, although this is an ongoing project, hopefully culminating with RINA being able to provide accreditation to you as we have been doing now for some years for the Queensland registration requirements.
- Our attendance at various maritime events including Fremantle Maritime Day (where our Section's Lego models of *Titanic* and *Nuyina* were a real drawcard) — we need to do more of these events — looking forward to hearing about our involvement at the Australian Wooden Boat Festival — wish I was there!
- Our attendance at SA's Le Fevre High School's Maritime Careers event — we really need to do more of these.
- Our continued engagement with Engineers Australia — at various levels we have had some moves forwards and backwards — very much a work in progress.
- Some very positive new engagement with Head of Navy Engineering — several key follow-ups to be pursued in the next couple of months.
- Continued engagement with those who are actually teaching Naval Architecture in Australia: the Australian Maritime College and UNSW Canberra.
- Continued engagement with AMSA, particularly through the Domestic Commercial Vessel sub-committee.
- Continued engagement with Standards Australia, on their maritime standards development projects.
- Continued engagement with the RINA International Board, Council and Committees — it is the involvement of Australia and Singapore which are particularly influential in providing a real international input to our organisation — please keep it up!
- A very successful year financially for the Division with a significant boost to our funds from the Indo Pacific IMC — we have set up a finance sub-committee and engaged a financial advisor to ensure that these funds are working well for us and we can now consider if/how/when we can best make use of them.

Jim Black

As you can see from the above, we have many ongoing projects to keep us focussed over the coming year as known and new challenges arise, but where should we best focus? Belinda's Improvement Committee will provide us with guidance here, and I do not want to deflect from their

considered priorities, but my own opinion is that these should be among our priority areas:

- Making maximum use of RINA's "Digital Transformation" as we see it rolled out from HQ in the next few months.
- Developing and supporting STEM activities in schools wherever and whenever we can, including in support of the initiatives of the AMC, UNSW Canberra and EA.
- And the big one, which I highlighted last May and in which we have made little progress: Succession Planning! We are working remarkably successfully in so many areas, but what happens when the incumbents can or do not want to continue in their various positions key to our success? If we don't have real succession plans in place by this time next year I will consider it a significant failure of my term as President — please all consider how you can help me turn this around — I'm waiting to hear from you!

Please feel free to chat to me any time on 0418 918 050 or <jimblack.marine@iinet.net.au>.

Jim Black

Editorial

How time flies! It is hard to believe, but this edition of *The Australian Naval Architect* is the 100th! In the 25 years since Phil Helmore and I took over the task of producing this journal from the Western Australian pioneers we have tried to make *The ANA* informative and, above all, interesting. We hope that we have succeeded.

Readers will have noticed that the front cover has changed. This is not just for Edition 100 but to reflect the changes in the Institution's style as defined in the 2021 Royal Institution of Naval Architects Brand Book. Internally the journal has not changed, except that technical papers will, in future, be presented in a single column format rather than in two columns. It makes the reproduction of charts and other illustrations easier and the paper more readable.

We are often reminded that the rewards one gets in life are directly related to the effort one puts in — to one's business or private life. One person whose constant contributions to our profession have deserved reward is our Australian Division Secretary, Rob Gehling. In the Australia Day Honours this year Rob was appointed an Officer in the Order of Australia (AO) 'For distinguished service to the maritime transport and safety industries, and to naval architecture.' Richly deserved Rob, and heartiest congratulations from the editorial team.

We have more to say about Rob's award later in this edition of *The ANA*.

John Jeremy

The Australian Naval Architect
The Beginnings

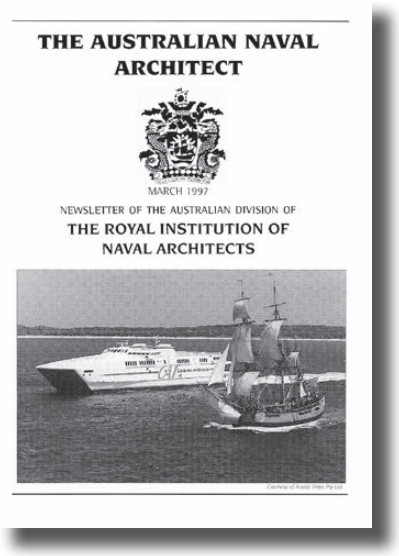
I have been asked to write a few words for the 100th Edition of *The ANA* about its origins — I was the founding editor. In early 1997 a small group of RINA members in WA got together to create "a high-quality newsletter to bring together all the activities around the country".

The idea and, I believe, the name were the brainchild of David Lugg. We decided to produce four issues, then review its popularity to see if further publication was justified. The first edition was distributed in March 1997 by the entire founding group spending a happy (?) hour or so stuffing copies of *The ANA* into envelopes and sticking on address labels. Although I was the founding editor, I took on the task on the express condition it would only be for the first edition. I stuck to my guns and David Lugg took over for the next three editions. It is worth noting that all the original team were working full time in early or mid-career, and production of *The ANA* was entirely a spare time activity. Today's very busy early-career naval architects can still turn their ideas into reality, just like we did.

By the time the fourth issue was released it was clear that *The ANA* filled a real need and was strongly supported by naval architects across Australia. The editorship for the fifth issue was handed to John Jeremy, with Phil Helmore as the other half of the new Editorial Committee. Some 25 years later these two amazing people are still in the job!

It is perhaps poignant to note that the main technical article in the first issue was on design loadings, written by Frank Jarosek. That topic is still the subject of research and debate today. There was also a short article which I wrote, explaining how to use a new thing called email, and describing what a website was. Haven't we come a long way from stuffing journals into paper envelopes!

Kim Klaka



COMING EVENTS

Australian Division AGM

The Annual General Meeting of the Australian Division of RINA will be held on Wednesday 28 March at 20:00 AEDT as a video-conference using RINA's Zoom platform; registration is required. See notice elsewhere in this issue.

NSW Section AGM

The Annual General Meeting of the NSW Section of RINA will be held on Wednesday 5 April immediately following the scheduled technical meeting of RINA (NSW Section) and IMarEST (ACT & NSW Branch) at 18:00 for 18:30 at the Royal Sydney Yacht Squadron, 33 Peel St, Kirribilli, and streamed live; notice will be emailed to NSW Section members. It is expected that the AGM will commence at about 19:30.

NSW Section Technical Presentations

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 streamed live, starting at 18:00 for 18:30 and finishing by 20:00. Guests are welcome.

The program of meetings for 2023 (with exceptions noted) is as follows:

1 Mar Philip Baldwin, Independent Contractor to Defence, Maritime Sustainment Division
Remediation of the LHD Propulsion Issues

5 Apr Sean Langman, Managing Director, Noakes Group
Finite Element Methods and Reality
Royal Sydney Yacht Squadron, 33 Peel St, Kirribilli

3 May Romina Fonhof, RAN Seaworthiness Group Westralia *Incident through to Seaworthiness Group and the New/Developing Navy Class/Flag Authority*

7 Jun Eric Fusil, Director of the Shipbuilding Hub for Integrated Engineering and Local Design, University of Adelaide
The Australian Future Submarine Multiverse: Between Myths and Realities

5 Jul Jeffery Kong, Project Engineer, Atlantic & Peninsula Australia
HMAS Choules *SEA3030 Mid-Life Upgrade*

2 Aug David Firth, Principal Engineer SEA1788, Naval Shipbuilding & Sustainment Group, Department of Defence
STS Young Endeavour *Replacement*
Royal Prince Edward Yacht Club,
160 Wolseley Rd, Point Piper

6 Sep IMarEST
TBA

4 Oct Paul O'Connor and Jon Branch, Bureau Veritas
Australian Naval Classification

7 Dec SMIX Bash 2023

Tasmanian Section Technical Presentations

Technical presentations generally alternate between Hobart and Launceston, with a room-and-zoom format.

The program of meetings for 2023 is as follows:

9 Mar Hobart Tim Oxley, The Cartela Trust
Saving Tasmanian Maritime Heritage

11 May Launceston
Bill Wright, Director, Norman R. Wright and Sons
Boats of Norman R. Wright and Sons

There are five other presentations to be scheduled from June through October.

ASRG Dockmaster Training Courses 2023

In 2021 the Australian Shipbuilding & Repair Group (ASRG) identified that a previous Dockmaster training course offered to industry did not fully meet the needs of the Australian industry. The ASRG commissioned Adrian Broadbent, CEng, FRINA, to develop and present a new practical course to suit the local industry. The resulting four-day course includes the necessary ship stability theory and applies it to multiple practical situations. Each course also includes a visit to a local docking facility to view the operations and consolidate the course discussions.

The course was submitted to RINA for review and was formally approved for Continuous Professional Development credits. For Defence contractors, the course is eligible for SADI funding and has been accepted by Defence as part of Plan Galileo to improve the industry's self-reliance.

The course is suitable for anyone in the shipbuilding or ship repair industry, including dockmasters, naval architects, consultants, owners' representatives, shipyard managers, project managers, etc.

The course has now been run on three occasions, in Adelaide, Cairns and Sydney and, to date, 42 delegates have attended the course, including from the United Arab Emirates and Papua New Guinea.

The next courses are scheduled for Darwin on 7–10 March and Henderson (Perth) on 28–31 March 2023. For further details and registration, contact Liz Hay <liz.hay@asrg.asn.au> or +61 7 5597 3550.

Further courses will be presented as required.

AOG Energy 2023

AOG Energy is Australia's premier oil, gas and energy trade event held annually in Perth, and is organised by Diversified Communications Australia. For over 40 years, AOG Energy has been recognised as the premier Australasian oil, gas and energy event, bringing together the entire supply chain from across Australia and the globe.

We are committed to delivering the event annually; however, 2022 presented its challenges in connecting the market at scale, and we therefore made the difficult decision to cancel AOG Energy for 2022. We look forward to bringing the industry back for a true celebration of what the Australasian oil, gas and energy market has to offer and to continue to innovate towards a clean energy future.

CALL FOR ABSTRACTS

imc 2023

INTERNATIONAL MARITIME CONFERENCE

7–9 NOVEMBER 2023

INTERNATIONAL CONVENTION CENTRE
SYDNEY, AUSTRALIA

Organised by The Royal Institution of Naval Architects, The Institute of Marine Engineering, Science and Technology and Engineers Australia, the International Maritime Conference 2023 Program will focus on the latest developments in naval architecture, marine engineering and maritime technology; both in the areas of defence and commercial shipping.

KEY DATES FOR IMC 2023:

Call For Abstracts	**Wednesday 25 January 2023**
Abstract Submission Deadline	**Friday 28 April 2023**
Author Acceptance Notification	**Friday 19 May 2023**
Refereed Paper Submission	**Monday 14 August 2023**

IMC 2023 is held in conjunction with INDO PACIFIC 2023

For more information: **www.indopacificexpo.com.au/IMC2023**

Contact the IMC Secretariat: **imc@amda.com.au**

INDO PACIFIC 2023
7 - 9 NOVEMBER
INTERNATIONAL MARITIME EXPOSITION
INTERNATIONAL CONVENTION CENTRE, SYDNEY, AUSTRALIA

The next edition will next take place on 15–17 March 2023 at the Perth Convention & Exhibition Centre.

For further details, visit the AOG Energy website at https://aogexpo.com.au/

62nd International Congress of Naval Architecture, Marine Technology and Maritime Industry

The Asociación de Ingenieros Navales y Oceánicos de España is organising the 62nd International Congress of Naval Architecture, Marine Technology and Maritime Industry. This is an event addressed to professionals, entities and institutions of the maritime sector. This is a unique Congress, professional, technical and scientific, involving the different interests of marine sector.

The International Congress will be held in Bilbao on 24–26 May 2023 in the Euskalduna Palace (an old shipyard transformed into an event and congress venue), an emblematic location for the Spanish naval and maritime sector. The motto of the Congress will be: "Technological boost for sustainable development".

The 62nd Congress will cover four industry areas: defence, merchant, special vessels and cruises, fishing, and offshore wind energy. The different technology themes will be covered in each of them. Lectures and round tables, with professional, scientific and technological character, will be covered by prestigious professionals and university professors from different countries. It will cover the latest projects and developments in the maritime sector.

An Honour Committee has been formed by the ministers with competencies in our sector, local government, Spanish Navy Admirals, relevant associations and presidents of the most important companies in Spain. HM The King Felipe VI has been offered the Presidency of the Honor Committee.

We invite members of the Royal Institution of Naval Architects to join us during the Congress or to present technical and scientific papers expressing the state of the art in our industry in the sectors mentioned above.

The call for papers is open until 15 April 2023. Instructions for papers are available at https://ingenierosnavales.com/wp-content/uploads/2023/01/20230207_Rules-of-presentation-of-papers-62-CIIN-English.pdf and submissions may be made to congress@ingenierosnavales.com.

Further details of the congress maybe found at https://ingenierosnavales.com/62nd-international-congress-of-naval-architecture-marine-technology-and-maritime-industry-call-for-abstracts-open/.

Indo Pacific 2023

Indo Pacific 2023 will be held on 7–9 November 2023 at the International Convention Centre Sydney. 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.

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.

The Indo Pacific International Maritime Conference (IMC 2023) is organised by the Royal Institution of Naval Architects, the Institute of Marine Engineering, Science and Technology and Engineers Australia, and coincides with the Royal Australian Navy's Sea Power Conference and the International Maritime Exposition which is organised by AMDA Foundation Limited.

The IMC 2023 program will include presentations concentrating on the following topics:

- Commercial ship technology
- Naval ship technology
- Submarine technology
- Autonomous vehicle technology
- Shipbuilding and sustainment
- Maritime safety
- Maritime environment protection
- Maritime cyber security

The Call for Papers is now open and key dates for paper submissions are as follows:

Abstracts submission deadline	28 April 2023
Author acceptance notification	19 May 2023
Registrations open	To be advised
Refereed paper submission deadline	14 August 2023
Other paper submission deadline	9 October 2023

NEWS FROM THE SECTIONS

New South Wales

SMIX Bash

The 22nd SMIX (Sydney Marine Industry Christmas) Bash was held on Thursday 1 December aboard the beautifully-restored *James Craig* alongside Wharf 7, Darling Harbour, from 1730 to 2200. The Bash was organised jointly by RINA (NSW Section) and the IMarEST (ACT & NSW Branch). About 200 guests came from the full spectrum of the marine industry, including naval architects, marine engineers, drafters, boatbuilders, machinery and equipment suppliers, regulators, classifiers, surveyors, operators, managers, pilots, navigators, researchers, and educators. Equally importantly, the full spectrum of age groups was represented, from recent graduates to the elders of the marine community. It was also great to see intrastate and interstate visitors in the throng, including Brendan Egan from Lake Macquarie, Liz Hay from Brisbane, Gregor Macfarlane, Nic Bender and Gabriel Tooker from Launceston, Ian Coker and Katie Tribe from Adelaide, and Gavin Stewart from Perth, among others.

James Craig alongside Wharf 7 in the late afternoon
(Photo Phil Helmore)

Some of the crowd enjoying drinks and finger food
on board *James Craig*
(Photo Phil Helmore)

Sydney turned on a beautiful evening, partners in attendance enjoyed the view from the decks of *James Craig,* and many tall tales and true were told.

Drinks (beer, champagne, wine and soft drinks) and finger food (parmesan-crusted chicken skewers and salt-and-pepper prawn cutlets with a chili glaze) were served on the main deck. A delicious buffet dinner was served in the 'tween decks, including hot, cold and salad selections, and mixed breads and butter. Desserts included individual ice-creams, mini mixed tarts and cream, and Australian cheese and crackers, followed by tea and coffee.

Formalities were limited to a speech from the Chair of the NSW Section of RINA and Chair of the SMIX Bash Organising Committee, Belinda Tayler, who welcomed the guests and thanked the industry sponsors and the others on the Organising Committee, and short speeches by representatives of the Platinum sponsors. These were Sam Benson for TeeKay Shipping (Australia) (deputising for Tony Armstrong who had been unavoidably detained and arrived after the speechifying), Martin Mitchell for Atlantic & Peninsula Australia, Chris Bradley for Halliday Engineering, and Sean Langman for Noakes Group.

The raffle was drawn by Sam Benson from TeeKay Shipping (Australia), who donated the hampers, and the winners were:

Third	Simon Spratt	Chandon Celebration Hamper
Second	Liz Hay	Moet with Australian Sweets and Nuts Hamper
First	Greg Hellessey	Christmas Bites with Moet Hamper

The lucky-door prize was drawn by Sean Langman from Noakes Group, who donated the prize, and the winner was Adam Williams, who scored a $100 gift voucher to Boat Books shops.

Belinda Tayler welcoming guests and thanking sponsors
(Photo Phil Helmore)

Sam Benson of TeeKay Shipping (Australia)
addressing the guests
(Photo Phil Helmore)

Martin Mitchell of Atlantic & Peninsula Australia
addressing the guests
(Photo Phil Helmore)

Raffle second-prize winner, Liz Hay (R)
with Sam Benson and Belinda Tayler
(Photo Phil Helmore)

Chris Bradley of Halliday Engineering
addressing the guests
(Photo Phil Helmore)

Raffle first-prize winner, Greg Hellessey (L)
with Sam Benson and Belinda Tayler
(Photo Phil Helmore)

Sean Langman of Noakes Group addressing the guests
(Photo Phil Helmore)

Lucky Door Prize winner, Adam Williams (C)
with Belinda Tayler and Sean Langman
(Photo Phil Helmore)

Dinner in the 'tween decks
(Photo Phil Helmore)

This year's event was sponsored by the following organisations:

Platinum

- Atlantic & Peninsula Australia
- Halliday Engineering
- Noakes Group
- TeeKay Shipping (Australia)

Gold

- Adroita
- AkzoNobel
- Asena Asset management
- Ausbarge Marine Services
- Ausbright
- Babcock
- DNV Australia
- Electrotech Australia
- Eptec Group—Marine
- SDS
- Shadbolt Group
- Sydney City Marine
- Wärtsilä Marine Power

James Craig alongside Wharf 7 in the late evening
(Photo Phil Helmore)

Silver

- AMC Search
- Bureau Veritas
- Cummins South Pacific
- Damen Shipyards
- High Risk Management Solutions
- Lloyd's Register International
- MAN Energy Solutions
- Maritime Survey Australia
- Thompson Clarke Shipping

Bronze

- Australian Shipbuilding & Repair Group
- Hempel (Wattyl) Australia
- Lightning Naval Architecture
- One2three Naval Architects

Our thanks to them for their generosity and support, without which SMIX Bash could not happen.

It is rumoured that some of the stayers, who were shown the gangplank late in the peace, rocked on to other venues and continued to party until the wee small hours.

Committee Meetings

The NSW Section Committee met on 22 November 2022 and, other than routine matters, discussed:

- SMIX Bash 2022: All coming together; sponsors signed, delivery of hampers arranged, and lucky-door prize to be checked; suggestions made for arrangements on the night.
- TM Program 2023: Presentation for September 2022 postponed to Thursday 9 February at Engineers Australia; proposals made for other venues and decided to move to the Sydney Mechanics School of Arts in the CBD with occasional visits to yacht clubs; four presentations proposed for 2023, with one more required.
- Finance: Accounts for 2022 to be finalised and audited prior to the NSW Section AGM on 5 April.

The NSW Section Committee also met on 31 January and, other than routine matters, discussed:

- SMIX Bash 2022: This event was successful; proceeds

of the raffle will be donated to the Sydney Heritage Fleet; projections are for a small surplus which will be shared with the IMarEST.

- TM Program 2023: Five RINA presentations agreed (but to be confirmed) for 2023, with one backup and some changes to the order a probability.
- NSW Section Committee: Elettra Ganoulis elected to the Committee.
- Finance: Accounts for 2022 have been finalised and audited, and are ready for presentation to the Australian Division and our AGM.

The next meeting of the NSW Section Committee is scheduled for 14 March.

Electric-drive Technology for Tugs

Tom Charter, Damen Shipyards Representative for Australia, New Zealand & South Pacific, and Sale & Purchase Manager with Australian Independent Shipbrokers/Asiaworld Shipping Services, gave a presentation on *Electric-drive Technology for Tugs—The Future is Now*, to a joint meeting with the IMarEST in the Harricks Auditorium at Engineers Australia's new premises at 44 Market St in the Sydney CBD and streamed live on 9 February. The presentation was attended by 24 with an additional 125 online.

Damen's RSD-e Tug 2513, better known as *Sparky*, will serve the Ports of Auckland, the company administering New Zealand's largest container and international trade terminal. The port manages over half of the country's imports and exports and is a primary docking point for cruise ships. *Sparky* is anticipated to have a 25-year life span and save approximately 465 tonnes of CO_2 in diesel emissions annually.

Sparky
(Photo from workboat365 website)

Using Damen's Electric Reverse Stern Drive (RSD-e) 2513 tug *Sparky* as the example, Mark's presentation focussed on the steps taken to design *Sparky* to meet Ports of Auckland sustainability and operational requirements, including an assessment of the operating profile, determination of suitable power and battery requirements, re-charging arrangements and the likely future path for harbour towage.

The vote of thanks was proposed, and the "thank you" bottle of wine presented, by Adrian Broadbent. The vote was carried with acclamation.

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

The Presenter

Tom Charter is responsible for managing the group's representation of Damen Shipyards across Australia, New Zealand and the South Pacific region, entailing business development and sales activities.

Tom is also the manager of AIS' Sale & Purchase Department which is operating on a worldwide basis providing Sale & Purchase/Chartering Brokerage services across a range of shipping sectors with a focus on the offshore support vessel and tug & workboat markets.

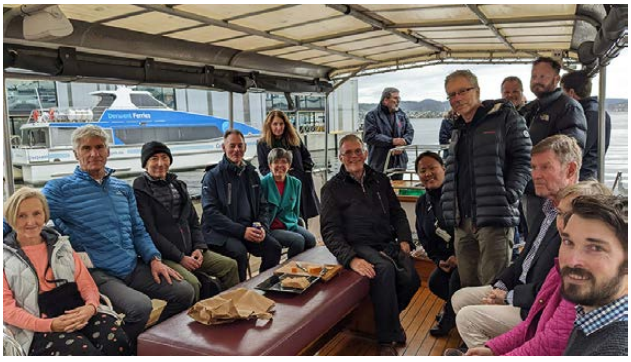
Phil Helmore

Tom Charter (R) with Adrian Broadbent
(Photo Phil Helmore)

Tasmania

Tasmanian Section Christmas Event

The RINA Tasmanian Section Christmas Event was a river cruise on board *Egeria,* a beautifully restored 1941 huon pine motor launch, owned and operated by the Motor Yacht Club of Tasmania.



Aboard *Egeria*
(Photo courtesy Chris Davies)

Dinner at the Waterline
(Photo courtesy Chris Davies)

The vessel's maximum capacity is 26 guests, which we managed to fill. A highlight was passing under the Tasman Bridge above the *Lake Illawarra* and seeing her on *Egeria*'s echo sounder and her proximity to the bridge pylons. The river cruise was followed by a restaurant meal at the Waterline Brooke Street Pier. All very appropriate!

Echo sounder image of *Lake Ilawarra*
(Photo courtesy Chris Davies)

Australian Wooden Boat Festival

RINA will have a presence at this year's Australian Wooden Boat Festival, from 10 to 13 February, as part of a Training and Careers display. This display will be part of the Maritime Market Place at Princes Wharf No. 1, and so will be surrounded by other maritime products, services and organisations.

Richard Boult

Victoria

Victorian Maritime Industry Annual Social Event

RINA Victorian Section hosted the 2022 Victorian Maritime Industry Annual Social Event on 18 November 2022 at The Mission to Seafarers, Docklands. The event was very successful, attracting 34 guests from RINA, IMarEST, and the Company of Master Mariners. The evening included fantastic food provided by the Mission to Seafarers, a prize draw which made three lucky attendees particularly happy, a summary of the Section's recent and upcoming activities by the Chair, Tom Dearling and, of course, plenty of good company.

Chair's speech by Tom Dearling
(Photo courtesy Luke Shields)

This year's event was sponsored by the following organisations:

Gold

- Altair

Silver

- AMT
- The Company of Master Mariners
- TheNavalArch

Bronze

- Maritime Survey Australia

Our thanks to them for their generosity and support, without which the Victorian Maritime Industry Annual Social Event could not happen.

Attendees enjoying drinks
(Photo courtesy Tom Dearling)

Committee

The Section has gained one new Committee member, Captain Ola Olubowale, who joined the committee as a general member on 11 November.

Technical Presentations

Multiple expressions of interest for delivering presentations came out of the social event and the Committee is actively working to secure presenters.

Tom Dearling

Lifecycle Seaworthiness on the Hobart-class Guided Missile Destroyer

Daniel Johnstone, Principal Engineer at AMOG Consulting, gave a presentation on *Using Reliability Analysis and Probabilistic Risk Assessment to achieve Lifecycle Seaworthiness on the Hobart-class Guided Missile Destroyer* at an in-person meeting at the Mission to Seafarers in Docklands and streamed live via Zoom on 16 February.

A key tenet of the Royal Australian Navy's Seaworthiness Management System is the achievement of operational effect, whilst ensuring safety and environmental protection. This presentation examined a case study of application of reliability-centred maintenance analysis to the Hobart-class Guided Missile Destroyers (DDG), using probabilistic modelling to assess risk to both mission and safety performance. The presentation outlined a methodology for optimising forward planned maintenance over the vessel lifecycle to balance several competing goals, such as maximising the likelihood of successful functional performance, minimising safety risk so far as reasonably practicable (SFARP), reducing the forecast maintenance costs, whilst also considering constraints such as the projected upkeep and operational cycle. This methodology provides valuable insights into system reliability performance throughout deployments and other life-cycle phases, which can inform decision makers when considering alterations to operational phasing (such as extending deployments or increasing utilisation).

We demonstrated, by means of example, a methodology for Reliability, Availability, and Maintainability (RAM) modelling of a system which can assist decision-makers by providing predictions of capability performance in hypothetical scenarios. This methodology is also intended to shift focus towards optimisation of system performance by utilising a repeatable methodology for finding the optimal balance between cost of operation and minimisation of risks, be it to operation and mission capability, or safety.

The Presenter

Daniel Johnstone is a Principal Engineer with AMOG Consulting, and a Chartered Professional Engineer with Engineers Australia. Daniel obtained his bachelor's degree in Mechanical Engineering from the University of Melbourne, and graduated with honours in 2010.

Daniel is currently the team lead for the Systems & Safety Engineering Team at AMOG. In this group, he applies his skills specifically to defence and civil infrastructure projects, leading activities such as the planning and conduct of system safety programs (including development of System Safety Program Plans and Safety Case Reports), conduct of safety-focused regulatory-impact analyses, reliability analysis of complex systems (RAM), regulatory compliance assessments of Major Hazard Facilities (MHFs), and quantitative risk assessment numerical analyses.

Daniel has recently been heavily involved in the defence sector for the last two years, working with various System Program Offices (such as MCDSPO and DDGSPO) to deliver a wide variety of systems engineering and safety engineering outcomes. These include Hazard Analysis Reports (in accordance with Defence standards such as MIL-STD-882E), Safety Case Reports, the underlying Safety Assurance Reports including Probabilistic Risk Assessments (PRAs), Operational Safety Risk Assessments, and more, all delivered within a Defence framework and in line with Commonwealth of Australia requirements and expectations.

Daniel's broader experience reaches across a wide range of projects and fields, in areas such as structural analysis using finite-element solvers, vessel motions, vortex-induced vibrations, fatigue analysis, numerical simulation work, and forensic failure and legal investigative work.

Sam Price

The Hobart-class destroyer HMAS *Sydney*
(Photo John Jeremy)

CLASSIFICATION SOCIETY NEWS

ABS and Suez Canal Authority Sign MoU

ABS and the Suez Canal Authority (SCA) signed a Memorandum of Understanding (MoU) to develop a long-term sustainability roadmap and decarbonisation strategy for the canal, one of the world's busiest shipping routes.

The MoU will see ABS and SCA work together on issues related to sustainability and the green environment as a part of the SCA's business plan to transition to a green canal by 2030. Over the year-long agreement, ABS and the SCA will work together to develop a decarbonisation strategy and assessment of energy and emission intensity and potential ways of emission reduction.

SCA and ABS will collaborate in developing a long-term sustainability roadmap and embedding sustainability as part of the SCA's core business strategy with a wide range of services such as technology selection, benchmarking and target setting, regulatory compliance documentation, carbon accounting and verification energy audits and more.

"The Suez Canal is a vital artery for global trade. Ensuring environmental stewardship for trade will make a significant contribution to creating a more sustainable platform for the entire shipping industry. ABS is a leader in maritime decarbonisation, and we are proud to be able to use our deep insight to address the complex set of challenges presented by such a key global waterway," said Christopher Wiernicki, ABS Chairman, President and CEO.

Admiral Ossama Rabiee, Chairman of the Suez Canal Authority, said "We are keen to enhance cooperation with all partners such as ABS, in the field of maritime transport in areas related to environmental sustainability and carbon removal within the authority's environment-friendly strategy, as a prelude to announcing the Suez Canal a 'Green Canal.' This is an important way to achieve environmental sustainability by raising the canal's efficiency and reducing carbon emissions."

ABS News, 16 January 2023

ABS Launches Custom Rule Book

ABS has launched *Custom Rule Book*, a powerful new tool which allows users to create tailored ABS rule sets in moments, saving significant time.

In the first development of its kind in classification, ABS MyFreedom™ users can now quickly filter 140 rules and guides, 28 000 pages and 600 notations to generate a Custom Rule Book for their specific vessel or project. By simply inputting a vessel's ABS class number or selecting six attributes, a custom collection of rules applicable to the vessel or project will be instantly created.

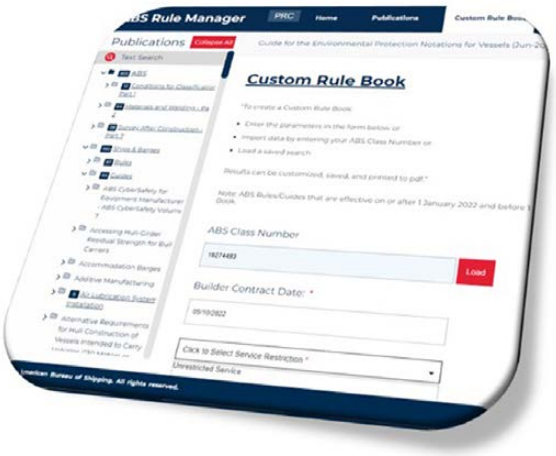
The service is available to all users who are signed up on the ABS MyFreedom™ client portal.

"ABS is committed to offering the most advanced class services to support our clients' operations, and the Custom Rule Book is the latest example of this. We are using technology to simplify and speed access to key information that will increase efficiency and make ABS even easier to work with," said Dan Cronin, ABS Vice President, Class Standards.

"As more types of marine vessels are needed in the 21st century, the quantity and complexity of regulations continues to expand. The ABS Custom Rule Book helps shipyards streamline the regulatory process by forming a single document which captures the unique ABS Rules and optional notations applicable to each individual vessel. The benefits of the ABS Custom Rule Book are clear, concise, and traceable requirements which correlate explicitly to the project stakeholder's needs on design and survey," said Rene Leonard, Conrad Shipyard Vice President for Engineering and Program Management.

View our video to learn more about the capabilities of Custom Rule Book. More information on ABS myFreedom™ is available at https://ww2.eagle.org/en/rules-and-resources/my-freedom.html.

ABS News, 12 January 2023



ABS' Custom Rule Book
(Image from ABS website)

DNV Awards AiP for Innovative Ammonia-fuel Ship Design

The design of a Kamsarmax bulk carrier, jointly developed by Sumitomo Corporation and Oshima Shipbuilding, has achieved an Approval in Principle (AiP) from classification society DNV.

The AiP confirms that the vessel design meets the technical requirements and safety standards following a Hazard Identification Study on the associated risks of using ammonia as a fuel. The award comes as a result of a collaboration agreement which Sumitomo Corporation and Oshima Shipbuilding signed in December 2021.

Stian Erik Sollied, Country Manager of DNV Japan Maritime, said "DNV is pioneering the research and development of viable future marine fuels and is delighted to be a part of this innovative project. We will continue cooperating with forward-leaning maritime industry leaders in their efforts to bring low-carbon ship designs to life, safely and sustainably."

At the award ceremony, Takanaru Toyota, General Manager, Ship & Marine Project Department of Sumitomo Corporation, said "Sumitomo Corporation and Oshima Shipbuilding are accelerating the development and promotion of ammonia-

fuelled ships. We will continue improving the operational environment, including the supply of ammonia fuel through internal and external collaboration, and aim to reduce carbon dioxide emissions across the entire supply chain."

Eiichi Hiraga, President of Oshima Shipbuilding, added: "An ammonia fuel ship is a powerful forward-thinking solution to decarbonising the maritime industry. Oshima Shipbuilding, alongside Sumitomo Corporation, DNV and other stakeholders, will endeavour to optimise these designs further."

DNV News, 16 January 2023

LR Study Traces the True Carbon Intensity of Sustainable Fuels

A new report from the Lloyd's Register's Maritime Decarbonisation Hub and Safetytech Accelerator highlights the role of technology in enabling the shipping industry to develop specific mechanisms to track, verify and assure the true carbon intensity of sustainable marine fuels.

Shipping's decarbonisation is focused on delivering alternative fuels which significantly reduce greenhouse gas (GHG) emissions. However, to be sure that alternative fuels can achieve the GHG reductions needed, emissions from the end-to-end supply chain of these fuels must also be measured, from the resource used to produce the fuels, to their consumption onboard the ship.

The key challenge facing the industry is that ship operators can lack visibility over the supply chain responsible for producing, delivering and bunkering a fuel used on their ships. A marine fuel can be presented as carbon-neutral, but could release substantial emissions when measured on a life-cycle assessment or well-to-wake basis.

Furthermore, alternative fuels may take diverse grey or blue production routes, thus delivering fuels which are often blended, mixed or re-labelled during transportation and distribution before they reach their final users. Consequently, there is no guarantee that fuel bunkered retains the same carbon footprint as the fuel which left the production facility.

For this reason, the LR Maritime Decarbonisation Hub and Safetytech Accelerator have explored technologies which can track the true carbon intensity of hydrogen and ammonia, two of the most promising long-term alternative fuel candidates for shipping's energy transition.

Working with two technology vendors, TYMLEZ and Authentix, the collaboration resulted in a joint report, tracing the true carbon intensity of sustainable marine fuels which examines new methods of tracing information on how a fuel is being produced, from the source of the electricity used in the production process, to the delivery of an un-altered final product.

The first method is through the TYMLEZ solution, which utilises a 'guarantee of origin' (GO) scheme where each unit of hydrogen or ammonia is certified through a live facility data platform which can capture emissions data during the production process, such as water and fuel usage and grid electricity consumption. Blockchain technology is deployed for green hydrogen and green ammonia tracking systems.

Following the production and supply of the fuel which is accompanied with a GO certificate, the second method is applied through the Authentix approach, which offers downstream assurance. The Authentix solution can account for any blending or mis-labelling of the fuel through the use of a synthetic marker system, where the fuel is evaluated via chemical detection of the origin of the fuel, as well as any occurred dilution.

Given the varied production routes of sustainable marine fuels, it is essential to develop new carbon-tracing authentication methods to ensure that the new fuels purchased are being produced, transported and stored in a way whicht will deliver emissions performance expectations.

Charles Haskell, LR Maritime Decarbonisation Hub Director, said "The complexity of the marine fuel supply chain, with its diverse production methods, presents significant challenges to the shipping industry as the definition of sustainability is extended to include all stages of well-to-wake emissions. We hope that this joint study can serve as the basis for synergies and pilot projects to emerge and further contribute to the discussions for the development of new industry standards which can authentically validate the environmental and commercial impact of these new fuels."

Dr Maurizio Pilu, Safetytech Accelerator Managing Director, said "The assurance of new green fuels, whether in terms of safety, origin or carbon footprint, is going to be a key component of the journey towards maritime decarbonisation. The right technologies could make the assurance process cost-effective, reliable and scalable. I am pleased that Safetytech Accelerator had the opportunity to collaborate with the Lloyd's Register Maritime Decarbonisation Hub and Authentix and TYMLEZ to understand how technologies, such as theirs, could be used in future assurance processes."

Daniel O'Halloran, Executive Chairman of TYMLEZ, said "We are extremely excited by the release of this report as it showcases the role of technologies such as the TYMLEZ Platform in the decarbonisation of the maritime industry. The guarantee of origin of sustainable fuels such as green hydrogen and green ammonia will be paramount for proving decarbonisation efforts across the industry. It is therefore vital that technologies which can verify the origin and green credentials of these fuels with total trust and transparency be utilised. The TYMLEZ Guarantee of Origin solution detailed in this report provides shipowners and operators total assurance over the sustainability credentials of the fuels they're using to power their vessels."

Jim Seely, Vice President of Solutions for Authentix, said "We have been a pioneer in fuel quality and authentication since our beginnings 27 years ago and this continues today. We are excited to be involved in this innovative project to provide the most advanced technology available for the assurance and verification of green fuels required by the maritime industry in its long-term goal toward decarbonisation."

The report may be downloaded from https://www.lr.org/en/resources/report-tracing-the-true-carbon-intensity-of-sustainable-marine-fuels/

LR News, 18 January 2023

FROM THE CROWS NEST

WSR Spirit 2

On 8 October 1978, 44 years ago, Ken Warby blasted across Blowering Dam to set his second (and current) Water Speed Record of 317.6 mph (511.1 km/h).

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 returned to the Manning River on 26 November for further trials. A 20–25 kn crosswind hampered the day, making it difficult to keep the boat on track, blowing the boat off course, but the rear of the boat was feeling better.

With the Murray River previously closed to boating due to flooding, it was considered that Blowering (and presumably Talbingo) should be kept available for recreational boat users as an alternative. The team is now looking to return to Blowering Dam in late March.

Phil Helmore
Martin Grimm

Spirit of Australia 2 at speed on the Manning River
on 26 November 2022
(Photo from Warby Motorsport Facebook Page)

WSR *Longbow*

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

Side view of the mounting cradles for *Longbow*'s jet engines
With the trunnion mouinting plates on top
(Photo from Longbow website)

The design for the mounting cradles for the twin Rolls-Royce Viper jet engines has been finalised, and the cradle is now being constructed by their welding guru, Steve Charlesworth, on his farm in the middle of nowhere!

Sail GP Series 3

Series 3 kicked off in Bermuda on 15–16 May 2022, with Australia, Great Britain, Canada, Denmark, USA, New Zealand, Spain, France, and Switzerland all competing.

Subsequent events have been held in Chicago (USA), Plymouth (UK), Copenhagen (Denmark), St Tropez (France), Andalucia (Spain), Dubai (UAE) and Singapore.

At this stage, the top of the table shows Australia 1 (68 points), New Zealand 2 (59 points) and Great Britain 3 (54 points).

Subsequent events in Series 3 will be held as follows:

Event 9	Sydney	18–19 February 2023
Event 10	Christchurch, NZ	18–19 March 2023
Event 11	San Francisco, USA	6–7 May 2023

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

Phil Helmore

SailGP returns to the iconic waters of Sydney Harbour 18-19 February 2023
(Photo John Jeremy)

GENERAL NEWS

AUKUS Defence Ministerial Joint Statement

On 7 December 2022, The US Secretary of Defense, Lloyd Austin, hosted the Hon. Richard Marles MP, Deputy Prime Minister and Minister for Defence, Australia, and the Right Hon. Ben Wallace, Secretary of State for Defence, United Kingdom, at the Pentagon to discuss the Australia–United Kingdom–United States Security Partnership (AUKUS).

The Secretary of Defense, Deputy Prime Minister, and Secretary of State for Defence reviewed the significant progress to date on the trilateral effort to support Australia's acquisition of conventionally-armed, nuclear-powered submarines and the trilateral development of advanced capabilities. They emphasised that AUKUS will make a positive contribution to peace and stability in the Indo-Pacific region by enhancing deterrence. The Secretaries and Deputy Prime Minister expressed their confidence in continued progress ahead of the end of the 18-month consultation period regarding naval nuclear propulsion and announcement on the optimal pathway by the President and Prime Ministers in early 2023.

The Secretaries and Deputy Prime Minister highlighted the exceptional progress that has been made on trilateral efforts to identify the optimal path for Australia to acquire conventionally-armed, nuclear-powered submarine capability at the earliest possible date. They reiterated their shared commitment to set and uphold the highest standards for nuclear non-proliferation, and welcomed the ongoing, extensive and productive engagement which has been carried out with the International Atomic Energy Agency to date.

The Secretaries and Deputy Prime Minister endorsed efforts to orient capability development to accelerate near-term delivery of technologies which will meet our militaries' requirements to enhance capability and increase interoperability. These include initiatives for advanced trilateral maritime undersea intelligence, surveillance, and reconnaissance capabilities, and the use of each country's autonomous systems to enhance maritime domain awareness. They further noted the role which recent exercises have played in demonstrating and testing advanced capabilities, and approved plans to pursue additional demonstrations of several collaborative initiatives — including hypersonic and autonomous systems — in the 2023–24 timeframe and beyond.

Trilateral capability development will benefit from targeted engagement with defence industry and academic communities within and across our national ecosystems. The three countries intend to intensify engagement with these communities beginning in calendar year 2023. Deeper government, academic, and defence industrial base cooperation on advanced systems will require sustained efforts to continue to improve information and technology sharing. The Secretaries and Deputy Prime Minister reaffirmed their commitment to ongoing work within national systems to enable more robust sharing in these areas.

The Secretaries and Deputy Prime Minister committed to continued openness and transparency with international partners on AUKUS. They further emphasised that AUKUS is a strategic partnership focused on enhancing regional stability and safeguarding a free and open Indo-Pacific where conflicts are resolved peacefully and without coercion. They confirmed that AUKUS will complement AUKUS partners' engagement with existing regional architecture, including ASEAN and the Pacific Islands Forum.

(L to R), CEO RN Submarine Delivery Agency Sir Chris Gardner, KBE; Royal Navy Director Nuclear Technology, RADM Tim Hodgson, CB, CBE, RN; Royal Navy Director Submarines; RADM Simon Asquith CB OBE, RN and Head Nuclear Powered Submarine Capability RADM Matt Buckley, CSC, RAN, during their recent visit to HMAS *Stirling* in Rockingham, Western Australia (RAN photograph)

Incat Poised to Deliver the World's Largest Zero-emissions Ferry

In January Incat Tasmania revealed that it is in discussions to deliver the world's first large, lightweight, zero-emissions ferry.

Amongst vessels under construction at the shipyard is a 130 m ferry, originally intended to be powered by LNG, which will carry 2100 passengers and 226 vehicles for Incat's long-term South American customer, Buquebús. Following close consultation with the customer, Incat was recently asked to investigate the possibility of replacing the LNG power plant with a battery-electric solution.

Whilst there are challenges to overcome the ship, which is to be delivered in 2025, with battery-electric power, would be the world's largest, lightweight, zero-emissions ferry operating on any route in the world.

Incat Tasmania has always been an innovator, ahead of the technology curve and the delivery of an electric zero-emissions ferry will cement Incat as the world leader in zero-emissions, lightweight shipping.

Incat Group Chairman, Robert Clifford, said "the customer wants this to happen, Incat wants this to happen and, whilst there are matters to be finalised, I am extremely confident that Incat can deliver this ground-breaking ship. In my experience, unless we see something come in from left field, this is a 'done deal'.

"Obviously, there needs to be sufficient energy supply in the ports which the ship would visit, but we understand that this is progressing positively. The batteries and electric motors are being worked through with our suppliers, to ensure that they can deliver the technology required in the timeframe we need them.

An impression of the 130 m ferry currently under construction by Incat Tasmania
(Image courtesy Incat)

"Zero-emissions shipping is the future and Incat, based in Tasmania, one of the few places on the planet which has already delivered net zero, is now poised to revolutionise the world's shipping fleet by delivering the world's first zero-emissions, lightweight ship," he said.

Incat's Managing Director, Craig Clifford, said that this is a unique opportunity for Incat. Whilst there are always challenges if you change any aspect of the design of a ship part way through build, in simple terms, this is just swapping one method of propulsion for another: it will, however, have significant environmental benefits and open up a whole new market for these types of vessels.

Babcock Selected as RMP West

On 1 November 2022 it was announced that Naval Ship Management (NSM), a Babcock company, had been selected as the Regional Maintenance Provider (RMP) West for Defence's new Regional Maintenance Centre (RMC) West, servicing the Royal Australian Navy.

The contract was formalised at a signing ceremony at HMAS *Stirling* on Garden Island in Western Australia on Thursday 13 October.

As the RMP West, NSM will manage the sustainment of RAN ships at Henderson in Western Australia over the next five years, starting with the Arafura-class offshore patrol vessels (OPVs), with the possible expansion to the Anzac-class frigates (FFH) and auxiliary oiler replenishment (AOR) ships over the initial contract term.

Babcock Australasia's Managing Director — Defence, Andy Davis, said that NSM brings extensive experience in warship sustainment to deliver the RMP West in partnership with the RAN and local industry.

"We are proud to be awarded the RMP West contract and to be working in partnership with the Commonwealth Government to continue to deliver naval sustainment capability for Australia in the region," Mr Davis said.

"Building upon our position as the premier warship sustainment company in Australia and New Zealand, we look forward to continuing to work closely with our Australian-based supplier network to deliver the RMP West scope of work."

The establishment of RMP West will create nearly 150 full-time direct jobs and hundreds of indirect roles, and is predicted to generate up to $300 million in economic benefits through local industry engagement across the contract term.

The initial RMP West contract is valued at $32 million for the maintenance and sustainment of two OPVs and could increase to up to $300 million with the inclusion of the sustainment of the six WA-based Anzac-class frigates in the initial five-year period.

RMC West is the second in a network of four RMCs to be implemented for the RAN's Future Maritime Sustainment Model (FMSM) as part of Plan Galileo.

NSM's General Manager, Gavin Stewart, said that a national approach to driving innovation, capability and capacity through Australia's maritime supply chain will be integral to delivering sovereign capability for the RAN.

"The partner primes, suppliers and subcontractors which make up our valued supply chain are at the core of delivering a truly national capability for the sustainment of the RAN's warships," Mr Stewart said.

NSM and Babcock currently sustain the RAN's Anzac-class frigates, the Canberra-class landing helicopter dock ships and their associated light landing craft between Australia's east and west coasts, making alignment across Australia central to their operations.

HMAS *Wollongong* Decommissioned in Cairns

In early December the Royal Australian Navy decommissioned the Armidale-class patrol boat HMAS *Wollongong* at a ceremony at HMAS *Cairns* after 15 years of service.

Commander Australian Fleet, RADM Jonathan Earley CSC, RAN, attended the ceremony and recognised the service of the Ship's Company.

"HMAS *Wollongong* and the crews who have served in the

vessel have made a significant contribution to our national interest," RADM Earley said.

"These professional and dedicated men and women have protected our nation's borders and offshore maritime interests from illegal activity.

"While today's decommissioning is a necessary part of renewing our fleet, it is also an opportunity to honour the contribution made by the crews who have served Australia in HMAS *Wollongong*," RADM Earley said.

"Navy is transitioning to 12 new Arafura-class offshore patrol vessels. These vessels have greater range and endurance than our existing boats. This will allow the Navy to protect Australian interests over great distances and in more complex maritime environments."

The Commanding Officer of HMAS *Wollongong,* LCDR Matthew Hams, said that since commissioning in 2007, HMAS *Wollongong* has worked alongside Border Force, Australian Fisheries and the Australian Federal Police as part of border protection operations.

"Of note, HMAS *Wollongong* has steamed almost one million km throughout its service and I commend the professionalism, dedication, and passion of the crews who have served," LCDR Hams said.

HMAS *Wollongong* has protected Australia against unauthorised entry, breaches of customs, fisheries protection, and upheld immigration and drugs legislation.

HMAS *Wollongong* has served as part of Operations AUGURY (Philippines), SOLANIA (South West Pacific) and APEC ASSIST (PNG) and the 2019 G20 Summit in Japan.

Approximately 30 crew of HMAS *Wollongong* recently marched through the streets of the boat's namesake city, Wollongong in the traditional last parade before decommissioning.

HMAS *Wollongong* alongside Fleet Base East in Sydney for the final time before the ship's decommissioning (RAN photograph)

Austal's Multiple New Contracts

On 17 January 2023 Austal provided an update about a number of contracts that the company has secured which further diversify Austal's near-term revenue base, whilst providing the company with enhanced exposure to significant long-term growth opportunities.

These future growth opportunities include the emerging autonomous vessel market and non-prime module projects, which leverage Austal's core shipbuilding, support, and advanced technologies expertise. Austal has entered into agreements for a number of strategic developments, with a potential combined value of approximately $US75 million (approximately $A108 million), with some early-stage contracts providing a pathway for potential, future awards.

Further details appear below; however, these agreements include;

• An 'undefinitised contract action' (UCA) with the US Navy to resolve the detail design for three fully-funded Emergency Medical Ships (EMS) — with these ships to be valued at over $US900 million.

• Partnership with L3Harris Technologies to construct and modify autonomous capabilities in support of the US Navy's Overlord Unmanned Surface Vessel (USV) Program.

• Concept design for the US Navy's Large Unmanned Surface Vessels (LUSV), involving a prototype of an unmanned ship which is capable of autonomous operation.

• Appointment as the exclusive manufacturer of Saildrone Inc.'s wind and solar-powered Surveyor USV, with discussions continuing as to the number of vehicles to be produced

• A trial with the Royal Australian Navy to develop PBAT *Sentinel*, a patrol boat modified with autonomous systems for autonomous operation.

• Partnership with General Dynamics Electric Boat to train Austal personnel in the manufacture of Command and Control Systems Modules and Electronic Deck Modules for US Navy nuclear submarines.

• A contract with Newport News Shipbuilding in the USA to fabricate aluminium aircraft elevators for two US Navy Ford-class aircraft carriers being constructed by Newport News Shipbuilding.

Austal's Chief Executive Officer, Paddy Gregg, said "The new contracts and partnerships demonstrate our growing capabilities across a broad range of naval shipbuilding and support programs in Australia and the US, as we increasingly diversify our revenue base and expand our future growth pathways.

"This is all underpinned by our modern and agile shipyards which can build in steel and aluminium, small to large vessels, and conventional crewing or autonomous capability. Our shipbuilding capacity is complemented by our expanded advanced technology efforts in autonomy and additive manufacturing."

New Agreements with US Navy for Expeditionary Medical Ship Design Definition

In the 2023 US Defence budget approved by US President Joe Biden, $US975 million was allocated and funded for

In early February Austal launched the fifth evolved Cape-class patrol boat, the future ADV *Cape Woolamai*
(Photo courtesy Austal)

the US Navy for the detail design and construction of three Expeditionary Medical Ships (EMS).

The approximately $US900 million EMS construction contract has yet to be awarded. However, Austal has entered into an undefinitised contract action (UCA) with the US Navy to finalise the design requirements for the EMS. The UCA is a binding agreement; however, its precise scope is deliberately undefined, allowing the parties to develop and explore the design proposal together in a less constrained scope of work.

The design definitisation and detail design work is a small component of the allocated funding for EMS, and there is no guarantee that Austal will be awarded the contract for construction of its design; however, Austal is the sole company contracted to define the design for these vessels.

The proposed EMS is a 110 m catamaran and will be a dedicated medical ship optimised to provide hospital-level care. Following completion of the UCA, design work is planned to be completed in 2023.

Autonomous Vessel Contracts

Austal has partnered with L3Harris Technologies in the United States to deliver autonomous capabilities in support of the US Navy's Overlord Unmanned Surface Vehicle (OUSV) program, which includes the 60 m modified crewboat design *Vanguard* OUSV and *Mariner* OUSVs. Austal is constructing the L3Harris-awarded *Vanguard* (OUSV 3) in its Mobile, Alabama facility. Additionally, Austal USA will upgrade L3's *Mariner* (OUSV 4) with its machinery control system which will interface with L3Harris' ASView™. Construction and delivery of OUSV 3 is scheduled to complete in December 2023 while the work program on OUSV 4 is set to be finalised in February 2023.

Austal is also one of six of US Defence contractors who have been engaged to undertake the concept design for the US Navy's Large Unmanned Surface Vessels (LUSV), involving a prototype of an unmanned ship which is capable of semi-autonomous operation. The LUSV design contract is expected to lead to a competitive tendering for a construction contract as the program develops.

Austal's EPF-13, the largest US Navy ship to have been successfully operated autonomously, provides the concept of a large platform capable of executing autonomous missions such as logistics, tendering and adjunct magazine mission profiles, and will form the basis of Austal's design proposal.

Additionally, in the US, Austal is commencing production under a partnership with Saildrone Inc. to be the exclusive manufacturer of the company's 'Surveyor' uncrewed surface vehicle (USV). The 65 ft (19.7 m) autonomous USVs are designed for deep-ocean mapping and intelligence, surveillance and reconnaissance (ISR) applications, above and below the surface. The USVs are wind and solar-powered, aligning with Austal's growing focus on sustainability.

In Australia, Austal is modifying a de-commissioned Armidale-class patrol boat (ACPB) to modify, test and evaluate autonomous and remotely-operated systems for the Royal Australian Navy. The transformed ACPB will be re-named Patrol Boat Autonomous (PBAT) *Sentinel* and is expected to commence sea trials in October 2023.

The Saildrone Surveyor USVs will now be produced utilising Austal's advanced manufacturing capabilities
(Photo courtesy Saildrone)

Non-prime Module Contracts

Austal has also recently secured and substantially progressed two packages of work as a sub-contractor to prime contractors producing modules for critical US Navy programs.

Austal and General Dynamics Electric Boat (GDEB) have partnered on production work to support the US Navy's Virginia-class and Columbia-class nuclear-powered submarine fleet. Under this partnership, Austal personnel will be trained up to enable them to construct and outfit electronic deck modules and command-and-control systems at its Mobile, Alabama, facility. Austal and GDEB have commenced a training program whereby Austal employees conduct on-the-job training at GDEB facilities so that Austal is able to manufacture the modules at its Alabama facility in due course.

Austal has also received a contract from Huntington Ingalls Industries Newport News Shipbuilding to fabricate the aluminium aircraft elevators for two US Navy Ford-class aircraft carriers, CVN 80 and CVN 81, the future USS *Enterprise* and USS *Doris Miller*. Austal will fabricate two shipsets of aluminium elevators, three elevators per ship, in its state-of-the-art module manufacturing facility located in Mobile, Alabama.

Update and Resubmission of Tender on T-AGOS Project

Austal is resubmitting its proposal for the design finalisation and manufacture of up to six T-AGOS vessels (ocean surveillance steel catamarans) for the US Navy, in accordance with requests from the US Navy to all tenderers to resubmit their proposals. While the company took the opportunity to make some modifications as appropriate, this will likely delay announcement of any award of this project to around the end of the 2023 financial year.

Austal USA Commences Submarine Work

On 8 December 2022 Austal announced that production had begun at Austal USA's shipyard in Mobile, AL, in support of their strategic partnership with General Dynamics Electric Boat (GDEB) to support the US Navy's recapitalisation of the nation's nuclear submarine fleet. Leveraging Austal USA's lean manufacturing techniques and modern steel production line facilities, a focus factory approach is being used to expand production capacity of the submarine industrial base.

As part of the partnership, Austal USA is constructing and outfitting Command and Control Systems Modules (CCSM) and Electronic Deck Modules (EDM) for the Virginia- and Columbia-class programs. GDEB commenced on-the-job training efforts in April 2022 to provide certification for skilled trades and supervisory positions to ensure consistent work practices and adherence to quality assurance standards.

"This partnership is representative of the talent which exists across the shipbuilding industrial base and how it can be optimised to support the throughput our US Navy and Nation require," stated Austal USA President Rusty Murdaugh. "Our team of shipbuilders are excited to support this long-term relationship with GDEB as we continue to explore more opportunities to maximise production capacity during concurrent submarine production."

Work commenced in late November on two tanks for a Virginia-class submarine. The first CCSM is scheduled to arrive at Austal USA's Mobile shipyard in late January 2023 for initial outfitting efforts. The work will support a gradual ramp up to full fabrication and outfitting of CCSMs and EDMs across both submarine classes beginning in 2026.

Austal Australia Delivers Fourth Evolved Cape-Class Patrol Boat to the RAN

On 13 February Austal Australia delivered the fourth of eight evolved Cape-class patrol boats (ECCPBs), ADV *Cape Capricorn* to the Royal Australian Navy.

Austal's Chief Executive Officer, Paddy Gregg, said that the delivery of the fourth ECCPB highlighted Austal's consistency in production and efficiencies at the Henderson shipyard.

"Austal has now delivered four Evolved Capes to the Royal Australian Navy since the contract was signed in May 2020 and we are launching a new vessel every three months, after around 12 months construction.

"The fifth vessel, the future ADV *Cape Woolamai*, is alongside now and we have three more evolved Capes at various stages of production, here in Henderson.

"With the continued support of our trusted supply chain partners from across Australia and around the world, the Austal shipbuilding team is well on track to deliver all eight Evolved Cape-class patrol boats to the Navy by mid-2024, on schedule."

The 58 m aluminium monohull patrol boat is the fourth of eight to be delivered to the RAN. The first three, ADV *Cape Otway*, ADV *Cape Peron* and ADV *Cape Naturaliste* were delivered in March, August and November 2022, respectively.

The evolved Capes feature new, larger amenities to accommodate up to 32 people, improved quality-of-life systems and advanced sustainment intelligence systems which further enhance the RAN's ability to fight and win at sea. The patrol boats will be utilised for a wide variety of constabulary and naval missions and play a critical role in Australia's national security, as a high-performing, reliable and effective maritime asset.

Austal Australia has delivered the fourth Evolved Cape-class Patrol Boat, ADV *Cape Capricorn* to the Royal Australian Navy. (Photo courtesy Austal)

Austal Australia continues to employ approximately 400 people (directly) in Western Australia and is engaging more than 300 supply-chain partners across Australia, to deliver the Evolved Cape-class Patrol Boat Project (SEA1445-1) for the Royal Australian Navy. In-service support for the Cape-, Evolved Cape- and Guardian-class patrol boat fleets operated by the Australian Border Force, Royal Australian Navy and Pacific Island nations is provided by Austal Australia through dedicated service centres located in Henderson, Western Australia; Cairns, Queensland; and Darwin, Northern Territory.

Austal Australia is also contracted to deliver 22 Guardian-class Patrol Boats to the Commonwealth of Australia under the Pacific Patrol Boat Replacement Project (SEA3036-1) and has delivered 15 vessels since 2018.

Luerssen Australia reaches 200 Employee Milestone

In January Luerssen Australia announced that it has reached a major milestone with its workforce reaching the 200 employee mark.

Over the last five years, Luerssen Australia has expanded its team in Perth and Adelaide as it delivers twelve Arafura-class offshore patrol vessels (OPV) for the Royal Australian Navy. Currently, Luerssen Australia has six vessels under construction across two sites. This follows the launch of NUSHIP *Arafura* in December 2021 in South Australia.

Luerssen Australia's Chief Executive Officer, Jens Nielsen, said that he is proud of this latest milestone. "This is a pivotal point for Luerssen Australia and its commitment to creating a world-class sovereign shipbuilding industry," he said. "It is fantastic to grow our workforce and create job opportunities for Australians."

With the Federal Government investing billions of dollars into the Western Australian shipbuilding sector over the next decade, Luerssen Australia sees a very bright future for the industry and looks forward to playing a pivotal role in the years to come.

"Luerssen Australia is extremely grateful for its supplier partners who have created a strong collaborative environment. They are helping to shape the future of Australian shipbuilding and are strengthening the sovereign supply chain."

To date, Luerssen Australia has achieved an impressive 63% Australian industry content on the OPV Program and aims to increase this further. Luerssen Australia is involving as many local companies as possible, and continues to embed almost 150 years of shipbuilding knowledge into Australia.

BAE Systems Develops Digital Simulation tool for Hunter-class Frigates

BAE Systems Maritime Australia, who will build nine Hunter-class frigates for the RAN, has further enhanced the shipbuilding process by developing a digital simulation tool. The Hunter-class frigates will be one of the most advanced anti-submarine warfare vessels in the world and the Hunter digital simulation tool (HUDS) will help to optimise the program schedule through automated decision-making logic. The digital shipyard tool allows for the rapid development of shipbuilding scenarios which are used for daily workstation analyses or development of future builds.

A manual scenario analysis whcih would typically take two weeks to develop using Microsoft Excel, PowerPoint and paper cut-outs, can be processed by HUDS in as little as two minutes.

This tool is already attracting attention from shipbuilding teams in the United Kingdom, who are building the Hunter-class reference design frigate, the Type 26.

First Assistant Secretary Major Surface Combatants and Combat Systems, Sheryl Lutz, said that the Osborne Naval Shipyard is at the cutting edge of innovation for a digital shipyard.

"Defence welcomes any opportunity to enhance productivity and speed up the build using advanced processes," Lutz said.

"The HUDS tool makes it easier to exploit the data which

The construction of prototype frigate modules by BAE Systems Maritime Australia at the Osborne Naval Shipyard in South Australia is well advanced ahead of the commencement of construction of the first Hunter-class frigate later this year
(Photo courtesy BAE Systems)

helps us understand the utilisation of the shipyard and apply key changes."

HUDS draws on software which is often used in fast-paced manufacturing environments, like the automotive sector.

The tool can also be applied to land and air domains, which can also benefit from the rapid development of their own build scenarios.

"We strive to be agile with how we apply new technology, and the Hunter-class frigate program operates at the forefront of digital shipbuilding," Lutz said.

"The workforce at Osborne Naval Shipyard will utilise advanced manufacturing practices to deliver one of the most capable and lethal anti-submarine warships to date."

Defence continues to work closely with BAE Systems Maritime Australia on optimising the Hunter-class frigate program and strengthening defence industry relationships within Australia.

Ghost Shark Coming

An autonomous robotic undersea warfare vehicle is being designed and manufactured in Australia for the Royal Australian Navy.

Its name — *Ghost Shark* — was revealed on 12 December at Anduril Australia, which is collaborating with the RAN and the Defence Science and Technology Group on the project. The collaboration was made possible by the Next Generation Technologies Fund.

Defence scientists, Navy personnel and Anduril robotics specialists will work together under a co-funded arrangement to produce three prototypes of the extra-large autonomous underwater vehicles (XL-AUVs).

The ceremony in Sydney featured a US-made 'Dive-LD' autonomous submarine, which will be the testbed vehicle for the development of the vessels.

The Head of Navy Capability, RADM Peter Quinn said that the stealthy, multi-role vessels, typically between 10 and 30 m long, represented a new undersea warfare capability for the Navy.

"They have the capacity to remain at sea undetected for very long periods, carry various military payloads and cover very long distances," RADM Quinn said.

Joining other autonomous systems, as Navy invested in smart AI-enabled technologies, he said that *Ghost Shark* would be a game-changer.

"The vessels will provide militaries with a persistent option for the delivery of underwater effects in high-risk environments, complementing our existing crewed ships and submarines, as well as other future uncrewed surface vessels," he said.

A Dive-LD autonomous underwater vehicle was on show at Anduril Australia
(Department of Defence photograph)

The Chief Defence Scientist, Prof. Tanya Monro, said that the project was an example of Defence's innovation system in action.

"By the Defence Science and Technology Group collaborating with our industry, we are able to co-develop critical capability which meets our specific needs much faster," Prof. Monro said.

Anduril will complete its testing on the submarines over the coming three years in Sydney with continued support from Defence.

Yu Feng Zhe from Incat Crowther

Incat Crowther has announced the handover of the new purpose-built catamaran crew-transfer vessel *Yu Feng Zhe* to Goldsea Marine & Offshore Engineering (Shanghai) Co. Ltd (Goldsea). The Incat Crowther 32, built by Afai Southern Shipyard in Guangzhou, PRC, represents a step change for the Chinese offshore wind industry, offering enhanced capabilities including a large cargo zone and a maximum speed of up to 25 kn.

The handover of the CTV follows recent sea trials which confirmed the vessel's high performance, with Incat Crowther meeting all contractual requirements. The state-of-the-art catamaran will now be put into service transporting up to 12 technicians and six crew to and from Goldsea's offshore wind assets.

Designed specifically for offshore conditions in China, the vessel offers stability, performance and functionality unmatched by other similar vessels in the region. The main deck features four crew cabins, two bathrooms and a large

Starboard bow of *Yu Feng Zhe*
(Photo courtesy Incat Crowther)

technician seating area with refreshment space. Internal storage for equipment is provided, as well as a large foredeck cargo zone.

The upper deck has two cabins, a bathroom, a large crew mess, pantry and an elevated wheelhouse which provides excellent visibility in almost any offshore conditions. Safety has also been prioritised with Incat Crowther's Resilient Bow Technology ensuring safe landings and transfers during wave height conditions in excess of 2 m. Below deck is a workshop, a utility room, additional storage and laundry facilities while the vessel is also prepared for a deck crane capable of lifting 2 t at a reach of 10 m.

The vessel is designed to work and stay offshore for extended periods and has a large deadweight capacity to allow this functionality.

Yu Feng Zhe on trials
(Photo courtesy Incat Crowther)

Commenting on the delivery of the 32 m catamaran CTV, Ed Dudson, Incat Crowther's Managing Director—Europe said "This vessel has been built in China and tailored to provide a comfortable, safe and efficient transport solution for Goldsea, a leader in the Chinese offshore wind industry."

"Incat Crowther has collaborated extensively with Goldsea and our long-term partners at Afai Southern Shipyard on this project, and we are delighted with the results. This vessel heralds a new era in China's offshore wind industry and ensures that Goldsea remains ahead of the game," said Mr Dudson.

The delivery of the 32 m catamaran CTV is the first collaboration between Goldsea and Incat Crowther, and reinforces Incat Crowther's position as a world leader in the design and delivery of CTVs for the offshore wind industry.

Principal particulars of *Yu Feng Zhe* are

Length OA	32.10 m
Length WL	29.33 m
Beam OA	10.00 m
Depth	4.15 m
Draft (hull)	1.40 m
Passengers	12
Crew	6
Fuel oil	39 000 L
Fresh water	25 000 L
Sullage	2000 L
Main engines	2×MAN D2862 LE466 each 1029 kW @ 2100 rpm
Propulsion	2×Kumera Helseth CPP
Generators	2×50 kW
Speed (service)	20 kn
(maximum)	25 kn
Construction	Marine-grade aluminium
Flag	China
Class/Survey	CCS * CSA Catamaran HSC, Cargo, Greater Coastal Service * CSM

Starboard quarter of *Yu Feng Zhe*
(Photo courtesy Incat Crowther)

Odalisque III from Incat Crowther

The Incat Crowther-designed *Odalisque III*, a new state-of-the-art 24 m boutique live-aboard cruise vessel, has been officially launched by Tasmanian luxury wilderness expedition cruise operator On Board.

On Board launched *Odalisque III* in January 2023 with a public ceremony attended by local media at Hobart's historic Constitution Dock and the vessel is now set for its maiden voyage into the Tasmanian Wilderness World Heritage Area.

Built by Tasmanian shipbuilder Richardson Devine Marine, the aluminium-hulled *Odalisque III* can host up to 12 guests in six stylish and flexible guest cabins, each with its own ensuite.

The upper deck features three large guest cabins, a wheelhouse lounge and dining area as well as an outdoor dining and viewing area. The main deck features four cabins, a large indoor dining area, an outdoor viewing platform and the galley. Configured to offer a world-class dining experience while also being operationally efficient, the galley is conveniently located adjacent to pantry, refrigeration, and cleaning facilities.

Starboard bow of *Odalisque III*
(Photo courtesy Incat Crowther)

In total, *Odalisque III* boasts three outdoor viewing decks and a bridge open to guests allowing uninterrupted views of the spectacular Tasmanian wilderness.

Odalisque III's design has also allowed for the addition of two tenders, accessible from the main deck, to allow guests to enjoy shore excursions.

Incat Crowther's CEO, Brett Crowther, said close collaboration with suppliers and On Board CEO Pieter van der Woude was a crucial element of the project. "Our team enjoyed collaborating with Pieter and Richardson Devine Marine to help bring On Board's vision of creating a floating wilderness lodge to life," said Mr Crowther.

"*Odalisque III* has it all, from six stylish and flexible cabins to multiple indoor and outdoor dining and entertainment areas — all supported by state-of-the-art commercial dining facilities.

"The vessel also features several guest lounge and bar areas, while the design of *Odalisque III* means that guests can either choose to board a tender for an onshore adventure or sit back, relax and enjoy the sweeping views on offer in one of the world's most stunning environments," said Mr Crowther.

Principal particulars of *Odalisque III* are

Length OA	24,0 m
Length WL	23.5 m
Beam OA	8.00 m
Depth	3.25 m
Draft (hull)	1.25 m
Passengers	12
Crew	5
Fuel oil	16 000 L
Fresh water	4000 l
Sullage	6000 L
Main engines	2×Scania D13 076M each 607 kW @ 2300 rpm
Propulsion	2×propellers
Generators	2×60 kW
Speed (service)	21 kn
(maximum)	25 kn
Construction	Marine-grade aluminium
Flag	Australia
Class/Survey	NSCV Class 1C/1D

Stewart Marler

Dining area on *Odalisque III*
(Photo courtesy Incat Crowther)

Lounge area on *Odalisque III*
(Photo courtesy Incat Crowther)

Cabin berth on *Odalisque III*
(Photo courtesy Incat Crowther)

Port quarter of *Odalisque III*
(Photo courtesy Incat Crowther)

Cruising in NSW

The summer cruise season has moved into high gear, with visits to Sydney in late November by *Queen Elizabeth, Ovation of the Seas, Carnival Splendor, Grand Princess, Majestic Princess, Star Breeze, Westerdam, Pacific Adventure,* and *Celebrity Eclipse.* The following months saw return visits by most of these vessels, and December added visits by *Coral Adventurer, Seaburn Odyssey, Viking Orion, Quantum of the Seas, Regatta, La Perouse, Noordam, Silver Muse, Norwegian Spirit, Viking Mars, Seven Seas Explorer, Azamara Quest* and *AIDAmar.* January added visits by *Silver Shadow, Silver Whisper* and *Pacific Explorer*, and early February added visits by *Europa 2, Amera* and *Zuiderdam.*

Zuiderdam competing for space on the harbour with the twilight sailors on 10 February (Photo John Jeremy)

Cruise vessels operating out of Sydney have continued to call at Eden, NSW, with vessels berthing at the Eden Cruise Wharf and passengers going ashore to visit local sights and shops. *Noordam, Le Laperouse, Norwegian Spirit* (four times), *Azamara Quest* (three times), *Seabourn Odyssey* (twice), *Silver Whisper* and *Viking Neptune* all visited between mid-November and mid-February.

Phil Helmore

Noordam berthed at the Eden cruise ship wharf on 15 December 2022 (Photo courtesy Robert Whiter)

Norwegian Spirit berthed at the Eden cruise ship wharf on 23 December 2022 (Photo courtesy Robert Whiter)

Pacific Adventure anchored in Athol Bight in Sydney Harbour on Australia Day (Photo John Jeremy)

Double-humped Roll Response for a Cruise Ship in Beam Seas

Tim Gourlay
Perth Hydro

Summary

A set of model tests was published by Ikeda *et al.* in 2006 for a Fincantieri cruise ship in regular beam seas of height 5.0 m, with varying wave period. They made the unexpected discovery of a "double-humped" roll response, with one hump at the resonant roll period of 23 s, and another hump at short wave periods of 7–11 s, where the wave-induced roll moment is largest. The hump at the resonant roll period is predicted by linear theory, but the hump at short wave periods is not. Here we show that including nonlinear effects on the GZ curve, including heave and position in the wave, allows the second roll peak to be predicted. The implication is that, for low-GM ships in short-period waves, linear roll theory may be inadequate, and a nonlinear theory may be needed.

Nomenclature

AP	Aft perpendicular
BWL	Waterline beam
GM	Transverse metacentric height above centre of gravity
KG	Centre of gravity height above keel
KM	Transverse metacentric height above keel
LBP	Length between perpendiculars
LCB	Longitudinal centre of buoyancy
LOA	Length overall
RAO	Response amplitude operator

1. Introduction

Ikeda *et al*. (2006) describe a set of model tests on a generic Fincantieri cruise-ship hull. The tests were done in the towing tank of Osaka Prefecture University, with the ship free to heave, sway, roll and pitch. Roll motions were measured in regular beam seas, of constant full-scale height 5.0 m and varying wave period. Results are shown in Figure 1, for the ship without bilge keels.

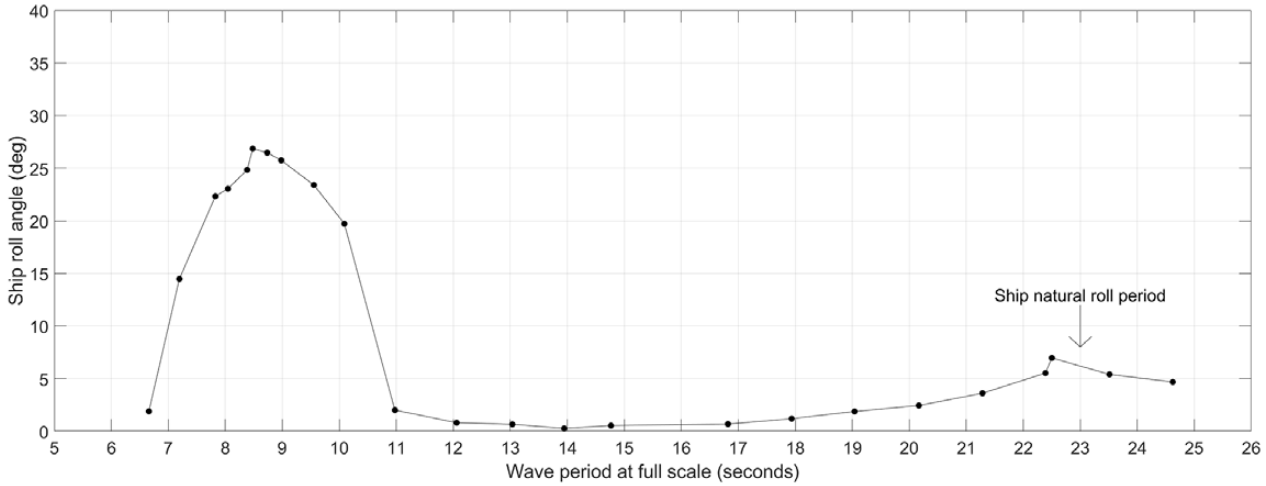


Figure 1: Measured roll angle of Fincantieri cruise-ship hull, in regular beam seas of height 5.0 m.
Data from Ikeda et al. (2006, Fig. 2) and Munif et al. (2005, Fig. 3)

For the large-wave conditions on which Figure 1 is based, the roll has a peak at the ship's natural roll period of 23 s, as expected. However, it also has another (much larger) peak at the short-wave period of 8.5 s. As we shall see, this peak is not predicted by linear seakeeping theory. It is the purpose of this paper to investigate the possible nonlinear effects which might produce this large roll peak at short wave periods.

2. Hull Modelling

The ship hull used in the model tests of Ikeda *et al*. (2006) was a small-scale model of the Fincantieri standard cruise-ship hull (IMO 2004, pp. 19–20). A body plan of the hull is given in Ikeda et al. (2006) and Munif et al. (2006).

A larger-scale model of the same hull is shown in Figure 2.

Figure 2: 1:40 scale model of Fincantieri standard cruise-ship hull, as tested at Vienna Model Basin (Photo from IMO 2004, p. 22)

Dimensions of the model tested by Ikeda *et al*. (2006) are shown in Table 1.

Table 1: Dimensions of model tested by Ikeda *et al*. (2006)

Model scale	1:125.32
LOA	290.0 m
LBP	242.24 m
BWL	36.0 m
Depth	20.0 m
Draft	8.40 m
Displacement	53,140 t
Block coefficient	0.709
GM	1.58 m
Natural roll period	23 s

A surface mesh of the hull, suitable for hydrostatics calculations, has been developed from the supplied body plan. This is shown in Figure 3.

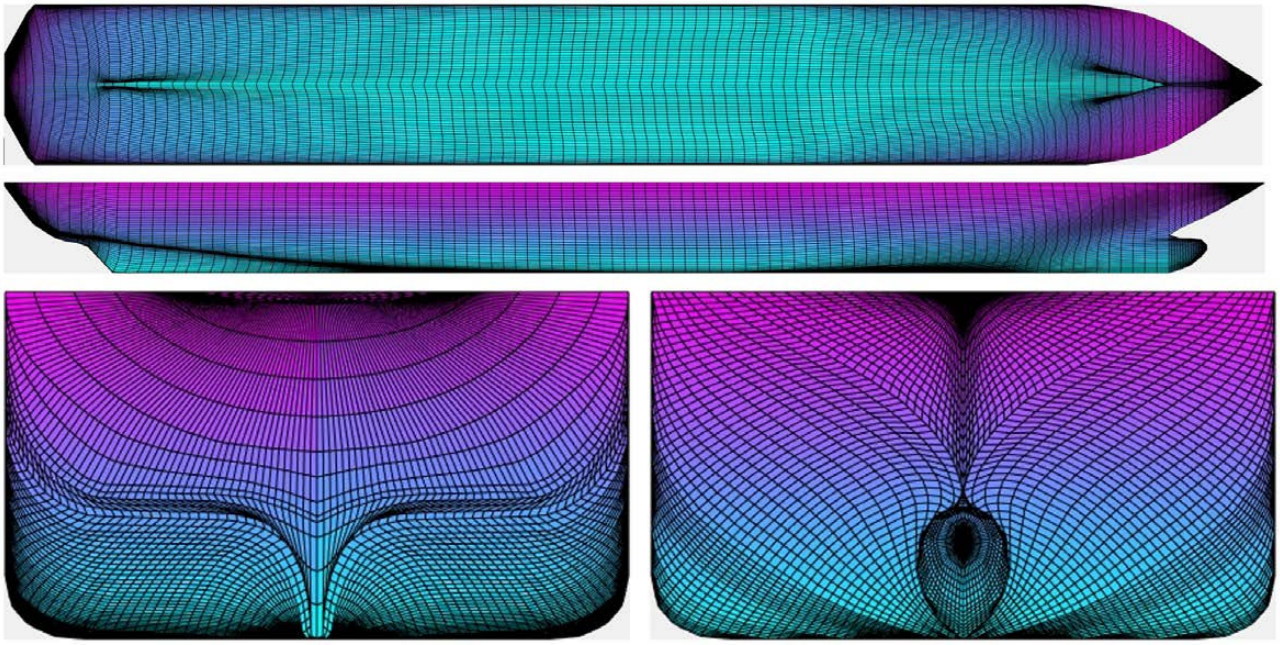


Figure 3: 14048-panel surface mesh, up to deck level, as developed with OCTOPUS 3D Mesher for hydrostatics calculations

Another (coarser) surface mesh of the hull, up to the still waterline, has been developed for seakeeping calculations. This is shown in Figure 4.

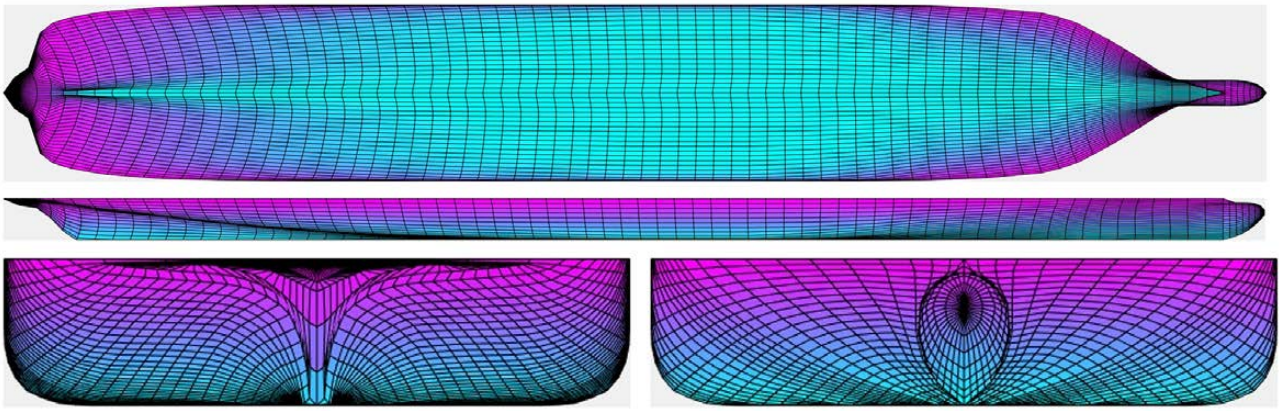


Figure 4: 3780-panel surface mesh, up to still waterline, as developed with OCTOPUS 3D Mesher for seakeeping calculations

From the developed surface meshes, stability parameters have been calculated, as shown in Table 2.

Table 2: Calculated stability parameters

KM	20.00 m
KG = KM–GM	18.42 m
LCB	119.4 m forward of AP

3. Linear Frequency-domain Calculations

Linear beam-sea ship roll was first calculated in the frequency domain. Wave loads, ship hydrodynamic coefficients and ship RAOs were calculated using WAMIT v7.4 software (WAMIT 2020). This software has been validated against beam-sea model test results in low wave conditions, in a previous study with DNV and Flanders Hydraulics (Gourlay *et al*. 2015).

We use a coordinate system with origin at the ship's LCG (119.4 m forward of the AP), on the ship centreline and on the still waterline. Roll moments are taken about this origin. The vertical centre of gravity is 10.02 m above this origin (from Table 2).

In this report, we shall use the following nomenclature for the six motion degrees of freedom:

x_1 = "surge" (fore-aft motion at ship origin, positive forward)
x_2 = "sway" (transverse motion at ship origin, positive to port)
x_3= "heave" (vertical motion at ship origin, positive upwards)
x_4= "roll" (angle, positive to starboard)
x_5= "pitch" (angle, positive bow-down)
x_6= "yaw" (angle, positive bow-to-port).

Roll motions are coupled with sway and yaw motions, but are uncoupled from surge, heave and pitch motions in the linear case. Nevertheless, we solve for the full 6-DoF motions, to prepare for the nonlinear analysis.

WAMIT settings for frequency-domain calculations are shown in Table 3.

Table 3: WAMIT settings for frequency-domain calculations

WAMIT solver	Direct solver
First-order wave loads	Diffraction potential, 6-DoF
Added mass and damping	Radiation potential, coupled 6-DoF
Restoring coefficients	Standard WAMIT upright hydrostatics
Force control method	Force control 2 with external damping
Water depth	Deep water
Ship speed	0 kn
Ship heading relative to waves	90º (starboard beam seas)
Wave periods	5.0:0.05:26.0 s
Roll gyradius	43% of waterline beam (tuned to correct roll period)
Viscous roll damping	Linear Ikeda method for eddy damping (Ikeda *et al.*, 1978)
Pitch gyradius	25% of LOA
Yaw gyradius	25% of LOA

The wave-induced roll moment, as a function of wave frequency, is shown in Figure 5. Sway and yaw wave loads are also calculated and included in the modelling.

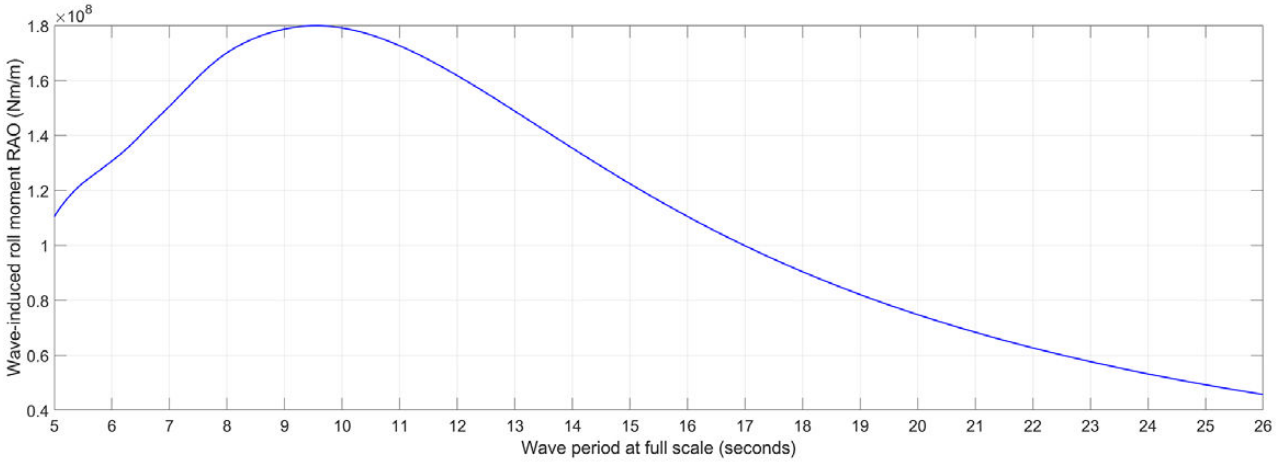


Figure 5: Wave-induced roll moment, per metre of wave amplitude, as a function of wave period

Roll added inertia and damping, as a function of wave frequency, are shown in the Appendix. Cross-coupling terms with sway and yaw are also calculated and included in the modelling.
The linear roll-restoring coefficient is shown in Table 4. There are no cross-coupling restoring coefficients for roll.

Table 4: Linear roll-restoring coefficient

C_{44}	8.24×10^8 Nm

4. Linear Time-domain Calculations

Time-domain motions were calculated using a fourth-order Runge-Kutta solver, as implemented in the software MoorMotions (see www.moormotions.com). The method solves for displacements, velocities and accelerations in multiple coupled degrees of freedom, using any input forcing functions.
The basic time-domain equation to be solved is (van Oortmerssen 1974, Equation 4.23; Gourlay 2019, Equation 1):

$$\sum_{j=1}^{6}\left[M_{ij}+A_{ij}(\infty)\right]\ddot{x}_j = X_i - C_i - B_{iV} - \int_0^{\infty}\sum_{j=1}^{6}L_{ij}(\tau)\ddot{x}_j(t-\tau)d\tau \qquad [1]$$

where

x_j = motion in each degree of freedom, j=1,…,6
M_{ij} = mass matrix
$A_{ij}(\infty)$= added mass at infinite frequency
X_i = wave load
C_i = hydrostatic restoring force
B_{iV} = viscous damping force
$L_{ij}(\tau)$= acceleration-based impulse response functions

Wave loads are calculated using WAMIT, as for the frequency-domain calculations.

For time-domain calculations, time-domain impulse response functions (Gourlay 2021) are used, instead of frequency-domain added mass and damping. Impulse response functions are calculated using WAMIT, as shown in Table 5.

Table 5: WAMIT settings for impulse response functions

Wave frequencies	0.00:0.01:5.00 rad/s, plus infinite frequency
Impulse response function method	WAMIT f2t utility, coupled 6-DoF
Time step	0.1 s
Time duration	60 s

The roll impulse response function is shown in the Appendix. Cross-coupling terms with sway and yaw are also calculated and included in the modelling.

Equation (1) is solved for regular waves of varying input frequency, with height 5.0 m, using the MoorMotions time-domain solver. Inputs are described in Table 6.

Table 6: MoorMotions inputs for linear time-domain calculations

M_{ij}	WAMIT (2019, eq. 3.3), as used in frequency-domain
X_i	Output from WAMIT, as used in frequency-domain
C_i	Output from WAMIT, as used in frequency-domain
B_{iV}	Linear eddy roll damping, as used in frequency-domain
$L_{ij}(\tau)$	Output from WAMIT for time-domain calculations
$A_{ij}(\infty)$	Output from WAMIT for time-domain calculations
Simulation timestep	0.1 seconds
Simulation time	900 seconds
Wave ramp-up time	300 seconds

5. Non-linear Time-domain Calculations

For nonlinear time-domain calculations, we use the nonlinear roll-righting moment, rather than the linearised roll-restoring coefficient shown in Table 4. The roll-righting moment is related to the ship mass m, acceleration due to gravity g, and righting lever GZ by

$$C_4 = m.g.GZ \qquad [2]$$

In still water, the GZ curve can be calculated by applying hydrostatic pressure to the heeled hull surface mesh. The calculated still-water GZ curve is shown in Figure 6, up to 30˚ heel angle. The heel angle for deck edge immersion is 33˚.

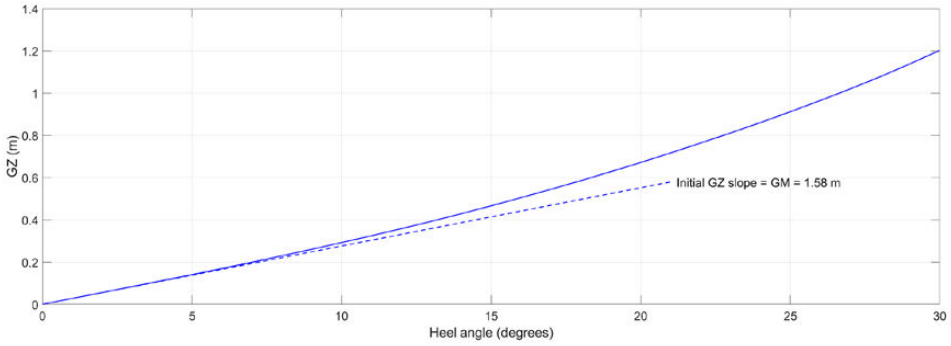


Figure 6: Calculated still-water GZ curve for the Fincantieri hull model

In a nonlinear analysis, we can also account for the changing righting moment with position in the wave. Results are plotted for different heave values: zero heave and equilibrium heave (as shown in Figure 7). Example calculated GZ curves for 8.5 s waves are shown in Figure 8.

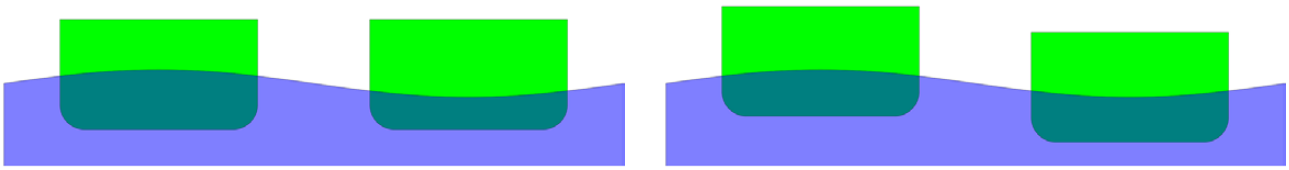


Figure 7: Stern view of cruise ship in beam seas, showing submerged hull in crest and trough. Wave height = 5.0 m, wave period = 8.5 seconds.
(Left) Zero heave, (Right) Buoyancy equilibrium heave

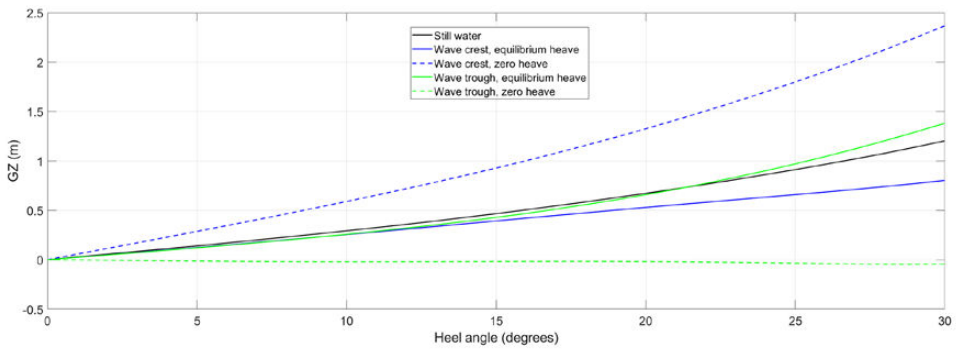


Figure 8: Righting lever curve for cruise ship in beam seas of height 5.0 m and period 8.5 seconds. Results are given for the ship in the wave crest or wave trough, and with zero heave or buoyancy equilibrium heave.

In a linear analysis, roll is coupled with sway and yaw, while heave is coupled with surge and pitch. In the nonlinear analysis, we see that ship heave affects the righting moment, so roll is coupled with heave. Therefore, in a nonlinear analysis, all 6-DoF motions are coupled.

We now proceed to solve Equation (1) for regular waves of varying input frequency, with height 5.0 m, using the MoorMotions time-domain solver. Inputs are as described in Table 6, with modifications shown in Table 7.

Table 7: Modified MoorMotions inputs for nonlinear time-domain calculations

C_4	*Output from hydrostatic calculations, using instantaneous roll, heave and position in wave*
B_{iV}	*Quadratic eddy roll damping (Ikeda et al. 1978)*

Example ship motion time-series are shown in Figure 9.

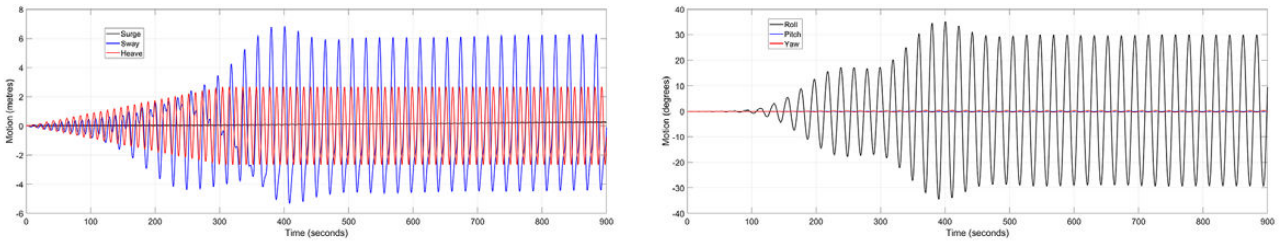


Figure 9: Calculated non-linear time-domain motions for the Ikeda *et al*. (2006) test case, 5.0 m beam seas with period 10.5 seconds. (left) heave; (right) roll

6. Comparison of Different Methods with Model Tests

Peak roll amplitude results for each wave frequency are shown in Figure 10, together with measured results.

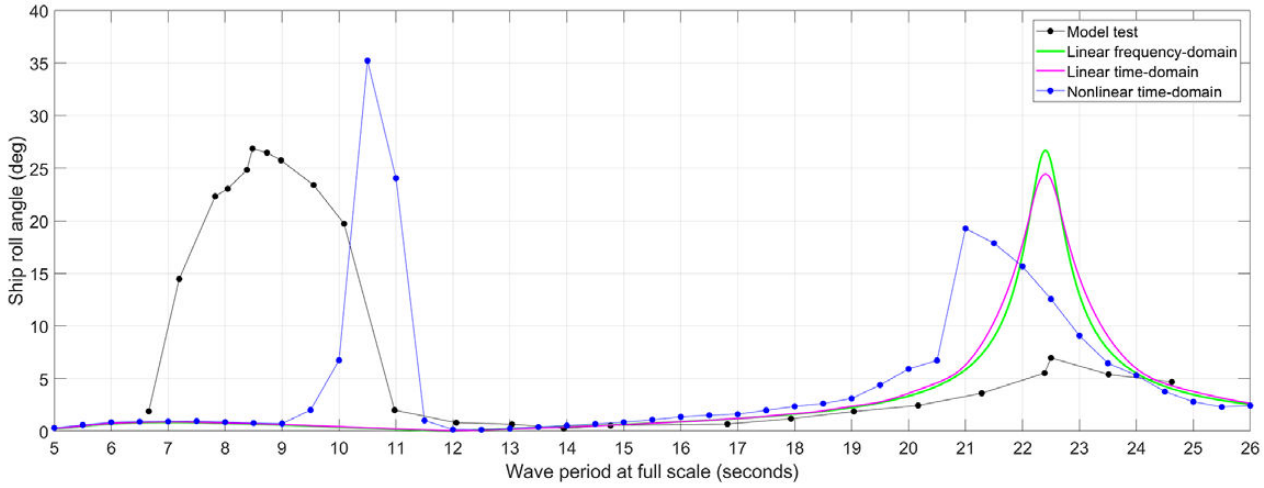


Figure 10: Comparison of measured and computed ship roll motions for the Ikeda *et al*. (2006) test case: cruise ship in regular beam seas of height 5.0 m

Points to note from Figure 10 include:

- The linear frequency-domain and linear time-domain methods produce near-identical results (see also Figure 11). This is a useful validation of the MoorMotions time-domain solver and impulse response functions.
- The linear and non-linear theories all predict the approximate location of the resonant roll peak, at 21–24 s.
- The magnitude of the resonant roll peak is over-predicted. The resonant roll peak is very sensitive to the roll damping. It is likely that the viscous roll damping is under-predicted, perhaps due to the inapplicability of the Ikeda roll damping method to this hull.
- The linear methods completely fail to predict the short-period roll peak, at 7–11 s.
- The non-linear method does predict a short-period roll peak, at 9–12 s. This roll peak is driven by the large wave-induced roll moment at these wave periods (see Figure 5), which is able to excite roll motions at the resonant frequency, primarily through the nonlinear GZ curve.
- Regular waves with 10 s period are able to produce resonant roll with 23 s period, through non-linear excitation. This is shown numerically in Figure 9, and experimentally in Ikeda *et al*. (2006, Fig. 5).

As an aside, the heave motions appear unaffected by nonlinear roll behaviour, with the linear and nonlinear methods giving nearly identical heave motions (Figure 11). This confirms the general view that heave may be well-predicted by linear seakeeping theory.

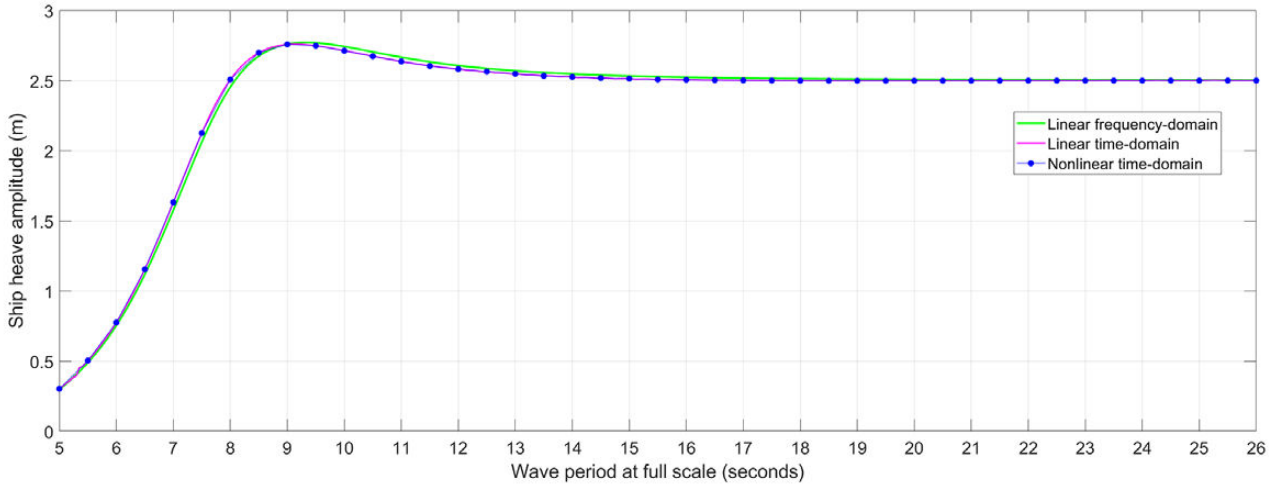


Figure 11: Computed ship heave, for the Ikeda *et al*. (2006) test case

7. Effect of Bilge Keels

The model test results shown in Figure 1 were measured without bilge keels. Further tests were done on the same ship with bilge keels, showing much lower roll motions at the 7–11 s peak. We conclude that roll damping is very important for this secondary roll peak.

8. Relevant Full-scale Measurements on Container Ships

Full-scale roll measurements were done on container ships in beam seas, as reported in Ha and Gourlay (2018, Fig. 11). It was found that for Post-Panamax ships with shorter natural roll periods, RMS roll motions were well-predicted by linear theory. However, for Panamax ships with long natural roll periods of 20–30 s, linear theory under-predicted the RMS roll motions.

9. A Warning on predicting Roll Motions of Low-GM Ships

Certain classes of ship have large displacement, combined with low transverse GM, resulting in long natural roll periods in the range 20–30 s. The cruise ship considered in this report fits into this category, as do Panamax container ships and fully-loaded LNG carriers.

Wave conditions around the globe typically have periods in the range 5–15 s (though sometimes longer).

Let us consider the case of a Panamax container ship, with natural roll period of 25 s, in irregular beam seas of peak period 12 s. A standard linear seakeeping analysis would calculate a roll RAO with peak at 25 s, and tiny RAO at 12 s. A measured wave spectrum in this case would have a peak at 12 s, and tiny wave energy at 25 s. Multiplying the RAO by the wave spectrum, in a standard convolution analysis, produces a tiny roll response. As discussed for the container ship full-scale trials above, this is incorrect.

Therefore, in either regular or irregular beam seas, care must be taken when the ship's natural roll period is much larger than the peak wave period. In this case, linear theory should be expected to under-predict the roll motions, while a fully-non-linear theory should provide a better prediction.

10 Conclusions

For the cruise ship without bilge keels tested by Ikeda *et al*. (2006), a double-humped roll response was found to occur. This cannot be predicted by linear seakeeping theory, but can be predicted by nonlinear seakeeping theory.

The implication is that, for low-GM ships such as cruise ships, container ships and LNG carriers, care should be taken when predicting roll motions using linear theory.

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Appendix

Frequency-domain added inertia and damping coefficients for roll, as calculated using WAMIT, are shown in Figure 12.

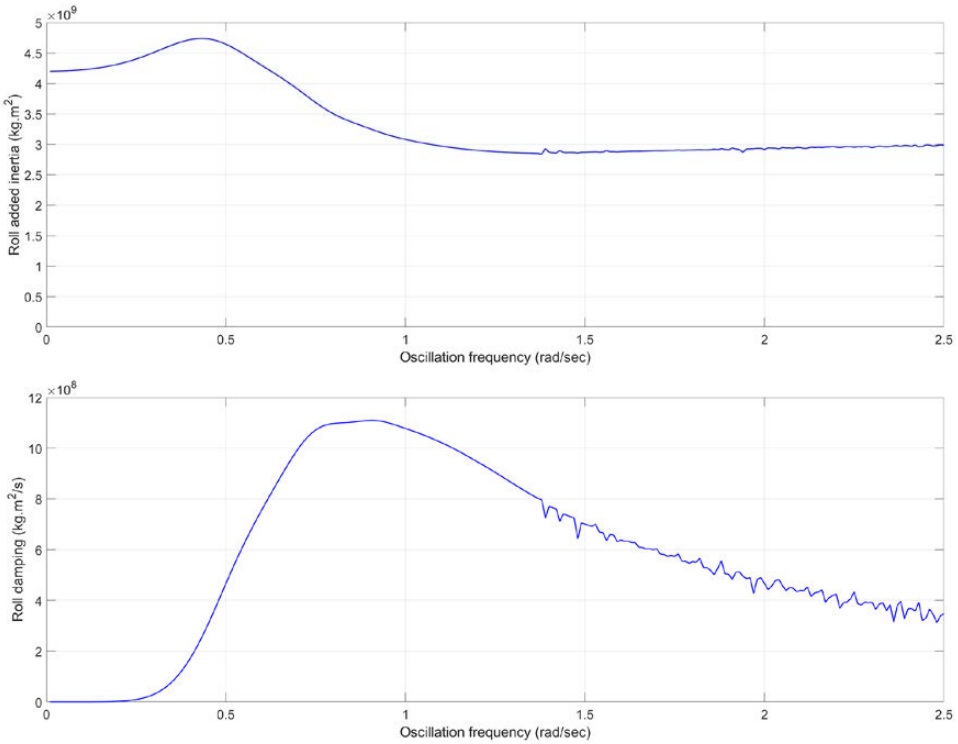

Figure 12: Roll added inertia (top) and damping (bottom), as calculated using WAMIT

Roll impulse response is shown in Figure 13.

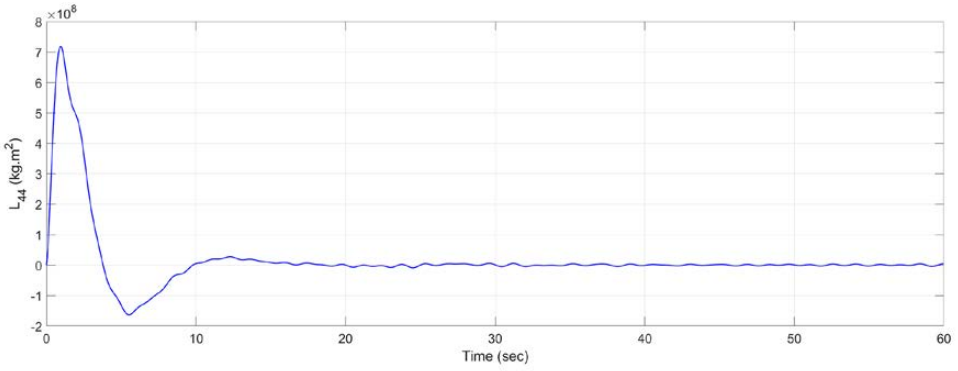

Figure 13: Roll impulse response function, as calculated using WAMIT

All other motion components and cross-coupling terms are also included in the analysis.

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EDUCATION NEWS

UNSW Canberra

As we start our second year of activity in our new "grey ship focused" naval architecture program, another two courses will be introduced in Semester 1, namely ZEIT4750 Ship Design Project A, and ZEIT4752 Ship Propulsion and Marine Engineering.

As described in past issues, SBLT Cooper Woods will have the honour of being our first graduate from our first student cohort of one. However, at the time of going to press our second cohort is expected to be five in number, a growth in student numbers of 500%! This second cohort is also swinging the gender balance with four of them female, and one of the females is our first civilian student.

In 2023, Cooper will be completing a thesis sponsored and supported by DSTG in the ship design optimisation domain. Through it is in collaboration with DSTG and DNE, we expect to grow our competence and expertise around tools such as ANSYS ModelCentre and ANSYS OptiSLang, an AI framework which automates the simulation process for uncertainty quantification and robust design optimisation (RDO) studies. Another student in our Mechanical Engineering program will complete his thesis in the further development of wave-making capability in SEIT flume tanks. By the end of the year, we should have a good understanding of the characteristic waves which we can produce in our flumes and have developed our wave measurement and attenuation systems. We are not duplicating the capabilities of AMC, but will have facilities expected to provide good demonstration and niche experimental opportunities in the ship resistance and seakeeping domains.

In April we will be busy with field trips for both Year 3 and 4 students. There will be a trip to AMC (including resistance and seakeeping test experience and tours of other facilities) and industry visits in Hobart, a training cruise out of HMAS *Creswell* on MV *Sycamore*, and a trip to Sydney for an inclining experiment and other industry visits.

Finally, as in the last issue, I wish to highlight some student pathways for those considering a career in naval architecture and for those looking for naval architecture graduates. There are currently three cohorts of UG students on the UNSW Canberra campus—those in uniform as officers-in- training at ADFA, and two groups of civilians. The civilians are either sponsored already by CASG under the Defence Civilian Undergraduate Scheme (DCUS), or they are unattached regular fee-paying students. The possibilities can expand to other scholarships and sponsorships, including those provided by industry. However, the following existing pathways could lead a successful applicant to a Naval Architecture degree with us.

- As a civilian, with the requisite entry requirements met, you can study with us as
    1. A regular fee-paying student,
       or, if looking for support via Defence sponsorship or scholarship;
    2. A DCUS student (https://www.defence.gov.au/jobs-careers/student-pathways/civilian-undergraduate-sponsorship), and
    3. The Defence Nuclear Science and Engineering Undergraduate Scholarships (https://www.defence.gov.au/jobs-careers/student-pathways/nuclear-science-and-engineering-undergraduate-scholarship).
- The uniform pathways include
    4. ADFA (https://navy.defencejobs.gov.au/students-and-education/australian-defence-force-academy), and
    5. By joining Navy under Defence University Sponsorship (https://navy.defencejobs.gov.au/students-and-education/defence-university-sponsorship).

Options 1, 3 and 5, covering both civilian and uniform pathways, could allow a student to study with us in their third and fourth years, taking advantage of the "2 + 2" nature of our degree, one that facilitates students transferring to UNSW Canberra after having undertaken the first two years of an accredited Mechanical or Aeronautical Engineering four-year degree program at another Australian tertiary institution.

We welcome enquiry and comment. Please do not hesitate to contact me (w.smith@unsw.edu.au) or David Lyons (david.lyons@unsw.edu.au) or us both (navarch@adfa.edu.au) via email, or either of us by other channels if you have any questions or would like to contribute to or join our enterprise.

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

BAE Systems Record Graduate Intake

Eighty six young people are preparing to start their careers with BAE Systems Australia after the Company recruited a record number of graduates.

The recruitment effort reinforces the Company's commitment to invest in the next generation, with graduates securing roles working on some of the most important defence programs being delivered across Australia.

Most have been employed in Victoria (28) and South Australia (50) supporting the Hunter-class Frigate Program, the Jindalee Operational Radar Network upgrade and the development of new technologies for the Australian Defence Force.

The remainder will be working across a range of maritime and aerospace sustainment programs and corporate roles in the ACT, NSW, QLD and WA. Thirty-two percent of the new graduates are female, reflecting BAE Systems Australia's commitment to improving diversity in STEM roles.

A further 30 apprentices will join the national defence engineering and technology business later in the year.

Half of this cohort will begin their careers in advanced manufacturing and aircraft sustainment roles. The other fifteen will join the Hunter-class Frigate Program, almost doubling the number of apprentices supporting the delivery of the future ships.

BAE Systems Australia Chief People Officer, Angela Wiggins, said "Our early career programs open the door for

young people to a long and diverse career with opportunities to move between projects, across states or countries as they build experience.

"There is high demand right across Australia for engineers, project managers and technologists, as well as trades including boilermakers, electricians, fabricators and aircraft maintainers.

"We are also growing our capability across specialist areas in big data, artificial intelligence, virtual reality, machine learning and autonomous systems, which provides a fantastic opportunity for our engineering and computer studies graduates to hone next generation technology skills on the job."

As the new graduates start, 57 students will be returning to university after completing their 12-week summer internships with the Company.

BAE Systems Manufacturing Engineering intern, Kieran Latter, said "My internship has highlighted the opportunities to be involved in manufacturing on a global scale as part of the Hunter-class frigate program at Osborne. Few industries can cater or provide these opportunities to the same depth that working in the defence industry has provided to me."

Next year, the company plans to recruit more than 100 graduates to roles across the Australian business. The three-year graduate program offers the opportunity to work at the cutting edge of technology on a diverse range of projects.

BAE Systems Australia also supports its graduates with tailored technical and personal development training, a supportive and flexible work environment and career mentoring. Applications for roles starting in 2024 will open in March.

Naval Shipbuilding College to Close?

Reports in the Adelaide press in January revealed government plans to close the Naval Shipbuilding College at the end of February 2023. *The Herald Sun* reported that the Minister for Defence Industry, the Hon. Pat Conroy MP, had confirmed the closure of the Osborne-based College which cost $114.4 million to run over five years.

The paper reported that a Defence Department spokesman said that the RAND Corporation had reviewed the NSC model in April 2022 and, after speaking to 56 industry participants, had concluded that "the College has not fully established itself as envisioned in the 2017 Naval Shipbuilding Plan."

The NSC had been run by a partnership of the US defence companies Kellogg Brown & Root and Huntington Ingalls Industries.

Studying Naval Architecture 60 years ago

Hugh Hyland

Reflecting on the recently-published Year 12 results, it is interesting to compare today with 60 years ago. Back then, school comprised 12 years with some states, including NSW, having seven years primary schooling plus five years secondary schooling, while other states such as Queensland had eight years plus four years respectively.

From every 100 Year 10 students only 22 would continue to Year 12, and only five would proceed to university. For those going to university, Commonwealth Scholarships covering university fees would be offered to around 25%, with Teachers Scholarships to around 25% and government and private cadetships to around 25%. Back then, 80% of engineers were employed within the three levels of government which also undertook the work in-house.

Typically, in order to enrol in engineering at university, a student from Year 12 must have passed six subjects: English (which included poetry from Chaucer to plays from Shakespeare), Mathematics 1 (including algebra, trigonometry and calculus), Mathematics 2 (including kinematics, geometry and solid geometry), Physics, Chemistry, plus a Language at Year 10. Since there were no calculators, logarithm tables were used, though slide rules were permitted for Physics and Chemistry. There was no "English as a Second Language", with overseas students needing to be proficient in all aspects of English. Also regarding the second language, there was no distinction between those who spoke such at home and others.

Soon after World War II, when the need for a naval architecture course in Australia was recognised, Sydney Technical College (STC) introduced a five-year part-time diploma with evening and Saturday classes leading to the Associate of Sydney Technical College (ASTC) with the last student completing around 1963. In the 1950s the various Diploma courses at STC were moved to the recently-established NSW University of Technology which subsequently became the University of New South Wales (UNSW). These courses were presented on behalf of STC. At this time Whyalla Technical College (which closed in 1966) and RMIT offered five-year part-time diplomas.

UNSW transitioned to offer a seven-year BE degree part-time course around 1960, which was replaced from the early 1960s by a six-year part-time (or one-year full-time plus four years part time) BSc(Tech) degrees. Students overall at UNSW were part time until the mid-1960s, with the last engineering subjects transiting from the original campus at STC up until 1967. Naval architecture-specific subjects at UNSW were covered over four part-time years, and included laying out on the scrieve board along with the shipwright apprentices at STC, and the towing tank at Sydney University. Naval architecture was offered as a four-year full-time BE course from 1968 with the naval architecture subjects grouped over three years. There were two lecturers, John Tuft and Owen Hughes. Examinations were taken from papers of those held by British universities but simplified where a box-shaped vessel would be substituted for a vessel of usual form. Professor Tom Fink became Head of Faculty in 1968 and introduced hydrodynamics. There was a final year design project, but no thesis in the BSc(Tech) course, and there were no "Honours" awarded, but "Merits" since it was not a four-

year equivalent course. Part-time class numbers varied from none to four, which increased after the addition of full-time candidates. The final year class of 1969 was the largest to that date, with six students, having two full-time and four part-time including one repeating, and two in the three-year conversion course from a Diploma from RMIT and from Whyalla, (three years being a mandated half of the UNSW course even though many subjects would be covered again).

The UNSW part-time years BSc(Tech) were 30 weeks (later reduced to 28 weeks) at 12 hours per week, but from 1970 after the IEAust declared the "1980 Rule" to bring part-time courses BSc(Eng) closer to the four year BE courses, the weekly hours were officially increased to 14.5, though unofficially they became 15.5, (noting that 15 hours would officially be full time). Part-time courses required a minimum of three years relevant industrial training in order to graduate, (with many candidates qualifying as draughtsmen or technical officers in the process.) Engineering subjects for part timers were offered in two or more streams, with a full range offered in blocks of four afternoons (which sometimes also included full-time students) as well as four evenings, so as to accommodate part-time students who may be able to get two to four half-days off work. Generally for engineering courses, full time initially was 24 hours per week for 30 weeks (later reduced to 28 weeks) except Year 2 which was 27 hours per week for 26 weeks in order to make available additional time for industrial training during the Christmas break where 100 days of relevant industrial training were mandated prior to graduation. Many naval architecture students worked for the Department of Defence, working 8.30 am to 4.31 pm (no flex time but with five hours off officially, and occasionally with up to three hours travel time depending on the boss), with four sessions of lectures initially from 2 pm to 5 pm or 6 pm to 9 pm before being increased to five sessions, so term time was full on.

Entry to the UNSW course required passes in the six above school subjects. However if matriculation was interstate then it was considered to be provisional, which meant that those undertaking the first-year four subjects full time had to pass at least three of them, and those students taking two subjects part time had to pass both. Failure to do so would require the student to repeat Year 12 in NSW prior to recommencing university studies. In second year full time engineering courses there were seven engineering subjects plus a humanities subject. Before 1968, failure in any second year engineering subject required the repeat of all engineering subjects in that year where at least a Credit grade had not been obtained. (High Distinctions were inaugurated in the mid-1960s.) Failure of any engineering subject twice resulted in a "Show Cause", failing which a full-time student would be downgraded to a part-time course, and a part-time student would be prevented from continuing. There were no "Cheat Sheets" allowed in examinations, and formulae, etc. had to be remembered. Examinations were three to three-and-a-half hours, and ran as three sessions per day, morning, afternoon and evening, over three weeks, so there sometimes were three examinations in a 24 hour period depending on the candidate's timetable of subjects. There were no computers or computer programs, and calculations were by slide rule.

The Rolex Sydney Hobart Race reveals great contrasts in yacht design, like the beamy 30.5 m maxi *Andoo Comanche* and the 11.9 m Beneteau *Crystal Cutter III* (on the right). *Andoo Comanche* took line honours with an elapsed time of 1 day, 11 hours, 56 minutes and 48 seconds. *Crystal Cutter III* finished 78th with a still-respectable elapsed time of 3 days, 18 hours, 39 minutes and 15 seconds to take 11th place in the ORCi Division 3
(Photo John Jeremy)

Austal Appoints Lee Goddard as Non-executive Director

Lee Goddard CSC is an executive leader with significant experience in leadership, command, industry and management roles; across the commercial, innovation and philanthropy sectors, defence, and a range of Australian Government agencies.

He continues to serve as a Royal Australian Navy active reserve officer (with the rank of Rear Admiral) following 34 years full-time service up until January 2021.

In April 2022 he was appointed as the inaugural Managing Director of the Australian Missile Corporation (AMC). He is also a Non-executive Director of the Commonwealth Superannuation Corporation, Advisor to Ocius and Willow Technologies, and Chairman (Race Director) of the Sydney –Hobart Yacht Race.

Throughout his career he has focused on setting the requirements for and identifying the solutions for a range of innovative dual technologies, across the security and wider commercial spheres. This has included; robotics, AI, unmanned systems, digital twinning and the wider AUKUS advanced technologies suite.

In 2021 he joined the Minderoo Foundation, Australia's leading philanthropy and he remains a Strategic Advisor.

Prior to joining the AMC and Minderoo Foundation he was dual appointed as Commander of the Joint Agency Taskforce 'Operation Sovereign Borders' and as Commander, Maritime Border Command. This was preceded by a two-year secondment to the Department of the Prime Minister and Cabinet.

On promotion to Commodore in late 2014, he assumed the role of Commander Surface Fleet, commanding 18 major warships and over 3500 personnel. He has commanded warships and joint-agency taskforces at every senior Navy rank from Commander to Rear Admiral.

He has contributed to a range of professional and academic journals focused on national security, maritime issues and international affairs. He is a Vincent Fairfax Ethical Leadership Fellow 2021 and completed the Executive Cranlana Colloquium in 2018.

Incat Tasmania Appoints Strategic Advisor

The former Tasmanian Premier and Climate Change Minister, Peter Gutwein, has joined the Incat team as Strategic Advisor.

Incat's Chairman, Robert Clifford, said "We are delighted to have former Tasmanian Premier and Climate Change Minister, Peter Gutwein, joining our team. As we position the company for significant growth, his knowledge and experience will be valuable as we deal with the rapidly-expanding low-emission (electric) global market.

"While we see some competitors continuing to construct ships overseas in low-wage economies and with significant incentives offered by some locations, Incat remains committed to manufacturing in Australia.

Peter is enthusiastic to work with Incat to support our future growth which means jobs and investment for Tasmania. The Incat appointment will see Peter working with the shipyard management on a regular basis, in one of several roles he has taken up since stepping down from Parliament and as Premier of Tasmania.

"The engineers, designers and research and development teams at Incat and Revolution Design have been working towards the electric revolution for several years and anticipate exciting times ahead. We are delighted to have someone of Peter's calibre providing strategic advice along the journey."

Babcock and A&P team for RMP East

Babcock Australasia (Babcock) and Atlantic & Peninsula Australia (A&P) have announced that they have partnered to respond to the Commonwealth's Request for Tender for the Regional Maintenance Provider East (RMP East) to provide fleet maritime sustainment services under Plan Galileo.

In May this year, both companies agreed to explore opportunities to collaborate on maritime sustainment on the east coast of Australia. RMP East is the first of what both companies hope will be many more.

As Team Bower, the partnership capitalises on the combined experience and stewardship of a significant portion of Royal Australian Navy's ships at the Garden Island Defence Precinct in Sydney.

Babcock's Managing Director—Defence, Andy Davis, said that the partnership will bring together the strength of both Babcock and A&P under an affordable 'one lanyard' approach, benefitting both the Commonwealth and supply-chain partners.

"Team Bower's solution will deliver a superior and highly-competitive solution which has lower transition risks and allows the Team to grow sovereign capability, keeping RAN ships ready to fight and win at sea and deploying their critical capability where it is needed," said Mr Davis.

The announcement follows a Maritime Industry Day in Sydney during which Babcock and A&P engaged with almost 300 current and future suppliers. The event highlighted the RMP-E opportunity and how local industry can support Team Bower's solution.

"Our offering builds on the existing capability of both companies to ensure that RMP East is not a stand-alone program but is also connected to both Babcock and A&P's broader local, regional and international capabilities as well as the other Regional Maintenance Centres being established across Australia," said Mr Davis.

David McGinley, CEO of Atlantic & Peninsula Marine Services, said that the new agreement will enable Defence to draw upon the expertise of two of the world's leading maritime defence companies, drawing upon their skills, capabilities and global experience to support Defence's objective of ensuring the continuous sustainment of the Royal Australian Navy.

"Babcock and A&P's proven track records and experience will enable Australia to continue the development of an in-country supply chain and defence capabilities, which will

ultimately de-risk future deployments of Navy assets in the region and underpin the availability of the Royal Australian Navy fleet."

A&P Australia's Managing Director, Scott Willey, said "The partnership creates a pathway for our collective businesses to optimise the delivery of maritime sustainment for Navy though our combined capabilities and supply chain.

"Our partnership reiterates Babcock and A&P's collective commitment to work with wider industry to provide high-value and low-risk outcomes, distributing economic benefits across the wider supply chain and underpinning the future security of both industry and Defence.

"By working together, Team Bower will support small-to-medium enterprises and primes in their continued delivery of services to the Royal Australian Navy. Through commonality of process and practice, we will simplify and enhance opportunities for local industry."

The Team Bower partnership builds on the existing relationships internationally, where Babcock and A&P support complex maritime sustainment programs across multiple dockyards in the United Kingdom.

Babcock and NORSTA Collaborate

On 14 December 2022 Babcock Australasia (Babcock) and NORSTA Maritime (NORSTA) announced an agreement to collaborate for the sustainment of the Royal Australian Navy's warships as part of Plan Galileo.

The backbone of Plan Galileo is the creation of a network of Regional Maintenance Centres (RMCs) at strategic locations around Australia.

The new collaboration follows last month's announcement that Babcock's wholly-owned subsidiary Naval Ship Management was selected as the Regional Maintenance Provider (RMP) West for the sustainment of RAN ships at Henderson, Western Australia, over the next five years.

In May 2020, NORSTA was selected as the RMP North East tasked with managing the maintenance of RAN ships in Cairns, Queensland.

Babcock Australasia's Executive Director—Strategy and Future Business, Martin Halloran, said that Babcock's new collaboration with NORSTA will provide the opportunity to build consistent approaches and share best practice across the dispersed geographic locations of the RMCs.

"A key element of Plan Galileo is bringing together the Commonwealth, large defence companies and small business suppliers to drive a common and consistent approach to naval maintenance across the RMCs. Committing our two organisations to work together will help ensure that we offer the Commonwealth a national perspective," Mr Halloran said.

"We are also committed to reducing barriers to entry for Defence-ready SMEs. This includes the implementation of a shared national sustainment supply chain to support small to medium business growth plans and the development of enduring sovereign naval sustainment industry capability in our region.

Babcock and NORSTA will share lessons learned across areas such as best-practice health, safety, and environmental control measures. Joint continuous improvement activities will also be implemented to identify efficiencies and opportunities for improvement in any region, where they are applicable.

NORSTA's General Manager, Stewart Barr, said that the collaboration between the Commonwealth and NORSTA is already making a significant difference to the efficiency and effectiveness of naval sustainment delivery in Cairns.

"Collaboration at all levels is important. We are working closely with our supply chain and other regional organisations such as the Cairns Regional Council and we're seeing immediate positive results.

"NORSTA looks forward to extending this across the nation with our collaboration with Babcock," said Mr Barr.

Babcock (and Atlantic & Peninsula, as Team Bower) and NORSTA have also pledged to extend these commitments should they be selected by the Commonwealth in their respective proposals for RMP East (Sydney) and RMP North (Darwin).

Lighting Contract for Hunter-class Frigates

The Australian business REDARC Defence & Space has been awarded a $23 million contract to supply 12 600 LED lights for the first batch of three Hunter-class frigates.

The contract is the culmination of a five-year collaboration between REDARC and UK company MARL International which will see Lonsdale-based REDARC lead the manufacture and delivery of lighting and related parts for the Royal Australian Navy's new frigates.

BAE Systems Australia is working closely with the Commonwealth to build Australian industrial capability by contracting small and medium Australian businesses which are collaborating with the supply chain for the Type 26 frigates under construction in the UK. The Hunter-class frigates to be built at the Osborne Naval Shipyard in South Australia are based on BAE Systems' reference ship Type 26 design.

REDARC Defence & Space is partnering with MARL International to manufacture and supply 79 different types of lights for each frigate, including bunk and flood lights, weatherdeck and step lights, general and emergency lights.

Shipbuilders working on the Hunter program are currently manufacturing five prototype ship blocks to test and refine the processes, systems, tools, facilities and workforce skills ahead of construction of four Hunter ship blocks in May 2023, planned to be used in the first ship.

BAE Systems Australia has already placed contracts with more than 50 Australian businesses to support Hunter's prototyping phase, and as the program progresses will contract more local companies for equipment and parts manufacture, supply and assembly for the first three frigates.

Shipping Company to Prohibit Carriage of Electric, Hybrid and Hydrogen-powered Vehicles on Norwegian Coastal Routes

The Norwegian shipping company Havila Kystruten has decided to allow only cars and motor vehicles which run on fossil fuels to be carried as vehicle cargo in its vessels in selected ports along coastal routes.

Havila had earlier requested an external assessment regarding the transport of cars and motor vehicles on board the company's coastal route ships. Business consultancy Proactima carried out the risk analysis, and Havila has decided to only allow motor vehicles which use fossil fuels in selected ports along the routes, meaning that electric, hybrid and hydrogen-powered cars cannot be transported on board the company's vessels.

Havila Kystruten CEO, Bent Martini, said that the conclusion of the risk analysis shows that a possible fire in fossil fuel-powered vehicles could be handled by the systems and crew on the company's ships, whereas any fire in electric, hybrid, or hydrogen-powered cars will require external rescue efforts and could put people on board, as well as the vessels themselves, at risk.

Mr Martini added that Havila Kystruten will continue to work on solutions which can minimise the risk of transporting these types of vehicles in the future.

Havila Kystruten's ships are equipped with their own battery packs installed in accordance with current fire safety requirements. This means that the batteries are separated into isolated and fireproof rooms with specific fire protection systems.

Baird Maritime

New Baleària Innovative Fast Ferry to feature Wärtsilä Propulsion Solutions

Wärtsilä is to supply dual-fuel engines and high-performance axial-flow waterjets for a new high-speed ro-pax ferry. The ship, *Margarita Salas*, is being built at the Astilleros Armon Gijon yard in Spain on behalf of the Spanish shipping company Baleària. It will have the same dimensions as its sister vessel, *Eleanor Roosevelt*, which at 123 m is currently the longest high-speed ferry in operation in the world.

While the dimensions of the two ships will be the same, the new vessel's Wärtsilä engines will have ten percent greater power and increased efficiency. Also, the latest-generation WXJ Wärtsilä waterjets will deliver even better performance. Overall, *Margarita Salas* will feature optimised speed and capacity and, like *Eleanor Roosevelt*, will operate on LNG fuel.

"This new ship will combine the most competitive features of *Eleanor Roosevelt* with a series of innovations in its design and engineering to enhance the customer experience," said Pablo Garcia, New Builds Project Manager at Baleària.

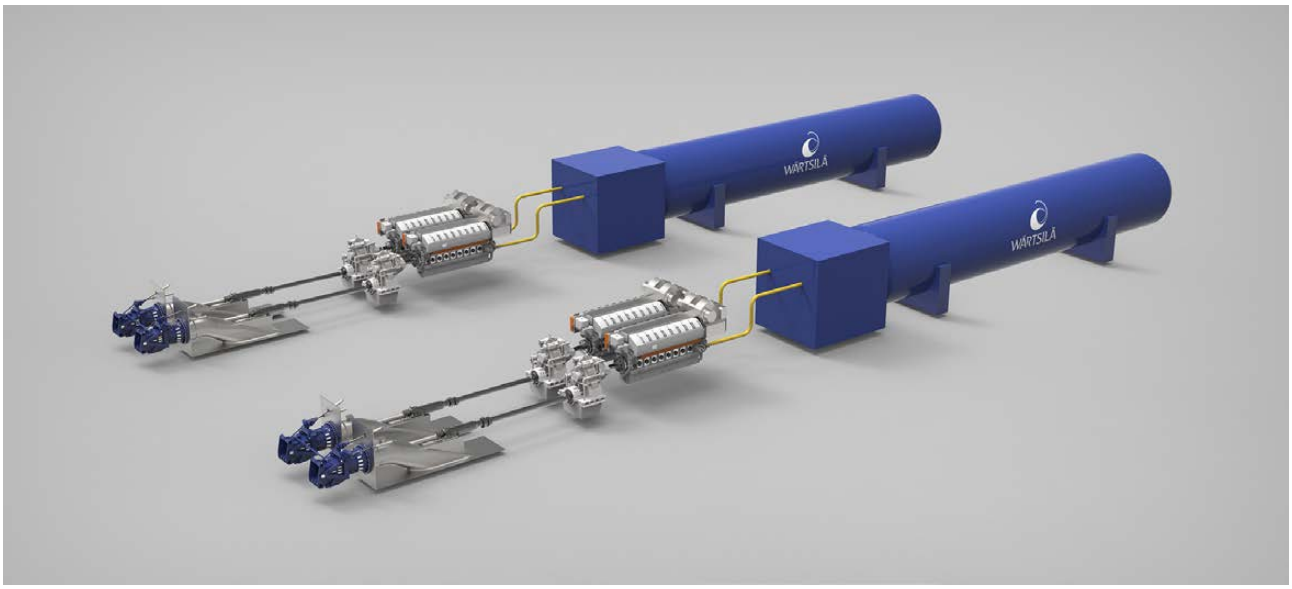
"It is an honour to have been selected as the integrated drivetrain package supplier for this state-of-the-art vessel. We have been able to offer superior technical performance, the best power-to-weight ratio, the best overall equipment efficiency, and enhanced integration support. This represents a value proposition which will make this new ferry superbly efficient," said Jesus Puelles, Wärtsilä's General Manager Sales, Spain.

The Wärtsilä scope includes four Wärtsilä 31DF dual-fuel engines operating primarily on LNG fuel, four Wärtsilä WXJ steerable-reversible inboard hydraulic waterjets with Protouch propulsion control system, and two LNGPac fuel storage and supply systems. LNG is currently the cleanest and most mature marine fuel available within the industry's decarbonisation focus.

The IMO Tier III-compliant Wärtsilä 31DF is the most powerful engine in its class and features outstanding efficiency. The diesel version of the Wärtsilä 31 has been recognised by Guinness World Records as being the most efficient diesel engine in the world.

The axial flow of the Wärtsilä waterjets reduces the installation footprint by an average of 25 percent compared to conventional systems. Furthermore, the propulsion system will enable the vessel to reach a service speed of 35 kn.

Wärtsilä has a long-standing business relationship with both the Astilleros Armon Gijon yard and Baleària. Previous ferries built for the operator are powered by Wärtsilä engines and/or propulsion solutions.



Wärtsilä 31DF engines, Wärtsilä LNGPac storage and supply system and Wärtsilä WXJ waterjets
(Image courtesy Wärtsilä)

Wärtsilä Hybrid Propulsion System with Methanol Engine to Power Four Future-proof Heavy-lift Vessels

Wärtsilä is to supply its hybrid propulsion system for four new heavy-lift vessels being built at the Wuhu Shipyard in China. The vessels have been contracted by SAL Heavy Lift GmbH, a German heavy lift and project cargo specialist and part of the Harren Group, in cooperation with its joint-venture partner, Netherlands-based Jumbo Shipping. There is an option for an additional two vessels. The order was included in Wärtsilä's order book in December 2022.

Wärtsilä's innovative hybrid system will minimise the ships' CO_2 emissions, thus supporting the marine sector's decarbonisation ambitions. The system will feature a variable-speed Wärtsilä 32 main engine capable of operating with methanol fuel. This will therefore make these ships among the first to be prepared to operate on methanol, a clean-burning sulphur-free alternative to conventional fossil-based marine fuels. They will also be the first methanol-capable ships to employ a variable-speed main engine.

The hybrid system also includes energy storage, a PTO/PTI generator and motor, a multidrive converter, and the Wärtsilä Energy management system for controlling and optimising the hybrid operations. The energy storage system will be based on lithium-titanium-oxide (LTO) batteries, which can handle higher numbers of deep cycles than normal lithium-ion based systems. The ESS will significantly reduce the fuel consumption and/or the necessary size of the port's electric shore connection during crane operations while also providing fuel savings at sea by reducing engine load fluctuations in rough seas.

For each vessel, Wärtsilä will also supply the gearbox, the controllable-pitch propeller (CPP), the bow and stern thrusters, air shaft seals, and the sterntube and bearings.

The ships are scheduled for delivery in 2025 and will be used mainly to support wind farm installations.

Wärtsilä is a market leader in hybrid solutions for shipping applications with installations on board more than 70 vessels, and an installed battery capacity in excess of 100 MWh. The company has a broad portfolio of fuel-flexible marine engines which offer sustainable alternatives as the industry journeys towards a decarbonised future.

WinGD and CMB Tech Co-develop Large Ammonia-fuelled Engine

The Swiss marine power company, WinGD, and the Belgian shipping and clean technology group CMB.TECH have signed an agreement on the development of ammonia-fuelled two-stroke engines. The companies aim to install the ammonia dual-fuel X72DF engine on a series of ten 210 000 DWT bulk carriers to be built at a Chinese shipyard in 2025 and 2026.

Under this joint development project, CMB.TECH will support WinGD in establishing its ammonia-fuelled engine concept for a large-bore engine. CMB.TECH has significant insight into alternative fuels and builds, designs, owns and operates large marine and industrial applications which run on hydrogen and ammonia.

Both WinGD and CMB.TECH believe that ammonia will play a significant role in the decarbonisation of the maritime industry. The series of large bulk carriers powered by WinGD's ammonia engines will be the first of its kind and proof that large sea-going vessels can be powered by zero-carbon fuels.

CMB's Chief Executive, Alexander Saverys, said "We believe that ammonia is the most promising zero-carbon fuel for deep-sea vessels. Our intention is to have dual-fuel ammonia diesel engines on our dry bulk vessels, container vessels and chemical tankers. Collaborating with WinGD on the development of the first ammonia-fuelled two-stroke engines for our fleet is a pioneering partnership on the road to zero emissions in shipping."

WinGD's Chief Executive, Klaus Heim, said "This project

Heavy-lift vessel with methanol engines and hybrid propulsion system
(Image courtesy SAL Heavy Lift)

is a significant step in accelerating our ammonia technology roadmap for a zero-carbon future. Having CMB.TECH's input into the engine development will be invaluable, given their alternative fuel expertise and their ship operator's perspective on how an engine concept is implemented and ultimately operated. The project is an opportunity to widen the roll-out of ammonia technology across our portfolio, in line with our previously stated timeframe of introducing the first engine concept in 2025."

These newest engines in WinGD's X-DF portfolio will add ammonia capability to the proven technology of WinGD's X engines. They will be based on the X92B engine, whose market-leading fuel efficiency makes it an ideal starting point for developing large-bore ammonia-fuelled engines.

The development project with CMB.TECH is one of several projects which WinGD is carrying out with shipowners and engine builders to ensure that dual-fuel ammonia two-stroke engines will be available as the global fleet prepares to adopt green fuels to meet long-term decarbonisation targets.

XLUUV Ordered for Royal Navy

Building on the experience the service has gained from trials of the Manta experimental uncrewed underwater vehicle (UUV), the UK's Royal Navy (RN) recently placed an order for the construction of an extra-large uncrewed underwater vehicle (XLUUV).

The Cetus XLUUV will be built by Plymouth, UK-based MSubs, a company focused on the development of advanced, specialised subsea craft.

Cetus will have a length of 12 m and will displace 17 t. Propulsion will be by electric motor linked to battery packs mounted on the outside of the hull. The design range is in excess of 1000 n miles and the XLUUV will reportedly be capable of diving to a greater depth than any submarine currently in the RN fleet.

A payload bay will be fitted at the centre of the craft. Situated between the fore and aft pressure vessels, this bay will be fitted to carry mines, small UUVs, and sensors.

An optional additional payload bay can be inserted, increasing the carrying capacity of the XLUUV, as well as allowing the fitting of extra battery packs, thereby increasing its range. Large, hydrodynamically-efficient "X" configuration control planes, rather than the more conventional cruciform type, will be fitted.

The Cetus XLUUV
(Image courtesy MSubs)

Cetus is due to enter service by the end of 2024, and it will then be deployed on an intense programme of trials and testing which will include autonomous operation. If the programme is successful, the RN will order the production variant, and its operational roles will likely encompass seabed warfare, force multiplier in company with manned nuclear-powered attack submarines, and long-range sustained underwater surveillance in support of both RN and multi-national surface action groups.

The XLUUVs are likely to be operated from the mission bays of the RN's next-generation Type 26, Type 31 and, eventually, Type 32 frigates.

Trevor Hollingsbee
Baird Maritime

Shipbuilding Returns to Belfast

The British-led Team Resolute, comprising BMT, Harland & Wolff and Navantia UK, has signed a contract with the UK Ministry of Defence (MoD) to build three support ships for the Royal Navy.

The contract, valued at £1.6 billion (about $A2.8 billion), is part of the UK's Fleet Solid Support (FSS) program. The consortium will deliver three support ships to the Royal Fleet Auxiliary (RFA).

The construction of the blocks which will make up the ships will be carried out at the Harland & Wolff shipyards in Belfast (Northern Ireland) and Appledore (south-west United Kingdom), as well as at the Navantia shipyard in Puerto Real (Spain).

"This news will be a significant boost to the UK shipbuilding industry. By selecting Team Resolute, the Ministry of Defence has chosen a proposal which includes £77 million (about $A132 million) of investment into the UK shipyards, creating around 2000 UK jobs, and showcasing cutting-edge British design," UK Defence Minister, Ben Wallace, commented.

The ships will be the second-longest UK military vessels behind the two Queen Elizabeth-class aircraft carriers. They will have commonality with the RFA's Tide-class fleet tankers, also built to a British BMT design.

Designed to support net carbon zero by the end of their 30-year service lives, the RFA vessels will be equipped with energy-efficient technologies to reduce power demand and will have the capability to reduce their carbon intensity by adopting low-carbon, non-fossil fuels and future energy sources.

Production of the blocks will start in 2025 and the three vessels will be operational in 2032.

An impression of the new supply ships to be built for the UK's Royal Fleet Auxillary by Team Resolute
(Image courtesy BMT)

Wärtsilä and Carnival Corporation Partner to Reduce Plastic Waste

Wärtsilä and Carnival Corporation have carried out a joint pilot project to reduce plastic materials being used in marine operations. The aim of the project is to boost maritime sustainability by preventing plastics from harming the environment and, since plastics are formed from fossil fuels, to also lower CO_2 emissions. As a result of this pilot, Wärtsilä Global Logistics Services is in the process of changing its spare parts packaging to achieve a reduction of approximately 40 percent in the amount of plastic used.

The project was carried out on two Carnival Cruise Line vessels, *Carnival Splendor* and *Carnival Freedom*. It involved the use of smarter packaging material for spare parts, primarily using recycled paper packaging materials instead of plastic. Despite the challenging sea freight and humid conditions, the quality of the eco-friendly packaging remained at the same level as earlier when plastic was used. The program resulted in both a considerable reduction in the number of plastic bags used, as well as less weight for the shipments being made. The change in packaging will be incorporated for deliveries to Wärtsilä customers in both the marine and energy sectors.

The UK's Mine-hunting Mothership Arrives in Plymouth for Conversion Work

A specialist ship bought to support Royal Navy mine-hunting operations, a mother ship to launch drones to find and destroy undersea threats, arrived in Plymouth in January.

Purchased from Island Offshore, the vessel, currently named MV *Island Crown*, but due to be renamed as it joins the fleet, arrived at HMNB Devonport, where she will undergo minimal conversion work, primarily to support the installation of military communication systems and Royal Fleet Auxiliary operations, before being handed over to the RFA later this year.

The uncrewed systems to be deployed from the ship will include the joint French-UK Maritime Mine Counter Measures (MMCM) system, the Combined Influence Sweep (SWEEP) system and Medium Underwater Autonomous Vehicles (MAUVs).

The purchase of the ship cost some £40 million (about $A70 million).

Island Crown arriving in Plymouth for conversion
(Photo courtesy UK MoD)

Austal Phillipines recently started its first major commercial vessel servicing contract; a 110 m steel ferry for Trans Asia Shipping Lines. Utilising their own floating dock *Lewek Hercules*, the Austal team undertook repairs, cleaning and painting on the vessel
(Photo courtesy Austal)

NSCV Section C2 Watertight and Weathertight Integrity

On 1 January 2023 Section C2 of the National Standard for Commercial Vessels came into effect, with a transition period of two years. Until 1 January 2025, new vessel constructions commencing during this period will have the option of complying with either NSCV Section C2 or Uniform Shipping Laws (USL) Code Sections 5C, 5D and 7.

Key changes in NSCV C2

1. New freeboard mark required for vessels except passenger vessels and larger workboats that are required to have a load line:
   - Vessels of less than 7.5 m in measured length must be provided with a stability notice or placard which complies with the requirements of NSCV Section C6C Annex J and which is displayed in the operating compartment of the vessel in a prominent position.
   - Vessels of 7.5 m and greater but less than 12 m in measured length must be provided with:
     (a) a freeboard mark in accordance with Annex A which shows the freeboard determined in accordance with Clause 4.19; or
     (b) where the freeboard mark required in (a) cannot be practicably marked or seen on the hull, a stability notice or placard which complies with the requirements of NSCV Section C6C Annex J and which is displayed in the operating compartment of the vessel in a prominent position.
   - Vessels of 12 m or more in measured length must be provided with a freeboard mark in accordance with the requirements of Annex A which shows the freeboard determined in accordance with Clause 4.19

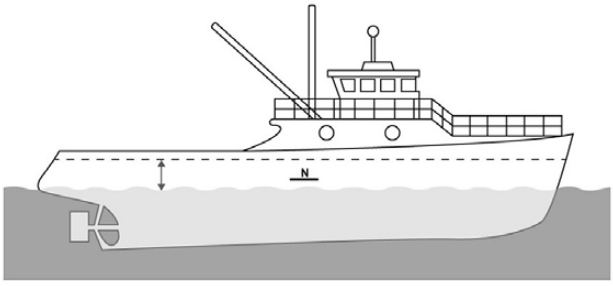
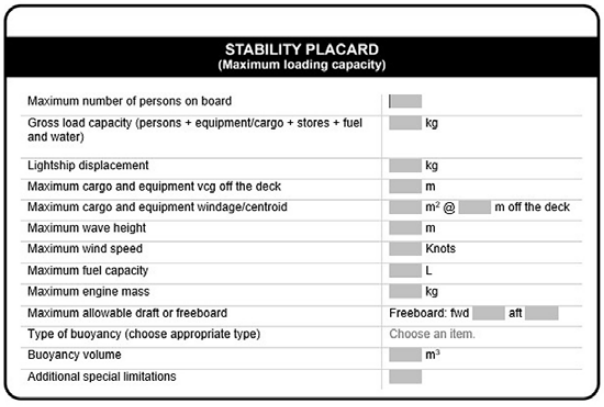


Figure 1: The proposed new freeboard mark on a 19 m fishing vessel
(Image courtesy AMSA)

2. Stability placard for vessels under 12 m: Vessels under 7.5 m in measured length must display a stability placard. Vessels between 7.5 and 12 m in measured length must display a stability placard if they are unable to display the required freeboard mark. The placard must be visible, preferably in the cockpit or near the main steering position in a prominent position.



STABILITY PLACARD
(Maximum loading capacity)

Maximum number of persons on board	
Gross load capacity (persons + equipment/cargo + stores + fuel and water)	kg
Lightship displacement	kg
Maximum cargo and equipment vcg off the deck	m
Maximum cargo and equipment windage/centroid	m^2 @ m off the deck
Maximum wave height	m
Maximum wind speed	Knots
Maximum fuel capacity	L
Maximum engine mass	kg
Maximum allowable draft or freeboard	Freeboard: fwd aft
Type of buoyancy (choose appropriate type)	Choose an item.
Buoyancy volume	m^3
Additional special limitations	

Figure 2: Example of a stability placard for a 7 m vessel
(Image courtesy AMSA)

3. Alignment with international standards for windows and portlights, marking of doors and hatches, valves and through-hull fittings and drain plugs.
4. Rapid drainage requirements. New requirements for scuppers (drains) and freeing ports to provide rapid drainage for decks and enclosed spaces. A simple and practical option has been added for calculating freeing port areas for vessels under 12 m and a simplified time-to-drain option for vessels under 24 m in measured length.
5. Improved and simplified approach to flush hatches. The current Generic Equivalent Solution 2017/19 has been incorporated into NSCV C2, with simplified tables and additional notes.
6. Clarification for:
   - the assessment of watertight and weathertight components, to ensure consistency across industry;
   - installation, testing and verification of watertight and weathertight components, to ensure consistency across industry; and
   - material standards for seacocks and drain plugs for vessels under 24 m. Also allows the use of modern materials like polymer in certain places when manufactured to ISO 9093.

Consultation Outcomes

During the public consultation process AMSA received 34 submissions from industry stakeholders (see the consultation feedback report). The feedback received resulted in the following changes since we last collaborated on the new standard:

- Removal of sliding door requirement from NSCV C2
- Inclusion of a new Annex C — Simplified methods for glass window design requirements has been developed for vessels under 24 m
- Addition of definitions
- Addition of requirement for transducers
- Updating Table 13 to include additional options for testing closing devices and components.

Next Steps

From 1 January the new NSCV Section C2, along with the template stability placard, will be available via the National Standards for Commercial Vessels page on the AMSA website, with a view to communicating the new standard broadly to external stakeholders in early January.

Finally, my sincere thanks for all your time and efforts in co-developing the new standard. AMSA strives to make standards which are relevant and practical and the only way we can make this happen is with the assistance of the people they apply to—including yourselves.

If you have any questions or concerns, please feel free to get in contact with me.

Craig Elliott
A/Principal Advisor
Domestic Commercial Vessel Standards
Australian Maritime Safety Authority

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 January 2023 e-Newsletter included:

- Commencement of NSCV C2 — Watertight and Weathertight Integrity
- MARS Updates — survey reminder letters
- Administration of fees for specific exemption and equivalence applications
- Are you issuing temporary operations documents correctly?
- How AMSA aligned certificates of survey to state issued certificates when Marine Order 503 was updated
- New regulations relating to air pollution from vessels
- Ensuring correct installation of float free EPIRBs

The article on *New Regulations Relating to Air Pollution from Vessels* is reproduced below.

Phil Helmore

New Regulations Relating to Air Pollution from Vessels

Marine Order 97 (MO97) deals with the prevention of air pollution from vessels and gives effect to the MARPOL Regulations for the Prevention of Air Pollution from Ships (Annex VI). MO97applies to regulated Australian vessels, domestic commercial vessels, recreational vessels, and foreign vessels.

MO97 has been re-issued and came into effect on 1 January 2023. It implements a new short-term measure adopted by the International Maritime Organization (IMO) to reduce the carbon intensity of international shipping by 40% by 2030. The short-term measure applies to certain types of foreign-flagged and commercial Australian vessels which undertake international voyages.

MO97 also requires that all marine diesel engines with a power output of more than 130 kW installed on a domestic commercial vessel from 1 January 2023 — or which undergo a major conversion from that date — must have on board an EIAPP certificate and associated technical file.

Any existing diesel engines installed before 1 January 2023 will not require an EIAPP certificate or associated technical file unless the engine undergoes a major conversion or the vessel undertakes an overseas voyage (for example, to undertake maintenance or for delivery).

Visit the AMSA website for more information on the new air pollution regulations from 1 January 2023 at https://www.amsa.gov.au/new-air-pollution-regulations-1-january-2023?utm_source=Talking_points&utm_medium=email&utm_campaign=MO97-consultation

Survey Matters, January 2023

VALE

Stephen Wheatstone

It is with sadness that *The ANA* records the passing of Stephen Wheatstone on 29 October 2022.

Stephen graduated from UNSW Sydney with his Bachelor of Engineering degree in Naval Architecture in 1974, commencing his career with the Department of Defence in Canberra before moving on to the Bureau of Transport Economics (which underwent subsequent name changes) from where he retired.

He is survived by his wife Valerie, children Nicholas, Katrina, Arthur and Alan, and grandchildren Rose, Sierra, Elijah, Charlie, Andini and Hunter.

The funeral service was held in the Chapel of Norwood Park Crematorium, Mitchell, ACT, on 11 November 2022.

Phil Helmore
Rob Gehling

HYDROCourses Meet the Requirements for Continuing Professional Development Hours

HydroComp is proud to offer our our newest innovation in online education, HYDROCourses, now officially endorsed by the Royal Institution of Naval Architects (RINA). The content of the first five courses has been evaluated and approved by the organisation. With this official RINA recognition comes the opportunity for users to earn Continuing Professional Development (CPD) hours. Plus, learners can have the utmost confidence that they are receiving the highest quality education.

These on-demand courses present complex hydrodynamic and propeller topics in an easy-to- understand format. Students can take the courses anywhere at any time, giving them control over their professional development.

A Course Certificate and Continuing Professional Development (CPD) are available.

The first collection of five courses is now available. Topics include:

Engine Power Curves
Sea Trials for Design
Pushboats and Propellers
Propeller Repitching
3D Propeller CAD
Ducted Propellers

Enrol at https://www.hydrocompinc.com/hydrocourses/

ROB GEHLING AO

The ANA is very pleased to record that Robin Charles Gehling was appointed an Officer in the Order of Australia (AO) in the Australia Day Honours List on 26 January. The award is for distinguished service to the maritime transport and safety industries, and to naval architecture.

Most members will know Rob Gehling as the long-serving Secretary of the Australian Division of the Royal Institution of Naval Architects, a position he took on the retirement of Keith Adams in 2009. Rob's contribution to our Institution has, however been much wider. He became a Member of RINA in 1975 and was appointed a Fellow in 2003. He has been a member of the Australian Division Council since 1998 and was President of the Division from 2003 to 2007. He also contributes as a member of the Program Committee for the biennial International Maritime Conference held in Sydney in conjunction with the Indo Pacific International Maritime Exposition.

Rob has also made a considerable contribution to the RINA in London. He has been a member of the Maritime Safety Committee since 1998, a member of the International Council and the Board of Trustees from 2014 to 2017 and since 2019. Since 2019 he has also been the Institution's Vice President (Pacific Region).

Back home, Rob has been active in the field of maritime safety in various roles since 1978. He was Naval Architect with the Australian Maritime Safety Authority from 1990, having also represented AMSA at the International Maritime Organisation (IMO) from 1988 to 2010. He was Principal Technical Adviser, Marine Standards, from 2000 to 2006. From 2006 to 2010 he was Consultant — Ship Safety and Principal Marine Surveyor and then (part time) 2013 to 2019.

During his time as a delegate to the IMO, Rob was Chairman of the Sub-committee on Ship Design and Equipment, High-speed Craft Working Group 1992 to 1994. In 2004 he became the Vice Chairman of the Sub-Committee on Stability, Load Lines and Fishing Vessel Safety and was Chairman of the committee from 2005 to 2010.

Rob Gehling AO

In a private consulting role between 2006 and 2013, in 2007 Rob was a technical expert at the Queensland Transport Board of Inquiry into the circumstances of a marine incident involving MV *Wunma*. Later, in 2012, he was an expert witness at the Papua New Guinea Commission of Inquiry into the sinking of *Rabaul Queen*.

Rob Gehling has made, and continues to make a considerable contribution to our profession and our industry. His award is well deserved.

MEMBERSHIP

Australian Division Council

The Council of the Australian Division of RINA met on the afternoon of Tuesday 6 December 2022 by Zoom conference under the chairmanship of our President, Jim Black, in Perth with links to Gold Coast, Sydney, Canberra, Melbourne, Hobart, Adelaide and Perth.

Among the items discussed were:

Meeting with Head Naval Engineering

Council noted that the President, Vice-President and Secretary would be meeting RADM Kath Richards in the week after the meeting. It should be noted that the subsequent meeting touched on a number of matters relating to our interactions with the Defence sector and work of the Improvement Committee in particular; a further meeting to review progress will be held mid-year.

Asset Management

Following the adoption of an investment policy at the December meeting, Council approved an agreement with a fund manager and formed an Investment Committee to oversee implementation of that agreement for the Division's funds in in accordance with the Division's legal status as a charity.

Council Elections

Council was advised of the procedure which was needed for election of members to Council for the coming two years, commencing with the call for nominations in the November issue of *The ANA*. Members should note that insufficient nominations were subsequently received to fill the vacant positions, so an election will not be required.

Joint Board on Naval Architecture

Council was advised of the subjects likely to be discussed during the meeting of the RINA–Engineers Australia Joint Board to be held a week after the Council meeting. I can advise that the Joint Board meeting was in accordance with those expectations.

Government Initiatives

Council held a discussion on the possible outcomes of the Houston/Smith Defence Strategic Review and the future submarine taskforce headed by VADM Mead. It was agreed to await the outcomes but that quick public responses on naval architectural issues related to those reviews may be necessary upon release of the relevant reports.

Improvement Committee

The Committee expects to be able to report back to the next meeting of Council in March.

Careers Brochure for Secondary Students

Council authorised the high priority development of a careers brochure to build on interest in ship/boat design, construction and operation and encourage prospective students to pursue appropriate subjects through their secondary years.

Independent Review of Domestic Commercial Vessels Legislative Framework

Council noted that a draft report had been issued. The extensive recommendations appeared to be at a high level and did not directly address many of the issues contained in the RINA submission. Members' comments were invited to be coordinated into a response by the required lodgement date of 30 November.

Indo-Pacific IMC 2023

Council received a brief report on initial preparations for the Conference in November 2023 and confirmed that continuing to offer peer refereeing of conference papers would have a positive effect on the quality and quantity of papers offered.

Victorian Engineer Registration

The Secretary advised Council that the application had been lodged for RINA to become an assessing entity under the Victorian legislation. An article providing relevant information on this subject would appear in the November issue of *The ANA*.

Budget

Council adopted the Division's budget for calendar year 2023 in accordance with the Treasurer's recommendation.

Next Council Meeting

The next Council meeting is scheduled for 21 March 2023, to be followed by the Division's Annual General Meeting one week later.

The draft minutes of the meeting have been circulated to Council members and are available to other members by request.

Rob Gehling
Secretary
Email ausdiv@rina.org.uk
Phone 0403 221 631

Free Papers for Members

Members should be aware that they are entitled to four free copies of RINA papers each year. This includes papers from previous transactions, conferences, etc., and is especially useful if you are interested in just one or two papers from a particular conference as you don't then need to buy a copy of the entire proceedings.

Papers published by RINA are searchable on the RINA website www.rina.org.uk; click on

Publications>Search Publications and Order.

The procedure for obtaining a free copy is to email your request to publications@rina.org.uk, with the subject line "Member's Free Paper", and specify the author(s) and year, the title of the paper, where the paper appeared (transaction year/volume, conference name and year, etc.) and, finally, your name and RINA membership number.

Free Places for Student Members at RINA Conferences

RINA also makes available two free places for Student Members of RINA at conferences organised by the Institution, including the Indo Pacific International Maritime Conferences in Sydney.

The procedure for obtaining a free student place is to email your request to the Chief Executive, Chris Boyd, at cboyd@rina.org.uk, and specify the conference, your name and membership number.

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.	rinaaustraliandivision@iinet.net.au
Section ACT	rinaact@gmail.com
NSW	rinansw@gmail.com
Qld	rinaqlddiv@gmail.com
SA/NT	rinasantdiv@gmail.com
Tas	tassec@rina.org.u
Vic	vicsec@rina.org.uk
WA	wa@rina.org.uk

Phil Helmore

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS
(AUSTRALIAN DIVISION), INC.

NOTICE OF ANNUAL GENERAL MEETING

TUESDAY 28 MARCH 2023

Notice is hereby given that the Annual General Meeting of the Australian Division of the Royal Institution of Naval Architects will be as a virtual meeting by Zoom conference at 2000 Australian Eastern Daylight Time on Tuesday 28 March 2023.

Please notify the Secretary no later than Friday 24 March 2023 if you wish to attend, to enable Zoom attendance details to be sent to you before the meeting.

Apologies should be received by the Secretary no later than Sunday 26 March 2023.

AGENDA

1. Opening
2. Apologies
3. To confirm the Minutes of the AGM held on 22 March 2022[1]
4. To receive the President's Report
5. To receive, consider, and adopt the Financial Statements and Auditor's Report for the year ending 31 December 2022
6. Announcement of appointments to the Australian Division Council
7. Other Business

Relevant documents will be made available to registrants as they become available.

R C Gehling
Secretary
Email rinaaustraliandivision@iinet.net.au
Phone 0403 221 631

7 February 2022

1. The draft is available on the Australian Division Forum (https://www.rina.org.uk/australian_forum.html)

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/videos

Bookmark this website and keep your eye on it!

Video recordings of presentations should be sent to Rusne Ramonaite <rramonaite@rina.org.uk> at RINA HQ for uploading.

Click on Playlists in the menu bar. Branch and Section presentations are shown fourth from the left in the top line. Click on *View full Playlist* to see the list (best for a recent presentation), or click on the search function to the right of About in the menu bar (for an older presentation), type the title of the presentation you are looking for (or at least the first few words thereof) and press Enter.

ACT Section Webcasts

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

- *Validation of frequency-domain Ship Motion*, presented by Prasanta Sahoo at an in-person meeting at UNSW Canberra at the Australian Defence Force Academy in Campbell, and streamed live via RINA's Zoom platform on 23 August 2022.
- *Hull Resistance Components, Running Trim and Wetted-surface Effects at Trans-critical Depth Froude Numbers*, presented by Torsten Lau at an in-person meeting at UNSW Canberra at the Australian Defence Force Academy in Campbell, and streamed live via RINA's Zoom platform on 1 November 2022.

Jordan Rayson

Victorian Section Webcast

The Victorian Section webcast recorded and uploaded within the last three months is:

- *Metocean Engineering in the Context of Naval Architecture and Marine Infrastructure*, presented by Alex Babanin as a webinar hosted by RINA's Zoom platform on 24 August 2022.

Sam Price

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

A busy time at Fleet Base East — HMAS *Brisbane* berthing alongside HMAS *Hobart* shortly before Christmas, with HMA Ships *Sydney*, *Canberra* and *Adelaide* in the background
(RAN photograph)

NAVAL ARCHITECTS ON THE MOVE

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

Greg Carmody has moved on from Dowse Projects and, after some time at CBRE Asia Pacific, has taken up the position of Project Manager with Tyrner & Townsend in Sydney.

Matthew Cleary has moved on within the University of Sydney and has recently been promoted to Professor in the School of Aerospace, Mechanical and Mechatronic Engineering in Sydney.

Graeme Collins has moved on from Lendlease and has taken up the position of Development Director with Stockland in Sydney.

Peter Dandy has moved on from ASC and has taken up the position of Design Manager with Bastion Defence Consulting in Adelaide.

David Firth has moved on from DIAB and has taken up the position of Principal Engineer for the SEA1788 *Young Endeavour* Replacement program with the Naval Shipbuilding and Sustainment Group of the Department of Defence in Canberra.

Zoran Jaksic has moved on within Navantia Australia and has taken up the position of DDG PSD Engineering Operations Manager in Sydney.

Ehsan Khaled moved on from Naval Ship Management (Australia) in 2020 and has taken up the position of Naval Senior Engineer with Bureau Veritas in Sydney.

Nick Kitching has moved on from Navantia Australia and, after some time at BAE Systems Australia, has taken up the position of Senior Naval Architect/Principal Consultant with Bastion Defence Consulting in Adelaide.

Percy Lentin has retired from DNV after a long career with them.

Christopher Lloyd-Jones has moved on from Avfeo Group and has taken up the position of Naval Architect with the Hull Systems Section of Naval Construction Branch at the Osborne Naval Shipyard in Adelaide.

Brian Morley retired from IT consulting in 2019, continues living in Brisbane and enjoys keeping his hand in with occasional powering and propeller calculations for friends.

Joanna Mycroft has moved on within Lloyd's Register International and, from Singapore, has moved to Perth to take up the position of Senior Surveyor.

Olav Kjetil Opheim has moved on from Marintek and, after some time at Fjellstrand and ShipCon, has taken up the position of Managing Director with WIND Naval Architects in Esbjerg, Denmark.

Luke Pretlove has moved on within Austal and has taken up the position of Technical Manager in Southampton, UK.

Ragni Rørtveit has moved on from Statoil and, after some time at Equinor, has taken up the position of Business Development Advisor with Northern Lights JV in Oslo, Norway.

Kumar Roy has taken up the position of Senior Naval Architect/Project Engineer with Floating Solutions Consulting in Perth.

Anne Simpson has moved on from Thales Australia and has taken up the position of Naval Engineering Specialist with Bureau Veritas in Sydney.

Emma Tongue has moved on from Austal and has taken up the position of Principal Naval Architect/Project Engineer with Floating Solutions Consulting in Perth.

Nelson Tsang has moved on from Incat Crowther and, after some time at Birdon Group, PM Fresh, and Lightning Naval Architecture, has taken up the position of Safety Compliance Officer with Surelinc Services in Sydney.

Mike Warren retired from ASC in 2021 and is enjoying retirement, with occasional consulting in engineering management, in Adelaide.

Mark Wilson moved on from Woodside Energy in 2006 and, after some time at Origin Energy and TSMarine Subsea, moved to Fugro, where he has now taken up the position of Project Delivery Manager in Perth.

Horden Wiltshire has moved on within Acacia Systems and has taken up the position of Chief Executive Officer in Adelaide.

Jinzhu Xia has moved on from Advanced Marine Structures and has taken up the position of Principal, Naval Architecture, with MISC Berhad in Kuala Lumpur, Malaysia.

LEUT Isabella Yan was awarded her submarine Dolphins and promoted from SBLT last year. She was selected for the first cohort of Australian submariners to undergo nuclear submarine training in Portsmouth, UK, and has commenced the course there.

Richard Young has moved on from UGL and has taken up the position of Project Engineer with Wood in Melbourne.

Amanda Zebulum has moved on within Petrobras and has now taken up the position of Naval Engineer for the FPSO Operation Support Project in Rio de Janeiro, Brazil.

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

FROM THE ARCHIVES

Naval Architecture nearly Two Centuries Ago

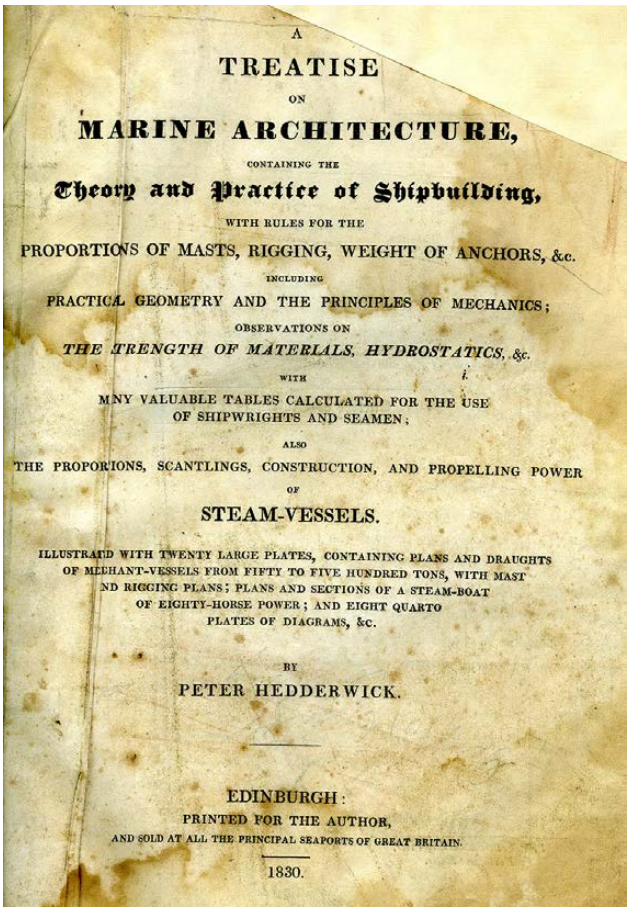
John Jeremy

Having a large library has both advantages and disadvantages. The most obvious disadvantage is the requirement for space, which is inevitably subject to domestic priorities. Extensive libraries do, however, provide endless hours of research — either to answer that occasional obscure question, or simply to open one's mind to the details of history.

One book recently emerged from the depths of the store room which provides a glimpse of the world of naval architecture one hundred and ninety three years ago. That book is *A Treatise on Marine Architecture* by Peter Hedderwick. It was published by the author and printed in Edinburgh in 1830. As was the practice in those days, the publication was supported by subscribers. Their names are listed in the book, and include some well-known names, like Mr John Denny, shipbuilder of Dumbarton and Robert Stevenson, Esq., civil engineer of Edinburgh. Listed at Leith were Messrs Robert Menzies and Son, shipbuilders — any relation, I wonder, of our long-serving post-war Prime Minister? There were 182 subscribers to whom the author dedicated the work with the words "The following pages, containing the result of much labour and experience, undertaken solely with a view to practical utility, (which can only be properly appreciated by professional persons), are most respectfully dedicated, by their most obedient and very humble servant, the Author."

The 401 page book was illustrated by a number of plates, not all of which have survived, unfortunately.

In his first chapter, the author provides an introduction:



A

TREATISE

ON

MARINE ARCHITECTURE,

CONTAINING THE

Theory and Practice of Shipbuilding,

WITH RULES FOR THE

PROPORTIONS OF MASTS, RIGGING, WEIGHT OF ANCHORS, &c.

INCLUDING

PRACTICAL GEOMETRY AND THE PRINCIPLES OF MECHANICS;

OBSERVATIONS ON

THE STRENGTH OF MATERIALS, HYDROSTATICS, &c.

WITH

MNY VALUABLE TABLES CALCULATED FOR THE USE OF SHIPWRIGHTS AND SEAMEN;

ALSO

THE PROPORIONS, SCANTLINGS, CONSTRUCTION, AND PROPELLING POWER OF

STEAM-VESSELS.

ILLUSTRATD WITH TWENTY LARGE PLATES, CONTAINING PLANS AND DRAUGHTS OF MERCHANT-VESSELS FROM FIFTY TO FIVE HUNDRED TONS, WITH MAST ND RIGGING PLANS; PLANS AND SECTIONS OF A STEAM-BOAT OF EIGHTY-HORSE POWER; AND EIGHT QUARTO PLATES OF DIAGRAMS, &c.

BY

PETER HEDDERWICK.

EDINBURGH:

PRINTED FOR THE AUTHOR,

AND SOLD AT ALL THE PRINCIPAL SEAPORTS OF GREAT BRITAIN.

1830.

The title page of Peter Hedderwick's book

"The object of the following Treatise is to explain, in an easy manner, the Theory and Practice of Marine Architecture — to put into the hands of the young or inexperienced Shipbuilder such information as his particular situation requires, with proper working plans of Merchant Vessels, of the best general Proportions and most approved Constructions, for his guidance — the methods of calculating the dimensions of Masts, Yards, Rigging, Anchors, &c.

"The reader need not expect to find in this work, an Historical Account of the Rise and Progress of the Art of Shipbuilding, which is in some respects interesting *only* to those persons who laudably pursue the study of this Science with a view to acquiring general information, and would be of no advantage in our principal design, *i.e. practical utility*; and as this will be best promoted by divesting of several subjects as much as possible of useless speculation, the Author has declined entering into laboured examinations of the various Theories that have from time to time been proposed, for the cultivation of Naval Architecture.

"It is almost unnecessary to insist upon the·Shipbuilder combining a knowledge of the theoretical with the practical branch of his business: individuals of the most eminent talents have already insisted upon this with great propriety — not an entirely abstract Theory; for, as Mr Harvey distinctly states, that much may indeed be said about Theory; but pure Theory has yet done but little for Shipbuilding — what we want is a Theory founded on the basis of experiment and observation. For without this no Theorist need pretend to the mastery of Shipbuilding; without·practical experience, his notions on the subject will, for the most part, be only useless and chimerical. On the other hand, although a person having but little knowledge of the theory or principles of Mechanics may be able to carry on in his accustomed practice with tolerable advantage, yet he is equally unable to carry on Shipbuilding to its full extent.

"Give him a vessel on a new construction, or out of his accustomed routine of dimensions, and he is comparatively lost; his ideas are in a great measure limited to his immediate practice, and he is unable to form an estimate of the effect of new inventions or proposed improvements. For although trial and experiment is the only sure test, which will either disclose their absurdities or prove their advantages, yet by a cool investigation of the principles of any proposed theory or improvement, we may be enabled to form some near conception of its ultimate success.

"The acquirements which the young Shipwright should possess, previous to entering into a consideration of the theory and practice of Marine Architecture, should no doubt be as extensive as his circumstances will allow; but if he has a proper understanding of the fundamental principles of Arithmetic, Practical Geometry, Mechanics, Strength of Materials, Hydrostatics, &c. to which the true principles of

Shipbuilding are consistent, it may be considered sufficient for what is required in general practice. In our opinion, the extensive course of instruction pursued at the College of Naval Architecture at Portsmouth is only necessary for those who are to be employed· in constructing ships of war.

"For the advantage of our young readers, we shall treat shortly on the above-mentioned subjects, with the exception of Arithmetic, by way of introduction to the other parts of the work.

"If the reader has not previously been engaged in the construction of plans or draughts of Vessels, it will be necessary for him to describe the different geometrical figures with his compasses. In this way, he will learn to handle his instruments with facility, and gain a familiarity with the explanation of figures or drawings by letters of reference, and soon be able to comprehend those of a more complicated nature, which are unavoidably requisite in describing the curves and sections used in delineating working plans or draught of vessels."

Whilst we may not agree with the author that 'pure Theory has yet done but little for Shipbuilding', some of his advice is as relevant today as it was 193 years ago.

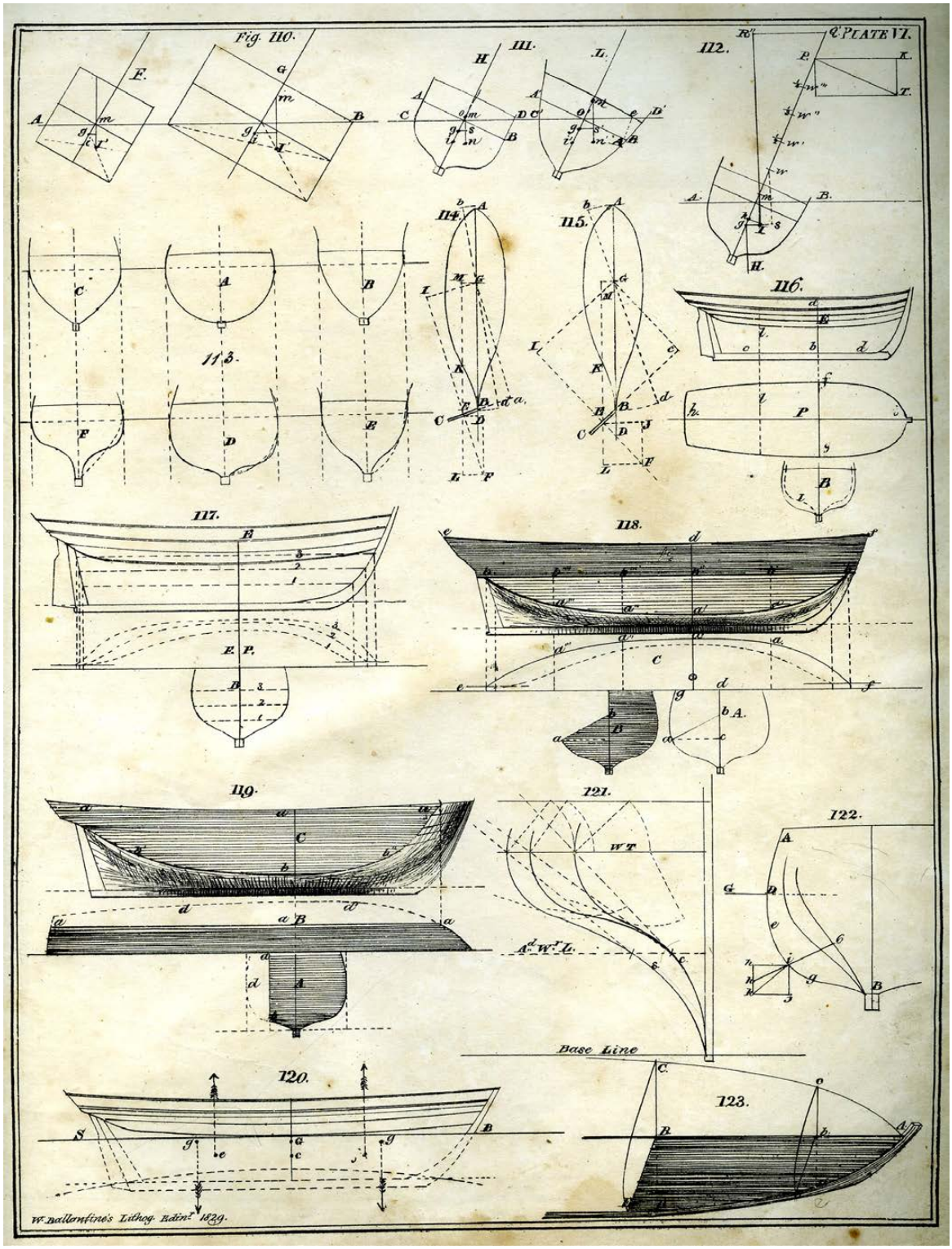


Plate VI — Figures in ilustration of the Stability of Ships and of tthe Principal Sections and Lines used in the plan

The historic 18-foot skff *Australia IV* sailing in the 187th Australia Day Regatta on Sydney Harbour. The Regatta Flagship was HMAS *Sydney*
(Photo John Jeremy)