THE AUSTRALIAN NAVAL ARCHITECT

Volume 26 Number 3
August 2022

STS *Young Endeavour* and HMAS *Arunta* docked together in the Captain Cook Graving Dock at Garden island in Sydney in June (RAN photograph)

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Journal of
The Royal Institution of Naval Architects
(Australian Division)

Volume 26 Number 3
August 2022

Cover Photo:
The 15th Guardian-class patrol boat *Te Kukupa II* recently completed by Austal in Western Australia. The Australian Government has gifted the vessel to the Cook Islands (Photo courtesy Austal)

The Australian Naval Architect is published four times per year. All correspondence and advertising copy should be sent to:

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The deadline for the next edition of *The Australian Naval Architect* (Vol. 26 No. 4, November 2022) is Friday 4 November 2022.

The Australian Naval Architect
ISSN 1441-0125

Editor in Chief: John Jeremy AM
Technical Editor: Phil Helmore

Print Post Approved PP 606811/00009
Printed by Focus Print Group

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From the Division President

To all Australian Naval Architects: welcome to *The Australian Naval Architect* Volume 26, Number 3 — that's quite an achievement of continuous publication! Who would have thought that the very modest publication we started all those years ago in WA would have developed into this most professional of publications that you have before you today? The continuing dedication of John Jeremy and Phil Helmore to this most important aspect of your continuing professional development is to be admired and applauded. But of course, it is not just the editors who make a great publication, it is all of you. Looking forward, I hope to see many more of your names appearing here in all forms of contribution: letters, articles, papers, news, adverts and sponsorship — this is your magazine; make the most of it!

Now, having referenced continuing professional development (CPD), please bear with me while I put forward some personal thoughts and comments on this essential subject.

CPD is something you do throughout your professional life, from graduation onwards: although some of it may be officially classed as initial (IPD), all your subsequent experience is some form or other of CPD. What is important is that, whatever stage of your career you are at, you always continue to keep yourself up-to-date in your current field and any field you intend to work in — that is the mark of an ethical professional. Apart from minimising any potential legal liability which you might incur by providing out-of-date or inadequate solutions to whatever you are working on, there is a great satisfaction in knowing that you are "up there" when discussing the matter at hand with your colleagues, be they senior or junior to you, your bosses or your clients — and that you can really help them to deal with whatever is currently on their plate.

So, how to keep up to date? Reading is one obvious way — critically of course — there is so much good stuff but also rubbish out there, so don't be afraid to question everything or anyone; all good professionals are happy to be questioned because, with their years of experience, they know that they are human and thus not always right.

Attending courses, lectures, talks, seminars, technical meetings (particularly RINA meetings), and not only attending, but preparing for and presenting at any of the above — in this way you are developing not only your own knowledge but those of your colleagues too, making us all winners.

And don't forget that many types of service to the profession are also beneficial forms of CPD, such as serving on relevant committees (particularly RINA of course), panels for setting and reviewing standards and regulations, interview panels, and the vital task of mentoring others.

I am well aware that most of you regularly, quietly, and maybe without quite realising it, do undertake a significant amount of continuing professional development, year on year. But now for the hard part: are you recording it? For most of you, particularly those of you who are chartered engineers or working towards becoming chartered, this is a requirement, an obligation that you have. May I suggest that you don't look on this as a chore, but as an opportunity, because if you are not recording your professional

Jim Black

development, it can be difficult to establish that you are on the right track in your career path. The best of you will have a professional career plan mapped out and will be recording your development against that plan — to the rest: please think about it!

And, finally, not wanting to wield a big stick but, when you are tapped on the shoulder by your professional institution to provide evidence of your CPD, but do not do so, you are leaving yourself open to the possibility of de-registration, and nobody wants that! If you do have concerns about any of this and want to talk to me about it, please feel free to do so.

Apologies for havering on about this, but the professional development of each and every one of your careers as naval architects is a matter of importance for all our futures. And anyway, I really didn't want to write about politics, frigates or submarines this time—far too many other people are already doing so wherever we look.

That said, please be assured that the Australian Division is keeping in touch with what is going on in Australia and around the world. We have written to the new ministers, wishing them well in their portfolios and reminding them that our professional expertise is available to be called upon. At the time of writing this column we are still awaiting responses to a number of government submissions which we have made, but are pleased to advise that we have finally received some feedback from Victoria which provides a bit of clarity concerning the requirement for registration of maritime engineers — we will keep you informed as this matter develops.

I would like to close by thanking all those of you who took the time to look after our Chief Executive, Chris Boyd, and show him the best of Aussie maritime talent on his recent whirlwind tour — he was most impressed!

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

Jim Black

Editorial

At this time three years ago we could not have imagined the world in which we live today. A pandemic has turned our lives upside down, a war is doing untold damage in Ukraine (and to many innocent people dependent on Ukraine and Russia for food), tensions have risen with our major trading partner and swords are being rattled in regions to our north which are strategically vital to our trade, fuel supplies and security. Moreover, just under a year ago, Australia was admitted to one of the world's most exclusive clubs as a result of the AUKUS agreement which will, amongst other things, admit us to the world of nuclear submarines.

Against this background it is, perhaps, not surprising that our new Federal Government has decided that a new Defence Strategic Review should be undertaken without delay. The review will be conducted by a former Minister for Defence, Professor the Hon. Stephen Smith, and former Chief of the Defence Force, Air Chief Marshal Sir Angus Houston. Their review is to be completed no later than March 2023. It is to outline the future strategic challenges facing Australia, identify and prioritise the estate, infrastructure, disposition, logistics and security investments required to provide Australia with the Defence Force posture required by 2032–33. The review must also outline the investments required to support Defence preparedness and mobilisation needs to 2032–33.

With many major defence investments underway in Australia today, it would be natural for those involved to regard yet another review as a potential disruption to their future execution. Was it not Sir Humphrey who recommended to the Minister that a troublesome matter could be dealt with by referring it to a committee which may report sometime when the imperatives have passed? I suspect that we all have some fear of 'paralysis by analysis'. In this case, the imperatives seem very real and the need for review understandable. For those who might feel moved to contribute to the review, submissions are welcome until noon AEST, Sunday 30 October 2022.

Meanwhile, I had the opportunity recently to visit the Australian Defence Force's recently-acquired Pacific Support Vessel, ADV *Reliant*. Whilst it had been intended that a ship to fulfil the requirement would be built in Australia, and some have disapproved of the overseas purchase (I would probably also have been vocal on that topic in my earlier business life), she is a fine modern example of the offshore construction-and-support type. I have a feeling that there is plenty of work looming for Australian shipbuilders and the fortuitous purchase of an existing ship was the right way to go.

John Jeremy

Australia's Pacific Support Vessel to assist South Pacific nations with disaster relief and other assistance, Australian Defence Vessel (ADV) *Reliant* arrived in Sydney on 6 July. *Reliant* is to be based in Brisbane to be close to her area of responsibility and Australia's stocks of disaster-relief materials. She was designed and built in Norway, entering service in 2017 for the Canadian Company Horizon Maritime as MV *Horizon Star*. *Reliant* is a multi-purpose offshore construction-and-service vessel. She is 102.8 m long with a displacement of about 5600 t. Berthing is provided for 60 persons. Her aft deck, as well as featuring 1060 m^2 of cargo space, has a high-capacity 150 t crane and a moon pool. ADV *Reliant* will be managed and operated by Teekay Shipping. Her normal complement will be 20, plus two RAN personnel. Additional personnel can be embarked as required
(Photo John Jeremy)

COMING EVENTS

NSW Section Technical Presentations

Technical presentations are arranged jointly with the IMarEST (ACT & NSW Branch) and held on the first Wednesday of each month, starting at 6:00 pm for 6:30 pm and finishing by 8:00 pm (local times).

Presentations have now reverted to in-person meetings at Engineers Australia's new premises at 44 Market St, Sydney, and streamed live via the WebEx platform. Registration is required, and details will be provided in the flyer for each meeting.

The *Coming Events* page on the RINA NSW Section website is updated with details and changes as soon as they become available.

The program of meetings remaining for 2022 is as follows:

7 Sep Mark Todd, Damen Shipyards Representative, Asiaworld Shipping Services
Tug Electric-drive Technology—The Future is Now

5 Oct Lachlan Toohey, Senior Technical Officer, Australian Centre for Field Robotics, University of Sydney
Hover-capable Autonomous Underwater Vehicles: Design and Use Cases

1 Dec SMIX Bash 2022

Maritime Robot X Challenge 2022

The Maritime Robot X Challenge 2022 will take place at the Sydney International Regatta Centre on 11–17 November 2022 and is a collaboration between the US Office of Naval Research (ONR), the Australian Defence Science and Technology Group (DST Group), and RoboNation.

The RobotX Challenge is an international university-level competition designed to foster interest in autonomous robotic systems operating in the maritime domain, with an emphasis on the science and engineering of cooperative autonomy. Team members can be from a single university or from several universities. This competition facilitates the building of international relationships between students, academic institutions and industry partners, and provides opportunities for innovators to demonstrate their potential and to make substantial contributions to the robotics community. The RobotX Challenge 2022 will be the fourth such event, the first of which was held in Singapore in 2012.

See https://robotx.org/ for more information about the challenge, and get a glimpse of the competition in Australia at https://youtu.be/oXlsnz4ye64.

The base platform for Robot X Challenge 2022 is the Wave Adaptive Modular Vehicle (WAM-V), which teams must outfit with propulsion, control systems, sensors, and other systems necessary to accomplish the competition challenges. All teams competing in Robot X must use the same core platform as the basis for their multi-vehicle multi-domain autonomous maritime system of systems and, to this end, RoboNation awarded a limited number of the WAM-V platforms to teams which committed to participate in this and future Maritime RobotX Challenges and Forums.

SMIX Bash 2022

The 22nd SMIX (Sydney Marine Industry Christmas) Bash will be held on Thursday 1 December aboard Sydney Heritage fleet's beautifully-restored barque, *James Craig*, alongside Wharf 7, Darling Harbour, from 1730 to 2200. This party for the whole marine industry is organised jointly by RINA (NSW Section) and IMarEST (ACT & NSW Branch). Join your colleagues in the maritime industry and their partners for drinks and a delicious buffet meal on board this unique vessel. Dress is smart casual, but absolutely no stiletto heels!

Bookings are now open for sponsors and members of RINA and IMarEST on the Trybooking website https://www.trybooking.com/BZUGL at $55 per head. Payment may be made by Visa or Mastercard. Bookings will open for non-members and friends in the marine industry on 1 October at $70 per head.

Due to prevailing pandemic restrictions, numbers for SMIX Bash 2022 may be more limited than usual, so members are advised to make bookings early!

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 regularly connect with our community so that AOG Energy can continue to meet the needs of the industry. Recently we surveyed our audience, spoke to key exhibitors, and consulted with our industry committees on their objectives for AOG Energy 2022. The results demonstrated that, while there is an appetite for local connection, it is abundantly clear that there is a stronger desire for this to happen at the large global scale to which the industry is accustomed.

We are committed to delivering the event annually; however, we understand that 2022 will continue to present its challenges in connecting the market at scale. We want to do the best by you and reunite the industry at the right time, therefore have 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 continue to innovate towards a clean energy future. 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/

NEWS FROM THE SECTIONS

ACT

The Australian Wave and Tidal Environment

Francois Flocard, Principal Engineer, UNSW Water Research Laboratory, gave a presentation on *The Australian Wave and Tidal Environment and the Inherent Marine Renewable Energies* as a webinar hosted by RINA using the Zoom software platform with the Chair of the ACT Section, Warren Smith, as MC on 24 May. This presentation attracted 18 participating on the evening.

While solar and wind are clear leaders in Australia's current renewable market, marine renewable energies (MRE), i.e. tidal, marine currents and wave energy, could become an additional solution for the future Australian renewable mix. Australia's coasts are home to the world's best wave-energy resource in the south, while the north with its large tidal range is ideal for the implementation of tidal-energy projects. MRE have seen major developments in Australia in the last two years, both in the research sphere and industry led projects.

Francois first introduced the categories of offshore renewable energy sources before explaining those grouped under Ocean Energy, namely: Salinity Gradient, Ocean Thermal Energy Conversion (OTEC), Tidal and Wave, and giving examples of the implementation of each. The focus of his presentation was on the latter two. He illustrated and discussed the tidal and wave power resources available globally and around the Australian coast. It could be seen that Australia's southern coast has amongst the world's best wave-energy resources, while areas in the north with their large tidal ranges are ideal for the implementation of tidal-energy projects. Francois noted that the suitability of such resources depended not only on the annual mean available power, but also seasonal variability and extremes that devices must withstand.

Various tidal and wave energy-conversion devices under development around the world were illustrated and discussed in further detail before summarising current marine renewables research and industry projects around Australia. Francois then fielded questions from the participants.

The Presenter

Francois Flocard is an expert in the field of renewable ocean wave energy; he has managed the installation of a 250 kW pilot device in Victoria and led several large studies related to wave dynamics and wave energy conversion processes over the last 15 years. He has also worked on projects in the fields of coastal hazards, coastal structures, climate change adaptation, physical and numerical modelling, and coastal monitoring. Francois is actively involved in collaborative research work (author of over 20 peer-reviewed publications) related to the assessment of climate-change effects in the coastal zone as well as innovative coastal protection solutions and wave energy.

The presentation was recorded, and is now available on the RINA YouTube channel (see *The Internet* column).

The "thank you" bottle of wine was delivered to Francois via an eGift card.

Development of the Atlantic Escort in the Second World War

Tim Lyons gave a presentation on *Development of the Atlantic Escort in the Second World War* at an in-person meeting at the Australian Defence Force Academy in Canberra, and streamed live via Zoom on 28 June. This presentation attracted 7 attendees and 16 participating online on the evening.

The Battle of the Atlantic was the longest battle of the Second World War, lasting from 3 September 1939 to 10 May 1945. If the lifeline to North America had been cut, Britain would never have survived; there could have been no build-up of US and Commonwealth forces, no D-Day landings, and no victory in western Europe.

The ships, technology and tactics employed by the Allies formed the subject of this presentation. During the war the balance of advantage was to see-saw between the U-boats and the convoy escorts, with new ship designs, weapons and sensors introduced at a rapid rate. For the Allies, the prime requirement was the numbers of escorts, and the most pressing problem was to improve capability without sacrificing simplicity and speed of construction, and at minimum cost. This presentation looked at the evolution of the Atlantic escort, the resulting designs of sloops, corvettes and frigates, and attempts to explain their relative effectiveness.

Tim also discussed the evolving weapon and sensor technologies and tactics employed by the Allies in the continued battle for advantage over the German U-boats.

That included the evolution of Asdic and the progression from use of depth charges to mortars of various types and the means with which they were used to significantly improve the success rate in locating and destroying submarines over the course of the Battle of the Atlantic.

Tim's presentation prompted a lively period of questions and answers

The Presenter

Tim is a naval architect and former project-management professional with experience in the detailed engineering, engineering management and project management of major capital projects. He worked for 18 years in the Department of Defence, the last ten as a senior manager in major capital equipment projects, before becoming a consultant in 1997. As a consultant for nine years, he provided services to the Department of Defence, other Government organisations and industry.

The presentation was not recorded.

The "thank you" bottle of wine was delivered to Tim via an eGift card.

Performance of Propellers in Off-design Conditions

Phil Helmore gave a presentation on *Performance of Propellers in Off-design Conditions* at an in-person meeting at the Australian Defence Force Academy in Canberra, and streamed live via Zoom on 26 July. This presentation attracted 19 attendees and 16 participating online on the evening.

Attendees socialising prior to the technical presentation on 26 July at ADFA in Canberra. Seen in foreground (L to R): Phil Helmore, Prasanta Sahoo (obscured), Adela Greenbaum, Peter Hayes, Ray Duggan, Jeremy Nolan, Martin Grimm (back to camera), and David Lyons. (Photo courtesy Lily Webster)

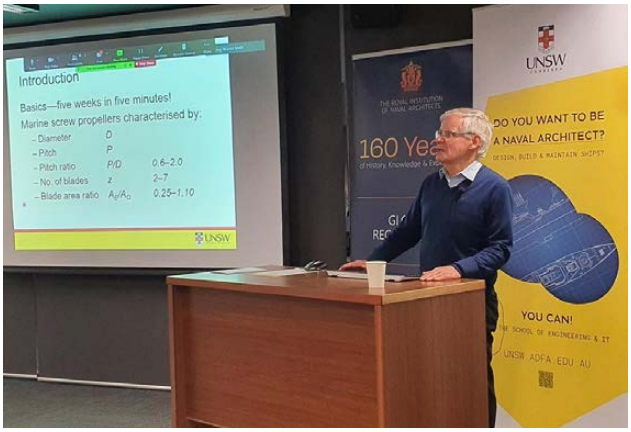
Marine screw propellers are usually designed for best performance at a given set of operating conditions which may include any, or all, of speed, power and engine RPM. However, having designed for these conditions, we often want to know what the performance will be at a different set of conditions, e.g. a different speed or RPM.

To do that, we need to know the output power characteristics of the engine, and match the propeller demand to those characteristics.

The presentation began by briefly covering the basics of propellers, their characteristics, and the initial design process. It then looked at the output power characteristics of diesel engines as the most-common power source, although the principles apply generally, as these are necessary for the analysis of off-design performance.

Examples were then given of the design and off-design conditions which apply differently to tugs, trawlers, and high-speed craft and merchant vessels. The presentation then looked at the influence of roughness and fouling of the hull and propeller and, because of their importance to high-speed craft and merchant vessels, how these can be analysed.

Phil's presentation triggered a series of questions and answers including the influence and management of fouling, operator preferences concerning propeller design optimisation, and attributes of the different forms of ducted propellers.



Phil Helmore introducing his presentation at ADFA on 26 July (Photo courtesy Warren Smith)

The audience at the technical presentation at ADFA on 26 July (Photo courtesy Warren Smith)

The Presenter

Phil graduated from the University of New South Wales with bachelor's and master's degrees in naval architecture, then spent three years working for the Naval Technical Services Annexe in Sydney, followed by five years working his way around Australia on various fishing vessels and coming ashore with Master Class V and Engine Driver Grade II certificates. He then worked as a naval architect with Commercial Marine Design, where Noel Riley taught him all he knows about propeller design (having learned all *he* knows from Jim Eken, who brought rational propeller design to Australia), then with the Maritime Services Board, and then lectured to the young hopeful naval architects back at the University of New South Wales, retiring in 2019. This year he is donning his old work clothes and lecturing part time at UNSW Canberra at ADFA.

The presentation was recorded and is now available on the RINA YouTube channel (see The Internet column).

The "thank you" bottle of wine was delivered to Phil via an eGift card.

Martin Grimm

Queensland

Technical Presentation

Graham Sussex, Technical Specialist with the Australian Stainless Steel Development Association, gave a presentation on *Stainless Steel and Copper-nickel Alloys in Marine Environments* on 19 July, in person at the Aus Ships Group office in Murarrie and streamed live, and was well attended on both platforms.

Graham explained that both families of alloys are widely used in large and small boats, but there are frequently misunderstandings about the alloy level required for immersion in seawater, the critical importance of removing/avoiding weld heat tint, and the effect of surface finish on durability. Crevices are always a corrosion initiation point and are usually avoidable, along with stainless steel fasteners on painted aluminium and carbon steel causing disbonding.

The Queensland Section thanks Graham for his time in giving the presentation, and Tommy Ericson of Aus Ships for allowing us to use his facilities again.

The Presenter

Dr Graham Sussex is a technical specialist with the Australian Stainless Steel Development Association. He has worked on corrosion and its control since 1979, with eight years at UMIST in Manchester before returning to Melbourne to work at ETRS. Since 2001 he has been the consultant technical specialist for the Australian Stainless Steel Development Association, answering technical questions, writing articles and presenting talks on corrosion-resistant alloy applications.

Ashley Weir

Tasmania

Committee

Following the Tasmanian Section AGM, held on 8 March 2022, there has been a number of changes to the committee. Jonathon Binns has stepped down as Chair following his move away from the Apple Isle, and so too has Gregor MacFarlane as Secretary and Nick Johnson as Treasurer.

The election of new committee members resulted in the following:

Chair/Technical Meeting Coordinator	Chris Davies
Deputy Chair	Martin Renilson
Secretary	Richard Boult
Treasurer	Michael O'Connor
Advertising/Sponsorship Coordinator (ANA)	Michael Woodward
Junior Representative	Doupadi Bandara
Undergraduate Student Representative	Oscar Kennedy
AD Council Nominee	Chris Davies
Member	Alan Muir

The section thanks all outgoing committee members for their contributions over a number of years and to everyone who attended the AGM.

Technical Presentations

The section has held a number of events and presentations this year. We have a presentation scheduled for every remaining month of the year except for December which has a small Christmas function programmed. The objective of our gatherings and presentations is to make the most of Tasmania's small, diverse and vibrant marine industry in conjunction with the extensive resources of the Australian Maritime College.

Section gatherings and presentations which we have had so far this year include:

- May: private tour of the Maritime Museum of Tasmania. (see photo); and visit of RINA CEO Chris Boyd to AMC, addressed the students and had a general meet-and-greet with AMC staff.
- June: Presentation *Mystery of Electrolysis* presented by Chris Davies, who currently works as a corrosion consultant, and is Chair of the Tasmanian Section, explaining myths and misconceptions in marine corrosion from aluminium to timber vessels.
- July: Presentation *Virtual Twin Experience in Ships* presented by Jeff Hawkins, CEO of Pivot Maritime International (a vessel simulation, maritime training and consultancy company).
- August: Presentation scheduled for 11 August *Preserving our Maritime History—Modern Techniques for Creating Digital Models of Historically Significant Vessels*.

A feature of these presentations has been a room-and-zoom, where we have had two venues, with the presentation given to a small audience in either the north (Launceston) or the south (Hobart) of the state and the same presentation has been Zoomed to the other venue. The plan has been to have alternative presentations between the north and the south. This also provides us with the opportunity to give the zoom invitation to persons who cannot make either venue. We have found this has provided members with a nice mix of social/technical interaction at each venue, with the added convenience of 'attending' the presentation remotely if individual circumstances prevent in-person attendance.

Unfortunately, at this stage, we have not been able to record any of our presentations. However, if anyone is interested in finding more information on any of the presentations given above, please contact the Section or the presenter directly.

RINA Tasmanian Section members and friends during the Maritime Museum of Tasmania private tour in May 2022 (Photo courtesy Richard Boult)

Wooden Boat Festival

The Australian Wooden Boat Festival will be held in Hobart in February 2023, for the first time in four years. The Tasmanian Section is looking at organising an event

for RINA members and friends at the Festival, which is scheduled for 10–13 February 2023. The Tasmanian Section event is proposed for Friday evening 10 February and would be a Derwent River cruise and cocktail party. The objective would be to provide a social environment for RINA members, friends and the maritime industry to mingle and network. It is envisaged that this would become a bi-annual event, held to coincide with the AWBF. For more information on the 2023 festival visit www.australianwoodenboatfestival.com.au.

Tickets will be available on Eventbrite at a nominal cost per head. Sponsorship packages for organisations, companies and sole traders would also be available. More information to follow in the coming months.

Richard Boult

Victoria

Victorian Engineering Registration

Zoe Williamson of Professionals Australia gave a presentation on *Victorian Engineering Registration* as a webinar hosted by RINA using the Zoom software platform with the Chair of the Victorian Section, Tom Dearling, as MC on 23 June. This presentation attracted 18 participating on the evening.

Zoe's presentation discussed the elements of the application process and requirements for the upcoming Victorian Engineering Registration legislation. Whilst beneficial in giving an introduction to the details to those who attended, this webinar was just the first one of further guidance sessions to come, and information which RINA Victorian Section (and RINA Australian Division) will be hosting and distributing to members — please stay posted for more information soon.

This presentation was not recorded.

CAD/CAE Workflow

Angus Houston, Naval Architect/Structural Engineer Consultant with Houston Engineering, Simon Crook, Senior Solution Specialist with ShipConstructor Software Incorporated, and Alexander Quirk, Technical and Sales Manager Australia and New Zealand with Altair Engineering, gave a presentation on *CAD/CAE Workflow: Capturing, Validating and Optimising Foundation Structural Design in Shipbuilding* at an in-person meeting in the Celia Little Room at the Mission to Seafarers, Docklands and streamed live via Zoom on 26 July. This presentation attracted 7 attendees and 23 participating online on the evening.

Shipbuilders and ship repairers utilise CAE tools to efficiently validate and optimise structural designs. Engineers can capture and reuse CAD (geometry and metadata) contained within the common product model at any time throughout the project lifecycle. This ensures information consistency without the need to create or reproduce geometry, mitigating the risk of errors which can occur from the double handling of information.

This presentation showed a typical foundation structural design example. A transformer and its nominal foundation modelled within the ShipConstructor environment, together with the surrounding structure was captured, validated and optimised using Altair HyperWorks FEA. The demonstration utilised specific software tools, but alternative CAD/CAE tools could be used.

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

Keegan Parker

Western Australia

Yacht Keel Design and Construction

Kim Klaka of the Royal Institution of Naval Architects gave a presentation on *Yacht Keel Design and Construction: What can we Learn from the Capsize of Finistere?* at an in-person at The Meeting Place in South Fremantle, and streamed live on 28 June. This presentation attracted 6 attendees and a number participating online on the evening.

Just before midnight on 23 February 2018, the yacht *Finistere*, competing in the Bunbury-and-return ocean race, suffered a catastrophic failure of her keel. This caused her to capsize and the six crew entered the water. Four of the crew were successfully rescued, but two tragically died.

This presentation summarised the Department of Transport (WA) technical report of the incident, followed by a structured discussion of what lessons can be learned, both by naval architects and by the broader yachting community.

The Presenter

Kim Klaka is a naval architect with over 50 years' experience. Selected career highlights include a master's degree and PhD in sailing yacht performance; Director of a university marine research centre; Sailed more than 30 000 n miles in over a dozen different countries; designer and builder of racing yachts; director of a marine technology company; lecturer and author on naval architecture and yacht design; member of the External Reference Group for the WA Department of Transport's review of recreational vessel safety equipment; Yachting WA David Walters Medallion 2015 recipient for contribution to yachting safety; Australian Sailing National Equipment Auditor; Chair and founding member of the RINA WA Section; and founding Editor of *The Australian Naval Architect*.

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

Ken Goh

New South Wales

Committee Meetings

The NSW Section Committee met on 14 June and, other than routine matters, discussed:

- SMIX Bash 2022: Sponsor letter updated and ready for sending; SHF and caterers happy to extend time on board *James Craig;* quote received from caterers.
- TM Program: Presenters arranged for July through October; return to in-person presentations expected in September; need to think about presentations and topics for next year.
- NSW Advertising Coordinator for *The ANA*: We have a volunteer for this position.
- Walter Atkinson Award 2021–22: Six papers from Indo Pacific 2022 short-listed for the award, two decided for nomination from NSW and advised to the Australian Division Council.

- AD Council Report: Gordon MacDonald, Immediate past President of RINA Australian Division, received the award of Medal of the Order of Australia (OAM) for services to naval architecture in the Queen's Birthday honours list; there is a new RINA AD policy requirement for each meeting of a section committee to address conflict of interest.

The NSW Section Committee also met on 26 July and, other than routine matters, discussed:

- SMIX Bash 2022: Organisation is proceeding well, and sponsors are being sought; time on board *James Craig* has ben extended from 2130 to 2200.
- TM Program 2022: Arrangements are being finalised for a return to in-person meetings with live streaming in September and October.
- TM Program 2022: Ideas for technical presentations next year were sought, and a number are being requested.

The next meeting of the NSW Section Committee is scheduled for 10 October.

Marine Biofouling

Clare Grandison, Discipline Leader Environmental Signatures, DST Group, gave a presentation on *Marine Biofouling: What is it, Why Does it Happen and Why Should we Try and Stop it?* as a webinar hosted by RINA using the Zoom software platform with NSW Section Deputy Chair, Phil Helmore, as MC on 4 May. This presentation attracted 18 participating on the evening.

The presentation was not recorded. However, Clare's presentation was based on a collaborative paper which has subsequently been published in *Ocean Engineering*:

Piola, R., Grandison, C., Shimeta, J., del Frate, A. and Leary, M. (2022) Can Vessel Sea Chest Design Improve Fouling Control Coating Performance? *Ocean Engineering*, Vol. 256.

Copies of this paper are available on request from Phil Helmore <p.helmore@unswalumni.com>.

Modern Technology Resins, Coatings and Glues

Dave Giddings Business Manager, Drive Marine Services and BoatCraft NSW, gave a presentation on *Modern Technology Resins, Coatings and Glues* as a webinar hosted by RINA using the Zoom software platform with committee member of IMarEST ACT & NSW Branch, Greg Hellessey, as MC on 1 June. This presentation attracted 10 participating on the evening.

Modern epoxy and polyurethane coatings and adhesives based on modern technology have come a long way since they were first developed for use in the construction and maintenance of wooden and composite boats. However, many have suffered from risks associated with allergic reactions in. and sensitisation preventing further use by, the people applying them.

The Australian Bote-Cote epoxy and Aquacote Polyurethane products from Boatcraft Pacific were developed three decades ago in response to a need in the boating industry for a range of resins, glues and finishes which could cope with our harsh Australian climate and sea conditions, while also being safer and easier to use.

Bote-Cote epoxy resin works well on polyester fibreglass boats, adheres tenaciously to sanded polyester, does not shrink (which polyester does), and is not prone to adhesion failure in shock or continual stress loadings. It was developed to handle the flexing of plywood.

Aquacote is a two-pack water-based polyurethane which lasts well outdoors and safely indoors. It is available in clear and a range of colours. Aqua-cote is hard to sand but that's the trade-off in having a hard-wearing surface. There is no waste as cross-linked Aquacote can be returned to the container and saved for future use.

Epox-E-glue is a two-pack thixotropic gap-filling glue. It adheres tenaciously to all substrates except poly plastics and is ideal for the ultimate bond when things are hard to clamp tightly.

Feronite Rusty Metal Primer is ideal for repairing rusted surfaces in the marine environment and converts, seals and primes rusty metal until a permanent refurbishment is available.

This presentation outlined these modern technology epoxies, coatings and glues, and discussed their applications and the safety issues involved with their use.

The presentation was recorded, and is now available on the RINA YouTube channel (see *The Internet* column).

The certificate was subsequently posted to Dave, and the "thank you" bottle of wine delivered via an eGift card.

Decarbonising International Shipping

Matthew Gregg, Senior Advisor Policy and Regulatory, Environment and Strategy, Australian Maritime Safety Authority, gave a presentation on behalf of Matt Johnston, Manager Environment and Strategy, on *Decarbonising International Shipping* as a webinar hosted by RINA using the Zoom software platform with Deputy Chair of RINA NSW Section, Phil Helmore, as MC on 6 July. This presentation attracted 19 participating on the evening.

Introduction

Matthew Gregg began the presentation by asking "Why decarbonise shipping?" There are two principal reasons: to contribute to global efforts which combat climate change and its impacts (see UN Sustainable Development Goal 13); and to comply with the Paris Climate Change Agreement, which aims to keep global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 °C.

Initial IMO Strategy on Reduction of GHG Emissions

In 2018, the International Maritime Organisation (IMO) adopted an initial strategy to reduce greenhouse gas (GHG) emissions from international shipping. The strategy sets an initial vision and targets for greenhouse gas emissions reduction for international shipping.

The vision set out in the strategy confirms the IMO's commitment to reducing GHG emissions from international shipping, with an aim to phase them out as soon as possible in this century.

The targets identified in the strategy aim to reduce international shipping GHG emissions as follows:

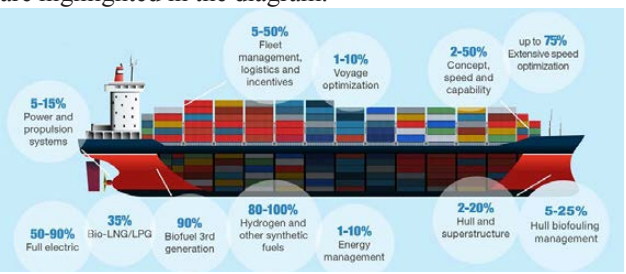
- total emissions reduced by at least 50% by 2050;
- carbon intensity reduced by an average of at least 40% by 2030 compared to 2008; and

- carbon intensity reduced by an average of at least by 70% by 2050 compared to 2008.

The strategy includes a specific reference to "a pathway of CO_2 emissions reduction consistent with the Paris Agreement temperature goals" and lists candidate short-, mid- and long-term measures to meet these goals.

Variety of Design, Operational and Economic Solutions

To meet the goals of the initial IMO GHG Strategy, a mix of solutions will be required. Some of them, along with indication on their approximate GHG reduction potential, are highlighted in the diagram.



Some possible solutions with approximate GHG reduction potential
(Image courtesy IMO)

IMO Measures to Reduce GHG Emissions

The IMO has already adopted global mandatory measures to reduce GHG emissions from international shipping. These are the Energy Efficiency Design Index (EEDI) for new builds and the requirements for ships to have in place a Ship Energy Efficiency Management Plan (SEEMP).

In June 2021, the IMO adopted a new short-term GHG reduction measure aimed at meeting the 2030 target set in the initial IMO GHG Strategy. The new measure will take effect from 1 January 2023 and consists of the Energy Efficiency Existing Ship Index (EEXI), which addresses how a ship is retrofitted and equipped; and the carbon intensity indicator (CII) and rating system, which addresses how the ship is operated. The CII and rating system are to be implemented through new requirements for an enhanced SEEMP.

The EEXI and CII apply to the same ship types of international ships, the difference being that the EEXI applies to ships 400 GT and above, whereas the CII applies to ships 5000 GT and above.

In June 2022, the IMO adopted a set of technical guidelines to support implementation of the EEXI and CII.

Energy Efficiency Existing Ship Index

The EEXI is a technical design measure to improve the energy efficiency of existing in-service ships which engage in international voyages. It is similar to the EEDI but applies to existing ships ($\geq$ 400 GT) regardless of build date. It is a one-time certification equivalent to the Phase 2 or 3 EEDI requirements, and compliance is reflected in the new IEE Certificate (the form of which has been amended).

How to meet the EEXI requirements?

The MARPOL regulations do not prescribe the improvement methods to be used to meet the EEXI requirements. Improvements can be achieved by methods including:

- engine/shaft-power limitation;
- propulsion optimisation; bow and/or propeller modifications;
- antifouling coatings;
- use of alternative fuels;
- engine de-rating; and
- installation of energy-saving devices and technologies (e.g. solar panels, rotor sails, etc.)

Carbon Intensity Indicator

The CII is a measure of how efficiently international ships of 5000 GT and above transport goods or passengers, and is given in grams of CO_2 emitted per cargo-carrying capacity and nautical mile.

While the EEXI is a one-time certification targeting design, the CII addresses actual emissions in operation. The CII provides ship operators with the factor by which they must reduce carbon emissions annually to comply with regulations and ensure continuous improvement. Annual reduction rates up until 2026 have been agreed. A CII rating (from A to E) will be given to the vessel based on the annual carbon intensity result. Under-performing ships, rated D for three consecutive years or E once, must develop a plan of corrective action.

A plan of corrective action outlines how the ship will achieve its required CII (e.g. C rating or above) and must be set out in the enhanced SEEMP within one month after reporting the ship's Attained CII.

Reduction factor Z will start from 5% in 2023 and be increased by 2% yearly to 2026. Z for the years of 2027–30 are to be further strengthened and developed, taking into account a review of the short-term measure.

How to Meet the CII requirements?

The CII is based directly on the fuel consumption, which is influenced by how a specific ship is operated in combination with its technical efficiency and fuel. Improvements to the CII can be achieved by:

- improved voyage planning/weather routeing;
- speed optimisation/port call optimisation;
- using alternative fuels;
- onshore power supply;
- hull maintenance—cleaning of biofouling/marine growth; and
- reducing cargo volume/passenger intake.

Implementation in Australia — Legislative and Regulatory Changes

The Federal Government's Joint Standing Committee on Treaties (JSCOT) recommended binding treaty action in relation to Resolution MEPC.328(76) — 2021 Revised MARPOL Annex VI, which contains the amendments to MARPOL Annex VI to implement the new short-term measure. Through this process it was identified that amendments will only be required to Marine Order 97 (MO 97). No other legislation needs to be amended to implement the new measure.

AMSA is in the process of drafting the required updates to MO 97. These updates to MO 97 are part of a second-phase review of the Marine Order, and AMSA is working to have MO 97 updated for 1 January 2023. The external consultation for Phase 2 updates to MO 97 will take place in August–October this year.

Review of the Short-term Measure

A review the effectiveness of the CII and EEXI requirements needs to be undertaken by the IMO by 1 January 2026 at the latest and, if necessary, further amendments will be developed and adopted. This review is expected to further develop and strengthen the annual CII reduction rates for 2027–30. More-rigorous enforcement and penalties may also be considered, along with a review of agreed CII correction factors and voyage adjustments, and reconsideration of those that were not agreed.

Mid-term Measures

A range of proposals for mid-term market-based measures has been submitted to the IMO. These include:

- Levy system based on absolute well-to-wake GHG emissions.
- Levy system based on CII performance.
- Levy system based on absolute tank-to-wake CO_2 emissions
- Emissions cap-and-trade system.

Proposals for technical measures include a well-to-wake GHG intensity fuel standard.

These proposals will be further considered at the next IMO Inter-sessional GHG Working Group meeting (ISWG-GHG 13) and future meetings as the IMO works towards a "basket of mid-term measures". The industry's proposal to establish an IMO Maritime Research Fund (IMRF) will now also be considered as part of the basket of mid-term measures.

A decision on which measures to develop further is expected to be made in mid-2023.

Long-term Measures

New technical solutions and alternative zero-carbon or fossil-free fuels are critical to decarbonising shipping, and the IMO's Maritime Safety Committee (MSC) is working to address safety aspects.

In April 2022 the MSC approved interim safety guidelines for ships using fuel-cell power installations. *Interim Guidelines for the Safety of Ships using Fuel Cell Power Installations* (MSC.1/Circ.1647) were also approved and the development of interim guidelines for the use of ammonia as fuel and a review of recommendations for the bulk carriage of liquefied hydrogen has also started.

AMSA's Novel Vessel Policy

Domestic Commercial Vessel builds which are intending to use alternative fuels and propulsion systems (such as hydrogen, ammonia and batteries) are currently managed according to AMSA's Novel Vessel Policy Statement, which:

- identifies the types of vessels that AMSA considers to be novel in accordance with the National Standard for Commercial Vessels (NSCV) Part B — General Requirements;
- clarifies what standards and other requirements with which novel vessels must comply to gain design approval, and
- provides additional pathway information for novel vessels to gain vessel certification.

As AMSA develops guidelines and standards for emerging technologies, the list of novel vessel types will change. AMSA will update the policy statement to reflect developments in this space.

Initial GHG Strategy to be Revised by 2023

The Initial GHG Strategy is to be revised by 2023 and a final Revised Strategy is expected to be adopted by consensus by the IMO in mid-2023. A key consideration will be whether the revised target will be "zero emissions", "zero carbon", "net zero", or "climate neutrality" by 2050, and how to achieve an equitable and fair transition for all IMO Member States.

Conclusion

Decarbonising international shipping is important to contribute to global efforts to combat climate change and its impacts. The Initial GHG Strategy confirms the IMO's commitment to reducing GHG emissions from international shipping and to phasing them out as soon as possible.

The new short-term GHG reduction measure adopted by the IMO in 2021 will require existing ships to make both technical [Energy Efficiency Existing Ship Index (EEXI))] and operational improvements [Carbon Intensity Indicators (CII)] in the short-term to reduce their carbon intensity by at least an average of 40% reduction across the international fleet by 2030, compared to 2008 levels. AMSA is currently updating Marine Order 97 to give effect to the short-term measure in Australia.

The IMO's attention is now shifting to mid- and long-term GHG reduction measures and ensuring the safety of the new fuels and technologies required to decarbonise international shipping.

Questions

Question time raised some further interesting points.

The presentation was not recorded. The certificates were subsequently posted to both authors, and the "thank you" bottles of wine delivered via eGift cards.

Submarines for Australia — Going Nuclear

John Jeremy of the Royal Institution of Naval Architects gave a presentation on *Submarines for Australia — Going Nuclear* as a webinar hosted by RINA using the Zoom software platform with Deputy Chair of the NSW Section, Phil Helmore, as MC on 3 August. This presentation attracted 36 participating on the evening.

It is nearly 112 years since the British Admiralty ordered two submarines for the new Australian Commonwealth Navy. HMA Submarines *AE1* and *AE2* arrived in Sydney Harbour for the first time on 24 May 1914. In subsequent decades submarines played an intermittent role in the RAN until the advent of the Oberon-class submarines in the 1960s.

In this presentation John traced the development of submarines from the pioneering days of World War I to the creation of the immensely-powerful nuclear-powered submarines of today.

With the announcement last September of the momentous decision to equip the Royal Australian Navy with nuclear-powered submarines, he speculated on the way ahead for the RAN submarine service in the 21st Century.

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

The certificate was subsequently posted to John, and the "thank you" bottle of wine delivered via an eGift card.

Phil Helmore

Indo Pacific 2022 Exposition

The Indo Pacific 2022 Exposition was held at the International Conference Centre Sydney at Darling Harbour on Tuesday 10 to Thursday 12 May 2022.

The Exposition comprised the Exhibition, in association with the following:

- International Maritime Conference IMC2022
- Sea Power Conference
- King-Hall Naval History Conference
- AAUS (Australian Association for Uncrewed Systems) Conference
- Innovation Pitchfest
- CivDef (Civil Defence) Conference

Indo Pacific 2022 IMC

There were 368 registrants for the IMC this year, a 15% increase over 2019 and a new attendance record!

The Opening Ceremony for the IMC was held in one of the conference rooms in the ICC and officiated by the Chair of the Organising Committee, John Jeremy AM, who welcomed the attendees and introduced Rowena Welsh Jarret to give the Welcome to Country. The welcome included a video which indicated that shipbuilding has been going on in Australia for 40 000 years, far longer than the 200 years that most people imagine!

John Jeremy welcoming guests at the IMC Opening Ceremony

Attendees at the IMC Opening Ceremony

The opening address was made by CDRE Rachel Durbin, Director-General, Navy Engineering, standing in for RADM Katherine Richards, Head, Navy Engineering, who was pandemic-bound in Canberra.

CDRE Rachel Durbin's opening address at the IMC Opening Ceremony

Chris Boyd's Keynote Speech at the IMC Opening Ceremony

The Keynote Speech was made by Chris Boyd, Chief Executive of the Royal Institution of Naval Architects, who had landed in Sydney from London early that morning.

A total of 168 papers in two parallel streams and a panel discussion on *Sovereign Digital Design and Verification: Building a Capability Edge in Platform Readiness through Digitally Engineered Solutions* were presented. The conference program can be seen on the IMC2022 website.

A feature of the International Convention Centre is the nautical-mile distance between the Conference Halls and the Exhibition Hall. This meant that delegates received their daily exercise with long treks between conferences, morning teas and lunches, and visits to the exhibitions! A pandemic innovation this year was the introduction of boxed lunches.

It was good to see delegates to the IMC from all Australian states and international, as well as naval architecture students from UNSW Canberra at ADFA along with their lecturers, Warren Smith and David Lyons.

IMC2022 Welcome Function

The Welcome Function for the IMC was held in the Terrace Room at the Australian National Maritime Museum, on the evening of Wednesday 11 October. Speeches were limited to the welcome by the Chair of the IMC2022 Organising Committee, John Jeremy AM, and a short address by Robert Inches, CEO of PFG who sponsored the function. Champagne, white and red wine, beer and finger foods were served throughout the evening for the delectation of the guests, and many tall tales and true were told.

John Jeremy welcoming guests to the Welcome Function

Robert Inches speaking to the guests at the Welcome Function

Indo Pacific 2022 Exhibition

The Exhibition was held in the Exhibition Hall at the ICC, and a new record for exhibitor numbers was set!

Exhibitors included Australian designers, builders, manufacturers, researchers, state representatives, and designers, builders and manufacturers from the UK, USA, Spain, Italy, New Zealand…..the list goes on.

Displays included the Sentinel 1100 HDPE (high density polyethylene) craft, designed specifically for defence and security applications by One2three Naval Architects and built by PFG in Hobart, and one of Ocius Technology's latest Bluebottles, *Beacon.*

Ocius Technology's bluebottle *Beacon*

Australia's Hunter-class frigate was a feature of the BAE Systems stand at Indo Pacific 2022

Starboard bow of the Sentinel 1100

Stern quarter of the Sentinel 1100

RINA Stand at Indo Pacific 2022 Exhibition

RINA had a stand at the Exhibition which was crewed almost continuously throughout the Exhibition by the Chief Executive of RINA, Chris Boyd, together with Australian members of RINA attending the IMC and who volunteered their time. Thanks to Andy Harris, Chris Davies, Adrian Broadbent, Belinda Tayler, Jonathan Binns, Rob Gehling and Phil Helmore.

IMC Closing Ceremony

The IMC was not immune to the pandemic, and a number of presentations were cancelled due to registrants having to isolate at home. As a result, the Closing Ceremony on the final day was brought forward by two hours.

The Closing Ceremony for the IMC was officiated by John Jeremy, who thanked

- the members of the IMC Organising Committee and the Program Committee for their hard work;
- Serena Davy, Manager Civil Conferences AMDA, who managed IMC2022, and was the power behind making it all work so smoothly; and
- all the attendees for their participation and contributing to the success of the event.

In concluding he reminded everyone that the next International Maritime Conference (IMC2023) would be held in Sydney on 7 to 9 November 2023 as part of Indo Pacific 2023.

The RINA stand with (L to R) Belinda Tayler (Chair, RINA NSW Section), Rob Gehling (Secretary, RINA Australian Division), Chris Boyd (Chief Executive, RINA), Stuart Cannon (previous President, RINA Australian Division), Phil Helmore (Deputy Chair, RINA NSW Section), and Chris Davies (Chair, RINA Tasmanian Section)

Serena Davy helping an attendee at the IMC2022 Information Desk

The IMC2022 Organising Committee
(L to R) Serena Davy, Adrian Broadbent, Stuart Cannon, John Jeremy, Tauhid Rahman, Geoffrey Fawcett, Bruce Howard, and Rob Gehling (Program Committee). Don Moloney was unable to be present at IMC2022

Bob Campbell Award 2022

The Bob Campbell Award is for the best written paper and presentation at the Indo Pacific International Maritime Conference, and commemorates the man who was instrumental in the original formation of this series of conferences.

The announcement of the Award was made at the Closing Ceremony of the IMC by Rob Gehling, RINA Vice President, Pacific Region, RINA Secretary, Australian Division, and member of the IMC Program Committee, who said that the selection of the winner from the 168 papers presented was particularly difficult. The papers committee winnowed the contenders to a short list of eight, and then to three finalists, with only percentage points between them!

The two with special mention are

Levi Catton	*Nav Archs (You Gotta) Fight for your Right (to Margins)!*
Rachel Horne	*An Australian Code of Practice for Autonomous and Remotely Operated Vessels*

and the winner was

Nigel Doyle	*Nuclear Propulsion is a Game Changer: What are the New Rules?*

Phil Helmore
(Photos by John Jeremy, Adrian Broadbent, Bruce Howard and Phil Helmore)

CLASSIFICATION SOCIETY NEWS

ABS issues AIP for Ammonia-Fuelled Ammonia Bunker Vessel

ABS has issued approval in principle (AiP) to Keppel Offshore & Marine for the ammonia-fuelled ammonia bunker vessel at the heart of Project Sabre, an initiative from a consortium of leading maritime organisations to develop an ammonia bunker supply chain in Singapore. As well as ABS, the consortium includes A.P. Moller–Maersk, Fleet Management Limited, Keppel Offshore & Marine, Maersk McKinney Møller Centre for Zero Carbon Shipping, Sumitomo Corporation, Kawasaki Kisen Kaisha, and the Maritime & Port Authority of Singapore.

The ammonia bunker vessel design, which is intended to carry liquid ammonia as a carrier as well as bunker fuel for a wide variety of receiving vessels, has been reviewed by ABS against the requirements outlined in the ABS *Guide for Ammonia Fuelled Vessels*. The design would receive the ABS Notation ✠A1 Liquefied Gas Carrier with Independent Tanks.

Awarding of ABS AiP is the latest phase of Project Sabre, which began with an agreement in 2021 to conduct a feasibility study to assess the technical, commercial and regulatory viability of establishing an end-to-end supply chain to enable ammonia ship-to-ship bunkering in Singapore.

"ABS understands the significant potential ammonia offers to shipowners and operators as well as ports and has developed deep insight into the unique safety challenges it introduces to the design, construction and operation of vessels using it for propulsion or power generation. ABS is leading the way in understanding the design and operation of ammonia-fuelled vessels and we are committed to working with key partners, such as those in Project Sabre, to support its safe adoption by the industry," said Panos Koutsourakis, ABS Director, Global Sustainability.

The ABS *Guide for Ammonia Fuelled Vessels* can be downloaded from

https://ww2.eagle.org/content/dam/eagle/rules-and-guides/current/other/325_guide_ammonia_fueled_vessels/ammonia-fueled-vessels-sept21.pdf.

ABS News, 21 June 2022

DNV Recognizes *Aegean Myth* as the first Verified SEEMP III Vessel

DNV presented Arcadia Shipmanagement Co. with a certificate recognising their vessel *Aegean Myth* as the first vessel globally to have a Ship Energy Efficiency Management Plan (SEEMP) Part III manual. The Ship Operational Carbon Intensity Plan or SEEMP Part III, is part of IMO's strategy to reduce shipping's greenhouse gas (GHG) emissions and a verified SEEMP Part III must be kept on board from 1 January 2023.

The SEEMP Part III, or Ship Operational Carbon Intensity Plan, was finalised with the latest amendments to MARPOL Annex VI and the associated Guidelines at MEPC 78 in June 2022. It requires ship owners and operators to monitor, report

and verify CO_2 emissions annually for all vessels larger than 5000 GT. It is a ship-specific document, a dynamic and regularly-updated three-year implementation plan describing how a vessel will achieve the required Carbon Intensity Indicator (CII) over the next three years, with yearly targets, procedures for self-evaluation and improvement, and a corrective action plan in case of an inferior rating.

"We are very proud to be the first shipping company to have received approval by the world's leading classification society, DNV, for our fleet's SEEMP Part III, starting with our *Aegean Myth* vessel," said Mr Dimitrios Mattheou, CEO of Arcadia Shipmanagement Co. "At Arcadia we are committed to providing safe, sustainable, and reliable transportation of oil by sea. Initiatives like this broaden the values of safety and environmental excellence by implementing effective management systems to comply with incoming regulations to consistently achieve reliable and environmental incident-free performance. This approval by DNV marks the first milestone for smooth compliance with IMO's requirements. We would also like to thank Alpha Marine Consulting PC for supporting us in SEEMP Part III preparation," he added.

"DNV congratulates Arcadia Shipmanagement Co. on being the first company to receive SEEMP Part III approval," said Ioannis Chiotopoulos, Senior Vice President — Regional Manager SE Europe, Middle East & Africa, DNV Maritime. "It demonstrates their willingness to ensure that their vessels are out in front, in terms of both regulatory compliance and their sensitivity to the environment. In addition, to have been able to complete the SEEMP Part III preparation and approval so quickly after MEPC showed great teamwork and the effectiveness of our new digital tools. The CII will require more of the shipping industry in terms of data collection and sharing. At DNV, we have invested in developing our competence and services for this new regime, including developing a set of digital solutions which will make compliance as simple and transparent as possible for our customers," he added.

DNV recently released the free SEEMP III Generator tool for DNV customers. The system can propose energy efficiency measures and help vessel operators reach the required CII. It can also help to reduce paperwork and can be used by both ship managers and third-party consultants working on behalf of DNV DCS customers.

DNV News, 5 July 2022

DNV Launches new SEEMP III Generator

DNV has launched its SEEMP III Generator as part of an integrated and easy digital solution to support customers in ensuring their compliance with SEEMP Part III verification. The SEEMP Part III guidelines were adopted at MEPC 78 in June 2022, with the deadline for having the first SEEMP Part III verified and onboarded by 1 January 2023.

The SEEMP Part III forms part of IMO's initial strategy to reduce greenhouse gas (GHG) emissions from ships, including the ambition to reduce the carbon intensity as an average across international shipping by at least 40% by 2030, pursuing efforts towards 70% by 2050 compared to 2008. The requirement will require affected vessels to submit a three-year implementation plan describing how it will achieve the required Carbon Intensity Indicator (CII). The IMO's CII will rate MARPOL ship types above 5000 GT on a scale from A to E on how efficiently they transport goods or passengers with regards to CO_2 emitted. For vessels obtaining an inferior rating the SEEMP III report must be updated with a corrective action plan which must be verified before a Statement of Compliance (SoC) can be issued.

"With only six months to go to ensure compliance with the new MARPOL regulation and meet the SEEMP III verification deadline, ship owners need to take immediate action," said Sven Dudszus, Head of GHG Certification at DNV Maritime. "Through our considerable experience running DCS and Emissions Insights reporting for our customers, DNV is uniquely positioned to take the pressure off customers, giving them the peace of mind that they can achieve compliance in this relatively tight time frame."

The SEEMP Part III is intended to help companies achieve the required CII. It is a dynamic document subject to regular updates and revisions, reflecting the changing performance and required measures. To help customers tackle the impending SEEMP III challenge, DNV has developed two pathways.

The SEEMP III Generator tool is a part of a wider suite of DNV digital tools and is free of charge for DNV customers. With customer data already available in the system, customers will be able to gain the initial fleet overview quickly. The system will propose energy efficiency measures, helping the vessel operator reach the required CII and improve fuel-efficient operations. This integrated solution is the next step in the emissions-management needs of a vessel, effectively becoming a working carbon intensity management platform. The online tool will also help reduce paperwork and its streamlined process can be used by both ship managers and third-party consultants working on behalf of DNV DCS customers.

In the case of inferior ratings and specific needs, DNV can support customers through the creation of GHG reduction plans. DNV Maritime Advisory will give ship operators additional support and insights into cost-effective operational, technical and alternative fuel abatement measures available to them, ultimately ensuring compliance in line with overall ambitions.

Scorpio Marine Management was invited to participate in the pilot project for the development of DNV's SEEMP III Generator. Following the successful collaboration in the pilot project, Scorpio can confirm the added value whichthe SEEMP III Generator will provide in achieving the required compliance within the allotted time. Captain F. Bhathena, Director, Systems & Processes, said "The user-friendly SEEMP III digital tool forms an important addition to DNV's suite of digital applications, helping DCS clients to save valuable time on fleet-wide emissions planning via a single platform."

DNV News, 10 June 2022

LR awards AIP for Daphne Technology's SlipPure™

Lloyd's Register has granted Approval in Principle (AiP) to Daphne Technology (DT) for its methane abatement technology SlipPure™. The SlipPure™ technology will

reduce emissions for LNG-fuelled engines, which can suffer from methane slip, a process which causes unburnt methane to leak, resulting in greenhouse gas emissions and increased ground-level ozone. Even though methane slip has been significantly reduced in modern engines, it remains a major risk in operating LNG-fuelled vessels.

DT's development will benefit a variety of LNG carriers and LNG-fuelled ships facing an imminent threat once methane is integrated into the GHG regulatory regime.

LR's awarding of the AiP will enable the technology to proceed to pilot applications, and further development to full commercialisation, reaffirming LR's commitment to supporting our partners in de-risking their operations whilst addressing some of the maritime industry's key challenges.

Panos Mitrou, Global Gas Segment Director, Lloyd's Register, said "LR is proud to award Approval in Principle to Daphne Technology for their new SlipPure™ technology, a significant milestone in methane-abatement technology development. Methane emissions constitute a key risk to the gas sector and its shipping supply chain. Mitigating this remains essential to climate alignment and longevity of many LNG carriers and LNG-fuelled ships. Retrofits of this technology in ships, in the future, would allow them to benefit from the full potential of GHG savings of LNG."

Mario Michan, CEO, Daphne Technology, said "This is an important milestone for Daphne Technology. The Approval in Principle from LR demonstrates that our technology meets international safety standards and regulations, bringing us a step closer to deploying and commercialising our SlipPure™ system. We believe our technology can help address the climate challenge in the maritime and other hard-to-decarbonise industries."

The AiP was granted on 8 June 2022 in a ceremony at LR's stand at the Posidonia exhibition in Athens, Greece.

LR News, 8 June 2022

LR and SHI sign MOU for Autonomous Ship

LR and Samsung Heavy Industries (SHI) have signed a Memorandum of Understanding (MoU) to develop an autonomous-ready ship design to support maritime digitalisation and the growing demand for operational benefits of increased autonomy.

SAS (Samsung Autonomous Ship) is an autonomous navigation system which integrates current navigation equipment, such as ECDIS with TCS (Track Control System), RADAR, CONNING, and remote-controlled BMS, with SHI's new SVISION® system, using technology to eliminate human error which accounts for the majority of maritime accidents. SAS can be installed easily onto a ship's system next to other software and evaluates collision risks around a vessel, whilst controlling the direction and speed of a ship in order to avoid objects.

Along with the MoU, LR will certify SHI's SAS with new SVISION® system used as part of the Autonomous ready ship design. SHI's SVESSEL® CBM (Condition Based Maintenance), which performs measurement and diagnosis tasks automatically on vessels, will also be certified as part of the Joint Development Project. This will support maintenance by providing remote fault detection of machinery.

LR's role as part of the MoU will be to perform cooperative studies on autonomous systems in navigational autonomy, including commissioning procedures, guidelines for autonomous systems, verification, and validation activities. This will support SHI with the successful development and implementation of its autonomous system.

LR has also announced the certification of SHI's digitised electronic logbook system SVESSEL® eLogbook at Posidonia 2022, replacing paper navigation logs with automated data entry from a voyage, along with a Statement of Fact for SHI's SVESSEL® CII Solution which features real-time monitoring and reporting of CII in response to IMO (International Maritime Organisation) greenhouse gas regulations.

Nick Brown, LR Group CEO, said "Leading our industry's transformation starts with partnerships like this which support the growing demand for operational benefits, such as improved efficiency, reduced workloads for crew and higher safety performance via increased autonomy. We are proud to work with Samsung Heavy Industries on the development and implementation of their autonomous capability."

Jin-Taek Jung, President & CEO, Shipbuilding Sales Engineering Team, SHI, said "We're pleased to collaborate with Lloyd's Register on the development of autonomous-ready technologies. This long and good partnership from early digital transformation to the autonomous-ready technology is concrete and expected to be a major key to the evolution of maritime industries."

The certification was awarded on 7 June 2022 at Posidonia in Athens, Greece, in the presence of Jin-Taek Jung, SHI's President & CEO and Nick Brown, LR Group CEO.

LR News; 7 June 2022

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*.

Spirit of Australia 2 was out on Talbingo Dam in the Snowy Mountains over the weekend of 18–19 June. Saturday morning the wind was up to 10–12 kn, blowing straight down the course, but started to drop and shifted across the course by early afternoon. The team launched *Spirit 2* and managed to make three runs up and down the course. The first run was to evaluate a new rudder, and to learn the course (this was Talbingo and not Blowering!) and work out land marker points, with later runs just over 200 mph. However, each time the wind blew the boat off course. On Sunday the wind didn't drop below 16 kn, thus ending the weekend.

The team plans for months in advance to run the boat, but Mother Nature has her own plans, and they now look to being back on the water in July and hope that Mother Nature plays nicely.

Once the Team-only runs on Talbingo Dam are finished, the plan is to return to Blowering Dam during the second half of this year. A huge thank you to Snowy Hydro, Waterways, and Snowy Valleys Council for their assistance.

Spirit of Australia 2 at speed on Talbingo Dam
(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.

With *Longbow*'s hull now the right way up and the inside of the hull generally cleaned of epoxy drips, the vessel is now ready for fitting of her twin Rolls Royce Viper 535 jet engines. May was spent building a gantry in David Aldred's driveway to lift the engines in and out of the hull and, in the first instance, to take measurements of one of the engines to design the cradles for mounting in the boat. Design is well under way.

Bird's-eye view of *Spirit of Australia 2* at speed on Talbingo Dam
(Photo from Warby Motorsport Facebook Page)

Dave Aldred with a Rolls Royce Viper 535 jet engine suspended on the gantry in his driveway
(Photo from Longbow website)

SailGP

Series 2

Australia won their home SailGP in Event 7 (of 8) of Series 2 in the F50 foiling catamarans on Sydney Harbour on 17–18 December 2021, with USA second and Spain third, putting Australia at the top of the point score table.

The fleet then moved to San Francisco for the series finals on 26–27 March 2022. Tom Slingsby and the Australia SailGP Team secured their second successive championship title with the defeat of Japan and the United States in the Season 2 Grand Final.

Series 3

Series 3 kicked off in Bermuda on 15–16 May, with Australia, Great Britain, Canada, Denmark, USA, New Zealand, Spain, France, and Switzerland all competing. After five fleet races and the grand final race, results were Australia 1, Great Britain 2, Canada 3.

Moving to Chicago, USA, for Event 2, the results were Australia 1, Canada 2, Great Britain 3.

Event 3 took place in Plymouth, UK, on 30 July–1 August, and the results were New Zealand 1, Australia 2, Denmark 3.

Subsequent events will be as follows:

Event 4	Copenhagen, Denmark	19–20 August 2022
Event 5	St Tropez, France	10–11 September 2022
Event 6	Andalucia, Spain	24–25 September 2022
Event 7	Dubai, UAE	12–13 Nov. 2022
Event 8	Singapore	14–15 January 2023
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 SailGP website at https://sailgp.com/general/sailgp-overview/.

Phil Helmore

The SailGP fleet in action in Sydney in December 2021.
(Photo Brett Costello for SailGP)

GENERAL NEWS

AUKUS Joint Steering Group Meetings

Australia, the United Kingdom, and the United States of America have established Steering Groups as part of the governance structure of the AUKUS partnership in September 2021. The following is a statement from the UK Ministry of Defence released on 31 July 2022.

Australia, the United Kingdom, and the United States of America recently held meetings of the AUKUS Joint Steering Groups, which were established as part of the governance structure of the AUKUS partnership in September 2021. The delegations discussed the intensive work under way and the progress that has been made since the announcement of AUKUS. Both meetings were held at the Pentagon, with additional sessions at the White House where the delegations met with National Security Advisor Jake Sullivan.

The Joint Steering Group for Australia's Nuclear-Powered Submarine Program met on 25–28 July 2022, continuing its progress on defining the optimal pathway to provide Australia with conventionally-armed, nuclear-powered submarines at the earliest possible date while ensuring the highest standards of nuclear stewardship, including the responsible planning, operation, application and management of nuclear material, technology and facilities.

The participants took stock of ongoing progress to deliver on our leaders' commitment to set the highest possible non-proliferation standards, including through continued close consultation with the International Atomic Energy Agency (IAEA). They welcomed the publication of the working paper on *Cooperation under the AUKUS Partnership* for the Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons. The paper details our proposal to provide complete power units to Australia, Australia's commitment that it will not conduct enrichment, reprocessing or fuel fabrication in connection with its nuclear-powered submarine program, and our engagement with the IAEA to find a suitable verification approach. They noted the introductory remarks of the IAEA Director General to the June Board of Governors in which he expressed "satisfaction with the engagement and transparency shown by the three countries thus far" and noted that he plans to present a report on AUKUS to the September Board.

The Joint Steering Group for Advanced Capabilities met on 28–29 July, reviewing progress across critical defence capabilities. The participants decided to bolster combined military capabilities, including by accelerating near-term capabilities in hypersonics and counter-hypersonics, as well as cyber. They also recommitted to deepening cooperation on information-sharing and other previously agreed working groups. As work progresses on these and other critical defence capabilities, we will seek opportunities to engage allies and close partners.

The Working Paper referred to above can be found at: https://www.state.gov/wp-content/uploads/2022/07/npt_conf.2020_wp.66_advance.pdf.

US Admiral to lead American AUKUS Effort

The admiral who oversees US attack submarine construction has been appointed to lead the Australia-United Kingdom-United States (AUKUS) partnership in the United States.

Rear Admiral David Goggins USN, who currently serves as the program executive officer for attack submarines, will report to the Assistant Secretary of the Navy for research, development and acquisition.

As the special assistant in support of AUKUS, RADM Goggins will lead the planning and stand-up of the US Navy's implementation of the approach selected by Australia after a consultation period, Secretary of the Navy Carlos Del Toro said.

"RADM Goggins' selection to lead AUKUS will further our efforts to strengthen our strategic partnerships with Australia and the United Kingdom," Del Toro said. "Dave comes to us at a critical time in the consultation period of AUKUS and is the right person to spearhead the analysis of the submarine development, production and testing efforts. Under his leadership, I'm confident that the AUKUS team will help meet the objective of determining the best path toward equipping the Royal Australian Navy with a nuclear-powered, conventionally-armed class of attack submarines by March 2023."

RADM Goggins previously served as the Virginia-class program manager. He oversaw the delivery of three submarines for the US Navy and started the design for the Block V Virginia Payload Module and Acoustic Superiority upgrades as part of the Virginia-class submarine construction program. He also previously worked on the Columbia-class ballistic-missile submarine as the program manager.

RADM David Goggins USN
(US Navy photograph)

Multiple Contract Awards for Austal

In June Austal provided information about a number of contracts that the company has secured which help to diversify the company's long-term revenue base while utilising its shipbuilding and support expertise.

Austal has recently been awarded contracts to:

- Sustain two Cape-class patrol boats which Austal built for the Government of the Republic of Trinidad and Tobago (Trinidad and Tobago Coast Guard), in country.
- Construct an additional two Evolved Cape-class patrol boats for the RAN, announced by the Australian Government in April 2022.
- Undertake the detailed design and construction of the United States Navy's new Auxiliary Floating Dry Dock Medium (AFDM).

Combined, the awarded contracts are worth more than $A300 million.

Austal's Chief Executive Officer, Paddy Gregg, said "The new contracts are a great demonstration of Austal's capability to take on multiple projects across diverse naval shipbuilding and support programs, in Australia and overseas".

"The Trinidad and Tobago support contract is another example of Austal constructing and then maintaining patrol vessels to ensure that they can operate safely and efficiently over extended durations, while providing important longer-term revenue to Austal."

"The two additional Evolved Cape-class patrol boats announced by the Australian Government have now been officially ordered, bringing the total number of vessels to be constructed to eight, demonstrating great confidence in the vessel by the RAN, who are already operating three of the patrol boats throughout Northern Australia."

"The competitively-awarded, $US128 million contract for the Floating Dry Dock is Austal USA's second steel vessel program for the US Navy and clearly demonstrates the US Navy's confidence in the Mobile, Alabama, shipyard's growing capability to deliver aluminium and steel vessels."

Support Contract for two Cape-class Patrol Boats

Austal has secured a two-year contract to sustain the two Cape-class Patrol Boats which the company constructed in Australia for the Trinidad and Tobago Coast Guard.

Austal will provide in-country support to the Trinidad and Tobago Coast Guard for the two Cape-class patrol boats, designed and constructed by Austal Australia and delivered in 2021, for an initial two year period
(Photo courtesy Trinidad and Tobago Coast Guard)

The two 58 m vessels, TTS *Port of Spain* (CG41) and TTS *Scarborough* (CG42), will be sustained by Austal in-country, through to at least 2024.

"We have been very clear that we want to grow Austal's support business, and this is a perfect example of how Austal can support vessels constructed so that, not only do the vessels continue to perform optimally for our clients, but also create a recurring revenue stream post-construction," Mr Gregg said.

Additional Patrol Boats for the RAN

Austal Australia was awarded a $324 million contract to construct six 58 m Evolved-cape-class patrol boats for the Royal Australian Navy in May 2020 and has already delivered one vessel, ADV *Cape Otway*, in March 2022.

The additional two ECCPBs, announced by the Australian Government on 18 April 2022 and valued at $110 million (to be adjusted for relevant inflation impacts), bring the total number of vessels to be delivered to eight and extend production at the shipyard through to 2024.

ADV *Cape Otway*
Austal Australia will construct an additional two Evolved Cape-class patrol boats for the Royal Australian Navy, bringing the total number of ships to be delivered to eight.
(Photo courtesy Austal)

US Navy Programs

Austal USA has commenced construction of two Navajo-class towing and salvage (T-ATS) vessels for the US Navy, marking the commencement of steel shipbuilding at the company's facility in Mobile, Alabama. Officially opened last month, the $US100 million facility was funded 50:50 by Austal and the United States Government.

The T-ATS program is a $US145 million contract to build two ocean-going tug, salvage, and rescue capabilities to support US fleet operations, and will be a multi-mission common-hull vessel capable of towing heavy ships. These ships will be able to support current missions, including oil spill response, humanitarian assistance, and wide area search and surveillance.

The United States Navy's new Auxiliary Floating Dock Medium (AFDM) will also be constructed at Austal USA's steel manufacturing facility in Mobile, Alabama. The Rennie-type floating dock will incorporate features to improve operability and maintainability, based on Austal USA's experience from owning, operating and maintaining a similar dry dock at its repair facility in Mobile. With a lifting capacity of over 18 000 t, length overall of 211 m and working area of nearly 8500 m^2, the dry dock will have the capability to service large vessels such as littoral combat ships (LCS), guided-missile destroyers (DDG), guided-missile cruisers (CG) and landing ship docks (LSD).

Austal USA Awarded Contract Option for two Additional Towing, Salvage And Rescue Ships for the USN

On 25 July 22 Austal announced that Austal USA has been awarded a $US156 171 650 (about $A225.5 million) fixed-price incentive contract option from the USN for the construction of two Navajo-class Towing, Salvage, and Rescue Ships (T-ATS 13 and 14).

With the award, the company is now under contract for four T-ATS, having received awards for T-ATS 11 and 12 in October 2021.

Construction on T-ATS 13 and 14 will commence in the second half of calendar year 2023 and first half of 2024; with delivery planned for the second half of 2025 and first half of 2026, respectively.

Austal USA commenced construction of T-ATS 11 in July
(Photo courtesy Austal)

Austal USA Awarded Contract for up to 11 United States Coast Guard Offshore Patrol Cutters

On 1 July 2022 Austal announced that Austal USA has been awarded a contract with a potential value of $US3.3 billion (about $A4.35 billion), for the detailed design and construction of up to 11 Offshore Patrol Cutters (OPC) for the United States Coast Guard (USCG).

The first vessel has been contracted by the US Coast Guard, with options for a further 10 vessels. Construction is expected to commence in 2023.

Construction of the 110 m OPCs will take place at Austal USA's new $US100 million steel shipbuilding facility in Mobile, Alabama.

The US Coast Guard's 110 m OPCs provide a capability bridge between the service's National Security Cutters, which operate in the open ocean, and the smaller, fast-response cutters which operate closer to shore. The new OPCs are capable of conducting a variety of missions including law enforcement, drug and migrant interdiction, and search-and-rescue operations.

With a range of 10 200 n miles at 14 kn and a 60 day endurance period, each OPC will be capable of deploying independently, or as part of task groups, and serving as a mobile command-and-control platform for surge operations such as hurricane response, mass migration incidents and other emergency events. The cutters will also support Arctic objectives by helping regulate and protect emerging commerce and energy exploration in Alaska.

The Austal contract has been challenged by unsuccessful competitor Eastern Shipbuilding Group which is building the first four of the OPCs.

Austal USA will build up to eleven 110 m Offshore Patrol Cutters for the United States Coast Guard
(Image US Coast Guard)

The future USS *Augusta* was launched by Austal USA on 23 May 2022
(Photo courtesy Austal USA)

Austal USA LCS Progress

On 22 July Austal USA delivered the future USS *Santa Barbara* (LCS 32) to the United States Navy.

Santa Barbara is the 16th Independence-variant Littoral Combat Ship (LCS) to be constructed by Austal USA in Mobile, Alabama.

Austal Limited Chief Executive Officer, Paddy Gregg, said the delivery of *Santa Barbara* demonstrated Austal USA's capability to maintain the delivery schedule of multiple naval vessel programs, while expanding shipbuilding capacity.

"Austal USA has continued delivering both the LCS and EPF (Expeditionary Fast Transport) programs for the US Navy while also establishing, opening, and now operating, a new steel shipbuilding facility, which is a credit to the entire team," Mr Gregg said

Austal USA is currently constructing three 127 m LCS, including the recently-launched future USS *Augusta* (LCS 34). Final assembly is underway on the future USS *Kingsville* (LCS 36) and modules are under construction for the future USS *Pierre* (LCS 38).

Austal USA has delivered LCS 32, the future USS *Santa Barbara* to the United States Navy
(Photo courtesy Austal USA)

Austal Delivers *Cape Peron* to the RAN

Austal Australia has delivered the second of eight Evolved Cape-class patrol boats to the Royal Australian Navy. The vessel, ADV *Cape Peron*, was officially accepted by the Commonwealth of Australia on 4 August.

Austal's Chief Executive Officer, Paddy Gregg, said that the delivery of the second Evolved Cape-class patrol boat highlights the critical importance of the vessel to the Royal Australian Navy, and Australia's national naval shipbuilding enterprise.

"The Evolved Cape-class patrol boats are not only enhancing the Royal Australian Navy's capability, but further strengthening Australia's sovereign shipbuilding capability, which is more important than ever before," Mr Gregg said.

"Austal continues to engage over 300 defence industry partners across Australia to construct the Evolved Cape-class patrol boats. We're part of the national naval shipbuilding enterprise which is delivering enhanced capability for the Navy, protecting Australia's borders, and maintaining security in our region.

"It's a great source of pride for the entire Austal team knowing that we're equipping our Navy, and our nation, with the best possible patrol boat capability. Our congratulations and thanks go to the Navy, the Commonwealth, and our industry partners on this latest delivery."

The 58 m aluminium monohull patrol boat is the second of eight to be delivered to the Royal Australian Navy. The first Evolved Cape-class patrol boat, ADV *Cape Otway*, was delivered in March 2022, following approximately 18 months construction. The six remaining vessels are in various stages of production at Austal's Henderson shipyard and deliveries are scheduled progressively through to 2024.

With greater capability than the benchmark Cape-class patrol boats, 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 Royal Australian Navy's capabilities.

The Evolved Cape-class patrol boat project (SEA1445-1) is employing approximately 400 people directly in Western Australia and engaging more than 300 supply-chain partners across Australia.

Austal Australia has delivered the second Evolved Cape-class patrol boat, ADV *Cape Peron* (315) to the RAN
(Photo courtesy Austal)

Austal Delivers 15th Guardian-class Patrol Boat

On 27 May Austal Australia delivered the 15th Guardian-class patrol boat to the Australian Department of Defence. The vessel, *Te Kukupa II*, was then presented by the Australian Government to the Cook Islands at a certificate signing ceremony held that day at Austal's shipyard in Henderson, WA.

The ceremony was attended by Commodore Ivan Ingham AM RAN, Senior ADF Officer Western Australia, with the Cook Islands being represented by Tepaki Baxter, Commanding Officer of *Te Kukupa II*.

The new Guardian-class patrol boat replaces the original *Te Kukupa*, a recently-decommissioned Pacific-class patrol boat given to the Cook Islands in 1989 under the Pacific Patrol Boat Replacement Project, part of the Australian Government's Pacific Maritime Security Program.

Austal's Chief Executive Officer, Paddy Gregg, said that the new vessel was the second of five Guardian-class patrol boats to be delivered to the Commonwealth of Australia in 2022.

Commanding Officer of *Te Kukupa II*, Tepaki Baxter (left) and CDRE Ivan Ingham AM, RAN, Senior ADF Officer Western Australia at the certificate signing and presentation of the Guardian-class patrol boat to the Cook Islands
(Photo courtesy Austal)

"We are well on track to deliver five 40 m Guardians this calendar year — an outstanding achievement and a great demonstration of our collective industry and the team's capability and productivity in steel shipbuilding," Mr Gregg said.

"The Pacific Patrol Boat Replacement Project engages more than 300 suppliers from around Australia. Each one is helping to form the National Naval Shipbuilding Enterprise which is delivering sovereign capability for Australia.

"Our warmest congratulations go to the Cook Islands Police Maritime Wing and we wish 'fair winds and following seas' to the Commanding Officer of *Te Kukupa II*, Tepaki Baxter and his crew."

The Pacific Patrol Boat Replacement Project was awarded to Austal Australia in May 2016, with an additional contract option awarded in April 2018, taking the program to 21 vessels, valued at more than $335 million. Twelve Pacific Island nations including Papua New Guinea, Fiji, the Federated States of Micronesia, Tonga, Solomon Islands, Cook Islands, Kiribati, Marshall Islands, Palau, Samoa, Tuvalu, Vanuatu and Timor-Leste will receive the vessels through to 2023.

The Pacific Patrol Boat Replacement Project supports more than 200 direct jobs at Austal Australia and more than 200 indirect jobs nationally through Australian businesses contracted by Austal.

Austal Australia's expanded service centre in Cairns, incorporating a 1200 t (80 m LOA) slipway and a 1120 t mobile boat hoist, continues to provide in-service support to the growing Guardian-class patrol boat fleet with more than 100 people now employed in a variety of engineering and sustainment roles in the Far North Queensland city.

The Chief of the Timor-Leste Defence Force, LTGEN Falur Rate Laek, during a visit on 3 August to Austal's Pacific Patrol Boat Replacement Production Facility in Naval Base, WA ,for laying the keel of first of two Guardian-class patrol boats for Timor-Leste, the future NRDTL *Aitana*
(Photo courtesy Austal)

Work Starts on 6th OPV

Luerssen Australia, a subsidiary of Naval Vessels Lürssen (NVL Group), has started construction of the Royal Australian Navy's sixth Arafura-class offshore patrol vessel (OPV).

The first steel has been cut in Henderson, WA, for the OPV which will become HMAS *Carpentaria*.

Luerssen Australia's Chief Executive Officer, Jens Nielsen, said that this represented another significant achievement in the program.

"It is a testament to the efforts of everyone involved in the program that construction is underway on vessel number six, as we continue to work on five other vessels across two sites in Osborne and Henderson." he added.

Luerssen Australia now has six vessels under construction in South Australia and Western Australia.

The Arafura-class will replace the Armidale-class and Cape-class patrol boats, Huon-class coastal minehunters and Leeuwin-class survey ships and will primarily be used for constabulary missions, maritime patrol and response duties.

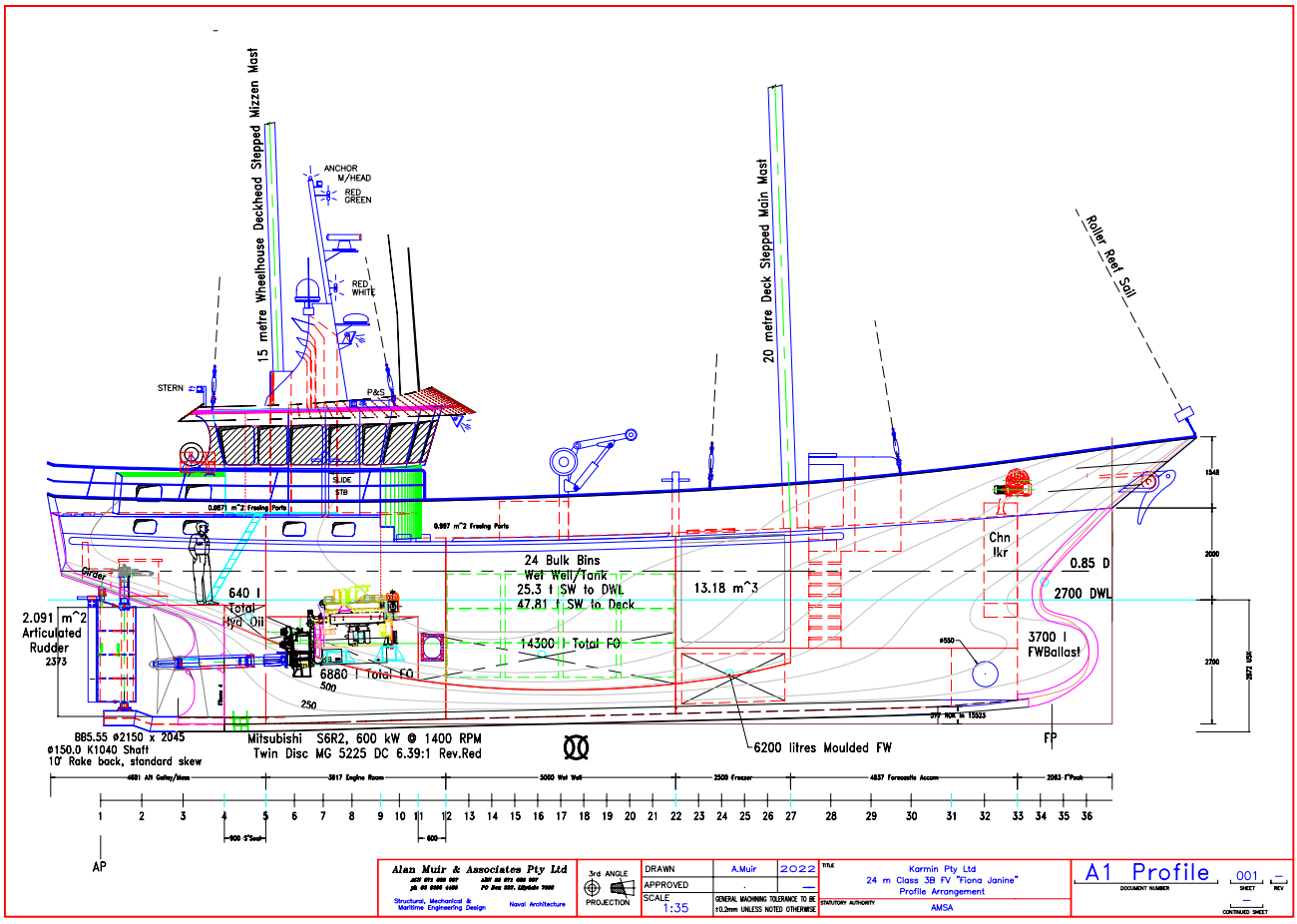
24 m Trawler from Tasmania

Under construction in Riverside, northern Tasmania, is a modern trawler designed for service in Tasmanian waters designed by Alan Muir & Associates. With a displacement of 139 t, *Fiona Janine* is 24 m long with a beam of 4.1 m and a depth of 2.87 m. Provided with a wet well of 25 t capacity, she will carry 18 t diesel fuel and 10 t of fresh water. Power is provided by a Mitsubishi S6R2 diesel delivering 600 kW at 1400 rpm through a Twin Disc MG5225 DC 6.39:1 gearbox to a Mikado five blade propeller of 2150 mm diameter and 2045 mm pitch. She will also be sail assisted.

Fiona Janine is constructed of steel with 6 mm stainless steel topsides. She is scheduled to be launched next February.

Fiona Janine under construction
(Photo courtesy Alan Muir)

The propeller and rudder of *Fiona Janine*
(Photo courtesy Alan Muir)



Profile of *Fiona Janine*
(Drawing courtesy Alan Muir)

The ship's company of HMAS *Ararat* line the upper decks during her decommisioning ceremony conducted alongside HMAS *Coonawarra*, in Darwin on 2 July 2022. The Armidale-class patrol boats are being replaced by the Evolved Cape-class patrol boats and, in due course, the Arafura-class offshore patrol vessels
(RAN photograph)

The Director General Naval Construction Branch, Commodore Steven Tiffen RAN, speaks to (from left) Premier of South Australia, the Hon. Peter Malinauskas MP; Deputy Prime Minister and Minister for Defence, the Hon. Richard Marles MP and Minister for Health and Aged Care, the Hon. Mark Butler MP, during their visit to the Osborne Naval Shipyard on 6 July 2022.
The second OPV, NUSHIP *Eyre*, is in the background
(RAN photograph)

27 m Crew Transfer Vessel from Incat Crowther

Incat Crowther has announced a new 27 m crew transfer vessel (CTV) for Patriot Offshore Maritime Services, to service Massachusetts' Vineyard Wind project. This US-built and operated CTV will bring together Incat Crowther's breadth of experience in designing vessels for offshore wind-farm operators around the world, combined with its extensive knowledge of US shipbuilding standards, regulations, and supply chain.

To be constructed at Gladding-Hearn Shipbuilding in Somerset, Massachusetts, the vessel is the latest chapter in a long and storied relationship between designer and builder which includes 43 vessels built together since 1987. Whilst outwardly similar to Incat Crowther's series of recently-delivered 27 m CTVs which are operating in Europe, the vessel is in fact a new design, tailor-made for American preferences, materials and requirements.

The vessel features a large working deck and cargo zone, having ample room for both 10 ft and 20 ft containers, as well as a moon pool, whilst the aft deck also adds flexibility with additional cargo capacity.

The main deck cabin has spacious facilities, including a saloon for 24 personnel, complete with pantry, lockers, showers and toilets, and crew accommodation. The elevated wheelhouse provides excellent visibility, allowing safe and effective operation, especially when approaching and docking at turbine boat landings.

27 m crew transfer vessel for Patriot Offshore Maritime Services (Image courtesy Incat Crowther)

The vessel is designed to maximise performance efficiency and operation. With a maximum deadweight capacity of 50 t and a foredeck area of 80 m^2, the vessel is designed with functionality and versatility in mind. Incat Crowther's Resilient Bow Technology fender system will be fitted for minimising impact loads on the boat landing and vessel's structure whilst maximising the vessel's wave-height transfer capability.

Main propulsion will be provided by four Scania DI16 082M diesel engines each rated at 588 kW at 2100 rpm coupled to Hamilton HM521 waterjets.

Incat Crowther has been able to seamlessly transfer the knowledge gained from designing CTVs for Europe and Asia, and apply this experience to custom designs for the US market. "This vessel is another demonstration of Incat Crowther's unique position of having well-established

offices in both the US and Europe with experience in the design of successful vessels for service in offshore energy", says Ed Dudson of Incat Crowther's UK-based office. Grant Pecoraro of Incat Crowther US-based office added "Incat Crowther is thrilled to have the opportunity to once again work with the team at Gladding Hearn. We have been preparing for this exciting new horizon in the US offshore wind market for several years and we are pleased to offer our proven capabilities to Patriot Offshore Maritime Services and Vineyard Wind."

The new vessel will be completed in mid-2023.

15 m Hybrid Catamaran Research Vessel from Incat Crowther

Incat Crowther has announced that construction has commenced at Snow & Company in Seattle, USA, on a 15 m hybrid catamaran research vessel for operation by the Pacific Northwest National Laboratory. The vessel demonstrates Incat Crowther and Snow & Co.'s expertise in designing and building low-emissions vessels which deliver practical solutions for their scientific mission requirements. Incat Crowther and Snow & Co. are proud to support PNNL's vision to secure a cleaner, safer future.

Incat Crowther has developed a bespoke design which offers exceptional capability for its size. The vessel's 28 m^2 main deck is equipped with an A-frame, boom crane and movable davit in addition to access to a foldable swim platform, extracting maximum functionality from the space. A set of stairs offers direct access from the main deck to the upper deck and flybridge, which affords excellent all-round visibility. The vessel can support the research of six scientists in a tailored layout containing multiple research workstations and convertible sleeping arrangements, providing PNNL with a capable platform to efficiently carry out their research.

The vessel will be powered by an advanced parallel hybrid-electric propulsion system, consisting of two Volvo Penta D8-510 main engines, capable of producing 374 kW each, supplemented by two Danfoss Editron EM-PMI375-T200-2600 motor-generators. Power is stored using a state-of-the-art Spear Trident battery system, allowing the vessel to operate quietly in a zero-emission electric state while engaged in a mixture of survey operational modes.

With this vessel, PNNL joins a growing list of operators taking advantage of Incat Crowther's history of innovation in hybrid and low-emissions technologies. Our partnership with Snow & Co. and PNNL enhances the research capability of the Pacific Northwest National Laboratory.

Port bow of 15 m hybrid research vessel for Pacific Northwest (Image courtesy Incat Crowther)

Port quarter of 15 m hybrid research vessel for Pacific Northwest (Image courtesy Incat Crowther)

Principal particulars of the new vessel are

Length OA		15.24 m
Length WL		15.15 m
Beam OA		4.86 m
Depth		2.30 m
Draft	(hull)	0.85 m
	(propellers)	1.15 m
Crew		2
Scientific Staff		6
Fuel oil		2300 L
Fresh water		300 L
Sullage		300 L
Main engines		2×Volvo Penta D8-510 each 374 kW @ 2850 RPM
Gearboxes		2×Twin Disc MGX-5075 SC
Motors/Generators		2×Danfoss EM-PMI375-T200-2600
Propulsion		2×propellers
Batteries		Spear Trident 113 kWh
Speed	(service)	20 kn
	(maximum)	29 kn
Range		400 n miles
Construction		Marine-grade aluminium

Maggie Cat from Incat Crowther

Incat Crowther has announced the launch of *Maggie Cat*, an Incat Crowther 31 which will partner *Coolgaree Cat* in a refreshed Sealink line-up operating out of Townsville. *Coolgaree Cat* entered service in late 2020 and operates between Townsville and Palm Island. *Maggie Cat* will operate as SeaLink's flagship to Magnetic Island.

Both vessels were developed in close collaboration with Sealink, with a goal of through-life efficiency, durability and robustness in the open waters off Townsville. With Incat Crowther's efficiency gains, *Maggie Cat*'s fuel burn is the same as the vessel it replaces, despite being a more sea-capable vessel with increased amenities, including an extra sun deck and a higher passenger capacity.

Maggie Cat features a narrower overall beam than *Coolgaree Cat* and, whilst the vessels are interchangeable, *Maggie Cat* is configured for the shorter, more-frequent Magnetic Island service.

Boarding is via a port side midship boarding door and upper aft boarding gates. The main deck features 186 seats in a mix of booth and forward-facing, with deep windows giving

Starboard quarter of *Maggie Cat*
(Photo courtesy Incat Crowther)

the cabin a light and airy feel. There is a large kiosk aft, in addition to multiple storage areas.

The upper deck seats 64 inside the cabin and 26 exterior seats are available on the upper aft deck. A large portion of the aft deck is dedicated to containerised freight stowage, with space for 9 luggage trolleys. The coamings of this deck have been reinforced to cope with the impact of the trolleys, whilst loading gates are specifically located to work with existing infrastructure.

An additional feature of *Maggie Cat* is its sun deck with 48 seats and 360-degree visibility. This feature is a real draw card for tourists visiting the island and a great platform for whale watching, as is the expansive foredeck.

The vessel is fitted with twin Caterpillar C32 engines, delivering 895 kW each. Propulsion is via fixed-pitch Veem Interceptor propellers. In recent sea trials, Maggie Cat exceeded 31 knots. She has a fuel-efficient fully-loaded operational speed of 25 kn at low main engine MCR, offering increased time between main engine overhauls.

Brisbane-based shipbuilders Commercial Marine Australia executed an exceptional build quality, supported by MET Services and Ultimate Marine Power. CMA and Incat Crowther's partnership and thoughtful innovation in delivering *Maggie Cat* has surpassed the client's expectations and is now having a real impact within the North Queensland fleet, becoming a firm favourite with crew and passengers.

Incat Crowther has a long-standing relationship with Sealink, earning the company's trust through proven well-considered and innovative vessel designs operating within the Sealink fleet.

Wheelhouse on *Maggie Cat*
(Photo courtesy Incat Crowther)

Starboard bow of *Maggie Cat*
(Photo courtesy Incat Crowther)

With *Coolgaree* Cat and *Maggie Cat*, Incat Crowther has provided long-term customer-centric value focused on efficiency, robustness, and passenger amenity.

Principal particulars of *Maggie Cat* are

Length OA		30.8 m
Length WL		30.3 m
Beam OA		8.5 m
Depth		2.8 m
Draft	(hull)	1.3 m
	(propellers)	2.1 m
Passengers		340
Crew		4
Fuel oil		4800 L
Fresh water		1700 L
Sullage		1500 L
Main engines		2×Caterpillar C32 each 895 kW @ 2000 rpm
Propulsion		2×propellers
Generators		2×Caterpillar C4.4
Speed	(service)	25 kn
	(maximum)	31 kn
Construction		Marine-grade aluminium
Flag		Australia
Class/Survey		NSCV Class 1C/1D

Chai Jinda from Incat Crowther

Incat Crowther has announced the successful launch and entry into service of the Incat Crowther 42 *Chai Jinda*. Built by Seacrest Marine in Muang Samutprakarn, Thailand, this monohull patrol boat has been developed in response to a strict set of mission requirements for use in patrol, rescue, and enforcement activities.

The eighth vessel built by Seacrest Marine Thailand (www.seacrest.co.th) from an Incat Crowther design, *Chai Jinda* accommodates 16 crew and 6 officers below deck with fourteen-day autonomy and an operational range of over 1000 nautical miles.

Chai *Jinda* is powered by three MTU 16V2000 M86 main engines, each providing 1630 kW @ 2450 rpm. These drive fixed-pitch propellers via ZF 3060 gearboxes, providing the vessel with an enforcement speed of 35 kn and a long-range patrol speed of 20 kn. The propellers are housed in Incat Crowther's highly-efficient propeller tunnels, reducing the vessel's draft.

Chai Jinda has a highly functional layout. The main deck features crew and officer messes, galley and stores, laundry, captain's cabin and arms stores, complete with a full walk-around deck. The aft deck features a deck crane and a fast rescue vessel for at-sea boarding activities. The foredeck features foundations for a remotely-operated 30 mm gun.

The upper deck houses a radio room and ship's office. A fire-fighting monitor and foundations for deck-mounted weapons are located around the exterior decks.

Chai Jinda showcases Incat Crowther's proven expertise in delivering tailor-made solutions for specific operational requirements.

Stewart Marler

Port quarter of *Chai Jinda*
(Photo courtesy Incat Crowther)

Port bow of *Chai Jinda*
(Photo courtesy Incat Crowther)

Nuclear Propulsion is a Game Changer: What are the New Rules?

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The AUKUS Trilateral Security Pact [1] was announced by the Prime Minister of Australia, the Prime Minister of the United Kingdom and the President of the United States of America on 15 September 2021. The first initiative under AUKUS is a commitment to a shared ambition to support Australia in acquiring nuclear-powered submarines for the Royal Australian Navy [1]. Under AUKUS, the three nations will focus immediately on identifying the optimal pathway to deliver at least eight nuclear-powered submarines for Australia [2].

A critical piece of early work is to examine the full suite of requirements that underpin nuclear stewardship and demonstrate a clear pathway to becoming a responsible and reliable steward of this sensitive technology. Australia has established a Nuclear-Powered Submarine Taskforce in the Department of Defence to lead this work [2].

At present, there is no nuclear component within Australia's armed forces. Australian civil nuclear reactor experience is limited to the operation of a 20 MW thermal research reactor (which is predominantly used to generate neutrons for radioisotope creation or materials research and analysis [3]).

This means that there is a clear difference between the nature and scale of operational nuclear reactor experience in Australia, and what is now proposed to occur under the nuclear submarine program. This difference is important and needs to be treated as such. This paper examines the difference and proposes that the embedding of an effective nuclear safety culture into all the relevant Australian organisations is an important step in the process of demonstrating responsible stewardship, that is best taken now.

I firstly review the current constraints under which nuclear vessels are hosted. I then describe and emphasise the change in risk vectors when considering a mobile nuclear power plant. Finally the paper examines the definitions of "nuclear safety culture", and explores what effective nuclear safety culture really means, what it looks like, as well as why now is the best time to focus on it.

The Difference between Hosting Visitation, and Operating Nuclear-powered Fleets

Australia has hosted nuclear-powered warships (NPW) from friendly nations, on both the east and west coasts (specifically, the berths at Brisbane and HMAS *Stirling* were visited nine times between 2017 and 2020 inclusive [4] [5] [6]). However, this is in no way equivalent to the challenges of operating nuclear-powered fleets.

These previous visits by NPWs have all been authorised under the guidance in OPSMAN1[1] [7]. This document lays out rigorous and explicit conditions on the entry of UK, US and French vessels, including liability considerations and assurance around the ability to remove the vessel (under its own or tug power) away from the port in the event of an accident. Specifically, the conditions of entry are [8]:

(a) Visits will be for purposes such as crew rest and recreation, and not for fuel handling or repairs to reactor plant (necessitating breach of reactor containment).

(b) Visits will be subject to satisfactory arrangements concerning liability and indemnity, and to provision of assurances relating to the operation and safety of the warships while they are in Australian waters.

(c) Movement of vessels must take place during daylight hours under conditions where visibility is not less than three-quarters of a nautical mile.

(d) Navigational controls on other shipping will be applied during the time that nuclear powered ships are entering or leaving port.

(e) There must be a capability to remove the vessel, either under its own power or under tow, to a designated safe anchorage or a designated distance to sea, as soon as possible within the time frame specified for the particular berth or anchorage, and in any case within 24 hours, if an incident should occur.

(f) An operating safety organisation, competent to conduct a suitable radiation-monitoring program and able to initiate actions and provide services necessary to safeguard the public in the event of a release of radioactivity following an accident, must exist in the port being visited.

The assessment completed for entry of foreign NPWs to a suitably authorised Australian port is based around a nuclear reference accident [8] which predicts the radiological consequences from a worst-case accident on board a nuclear-powered warship. However, a caveat of this reference accident, based on the forbidding of any fuel handling or reactor repairs, is the assumption that both the primary and secondary reactor containment are intact. This restriction significantly reduces the consequences, and the complexity, of the assessment.

These restrictions, around both the reference accident and the entry conditions, would be neither feasible nor desirable for a fleet of Commonwealth-owned and -operated vessels. It would preclude the ability to do any significant reactor servicing or maintenance operations. In addition, the ownership of the vessel by the Commonwealth would also mean that significant non-nuclear servicing and operational activities could be taking place at the berth in the direct vicinity the vessel. Any such activity would then need to be viewed in light of the presence of the NPW, due to the added risk of operations affecting containment and/or nuclear risk (e.g. risk of impact from falling objects in the vicinity, even if those are separately assured for workplace safety). This is a significant change in mindset for all working on this site, but one that is key to effective nuclear stewardship by the Royal Australian Navy. There is evidently a gap in where Australia is compared with where it needs to be.

Nuclear stewardship on this scale, where all activities in the dockyard must be considered for nuclear risk, will require more than simply the development of advanced nuclear-related technical and engineering capability and capacity.

1 OPSMAN1 is the formal guidance document on how visits to Australian ports of foreign nuclear-powered warships must be assessed for approval.

It will demand the development and broad uptake of an effective nuclear safety culture, beyond that which already exists in Australia.

A different approach to safety and risk management will be required for hosting our own nuclear-powered submarines — one that is both more in-depth whilst also being more manageable for routine activities. At the time of writing, significant details around how the fleet will be built, accepted, and operated are not published. That said, there are still some things which can be discussed as to how this approach will need to be driven to ensure maximum benefit to the Commonwealth whilst also continuing to ensure that the exemplary nuclear safety record demonstrated by both the US and UK fleets is upheld with Australia's new membership of this important strategic alliance.

How does Nuclear Safety Differ from Normal Safety?

The Australian Department of Defence (DoD), including the Royal Australian Navy (RAN), has in place tried-and-tested systems, processes, and controls to ensure that the vehicles and equipment which it operates do not cause unwanted harm to either its personnel or the wider public, whilst also ensuring that the effectiveness of their assets is not unduly constrained. These systems and processes form an excellent base on which to build. However, several hazards associated with nuclear power manifest differently to those from more conventional equipment.

As a hazard, radioactivity is not axiomatically worse or more dangerous than other industrial hazards. However, it does have unique and challenging attributes. It is invisible, transmissible over considerable distance, not signalled through other senses such as smell or sound, deadly in very large doses, and presents a stochastic risk of serious future illness in lower doses. While readily detectable, the sources of hazard are also frequently long-lasting, meaning the impacts of the worst incidents are both acute and then chronic. Collectively, these attributes naturally evoke a primal reaction of fear among many people. In risk communication terms, it evokes a sense of "dread" [9].

Due to the non-local and long-lasting impacts which can potentially occur if highly-radioactive material is allowed to spread to the environment, assessment of nuclear risks do not just limit themselves to the dangers within and around the nuclear power system, but stretch to other aspects as well, such as lifting activities in the area, or other nearby sources of risk to the containment boundaries that are in place to mitigate the danger from radioactive contamination. Nuclear power is also unlike other thermal power sources (e.g. coal/gas) as heat continues to be generated (initially ~6-8% of full power, falling to ~1-2% after ~1 hour) for an extended period after operation, sufficient heat to seriously damage the reactor core and create additional risks if it is not managed. Nuclear safety for a power reactor is therefore not just concerned with what happens in the reactor during operation. It stretches to the surrounding infrastructure and hazards, and hazard management must continue long after the reactor itself is not actually operating. If cooling is lost, then as demonstrated by events at the Fukushima Daiichi nuclear power station, irrecoverable damage can occur to the reactor, leading to possible loss of containment and the risk of radiation contamination over a large area. Management of this is not just a safety consideration but clear communication around the risk and management thereof is essential in ensuring the effective management of public opinion which could otherwise be set against the Commonwealth and lead to considerable difficulties. This topic of public communication is worthy of further expansion, but is outside the scope of this paper.

The corollary of these unique hazards and operational challenges is that the global nuclear energy industry has developed a justifiably good reputation amongst safety professionals for the way in which the risks are managed, resulting in it being one of the safest producers of large-scale electricity, normalised for production (see Figure 1). There is already good Australian expertise around managing safety in a nuclear environment within the respected guidelines laid down by the IAEA. However this expertise is narrowly held, consistent with our limited sector.

Having established why nuclear safety is important, we can now move on to the role of nuclear safety culture within that picture. This starts with a discussion of what nuclear safety culture is and then expands into what it looks like when applied well, and how that culture benefits the organisation.

What is Nuclear Safety Culture, and How did it Arise?

The implementation and development of strong nuclear safety and security culture[2] will provide enhanced consistency, accountability, reliability, security and, most obviously, safety for crew, employees, and the broader public. This approach, combined with effective and transparent communication on how the risks are both well understood and well managed, will also raise the prospect of broad social acceptance.

According to the International Atomic Energy Agency (IAEA), "Establishing a strong safety and security culture is one of the fundamental management principles for an organisation dealing with radioactive material. Such a culture influences the organisation's structure and style, as well as the attitudes, approaches and commitment of individuals at all levels in the organisation" [11]. In other words, a safety culture is not just a series of regulations but is in fact a mindset which affects not just what you do, but also how you even approach it.

The term "safety culture" was first widely introduced to the nuclear industry by the International Nuclear Safety Advisory Group (INSAG), reporting to the International Atomic Energy Agency. This was following their investigation into the 1986 Chernobyl nuclear disaster [12]. The report concluded that faults existed in safety culture within the safety management systems [13]. This conclusion was similar to that of a report commissioned by the US President on the earlier 1979 Three Mile Island (TMI) incident [14]. This report concluded that the accident was a result of "a series of human, institutional, and mechanical failures". The report notes that "the major factor which turned this incident into a serious accident was inappropriate operator action",

2 It is worth noting that the safety and security aspects of nuclear safety should both be covered within a strong safety culture. For ease of discussion, nuclear safety, and nuclear safety culture, should (nearly) always be assumed to include nuclear security, as the two are so intricately tied.

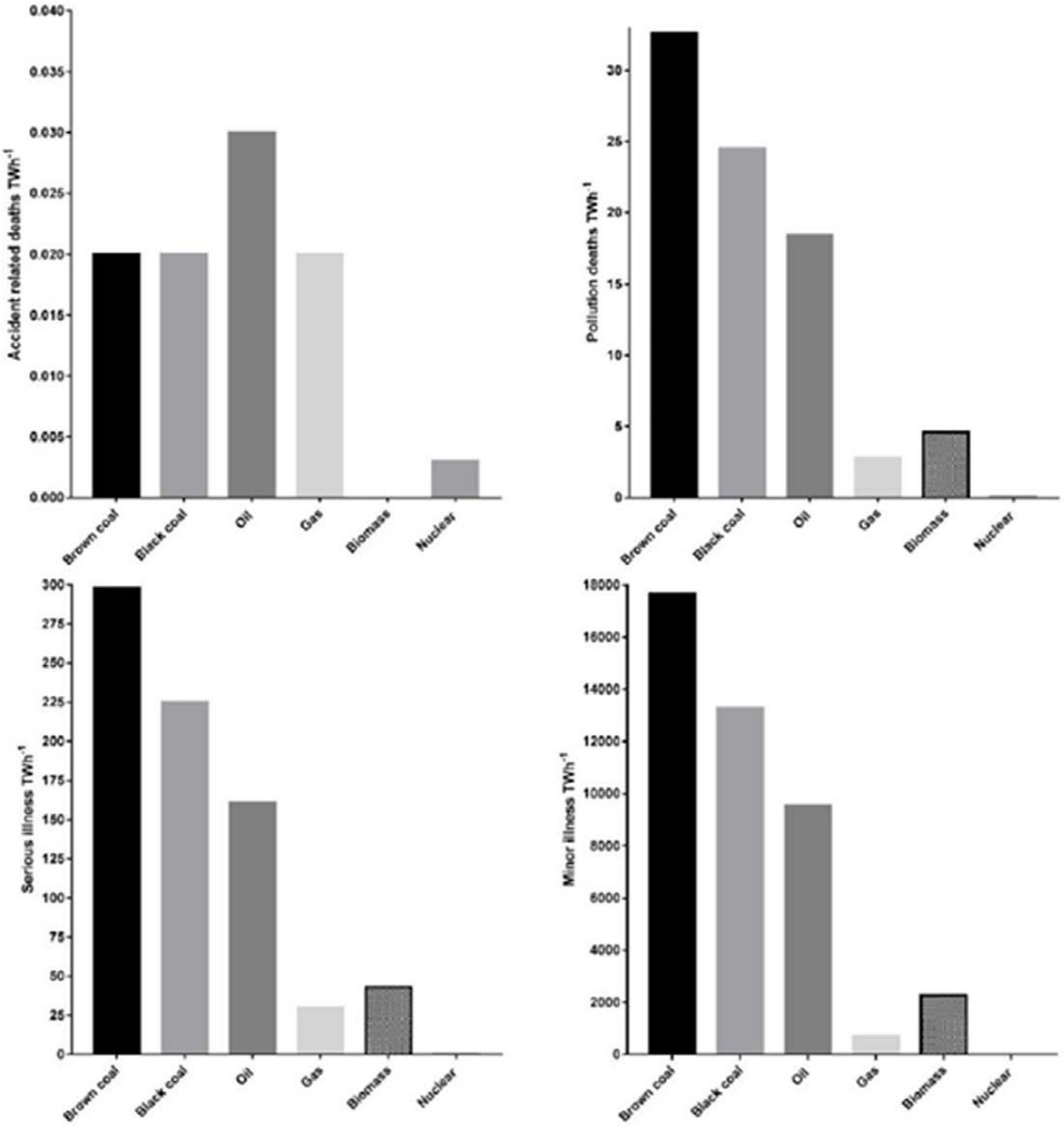


Figure 1 Comparison of mortality and morbidity, normalised to units TW/h, between brown coal, black coal, oil, gas and nuclear power [10].

and that this was not the fault of the operator but, instead, the result of insufficient training, lack of communication (or action on known issues), and failure to learn the lessons of previous incidents. These attributes will be seen again, in reverse, when we discuss the traits of an effective nuclear safety culture.

Since the INSAG report, the term "safety culture" has been adopted across the industry. A widely-used definition comes from the UK's Advisory Committee on the Safety of Nuclear Installations (ACSNI). ACSNI defined the nuclear safety culture of an organisation as "the product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management" [15]. Using this definition, safety culture is not directly linked to the quality of safety management systems within an organisation, instead it is dependent on how the individuals within an organisation behave.

Whilst Australia clearly has, within the Defence industry, a well-developed safety culture, this is not a nuclear safety culture[3]. This difference is important, as within a nuclear safety culture, the importance of appropriate nuclear training is widely agreed as essential [16]. This is important for all people on site[4], or responsible for changes on site — knowledge that radiation is not humanly detectable, or that some supplies (e.g. water, power, pressurisation, cooling) remain essential, even after shutdown, is important. These, and other such considerations, can and should affect decisions that people make even when their job is only related to non-nuclear plant. Recognising the nuclear aspect

3 Although it should be emphasized that important and valuable nuclear and nuclear-safety expertise and culture do reside in both ANSTO (Australian Nuclear Science and Technology Organisation) and ARPANSA (Australian Radiation Protection and Nuclear Safety Agency).

4 Whether that "site" is a dockyard, or a submarine.

requires a base level of knowledge. Further, developing the culture where every question includes that nuclear aspect is something which will be new for Defence and much of its supply chain.

How do you Define and Recognise an Effective Nuclear Safety Culture?

According to the UK's Office for Nuclear Regulation (ONR), the health of the safety culture is "one of the key factors determining safety performance in organisations" [17]. In order to illustrate effective safety culture, personal examples will be discussed which highlight how it can be seen. In addition, whilst an effective nuclear safety culture will clearly help ensure safety, other benefits from the mindset are also presented.

According to many organisations (e.g. UK ONR, US Nuclear Regulatory Commission (USNRC)) there are nine key traits of a strong nuclear safety culture, specifically, from the USNRC [18]:

- **Leadership Safety Values and Actions**: Leaders demonstrate a commitment to safety in their decisions and behaviours.
- **Problem Identification and Resolution**: Issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with their significance.
- **Personal Accountability**: All individuals take personal responsibility for safety.
- **Work Processes**: The process of planning and controlling work activities is implemented so that safety is maintained.
- **Continuous Learning**: Opportunities to learn about ways to ensure safety are sought out and implemented.
- **Environment for Raising Concerns**[5]: A safety-conscious work environment is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination.
- **Effective Safety Communication:** Communications maintain a focus on safety.
- **Respectful Work Environment:** Trust and respect permeate the organisation; and
- **Questioning Attitude**: Individuals avoid complacency and continuously challenge existing conditions and activities in order to identify discrepancies which might result in error or inappropriate action.

An overarching theme through these traits is around clear, efficient, effective, and uninhibited communication around safety, and maintaining a challenging environment to ensure that errors or inappropriate actions are not accepted[6]. This general aura has been described as "chronic unease" [19] — where all that you see and do is challenged with a healthy internal scepticism.

What does it Feel Like to Work in an Effective Nuclear Safety Culture?

The fundamental behaviours observed in a nuclear safety culture are personal accountability and excellent safety communication (specifically, the ability to raise concerns freely, openly, and without fear of reprisal). The culture is then one of shared ownership — where there are any issues, be they actual or perceived, anyone can raise them and see that their concern or query is treated with due consideration. Once this culture is embedded, safety becomes not just a consideration, and not even just the over-riding consideration, but simply part of subconscious thought — affecting all that is done both inside and outside of the nuclear environment. I believe that it is this subconscious action which differentiates a nuclear safety culture from a simple stated focus on safety.

I recall a work social event around 10 years ago. Following an enjoyable evening, a large crowd were exiting the top tier of the stadium where we had been watching the cricket. I happened to look ahead of me through the dense crowd of hundreds of people and saw our team descending the wide stairs — all at one side, all holding the handrail. They were the only people within sight to do so, despite the inconvenience of this in such a large crowd. None of these individuals had made any conscious effort to do so I later found, but the simple habit, a learned behaviour, had embedded itself so deeply that even away from a work environment where social conformity would imply otherwise, all chose to make their world just that little bit safer. Whilst this may seem trivial, it is a sign of the general atmosphere throughout the UK nuclear industry where all sites are (justifiably) proud of their record since their last lost-time accident — for some of the power station sites, this record stretches over a decade [20], despite part-time contractors, high-activity around-the-clock outage periods every couple of years, and various other significant industrial risks associated with high-speed rotating machinery, heavy plant, dangerous chemicals, and superheated steam. This example therefore demonstrates both the personal responsibility and the avoidance of complacency which are inherent in effective nuclear safety culture.

A second example comes from one of the Magnox nuclear power stations — one of the longest-running nuclear power stations in the UK (now in decommissioning). To simplify both safety compliance and clarity, all industrial areas of the site (where hazards exist from large/heavy/overhead objects and/or excessive noise) are demarcated by a blue line. Within the "blue line area", all people must wear steel toecaps, a safety helmet, and have hearing protection (with them, not necessarily worn). A station director (the most senior member of the site management team) was doing a tour of the site, when he crossed this line — whilst it's not possible to tell whether someone is wearing protective footwear, or carrying hearing protection (e.g. ear-plugs), the absence of a hard hat is plain to see. This director was immediately confronted by a junior member of staff who asked him to immediately leave the area. This the station director did, whilst also thanking the person and calling out to all both

5 This is not exposed separately in the ONR approach, which explicitly folds this into the communication trait, and instead pulls out the importance of "Decision-making: Decisions are systematic, rigorous, thorough, and prudent" as its other trait.

6 Returning briefly to the TMI accident discussed earlier, it is worth emphasising that TMI occurred due to many of the above traits being absent within the equipment manufacturer, the plant management, and the nuclear regulator.

his own lapse and the excellent behaviour of that person in later communications. This simple example is a clear demonstration of many of the positive traits listed: leadership actions; personal accountability; work process; continuous learning; safe environment for raising issues; respectful work environment; and, importantly, but maybe not obviously, a questioning attitude. The station director is the person responsible, to the regulator, for demonstrating that the station is operating safely. As such, they have ultimate power on the site — be that implementing or changing rules, or even initiating an emergency reactor shutdown. This position of ultimate power could mean that the rules don't apply — they set the rules — but the actions of the station team member demonstrate that a blind assumption that "it must be OK" is neither correct nor valid — this is core to not only the safety, but also the efficiency and effectiveness of the site. A culture which lets junior team members challenge senior team members on whether or not the action is correct allows improvements to the process that drive effectiveness and efficiency, as well as ensuring the safety of all involved.

As hinted in the historical reflections of the development of nuclear safety culture, the on-site culture was not always this way — nuclear safety culture had to be created. The early days of the UK nuclear industry are full of various incidents that show a sea change in the way in which risk was approached from that today. The health and safety chief (at the same station as the second example above) told me that when he was an apprentice (back in the early '70s), they used to race around the top of the railings at the edge of the cooling water inlet — a structure that is over 5 m above the ground below, making this "bit of fun" a potentially deadly activity. The process of change that has taken place in the UK (and exemplified by the change in culture at this station) was driven across the industry, and covered all aspects from regulators to senior management and from reactor desk operators to temporary on-site contractors. Without question, the modern Australian Defence Force is in a significantly better position on safety than '70s Britain. However, the importance of maintaining strong, values-driven improvement is essential to the successful adoption of a strong nuclear culture within the Royal Australian Navy and its supply chain, and should see additional benefits in operational efficiency and effectiveness.

What's the Importance of the Nuclear Safety Culture at this early stage?

This early period in the life of the submarine task force will inevitably set the values which will be inherited by a later operating organisation. This operating organisation will be ultimately responsible for designing and building maintenance facilities, operating those facilities, maintaining the operability, effectiveness, and safety of the submarine fleet, and decommissioning that fleet at the end of its operating life. Ensuring that all staff making decisions are suitably knowledgeable to make those decisions, as well as ensuring that all supporting staff have an environment where valid concerns can be raised and managed without fear of reprisal, are the types of behaviours that can be easily set now, but would be hard to change in the future.

In addition to this, the behaviours that form a strong nuclear safety culture (such as a questioning attitude, willingness to learn, and personal accountability), are also self-evidently behaviours that will lead any enterprise on a journey of continuous improvement. This journey will not just evidence itself in a justifiably-good reputation for safety, but will also lead to improvement in all areas of operational effectiveness and efficiency.

The first stage in embedding a strong nuclear safety culture is ensuring that the management of an organisation buy-in to all aspects of that culture. As the submarine task force is currently a very thin organisation, this makes it significantly easier to set a tone which enhances this. Communicating clearly, openly and honestly about safety, and the opportunities for learning, will foster that culture. Equally important is a willingness to be challenged on whether or not actions are "right" — not just accepting that "we've always done it that way". The culture also needs to be embedded in all related activities, whether they are elsewhere within the Commonwealth (e.g. RAN development activities), or devolved down to third-party suppliers (such as dockyard activities). If the entire supply chain is not onboard, then opportunity will quickly be lost.

Conclusion

Effectively applying the nine listed inherent traits of an effective nuclear safety culture to a wider organisation and the way in which it thinks and acts clearly ensures that safety retains the necessary priority, and provides greater opportunities for efficient and effective use of available resources.

The open and questioning attitude that this culture entails will, when correctly implemented, stretch to all aspects of work — bringing together the whole organisation in a continual journey of constant self-improvement which will affect everything from requirements definition at the start of the process, through to the correct, timely, and, efficient application of maintenance activities.

This paper has looked at where Australia currently is on its journey to nuclear-powered submarines, and where work will be required to develop existing practices. This led to examining the role which safety culture will play, and to that end, looked at what safety culture is, why it is needed, and what it looks like once embedded.

A safety culture can also be described as "how things are done around here." This latter description, whilst casual, is I believe, one of the best guides to knowing that the culture is truly embedded — as discussed, the reduction of risk is second nature to all involved, and this leads to more productive and engaged crews, enhanced public safety and perception, and the best possible outcome for Defence. An apocryphal Chinese proverb states "The best time to plant a tree is 20 years ago. The second-best time is now." As there is no earlier time to embed a nuclear safety culture for the Australian Department of Defence, now is surely the best time?

Acknowledgements

The author is grateful for the support and review from Dr Ian Watson and Dr Ben Heard, as well as the research assistance from Lara Tulloch and Francois Du Toit.

References

[1] Prime Minister of Australia, "Joint Leaders Statement on AUKUS," 16 September 2021, [Online]. Available: https://www.pm.gov.au/media/joint-leaders-statement-aukus. [Accessed 22 February 2022].

[2] Prime Minister of Australia, "Australia to pursue nuclear-powered submarines through new trilateral enhanced security partnership," 16 September 2021, [Online]. Available: https://www.pm.gov.au/media/australia-pursue-nuclear-powered-submarines-through-new-trilateral-enhanced-security. [Accessed 22 February 2022].

[3] ANSTO, "OPAL multi-purpose reactor," ANSTO, [Online]. Available: https://www.ansto.gov.au/research/facilities/opal-multi-purpose-reactor. [Accessed 22 February 2022].

[4] ARPANSA, "Visits by Nuclear Powered Warships," [Online]. Available: https://www.arpansa.gov.au/research/radiation-emergency-preparedness-and-response/visits-by-nuclear-powered-warships. [Accessed 30 January 2022].

[5] Australian Department of Defence, "Visits by nuclear powered warships to Australian ports: Report on Radiation Monitoring during 2019," Australian Government Department of Defence, Canberra, Australia, 2020.

[6] Australian Department of Defence, "Visits by nuclear powered warships to Australian ports: Report on Radiation Monitoring during 2020," Australian Government Department of Defence, Canberra, Australia, 2021.

[7] Department of Defence, "Visits by Nuclear Powered Warships to Australian Ports (OPSMAN1)," Edition 10, 2016.

[8] ARPANSA, "The 2000 Reference Accident Used to Assess the Suitability of Australian Ports for Visits by Nuclear Powered Warships," Regulatory Branch, ARPANSA, RB-NPW-66-00, December 2000.

[9] V. C. a. P. M. Sandman, "Risk communication: Evolution and Revolution," *Solutions to an Environment in Peril,* pp. 164-178, 2001.

[10] B. P. Heard, "Clean. Reliable. Affordable. The role of nuclear technology in meeting the challenge of low greenhouse gas electricity supply in the 21st century," University of Adelaide, School of Biological Sciences, Adelaide, 2018.

[11] IAEA, "Safety and Security Culture," [Online]. Available: https://www.iaea.org/topics/safety-and-security-culture. [Accessed 30 1 2022].

[12] International Nuclear Safety Advisory Group (INSAG), "Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident - INSAG-1," International Atomic Energy Agency, 1986.

[13] G. K. K. V. E. B. Stephanie L. Morrow, "Exploring the relationship between safety culture and safety performance in U.S. nuclear power operations," *Safety Science Volume 69,* pp. 37-47, 2014.

[14] The President's Commission on The Accident at Three Mile Island, "The Need For Change: The Legacy of TMI," Washington, D.C., October 1979.

[15] R. J. Cullen, "Safety Culture; Cornerstone of the Nuclear Safety Case," *Symposium Series, IChemE,* vol. 155, 2009.

[16] F. Mautner-Markhof and K. Mahadeva Rao, "Nuclear Power: Training for safety and reliability," *IAEA Bulletin,* Vols. 37-2, pp. 18-20, June 1995.

[17] Office for Nuclear Regulation, "Safety Culture Guide for Inspectors," NS-INSP-GD-070, ONR Guide, Rev 2, December 2019.

[18] US Federal Register, "76 FR Vol. 76, No, 114," *Federal Register,* pp. 34777-34778, 14 06 2011.

[19] R. F. &. R. M. L.S. Fruhen, "Chronic unease for safety in managers: a conceptualisation," *Journal of Risk Research,* vol. 17:8, pp. 969-979, 2014.

[20] EDF Energy, "Hunterston B monthly report - April 2018," April 2018, [Online]. Available: https://www.edfenergy.com/sites/default/files/hnb_april_2018.pdf. [Accessed 23 February 2022].

[21] Australian Department of Defence, "Visits by nuclear powered warships to Australian ports: Report on Radiation Monitoring during 2017," Australian Government Department of Defence, Canberra, Australia, 2018.

[22] J. G. C. v. G. W. Z. S. L. P. Swuste, "Safety management systems from Three Mile Island to Piper Alpha, a review in English and Dutch literature for the period 1979 to 1988," *Safety Science,* vol. 107, pp. 224-244, 2018.

[23] J. Fuming, "Different Countries, Similar Nuclear Safety Culture: A Study on Comparison of Nuclear Safety Cultures in China and USA," *Journal of Nuclear Energy Science & Power Generation Technology,* vol. 3, no. 1, 2014.

This paper was presented at the Indo Pacific 2022 International Maritime Conference (IMC2022) and was the winner of the Bob Campbell Award for the best written paper and presentation at the conference.

Nigel Doyle presenting his paper at IMC2022
(Photo John Jeremy)

Nav Archs (You Gotta) Fight For Your Right (To Margins)!

Levi Catton
Gibbs & Cox Australia

Warship design and build is technically complex, involving highly integrated engineering products which form an essential contribution to the national security of their sovereign nation.

Warship prototypes are a luxury which most nations simply cannot afford, so it is imperative that every effort is made to get the design right first time, especially as the service life of a warship is typically 25 years. Our choices have long-term consequences.

Margins are needed to (1) address uncertainty in acquisition; (2) ensure adequate reserve levels of safety throughout the service life of the program; and (3) provide capacity for technology upgrades to ensure that warships remain effective in an evolving threat environment.

Unfortunately, in past and present naval programs around the world, we continue to observe chronic optimism whereby margins are traded off for up-front capability delivery on the assumption that a little margin will be OK, and naval architects are trying to stretch the laws of physics to stay in distant touch with appropriate margining policy.

In order to maximise the chances of success, naval architects must learn from previous programs and this learning involves the application of and adherence to appropriate margining practices throughout the design, build and sustainment phases.

The purpose of this paper is threefold:

1. Act as a reminder to Nav Archs — (You Gotta) Fight For Your Right (To Margins)!
2. Show that proper margins are an actual warfighting asset, worth paying for up front.
3. Highlight the importance of disciplined data collection and learning to benefit our successors.

Introduction

Warships form an essential contribution to national security, and our choices in warship programs have significant long-term consequences. Warship design and build is also technically very complex, involving highly-integrated engineering products with in the order of 1–2 million parts. Warships are developed through long and complex design and construction processes, and have long service lives, ranging between 15 and 50 years. There is a range of major uncertainties over the course of this capability life-cycle (CLC), which we seek to prepare for in what we hope is an intelligent way.

To address these uncertainties we use a range of hedging and de-risking measures. One of the primary measures is to incorporate a range of technical margins into the design. Margins are applied with the intention to (1) mitigate uncertainty in acquisition processes; (2) ensure adequate reserve levels of safety throughout the service life of the program; and (3) provide capacity for technology and capability upgrades to ensure that warships remain effective and competitive in an evolving threat environment.

The extent to which margins achieve these effects is correlated with the amount of margins applied and how effectively they are managed. The more margin available, the greater uncertainty the margin is able to cover. Since margins are exemplified by physical characteristics like size, weight, and system capacity, margins cost money, and compete for these parameters with the baseline warfighting capability of the ship at delivery. In acquisition there is typically a direct tension between the application of margins on the one hand, and cost and delivered capability objectives on the other hand.

In past and present naval programs around the world we observe unrealistic optimism in relation to the definition of margin positions [1], whereby margins are traded off for up-front capability delivery on the assumption that a little margin will be OK. Historical and current data shows that margins continue to be consumed more or less at trend rates, which are in some cases not supported by the margins we are designing into new ships. This means that some classes fall into technical margin deficits well before the end of the service life, and a range of quite drastic measures have to be taken to address this. This pattern is exhibited in allied navies, as well as being a central characteristic of Australian surface combatant programs over the last three decades, and will likely continue to be a challenge going forward.

Given this context, there are some questions we can usefully ask:

1. How are we advocating for and enforcing the application of correct margin budgets?
2. What are the long-term consequences of lower-than-required margin budgets?
3. Do we understand what the correct margin budgets are?

Margin Budgeting

Ship design is an iterative process in which key design parameters are balanced against one another as the various design elements, such as hull geometry, structure, propulsion system, energy storage, combat and payload systems, etc., are refined. The key parameters governing vessel margins are locked in relatively early during the design process. Therefore it is important to establish a clear set of appropriate margin requirements, along with effective monitoring and enforcement processes, at the outset of design activity.

There are different types of margins applied at various stages of the CLC, by different parties within each program, to manage various types of uncertainty. These different margins are applied in varying amounts across different design characteristics, systems and services. Ultimately, each margin applied at various stages of the CLC contributes to ensuring that the capability required by Navy is delivered and remains available and relevant throughout the service life of the class.

While weight and stability margins are often a key consideration, it is also typical and important to apply and manage margins across a range of systems and characteristics such as HVAC, chilled water, electrical power, data and signal-processing capacity, structure, and space. The planned application of margins across different margins types, when documented, is known as a margin budget.

Purposes and Types of Margins

There are three main categories of purpose for which we apply margins to naval ship designs: mitigating uncertainty in acquisition, ensuring safety throughout the service life, and providing capacity for technology upgrades in an evolving threat environment.

Mitigating Uncertainty in Acquisition

The acquisition phase faces the most diverse set of uncertainties, and a range of margins are included in the design for use during this phase. Regarding terminology, this paper uses terms in current use in Australian surface combatant circles; however, different countries and marine design sectors do use different terms to describe the same fundamental concepts. As always, it's prudent to check that your counterparty understands terms the same way you are using them!

Design Margin

During design, the designer faces uncertainty around design characteristics. This uncertainty is gradually retired as the design evolves and matures towards a production baseline. To address this uncertainty, the designer applies a margin to account for the difference between early design estimates of the system that is intended to meet the requirements (at a low level of confidence), and the out-turned production baseline that is expected to meet the requirements (at a moderate level of confidence). The amount of design margin should address the amount of development risk and design uncertainty in the program. A highly-developmental program will require a wider and deeper suite of margins compared with a program based on incremental change to an existing well-understood in-service design.

Build Margin

During production, the shipbuilder faces uncertainty related to how accurately their supply chain and their own shipbuilding processes can produce the design and deliver the design characteristics and performance in the physical ship. Additionally, ship designs are complex and include errors, so the shipbuilder also faces uncertainty related to the producibility of the design, and the quality and accuracy of the production data. The shipbuilder applies margins to address these uncertainties. Again the amount of margin applied must account for the level of uncertainty in production processes and production design maturity. If the designer and builder are the same enterprise, then design and build margins are sometimes combined and termed DBM. This is poor margin budgeting practice, as the design and build divisions of the enterprise are separate entities and need to have clearly-separated margin budgets to address the different risks that those divisions face. Following expiry of warranties, unused design margin and build margin are rolled into Capability Upgrade Margin (CUM) or In-Service Growth Margin (IGM).

Performance Margin

Some performance parameters are considered particularly critical for the capability, particularly at risk of achievement (likely due to a demanding or developmental requirement), or represent some other special risk. Typical examples include signature performance, and top speed. Performance margins can be applied by the designer to mitigate the risk that the customer requirement is not met, or may be specified by the customer as a mandated additional risk mitigation to the designer's margins. On occasion the customer may not disclose the absolute performance requirement to the designer, but will propose a requirement with a margin built in to further hedge risk in the designer's margins.

Contract Modification Margin (CMM)

Due to the complexity of naval ships, and the typically long development time from initial requirements establishment to delivery, there is often some changes in requirements or Government Furnished Material (GFM) allocations during the acquisition phase. The customer may include margins to account for these uncertainties during design and build. Unused CMM at delivery is rolled into CUM or IGM.

Ensuring Safety throughout the Service Life

During the in-service phase, the ship must remain within safe operating limits with respect to structural strength, stability, and provision of critical services. This need is addressed by the application of In-Service Growth Margins (IGM).

In-Service Growth Margin

The customer includes margins at the design stage to allow for unplanned, unattributable or uncontrolled changes which typically occur during the service life. These changes occur as a result of obsolescence management, general sustainment activities, accumulation of unconfigured equipment, progressive degradation of system performance over time, accumulation of coatings, etc. These changes can be forecast based on historical data, and various standards offer recommendations on the amount of margins to apply in early design for different ship types, based on analysis of technical records from current and previous classes.

Providing Capacity for Technology Upgrades in an Evolving Threat Environment

During the in-service phase, the ship must remain relevant to and competitive with the evolving threat environment. If the ship is not a credible threat to adversary actors expected within the allocated mission portfolio, it cannot be expected to perform those intended missions with a reasonable probability of success and therefore loses its primary purpose and value as a military asset. If the ship is not able to defend itself against the expected threat environment at a reasonable level of risk, it should not be operated in that threat environment and again loses its value as a military asset.

The threat environment evolves in proportion with the technological development of sensors and effectors, which have refresh cycles in the order of two to five years and lifecycles in the order of one to two decades. Ships as a complete system have refresh cycles of one to two decades and lifecycles of two to four decades. This means that ships need to be able to receive new technologies throughout the service life, while remaining within design safety limits and service capacities. This need is addressed by the application of CUM.

Capability Upgrade Margin

The customer includes margins to address the uncertainty around technology development, the changing threat environment over the life of the vessel, and the consequent probability of needing to add equipment or change the

configuration to remain competitive and effective in the evolving threat environment. The amount of margin applied for capability upgrade depends on the type of missions the ship performs, the expected pace of technology development associated with the threat environment, forecasts of the types of systems which will be needed to address expected changes in the threat environment. CUM should also address the level of uncertainty in such assessments. There may be general consideration of a substantial mid-life refit as part of this allocation.

Fight for your Right to Margins!

How are we advocating for and enforcing the application of correct margin budgets?

The Zero-sum Game

After the concept design is chilled, management of the margin budget becomes a quasi-zero-sum game. It's about as hard to find extra margin in the design late in the design schedule as it is to find extra money in the budget late in the design schedule. Any overconsumption of margin during acquisition is likely to deplete the available customer margins required to upgrade and sustain the vessel through life and maintain the relevance and effectiveness of the class.

As a result of this zero-sum situation, margin consumption issues can quickly become challenging. It is not unusual for a margin consumer in the active phase of a project (e.g. design or build) to consume over their budget, and common themes that go along with this situation can be colloquially summarised as follows:

The Margin Consumers' Claim	Translation	Outcome
We will find a way to make up the margin deficit through other mitigating changes.	We should spend more budget (we don't have enough) to recover the deficit.	Some of the deficit might be recovered with a cost penalty.
Later consumers will find a way to make up the difference through other mitigating changes (with suggestions).	Someone else should spend some of their budget (they have plenty) to recover our deficit.	Some of the deficit might be recovered with a cost or other penalty.
Later consumers don't actually need all the margin in their budgets because they can do fine with less (with justifications).	The next phase is less important than our phase. The next phase is less informed than us as to what they need.	The deficit is passed on right through the next phase because they actually need their margin budget. Little to no deficit is recovered.
Later consumers will simply have to do with less budget.	We don't care about the next Phase.	The deficit is passed on right through the next phase because they actually need their margin budget. Little to no deficit is recovered.

Budget Discipline

In the context of the potentially contested margin-management environment, a clear policy on authorities and consequences for margins use and misuse is critical to enforce constraints. It is also critical to provide oversight throughout acquisition in order to assess and mitigate any risk to the margin budget and delivery of customer margins.

In some situations the margin budget is treated as a second-order constraint compared with customer functional requirements. Is this attitude justified in terms of best capability outcomes over the whole CLC? We need to carefully consider the assumptions and requirements which lead to any margin over-consumption. Commitment bias (i.e. biased towards what we have committed to as a documented requirement) and ambiguity bias (i.e. biased towards what we know we need now rather than what we might need in the uncertain future) can and do lead to requirements fixation. It can be the case that the rationale or requirement driving a margin over-consumption is actually less important than delivering those quantums of margin to address uncertainty in the service life. A design engineer with a margin challenge should consider testing this with the customer, and not blindly follow a functional requirement as the superior objective, at the cost of the margin budget. Customers can also continue to review the relative level of priority of margin requirements in comparison with other functional requirements as design proceeds. This might avoid achieving a tactical gain while suffering a strategic loss.

Budget discipline is as hard in design management as it is in financial management, and perhaps even less successfully exhibited. In a complex design environment such as ship design, the designer's first instinct should be that a solution outside the budget is not the solution. As a cultural norm this instinct is not always well established in ship acquisition and sustainment activities, where we are just as likely to believe that there is margin to cover a difference between budget and solution. We can also be too quick to permanently borrow someone else's margin budget. This behaviour may arise from the bias that, since margin is a conservative hedge against uncertainty, others' need to use all their budgeted margin probably won't arise, whilst our need has been realised, and is actual and immediate and therefore justified. Finally, over-consuming margin when we haven't met our margin budget is of course the easiest course of action, and therefore a fairly popular approach!

Although it is essential to ensure that margins are available to accommodate upgrades throughout the CLC, it is equally important to avoid consuming margins inefficiently because they are available. Therefore it is critical to establish a well-structured margins-management system to control the use of margins, not only through acquisition but throughout the service life [2].

Margins are the Future Capability

What are the long-term consequences of lower-than-required margin budgets?

We can reasonably assume that unattributable margin consumption will proceed generally in accordance with the relevant historical evidence and the derived trends indicated in standards. These trends are well-established and it is unrealistic to suggest that next time it will be different, without major changes in typical and entrenched operating and support patterns. In general, ISG margin shouldn't be assumed to be significantly variant to historical trends without a significant base of evidence as to how ship management would be performed differently.

This leaves CUM as the main variable quantity in the equation. So, at a basic level, margin budgets lower than indicated by evidence are likely to result in CUM getting sacrificially compressed. This is a significant capability risk. Ships are delivered with a certain required set of capabilities, but these are not the capabilities which they need for competitive operations in the latter part of their service life. CUM is likely to be required to realise the capabilities required in the future. So how do we balance the importance of future needs compared with the importance of current needs?

Firstly, we need to acknowledge present bias — a dominant human decision heuristic is that a present known thing is more important than a future uncertain thing.

Secondly, in margin budgeting, as in managing many uncertainties, we would take a typical risk costing approach, in which the greater the uncertainty, the greater the hedge required to cover that uncertainty. The required size of this

hedge is accelerating with the rate of technology development and disruption. So, in assessing future capability uncertainty to budget our IGM, we need to consider the rate of change of uncertainty in the threat environment. Some current and near-future technological and operational concepts which are likely to disrupt typical design assumptions for surface combatants include:

- Long-range and persistent weaponised autonomous underwater vehicles (AUV)
- Crewed/uncrewed teaming
- Advanced passive radars
- Directed-energy weapons
- Hypersonics
- Quantum computing
- Quantum radars
- Cheap, pervasive, high-performance acoustic sensing, along with the AI/ML capacity to process the data volume
- Distributed lethality
- Non-carbon fuels

Compared with technology developments during the last 50 years or so of warship design, sensor and effector development and technology disruption continues to progress at a rapid rate, with major disruptors observable, and the probability of other unknown disruptors we don't yet observe, within one ship service life into the future. Dealing with the capability uncertainty in the second half of the service life may actually be strategically more important than addressing the known capability advantage we need to achieve in the first half of the service life. Additionally, the rate of technological development may suggest that CUM will become increasingly important in the future compared with recent historical trends.

Margins are the warfighting asset for the second half of the service life, and should be considered equally important as the warfighting systems established in the delivery baseline. The logical extension of this assertion is that CUM should be deliberately traded off against cost and delivery capability as an equally important factor during acquisition. When we trade CUM away for delivery capability, we make the implicit judgement that either (1) the future capability upgrade need will not require as much margin as first thought (which is contradicted by Australian surface combatant history); or (2) addressing threat competition in the first half of the service life is more important than in the second half of the service life (which is contradicted by the technological outlook).

In relation to the first case above, we sometimes observe an assumption that future capability will be more efficient and have a smaller footprint or service demand that that which it replaces. Hence the capability upgrade provides its own margin. This argument is not uncommon but it is not played out in the growth data or the observed scope of upgrade programs. Firstly, because capability upgrade is rarely capability neutral; more new capability tends to be added. Secondly, because it is expensive and time consuming to remove old capability and so often it stays, or the new technology is developmental so there is a desire to hold onto the old until the new is proven. In general, we should not reasonably expect upgrades to provide their own margin.

Accordingly, during acquisition we should continue to actively consider rebalancing delivery capability in favour of increased CUM, even if this materially increases capability superiority risk in the delivery baseline.

Learning from Experience

Do we understand what the correct margin budgets are?

Cost Considerations

Technical margins are an established and, in relative terms, very cost-effective means to treat uncertainty and assure utility and relevance throughout the lifecycle of a system. They are particularly important for finely-balanced, high-value, complex systems like naval vessels.

While the application of a margin is a significant cost factor in ship acquisition, the relative cost is much lower compared with remediation activities after delivery. As an example we can observe this in the Adelaide-class and Anzac-class upgrade programs. These experiences suggest that we should budget considerable margin for major changes during the life of surface combatants.

Building substantial margins into the ship during acquisition is radically cheaper and technically less constrained than seeking to develop additional margin during an upgrade project, which will present more constrained and typically less-satisfactory technical outcomes for much greater cost. Accordingly, more aggressively prioritising the provision of substantial ISG and CUM at delivery is likely to materially reduce CLC total cost of ownership.

Mod-repeat Trend Requires Larger Margin Budgets

In a modified-off-the-shelf or mod-repeat program, the modifications against the original design intent represent in additional complicating factor in margin budgeting. The recent popularity of mod-repeat acquisition strategies in NATO+2 navies reflects the perception that this strategy helps to control technical and program risk, which is true if certain conditions and boundaries are respected. Cole [3] addressed the question of the relative value presented by an off-the-shelf approach to naval acquisition.

The extent of modification applied in such programs can vary significantly, from reasonably modest changes (e.g. the Hobart class), to very significant changes (e.g. the Hunter and CSC, DDG Flight III) to fundamental re-design (e.g. the Constellation class). In a mod-repeat program the "mod" aspect is often equal to or greater in scope than a major mid-life upgrade of the parent class. Since ships are not typically designed to accommodate more than one major upgrade, it is almost inherent in the acquisition strategy that the margin budget is going to be placed under significant pressure unless very substantial secondary remediation changes are included in the modification design. Constellation is an example of this situation.

In all cases, the mod-repeat acquisition strategy places major additional stress on the margin budget, over and above the existing tensions in the original margin budget of the reference design. The current trend in surface combatants to mod-repeat reference designs makes the establishment of a generous margin budget in any new design or major re-design an even more foundational objective for designers. Based on experience we can be confident that customers

will continue to require more capacity from platforms and drive platforms to their capacity limits.

Data Collection

Another area where the enterprise can benefit from an increase in discipline and consistency is in the collection and management of margins data.

There is an opportunity to collect and maintain margins data across the naval enterprise through efficient broad-based access to a common, accurate and consistent set of margins data, covering both the active fleet and current acquisitions. This database would serve as a historical record of margin consumption, margin decisions and margin requirements for each ship in each class, and allow future regulatory and acquisition activities to benefit from experience on past and current programs, and establish margin requirements based on a reliable base of objective evidence.

Evolving our Approach to Margin Management

There is a range of opportunities available to develop the approach we take to margins management in the naval enterprise. We can consider actions across four general categories: margins management culture; policy framework and standards; margins definition and management; and engineering capability [4].

Margins Management Culture

It is important to establish a strong culture of margins management and preservation across the naval enterprise. With regard to margins management, an effective organisational culture adopts a number of fundamental attributes to deliver safe and competitive platforms with sufficient margin availability through the service life.

Leadership Responsibility

Leadership understands margin tradeoffs for capability versus in-service growth. Leaders ensure that effective margins management is prioritised and promoted across the organisation. Leadership behaviour demonstrates that margins are an essential element of capability delivery, sustainment and overall safety. Leadership endorses and supports the continual development of processes and policies that serve as the framework for effective margins management throughout the capability lifecycle. Leaders are provided with clear, accurate and concise information necessary to make appropriate decisions.

Decision Making

Authority and responsibility for margins decision making is specific and well defined. Delegated authorities follow the established process and make decisions using a consistent and systematic approach to evaluate key factors and risks. A systematic approach is used to collect and store high-quality information from all relevant sources to inform current and future decisions. Decisions which lead to the consumption of margins are recorded and preserved to influence future decision making.

Continuous Learning

The organisation systematically collects and evaluates margins data, requirements and decisions to record lessons learned and identify opportunities for improvement. Lessons learned and resultant opportunities are shared across programs to support continuous learning and improvement. Effective training is provided to operators, practitioners and leaders, to ensure that all members of the organisation are equipped with the necessary skills and knowledge, and are aware of their individual responsibility with regard to margins.

Communication

Leaders frequently communicate and reinforce the expectation that margins are prioritised to address uncertainty. Clear communication lines across stakeholders ensure that margins information, and decisions that affect margins, flow throughout the organisation as well as across programs. Key stakeholders including the designer, builder, sustainment organisation and customer are transparent and communicate key information impacting margins in a clear, timely and effective way.

Proactivity

The organisation is proactive in the management of margins. Teams consider and manage risk to margins as a priority. This includes strong cultural awareness and clear processes to reduce unnecessary or uncontrolled growth which impacts upon margin availability. Operators understand the importance of maintaining control of the platform configuration and actively seek to minimise unrecorded impacts on the configuration baseline. Teams recognise and plan for future challenges by forecasting margin risk and implementing recovery solutions to address the risk prior to it being realised.

Policy Framework and Standards

Margins management policy, and any subordinate standards, would describe a systematic approach to margins management which is supported by a common framework implemented across the naval enterprise. Conformance with margin policy and standards is promoted as a priority by leadership, linking to the development of a proactive margins management culture.

A common margins management framework would take account of the differences in various projects and ship classes. The framework would provide a clear baseline of consistent margins principles, but is tailorable (within limits) to suit the needs and characteristics of the class. A robust policy framework would implement the following principles:

Common Approach to Margins Management across Enterprise

A review of current margin management practice and policy [4] observed that there are inconsistencies and misalignments in existing margins requirements. There is opportunity to introduce measures such as a singular set of margin definitions, a more prescriptive approach to margin assessment and measurement, and a more robust and prescribed margin budgeting process.

Common Margins Documentation and Deliverables

To achieve a common baseline of good practice, a standardised suite of margins deliverables would be developed and implemented in the form of templates included as annexes to ANP-4801 [5]. These templates would then be tailored by projects (within limits) to meet project requirements, and used to govern margins application and management in that project. A Margins Management Plan would set out the margin budget as an agreed baseline,

and define how change is implemented against that baseline. A Margins Usage Report would record all changes on a periodic basis.

Common Roles and Responsibilities

Currently, margin-related roles and responsibilities vary across the naval enterprise. A consistent set of roles and responsibilities relating to each margin, as well as defined roles for margins management and assessment, could be implemented across the maritime domain. A Margins Working Group could be established within each project, with consistent functions and processes.

Margins Definition and Management

The framework set out in the policy must be enacted through the requirements, tools and processes used in each program. The following principles could be considered in establishing these processes:

Consistent Margin Requirements Managed throughout CLC

Margin requirements need to be considered as early as possible in the Risk Mitigation and Requirements Setting Phase. This is because decisions made during this phase have the most significant impact on margins availability through life [5]. A minimum set of standard margin requirements should be included in the Request for Tender (RFT) phase to ensure that an assessment of margin compliance is made as early as possible in the acquisition process. To ensure that the full suite of possible margins is considered for inclusion in the requirements set, a comprehensive margins checklist could be used.

Assessment of Tenderer Margin Positions

The most significant contributor to successful margins outcomes over the CLC is ensuring that adequate margins are included within the design from the beginning of the acquisition process. This is because the key characteristics which fix the physical limitations of the platform, and essentially set the available margins within the design, are established early in the design process. This is true regardless of the acquisition strategy, be it a developmental design based on RAN requirements, or a MOTS design based on an existing reference ship. Therefore it is important that the tender process ensures that margin availability is prioritised as a key assessment objective and outcome. This could be achieved by, for example, increased technical engagement between customer and contractor SMEs in the form of detailed exploratory workshops, and co-modelling activities by embedded customer representatives.

Standardised Growth Forecasting and Margin Risk Prediction

Some projects forecast margin consumption out to End of Life (EOL) to anticipate risks and challenges related to margin availability. To facilitate a common approach to growth forecasting and margins risk prediction, a standard toolset could be developed and applied.

Management of Change Proposals to Reduce Growth Rates

A typical priority for surface ship management is to manage the approval of margin consumption through the standard Engineering Change Proposal (ECP) and Contract Change Proposal (CCP) processes. This can lead to a fundamentally reactive approach to margins management whereby strict growth reduction measures and options to recover margin are typically only enacted as margins become tighter. In comparison, management of submarine platforms by some navies demonstrates that actively controlling growth by implementing clear targets for recovering margin, or reducing the impact on margin, during change can slow the rate of growth and increase margin availability through life. Implementing a proactive approach to growth reduction using a goal-based process to minimise impact on margin will ensure greater margin availability throughout the service life.

Engineering Capability

Establishing appropriate engineering capabilities would help provide an improved margin position from acquisition by supporting thorough and consistent requirement definition, specialist engineering assessment, and access to accurate and timely information for decision makers.

Specialist Margins Design and Engineering Team

A number of in-service classes and acquisition projects face challenging margin positions, for which remediation action may be required. These remediation actions typically require complex design engineering and analysis. This requires an engineering capability equipped with appropriate naval design skillsets, tools and processes to deal with the level of design and engineering analysis necessary to develop resolved design solutions to margins challenges. The tools, skills, techniques and approaches which would be applied to margin-remediation design engineering tasks are generally common with other whole-ship design engineering tasks. Therefore, this concept aligns with the mandate arising from the Naval Shipbuilding Plan [6] to develop Australia's naval design engineering capability in support of delivery of the maritime elements of the Force Structure Plan.

Conclusions

The ultimate purpose of all margins is to ensure that the capability needed by the navy is delivered and remains available and competitive throughout the service life. Margins achieve this by mitigating uncertainty in acquisition; ensuring safety throughout the service life; and providing capacity for technology upgrades in an evolving threat environment.

Unfounded optimism and present bias are challenges in margining practice across various previous and current NATO+2 naval programs. Margins are difficult to recover once in deficit, and under-margining is dangerous to program objectives when viewed over the CLC. Discipline is a foundational characteristic needed in the engineering management of margins.

A well-structured margins management system is critical to control the use of margins across margin-consuming stakeholders through design, production and service. The foundation of a robust margins management system is a margin budget which clearly sets out all margin allocations and describes who is authorised to use what margins and when.

Robustly managing a ship margin budget across the CLC requires:

1. An evidence-based understanding of the types and amounts of margins required through the various phases of the CLC.
2. A clearly-documented margin budget, which sets out

the amounts of margins, how they are measured, how they are allocated to the different phases of the CLC, and who is authorised to consume them.

3. A clearly-documented margins management policy which sets out treatment and enforcement measures for budget exceedance.
4. A culture of margin budget discipline throughout acquisition and sustainment.

Naval acquisition and sustainment professionals need to fight for margin discipline and margin preservation. Margins are future capability and, as such, need to be treated with the same priority as existing warfighting capability.

The costs of remediating a deficient margin position during the service life are much higher than a healthy margin budget established early and maintained with discipline. Based on recent surface combatant history, provision of generous margin budgets is a significant opportunity to reduce the total cost of ownership. The trend of mod-repeat acquisition strategies indicates that even-higher margin allocations are required in new designs which may later become reference designs. This is something to be reviewed carefully during the tender stage if this acquisition strategy is to be pursued.

In order to maximise the chances of long-term success in the technical management of our naval fleet, the enterprise must learn from previous programs. This learning involves disciplined collection, management and analysis of margins data across the fleet, and adherence to appropriate margin setting and margin management practices throughout the acquisition and sustainment phases.

There is a range of opportunities to develop our approach to margin management by improving our margin management culture; establishing and enforcing a consistent policy framework and standards; establishing and enforcing consistent margins definitions and management processes; and improving our specialist engineering capability in relation to ship margins engineering.

Considering recent history, the future threat environment, and taking a CLC view of ship projects, we would be prudent to focus more priority on the provision of generous margin budgets, with the expectation that significant changes will be required over the service life of the ship. Improvement of margin outcomes will allow increased platform availability through life, simpler and cheaper platform management, extended platform service life where required, and an increased ability to maintain capability competitiveness.

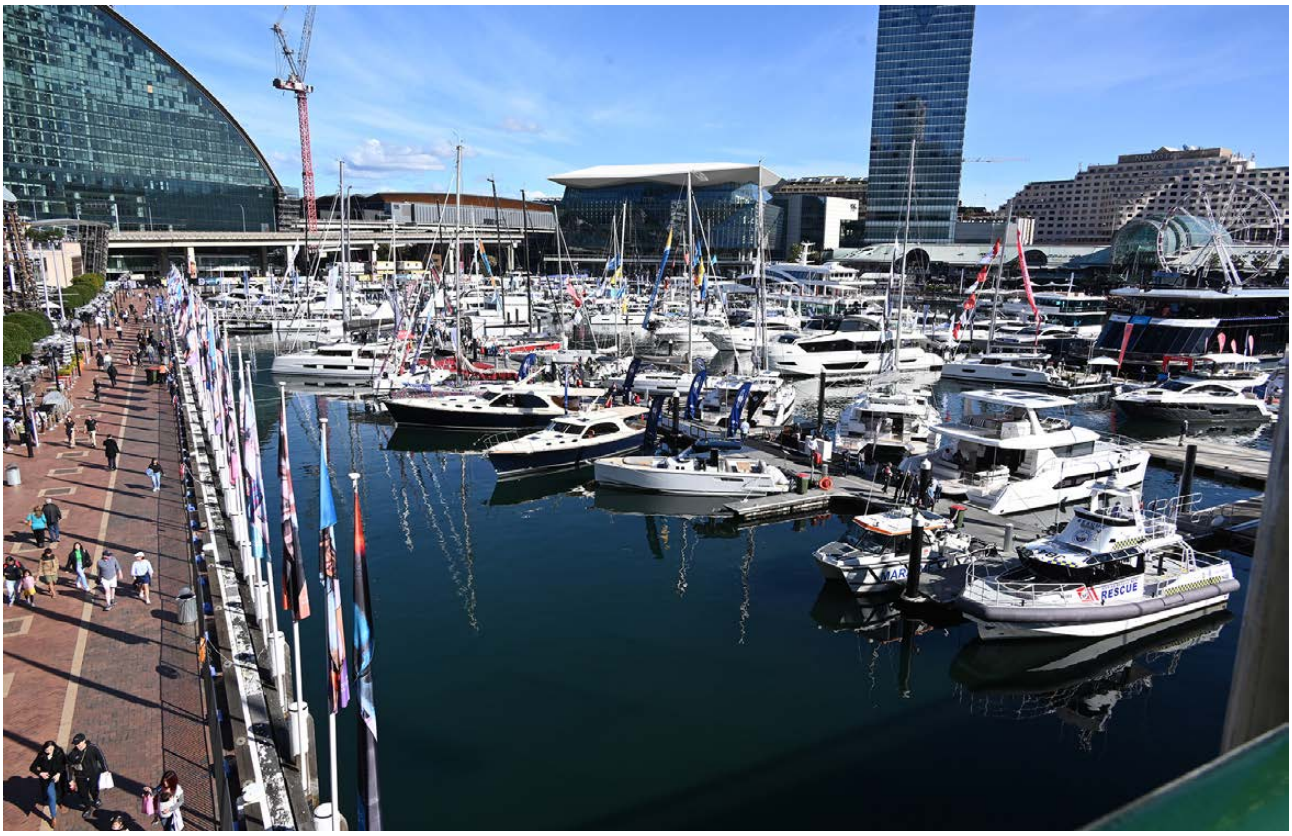
References

1. Pedatzur, O. (2016) Weight Design Margins in Naval Ship Design — A Rational Approach, *Naval Engineers Journal* No. 128-2, June 2016
2. Maritime Acquisition Publication (MAP) 01-070, *Surface Ship and Submarine Margins Guidance*, Issue 02, May 2007
3. Cole, J. (2017) First and Second Order Technical Implications of an Off-The-Shelf Approach to Naval Ship Acquisition. *Proc. Pacific 2017 International Maritime Conference.*
4. Gibbs & Cox Australia (2021) *Development of Options for an Improved Navy Enterprise Margins Management System*. unpublished.
5. Commonwealth (2018) ANP 4801 *Development and Maintenance of Materiel Margins for Naval Capabilities*, Version 1.0, Dec 2018
6. Commonwealth (2017) *Naval Shipbuilding Plan.* Retrieved from Department of Defence — National Naval Shipbuilding Enterprise: http://www.defence.gov.au/NavalShipbuilding/Plan/

This paper was presented at the Indo Pacific 2022 International Maritime Conference (IMC2022) and was a runner-up for the Bob Campbell Award for the best written paper and presentation at the conference.

The CEA Technologies and Lockheed Martin stands at Indo Pacific 2022
(Photo John Jeremy)

SYDNEY INTERNATIONAL BOAT SHOW



Cockle Bay on Sydney Harbour was once again awash with boats for the Sydney International Boat Show between 28 July and 1 August 2022. Predominently motor-driven craft were on display — one wonders where they might all go (Photo John Jeremy)

The Boat Show occupied two levels of the International Convention Centre in Sydney. One level was substantially occupied by aluminium fishing and recreational craft and rigid inflatables of all sizes (Photo John Jeremy)

NAVAL ACTIVITY

Australia's two new replenishment ships, HMAS *Stalwart* (left) and HMAS *Supply* together at Fleet Base East for the first time in June. HMAS *Supply* has since taken part in the major multi-national excercise Rim of the Pacific (RIMPAC) 2022
(RAN photograph)

HMA Ships *Canberra* and *Warramunga* conduct a dual replenishment at sea with USNS *Yukon* during regional presence deployment; RPD22-3, in the Pacific in June
(RAN photograph)

INDUSTRY NEWS

Australian-Canadian Partnership for XLUUVs

British Columbia-based technology company Cellula Robotics and Australian unmanned systems specialist Trusted Autonomous Systems (TAS) are presently working on a new series of fuel-cell powered, extra-large unmanned underwater vehicles (XLUUV).

Funded by the Royal Australian Navy and in collaboration with sub-contractors, project SeaWolf is set to launch the first 12 m XLUUV hull in the fourth quarter of 2022.

Notable features of the SeaWolf project include a mission range of over 2700 n miles powered by a state-of-the-art fuel-cell power system and two modular 2500 L flooded payload bays. With a 12 m by 1.7 m hull, SeaWolf can be shipped in a single 40-foot ISO container.

As part of the work on the SeaWolf project, Cellula will establish a new office in Brisbane. The company also plans to put up additional design and construction facilities for the XLUUVs in Australia.

Demonstration missions with the prototype SeaWolf XLUUV will take place in Australia in the first quarter of 2023.

An impression of the SeaWolf XLUUV
(Image courtesy CNW Group/Cellula Robotics)

Naval Group Settlement

The Prime Minister announced on 11 June that the Australian Government had finalised negotiations with Naval Group to conclude the Attack-class submarine program.

The previous government made the decision to terminate the contract on the basis of advice about capability requirements for the Australian Defence Force — advice which was accepted by Labor in Opposition.

The Government has reached a fair and equitable settlement of €555 million (around $830 million) with Naval Group.

Austal Establishes Strategic Partnership with Spectainer

On 8 July Austal announced the establishment of a strategic partnership with Spectainer, an industrial technology developer for shipping and logistics.

Spectainer (https://spectainer.com/) has developed an innovative, fully-patented collapsible container, COLLAPSECON® and associated, fully-automated COLLAPSECON® Operating Station (COS) which improves operational efficiencies, delivers economic savings and reduces environmental impact across global logistics supply chains, without requiring a fundamental change to the industry or trade.

The strategic partnership is centred on optimising COLLAPSECON® and the Operating Station (COS) for mass manufacturing at Austal Vietnam's shipyard in Vung Tau; and includes developing production capability, capacity and the necessary material supply chain to support mass production of COLLAPSECON® and COS.

Austal's Chief Executive Officer, Paddy Gregg, said "Austal is very excited to be involved with Spectainer in a venture which has tremendous potential to positively impact global greenhouse emissions. We are confident that our team of skilled engineers, in Vietnam and Australia, working closely with Spectainer will successfully bring this game-changing product to market."

Spectainer's Managing Director, Nicholas Press, said "We are thrilled to be partnering with Austal for the optimisation and mass production of COLLAPSECON® and COS. Austal is one of the best shipbuilders not just in Australia, but globally. Austal partnering with Spectainer for mass manufacturing will ensure that we can deliver COLLAPSECON® and COS reliably, cost effectively and at scale, thus enabling us to achieve our goal of establishing COLLAPSECON® as the world's first mass-produced collapsible container solution".

COLLAPSECON® containers are designed so that four collapsed containers may be transported in one container, resulting in meaningful economic savings, increased operational productivity on land and sea, and reduced carbon emissions.

COLLAPSECON® containers are designed so that 4 collapsed containers may be transported in one container, resulting in meaningful economic savings, increased operational productivity on land and sea, and reduced carbon emissions
(Image courtesy Spectainer)

HydroComp NavCad® 2022 Released

Development in 2022 for HydroComp NavCad offers new features across the range of applications.

Miscellaneous updates

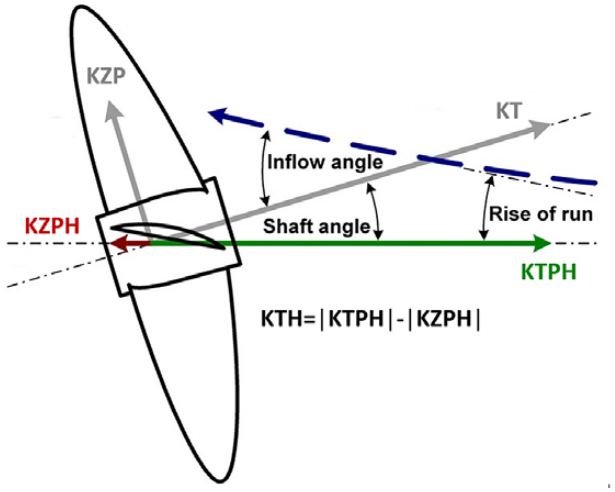
Building upon work for the 2021 version relating to new barge drag prediction methods, NavCad 2022 has been updated with a new *Simple Towboat* method for prediction of hull-propulsor coefficients and an update to the drag prediction models for barges with true box-like sterns. Updates also include the use of $K_T K_Q$ data for a CRP

[Simple] propeller type, as well as various interface and process improvements.

Extensive update for Oblique Propeller Effects

Propeller performance in NavCad utilises various systematic propeller series. One characteristic of all propeller series is that the water flow is uniform and axial (i.e. in line with the propeller axis). Axial flow is suitable for laboratory tests, but it does not always correspond to real "behind-the-ship" applications. In fact, true axial flow on ships is rare.

NavCad considers the effect of non-axial flow — commonly known as oblique (or inclined) flow — with its oblique flow corrections. These corrections have been updated for NavCad 2022 to provide an evaluation of the propeller normal force which is created by oblique flow. A propeller's in-plane vertical normal force (shown below by the coefficient KZP) can greatly affect a boat's dynamic trim, so understanding the magnitude of this force can be crucial to a complete planing hull simulation.



Forces on a propeller

Export K_TK_Q utility

A new utility for NavCad 2022 provides the export of a set of KTKQ data for the project's propeller. The data is exported to a CSV file using standard formatting (e.g. decimal point indicator with comma delimiter). This new export can be a valuable tool for the proper performance definition of a CFD "virtual propeller" (actuator disk).

The calculation of coefficients is based on the entered propeller data and prediction settings. If oblique flow settings are enabled, the prediction of K_T and K_Q will include oblique effects with additional coefficients included in the export: JH and KTH (oblique horizontal components), as well as KZP (normal force) and KT* (which includes the effect on KT of the KZP normal force component).

AC Electric Motor Module

The support for electric motors introduced with NavCad 2021 has been updated for AC three-phase motors. This includes use of generic curve shapes based on NEMA A/B definitions as well as estimated prediction of partial load values for motor efficiency and power factor.

A screen shot from NavCad 2022 showing electric motor data

HydroComp PropElements® 2022 Released

PropElements was developed not only for propeller specialists and manufacturers, but for naval architects and vehicle designers as well. It provides a key optimising design stage between parametric specification and full 3D design for manufacture. The initial release of HydroComp PropElements 2022 offers new features across this range of applications and workflow.

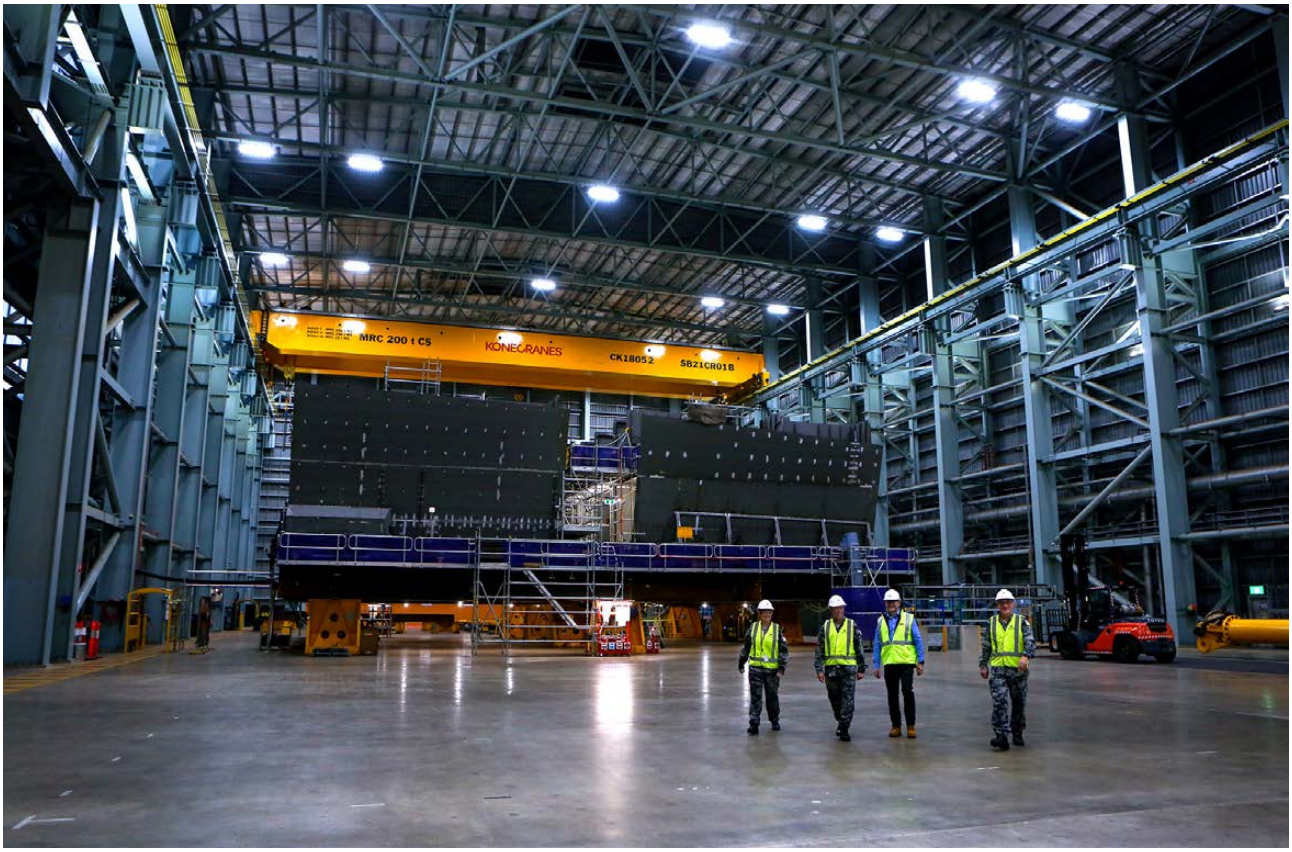
Expanded Workflow Support for Propeller CFD Computations

PropElements is a valuable companion for CFD computation of propeller performance, such as for direct open-water prediction or full-ship self-propulsion simulations. The extent of supporting calculations and exports with PropElements 2022 now includes:

- Employ PropElements as a preparatory stage for design space investigations and optimisation of a wake-adapted propeller.
- Use output from PropElements as benchmark thrust and torque/power figures for quality-assurance review of CFD computations.
- Prepare T/Q/N or K_TK_Q data for definition of actuator disk performance.
- Quickly generate a propeller (see below) and export 3D CAD of a propeller.
- Extend the CAD export to include the fixed and rotating domain surfaces for a typical open-water computation in CFD.
- Export 3D CAD of standard nozzles suitable for CFD models (see below).
- Couple CFD with PropElements as a higher-fidelity alternative to an actuator disk.

Project Starter

Starting a new project with PropElements has never been easier. In this newly-updated utility, users can take system-level propeller data — such as parameters developed with HydroComp NavCad®, for example — and generate a full initial model of the propeller suitable for wake-adapted analysis or design. Full blade distributions and shapes can be derived from standard series (S Series, Ka Series), application-specific forms (UV thin, ducted wide), or well-



Warrant Officer of the Navy, Warrant Officer Deb Butterworth OAM CSM and Bar, Chief of Navy, Vice Admiral Michael Noonan AO RAN, Operations Director, BAE Systems Marine Australia, Mr Jim Cuthill, and Director General, Naval Construction Branch Commodore Steve Tiffen CSM RAN, tour the Osborne Naval Shipyard in Adelaide at the end of May. Prototype frigate modules are in the background (RAN photograph)

known benchmark propellers (VP1304, N4990, KP505). Each new project is then built to user-defined diameter, blade area ratio, and reference P/D values.

New Nozzle CAD Export Utility

CAD files of nozzle geometries can be useful for a variety of purposes, from manufacture (small nozzles for UVs, for example) to CFD analysis.

PropElements 2022 provides a new utility to export a 3D CAD from a collection of standard nozzles styles (19A, 37, 33 and 34). User-defined parameters allow for the nozzles to be scalable to any propeller diameter, as well as customised for tip clearance and nozzle L/D ratio.

Wärtsilä and Stena to build the World's Largest Hybrid Vessels

Wärtsilä is to supply its hybrid propulsion system for three new ro-pax vessels currently built for Stena RoRo, Europe´s largest ferry company. Two of the ferries will have a battery capacity of 11.5 MWh, making them the marine industry's largest hybrid vessels to date. This battery power is approximately double that typically being used currently for hybrid propulsion. The order was placed in May 2022.

The ships have been designed and developed by Stena RoRo and Brittany Ferries and they will be long-term chartered to Brittany Ferries for operation between Portsmouth in the UK and French ports of St Malo and Caen. Wärtsilä had already been contracted to supply a broad range of solutions for the vessels, including the main and auxiliary engines, gearboxes, controllable pitch propellers, thrusters, the fuel-gas supply system, Nacos navigation and automation as well as integrated control alarm and monitoring systems. The ships will be capable of operating with either LNG fuel or batteries.

The vessels will be equipped with the latest generation Leclanché energy-storage system — the Navius MRS-3 — which has both a size and weight advantage versus comparable marine batteries.

Important elements of hybrid vessels include the ability to integrate multiple vessel systems and real-time optimisation of the on-board energy system. Wärtsilä combines a wide range of system expertise across a broad range of ship power and propulsion machinery. Combining the benefits of the hybrid propulsion system and shore power leads up to 15% GHG emissions saving compared to a conventional diesel mechanical propulsion system.

The vessels are being built at the China Merchants Jinling (Weihai) Shipyard. Delivery of the ferries is expected to take place in 2024 and 2025.

EDUCATION NEWS

UNSW Canberra

As we have moved into Semester 2 another three new courses are being taught in the new Naval Architecture program: ZEIT3751 Hydrodynamics of Ships and High-speed Craft, ZEIT3752 Ship Structures, and ZEIT3753 Design of Ships and High-speed Craft. All undergraduate teaching has moved back to being face-to-face which we all much appreciate.

In May we conducted our second discipline field trip to attend the Indo Pacific 2022 International Maritime Exposition and the International Maritime Conference in Sydney (see photo). Six students, all in RAN uniform, attended and they have related the experience as significant in further shaping their perceptions and understanding of the sector and the role of naval architects.

UNSW Canberra at Indo Pacific IMC2022
(Photo courtesy Warren Smith)

As the courses develop, so also do our facilities. We won't be challenging AMC's experimental capabilities, but a new flume which we share with Civil Engineering has just been filled with water for the first time. In parallel, we have recently taken delivery of some 1:72 scale models of Attack-, Fremantle- and Armidale-class patrol boats crafted by model maker Stephen Batcheldor.

Steve Batcheldor with models
(Photo courtesy Warren Smith)

Our current Year 4 thesis students are working on projects associated with the flume: establishing and setting-to-work wave-making and measurement capabilities, and undertaking carriage design and instrumentation developments. The cross section of the flume (nominally 600×600 mm) and its length (nominally 13 m) restrict "open water" research quality output, but the facility will provide opportunities to explore a range of demonstration and restricted-water experiments. We are excited to see what might be possible.

In our first year, the student numbers are naturally small and most are spoken for, being in RAN uniform. However, we are working hard to publicise our existence and encourage government and industry to consider a strategy for growing naval architects in addition to attracting them into graduate programs once they have a degree. Our degree leading to a BE (Nav Arch) (Hons) is built essentially on a common Year 1 and Year 2 foundation with Mechanical (and Aeronautical) Engineering. This reflects a program plan that we refer to as a 2+2 model, i.e. one which facilitates students transferring to UNSW Canberra having undertaken the first two years of an accredited Mechanical (or Aeronautical) Engineering four-year degree program at another Australian tertiary institution. Exact course credits for individual transferees will be managed on a case-by-case basis. This leads to a suggestion that organisations could pick up students as cadets from across the country who are approaching the mid-point of their Mechanical or Aeronautical degree and help them on a path to becoming Naval Architects by sponsoring them for their Year 3 and Year 4. We have to first find the students, to do the study, to become a graduate, and to enter the sector (to attend UNSW Canberra there would be an expectation of these students being Australian citizens). Organisations picking students up now in Year 2 from UWA, UQ, RMIT, UniSA, USyd or UNSW Sydney (for example) would mean that the students could potentially be graduating in December 2024 and entering graduate programs in 2025. Perhaps food for thought. I make these comments acknowledging that there are three cohorts of undergraduate students on the UNSW Canberra campus — those in uniform as training officers 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. We are suggesting that other organisations run schemes which might parallel that of CASG.

Please do not hesitate to contact me via email (w.smith@unsw.edu.au, or navarch@adfa.edu.au) or by other means if you have any questions or would like to contribute to our enterprise.

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

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 Ms Rusne Ramonaite <rramonaite@rina.org.uk> at RINA HQ for uploading.

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

ACT Section Webcasts

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

- *The Australian Wave and Tidal Environment and the Inherent Marine Renewable Energies,* presented by Francois Flocard, Principal Engineer, UNSW Water Research Laboratory, as a webinar hosted by RINA on 24 May 2022.
- *Performance of Propellers in Off-design Conditions*, presented by Phil Helmore as a hybrid meeting, with attendance in person at the Australian Defence Force Academy in Campbell, and streamed live via RINA's Zoom platform.

Jordan Rayson

NSW Section Webcast

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

- *Modern Technology Resins, Coatings and Glues,* presented by Dave Giddings Business Manager, Drive Marine Services and BoatCraft NSW, as a webinar hosted by RINA on 1 June 2022.

Phil Helmore

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

THE AUSTRALIAN NAVAL ARCHITECT

Contributions from RINA members for
The Australian Naval Architect
are most welcome

Material can be sent by email or hard copy. Contributions sent by email can be in any common word-processor format, but please use a minimum of formatting — it all has to be removed or simplified before layout.

Photographs and figures should be sent as separate files (not embedded) with a minimum resolution of 200 dpi. A resolution of 300 dpi is preferred.

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 June 2022 e-Newsletter included:

- Audits and application assessments
- Monitoring conditions on accreditation
- Recognised Organisation surveys and submissions – common findings
- Simplified stability criteria / stability proof tests on Class 1 vessels over 12 metres
- Vessels permanently connected to shore
- Engine changes
- Alternate survey processes

The article on *Alternate Survey Processes* is reproduced below.

Phil Helmore

Alternate Survey Processes

There are many vessels which, for varied reasons, cannot follow the phases of initial survey set out in SAGM Part 2 Chapter 3.8. A common example is a vessel which has triggered full initial survey and must undertake an initial hull survey. For any number of reasons this might not be possible or appropriate.

As a result, the alternate survey process exists to allow for approved deviations from the survey process prescribed by SAGM and Marine Order 503. SAGM Part 2 Chapter 3.8 (2) states:

> All three phases mentioned in (1) must be conducted to complete the initial survey process, unless the National Regulator approves otherwise in writing.
>
> *Note Initial Survey requirements for Load Line Certificates Are in Chapter 6.*

The key is '*approves otherwise in writing*.' All deviations from the survey process require this written approval from AMSA.

The AMSA 1854 form shall be completed and emailed to <dcvsurvey@amsa.gov.au> along with supporting information. It is important that the application explains why the defined process cannot be followed and proposes an alternate process.

To give an example, consider an aluminium fishing vessel currently in survey with a geographic restriction to South Australia. Full initial survey would be required to remove this restriction. In this example the hull hasn't been altered, the vessel has a current certificate of survey and has been maintained in survey for the vessel's life. To perform an initial hull survey would be challenging. It could be proposed on the AMSA 1854 form to perform a 10 yearly hull inspection in lieu of the initial hull survey.

There are any number of different cases which could require an alternate survey process, but it is critical that the approval be made in writing by the National Regulator. This saves time and gives greater certainty when submitting survey recommendations for a vessel which is slightly out of the ordinary.

Survey Matters, June 2022

HYDROCourses Meet the Requirements for Continuing Professional Development Hours

HydroComp is proud to announce that our our newest innovation in online education, HYDROCourses, is 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/

MEMBERSHIP

Australian Division Council

The Council of the Australian Division of RINA met on the afternoon of Tuesday 14 June 2022 by Zoom conference under the chairmanship of our incoming President, Jim Black, in Perth, with links to Cairns, Airlie Beach, Gold Coast, Sydney, Canberra, Melbourne, Hobart, Adelaide and Perth. To commence the meeting, the President welcomed members attending their first meeting and expressed appreciation of the service of his predecessor, Gordon MacDonald whom he congratulated on the award of the Medal of the Order of Australia (OAM) in the Queen's Birthday Honours earlier in the week.

Among the items discussed were:

Vacancies — Vice President and Council Member

Based on the President's nomination, Council elected NSW Section Chair, Belinda Tayler, to these vacancies.

Formation of Improvement Committee

Given that Ms Tayler had only just been elected to Council, and that she had undertaken to Chair the Committee, it was agreed that finalisation of terms of reference should be undertaken intersessionally. The Committee will report to Council's December meeting.

Amendment of Section Rules

Council approved amendments to the Section Rules. The changes involved were largely administrative but included a small reduction to quorum requirements for Section Annual General Meetings**.**

Proposed Australian Standard for LNG Bunkering

Council appointed Adrian Macmillan as its representative on the Standards Australia committee for this standard**.**

Indo Pacific 2022 IMC

Council noted that the IMC and the Indo Pacific 2022 Exposition with which it was associated had generally been accepted as the most successful yet, despite the residual health and travel restrictions related to COVID-19. Full details of the outcome would be provided in due course.

Council Meeting — London 20 April 2022

A report was received from the Division's attendees at the meeting, which was the last one of Maurizio d'Amico's term as President and accordingly included his final report in that role.

The main business of the meeting was to receive reports of the activities of the Institution's technical committees. Whilst these reports were relatively routine they did include election of new chairs for the Maritime Safety and Professional Affairs Committees, Sarah Watts and Mark Barton respectively.

Another significant development was the election to Council of Navitalai Ratukalou of Fiji and Martin Renilson to fill a Council vacancy following the elevation of Jim Black to Division President.

Government Initiatives

Council noted that the Senate Economic References Committee inquiry into *Sovereign Naval Shipbuilding Capability* had issued its final report on 18 May during the Federal Election campaign. This was somewhat unexpected as evidenced by this column in that month's issue of *The ANA*.

Next Meeting

Council provisionally agreed to hold its next meeting on Wednesday 21 September 2022 at 14.00 hours Eastern (12.00 hrs Western) Standard Time.

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

Rob Gehling
Secretary
ausdiv@rina.org.uk

Continuing Professional Development

Continuing professional development (CPD) is the systematic maintenance, improvement and broadening of knowledge, understanding and skills, and the development of the personal qualities, necessary to carry out professional and technical duties throughout a member's working life. Continuing professional development will therefore enable the member to:

- Update professional competence, so that practice is fully in line with current requirements.
- Develop personal and management skills.
- Broaden experience leading to new career opportunities.

Continuing professional development can be achieved through a range of activities, both in and outside the workplace, which are related to members' careers as professional engineers. The types of activity which contribute towards members' continuing professional development and their obligations as a member of the Royal Institution of Naval Architects are described in the RINA publication *Guidance on Continuing Professional Development* available at www.rina.org.uk/guidance_notes.html.

All Fellows and Members who are in or seeking active work are required to take all reasonable steps to maintain and develop their professional competence and knowledge after election. The Institution requires that members achieve a minimum of 35 hours of CPD activity per annum. However, it is expected that most members will exceed this amount.

Associate Members are expected to complete Initial Professional Development (IPD) in order to progress to Member grade, for maintenance of which CPD is a requirement.

The Institution requires that CPD activities should be authenticated either by mentors, employers or the providers of CPD. Some informal learning activities may be self-authenticated. The roles of the mentor, employer and the Institution in assisting members to achieve their CPD are described in the *Guidance* document.

The Institution places an obligation on its members to plan and record their CPD and to produce evidence of their CPD achievement. The Institution may request to see a member's CPD Plan and Record at any time, and when upgrading class of membership.

RINA Council and Committee Members

To keep members up-to-date with who is doing the hard yards on their behalf in Australia, current council, section and committee members are as follows:

Australian Division Council

President	Jim Black
Vice President	Belinda Tayler
Secretary	Rob Gehling
Treasurer	Craig Boulton
Members nominated by Sections	
	Nick Bentley (Qld)
	Phil Bevan (SA&NT)
	Adrian Broadbent (NSW)
	Chris Davies (Tas)
	Emma Tongue (WA)
	Nathan Wallace (Vic)
	Lily Webster (ACT)
Members elected or appointed by Council	
	Sammar Abbas
	Walid Amin
	Jonathan Binns
	John Butler
	Ken Goh
	Andrew Harris

ACT Section

Chair	Warren Smith
Deputy Chair	Trevor Dove
Secretary	Jordan Rayson
Assistant Secretary	Martin Grimm
Treasurer	Lachlan Clarke
Nominee to ADC	Lily Webster
Members	Ray Duggan
	David Lyons
	Jeremy Nolan

NSW Section

Chair	Belinda Tayler
Deputy Chair	Phil Helmore
Secretary	Lauren Stotz
Treasurer	Adrian Broadbent
Nominee to ADC	Adrian Broadbent
Auditor	David Wong
TM Coordinator	Phil Helmore
Members	Craig Boulton
	John Butler
	Valerio Corniani
	Ehsan Khaled
	Molly McManus
	Alan Taylor

Queensland Section

Chair	Jalal Rafieshahraki
Deputy Chair	Hamish Lyons
Secretary	Ashley Weir
Treasurer	James Stephen
Nominee to ADC	Cameron Whitten
Members	Gerard Anton
	Dean Biskupovich
	Mark Devereaux
	Tommy Ericson
	Tom Pipon
	Timothy Vaughan

South Australia and Northern Territory Section

Chair	Phillip Bevan
Deputy Chair	Peter Samarzia
Secretary	Cameron Wilkinson
Treasurer	Donal Gallagher
Nominee to ADC	Andrew Harris
Members	Peter Dandy
	Omar Hostia
	Alistair Mitchell

Tasmanian Section

Chair	Chris Davies
Deputy Chair	Martin Renilson
Secretary	Richard Boult
Treasurer	Michael O'Connor
Nominee to ADC	Chris Davies
Members	Doupadi Bandera
	Conor Dalton
	Callum Finney
	Alan Muir
	Chance Ong
	Michael Woodward

Victorian Section

Chair	Tom Dearling
Secretary	Keegan Parker
Assistant Secretary	Samuel Price
Treasurer	Alex Conway
Nominee to ADC	Nathan Wallace
Members	Jese Millar
	James Nolan
	Luke Shields
	Karl Slater

Western Australian Section

Chair	Piotr Sujkowski
Deputy Chair	Kenneth Goh
Secretary	Kenneth Goh
Treasurer	Hadiqa Khan
Nominee to ADC	Emma Tongue
Members	Sammar Abbas
	Nathan Chappell
	Bertrand Gorjux
	Suzanne Hutchison
	Evgenia Koutsoukou
	Anuj Sharma
	Yuriy Drobyshevski

The Australian Naval Architect

Editor-in-chief	John Jeremy
Technical Editor	Phil Helmore
Referee	Noel Riley

Walter Atkinson Award Panel

Chair	Michael Squires
Members	Jonathan Binns
	Dan Curtis
	Alan Muir
	Karl Slater
	Lily Webster

Bob Campbell Award Panel

Convenor	Rob Gehling
Members	Volunteers from the WAA Panel and others

RINA London

Vice President Pacific Region	Rob Gehling
Board of Trustees	Rob Gehling
Council Members	Jim Black (*ex officio*)
	Rob Gehling
	Martin Renilson
Maritime Safety Committee	Rob Gehling
	Doug Matchett
IMO Committee	John Manning
Professional Affairs Committee	Jim Black

RINA/Engineers Australia Joint Board of Naval Architecture

Members	Jim Black
	Rob Gehling

Improvement Committee of AD Council

Chair	Belinda Tayler
Members	Ken Goh
	Andy Harris
	Michael Woodward

AMSA DCV Liaison Working Group

Chair	Rob Gehling
Members	10 (names confidential)

Standards Australia Committee CS114 (Small Craft)

Member	Peter Holmes
	David Lyons

Standards Australia Committee ME059 (Shipbuilding)

Member	Adrian Macmillan

International Standards Organisation (ISO)

Chair Working Group 35 reviewing ISO12215 Small Craft — Hull Construction and Scantlings
David Lyons

Project Leader reviewing ISO12215 Part 9 Sailing Craft Appendages
David Lyons

Offshore Racing Congress

International Technical Committee Member
David Lyons

Sailing Yacht Research Foundation (USA)

Advisory Member	David Lyons

Indo Pacific 2022 IMC Organising Committee

Chair	John Jeremy
Members	Adrian Broadbent
	Stuart Cannon
	Tauhid Rahman (representing IMarEST)

Indo Pacific 2022 IMC Papers Committee

Chair	Adrian Broadbent RINA
Members	Craig Boulton ASO Marine Consultants
	Giuseppina Dall'Armi-Stoks DST Group
	Rob Gehling RINA
	Gregor Macfarlane AMC/UTas
	Tauhid Rahman DNV and IMarEST
	Karl Slater DST Group
	Warren Smith UNSW Canberra

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 AUSTRALIAN DIVISION INVITES ADVERTISING AND/OR SPONSORSHIP FROM COMPANIES AND PERSONS WISHING TO SUPPORT CONTINUATION OF THIS JOURNAL AND DIVISION ACTIVITIES

Contact the Division Secretary, Rob Gehling

Phone: 0403 221 631

Email: rinaaustraliandivision@iinet.net.au

NAVAL ARCHITECTS ON THE MOVE

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

Bronwyn Adamson has moved on from Rolls-Royce Services Australia and has taken up the position of Lead Platform Systems Engineer with KBR Inc. in Sydney.

Zia Ahmed has moved on from Nova Systems and, after three years with Thales Australia, has taken up the position of Naval Architecture Manager for the SEA 5000 (Hunter-class Future Frigate) Project with the Department of Defence in Canberra.

Andrew Baglin has moved on from Multiphase Design and Stuart Friezer Marine and has taken up the position of Design and CFD Group Coordinator with Caponnetto Hueber in Valencia, Spain.

Jonathan Binns has moved on from the Australian Maritime College at the University of Tasmania, and has taken up the position of Group Leader—Naval Architecture and Platform Systems Analysis with DST Group in Melbourne.

Nick Browne has moved on within the Australian Antarctic Division and has taken up the position of Manager Shipping in Hobart.

Yew Jinn Chieng moved on from International Maritime Consultants in 2014 and, after some time at Bible-Presbyterian Church of WA, has taken up the position of Test Analyst with Nuheara in Northbridge, WA.

Alan Dowd has moved on and has taken up the position of Shipyard Manager with Birdon Group in Port Macquarie, NSW.

James Fenning has moved on from Sapura Energy Australia and has taken up the position of Senior Project Manager Marine with Fortescue Future Industries in Perth.

Adela Greenbaum has moved on from Sea Power Centre–Australia and, after some time with the Department of Prime Minister and Cabinet and ACT Health, has taken up the position of Data Manager Navy ERP with the Department of Defence in Canberra.

Peter Henry has moved on within Lloyd Warwick International from Houston, TX, and has taken up the position of Senior Engineering Loss Adjuster in Sydney.

John Lynch completed his Naval Architecture and Marine Engineering degree at the Australian Maritime College last year and has taken up the position of Graduate Naval Architect with BMT, currently on secondment to the SEA 5000 (Hunter-class Future Frigate) Program in the Capability Acquisition and Sustainment Group of the Department of Defence in Adelaide.

Georgia McLinden has moved on from Naval Group in Cherbourg-en-Cotentin, France, and has taken up the position of Lead Naval Architect with ASC in Adelaide.

Paul O'Connor has moved on from Lloyd's register and has taken up the position of Principal Naval Engineering Specialist, Bureau Veritas Marine & Offshore, in Sydney.

Prasanta Sahoo has moved on from the Florida Institute of Technology and has taken up the position of Visiting Faculty Member at UNSW Canberra at the Australian Defence Force Academy in Canberra.

Peter Samarzia has moved on from PMB Defence and has taken up the position of Principal Naval Architect with BMT Defence & Security in Adelaide.

Paul Steinman has moved on from VEEM Gyro and has returned to consulting as Principal of Halcyon International, a business advisor to growth technology companies with focus on maritime sector and renewable and transition energy solutions, in Perth.

Belinda Tayler has moved on within the Maritime Docks and Marine Services System Program Office and has taken up the position of Seaworthiness Manager in Sydney. She has also taken on the position of Vice-President of the Australian Division of RINA. Congratulations Belinda!

Peter Tomic has moved on from Siemens Gamesa and has taken up the position of WTG Transport and Installation Manager for the Hai Long Offshore Wind Farm with Northland Power Inc. in Taipai City, Taiwan.

Nick van den Hengel is now consulting as Platform Engineering Team Manager to CASG on the AWDs in Sydney.

Dylan van Drunen has moved on from Navy Engineering and, after some time at Intecsea and Fugro, has taken up the position of Project Engineer with Nexans in Oslo, Norway.

Thomas van Peteghem has completed his master's degree in Management of Innovations and is now consulting as a Designer of Immersive Experiences in Virtual/Augmented/Mixed Reality in Paris.

John van Pham has moved on from Incat Crowther and is now consulting as a naval architect and software developer in Sydney.

Max van Someren has moved on from Austal and, after some time at the Australian Energy Market Operator, has taken up the position of Group Leader with Frazer-Nash Consultancy in Perth.

Jan Verdaasdonk has moved on from RSC Bio Solutions and, after some time at APTO Innovations, has taken up the position of Business Development Manager with BMT Asia Pacific in Singapore.

Alistair Verth has moved on from Corrosion Control Engineering and has taken up the position of Senior Pipeline Corrosion Engineer with Verbrec in Brisbane.

Gabriel Wong has moved on from Offshore Technology Development and has taken up the position of System Analyst with PUB, Singapore's National Water Agency, in Singapore.

Dan Wupperman has moved on within Espen Oeino International and has taken up the position of Head of Initial Design in Monaco.

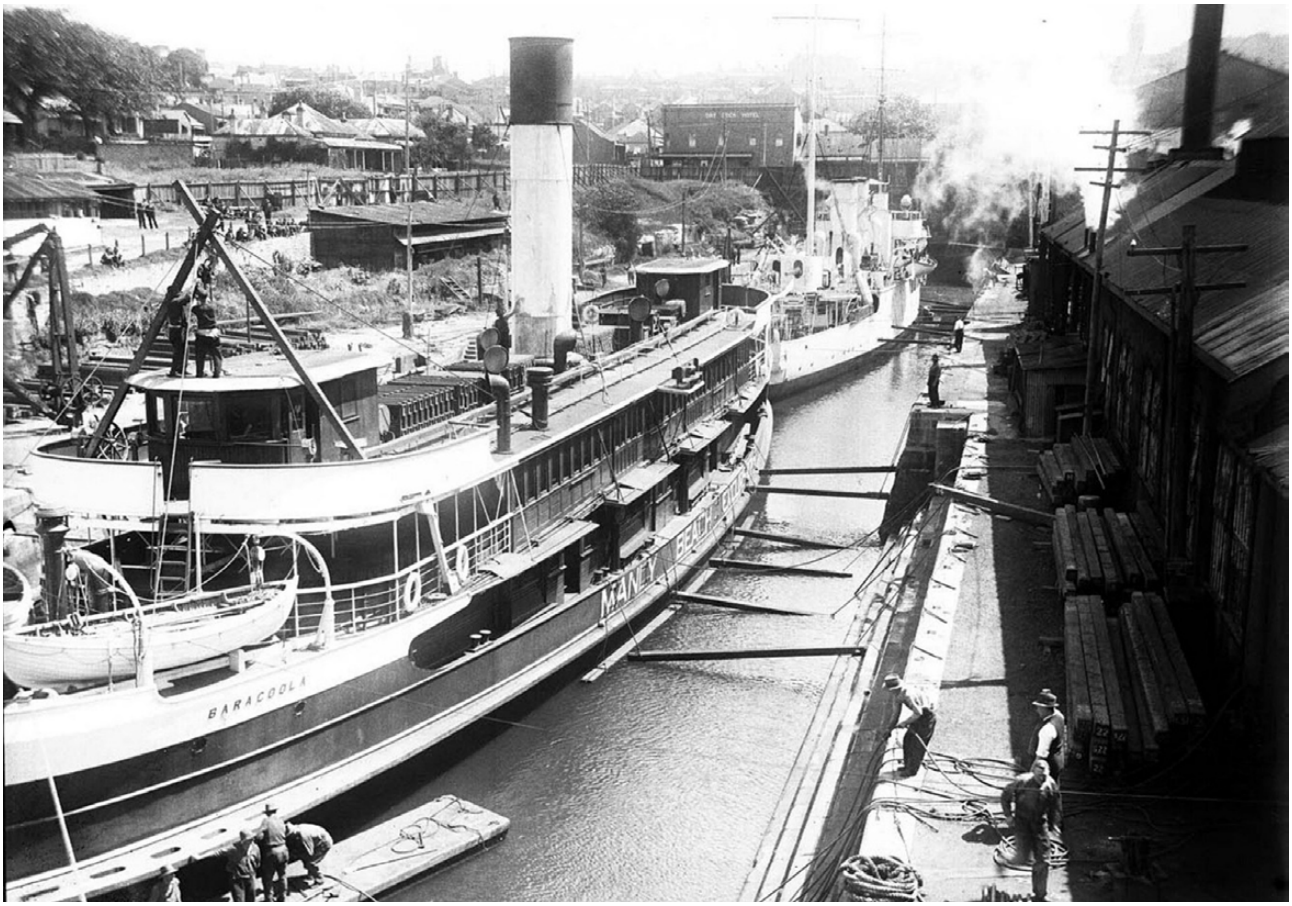
This column is intended to keep everyone (and, in particular, the friends you only see occasionally) updated on where you have moved to. It consequently relies on input from everyone. Please advise the editors when you up-anchor and move on to or if you know of a move anyone else has made in the last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

Phil Helmore
Martin Grimm

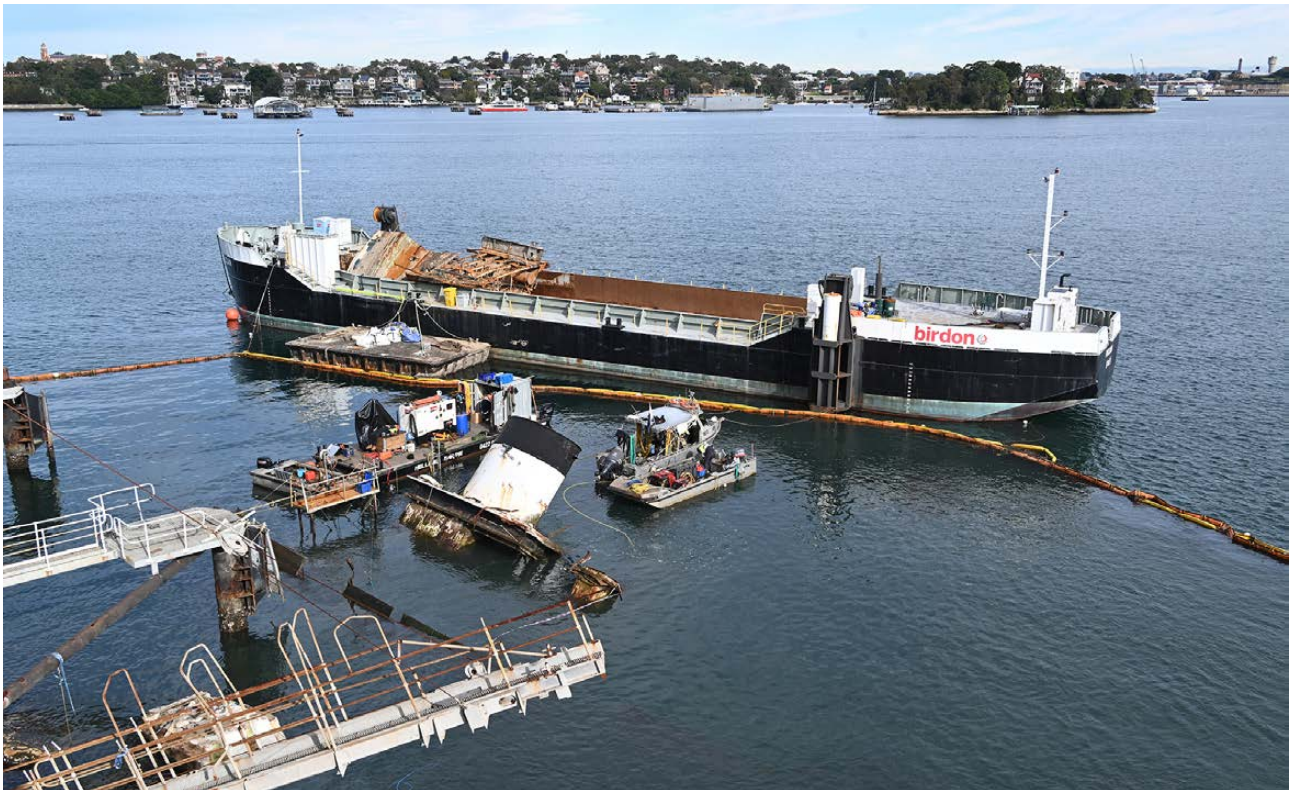
FROM THE ARCHIVES

Whilst construction of the Fitzroy Dock on Cockatoo Island was begun in 1847, it was not completed until 1857. Meanwhile, Thomas Sutcliffe Mort and his partner Captain T S Rowntree constructed a graving dock at Waterview Bay in Balmain between 1853 and 1855. Australia's first graving dock was extended in length twice — in 1874 to 118 m and in 1889 to 194 m.
This photo shows the dock around 1920
(Photo National Library of Australia)

Morts Dock was closed in 1959. The Australian National Line acquired part of the site in 1963 and the remainder in 1966. The site became the passenger terminal for *Empress of Australia* and a container depot. The dock was filled in and the site raised and levelled for container handling. The depot was closed in 1975 and the site was subsequently redeveloped as a park. The outline of the buried dock is revealed by stonework but the original caisson is still in place
(Photo John Jeremy)



The Manly ferry *Baragoola* and the French sloop *Bellatrix* in Morts Dock about 1930.
Baragoola was built at Morts Dock in Balmain and was completed almost 100 years ago on 3 September 1922.
Subsequently converted to diesel-electric propulsion, she continued in service until January 1983
(Photo Australian National Maritime Museum)



For many years attempts were made by various owners to find a new life for *Baragoola* and to restore her to operating condition. Years were spent alongside the Coal Loader at Balls Head with little real progress being made. Gradually deteriorating, *Baragoola* finally took matters into her own hands when she sank on 1 January 2002 at her berth. Beyond salvage, the NSW Government arranged for her wreck to be broken up and, by the centenary of her first commissioning, little of the old ferry should remain
(Photo John Jeremy)

The aviation support team of HMAS *Canberra* transfer an embarked U.S. Marine Corps MV-22B Osprey into the ship's hangar during Exercise RIMPAC 2022
(RAN photograph)