THE AUSTRALIAN NAVAL ARCHITECT

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February 2026

Minister for Resources, the Hon Madeleine King MP and Republic of the Marshall Islands Minister of Foreign Affairs & Trade, the Hon Kalani Kaneko conduct the formal handover of the Guardian-class Patrol Boat Jelmae during a ceremony at HMAS Stirling in Western Australia.
(RAN Photo)

THE AUSTRALIAN NAVAL ARCHITECT

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Cover Photo:
Incat Tasmania's full electric catamaran *China Zorilla* undergoes manoeuvring trials in Hobart
(Photo courtesy Incat Tasmania)

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FROM THE DIVISION PRESIDENT

Welcome to another edition of the Australian Naval Architect. This is once again an amazing effort by the team to bring this edition together, thank you to all involved, especially especially Trevor Ruting, Rob Gehling, Martin Grimm, Jennifer Knox, Jack Mclaren Noel Riley and Abigail Jane. Without these amazing efforts this publication would not keep going. Throughout 2025 RINA HQ has been updating our publication offerings; The Australian Naval Architect compliments those offerings extremely well and serves the Australian Division equally as well. This edition is no exception. I've a quick look through the drafts and we have a great mix of design, build and research information, sure to keep you reading and catching up on events coming and colleagues moving!

From our section reports we have had a range of technical presentations including:

- "How marine rescue services in Australia must adapt to new boating technologies" in the ACT Section, by Mike Hammond of Marine Rescue NSW on 19 November
- "Smart Composites for Marine Propulsion" in Sydney by Prof Gangadhara Prusty on 1 October
- Matt McGellin giving a talk on Lessons from the World's First Ammonia Powered Vessel" at the IMarEST Fremantle meeting on 27 November
- 26 November 2025 Mal Waugh, RINA WA Secretary, presented "The Ships That Defined the Viking Age to the Old Gaffers Association" at the Royal Freshwater Bay Yacht Club
- 1 December 2025 Ken Goh, RINA WA Section Chair and General Manager for Knud E Hansen (AU), challenged the RINA Technical Meeting audience to consider what are currently referred to as alternative fuels.
- "Design and Engineering Experiences Working in an Offshore Construction Yard" by James Stephen at Sheerline Solutions on 11 December.

These offer an amazing way to find out what naval architects are doing around Australia and increase your CPD.

2025 was another big year for the maritime industry in Australia, our designers, shipbuilders and maintainers are all advancing on a global scale. Just choosing two advances that I noticed, the largest battery powered vessel continually getting larger from Incat and significant advances in alternative fuels being made by Austal all contributing massively to the drive to renewable fuels. Combining that sort of innovation with a demand for sovereign capability across industries and we are starting to see new leases on life for boatbuilding across Australia. Just this week I visited a new build by international company Leidos using NSW Central Coast-based Oceans Rivers Lakes.

In the last two years we've seen 12 offshore wind farm leases being granted (total of 25GW). Combining this with the very real strategic fleet demands we have, there is lots of work for the maritime industry from domestic consumption.

From a RINA point of view, in 2025 we have had a new

Jonathan Binns

CEO appointed and about to see a new President appointed. The online presence for RINA has been completely revamped along with The Naval Architect publication.

For RINA Australia we went to the Australian Wooden Boat festival in February. Then in March the west went to the Energy Exchange Australia Exposition (EXA, the new AOG), we are set to be at the next Energy Exchange in Perth from 10-12 March. RINA is a key partner in this exposition covering all aspects of the offshore energy industry. Essentially covering discussions on how this vital section of maritime industry will adapt to the changing needs and aspirations of society. Throughout the middle of the year we had the numerous boat shows throughout the leisure industry.

Then in November 2025, we had an incredibly successful IndoPac and International Maritime Conference with 28,000+ attendees at the expo across the three days, 1,019 exhibitor companies, 62 nations represented, 241 official delegations in attendance and 32 Chief of Navy or counterparts participants (I do remember our Minister of Defence calling it "Disneyland for Chiefs of Navy"). In the months prior to the conference and exposition RINA Australian Division signed a continuation of the MOU with AMDA Foundation Limited to co-manage the IMC out to 2031.

2025 was certainly a hard year for me, making me think about the past present and future. I have lost three mentors. Firstly Phil (Helmore), then John (Jeremy) and finally a man named Professor Norman Saunders (not a naval architect). These are the people who educated me, oversaw my work and guided me through the infinite possibilities that make a career. I would not be the person I am today without the influence of these people. Vale to my mentors Phil, John and Norman, I hope I can emulate the mentorship you provided

me. Although 2025 certainly has made me feel a little lost, I do feel a part of something bigger because of this guidance I have received, a bigger picture of continuing innovation and making things just a little bit better all round.

As Rob has pointed out John and Phil made huge contributions to the Division, in committee and council roles, but also on keeping the ANA going for 26 years. Both played enormous roles in managing our relationship with AMDA and IMC.

Finally, and most importantly, we are always on the lookout for more volunteers to assist with how the Australian Division and sections run. The critical positions of Secretary, Treasurer and ANA editors (2) will all need people to contribute to with the same amazing dedication as those currently serving RINA and the profession so amazingly well. Please do get in touch with ideas on how we can continue the amazing work that has been done over many years by the dedicated members in these positions.

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

Jonathan Binns

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EDITORIAL

The 26th January this year marked not only Australia Day but also the release by the United States (US) Congressional Research Service (CRS) of its report *Navy Virginia-Class Submarine Program and AUKUS Submarine Project*. This report (see The Internet in this issue) delves into a number of subjects that have been speculated upon by various defence and political commentators since initial announcement of AUKUS and it's Pillar 1 Submarine Project. While not currently US government policy, its publication may indicate possible future action by the United States in relation to its implementation.

It should be stated at the outset that the relevant decisions are matters for the Federal Government under the Defence and Foreign Affairs portfolios. Given the projected cost of AUKUS Pillar 1 and the impact of the project on Australia's national and international security, it is the responsibility of those naval architects and other engineers involved to apply their full skills the task at hand and to speak up where necessary to secure the best possible safe outcome in the national interest. Outlined below is a summary of issues arising from the AUKUS Submarine Project and comments on it already provided by informed defence and industry commentators rather than any new commentary.

Pillar 1 is a project to:

(1) rotationally deploy four US SSNs and one UK SSN out of a port in Western Australia;

(2) more significantly, sell three to five Virginia-class SSNs to Australia and build three to five replacement SSNs for the US Navy; and

(3) have the United States and United Kingdom (UK) provide assistance to Australia for an Australian effort to build additional three to five SSNs of a new UK-Australian SSN design to complete a planned eight-boat Australian SSN force.

The Australian Government has adopted an "optimal pathway" which involves:

a. Regular Australian port visits by US and UK nuclear submarines on rotational deployment

b. Establishment of a submarine maintenance base in Western Australia with capability of all sustainment work on US *Virginia* class and UK *Astute* class submarines preparatory to Australia's introduction of SSNs

c. Design and construction of a new submarine construction shipyard at Osborne South Australia

d. Australian participation in the design of the SSN-AUKUS class submarines to be constructed at Osborne commencing in the late 2020s and completed in the early 2040s following first-of-class constructed in the UK according to the timeline set on the Australian Submarine Agency (ASA) website

e. Purchase from US of 3 to 5 *Virginia* class submarines in the early 2030s

f. Life-of-type-extension (LOTE) refurbishment of *Collins* class submarines to facilitate their continuation in service until replaced by *Virginia* class and/or SSN-AUKUS vessels

g. Training of RAN personnel to appropriate levels for operation of Australian nuclear propelled submarines through courses and embedding in the US Navy and Royal Navy fleets.

Of these measures, d, e, f and g relate to the availability of sovereign Australian submarine capability and the design and construction of SSN-AUKUS vessels for the Royal Australian Navy. As point g is related to the personnel side of the pathway rather than hardware, it is left aside in this discussion.

We as naval architects know that the design of a complex naval ship, particularly a submarine and even more particularly a nuclear propelled submarine cannot be considered complete until after the first-of-class enters and is settled into service, hence the regular cost increases and time delays that are typical for such projects. It is therefore a concern that the first-of-class SSN-AUKUS submarine is scheduled to be constructed for the UK at Barrow-in-Furness following and using the same construction dock as the *Dreadnought* class, the first of which is not due to be commissioned until into the early 2030s. Sources in both the UK and Australia (including the ASA website) set the late 2030s as the delivery date of the first UK SSN-AUKUS.

ASA indicates that construction of the first Australian SSN-AUKUS submarine will commence before the end of the 2020s, leading to delivery in the early 2040s. It is to be hoped that this schedule and associated cost estimates are realised but history of naval shipbuilding projects in Australia and overseas indicates this to be an unrealistic expectation.

The sale to Australia of *Virginia* class submarines is subject to a legislative requirement for the US President to certify to Congress at least nine months before the transfer that the transfer will not degrade the United States undersea capabilities, is consistent with United States foreign policy and national security interests, is in furtherance of the AUKUS partnership and that the United States is making sufficient submarine production and maintenance investments to meet the combination of these and other United States military requirements. Notwithstanding the confirmation of support for AUKUS by the current US President, this leaves a question mark over the proposed sale until after 2030.

It is unclear whether US shipyards will be able to effectively double their production rate of Virginia class submarines to facilitate the sale to Australia of 3 to 5 of these vessels.

The CRS report puts forward the alternative "division of labor" whereby these *Virginia* class submarines would remain in service with the US Navy rather than being sold to Australia. It states:

Under a U.S.-Australia military division of labor for performing SSN missions and non-SSN missions,

- the forward rotations of U.S. and UK SSNs to Australia planned under Pillar 1— SRF-West—would still be implemented;
- up to eight additional Virginia-class SSNs would be built, and instead of three to five of them being sold to Australia, these additional boats would instead be retained in U.S. Navy service and operated out of Australia along with the five U.S. and UK SSNs that are already planned to be operated out of Australia under Pillar 1 as SRF-West; and
- Australia, instead of using funds to purchase, build, operate, and maintain its own SSNs, would instead invest those funds in other military capabilities—such as, for example, long-range anti-ship missiles, drones, loitering munitions, B-21 long-range bombers or other long-range strike aircraft, or systems for defending Australia against attack by ballistic missiles, cruise missiles, manned aircraft, or drones—so as to create an Australian capacity for performing other missions, including non-SSN military missions for both Australia and the United States.

Adoption of this alternative would ensure that all *Virginia*-class SSNs remain under US operational control.

Turning to point f of the optimal pathway as summarized above, it is notable that the ASA website shows *Collins* class capability tapering off around 2043, 46 years after HMAS *Collins* was commissioned. Wikipedia states "The *Collins* class was expected to be retired about 2026, however, the 2016 Defence White Paper extended this into the 2030s. The *Collins* class life will now be extended and will receive an unplanned capability upgrade, including sonar and communications". This LOTE would appear to fall about 10 years short of extending the national capability until the first of the Australian SSN-AUKUS vessels enters service if the schedule outlined above is maintained. Any slippage of that schedule would increase this shortfall.

So, in the absence of further action, it appears that an Australian submarine capability gap is likely to arise irrespective of whether the United States elects to follow the "division of labor" approach suggested in the CRS report. If so, and the capability gap is found to be significant, what are the options to fill that gap?

a) In his essay "Facing up to AUKUS Realities" (The Navy Vol. 88 No.1) Robert McKeown suggests that Australia should immediately commence building Astute class submarines now. But this ignores the fact that Rolls Royce is ceasing production of PWR2 reactors in favour of the PWR3 design being installed in the Dreadnought class.

b) The same proposal might be applied to Australian build of Virginias but this is also understood to not be possible due to the unavailability of additional PWR2 reactors.

c) A second LOTE for Collins class has been suggested by some knowledgeable people in these matters. Even without any slippage in the delivery of the first SSN-AUKUS, this would probably not extend the vessels' lives sufficiently to fill the capability gap.

d) There is of course the possibility of the urgent purchase or construction of conventional submarines to an existing off-the-shelf design. If these vessels were to be constructed in Australia they would have the effect of filling the gap in submarine construction skills that will be required for construction of SSN-AUKUS. But the normal Defence timeline for selection of a new vessel design and delays associated with Australian construction must be ruthlessly minimized to avoid increasing the capability gap.

e) The final dot point quoted above from the CRS report suggests a non-submarine option of attaining the capability from a US perspective but may not meet Australia's needs.

A final point to be made is that Australia's ability to sustain more than one submarine type at a time has been questioned in relation to the prospect of simultaneous operation of *Collins*, Virginia and SSN-AUKUS classes. This number will increase to four if a new conventional submarine is selected as an interim solution.

Hopefully these issues are under consideration within Defence and ASA and will receive a full and open public hearing. We await the Government's decisions, but the present uncertainties would seem to indicate that there is no certainty that Australia will maintain a sovereign submarine capability through to the mid-2040s and so it is not in the national interest to proceed without urgent clarification.

Rob Gehling AO

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COMING EVENTS

Australian Division Annual General Meeting

Tues. 24th March 2026 at 8pm AEDT by Zoom

(see page 29)

NSW Section Technical Presentations

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

4 Mar	Section AGM
4 Mar	Alan Steber, General Manager, Steber International. *Steber 43 Hybrid Diesel-Electric Workboat* at Royal Sydney Yacht Squadron
1 Apr	Greg Hodge *Commercial vs naval ship sustainment practices and processes*
6 May	TBA
3 Jun	Rounok Saha Niloy *Multi-Concept Optimization: Challenges and Opportunities*
1 July	TBA
5 Aug	William Jones *CCD Robotics and Automation*
2 Sep	TBA
7 Oct	Pat Doherty *TBA*

Tasmania Technical Presentation

17 Mar. Levi Catton, of Gibbs & Cox. *Topic TBA*

This presentation will be in usual Launceston location with live stream to Hobart

WA Section

WA Section Committee Meetings

Committee Meetings are due to be held on 04 February and 04 March in the run-up to the WA Section AGM, due 18 March 2026. There is opportunity for new Committee members and support is encouraged from the Section.

WA Section AGM 18 March 2026

The WA Section AGM is due to be held 18 March 2026 with early planning and report preparations underway by the Committee Members. The Flying Angel Club, Fremantle, is the provisional venue with a 6pm start. Following the AGM will be a Technical Presentation.

Energy Exchange Australia Expo 10-12 March 2026

As in previous years WA Section will have a presence at the EXA Expo at the Perth Convention and Exhibition Centre.

RINA Warships 2026: "Scaling the Fleet- Delivering Added Mass with Affordable Minor Warships 30 September -1 October 26 Perth WA

Exciting news announced during I-PAC 25 was that, after the success of Warships2024 conducted in Adelaide, RINA HQ has decided to conduct their internationally recognised Warships conference in Perth, WA on 30 September - 01 October 2026 at the Optus Stadium, Burswood.

Topics will include:

- Integration of Minor Warships
- Technology to improve availability
- Autonomous Systems
- Blend of crewed/uncrewed – Optionally Crewed Systems
- Lean crewing
- Tech advancement
- More sustainable build techniques

Abstracts for potential papers are due by 12 March 2026.

For more information visit: https://www.rina.org.uk/Warship-2026-Scaling-the-Fleet-Delivering-Added-Mass-with-Affordable-Minor-Warships

Indian Ocean Defence and Security Conference and Exhibition 26-28 May 2026, Perth WA

The AMDA Foundation (that runs the I-PAC Conference/Exhibition series) is also conducting this Indian Ocean-focused conference at the Perth Convention and Exhibition Centre 26-28 May 2026. Among a wide range of topics, it will include the following activities:

- A panel of former Australian Defence Ministers for a candid discussion of defence and strategic issues.
- MHI and Mogami-class frigates update
- Strategic Shipbuilding Agreement with Austal Defence Shipbuilding Australia.

WARSHIP 2026
Scaling the Fleet

Following the success of Warship 2024, with over 230 delegates, Warship 2026 is back in Australia, bringing together international experts in naval design, engineering, and innovation. The conference will focus on delivering affordable, capable minor warships and the latest technical developments shaping future fleets.

The event attracts defence professionals, industry specialists, academics, and technology experts. Delegates will hear from leading speakers, join technical discussions, and connect with fellow professionals from around the world.

Why Attend

Warship 2026 offers a unique opportunity to engage with the forefront of naval innovation:

- Discover the latest technologies and strategies for minor warships
- Join expert-led discussions on fleet development and innovation
- Connect with defence, industry, and academic leaders worldwide
- Gain insights into trends shaping the future of naval capability

Topics (including but not limited to):

- Integration of Minor Warships
- Technology to improve availability
- Autonomous Systems
- Blend of crewed/uncrewed – Optionally Crewed Systems
- Lean crewing
- Tech advancement
- More sustainable build techniques

30th Sept 2026 - 1st Oct 2026
Perth, Australia

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

Event Partner
BMT

ACT Section

End-of-Year Function at Capital Brewery

The ACT Section Christmas drinks were held on Thursday 27th November at the Capital Brewing Company at Fyshwick. The photo below depicts the convivial environment and attendees.

(L to R:) Lily Webster, Kerry Johnson, Vesna Moretti, Greg Swalwell, Peter Hayes,, Garry Duck, John Colquhoun, Rob Gehling, Ewan Farquharson
(Photo courtesy Martin Grimm)

Martin Grimm

NSW Section News

SMIX onboard James Craig

On 4 December 2025 SMIX 2025 was again held successfully on the *James Craig* alongside at Darling Harbour, with about 200 guests from the maritime industry attending. Once again, the weather favoured us with a beautiful Sydney summer evening looking over the harbour. A buffet dinner, drinks and very many conversations were had around the ship.

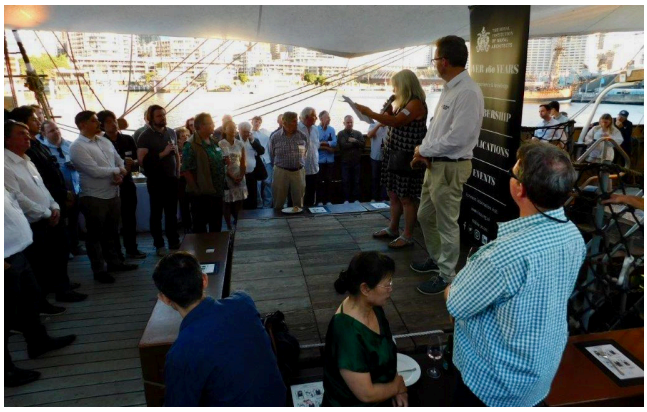
Welcome speeches were by John Butler (SMIX Chair), Scott Willey (TK Shipping), Bill Harkin (Beaver Engineering) and Sean Langman (Noakes Group).

A rousing 'Save our Shipyard' speech was given by Peter Cole from the Sydney Heritage Fleet (SHF). This was followed by an 'In Memoriam' speech by Helen Wortham in remembrance of Phil Helmore's contributions to the naval architecture profession.

Three raffle prize hampers were generously donated by Teekay Shipping and drawn by Scott Willey. All raffle proceeds were donated to the SHF.

The Lucky Door Prize #1 for an accommodation package at Kermandie Hotel, Tasmania, was donated by Noakes Group and won by Miki Romanyk.

Lucky Door Prize #2, was a copy of the Australian Boating Manual, donated by Ocean Publications (Jing Gandy) and won by Michael Sokialis.



Helen Wortham delivering her tribute to Phil Helmore
(Photo courtesy Martin Grimm)

Hull Half-Model of Lady Hopetoun
(Photo courtesy Adrian Broadbent)

Some of the many attendees aboard James Craig
(Photo courtesy Martin Grimm)

The silent auction of a half-model of the *Lady Hopetoun* achieved a winning bid by Sean Langman with a donation of $800 to the SHF. The half-model was crafted by Bill Bollard, in 2006 and was donated for auction by Helen Wortham, Phil Helmore's widow.

Adrian Broadbent and Michael Sokialis

Future of Protective Coatings

This presentation on 4 February 2026 by Keith Mackenzie, Chief Executive Officer of MCU-Coatings, set out to answer a fundamental question in marine corrosion control: how do we know a coating will actually adhere to the surface in real operating conditions for a long-time?

Keith delivered an engineering-led session focused on durability, surface preparation requirements, and the root causes of repeated coating failures in marine assets. Independent test data shows high durability - 25+yrs LFTM in C5 M/VH.

The discussion drew on real-world challenges encountered in dry docks, shipyards, ports and offshore structures,

referencing problematic areas like ballast tanks, void spaces, splash zones, heated lines, corrosion under insulation (CUI), wharves, welds, stiffener terminations, crevices and lap joints. Particular attention is given to how moisture-cured urethanes achieve remarkable adhesion on marginally prepared or damp substrates, and how this surface tolerance contrasts with conventional systems.

The session demonstrated how these characteristics reduce application risk, compress project schedules, lower whole-of-project costs and extend asset service life in demanding marine environments**.**

Trev Ruting from meeting notice

Queensland Section

Design and Engineering Experiences working in an Offshore Construction Yard

James Stephen's presentation on 11 Dec 2025, covered the following issues:

- Design of heavy lifts, including the lifting lug design and stress analysis.
- Design and structural analysis of construction supports for a 12,000t offshore module, including the ability to lift and weigh the module when complete.
- Loadout of offshore modules and steel jackets over the quay onto floating barges, including the procedure, ballasting and pumping, naval architecture calculations, mooring and sea fastenings.

The presenter, James Stephen worked as a design engineer in the early 1990's for Press Offshore (later AMEC Offshore), located in Newcastle upon Tyne in England. The yard built and loaded out offshore modules and small steel jackets for the North Sea oil and gas industry. James presented a detailed insight into some of the design and engineering work that was carried out. Whilst working there, Press Offshore built what was at the time the heaviest offshore module ever built for the North Sea – the EEC Saltire platform, weighing about 12,000t.

RINA QLD Social functions

Following the technical presentation in Brisbane on 11 December, RINA QLD and IMarEST members adjourned to The Boathouse Tavern for their joint Christmas social. Sponsors of the event included: Horizon Aluminium Boats / Stessl Boats, Aushipss Group, Norship, Twindisc / Seakeeper, Sea Transport, and the Institute of Marine Engineering, Science & Technology.

The Cairns group also conducted an end-of-year gathering at the Crown Hotel, on Thursday 4 December.

Trev Ruting from meeting notices

Tasmania Section

End of Year Christmas Get-together

Members of the RINA Tasmanian Section and friends enjoyed a relaxed and convivial evening at Rupert & Hound in Launceston, Tasmania, on 12 December 2025. The event provided a valuable opportunity to reflect on milestones achieved during 2025 and to discuss plans and aspirations for 2026.

During the evening, members and guests shared insights into key projects undertaken throughout the year and celebrated individual and collective achievements in an informal setting.

The Tasmanian Section gratefully acknowledges AMC Search and the Tasmanian Maritime Network for their generous sponsorship of the event. Following is a photo taken during the dinner.

Attendees at the 2025 End-of-Year Celebrations
(Photo courtesy Chris Davies)

Nipuna Rajapaksha

WA Section

Lessons from the World's First Ammonia Powered Vessel

Matt McGellin, RINA WA Committee Member, presented "Lessons from the World's First Ammonia Powered Vessel" at the IMarEST Fremantle meeting on 27 November 2025. Matt is Lead Project Engineer for *Fortescue Green Pioneer*, the world's first ammonia powered vessel.

The talk focused on the challenges of ammonia as a marine fuel and some of the solutions pioneered by this unique vessel. Matt outlined the Fortescue *Make it Happen* philosophy. The talk was a terrific blend of retrofitting the gas plant, main engine adaptation, safety case, modelling of worst case gas dispersion and general arrangement changes for refuge areas.

The Ships That Defined the Viking Age

Mal Waugh, RINA WA Secretary, presented "The Ships That Defined the Viking Age" to the Old Gaffers Association, on 26 November, at the Royal Freshwater Bay Yacht Club.

Matt McGellin presenting on Ammonia Powered Ships
(Photo courtesy Mal Waugh)

The presentation was a mix of culture, marine archaeology, reconstruction for museum display versus historic ship reproduction plus built-by-eye rule of thumb skill of the master shipbuilder. Mal presented that these ships, arguably, were key to understanding the Nordic sailor - explorer - trader - settler culture and without the Viking Longship there would have been no Viking age.

Viking Ship - Mal Waugh presentation
(Photo courtesy Mal Waugh)

End-of-Year Function and Technical Presentations in Fremantle

Ken Goh presenting on Fuel Cells
(Photo Courtesy Mal Waugh)

The WA end-of-year function was combined with a double technical presentation on 1 December 2025. The event was held at the Flying Angel Club, Fremantle. Pizza is always a good attendance encourager and there were around 25 present for the evening. The first presentation was on Viking Longships, given by Mal Waugh, with the second presentation on Marine Application Fuel Cells, given by Ken Goh. There was time after the presentations to catch up with friends and colleagues to share anecdotes from 2025 and thoughts for 2026. The Committee thanks all who attended.

Mal Waugh

THE INTERNET

AUKUS Submarines

The Editorial in this issue was prompted by the publication by the United States' Congress Research Service of the report "Navy Virginia-Class Submarine Program and AUKUS Submarine (Pillar 1) Project: Background and Issues for Congress" which can be downloaded from https://www.congress.gov/crs-product/RL32418.

Almost a year ago an article "All or Nothing – Australia and its AUKUS submarine dilemma" by Alex Luck was published in Naval News (https://www.navalnews.com/naval-news/2025/03/all-or-nothing-australia-and-its-aukus-submarine dilemma) forecasting the situation outlined in the editorial. A similar reference relevant to the future shape of the AUKUS submarine project is the article "After Rejecting France in Favor of the US, Australia Now Risks Being Left Without Any Submarines" variously listed as being authored by Macwen Denis or Stoneford Easton on some obscure websites.

However, it appears that some related information such as the papers "Facing up to AUKUS Realities" by Robert McKeown and "Submarine Sea Power 2025" by Christopher Skinner, both of which are not available on the internet and interested readers may need to access them in hard copy in Navy News Vol.88 No.1.

RINA YouTube Channel

Recent changes to the RINA website have made access to the YouTube channel somewhat less user-friendly. The channel may be accessed through the "Branch Lectures" button at https://www.rina.org.uk/On-Demand-Learning or alternatively the "Playlist" option and "Australian Division" button at www.youtube.com/@RoyalInstNavArch. Organisational and membership videos are available through the "Home" and "Videos" buttons alongside "Playlist".

In recent times videoed technical presentations from within the Division have largely been posted Tasmania Section. However, Sections wishing to post a presentation (with consent from the presenter(s)) should contact Klaudia Rogala-Haracz (krogalaharacz@rina.org.uk) to arrange for posting. If there are any problems, please contact me.

Rob Gehling
0403 221 631

UNSTEADY HYDRODYNAMIC AND HYDROELASTIC REDUCED ORDER MODELS FOR PROPELLERS

Michael Candon[1], Thomas Keith[2], Arturo Delgado[1], Sara Vahaji[1], Errol Hale[1], Vincenzo Muscarello[1], and Pier Marzocca[1]

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Abstract

Propeller hydrodynamics and hydroelastics can involve complex nonlinear flow physics, such as, vortex shedding, cavitation, and nonlinearities introduced by wake interactions. Unsurprisingly, numerical modelling of such systems can be computationally exhaustive, particularly when considering nonlinear unsteady flow phenomena. This paper presents recent developments that have been made in a collaborative partnership between RMIT University and DST Group towards high-fidelity and reduced order modelling for propeller wake interactions and hydroelastic response. The results demonstrate that the developed nonlinear reduced-order models can model the propeller wake interactions with sufficient accuracy and at a fraction of the computational cost, with online computational savings are measured in weeks and hundreds of CPU-cores.

1. Introduction

Underwater propellers are often subjected to highly unsteady and spatially non-uniform inflows arising from a range of operational and environmental sources. These include turbulent wakes produced by underwater vehicle hulls and appendages, encountering wave-induced orbital velocities, and sudden velocity surges due to manoeuvring. In addition, low-frequency shaft speed fluctuations introduce further disturbances. These factors, among others, contribute to broadband hydrodynamic load variations and excitation of the natural modes of the propeller blades, affecting the hydrodynamic behaviour of the tip and trailing-edge vortices. The connection of all these effects results in a computationally challenging and expensive Fluid-Structure Interaction (FSI) problem.

High-fidelity simulations have highlighted the sensitivity of propeller loads to the complexities of spatial and temporal wake dynamics [1, 2]. The dynamics of external shafts further complicate these fluid-structure interactions. For instance, two-way coupled simulations presented by Meng et al. [3, 4], indicate that even mild whirling vibrations can increase radial excitation by approximately one-third, and that shaft speed variations also affect mean thrust and torque while introducing sidebands around the primary tonal components. Off-axis inflows create additional instabilities as shown by Lin et al. [5].

Zhao et al. [6] emphasised the role of vortex-induced vibrations and the effectiveness of control strategies to mitigate them. Among these FSI effects, there is a narrow-band tonal noise known as propeller singing. In the work of Wang et al. [7], cavitation-tunnel tests with uniform flow have identified singing tones for a typical moderate-skew propeller in the 2.5 - 20 kHz range. These tones are shown to shift upward with rotation speed and, at very low advance ratios, decrease in overall magnitude while splitting into multiple discrete peaks. However, these tests did not address how the tones are influenced by the broader gust spectrum found in real-world conditions. Additionally, insights from LES simulations of turbulence ingestion presented by Yao et al. [8], have suggested that span-wise unequal loading on the outer half-radius primarily drives the broadband hump, and that integrating anisotropic effects in correlation analyses can elevate predicted sound-pressure levels by nearly eight decibels. Complementary FSI simulations have further linked these tonal phenomena to frequency lock-in mechanisms, suggesting that structural resonance can substantially amplify noise emission [9].

In terms of modelling gusts (flowfield velocity perturbations), Field Velocity Method (FVM) has emerged as a powerful approach to resolving transient inflow conditions. In maritime applications, such disturbances may arise from hull wake interactions or ambient environmental variability, necessitating their accurate reconstruction in simulations. Techniques like the synthetic eddy method (SEM) and digital filtering have been embedded within LES and hybrid RANS-LES solvers to replicate the stochastic nature of marine turbulence. Recent computational studies have demonstrated that even mild deviations from uniform inflow, including oblique and sheared gusts, can have profound effects on tip vortex formation, cavitation extent, and fluctuating blade loads [6, 10].

One major limitation that arises from time-marching CFD computations of propeller hydrodynamics and hydroelastics is of course the computational cost. Resolving turbulence dynamics and blade deformations for a single operating point can require days to weeks of computational time on hundreds or thousands of CPU cores. Evaluating multiple advanced ratios, yaw angles, or gust amplitudes further amplifies this cost, while optimisation or uncertainty quantification would demand hundreds or even thousands of such simulations. This computational burden contrasts sharply with the need for responsiveness in modern design cycles and data-driven control systems. Therefore, it is desirable to develop reduced order models (ROMs) that can retain the accuracy of high-fidelity simulations at a fraction of the computational cost.

Recent collaborative efforts between RMIT University and DST Group have led to the development of a Python-based multi-fidelity fluid-structure interaction (FSI) software package, known as PyFSI [11]. The modular FSI framework is based on classical and contemporary methods from unsteady aerodynamics, computational aeroelasticity, and systems and control theory. This paper presents recent developments related to high-fidelity and reduced order unsteady hydrodynamic models for propeller wake interactions and hydroelastic response. High-fidelity models utilise FVM, implemented in ANSYS Fluent 2024 R2 via User Defined Function, to modify cell fluxes as the wake moves through the flowfield. The reduced order models leverage a data-driven approach based on sparse Volterra theory, where the training data is obtained from CFD simulations. The results demonstrate that significant nonlinear dependencies exist in the hydrodynamic wake response of the propeller that can only be captured using nonlinear ROMs. The online computational savings are measured in weeks and hundreds of CPU-cores.

2. External Velocity Perturbation via Field Velocity Method

Field velocity method (FVM) was first proposed over 20 years ago [12] as a means of applying indicial functions to CFD flowfields. More recently this approach has been used extensively within the aerospace sector for the high-fidelity computation of aircraft gust loads in transonic flow conditions. A summary of the most recent applications is given in the final report of the AEROGUST project, funded by the European Union [13]. Initially consider the momentum transport equation:

$$\frac{\mathrm{d}}{\mathrm{dt}} \int_{\mathrm{V}} \rho \mathrm{u} \mathrm{dV} + \int_{\partial \mathrm{V}} \rho \mathrm{u} \mathrm{u} \cdot \mathrm{dA} = 0 \tag{1}$$

where V is the cell volume, ***u*** is the velocity field, ***A*** is cell area and ρ is the fluid density. The momentum flux induced by the presence of the gust is described in the advection term, and the equation becomes:

$$\frac{\mathrm{d}}{\mathrm{dt}} \int_{\mathrm{V}} \rho \mathrm{u} \mathrm{dV} + \int_{\partial \mathrm{V}} \rho \mathrm{u} \left(\mathrm{u} + \mathrm{u}_{\mathrm{g}}\right) \cdot \mathrm{dA} = 0 \tag{2}$$

where u_{g} describes the modified velocity field in the region of the gust which is a profiled imposed by the user. Rather than convecting the gust profile through the domain, the perturbation velocity can be conveniently described by the grid velocity:

$$\mathrm{u}_{\mathrm{g}(\mathrm{j})} \cdot \mathrm{A}_{(\mathrm{j})} = \frac{\delta \mathrm{V}_{(\mathrm{j})}}{\Delta \mathrm{t}} \tag{3}$$

where $\mathrm{A}_{(\mathrm{j})}$ is the j^{th} face area vector and $\delta \mathrm{V}_{(\mathrm{j})}$ is the volume swept out by the control volume face over the time step $\Delta \mathrm{t}$.

3. Reduced-Order Modelling Framework

3.1 Unsteady Hydrodynamic Reduced Order Model for Structural Perturbations

In discrete time, for a linear time-invariant system the hydrodynamic forces Q at the current time-interval n can be described for small structural perturbations about a steady-state response by the convolution integral:

$$\mathrm{Q}\left[\mathrm{n}\right] = \mathrm{H}_0 + \sum_{\mathrm{k}=0}^{\mathrm{n}} \mathrm{H}_1\left[\mathrm{n}-\mathrm{k}\right] \mathrm{u}\left[\mathrm{k}\right], \quad \mathrm{n} = 0, 1, 2, \ldots \tag{4}$$

where H_0 represents the steady-state response of the system and H_1 is the systems unit impulse response, and k is the number of time lags. Practically, it is often not possible to apply a unit impulse to the system, so the unit

impulse response is derived using a physical modal amplitude. With small perturbations, the impulse response of the linearised system is unique, i.e., the modal amplitude does not matter if it is small enough to avoid violating linearisation and large enough to minimise the signal-to-noise ratio. Detailed tutorials on the derivation of the aerodynamic impulse response function are provided by Silva [14] and Raveh [15].

3.2 Unsteady Hydrodynamic Reduced Order Model for Wake Perturbations

The linear and nonlinear reduced-order modelling approaches for the wake forces are based on a data-driven approach where coefficients of the transfer function are derived from input-output training data. This method was first proposed by Candon et al. [16, 17, 18] for nonlinear transonic unsteady aerodynamic problems. In this paper it is shown that the method is also well-suited to modelling the hydrodynamic and hydroelastic physics associated with gust and wake interactions. The benchmark gust ROM used for comparison are linearised frequency domain (LFD) and linearised time domain (LTD) transfer functions.

3.2.1 Velocity Perturbation as an Input Signal

In its generic form, the CFD-based velocity perturbation to the flowfield is stored as a discrete-time vector, given as:

$$u_g = \{u_{g1}, ..., u_{gn}\} \in R^n \quad (5)$$

where *n* is the total number of training samples being simulated in the transient CFD code. Considering a total of *m* structural modes, the vector of output training samples is obtained using the full-order hydrodynamic model sweeping $u_g\ (x,\ t)$ through the flowfield. The forces are then projected onto each j^{th} structural mode, $Q_g^l \in R^n$, $i = 1...m$, giving the generalised hydrodynamic gust response matrix:

$$Q_g = \left[Q_{g'}^1, ..., Q_{g'}^m\right] \in R^n \quad (6)$$

3.2.2 Identification of the Reduced-Order Model in the Frequency Domain

For a linear time-invariant (LTI) system, the frequency response function H(jω), can be computed according to the input and output relation in the frequency domain as:

$$H\left(j\omega\right) = \frac{\widehat{Q}_g\left(j\omega\right)}{U_g(j\omega)} \quad (7)$$

where $U_g(j\omega) = FFT(u_g)$ is the fast Fourier transform of the velocity perturbation input signal and $\widehat{Q}_g\left(j\omega\right) = FFT\left(Q_g\right)$ is the Fast Fourier transform of the generalised hydrodynamic force vector.

3.2.3 Identification of the Reduced-Order Model using Orthogonal Matching Pursuit

First a lower left triangular circulant matrix is constructed from u_g (truncated for *k* time lags) as follows:

$$L = [u_g\{0\} \quad 0 \quad 0 \quad \dots \quad 0 \quad u_g\{1\} \quad u_g\{0\} \quad 0 \quad \dots \quad 0 \quad (8)$$

Then, to add nonlinear terms, the matrix of inputs can be expanded up to order according to:

$$M = \left[L, L^2, ..., L^p\right] \in R^{n \times pk} \quad (9)$$

It should be noted that this construction of the matrix of inputs can be used to identify a pruned representation of the Volterra series, while the identification of full Volterra kernels requires a slightly different approach as given in Refs. [16-18].

Now, in terms of the ROM identification, one can start by considering the linear problem [19]:

$$\frac{MH_g}{g} = Q_g \quad (10)$$

where $H_g \in R^{kp \times m}$ is an unknown matrix of first-order partial derivatives which describe the gust response as a function of the input. Practically speaking each column $H_g \in R^{kp}$ contains the transfer function for the j^{th} mode gust loads. The objective of the OMP-based identification strategy is to identify a sparse representation of H_g, denoted by H_{gs}, by adding terms to H_{gs} iteratively one-by-one until a pre-defined stopping criterion is met. This requires the following l_0 -minimisation problem to be solved:

$$\| H_{gs} \|_0 \quad \text{s.t.} \quad MH_{gs} = Q_g$$

where $\kappa = \| H_{gs} \|_0$ is the l_0 pseudo-norm of H_{gs} (the number of non-zero elements). The ROM coefficients can be identified from *m* and Q_g using any standard OMP algorithm, as follows:

$$H_{gs} = \mathrm{OMP}(M, Q_g, \kappa) \in R^{p \times m} \tag{11}$$

and $\| H_{gs} \|_0 \ll \| H_g \|_0$ meaning that the required length of training data and the chances of over-fitting are greatly reduced.

4. Reduced-Order Modelling Framework

4.1 DSTG 115-1 Propeller

The DSTG 115-1 propeller is a 5-blade generic aluminium propeller with a 250mm diameter. In this paper, the propeller is modelled using steel to improve stability in the FSI solver at a higher time step. Only a single blade and is elastic, while the remaining blades, boss-cap and extended shaft are assumed to be rigid, presented in Fig. 1.

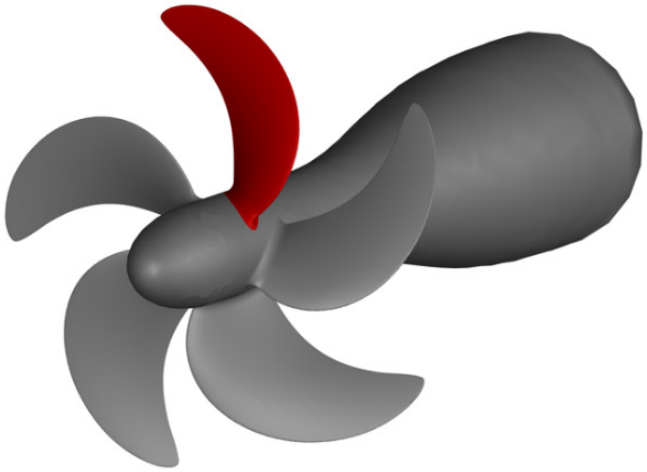


Figure 1: Isometric view of the propeller with the elastic region highlighted.

4.2 Hydroelastic Equations-of-Motion

The undamped equation-of-motion for a hydroelastic system can be described in generalised coordinates, such that the structural motion is approximated as the linear superposition of a subset of m normal modes ϕ due to generalised displacement ξ, given as:

$$GM\ddot{\xi} + GK\dot{\xi} + q_\infty(Q + q_g) = 0 \tag{12}$$

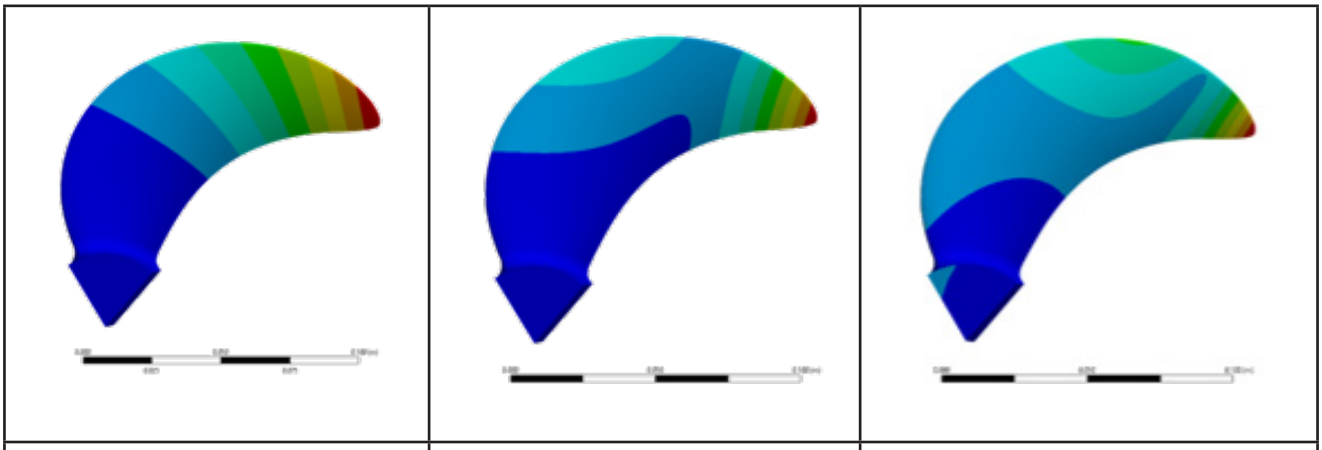
where $GM = \Phi^T M \Phi$ and $GK = \Phi^T K \Phi$ are the generalised mass and stiffness matrices respectively, $Q = \Phi^T F_m$ and *k* are the mass and stiffness matrices in nodal coordinates respectively, is the generalised hydrodynamic force vector due to structural displacement (where is the aerodynamic force vector in nodal coordinates), $Q_g = \Phi^T F_g$ is the generalised hydrodynamic force vector due to external wake perturbation (where F_g is the wake force vector in nodal coordinates), and $\ddot{\zeta}$ is the second time derivative of . Equation 12 can be marched forward in time solving for Q and Q_g at each time step using a CFD code. Alternatively, using the reduced-order hydrodynamic formulation, at each time-step the generalised hydrodynamic force vector in mode , due to the displacement of mode , is obtained using the sum of convolution integrals:

$$Q\left[n\right] = \sum_{i=1}^{m}\sum_{j=1}^{m}\left(H_0^i + \sum_{k=0}^{n} H_1^{ij}\left[n-k\right]\xi^j\left[k\right]\right) \quad (13)$$

For the wake, one can assume that the wake forces are not affected by the structural motion, and therefore the generalised hydrodynamic force vector due to external wake perturbation is solved for prior to marching Equation 12 forward in time using $Q_g = MH_{gs} \in R^{nTOTAL}$, where *M* contains any arbitrary wake profile, and n_{TOTAL} is the total number of time-steps to be simulated. The contribution $Q_g[n]$ is then added at each time-step as Equation 12 evolves in time.

4.3 Structural Model

A single-blade structural model is used in this work. It was shown by Candon et al. [20] that the single-elastic blade representation adequately describes the hydroelastic physics of the system. A medium resolution mesh of the single blade model is used in this study which has a total of 64,978 tetrahedral elements (115,700 nodes). Modal analysis is conducted using ANSYS Mechanical 2024 R2 and the first three modes are presented in Fig. 2. The structural model is exported using ANSYS MAPDL 2024 R2 for use in the PyFSI code.



(a) Mode 1: 642 Hz | (b) Mode 2: 1214Hz | (c) Mode 3: 2342Hz

Figure 2: Dry mode shapes of the propeller.

4.4 Fluid Model

The Euler equations for transient flowfields are solved using the commercial finite volume code ANSYS Fluent 2024 R2 with a coupled pressure-based solver, implicit second-order spatial and first-order temporal discretisation with Rhie-Chow: distance-based flux interpolation. The convergence criteria are set to 1×10−4 for the scaled residuals at each time-step. A rectangular domain is used with the inflow modelled using a velocity inlet boundary condition and the outflow using pressure outlet. Non-conformal periodic boundary conditions are applied to all other external faces. A moving reference frame (MRF) model is used in this work, rather than a sliding mesh. Candon et al. [20] demonstrated that an MRF-based hydrodynamic model was adequate to model the hydroelastic physics. An unstructured tetrahedral fluid grid is constructed using ANSYS Meshing 2024 R2 as is presented in Fig. 3. The inner most refinement region is where the flow is rotated. The domain and grids are generated targeted specifically at the requirements of field volume method and gust/wake model. Two bodies of influence are used to ensure consistent x-direction sizing when the gust is in the vicinity of the propeller blades. The mesh contains ~4.9M cells.

Grid deformation in the fluid model utilises a dynamic mesh approach where the deforming grid contributed to the induced flux in the convective equations. The deformation of the internal grid due to the motion of the boundary was done using a diffusion-based approach where the Laplace equation is used to control how much of the motion diffuses into the interior grid.

4.5 Fluid Structure Coupling

The hydroelastic system is solved using the RMIT in-house Fluid-Structure Interaction code PyFSI. Hydroelastic solutions are achieved by marching Equation 12 forward in time, where the propeller transient structural motion is solved using Newmark-β time-integration. A time-step of $\Delta t = 2 \times 10^{-5}$s is used for the full-order solutions and $\Delta t = 1 \times 10^{-5}$s for the ROM solutions.

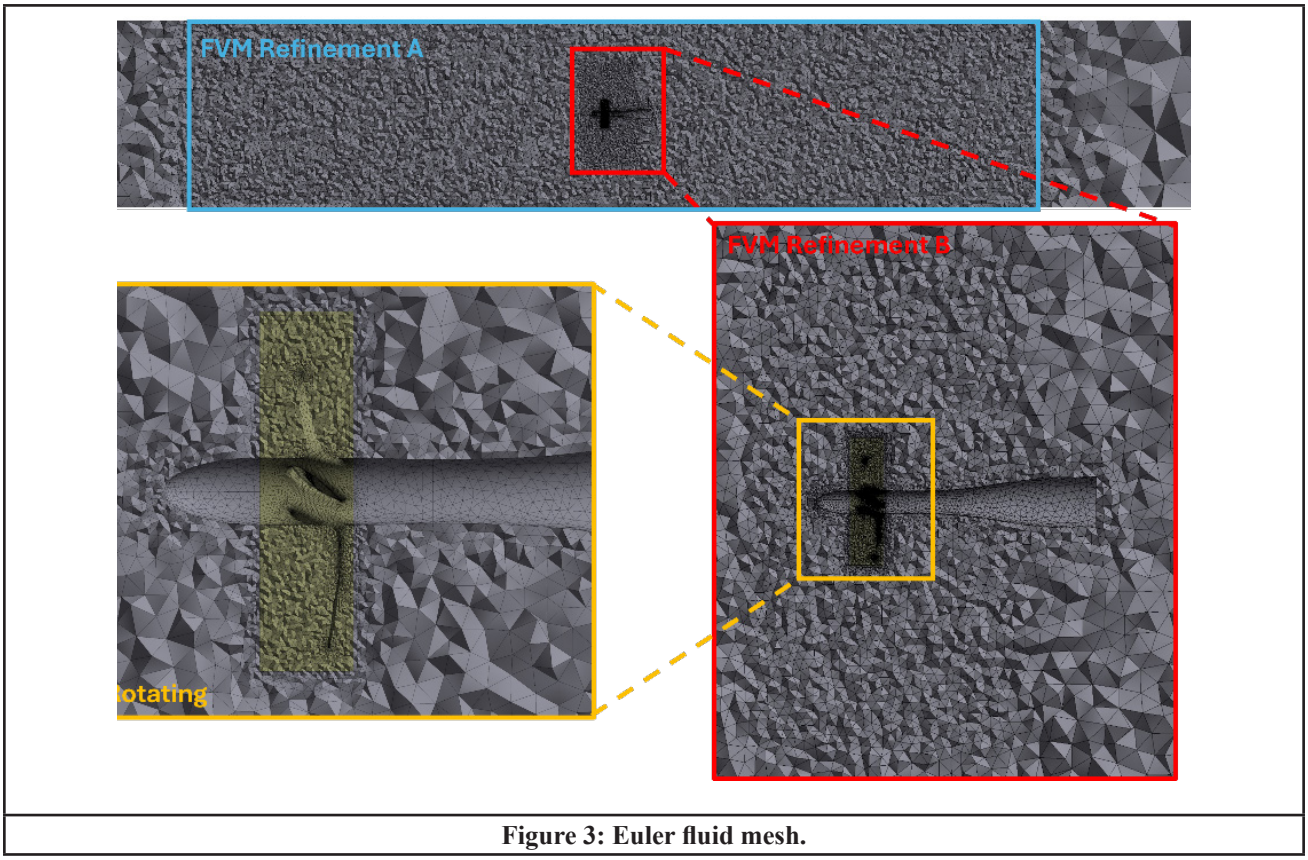


Figure 3: Euler fluid mesh.

5. Results

For all simulations in this section the freestream velocity is V_∞ = 4m/s and the propeller is rotating at $\mathfrak{r}$ = 94.2rad/s, with an advance ratio of J≈1.1. Any results concerning hydrodynamics only use a transient time-step of $\Delta t = 1 \times 10^{-5}$s. Only the vertical component of the wake is presented in this paper, i.e., a velocity perturbation acting perpendicular to the propeller face. The axial component is also considered, however, is omitted for brevity. The normalised root mean square deviation (nrmsd) is used to assess the error, defined for a 1D time-series as:

$$\mathrm{nrmsd}\left(\mathrm{FOM}, \mathrm{ROM}\right) = \frac{\sqrt{\sum_{i=0}^{n} \left(\mathrm{FOM}[i] - \mathrm{ROM}[i]\right)^2}}{\mathrm{FOM}_{\mathrm{MAX}} - \mathrm{FOM}_{\mathrm{MIN}}} \tag{14}$$

where FOM is the ground truth (a CFD model in this case), and ROM is the reduced-order prediction.

5.1 Hydrodynamic Reduced Order Model for Wake Loads

In this section, the wake reduced order model is investigated in the absence of structural dynamics, i.e., only the generalised hydrodynamic loads are considered but the structural response is neglected. The objective is to verify performance for an arbitrary wake profile, mimicking a turbulent flow structure, interacting with the operating propeller. To clarify, the linearised frequency domain (LFD) and linearised time domain (LTD) approaches are close to the "unique" impulse response or frequency response functions under small perturbations, which are computed from blended impulse training data. Conversely, the first-order ROM is derived from the large amplitude pseudo-random training signal and can be considered as a first-order approximation of a nonlinear state.

In previous work by Candon et al. [20], the relationship between velocity perturbation amplitude and force response amplitude, was studied for both axial (perpendicular to the propeller face) and vertical (parallel to the propeller face) wakes. The maximum amplitude in both cases is extreme, at 5m/s which is 25% greater than the freestream flow velocity. Figure 4 presents the mode 1 generalised force responses, and the maximum generalised force in mode 1 as a function of the vertical wake magnitude. The nonlinear relationship is clear, where the force response magnitude predicted by CFD is nearly double that predicted by the linear model at the most extreme case. The point to be made here is, for vertical wakes, a polynomial approximation is expected to improve the prediction accuracy significantly, as will be shown.

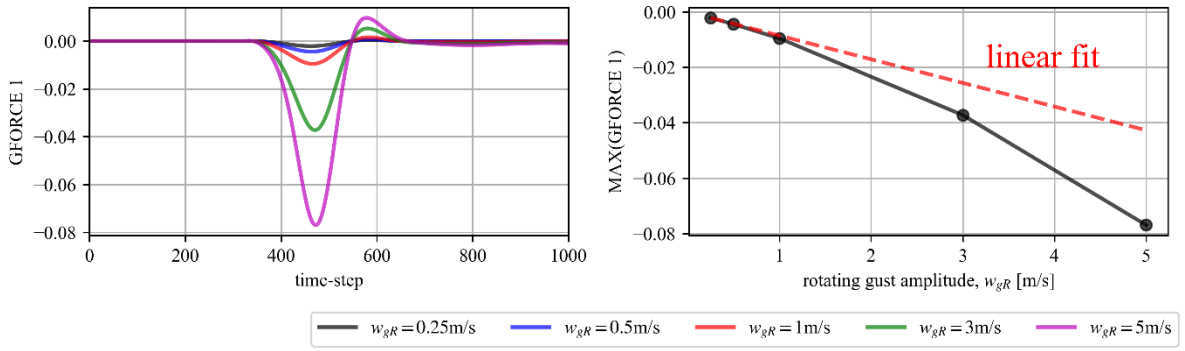


Figure 4: Response to vertical 1-cosine blended impulses of varying amplitudes (rotating).

The vertical component is defined by a velocity perturbation parallel to the face of the propeller. This means that the vertical component of direction is time periodic. Specifically, the generalised force on the blades is a function of the angular position of the blades, which is periodic in time. Accordingly, periodicity cannot be neglected when modelling the vertical component of the wake, and if one chooses to model the operating propeller using a MRF, then periodicity must be enforced by rotating the gust. The difficulty with this time-periodic problem is in verifying the ROM performance for a random wake profile. Therefore, a vertical non-rotating profile is used in this section to perform a time-invariant assessment of the linear and polynomial ROM performance. The vertical non-rotating gust retains the nonlinear features of the vertical rotating gust, ensuring that this verification exercise is purposeful and useful. The train and test data is presented in Fig. 5, which includes the pseudo-random perturbation signals, and an impulse. The objective is to predict the test response, from different ROM approaches, either derived using the train-impulse set, or the train-random set.

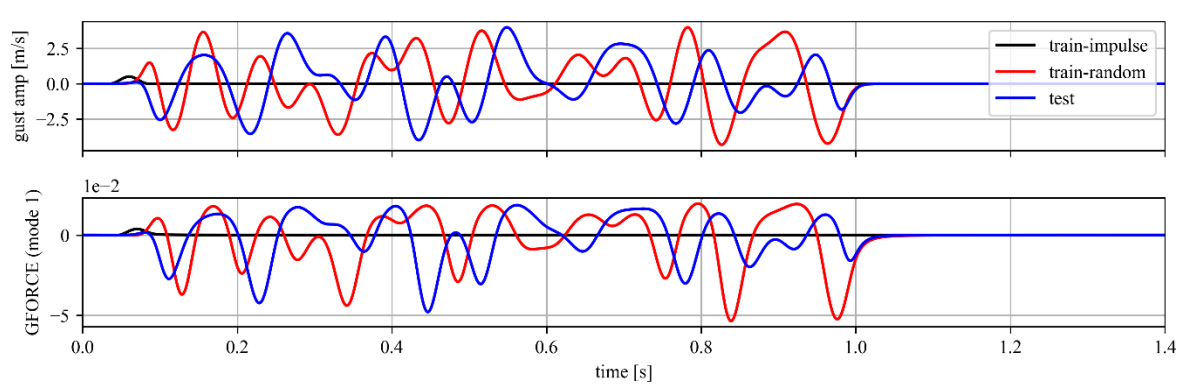


Figure 5: Testing and training data sets for the vertical wake perturbation (not rotating).

Figure 6 shows all predictions of the test set for mode 1. The linearised frequency domain (LFD) model, which is the standard method used to model gusts for aircraft, performs worst. The two time-domain linear models, LTD and first-order ROM, both which use 1000 lags and 10 coefficients, make very similar predictions. By adding some nonlinear terms, as depicted by the second-order ROM and third-order ROM (both of which use 1000 lags and 20 coefficients), the mean nrmsd drops to less than 1% (as compared to more than 7% from the first-order ROM). The second-order approximation is better than the third-order approximation. The fourth-order approximation overfits. The time response of all modes, comparing LTD and 2nd-order ROM approximations, is presented in Fig. 7. Here, in particular for examples like modes 3-6 and 9, the power of employing a polynomial-based nonlinear ROM is obvious. Polynomial methods like the Volterra series are very well suited to modelling the operating propeller response to the vertical component of a wake perturbation.

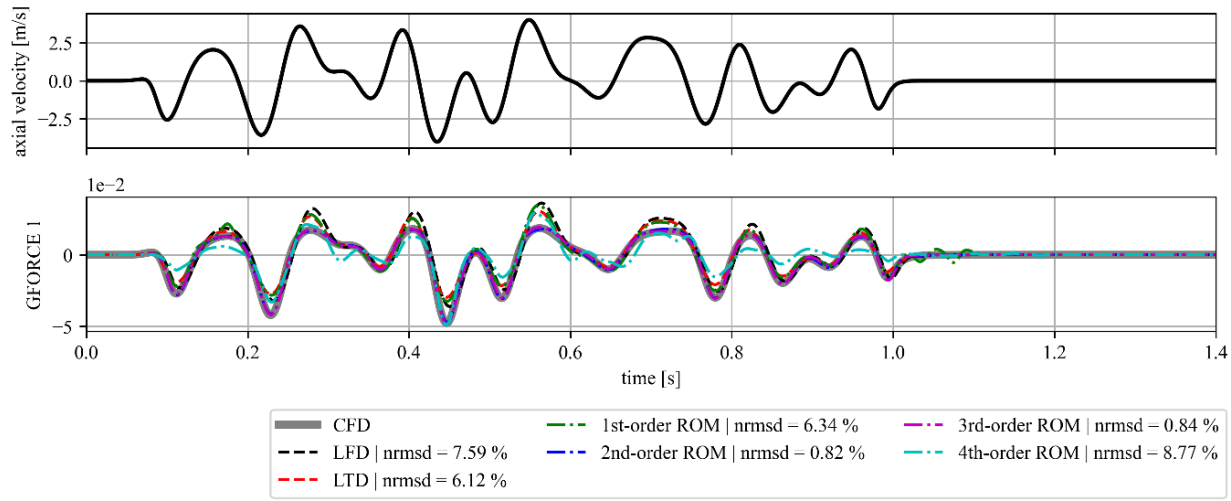


Figure 6: Predicted generalised force response to the vertical wake perturbation in mode 1 for the test dataset (not rotating).

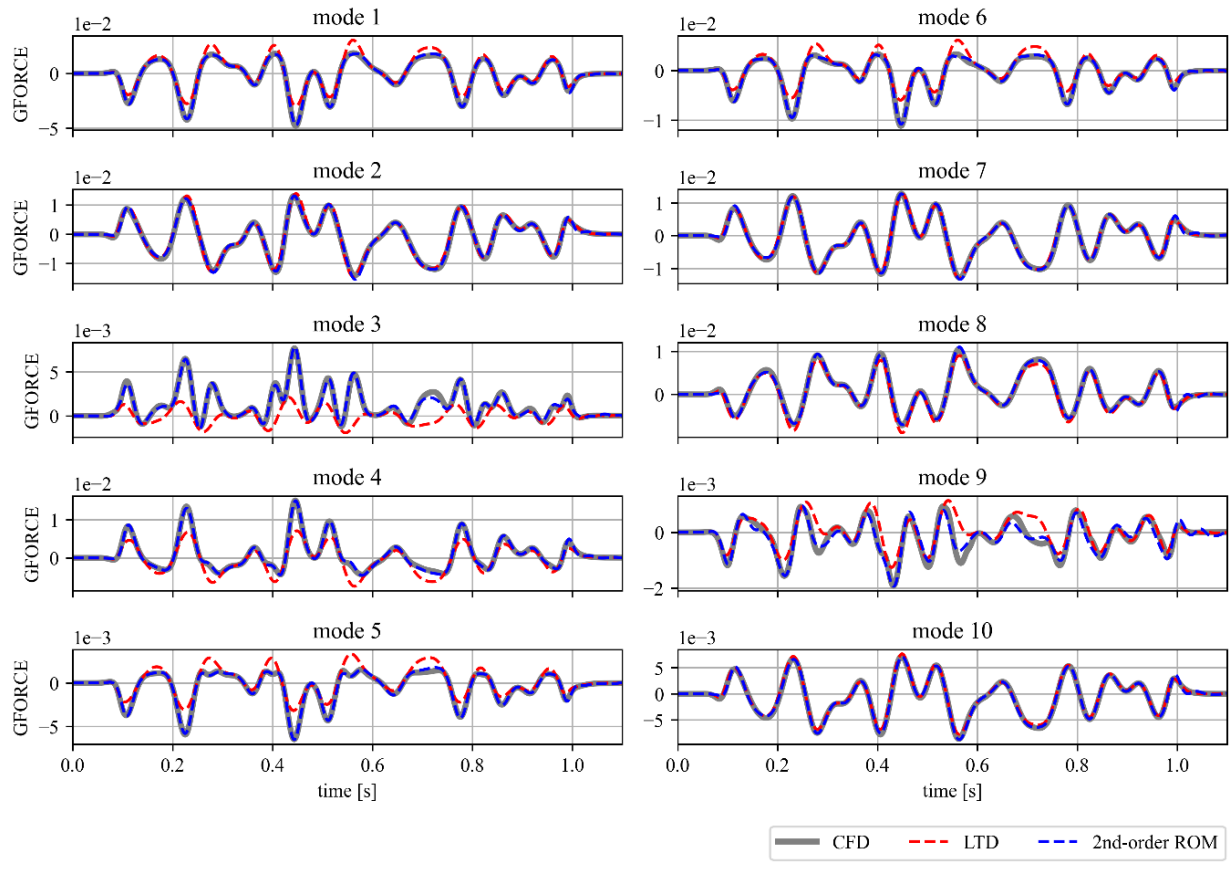


Figure 7: Predicted generalised force response to the vertical wake perturbation in all modes for the test dataset (not rotating).

5.2 Hydroelastic Response to an External Wake

Finally, the propeller hydroelastic response to a 1-cosine gust is presented using the full-order CFD-CSD model, the linearised hydroelastic ROM with a linear gust ROM, and with a nonlinear linear wake ROM. This closes the loop on the different developments and flow-structure coupling mechanisms that are of interest in this research. The results, presented in Fig. 8, demonstrate that for the first three elastic modes the hydroelastic response can be computed with a high level of accuracy. This level of accuracy is also observed for higher modes; however, this has been retracted for brevity herein. The FOM simulation took approximately five days on 70 CPU cores while the ROM simulation takes seconds.

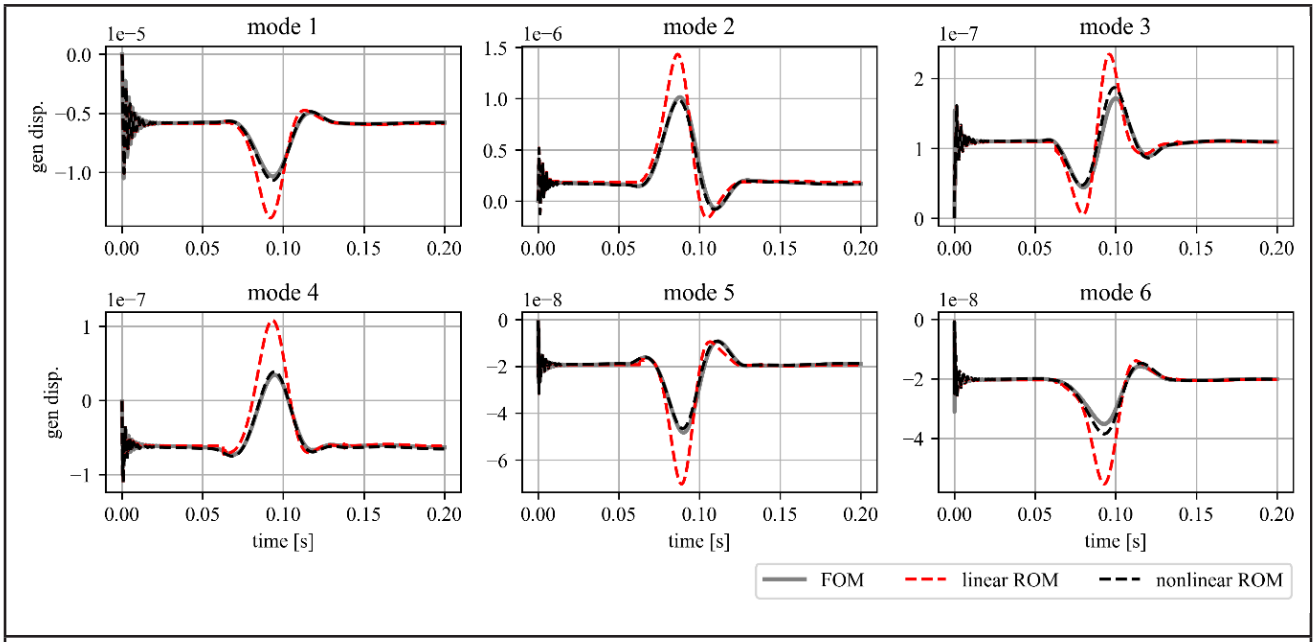


Figure 8: Hydroelastic response of the propeller to a vertical wake encounter.

6. Conclusions

This paper presents recent progress made in a collaborative effort between RMIT University and DST Group towards high-fidelity and reduced-order hydroelastic modelling for propellers. The objectives which have driven the development of the PyFSI GustROM module differ slightly from those seen in aerospace gust modelling. Specifically, in this case, propeller wake interactions are modelled as random velocity perturbations over extended time periods, as opposed to the conventional 1-cosine gust profile used in aerospace applications. For an underwater vehicle, this is mainly concerned with underwater turbulence, which can be represented by band-limited pseudo-random velocity perturbations. When coupled with propeller hydrodynamic physics, convenient linearisation that can be leveraged for gust ROM on fixed bodies no longer applies and nonlinear ROM approaches need to be considered. The findings are as follows:

- For interactions with a vertical wake, a polynomial relationship exists and can modelled with extremely high accuracy using a sparse representation of the Volterra series. A second-order approximation from pseudo-random training data is most accurate - reducing the ROM error by 85% compared to a conventional linearised gust ROM.
- For interactions with an axial wake, the relationship is predominantly linear (within a reasonable range of perturbation amplitudes). The higher-order sparse Volterra kernels do not improve accuracy. A first-order approximation from pseudo-random training data is most accurate - reducing the ROM error by 33% compared to a conventional linearised gust ROM. For this adding more training data significantly improves the prediction, further reducing the ROM prediction error to a total of 61%.

Two directions are identified to progress this research:

- A rigorous investigation for time-periodic reduced-order modelling of the propeller-wake interaction.
- Alternative and more efficient CFD approaches, such as Lattice-Boltzmann Method.

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New SOLAS Requirements for Anchor Handling Winches

The International Maritime Organisation (IMO) has introduced new requirements for anchor handling winches. They are mandatory under SOLAS Regulation II-1/3-13, as amended by IMO Resolution MSC.532(107), and entered into force on 1 January 2026. (Corresponding requirements for lifting appliances were previously reported in Class News 12/2025). These SOLAS amendments are supplemented by the IMO Guidelines for Anchor Handling Winches (MSC.1/Circ.1662).

Applicability of new requirements

They apply to anchor handling winches, which are defined as "winches used for the purpose of deploying, recovering and repositioning anchors and mooring lines in subsea operations". These are typically installed on dedicated anchor handling vessels, offshore support ships, and certain tugboats. These winches may be purpose-built for anchor handling or integrated into a towing winch system.

Note: These new requirements do not apply to anchor windlasses, which handle a ship's own anchors.

Requirements for new anchor handling winches (installed on or after 1 January 2026)

Under SOLAS Regulation II-1/3-13.2.2, new anchor handling winches must comply with the technical requirements specified in the IMO circular and are to be certificated before entering service. Certification includes:

- A plan appraisal of the anchor handling winch and foundation connections
- Verification of materials
- Survey, testing and examination during fabrication
- Verification of component certificates, including its loose gear
- Overload brake holding capacity (BHC) test at 110% of BHC (calculations may be accepted if testing is impractical)
- Overload testing to 110% of maximum line pull (MLP)
- Testing and thorough examination when installed on board.

These new requirements will be incorporated under new Section 10 Anchor handling winches, associated equipment and loose gear in Lloyd's Register (LR) Rules and Regulations for the Classification of Ships, Part 4,Chapter 4.

Requirements for existing anchor handling winches (installed before 1 January 2026)

Under SOLAS Regulation II-1/3-13.2.5, existing winches must undergo testing and thorough examination in accordance with IMO guidelines.

Although the IMO guidelines permit acceptance of certification under another international instrument approved by the Administration, there have been no previous class requirements specifically for anchor handling winches. In some cases, LR certification may still be available on board, covering aspects such as structural appraisal, foundations and brake holding capacity, which can support compliance.

The International Association of Classification Societies (IACS) is expected to standardise survey and testing requirements, LR will apply the following for existing installations:

- Document review, including verification that maintenance and operations manuals are available on board
- Survey of winch structure, foundations and supporting structure
- Survey of wires and loose gear
- Survey of hydraulic systems, control stations and electrical arrangements
- Operational testing, including alarms and safety functions
- Overload brake holding capacity test at 110% of BHC (calculations may be accepted if testing is impractical)
- Overload testing to 110% of maximum line pull (MLP)
- Thorough examination after completion of overload tests.

These requirements must be verified no later than the first Cargo Ship Safety Construction Renewal Survey conducted on or after 1 January 2026. A suitable note will be raised on a ships record.

Maintenance, operation, inspection and testing for all anchor handling winches

Under SOLAS Regulation II-1/3-13.3, all anchor handling winches, associated equipment, and loose gear must be operationally tested, thoroughly examined, inspected, and maintained in accordance with IMO guidelines.

Shipowners and operators must:

- Follow manufacturer recommendations, industry standards and operational profiles
- Include winches in the onboard maintenance program
- Ensure maintenance and operational manuals are available (or reconstructed per IMO guidelines if missing)
- Confirm personnel are properly qualified and familiarised with equipment.

Records of thorough examinations

Although no prescribed register booklet exists (as for lifting appliances), IMO guidelines require thorough examination and testing records to be legible, complete, and authenticated by a competent person. LR will issue its own forms upon survey completion and recommends these be kept in a dedicated folder as documentary evidence.

For further information

If you would like to know more or need support with these requirements, please contact Lloyd's Register Global Technical Client Care via TechnicalExperts@lr.org or access the LR Client Portal.

Lloyds Register Class News 01/2026 14 January 2026

Marine diesel engine amendments to NOx Technical Code

The International Maritime Organisation's MEPC 83 (April 2025) adopted a number of amendments to the NOx Technical Code 2008 in Resolution MEPC.397(83). They cover the re-certification process for marine diesel engines and include the use of multiple engine operational profiles (MEOP), as well as clarifying existing engine test cycles.

Applicability: Shipowners, ship operators, ship managers, ship masters, shipbuilders and ship manufacturers.

Amendments introduce changes to the re-certification process for marine diesel engines, including the use of Multiple Engine Operational Profiles (MEOP). The main application date is 1 January 2028 for new engines.

Applicability of amendments

These changes enter into force as follows:

- For new individual or parent engines not previously certified, these amendments apply from 1 January 2028.
- For a new member engine to an engine family or group that was certified before 1 January 2028, it will need to be shown that the engine family or group meet the new requirements by 1 January 2030.
- For existing certified engines, these amendments apply if the engine is subject to substantial modification on or after 1 January 2028.
- In the case of identical replacement of an engine on or after 1 January 2028, the version of the NOx Technical Code at the time of the Engine International Air Pollution Prevention (EIAPP) Certificate is issued continues to apply unless the replaced engine is equipped with MEOP.
- Amendments also clarify the application of existing test cycle requirements, so do not have specified effective dates.

Controls on multiple engine operational profiles

Alternative MEOP have been used in the NOx certification process for some time, for example, where a particular engine is certified for both Tier II and Tier III, or a non-propulsion engine is to be used in more than one (i.e. E3 and D2) duty application.

These amendments allow for more than one engine operational profile for a particular engine duty application, thereby covering several differing load scenarios: for example, a generator engine "at sea" or "cargo handling" conditions, leading to fuel optimisation.

However, in this instance, the highest NOx emission value at each mode point in the relevant test cycle across all the engine operational profiles is used in a composite approach to give the actual NOx certification value.

To cover these situations, a new Chapter 8 has been added to the NOx Technical Code.

Application of a rational emission control strategy

An irrational emission control strategy is where the mode points values of relevant test cycles do not represent the intermodal values. Since the 2008 revision of MARPOL Annex VI, there has been an explicit prohibition on the use of irrational emission control strategies. However, there were no specific provisions in the NOx Technical Code to cover that issue.

These amendments require applicants for NOx certification to demonstrate that the engine's control arrangements are such that, under normal operating conditions, there is a generally linear progression between the mode points over the entire operating load–speed range other than were declared auxiliary control devices function to ensure engine safety or operability.

Furthermore, limits are set on the extent to which the NOx emissions may increase away from the intermodal line. It is for the applicant to define, according to the intended usage of an engine, as to how far from that intermodal line the engine is to operate and those power – speed values.

Clarifications on use of emission test cycles

These amendments are to the engine type descriptions, not to the actual test cycles or weighting factors as given in the NOx Technical Code. Hence the terms "main" and "auxiliary" have been replaced by "propulsion" or "non-propulsion", as now defined, to provide a clear binary choice. This binary choice has been used to provide clear and unambiguous direction as to which test cycle applies in all instances. A flow chart illustrating this process has been added as Appendix IX to the Code.

What shipowners and operators should do now

Please review the new amendments and test requirements and act as necessary to ensure you remain compliant.

For further information

Resolution MEPC.398(83) contains the complete documentation for the amendments. If you would like more details or need support with these requirements, please contact technicalexperts@lr.org.

Lloyds Register Class News 27/2025 10 December 2025

Changes to International Maritime Solid Bulk Cargoes

SOLAS regulation VI/1-2 requires solid bulk cargoes other than grain to be carried in compliance with the relevant provisions of the International Maritime Solid Bulk Cargoes (IMSBC) Code. New amendments to the IMSBC Code will enter into force on 1 January 2027, with voluntary implementation from 1 January 2026.

New cargoes

The amendments introduce new individual cargo schedules with specific carriage requirements for the following Group B cargoes (cargoes that possess a chemical hazard which could give rise to a dangerous situation on a ship):

- Aluminium Sulphate Granular
- Ferric Sulphate Granular

Note: The above cargoes have been added to the list of cargoes which may be exempted for fixed gas fire-extinguishing system in the cargo holds, published as IMO circular *MSC.1/Circ.1395/Rev.7*.

Castor Beans UN 2969

'Castor Beans' cargo has also been renamed, removing reference to Castor Meal, Castor Pomace and Castor Flake.

Fish meal (Fish Scrap), Stabilize

'Fish Meal (Fish Scrap), Stabilized Anti-oxidant treated' has effectively been re-classified from a 'MHB' cargo to a Class 9 dangerous goods cargo (reversing the change made by the IMO in the 07-23 Amendments to the Code). After the changes come into force, ships will require a dangerous goods Document of Compliance to carry the cargo.

Other changes to the IMSBC Code include:

- Addition of Group A cargo schedules for 'Apatite Concentrate' and 'Phosphate Rock Fines (uncalcined)'.
- Addition of Group C cargo schedules for 'Asphalt Granulates', 'Crushed Granodiorite, Coarse', 'Fish Meal (Fish Scrap), Stabilized', 'Iron Ore Briquettes', 'Pea Protein Concentrate Pellets', 'Tuff, Coarse' and 'Zinc Slag (coarse)'.

Note: Group A and Group C cargoes are not individually listed on LR's IMSBC Certification, i.e. the certificate allows carriage of all Group A and C cargoes.

Self-contained breathing apparatus

The requirement for two additional sets of self-contained breathing apparatus (SCBA) has been removed from several dangerous goods' cargo schedules in the IMSBC Code, because the same requirement is in SOLAS Regulation II-2/19.3.6. This change removes unnecessary duplication of the requirements. For certain MHB cargoes, two additional SCBA sets are still required by the IMSBC Code, although it has been clarified in the Code that the SCBA sets supplied for SOLAS Regulation II-2/19.3.6.2 may also be used to comply with this requirement.

What shipowners and ship operators should do now

Certification that includes the new Group B cargoes can be requested from Lloyd's Register after the voluntary application date of 1 January 2026.

For further information

For more details on the amendments and a full list of the new cargoes added to the IMSBC Code, please see *MSC.1/Circ.1395/Rev.7* and IMO Resolution MSC.575(110).

Lloyds Register Class News 02/2026 21 January 2026

IMO Ship Design and Construction Sub-Committee (SDC12) - LR Summary Report

The IMO Ship Design and Construction sub-committee (SDC) is where many technical and operational requirements related to ship design and construction (including tonnage, load line and stability) are discussed. SDC reports to the Maritime Safety Committee.

Key Outcomes:

- Draft Guidelines on Remote Inspection Techniques (RIT)
- Draft amendments to MSC.1/Circ.1369 - Interim explanatory notes for the assessment of passenger ship systems' capabilities after a fire or flooding casualty.
- Draft guidelines for use of fibre-reinforced plastics (FRP) within ship structures
- Draft circular - Technical guidance on co-optimising energy efficiency and underwater radiated noise at the design and retrofit stage.

Progress was also made on:

- Draft Guidelines on Remote Inspection Techniques (RIT)
- Draft amendments to MSC.1/Circ.1369 - Interim explanatory notes for the assessment of passenger ship systems' capabilities after a fire or flooding casualty.
- Draft guidelines for use of fibre-reinforced plastics (FRP) within ship structures
- Draft circular - Technical guidance on co-optimising energy efficiency and underwater radiated noise at the design and retrofit stage.

Lloyds Register Summary Report 24 January 2026

IMO Ship Design and Construction Sub-Committee (SDC12) - DNV Summary

The 12th session of the IMO Sub-Committee on Ship Design and Construction (SDC 12) took place from 19 to 23 January 2026. SDC 12 finalized the revised Explanatory Notes for the Safe Return to Port concept, the new guidelines for the use of remote inspection techniques under the 2011 ESP Code, and the interim guidelines for the use of fibre reinforced plastics in ship structures (MSC 1/Circ 1574). New initiatives were also considered, including performance standards for engine control room alert management as well as a work plan for the development of a safety framework for emerging technologies such as wind propulsion, battery power and nuclear reactors.

Safe Return to Port for passenger ships

The Safe Return to Port (SRtP) concept was introduced in SOLAS in 2010 with the intention to increase the robustness and fault tolerance of passenger ships. Even in the event of a flooding or fire casualty, the ship shall be able to return to port with its own machinery and provide a safe area for all the persons on board. The SRtP regulations apply to passenger ships with a length of 120 metres or more or with three or more main vertical zones.

SDC 12 finalized a revision of the "Interim Explanatory Notes for the Assessment of Passenger Ship Systems' Capabilities After a Fire or Flooding Casualty" (MSC.1/Circ.1369) to facilitate uniform implementation of the concept, taking into account experience gained.

The draft revision of the Explanatory Notes expands the scope of the guidance beyond that set out in MSC.1/Circ.1369 to cover the full life cycle of passenger ships – from design and verification to testing and operational aspects, including the following:

- Essential aspects to be addressed in the pre-contract/early project phase
- Design requirements and acceptance criteria for all SRtP and OEA systems

- The SRtP assessment process
- Documentation, verification and approval
- Tests and trials
- On-board documentation for SRtP and OEA
- High-level operational aspects

The new draft of the revised guidance "Explanatory Notes for Safe Return to Port and Orderly Evacuation and Abandonment after a Fire or Flooding Casualty" will apply to ships:

- for which the building contract is placed on or after1 January 2028, or
- in the absence of a building contract, the keel of which is laid or which is at a similar stage of construction on or after 1 July 2028, or
- the delivery of which is on or after 1 January 2032.

The draft revision of the Explanatory Notes will be submitted to MSC 111 (May 2026) for approval.

The Sub-Committees on Human Element, Training and Watchkeeping (HTW) and Implementation of IMO Instruments (III) will be invited to consider whether existing instruments on operational aspects need to be amended to support the new Explanatory Notes.

2011 ESP Code

Remote inspection techniques

Remote inspection techniques – for example real-time sensing devices carried by drones, remote-operated vehicles, unmanned robotic arms, divers and climbers – are increasingly useful tools for supporting an attending surveyor on-site when conducting inspections.

MSC 110 approved draft amendments to the 2011 ESP Code to allow the use of remote inspection techniques (RIT) for closeup surveys of existing tankers and bulk carriers. An RIT is defined as a means of survey of any part of the structure without the need for direct physical access by the surveyor and should not be mixed with the concept of remote surveys.

SDC 12 finalized new draft guidelines for the use of RIT under the 2011 ESP Code.

The draft of the new guidelines will be submitted to MSC 111 (May 2026) for approval in conjunction with the adoption of the related draft amendments to the 2011 ESP Code.

Fraction detection procedures

SDC 12 agreed to draft an amendment to the 2011 ESP Code to harmonize the fracture detection procedures between bulk carrier and oil tankers by including the option for "other equivalent means" to paragraph 5.4.2 of both parts A and B of Annex A.

The draft amendments will be submitted to MSC 111 (May 2026) for Approval in Principle and is planned to be adopted by MSC 114 (2028).

Means of access to the cargo hold of single-side skin bulk carriers

SDC 12 agreed on draft amendments to the "Technical provisions for means of access for inspections" (Resolution MSC.133(76), as amended by Resolution MSC.158(78)) to align the provisions regarding the use of portable ladders with the requirements of the 2011 ESP Code.

The draft amendments will be submitted to MSC 111 (May 2026) for approval and subsequent adoption by MSC 112, and are expected to enter into force on 1 January 2032.

New technologies and alternative fuels

The Maritime Safety Committee has considered potential alternative fuels and new technologies to support the reduction of greenhouse gas (GHG) emissions from ships from a safety perspective, and has identified safety obstacles, barriers and gaps in the current IMO instruments that may hinder their use. Related recommendations to support the possible safe use of these new fuels and technologies have been assigned to the relevant Sub-Committees.

SDC 12 considered the recommendations from MSC 110 and prepared a work plan for the development of a safety regulatory framework to support the safe uptake of new technologies and alternative fuels. The work plan includes the following technologies and possible deliverables:

Lithium-ion batteries and swappable traction lithium-ion battery containers:

- Consideration of draft amendments to SOLAS Regulation II-1/41 to allow for batteries to be used as the main source of electrical power and lighting systems.
- The initial work plan indicates target completion in 2028 of any draft amendments.

Wind propulsion and wind-assisted power:

- Consideration of revisions to the Intact Stability Code and the development of interim guidelines for the safety of ships using wind propulsion and wind-assisted power.
- Initial tasks include identifying relevant parts of IMO instruments, and relevant existing hazard-identification work
- The initial work plan indicates target completion in 2029 of any draft amendments and new guidelines

Nuclear power:

- Consideration of a revised Nuclear Code and related amendments to SOLAS Regulation VIII.
- Initial tasks include compiling information on previous hazard identification work and developing a comprehensive inventory of potential challenges related to the use of nuclear reactors for maritime applications.
- Any deliverables are expected in 2030, at the earliest.

Engine control room alert management

In March 2019, the passenger ship Viking Sky lost propulsion and nearly grounded off the coast of Norway. The accident investigation indicated that engine control room operators were overwhelmed by alarms during critical situations, increasing the risk of human error and delayed response. As a result, the IMO has agreed to develop performance standards for engine control room alert management (ECRAM) to mitigate these risks.

SDC 12 agreed to a draft outline for ECRAM performance standards and a related road map for the development

work. A Correspondence Group was established to progress the work until SDC 13 in 2027. The road map indicates finalization of the performance standards by 2028.

Fibre-reinforced plastics

SDC 12 finalized a draft revision of the "Interim Guidelines for Use of Fibre Reinforced Plastics (FRP) Elements Within Ship Structures: Fire Safety Issues" (MSC.1/Circ.1574) to address experiences in application of the interim guidelines since their approval in 2017.

The draft revision is intended as a guidance regarding the assessment of the fire safety in the case of alternative designs, and addresses main fire safety aspects, including ignition potential of the FRP material, fire growth potential, firefighting strategies and equipment, and maintenance of the insulation to protect the FRP.

The revised interim FRP guidelines will be submitted to MSC 111 (May 2026) for approval.

Propulsion and steering systems

SOLAS Chapter II-1 addresses traditional steering gear arrangements with a rudder. Alternative, modern combined steering and propulsions systems (e.g. azimuth thrusters or waterjets) are, however, not addressed in the current regulatory framework.

SDC 12 considered a revision of SOLAS Chapter II-1 to address both traditional and non-traditional propulsion and steering systems. The new requirements will be goal-based and apply to all steering and propulsion systems, both existing conventional systems and modern combined steering and propulsion systems.

SDC 12 further discussed the ongoing development of draft new international ship manoeuvrability standards. The draft new standards are intended to be applicable to new ships subject to the new goal-based SOLAS regulations; however, they should not strengthen the required manoeuvring performance compared to the current fleet. The existing standards for ship manoeuvrability in Resolution MSC.137(76) will continue to be applicable to existing ships.

Members states and international organizations were encouraged to submit relevant trial data to support the development of the manoeuvrability standards. The work will be progressed in a Working Group at SDC 13 in 2027.

The draft revision of SOLAS Chapter II-1 to address both traditional and non-traditional propulsion and steering systems targets entry into force on 1 January 2032.

Underwater radiated noise

In October 2024, MEPC 82 agreed to continue the work on reducing underwater radiated noise (URN) from ships by introducing an experience-building phase (EPB) and to extend the target completion year to 2026.

SDC 12 agreed to a draft technical guidance on co-optimizing energy efficiency and URN at the design and retrofit sage.

The draft technical guidance will be submitted to MEPC 84 for approval. MEPC 84 will also be invited to extend the target completion year of the EPB to 2028.

Emergency escape from machinery spaces

SOLAS Regulations II-1/13.4.1 and 13.4.2 require an escape trunk to extend from the lower part of the machinery space, without defining "lower part". The Unified Interpretation in MSC.1/Circ.1511/Rev.1 clarifies that the term "lower part of the space" should be regarded as the lowest deck level, platform or passageway.

Many ships have escape trunks that do not extend fully down to the lowest deck level of the engine room, and recent Port State Control (PSC) inspections have challenged these arrangements, although they were approved by the flag administration.

MSC 110 acknowledged the differing interpretations and approved MSC.1/Circ.1689, inviting PSC authorities to adopt a pragmatic approach in the inspection of such arrangements while the Committee works on a long-term clarification of this issue.

SDC 12 considered whether there were any safety concerns with the current regulations and how they had been applied. It was agreed that no safety issues were demonstrated and that no further discussion was needed.

MSC 111 will be invited to note that no safety issues have been demonstrated and that the agenda item may be considered complete. Circular MSC.1/Circ.1689, being an interim solution, may be revoked accordingly.

MODU Code – emergency shutdown

The 2009 MODU Code requires equipment on an open deck to be shut down upon explosion hazards (gas leaks) unless the equipment is intended to be operational after shutdown and therefore rated for operation in Zone 2 locations.

SDC 12 agreed to draft amendments to paragraph 6.5 of the 2009 MODU Code to clarify the term "after shutdown" in the context of emergency shutdown systems with multiple levels of shutdown.

The draft amendments clarify that any equipment that must continue operating after emergency shutdowns must be either suitable for Zone 2 hazardous areas or subject to a conclusive risk assessment, or be properly protected within enclosed spaces. Furthermore, it was clarified that the term "after shutdown" refers to any level of emergency shutdown and not only total shutdown of the unit.

Critical functions like emergency lighting, blow out preventer controls, alarms, public address and battery radio systems must always remain operable. Shutdowns may isolate ignition sources by location or system, and any enclosed-space equipment still operating must have protective measures to stay safe during a gas-release incident.

The draft amendments will be submitted to MSC 111 (May 2026) for adoption and are expected to take effect from 1 January 2027.

Nitrogen receiver / buffer tank spaces

Paragraph 2.4.1.4 of Chapter 15 of the FSS Code requires an "enclosed space" where a nitrogen receiver or buffer tank is installed to have access from the open deck and be provided with extraction-type ventilation.

SDC 12 considered draft amendments to Chapter 15 of the FSS Code, to clarify the access and ventilation requirements when the nitrogen receiver or a buffer tank of the nitrogen generator system is located inside the engine room.

The work will continue at SDC 13 in 2026.

Recommendations

As SDC is a Sub-Committee, all decisions concerning rules, regulations and dates are subject to further consideration and approval by the Maritime Safety Committee (MSC).

DNV Update *26 January 2026*

HD Hyundai 20,000m3 LNG bunkering vessel design awarded BV approval

HD Hyundai Heavy Industries Co., Ltd (HD HHI) and Bureau Veritas Marine & Offshore (BV) have successfully concluded Joint Development Project (JDP) and design verification for a 20,000m3 LNG bunkering vessel (20K LNGBV), driving the advancement of next-generation LNG.

HD HHI's proprietary hull designs have been meticulously developed to meet the future demands of the 20K LNGBV. Through comprehensive optimization of hull performance and rigorous design verification, the new design concepts deliver improved design efficiency and production advantages compared with existing 20K LNGBV designs. The 20K LNGBV design offers increased bunkering capacity, which enhances operational flexibility, reduces bunkering frequency and operating costs for operators, and enables HD HHI to meet the evolving needs of charterers.

Throughout this project, HD HHI developed technical specifications and conceptual drawings, including G/A, Process Flow Diagram (PFD), etc. in compliance with BV's Rules and requirements as well as relevant regulations. Subsequently, HD HHI and BV agreed to jointly develop the new vessel designs to provide a practical solution for LNG fuel delivery and to obtain Approval in Principle (AiP).

BV carried out technical verification of the 20K LNGBV design based on the documentation submitted by HD HHI. The assessment covered all essential aspects of the vessel's safety and operability, including structural integrity, LNG cargo containment and handling systems, process safety architecture, risk analysis, intact and damage stability performance, and full compliance with applicable regulatory frameworks.

This rigorous and collaborative evaluation confirmed that the 20K LNGBV design satisfies the required standards for safety, environmental protection, and operational efficiency, demonstrating the technical feasibility and robustness of the proposed concept. These collaborations represent significant milestones in the long-standing partnership between HD HHI and BV, showcasing their combined expertise and commitment to advancing next-generation bunkering vessel technology.

BV Ocean Maritime News *3 February 2026*

Bureau Veritas grants Approval In Principle to Greenroom Maritime Autonomy software

Bureau Veritas Marine & Offshore (BV) has granted an Approval in Principle (AiP) to Greenroom Robotics for its maritime autonomy software, GAMA. This is the first time a maritime autonomy software, enabling self-navigation has been granted AiP by Bureau Veritas, marking a key advancement for maritime robotics and autonomous operations.

Greenroom's GAMA software employs AI to create a fully autonomous navigation system. By doing so, it integrates data from multiple onboard sensors to support situational awareness, monitoring of vessels, decision-making, and vessel control, and can be operated either onboard or from a remote-control center. Its modular and scalable architecture is designed to support flexible integration, enabling any vessel to be converted into a fully autonomous craft.

The AiP confirms that, based on a design-level assessment and within the defined scope, GAMA's overall design principles are aligned with the applicable Bureau Veritas rules for autonomous and remotely operated vessels. This enables faster integration of autonomy into new builds and existing vessels, streamlines flag-state approval, reduces risk for Defence and commercial operators and provides a clear pathway to full certification.

The assessment was conducted in accordance with BV NI641 "Guidelines for Autonomous Shipping", providing an independent, early-stage appraisal of the system's technical approach.

Through this collaboration, BV contributes its expertise in global maritime regulations, classification, and best practices for autonomous and remotely operated systems, supporting the alignment of innovative technologies with internationally recognized safety and performance objectives.

Harry Hubbert, Chief Operating Officer, Greenroom Robotics, said:

> For shipbuilders and operators, this AiP accelerates the path to autonomy by validating GAMA's design intent against class expectations. As one of the first maritime autonomy software to be granted AiP by Bureau Veritas, we're proud to be leading the adoption of autonomy through proven and validated solutions. We look forward to continued collaboration with Bureau Veritas to transform maritime robotics, autonomous navigation, situational awareness, and advanced operations management across the global maritime industry.

The AiP follows a Memorandum of Understanding (MoU) signed by BV and Greenroom Robotics in 2024, which established a collaborative framework to advance maritime robotics, autonomous navigation, situational awareness, and operations management. BV and Greenroom Robotics will continue their cooperation under the MoU framework, supporting further development and engagement as maritime autonomy progresses toward broader operational adoption.

Bureau Veritas media release *9 February 2026*

FROM THE CROWS NEST

The focus of this column is on maritime record breaking projects, carrying on Phil Helmore's tradition. News tips are always welcomed.

Spirit of Australia 2

In mid February the Warby team reported it has been monitoring water levels at Blowering Dam which, since their last trials with *Spirit of Australia 2* in early November, have gradually reduced to the current 21% of capacity. The team is hopeful that in the coming months water will flow back into the dam which has a capacity of 1,628 Gigalitres. Unsurprisingly, no new trial dates have been set for 2026.

Recent view of Blowering dam at a very low level
(Photo via Spirit of Australia 2 Facebook page)

The team has been in the workshop returning their spare engine to an operational condition in case it is needed. They will also inspect and service the engine currently in *Spirit of Australia 2*, ensuring it is ready to run when there is a reasonable water level to run safely. *Spirit of Australia 2* is powered by a Rolls Royce (formerly Bristol Siddeley) Orpheus 803 turbojet. The gas turbine once powered an Italian Air Force Fiat G.91 jet fighter.

Spirit of Australia 2 in the Warby workshop with the spare gas turbine alongside
(Photo via Spirit of Australia 2 Facebook page)

David Warby also has a commitment to piloting demonstration runs of Bluebird K7 at Coniston Water in the UK during May, see following item.

Based on `Spirit of Australia 2 Facebook page

Blue Bird K3 and Bluebird K7 UK Demonstrations

Donald Campbell's Bluebird K7 will return to operate on Coniston Water during 11-17 May 2026 after being granted a Speed Exemption for the "Bluebird K7 - The Festival" event. The event will celebrate the approaching 70th anniversary of Donald Campbell's third Water Speed Record, but his first on Coniston Water which was set on 19 September 1956 at 225.63 mph. Campbell set seven successive speed records from 202.32 mph to 276.33 mph between 1955 and 1964, four of which were achieved on Coniston Water. His last record had been set at Lake Dumbleyung in Western Australia, the same year he achieved his wheel driven land speed record on a relatively dry Lake Eyre.

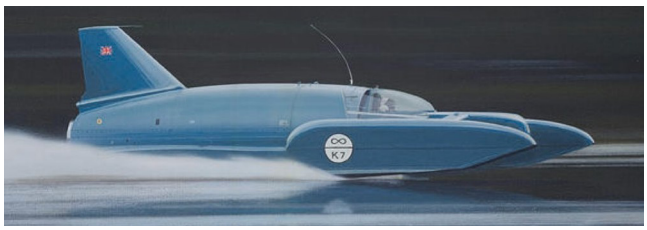


Illustration of Bluebird K7 operating at high speed
(Image courtesy ginacampbell.co.uk website)

While holding the anniversary event in September would have coincided with the 70th anniversary of Campbell's 1956 record, northern hemisphere spring conditions offer greater prospects for calm water essential to safely operate the hydroplane. The Lake District National Park Authority granted a speed exemption from Coniston Water's usual 10mph limit for the week-long event. Donald Campbell's daughter Gina Campbell expressed support for the demonstration stating that her father "would be delighted and pleased that the exemption has been approved".

Bluebird K7 will be piloted by David Warby in the hydroplane's first operation on the lake since Donald Campbell's fatal crash in January 1967. Campbell still held the world water speed record at 276.33 mph at that time. Bluebird K7 became unstable during the return run and somersaulted before disintegrating on impact with the water. RAF pilot Flight Lieutenant David-John Gibbs is reserve pilot in the event Dave Warby cannot fulfil the role. Gibbs is designated pilot for the *Longbow* water speed record challenger project led by Dave Aldred. Ruskin Museum director Tracy Hodgson confirmed that two Orpheus 101 engines are being prepared for *K7*. One engine will be installed for the demonstration runs, whilst the second will serve as a spare.

Malcolm Campbell's *Blue Bird K3* will also be operated during the festival, making this the first time both record-breaking boats have appeared together on Coniston Water. Karl Foulkes-Halbard, owner of Filching Manor Motor Museum where *K3* underwent restoration, will pilot Malcolm Campbell's hydroplane during the festival.

Blue Bird K3 in Foulkes Halbard collection after restoration in 1989
(Image via k3bluebird.com)

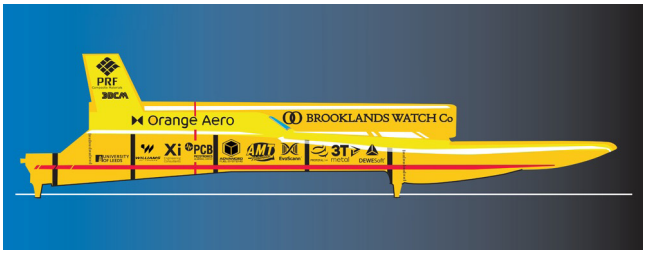
Between Malcolm and Donald Campbell, with Stanley Sayres from the USA between them, the water speed record was driven up from its prior 124.86 mph to 276.33 mph. In particular, the speed record was repeatedly and significantly increased from the 1920s to the 1950s as tabulated at http://www.solarnavigator.net/water_speed_records.htm..

Via Powerboat News link on `Spirit of Australia 2 Facebook page & Ruskin Museum website

ThrustWSH World Water Speed Record Project

Aside from *Spirit of Australia 2* and *Longbow*, which have been regularly reported upon in this column, a number of other world water speed record projects have been initiated over recent decades but many remained dormant.

One project that is making headway is *ThrustWSH* (https://thrustwsh.com/). The team is led by Richard Noble who has previously lead the successful land speed record projects *Thrust 2* (633.468 mph) and *ThrustSSC* (714.144 mph and subsequently 763.035 mph). *ThrustSSC* remains the only land vehicle to exceed the sound barrier.

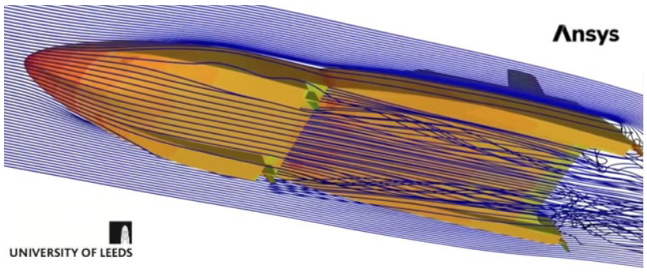


ThrustWSH profile
(Image courtesy ThrustWSH website)

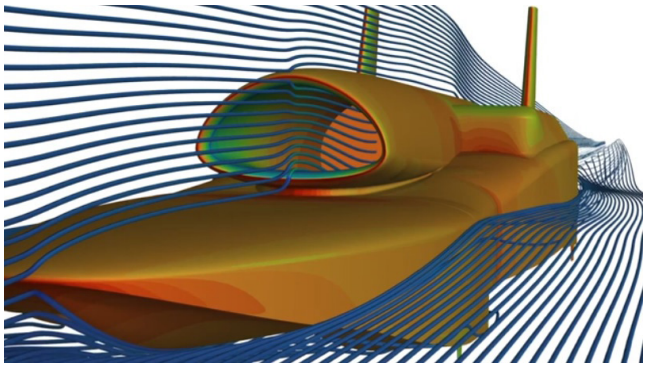
Richard and his associates turned their attention to the world water speed record in 2020. Rather than plunging directly into the construction of a full-scale craft to challenge the record, the team are instead focussed their initial effort on scale model testing and computational analysis. This allows them to validate and refine their design with a more modest budget while seeking the sponsorship necessary to build the full-scale *ThrustWSH* craft. The WSH in the project name originally represented "Water Speed Hydroplane" but now represents "Water Speed Hydrofoil".

The team initially took inspiration from the Reid Railton designed gas turbine powered *Crusader* that John Cobb had used for his fatal water speed record attempt in 1952. This involved building and testing a scale model "*Crusader 2*" (C2) powered by a model jet engine which was anticipated to be capable of speeds to 100 mph. This model, closely resembling the reverse three-point design of *Crusader*, appears to have exhibited stability problems.

Following experience gained with the C2 model, the team developed a four-point hydroplane configuration. This was assessed using a new 1.7m long model C3.1 representing a



CFD output of air flow around ThrustWSH as seen from below. This computation at 316 mph with a ride height of 200mm showing streamlines originating at 500mm above the waterline
(Image courtesy ThrustWSH website)



Further illustration of CFD computations for ThrustWSH
(Image courtesy ThrustWSH website)

1:7th scale craft. The model was powered by a 48 lb thrust hobby jet engine with a maximum speed projected to be 110 mph. However testing this model demonstrated that it would be difficult to safely control a powered scale model at high speed using only conventional radio control equipment.

The earlier four point hydroplane C3.1 model on display
(Image courtesy ThrustWSH website)

Effort has since turned to building and testing a larger quarter scale 3.0m long model designated C3.2B. This is fitted with a 352 lb thrust AMT Jets Lynx jet engine that is typically installed in larger UAVs and military target drones. This model, while similar in overall configuration to C3.1, is now fitted with a set of four controllable foils. The new model is estimated to have a maximum speed of 225 mph. This model is currently undergoing testing, with the initial focus being on achieving consistent and safe autonomous operation.

Separately, the team already has access to a Rolls Royce Spey Mk 205 gas turbine. This gas turbine is an upgrade of the Mk 202 and 203 that had been used in pairs on the McDonnell Douglas F-4K and F-4M Phantom previously operated by the RN and RAF. The Mk 205 owned by the team had been in storage for nearly 30 years since last tested as part of the ThrustSSC project. In 2023 it was successfully statically tested at full with afterburner producing ~25,000 lb thrust. The team envisage that this could propel the 12.2m

The larger quarter scale C3.2B composite model under construction
(Image courtesy ThrustWSH website)

Model C3.2B being tested on a lake in the UK during 2025
(Image courtesy ThrustWSH website)

Testing of the Rolls Royce Spey Mk 205 proposed for ThrustWSH at Cotswold Airport in 2023
(Image courtesy ThrustWSH website)

ThrustWSH craft at 400+ mph (~350 knots or ~640 km/h).

Richard Noble and his team are not only focussed on the water speed record. A major objective of the project is to also inspire young people to choose STEM-based careers. Their website discusses this initiative further.

Compiled based on thrustwsh.com website

Sodebo Ultim 3 sets new Non-stop around the World record for Jules Verne Trophy

The foiling trimaran *Sodebo Ultim 3* has set a new Jules Verne Trophy record after sailing around the world in 40 days, 10 hours, 45 minutes and 50 seconds. This exceeds the previously fastest non-stop around the world record held by *IDEC Sport* since 2017. The team sailed 28,315 miles non-stop at an average speed of 29.17 knots.

The Jules Verne Trophy requires participants to complete a non-stop, unassisted, crewed, around-the-world sailing circumnavigation via the "three capes", namely the Cape of Good Hope, Cape Leeuwin and Cape Horn.

Sodebo Ultim 3 underway foilborne

(Photo courtesy Vincent Curutchet / Sodebo)

The trimaran was crewed by Thomas Coville as skipper with Benjamin Schwartz, Frédéric Denis, Pierre Leboucher, Léonard Legrand and Guillaume Pirouelle. The new record is some 12 hours and 44 minutes faster than Francis Joyon's previous record, with *IDEC Sport*. However due to prevailing weather conditions for the latest record a longer course had to be sailed, so while *Sodebo Ultim 3* increased the average speed by 8.6% over the previous record, time to complete the circumnavigation was only reduced by 1.3%.

After departing from Ushant south of the French mainland, they reached the Equator in just 4 days and 4 hours, and the Cape of Good Hope in under 11 days. They then rounded Cape Leeuwin in about 17 days and 1 hour having maintained an average speed of 32.1 knots to that point since their departure. They then crossed the Pacific in about 7.5 days, provisionally also setting the fastest Pacific crossing time (subject to WSSRC validation). They team were set to break the 40-day round the world target until Storm Ingrid forced them to divert on a westerly course and slow the trimaran down in seas that could potentially damage the boat.

Aside from the loss of a rudder casing, the crew cleared Storm Ingrid relatively unscathed and were able to resume a speed of around 30 knots on approach to Ushant, crossing the virtual finish line between Ushant and Lizard Point at 0746 25 January 2026. Aside from the various overall speed records achieved, the boat achieved maximum speeds above 45 knots on 13 days, with a record of 48.1 knots on the first day of sailing.

Colville has twice previously crewed on Jules Verne record setting boats: with Olivier de Kersauson in 1997 on *Sport Elec* (71 days), and in 2010 with Franck Cammas on *Groupama 3* (48 days).

Sodebo Ultim 3 was launched in 2019 with the aim of becoming the fastest boat to sail around the world. Over

Frontal view of Sodebo Ultim 3 showing foil arrangement
(courtesy ultim3.sodebo.com website)

Stern quarter view of Sodebo Ultim 3 again showing foils
(courtesy ultim3.sodebo.com website)

the past six years the Sodebo team have competed in other events and had made two earlier attempts for the Jules Verne Trophy.

Coville has been primarily sponsored by Sodebo, a family-run food company that has a significant involvement in French offshore racing since 1998.

As is becoming prevalent across a range of sailing classes, *Sodebo Ultim 3* is equipped with lifting foils. There are a pair of L-shaped main foils on each of the amas. These are 4 metres long and can be adjusted both in height and incidence to optimise stability and generated lift. In addition there are three T-foil rudders, one at the stern of each hull. Finally, the centre-hull mounted daggerboard is also a T-foil able to generate lift as well as side-force counteracting sail forces. The foils and the rudders attached to the amas are retractable, in order to reduce the drag created when they are upwind, while also somewhat reducing the risk of collisions with sea life.

The configuration allows the boat to rise above the surface by about 1.5 m. With the hulls no longer in contact with the water, only the foils contribute the hydrodynamic drag and the craft is less influenced by the action of waves.

Summary from ultim3.sodebo.com, Wikipedia and www.sailsmagazine.com.au.

Martin Grimm

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

AUSTRALIAN DIVISION NOTICE OF ANNUAL GENERAL MEETING

THURSDAY 24 MARCH 2026

Notice is hereby given that the Annual General Meeting of the Australian Division of the Royal Institution of Naval Architects will be as a virtual meeting by Zoom at 20.00 Australian Eastern Daylight Time on Tuesday 24th March 2026.

Please register attendance or apology with the Secretary using the link (https://forms.gle/kKzrkyYVYrTAY8ih8) or alternatively by email to the address below) no later than Sunday 22nd March 2026, to enable documents and Zoom meeting details to be sent to you before the meeting.

AGENDA

1. Opening
2. Apologies
3. To confirm the Minutes of the AGM held on 18 March 2025
4. To receive the President's Report
5. To receive, consider, and adopt the Financial Statements and Auditor's Report for the year ending 31 December 2025
6. Announcement of appointments to the Australian Division Council
7. Other Business

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

R C Gehling

Secretary

(Email: rinaaustraliandivision@gmail.com ; Phone: 0403 221 631)

22 February 2026

INDUSTRY AND GENERAL NEWS

NAVAL SHIPBUILDING/ SUSTAINMENT

ASC Pty Ltd appoints new CEO

The Board of ASC Pty Ltd (ASC) announced on 5 December 2025, the appointment of Mr Alex Walsh as Acting Chief Executive Officer (CEO) of ASC from 12 December 2025.

Previously serving as ASC's Chief Nuclear and Capability Officer and Chief Operating Officer Multi-Class Sustainment Delivery, Mr Walsh brings a unique mix of global executive experience across defence and nuclear industries to the role. He has held several senior roles at ASC, including General Manager of Engineering, and is currently focused on the Multi-Class Sustainment Delivery.

Alex Walsh
(Courtesy ASC)

Mr Walsh previously held executive positions at Sellafield Limited—the UK government entity responsible for the Sellafield nuclear site—serving as Executive Project Manager and Executive Manager of Engineering. He also held leadership roles at BAE Systems as Head of Nuclear Construction and Head of Nuclear Safety Engineering.

Mr Walsh will succeed Mr Stuart Whiley AM, who has served at the helm of ASC since 2014 through a transformative period. Mr Whiley commenced at ASC at the start of the Collins Class program more than 35 years ago and has played an instrumental role in establishing Australia's sovereign capability.

ASC Chair Bruce Carter AO said:

> Alex brings deep organisational knowledge and extensive nuclear engineering experience that will support the ASC Board and executive leadership in transitioning ASC to a multi-platform, nuclear-capable organisation. He previously worked at ASC from February 2013 to October 2014 and then rejoined ASC in January 2022.
>
> Stuart has continued to demonstrate his unwavering commitment and dedication to ASC. We sincerely thank him for his outstanding leadership and more than 35 years of service to the organisation.

ASC Media release *5 December 2025*

Austal Awarded Contract for two more Evolved Cape-Class Patrol Boats for Border Force

Austal Limited is pleased to announce that Austal Ships Pty Ltd has been awarded a further contract extension for the construction of two additional Evolved Cape-class Patrol Boats for the Australian Border Force (ABF).

This latest award, valued at over A$135 million brings the total number of Evolved Cape-class Patrol Boats contracted to Austal to 14 vessels, reinforcing the long-standing partnership between Austal, the Australian Border Force and the Royal Australian Navy in delivering critical maritime capability for Australia's national security.

Austal Limited Chief Executive Officer, Paddy Gregg, said the additional vessels continue to strengthen Maritime Border Command's readiness and operational reach.

> Over the past five years, the Evolved Cape-class Patrol Boats have proven themselves as highly capable, reliable assets for Australia's border protection missions. With nine Evolved Capes already delivered and performing exceptionally with the Royal Australian Navy, and two more already under construction for the Australian Border Force, this new order further enhances Australia's maritime surveillance and response capability across Northern Australia and our vast maritime domain.

Austal delivered eight original Cape-class Patrol Boats to the Australian Border Force between 2012 and 2015; these were followed by additional orders and deliveries to the Royal Australian Navy (2 vessels) in 2017 and Trinidad and Tobago Coast Guard (2 vessels) in 2021.

Since 2020, the Commonwealth of Australia has ordered 12 Evolved Cape-class Patrol Boats for the Royal Australian Navy, and Australian Border Force. The addition of these thirteenth and fourteenth Evolved Capes reflects continued confidence in the platform's performance, Austal's proven reliability and the strength of Australia's sovereign shipbuilding capability.

The Evolved Cape-class Patrol Boat design features expanded accommodations for up to 32 personnel, enhanced quality-of-life systems and advanced sustainment technologies to maximise operational availability. The vessels support a wide range of constabulary and naval missions and are a key element of Australia's border security architecture.

Construction of the two new patrol boats will take place at Austal's Henderson shipyard in Western Australia, supported by a proven national supply chain and integrated project teams from the Department of Defence and the Australian Border Force.

Austal continues to provide comprehensive in-service support for both Cape-class and Evolved Cape-class fleets through service facilities in Henderson (WA), Cairns (QLD) and Darwin (NT).

Austal Australia has been awarded a contract extension for two additional Evolved Cape-class Patrol Boats, Hulls 1103 and 1104, to be delivered to the Australian Border Force
(Image: Austal Australia)

Austal Australia also continues to deliver the Guardian-class Patrol Boat program, with 22 of 24 vessels handed over under the Pacific Patrol Boat Replacement Project (SEA3036-1).

Austal media release *January 2026*

Austal awarded $1B contract for Landing Craft Medium Design and Build contract

Austal Limited is pleased to announce that it has been awarded a $1.029 billion Design and Build Contract for Landing Craft Medium (LCM) under the Strategic Shipbuilding Agreement (SSA) signed with the Commonwealth of Australia.

The LCM Design and Build Tasking Statement Contract appoints Austal subsidiary, Austal Defence Shipbuilding Australia Pty Ltd (Austal Defence Australia), to complete the detailed design and build 18 Landing Craft Medium (LCM) vessels at Austal's Henderson, Western Australia, shipyard. Construction of the first LCM is scheduled to commence in 2026 with the 18th and final vessel scheduled for delivery in 2032.

The LCM, being built for the Australian Army, will be manufactured in steel and capable of projecting loads up to 80 tonnes.

Austal Limited CEO Paddy Gregg said the first design and build contract awarded under the SSA was a significant milestone for Austal Defence Australia, as the Commonwealth's Strategic Shipbuilder in Western Australia:

> This Landing Craft Medium design and build contract awarded to Austal Defence Australia is the first vessel construction program in the Government's commitment to delivering continuous naval shipbuilding at Henderson, Western Australia, enlivening decades of opportunity for individuals and businesses to engage, collaborate and invest in defence programs. With these 18 Landing Craft Medium and any further vessels planned as part of the Strategic Shipbuilding pilot program, we are developing the shipbuilding capability to build larger, more complex vessels, in Henderson into the future and delivering sovereign shipbuilding capability for Australia.

Austal LCM Design for Army
(Image courtesy Austal Defence Australia)

Austal Defence Australia Executive General Manager – Strategic Shipbuilding, Gavin Stewart, said local industry was ready to deliver for the Australian Army:

> The Austal Defence Australia team, and our industry and supply chain partners in the Henderson Defence Precinct, across Western Australia and around the nation, are ready to deliver this important new amphibious capability for the Australian Army.

Austal ASX Announcement *18 December 2025*

Austal awarded $4B LCH contract

Austal Limited announced that, in accordance with the announcements from the Deputy Prime Minister and Minister for Defence, the Hon. Richard Marles, and the Hon. Pat Conroy, Minister for Defence Industry, earlier today, Austal Defence Shipbuilding Australia Pty Ltd (Austal Defence Australia) has been awarded a ~$4 billion contract for the construction of eight Landing Craft Heavy (LCH) vessels, under the Strategic Shipbuilding Agreement (SSA) with the Commonwealth of Australia. Following the Minister's announcement, the contract will be executed later today at Henderson; Austal will confirm its execution in a separate short announcement to the ASX thereafter.

Construction of the 100 metre Landing Craft Heavy vessels, based on the Damen LST100 design, will be undertaken using Austal facilities and the Common User Facility at Henderson in Western Australia. Construction is scheduled to commence in 2026, with the eighth and final vessel scheduled for delivery to the Commonwealth in 2038.

Austal Limited Chief Executive Officer, Paddy Gregg, said the award of the Landing Craft Heavy contract to Austal Defence Australia under the Strategic Shipbuilding Agreement reinforced the company's position as the Commonwealth of Australia's sovereign shipbuilder and a trusted partner to the Australian Defence Force. This contract generates a record order book for Austal, provides a long-term demand signal for our supply chain, and provides the incentive to invest in uplifting our capability. Mr Gregg said:

> This contract represents another significant investment in Australia's sovereign shipbuilding

capability - and Austal Defence Australia is ready to deliver these highly capable vessels to support the ADF's operational requirements,

While Austal's US business has traditionally accounted for a large share of our defence order book in recent years, this contract reflects the growing strength and success of Austal's Australian operations — and Australian industry — within the national shipbuilding and sustainment enterprise. This LCH construction contract balances out the split and provides greater geographic diversity of earnings. It also provides earnings and employment stability for the next 12 years.

Austal LCH Based on LCT100 Design by Damen
(Image courtesy Austal Defence Australia)

Austal Defence Australia Executive General Manager – Strategic Shipbuilding, Gavin Stewart said Landing Craft Heavy was the second major construction contract awarded under the Strategic Shipbuilding Agreement, following the award of the $1.029 billion Landing Craft Medium design and build contract in December 2025:

With Landing Craft Medium and Landing Craft Heavy contracts now underway, there are outstanding opportunities for people and businesses to engage with Austal Defence Australia, and our industry and supply chain partners, to help deliver new capability for Australia. Austal Defence Australia is looking forward to expanding and developing the industrial capabilities at Henderson and beyond, into a reliable shipbuilding enterprise to support the Commonwealth's objectives of sovereign shipbuilding capability.

These Programs under the Strategic Shipbuilding Agreement represent decades of continuous naval shipbuilding work, to be delivered here in Western Australia.

The Landing Craft Heavy (LCH) vessels will provide the Australian Defence Force with a critical maritime capability, supporting amphibious operations, logistics, humanitarian assistance and disaster relief across Australia's region of interest.

Key specifications:

- Length: Approximately 100 metres (approx. 328-330 ft)
- Beam (Width): 16 metres (52 ft 6 in)
- Displacement: Approximately 3,900 - 4,000 tonnes
- Capacity Examples: Over 200 embarked soldiers, plus 6 x M1A2SEP3 Abrams Tanks or 9 x Redback Infantry Fighting Vehicles

Austal also notes that in addition, Austal USA is presently constructing up to 12 smaller Landing Craft Utility vessels for the US Navy at its Mobile, Alabama, US shipyard.

Austal ASX Announcement *20 February 2026*

Final Guardian-Class Patrol Boat Launched and 23rd Vessel Delivered

Austal has announced the successful launch of Hull 544 — the final Guardian-class Patrol Boat contracted for construction under the Pacific Patrol Boat Replacement Project (SEA3036-1) for Defence Australia.

The launch marks a significant milestone in the (now) 24 vessel program that began in May 2017 with the plate cutting on the first Guardian, HMPNGS *Ted Diro;* and has now seen 23 vessels delivered to date, to support maritime security across the Pacific.

The Marshall Islands took delivery of a new Guardian-class Patrol Boat, RMIS *Jelmae*, in a ceremony at HMAS *Stirlin*g, Western Australia on 30 January 2026. The Foreign Minister of the Republic of the Marshall Islands Kalani Kaneko, received the vessel on behalf of the government of the Marshall Islands.

Marshall Islands Guardian Class Patrol Boat Handover,
(Photo courtesy Defence)

Every Guardian-class Patrol Boat constructed by Austal in Henderson Western Australia reflects the skill, dedication and resilience of their team and supply chain and industry partners.

Through challenges and change, they have worked collaboratively to refine processes, strengthen capability and establish a highly efficient steel shipbuilding production line.

Austal Australia & Department of Defence
30 January 2026

FIRB Approval of Hanwha 19.9% stake in Austal

On 12 December 2025, the Australian Treasurer announced that he had agreed to the clear recommendation from the Foreign Investment Review Board to not object to Hanwha's proposal to increase its shareholding in Austal Limited from 9.9 per cent to 19.9 per cent, subject to strict conditions.

His decision comes after extensive consultation and long and careful deliberation, following a thorough and robust process that took account of all the relevant economic, national security and other national interest issues.

Hanwha would remain a minority shareholder under this proposal and cannot increase its shareholding above 19.9 per cent.

This decision ensures there are greater protections for our Strategic Shipbuilder and the Government's sovereign interests in Austal. It is entirely consistent with FIRB's unequivocal advice not to object to the proposal, subject to conditions.

It incorporates advice from relevant agencies including the Department of Defence, the Department of Home Affairs, the Department of Foreign Affairs and Trade and our national security agencies.

If the proposal goes ahead, it would be subject to a number of strict conditions relating to governance, and data information and security, including:

- Limits on Hanwha's access to sensitive information.
- Limits on the storage of sensitive information.
- Stringent criteria on any Hanwha nominee to Austal's board.

These conditions build on the strong safeguards that already apply to Austal Defence Australia as Australia's Strategic Shipbuilder. Austal is an Australian-based global leader in shipbuilding and defence capability. It will continue to play an instrumental role in building Australia's defence industry, strengthening our supply chains and boosting our skills and economic resilience.

This decision and associated conditions will protect our sovereign interests in this capability and ensure the company can continue to grow, invest, and deliver continuous shipbuilding in Western Australia.

Australia welcomes foreign investment and operates a non-discriminatory foreign investment framework to ensure foreign investment is in our national interest.

Treasury Portfolio Media release *12 December 2025*

Birdon to deliver next-generation amphibious vehicles under $125m Defence contract

Australian-owned maritime engineering company Birdon has signed a $125 million contract to design and build one prototype and 15 Amphibious Vehicles – Logistics (AV-L) for the Australian Army, marking a major milestone in the Land 8710 Littoral Manoeuvre Program.

This new fleet of revolutionary amphibious vehicles will replace the Army's aging Lighter Amphibious Resupply Cargo vehicle (LARC-V), significantly enhancing the Australian Defence Force's amphibious capabilities with improved speed, safety, reliability and performance.

Birdon CEO Jamie Bruce said the AV-L contract strengthens Australia's sovereign defence capability and showcases Birdon's leadership in innovative maritime and automotive engineering excellence.

> The project reflects Birdon's commitment to delivering Defence-ready solutions tailored to Australia's unique operating environments. It builds on our proven expertise in integrated design, engineering, logistics, and construction.

The AV-L design integrates cutting-edge technologies to deliver superior performance across both land and sea. It is engineered to operate as a deep-sea vessel capable of reliable surf zone transitions, while also meeting Australian road safety regulations for on-land mobility.

Proposed Amphibious Vehicles
(Image Birdon Group website)

Designed to withstand Australia's harsh environmental conditions, the AV-L can sustain immersion in corrosive saltwater far exceeding the limitation of most amphibious vehicles. It is built to perform in extreme humidity, high temperatures, rough surf zones, and different beach landing zones, ensuring operational readiness in diverse terrains and climates.

The vehicle's advanced propulsion and steering systems combine water jet and dynamic drive train technologies, enabling seamless transitions between marsh, clay, and surf environments. Enhanced in-water manoeuvrability, improved speed, and responsive reversing performance allow for agile operations, including rapid rescues in emergency scenarios.

Operator safety is central to the AV-L's design. It features a system that automatically detects and adjusts for wheel bogging and slipping, providing the traction needed to exit dangerous wave zones quickly. Shock-absorbing seating and comfort features reduce operator fatigue, while front and rear steering, automatic tyre inflation and self-levelling suspension with ride height control further enhance safety during high-risk missions.

The AV-L includes a modular payload system with a deck crane, advanced fire safety measures, and a reverse flush system to clear debris from the jet intake. These features ensure the vehicle is not only mission-ready but also adaptable to a wide range of defence and humanitarian applications.

All AV-L vehicles will be constructed at Birdon's shipbuilding yard in Port Macquarie on the NSW Mid North Coast. Coupled with Birdon's ongoing investment in growing Australia's maritime engineering and defence industries, the AV-L project will support local job creation and skills development in regional Australia.

Birdon media release *14 January 2026*

Advanced composite technology for RAN and RNZN Ships

Innovative new composite repair technology, which could revolutionise in-water maintenance of Defence vessels and significantly boost fleet availability, has been successfully trialled by Babcock Australasia (Babcock) on three ships across the Royal Australian and Royal New Zealand Navies.

Serving as a permanent alternative to steel, the technology enables faster repair schedules and greater flexibility in where and when maintenance can be conducted — keeping ships at sea for longer and boosting capability available to put to sea.

Made from Fibre Reinforced Polymers, the method ensures durability while opening opportunities for future

lightweighting. Unlike traditional steel fixes, it requires no hot works, cures quickly even underwater, and minimises disruption to systems and personnel.

The composites were used to crop and renew sections of the deck on the RNZN's maritime replenishment vessel, HMNZS Aotearoa and repair hangar corrosion on HMNZS Te Mana. A complete targeted floor remediation was undertaken on the RAN's HMAS Ballarat.

Babcock engaged FUZE, a leading provider of engineered composite solutions across the mining and offshore oil and gas sectors, to deliver the scheduled and unscheduled maintenance as part of its growing regional supply chain.

On HMNZS Aotearoa, repairs were completed in just eight days, compared with the four to six months typical of conventional methods, and received Lloyd's class approval within 24 hours.

Babcock Australasia Managing Director Marine Simon Spratt said:

> The outcomes of these trials alongside the Royal Australian Navy and across ships in both Australia and New Zealand are highly encouraging. It represents another avenue to deliver repairs more quickly, with less disruption, and at lower cost than traditional methods.
>
> By reducing maintenance windows and extending asset life, the technology helps us enhance fleet availability and delivers rapid response capability aligned with Defence priorities for readiness and resilience. Leveraging an integrated regional approach, we are generating efficiencies and sustainment outcomes that strengthen maritime capability across both nations while delivering greater value to our customers.

FUZE Managing Director Jason Le Coultre said:

> We've been working closely with Navy and Babcock for several years to demonstrate how advances in composite engineering can directly benefit our armed forces. These trials show how composite technology can reduce the impact of the repair process.
>
> By combining carbon or glass fibre with proven engineering, we deliver permanent, load-bearing solutions that resist corrosion and adapt to complex shapes. Their flexibility and rapid response capability makes composites ideal for urgent repairs, supporting longer deployments, enhancing performance, reducing costs, and strengthening fleet readiness. We look forward to partnering with Babcock and the Australian and New Zealand Royal Navies to deliver future rapid response maintenance services.

Babcock *8 January 2026*

Babcock completes first maintenance package for RAN replenishment ship

Babcock Australasia has delivered its first major maintenance package on the Royal Australian Navy's new Supply Class auxiliary oiler replenishment fleet, marking another

Repair works delivered by FUZE.
(Photos courtesy Babcock)

expansion of the company's role as Regional Maintenance Provider – West.

The work was carried out on HMAS *Stalwart* during a three-week maintenance period at Fleet Base West, HMAS Stirling, in Rockingham, Western Australia. In total, Babcock and its local supply chain completed more than 6,600 hours of work, encompassing over 130 individual maintenance tasks.

The Supply Class auxiliary oiler replenishment (AOR) fleet, HMAS *Supply* and HMAS *Stalwart*, form a cornerstone of Australia's ability to sustain maritime operations at range.

Built by Navantia in Spain and based on the Cantabria Class design, the vessels entered Australian service in 2021 and 2022, respectively, replacing the ageing HMAS Success and HMAS Sirius.

With a full-load displacement of more than 19,000 tonnes, the AORs provide fuel, aviation fuel, dry cargo, food, water, ammunition and spare parts to deployed naval and joint forces, enabling task groups to remain on station for extended periods without returning to port. They are a critical enabler for Australia's increasing focus on sustained operations across the Indo-Pacific. Babcock Australasia managing director for marine, Simon Spratt, said the completion of maintenance on HMAS Stalwart demonstrated the maturity of the company's Regional Maintenance Provider – West (RMP-West) capability and its growing role in supporting the Navy's most complex vessels:

> As RMP-West, Babcock continues to provide Royal Australian Navy ships with critical maintenance to keep the fleet mission-ready and operating safely, Supporting an auxiliary oiler replenisher is a significant responsibility, given the central role these ships play in enabling naval operations far from home ports.

Spratt said the work was delivered in close partnership with small and medium enterprises across Western Australia, reinforcing local industry participation and sovereign sustainment outcomes.

Babcock was appointed Regional Maintenance Provider – West in 2020, taking responsibility for deep maintenance and sustainment of Navy vessels operating from Fleet Base West. Since then, the company's remit has steadily expanded as new classes enter service and older platforms are withdrawn.

The addition of the Supply Class AORs follows the recent expansion of Babcock's RMP-West portfolio to include the Navy's new Arafura Class offshore patrol vessels, which are progressively being introduced to service from Western Australia. Together, these platforms represent a significant uplift in both the size and complexity of the fleet being sustained in the west.

Babcock's Australian operations sit within a broader global footprint, with the company providing through-life support, maintenance and fleet management services to more than 10 navies worldwide.

The successful maintenance period on HMAS *Stalwart* underscores the growing importance of Fleet Base West as a sustainment hub and highlights the increasing role of Australian industry in supporting a larger, more capable navy as it prepares for more demanding regional operations.

DefenceConnect *14 January 2026*

AUKUS RELATED

Building the Skills behind AUKUS

When defence analysts discuss AUKUS, the trilateral security pact between Australia, the U.S., and the U.K., they often focus on the nuclear-powered attack submarine (SSN-AUKUS) platform. But the real challenge isn't steel, uranium or zirconium for that matter. It's the human capital required to operate, maintain, and eventually build these systems safely.

More specifically, it is the on-shore sovereign capability in terms of human capital that lends the confidence to our partners that highly sophisticated, highly sensitive systems will be utilised and deployed as they should.

AUKUS represents one of the most complex systems-engineering collaborations in history. The exact number of parts in a modern nuclear submarine is of course classified, but it is safe to say that it is in the several millions. Success in operating such complex technological assets depends heavily on developing a skilled, future-ready workforce, capable of sustaining nuclear propulsion, advanced materials, and precision manufacturing. Without this, the alliance risks delays, cost overruns, or compromised safety standards.

The submarine clock is ticking

When Australia takes delivery of its first nuclear-powered submarines from the United States, the nation must be able to operate the nuclear reactors independently, transition periods notwithstanding. The problem is urgent – these skills cannot simply be imported, and countries worldwide are grappling with shortages of qualified nuclear engineers, reactor materials specialists, and propulsion experts.

Australia also aims to deliver its first domestically built submarine, based on UK designs, in the 2040s. Construction must start by 2030, leaving less than a decade to establish a workforce capable of handling reactor specifics, manufacturing, and integration. Any delay in developing human capital will cascade directly into delivery risk.

The solution is to invest in education, research, and workforce development immediately. A saying says: "The best time to plant a tree is twenty five years ago. The second best time is now". It is urgent and imperative to infuse the entire knowledge chain with resource and purpose, if we are to catch up.

This involves bolstering the number of undergraduates and apprentices in relevant domains, all the way to supporting specialised PhD programs in nuclear materials engineering, training engineers in advanced manufacturing for reactor-grade components, and building expertise in thermohydraulics, corrosion, metallurgy, and control systems, and everything in between.

None of these components can be neglected, because then the ecosystem simply does not work – there are ample examples of this from around the world. So, systematic workforce preparation is essential to close the skills gap in time for operational readiness, and this preparation needs to start now.

From collaboration to capability

The AUKUS pact is already spurring unprecedented collaboration between universities, defence agencies, and industry across three nations. Over the past five years, our researchers have received approximately US $170 million in defence-related research funding spanning propulsion, advanced materials, and systems engineering.

Trans-Pacific partnerships with Stanford, Caltech, NASA, and the U.S. Office of Naval Research focus on advanced propulsion architectures, highlighting the mutual capability building that underpins the alliance. This is not, and cannot be, and should not be, passive technology transfer: instead, it is an active process of synchronised R&D and workforce development.

Everyone will benefit from this: we are reminded that currently, bottlenecks in manufacturing of adequate nuclear submarine numbers already affect the US Navy, as far as American needs alone are concerned.

A recent initiative, the Victorian Materials and Manufacture Research Cluster, aims to connects global primes with regional SMEs. The cluster develops high-value materials, additive processes, and digital manufacturing standards essential for nuclear-grade component certification. Modelled partly on the UK's Defence Materials Experimentation program, it demonstrates how distributed R&D networks can accelerate qualification cycles and reduce technology readiness gaps.

An industrial systems challenge

Producing a Ship Submersible Nuclear (SSN) is among the most demanding feats of engineering. Each vessel requires integration across propulsion thermo-hydraulics, metallurgy, and rugged computing for onboard control and diagnostics, to mention only a few of the subsystems at play. The AUKUS build cycle will drive rapid evolution in manufacturing precision, sensor fusion, and validation frameworks across Australia's industrial base.

While Rolls-Royce Submarines Ltd will supply the propulsion plant for SSN-AUKUS, sovereign opportunities exist in fabricating reactor water-circuit components and other high-assurance instrumentation. Developing this capability requires not only sophisticated equipment but sustained knowledge exchange, shared simulation tools, and

cross-disciplinary collaboration – exemplifying a distributed experiment in industrial resilience.

Why people matter most.

The challenge of AUKUS mirrors that of 21st-century alliance systems: integrating industrial bases, removing export and communication barriers, synchronising education, and aligning scientific priorities across borders. Yet its benefits extend far beyond submarines, or even beyond defence.

The computational modelling, materials characterisation, and autonomous systems work feeding into AUKUS will also underpin advances in quantum sensing, hypersonics, and cyber-resilient systems. For Australia, it is a once-in-a-century industrial upgrade opportunity; for the United States, a reinforcement of allied capability in the Indo-Pacific.

Ultimately, AUKUS will succeed not because of submarines but because of the engineers, scientists, and technicians it empowers – the people who ensure these technologies remain safe, effective, and adaptive for decades.

Professor Yiannis Ventikos, APDR 30 November 2025

H&B and Curtin University Nuclear Fundamentals Training Micro-Course

H&B Defence and Curtin University have announced a new partnership to deliver Australia's first nuclear fundamentals training course designed and taught by UK and US nuclear-powered submarine experts. Beginning in March 2026, the two-day micro-credential will be offered several times throughout the year, strengthening Western Australia's technical readiness as the state prepares to support the sustainment of nuclear-powered submarines under AUKUS.

Targeted at engineers, technicians, project managers and defence industry support professionals, the course will provide foundational knowledge of naval nuclear propulsion, including:

- naval nuclear engineering fundamentals
- history and evolution of US and UK naval nuclear programs
- critical quality, assurance and risk-management frameworks
- safety, regulatory and compliance expectations for nuclear-powered submarine sustainment.

Participants will gain practical insights into the standards, culture and discipline required to work safely and effectively within a nuclear-regulated environment — skills increasingly in demand as Australia builds its sovereign capability in this space. Accredited as a Curtin University micro-credential, the course will be delivered by H&B Defence's international team of certified nuclear professionals, drawing on the proven global experience of parent companies HII (US) and Babcock (UK). These subject matter experts bring a level of unmatched nuclear capability to the region, holding more than 160 years of collective real-world experience in nuclear engineering, operations, safety and regulatory compliance.

This depth of expertise ensures participants learn directly from practitioners who understand the demands of modern nuclear programs and can translate complex concepts into practical, job-ready skills for Australia's emerging submarine workforce.

In a further boost to WA's defence workforce pipeline, the Western Australian Government has confirmed new funding through its Defence Industry Reskilling and Upskilling Grant Program to support a second micro-credential course in late 2026. This follow-on course will focus on submarine technology, regulations and support infrastructure, complementing the nuclear fundamentals program, and forming a broader training pathway for industry professionals seeking to enter or advance within the submarine sustainment workforce.

A number of places in the inaugural course will be reserved exclusively for Henderson Alliance members, further supporting the growth of WA's defence industrial ecosystem. The course will be delivered in person in Perth, with limited places available per intake to ensure high-quality, interactive learning. Expressions of Interest for the course on 25-26 March are now open through Curtin University.

APDR 22 December 2025

Albanese and Malinauskas governments back submarine building in SA

The Albanese and Malinauskas Labor Governments are ensuring that South Australia remains the home of Australia's submarine construction, with expenditure projected to be billions of dollars in the state over coming decades.

Today the Albanese Government is announcing it will invest $3.9 billion as a down payment to deliver the new Submarine Construction Yard in Osborne.

While the design process continues, significant investment is critical to delivering Australia's conventionally-armed, nuclear-powered submarines which will create nearly 10,000 jobs across the entire program in South Australia alone.

The Osborne construction yard will comprise three substantive areas, including fabrication, outfitting and further area for consolidation, testing launching and commission.

Australian Naval Infrastructure (ANI) projections show an estimated projected investment of $30 billion over coming decades, to build the construction yard in Osborne.

Enabling works and the Skills and Training Academy (STA) are expected to cost approximately $2 billion and more than $500 million respectively.

Both state and federal governments are strengthening Defence investment in South Australia. This investment complements the existing Collins-class sustainment facilities and Hunter-class shipyard, also located in Osborne.

The total floor area of the new Submarine Construction Yard is expected to be 10 times larger than the existing Osborne South Development project. Construction is expected to use 66 million man hours – 44 times more than Osborne South.

Construction is expected to use 126,000 tonnes of structural steel, equal to the weight of steel in 17 Eiffel Towers.

The Fabrication Hall in Area 1 is 420 metres long, which is 2.5 times the length of Adelaide Oval.

All of these works continue at pace, with future investment decisions to follow as infrastructure needs are further defined,

designs mature and licences are progressed across the yard including for consolidation, launch and commissioning facilities.

The total construction costs associated with the infrastructure program will depend on the details of design and commercial delivery arrangements to be negotiated by Australian Naval Infrastructure (ANI) Pty Ltd, as the Government's appointed design and delivery partner for the yard.

ANI is also delivering progress across the precinct with the recent completion of construction of a new link road that will streamline access to the shipyards for thousands of workers.

Eurimbla Way will connect Pelican Point Road in the east with the shipyard and is part of critical supporting infrastructure at the construction yard that will enable a direct route bypassing the existing railway line, ensuring secure access to both current and future shipyards.

Around 170 workers completed Eurimbla Way on time and on budget and it became operational for traffic at the beginning of this week (9 February 26).

More than 500 South Australians are already on the job helping to build the STA Campus and the Production Demonstration Facilities within the Submarine Construction Yard.

Works for the STA Campus began in 2025, with the first students of the Skills and Training Academy to commence in 2028 ensuring a pipeline of skilled workers for decades to come. This Campus will be a world-class training facility, designed to support up to 1,000 learners each year.

This landmark investment will create thousands of jobs in South Australia with at least 4,000 workers who will design and build the submarine construction yard, and around 5,500 workers who will support nuclear-powered submarine production at its peak.

Roles will range from engineers and skilled trades to project managers and logistics specialists.

Development of the Submarine Construction Yard is coupled with the South Australian Defence Industry Workforce and Skills Action Plan, which has committed $300 million to workforce development initiatives aligned with defence industry and the creation of Technical Colleges in South Australia.

The Prime Minister, the Hon Anthony Albanese MP, said:

> Together with the Malinauskas Government in SA, we are accelerating AUKUS opportunities to secure Australia's future defence capability and create lasting prosperity and jobs for the state.
>
> Investing in the Submarine Construction Yard at Osborne is critical to delivering Australia's conventionally-armed, nuclear-powered submarines.
>
> Labor will always back continuous naval shipbuilding and advanced manufacturing, which is vital to South Australia's economy and long-term growth in local industry.

Deputy Prime Minister, the Hon Richard Marles MP, said:

> The Albanese Government is unwavering in its commitment to delivering Australia's nuclear-powered submarine capability under AUKUS. The momentum is real and the scale of what is being achieved at Osborne is extraordinary.
>
> South Australia is at the centre of one of the most significant defence undertakings in our history. Osborne will be critical to Australia's nuclear-powered submarine program under AUKUS, while supporting continuous naval shipbuilding and sustainment.
>
> From construction of the submarine yard to delivery of critical infrastructure and the development of a skilled workforce, progress is accelerating. The transformation underway at Osborne shows Australia is on track to deliver the sovereign capability to build our nuclear-powered submarines for decades to come.

The Hon Peter Malinauskas MP, Premier of South Australia said:

> AUKUS presents a watershed moment for the South Australian economy, and the scale of the work coming our way is difficult for most people to comprehend.
>
> At least $30 billion will be invested at Osborne constructing the shipyard. That investment has already started flowing and is only set to grow.
>
> This is just the beginning. That figure only represents the task of building enabling infrastructure. There will be many billions more invested in the incredibly complex task of building nuclear-powered submarines, which will in itself provide for thousands of highly skilled, well-paid jobs for decades.
>
> This work, and the accompanying research and development, presents an opportunity to lift skills, wages and economic complexity, providing a better standard of living for all South Australians.
>
> Albanese and Malinauskas governments back submarine building in SA.

Joint media release *15 February 2026*

SHIP/BOATBUILDING & REPAIR

Incat's largest Electric Ferry "*China Zorilla*" powers up 13 December 2025 and starts harbour trials 16 January 2026.

Incat Tasmania has achieved a world first and defining moment in maritime history – on 14 December 2025, the largest battery-electric ship ever constructed was powered up and successfully completed its first e-motor trial in Hobart, Tasmania.

The powering of Hull 096 – the world's largest battery-electric ship and the largest electric vehicle of any type on the planet – marks a watershed moment as the 130-metre vessel, capable of carrying 2,100 passengers and more than

220 vehicles, activated the largest battery-electric propulsion system ever installed on a ship for the very first time.

In front of invited dignitaries including Australian Trade Minister Don Farrell, Tasmanian Premier Jeremy Rockliff, and Her Excellency Barbara Baker, Governor of Tasmania, Incat Chairman Robert Clifford powered up the waterjets and delivered an impressive demonstration of the vessel's propulsion capability.

The achievement is the first time a ship of this size, weight, and passenger-vehicle capacity has operated solely on battery power anywhere in the world. Designed and built in Hobart, the vessel represents a major leap forward in advanced manufacturing and confirms Tasmania's position at the forefront of the global transition to sustainable shipbuilding.

Powered by more than 250 tonnes of batteries, the vessel's Energy Storage System delivers over 40 megawatt-hours of installed capacity – four times larger than any previous maritime battery installation in the world.

Incat Chairman Robert Clifford said the moment is not only historic for Incat but for the global maritime industry:

> This is the first time a ship of this size, anywhere in the world, has been trialled under 100 percent battery-electric propulsion. It's a remarkable achievement by our workforce and a turning point for shipbuilding. Tasmania has been at the forefront of international aluminium shipbuilding for decades, and today's milestone shows we are now leading the world in the next era – sustainable, high-performance vessels at scale.

Mr Clifford said the vessel demonstrates what Australian innovation is capable of delivering.

> We are proving that advanced manufacturing in Australia is not only alive but setting global benchmarks. This ship will stand as a flagship for what's possible when industry, design, and clean-energy technology come together.

On 16 January it was announced that China Zorilla had commenced harbour trials under its own electric power. The harbour trials form part of an extensive testing and commissioning program that will continue in the lead-up to the vessel's delivery to South America, aboard a heavy-lift vessel. The harbour trials will see the vessel undertake a carefully managed series of movements on the Derwent, allowing crews to test propulsion, manoeuvrability, control systems, and onboard operational performance in real-world conditions. The trials represent the first time a ship of this size and passenger-vehicle capacity has operated solely on battery power anywhere in the world, marking a major step forward for large-scale electric shipping

Incat Media releases *14 Dec'25 and 16 Jan '26*

Major Safety Milestone achieved on Incat's "*China Zorilla*"

A significant safety milestone has been completed at Incat Tasmania's Hobart shipyard today, with the successful deployment of the Marine Evacuation System (MES) aboard Hull 096.

Supplied by fellow Tasmanian company Liferaft Systems Australia (LSA), the system forms a critical component of the vessel's safety infrastructure and highlights the strength of local manufacturing capability supporting globally significant shipbuilding projects.

China Zorilla undertaking Escape Slide Trials
Photo courtesy Incat Tasmania

The deployment included three 22-metre inflatable evacuation slides, each connected to a 128-person open reversible liferaft, alongside an additional linked liferaft. Once fully equipped, the world's largest battery-electric ferry will feature six MES units and 13 linked liferafts, providing a total liferaft capacity of 2,432 people.

Incat Chairman Robert Clifford said the deployment reinforced the company's focus on safety:

> Safety is fundamental to every vessel we build at Incat. The successful deployment of the Marine Evacuation System on Hull 096 demonstrates the depth of engineering, planning and collaboration required to deliver vessels of this scale." We are proud to continue our partnership with another industry leading Tasmanian company in Liferaft Systems Australia to deliver world-class safety capability, showcasing the expertise that exists right here in our state.

Liferaft Systems Australia Managing Director Mike Grainger said the milestone reflected a strong and enduring partnership between the two companies:

> Our long-standing relationship with Incat is built on a shared commitment to quality, reliability and passenger safety. Seeing these systems successfully deployed on a vessel of this size is a proud moment for our team and a testament to what Tasmanian industry can achieve together on the global stage.

Today's deployment forms part of an extensive testing and commissioning program that will continue in the lead-up to the vessel's delivery to South America

Incat Insider *11 February 2026*

Incat Tasmania signs contract for third battery-electric high speed ferry

Incat Tasmania and leading Danish operator Molslinjen have signed a contract for a third 100% battery-electric high-speed ferry, expanding the companies' partnership and advancing the world's largest electrification project at sea.

The new 129-metre vessel will join the two electric ferries already underway at Incat's Hobart shipyard. Operating across the Kattegat routes between Aarhus–Odden and Ebeltoft–Odden, the fleet will provide fast, reliable and fully emissions-free transport on one of Denmark's busiest domestic corridors.

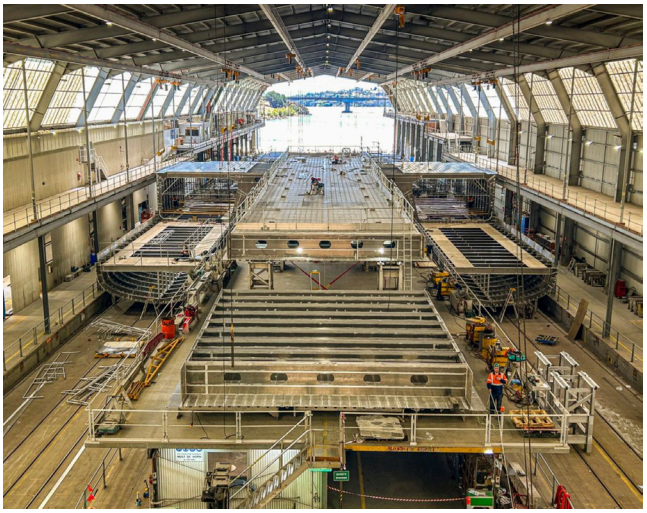
Incat Tasmania CEO Stephen Casey said the commitment to a third ship demonstrates strong confidence in the companies' collaboration and in the readiness of large-scale electric ferries for commercial service.

Mr Casey said:

> This is an important milestone for both organisations," Molslinjen is leading the way in the decarbonisation of high-speed ferry services in Europe, and we are proud to be delivering vessels that will play a central role in Denmark's clean-transport future. This additional order reflects Molslinjen's confidence in our people, our processes and our capability to build the world's most advanced electric high-speed ferries. Together, we are showing what's possible when innovation, ambition and real-world operational needs come together.

Molslinjen CEO Kristian Durhuus said the decision to build all three ferries at Incat reflects the strength of the collaboration and the company's commitment to accelerating the green transition:

> By building all three ferries at the same shipyard, we gain clear advantages and valuable learning from the first to the last vessel. And it is also important for us to have a stable and reliable partner, as we do with Incat. We and our owners are taking the lead and trying to show the way forward in the green transition using technology that, until recently, simply did not exist,



First 129m vessel for Molslinjen takes shape in the Încât building hall
(Image courtesy Încât Tasmania)

Construction of all three electric ferries is already progressing in Hobart, with delivery of the three-ship program scheduled over the coming years.

Incat Insider Issue 087

Swan River WA Moves to Electric Ferries

The WA Government has awarded a $66 million contract to Henderson-based shipbuilding company, Echo Marine Group, to design and construct five new electric ferries as part of the METRONET on Swan Ferry Expansion project.

The contract will deliver Western Australia's first electric ferry fleet, with five modern, fully accessible vessels designed to improve connections across the Swan River.

The Western Australian Planning Commission recently granted development approval for two new ferry terminals at Matilda Bay and Applecross, the first to be delivered as part of a landmark expansion of Perth's ferry network.

Each ferry will feature passenger toilet facilities, bike storage and external seating for passengers, providing a high-quality, accessible experience for commuters and recreational users. The new ferries will be designed to produce a low wake, have a carrying capacity of approximately 140 passengers and a maximum operating speed of 25 knots.

The contract award follows a Request for Tender issued earlier this year inviting vessel manufacturers to submit for a tender as part of plans for a future expanded ferry service on the Swan River.

Construction is expected to commence in coming weeks with the new ferry services expected to start in late 2027.

The project is part of the Cook Government's commitment to supporting quality local jobs, with around 130 Echo Marine employees, including apprentices, expected to work on the construction of the vessels.

Development approval was recently secured for new ferry terminals at Applecross and Matilda Bay in the largest ever expansion of Perth's ferry network. Early tender advice has been issued on the design and construction of the two ferry terminals with a formal tender to be released in early 2026.

WA Government media release *19 December 2025*

DECARBONISATION

Hydrogen Storage increase with world's largest 40,000 m³ LH2 carrier to be build by Kawasaki and JSE

Japan's drive to build a massive hydrogen storage supply chain just scored a big win. Kawasaki Heavy Industries has teamed up with Japan Suiso Energy to ink a deal for a colossal 40,000 cubic-metre liquefied hydrogen (LH2) carrier at Kawasaki's Sakaide Works in Kagawa Prefecture. Backed by the NEDO Green Innovation Fund, this ship will show off commercial-scale LH2 transport to the Ogishima terminal in Kawasaki City by the early 2030s—paving the way for next-level hydrogen infrastructure.

The new carrier stretches about 250 m long, 35 m wide and drafts 8.5 m—tailored for LH2's low density. Inside, four spherical tanks hold 40,000 m³ of liquid hydrogen. They're wrapped in super-efficient multilayer insulation to reduce boil-off. When gas does escape, it's captured, compressed

and fed into hydrogen-oil dual-fuel generators that power the ship's electric and diesel propulsion. Transfer lines are vacuum-jacketed to maintain temperature during ship-to-shore operations, cutting losses and boosting safety. ClassNK will class the ship and it will be registered under the Japanese flag.

This carrier is considerably larger than Kawasaki's 2021 Suiso Frontier (1,250 m³), marking a real jump from pilot to full-scale logistics. For hydrogen exporters like Australia, it means reliable bulk deliveries into Japan's growing network of terminals. Japan Suiso Energy, riding on its NEDO-backed project, will put the vessel through its paces at Ogishima, testing performance, safety and cost metrics. Early ocean trials in 2030–2031 will create vital data to refine pricing models, shape rules and lay the groundwork for a fleet of carriers and terminals across Asia—and beyond.

Hydrogen Fuel News *7 January 2026*

Shipping companies are reducing GHG emissions, but progress likely to remain modest

Progress towards reducing shipping greenhouse gas emissions is occurring but is likely to remain modest through to 2030, new research reveals. The research, *Climate Transition Trends: Global Shippers Chart A Complex Course*, was prepared by S&P Global Ratings analysts Bryan Popoola and Terry Ellis.

It also notes the importance of technological innovation. According to the report maritime shipping, "while highly fuel-efficient compared with other transport modes, remains a hard-to-abate sector due to its substantial energy consumption and emissions".

The authors noted the sector accounted for about 11% of global transport-related emissions and 2% to 3% of total global greenhouse gas emissions, citing the International Council on Clean Transport as a source:

"More than 99% of shipping fuel is currently fossil fuel-based, and many companies have additional ties to the fossil fuel supply chain through the shipping and storage of oil, gas, and coal," the report stated.According to the authors, "a significant scale up of low-carbon fuel production is needed to decarbonise the maritime shipping sector. The International Energy Agency projects that biofuels will account for half of all low-emission shipping fuel use in 2030," the report states. Some biofuels are compatible with conventional engines, but further technological developments are needed to enable the development and adoption of other low-carbon fuels such as hydrogen and ammonia."

The long operational lifetimes of existing vessels, typically around 25 to 30 years, is also expected to delay the sector's decarbonisation, given the need for non-fossil combustion engines to use these fuels.

"We note that orders for new ships indicate a growing shift toward alternate fuels," the authors stated, but almost all the companies assessed in the research relied heavily on vessels that used conventional, fossil-based shipping fuels.

The authors noted that the International Chamber of Shipping, energy products (coal, oil, and natural gas) accounted for about 36% of global seaborne trade in 2021, and more than 60% of oil produced globally was transported by ship.

"We view companies with significant exposure to transporting these fuels as having higher climate risk, given the inconsistency of these fuels with a low-carbon, climate resilient future," the authors stated.

David Sexton DCN *22 January, 2026*

[Ed - For those wanting to know more about the IMO strategy for Reduction of Greenhouse Gas Emissions from Ships, measures (including Energy Efficiency Design Index and Management Plans) and reporting/monitoring requirements of all Australian -flagged ships and international shipping operating in Australian waters, please consult the AMSA website at:

https://www.amsa.gov.au/marine-environment/air-pollution/greenhouse-gas-emissions-international-shipping.]

Metal cut by Austal Philippines for the future of sustainable ferries

Austal has officially commenced construction of 'Horizon X', the next-generation high-speed ferry for Gotlandsbolaget, with a plate cutting ceremony held on 5 February 2026 at our Austal Philippines shipyard in Balamban, Cebu.

Hosted by Austal Asia President Wayne Murray, the milestone was celebrated by Austal Limited CEO Paddy Gregg and Gotlandsbolaget CEO Björn Nilsson; joined by Gotlandsbolaget's Deputy CEO, Håkan Johansson and Head of New Buildings, Jonas Moberg and Austal's Executive Vice President Sales and Strategy Oliver Morton - recognising both the start of build activity and the strengthening partnership between our organisations.

Horizon X will be a 130-metre, hydrogen-ready high-speed catamaran — the largest vessel ever contracted to Austal — designed to carry up to 1,500 passengers and 400 vehicles, and capable of operating on multiple fuel types as alternative fuels and infrastructure evolve.

Mr Gregg said achieving meaningful decarbonisation in commercial shipping would require a flexible, technology-agnostic approach.

> There is no single solution that fits every operator or route. Long-term success in decarbonisation will come from flexible fuel and technology solutions that allow operators to adapt as alternative fuels mature and infrastructure develops. Horizon X has been designed with that flexibility at its core.

Built using lightweight green aluminium, Horizon X represents a major step forward in efficient, flexible and future-ready ferry design, supporting Gotlandsbolaget's long-term climate-neutral goals.

Delivery is scheduled for mid-2028, with hull fabrication commencing in the first half of 2026.

Austal LinkedIn *9 February 2026*

OFFSHORE

Chevron Gorgon Underwater Gas Project

Chevron Australia and the Gorgon Joint Venture Participants have taken a Final Investment Decision (FID) on the Gorgon Stage 3 development off the northwest coast of Western Australia. The A$3 billion backfill development will connect the offshore Geryon and Eurytion natural gas fields in the Greater Gorgon Area to Gorgon's existing subsea gas gathering infrastructure and processing facilities on Barrow Island.

Part of the original development plan for Gorgon, Gorgon Stage 3 is the first in a series of planned subsea tiebacks. The development involves the installation of three manifolds and a 35-kilometre production flowline among other associated infrastructure.

Six wells will be drilled in the two fields located about 100 kilometres northwest of Barrow Island in water depths of about 1300 metres.

"Gorgon Stage 3 is a cost-competitive development which will optimise existing infrastructure and complement the well-progressed Jansz-Io Compression Project and previously completed Gorgon Stage 2 infill development," Krishnamurthy said.

Gorgon has the capacity to produce 300 terajoules per day of gas for the WA market and 15.6 million tonnes of LNG per year.

Chevron Australia media release *5 December 2025*

INTERNATIONAL

IMO Secretary-General sets his priorities for 2026 in new year message.

The International Maritime Organization (IMO) Secretary-General Arsenio Dominguez has emphasized key items on the IMO's upcoming agenda.

In a video message, Secretary-General Dominguez said:

> As we start 2026, I would like to focus on something simple: getting things done. At IMO, this is the year of implementation; moving from plans to concrete actions and measurable progress, reflected in our world maritime theme: "From Policy to Practice – Powering Maritime Excellence.
>
> Seafarers. Nearly two million work at sea. Recognizing that training needs to keep up with the new realities of the industry, we will start a major update of the STCW Convention – including emerging technologies, new fuels and changing requirements.
>
> On decarbonization, we are moving ahead with efforts to cut greenhouse gas emissions from the sector by or around 2050. Stay tuned for further developments.
>
> When it comes to technology, all eyes will be on the finalization of the autonomous ships code.
>
> And of course, IMO will continue supporting the implementation of the High Seas Treaty as it enters into force this month, underlying our global commitment to protect the ocean and biodiversity.
>
> I wish you all a successful 2026 and do not forget to check out our new logo!

IMO media release *5 January 2026*

IMO Assembly adopts new Capacity Development Strategy

The 34th session of the Assembly of the International Maritime Organization (IMO) concluded in London with the adoption of a new strategy to strengthen Member State compliance with IMO rules, by expanding capacity-development support.

The Capacity Development Strategy was among 22 resolutions adopted by the Assembly, including decisions on the Organization's budget, financial statements, work programme and strategic plan, among others. The Assembly also elected a new Council to serve for the 2026–2027 biennium.

Concluding the meeting, which ran from 24 November to 3 December, IMO Secretary-General Mr. Arsenio Dominguez said:

> Everything placed before this Assembly has been achieved, adopted, or approved. You have turned ideas into action and transformed collective ambition into concrete outcomes. Your decisions this week have strengthened the governance and strategic direction of IMO.

Capacity Development Strategy

The IMO Capacity Development Strategy establishes a streamlined framework to support all Member States - particularly Small Island Developing States (SIDS) and Least Developed Countries (LDCs) - in implementing IMO regulations through strengthened national maritime policies and strategies that boost economic growth while protecting the marine environment and promoting sustainable shipping.

Approved earlier this year by the Technical Cooperation Committee (TC 75), the Strategy aims to:

- Improve effective implementation of IMO instruments
- Expand the suite of capacity-development offerings
- Enhance international and regional cooperation and partnerships
- Improve effective management, coordination and delivery of capacity development and technical cooperation
- Secure and mobilize sustainable funding and resourcing

Revised Strategic Plan

The Assembly also adopted the revised Strategic Plan for the six-year period 2024 to 2029, including the mission statement, vision statement, overarching principles and strategic directions and updates to the 2026-2027 work programme of IMO organs and the table of performance indicators. There are eight strategic directions:

- SD 1: Ensure implementation of IMO instruments supported by capacity development
- SD 2: Integrate new, emerging and advancing technologies in the regulatory framework

- SD 3: Respond to climate change and reduce greenhouse gas emissions from international shipping
- SD 4: Continue to engage in ocean governance
- SD 5: Enhance global facilitation, supply chain resilience and security of international trade
- SD 6: Address the human element
- SD 7: Ensure the regulatory effectiveness of international shipping
- SD 8: Ensure organizational effectiveness

The Assembly further adopted a uniform approach for the application of the Strategic Plan by all IMO organs, with the aim of strengthening planning and reporting procedures to enhance delivery and efficiency.

IMO website *4 December 2025*

International Treaty on International Waters and Seabed Protection now in Force.

The agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (the BBNJ Agreement) was adopted on 19 June 2023 and came into effect on 17 January 2026. Officially known as the Biodiversity Beyond National Juristriction (BBNJ) Agreement, the legally binding UN treaty covers the ocean zones that lie beyond national waters and declared EEZs (namely, the "high seas") and the international seabed area. These regions make up over two-thirds of the ocean's surface, representing over two thirds of the Earth's habitat by volume.

The BBNJ strengthens the current international legal framework: it builds on the UN Convention on the Law of the Sea which has set the rules for maritime and seabed exploitation and marine protection since it came into force in 1994.

According to the United Nations, the agreement addresses four main issues:

- Marine genetic resources, including the fair and equitable sharing of benefits
- Measures such as area-based management tools, including marine protected areas
- Environmental impact assessments; and
- Capacity-building and the transfer of marine technology.

The Agreement includes provisions for area-based management tools, such as marine protected areas, as well as scientifically robust environmental impact assessments. It establishes equitable benefit-sharing arrangements for the use of marine genetic resources and creates a clearinghouse mechanism to facilitate information exchange, financing, capacity building and the transfer of marine technology among parties. It thus provides a procedure for nations to set up large marine protected areas, including the seabed, in international waters to provide protection of our deep-ocean environment, including its ecosystems and resources. It also aims to promote coherence with existing global and regional frameworks for managing marine biodiversity including multilateral environmental agreements managed by UNEP

United Nations Environment Program and News 15 January 2026

Birdon Awarded U.S. Coast Guard Contract for Response Boat–Small (RB-S) Demonstrator

Birdon America, Inc. has been awarded a firm fixed price contract to build a Response Boat-Small (RB-S) Demonstrator for the United States Coast Guard (USCG). This award underscores Birdon's commitment to providing its customers with innovative, reliable solutions that ensure mission success in maritime operations.

The RB-S Demonstrator program is a critical initiative by the USCG to evaluate advanced capabilities for key missions such as Search and Rescue (SAR); Ports, Waterways, and Coastal Security (PWCS); Drug Interdiction (DI); and Migrant Interdiction (MI). Birdon's design was selected for its ability to meet stringent performance requirements.

Tony Ardito, President at Birdon, said:

> This award reflects Birdon's dedication to supporting the U.S. Coast Guard with cutting-edge solutions that enhance mission performance and crew safety. We are proud to contribute to the Coast Guard's vital role in safeguarding our nation's waterways.

Birdon will leverage its in-house rapid prototyping capabilities to build an RB-S Demonstrator. Under the contract, Birdon will deliver its Demonstrator to one of the designated USCG facilities in Norfolk, VA, or Charleston, SC, for a three-month operational evaluation period.

Birdon US media release *12 January 2026*

Birdon Announces Plans for Sixth US Location in Pensacola, Florida

On Wednesday 28 January, Birdon announced plans to develop and operate a 400,000-square-foot advanced ship manufacturing facility at the Port of Pensacola, Florida. This will be Birdon's sixth US location.

In partnership with the City of Pensacola and other regional and national stakeholders, Birdon plans to establish a facility that will incorporate the latest technology and modern shipbuilding practices, creating more than three million production man-hours per year of additional capacity for fabrication of ships and modules to support the US Maritime Industrial Base. The facility will employ approximately 2,000 personnel, including engineering, skilled trades, and other support roles.

Birdon's announcement follows initial approval by Triumph Gulf Coast, Inc. for a $76 million grant to the City of Pensacola to help build the facilities Birdon will operate at the Port. Triumph is a nonprofit corporation that oversees the expenditure of funds for economic damages resulting from the 2010 Deepwater Horizon oil spill. Funds must be used for recovery, diversification, and enhancement in Northwest Florida.

Tony Ardito, President of Birdon America, said:

> Birdon has an excellent track record as a reliable partner to U.S. Government customers. Our expansion to a sixth location at the Port of Pensacola demonstrates our commitment to helping to revitalize and rebuild America's Maritime Industrial Base.

The expansion complements Birdon's existing facilities and its ongoing US Government programs, including Waterways Commerce Cutter (WCC) construction for the US Coast Guard in Bayou La Batre, AL; and the 47' Motor Lifeboat (MLB) Service Life Extension Program (SLEP) for the Coast Guard in Bellingham, WA, and Portland, CT.

Birdon expects to open the new facility at the Port of Pensacola as soon as the third quarter of 2027.

Birdon US *30 January 2026*

USN announces contract to build FF(X) Small Surface Combatant

On 19 December the US Navy announced its plan to introduce a new class of smaller combatant ships, the FF(X), as a critical component of the Navy's fleet of the future. The FF(X) will be a smaller, more agile surface combatant designed to complement the fleet's larger, multi-mission warships and enhance operational flexibility around the globe.

John C. Phelan, Secretary of the Navy:

> To deliver at speed and scale, I've directed the acquisition of a new frigate class based on HII's Legend-Class National Security Cutter design: a proven, American-built ship that has been protecting US interests at home and abroad. President Trump and the Secretary of War have signed off on this as part of the Golden Fleet. Our goal is clear: launch the first hull in the water in 2028. To expand capacity and production across our maritime industrial base, we will acquire these ships using a lead yard, and competitive follow-on strategy for multi-yard construction. Shipyards will be measured against one outcome: delivering combat power to the Fleet as fast as possible.

The FF(X) is a highly adaptable vessel. While its primary mission will be surface warfare, its ability to carry modular payloads and command unmanned systems enables it to execute a broad spectrum of operations, making it ready for the challenges of the modern maritime environment. Small surface combatants have always been essential to the fleet, handling a wide range of missions where a large warship isn't required. The FF(X) will continue this vital role, and will take on more routine operations, enhancing the fleets operational flexibility, adaptability, and mission readiness.

Admiral Daryl Caudle, 34th Chief of Naval Operations said:

> Like the Medium Landing Ship, leveraging a complete design and production baseline approach will allow the Navy and shipbuilders to reduce costs, schedule and technical risk, We know this Frigate design works, we know it operates with the Fleet, and most importantly, we know how to build it now.

FF(X) is engineered for rapid, cost-effective production, enabling this vital capability to the fleet faster. This is made possible by basing the new frigate on HII's proven *Legend*-Class National Security Cutter. This approach leverages a mature design to deliver ships to our sailors without delay.

[*Ed: Chosen quickly to replace the cancelled Constellation class, this FF(X) is based on the USCG Legend class that are 127m LOA,16m Beam, 6.9m draft and 4700t full load with CODAG propulsion and 12000nm range. See following article]*

USN FF(X) Presentation at Surface Navy 2026 Future Fleet

During Surface Navy 2026's Future Fleet Panel hosted by Mr. Chris Miller, Executive Director at NAVSEA, and featuring Rear Admiral (RADM) Derek Trinque, the U.S Navy's Surface Warfare Director (N96), new details surrounding the U.S Navy's FF(X) program were unveiled.

As revealed in the presentation, the design is a radical departure from the design philosophy present in the Constellation-class of ships, a reminder that speed is now the primary factor driving the program. FF(X) hulls will be a derivative of the Legend-class Coast Guard cutters already in service, with both being produced by Huntington Ingalls.

The new Frigate's armament will consist of a 57mm main cannon, a 30mm auxilary cannon, a Mk-49 launcher with 21 Rolling Airframe Missiles, and a payload space at the stern of the ship capable of carrying 16 Naval Strike Missiles, 48 Hellfires, or other containerized weapons. Electronic warfare is handled by two SLQ-32 (V)6 suites, with 2 soft-kill Nulka decoy launchers present.

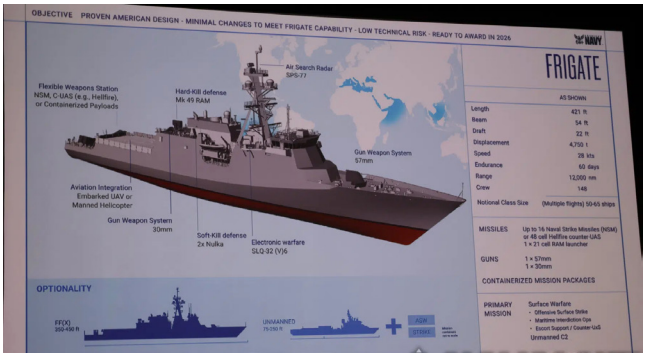
It is planned that 50-65 ships will be built with multiple flights, leaving room for some potential upgrades over the class's total production cycle. What type of upgrades may be fielded as the class progresses are unknown, but possibilities for the inclusion of armaments like VLS cells and upgraded sensors remain potential options.

Chris Miller, Executive Director, Naval Sea Systems Command said:

> The vision here is we (the U.S Navy) will have capability in a box… The idea here is that we use those capabilities on both the frigate and other unmanned platforms to be able to give option-ality and it allows us to bring down risk.

Of particular note is the emphasis on modularity regarding payloads and potential strike options, with the aft deck designed to slot in a number of intended missions depending on the type of task designated to the frigate. This was also supplemented by the emphasis placed on potential manned-unmanned teaming opportunities with USVs.

FF(X) is intended to be the low in a low-medium-high mix, joining with DDG-51 FLT III and BBG(X) to round out fleet



FF(X) presentation slide - characteristics
(Courtesy Naval News)

capabilities. FF(X) is wholly intended to target low-end threat profiles and missions such as narcotics interdiction to allow for larger surface combatants to be used elsewhere. It was very much stressed by the panel to view the FF(X) program and it's capabilities in this context, a strategy likely meant to combat views of the frigate being too close in design to it's Coast Guard Cutter cousin causing errant capability and survivability concerns.

This low-end threat profile, combined with a doubling-down on speed (first hull in the water by 2028) is the probable reason for the selection of a Coast Guard Cutter derivative. This is a stark departure from the FFG-62 program, which produced a VLS armed, larger (7,000+ ton), Aegis/AN-SPY(V)3 equipped, and more multi-role vessel with a trade-off of greater cost. This was in addition to a long string of production lags in the class, continually increasing costs with changing program requirements.

Anti-Submarine Warfare (ASW) was also strongly noted by the Admirals, with a promise to maintain ASW capabilities in the fleet even in the face of the cancellation of the Constellations. Despite this, it is still unknown what ASW functions the frigate can maintain, a question raised by the apparent absence of either a hull mounted or towed array sonar.

Ethan Gossrow, Naval News *16 January 2026*

Ukrainian Hybrid attack a world first

The reported strike on a Russian Kilo-class submarine alongside in a Black Sea naval base is best understood not as a fully submerged drone attack, but as a hybrid operation that solves the long-standing problem of underwater communication and control.

True underwater vehicles are extremely difficult to control in real time. Radio communications do not propagate through seawater, and acoustic communications are slow, low-bandwidth, and unreliable in shallow, cluttered harbour environments. These constraints make it impractical to remotely guide a fully submerged attack drone with the precision required to penetrate a defended naval base and strike a specific vessel.

The far more plausible explanation is that the attacking system operated primarily as a low-profile surface or semi-submersible drone. By travelling at or just below the surface, with a small mast or antenna exposed, the drone could maintain continuous communication with its operator via satellite or line-of-sight radio. This allows real-time navigation, target confirmation, and steering all the way into the harbour.

Only in the terminal phase of the attack would the weapon have gone fully underwater — either by diving beneath the submarine's hull or detonating a charge below the waterline.

At that point, continuous communication is no longer necessary, as guidance can be handled by simple inertial navigation, depth control, or proximity fusing over very short distances.

In effect, the attack was "underwater" in outcome rather than in transit. The control problem was solved above the surface, while the destructive effect was delivered below it. This approach combines the ease of controlling a surface drone with the lethality of an underwater explosion.

What makes the event significant is not that the technologies involved are entirely new, but that they were combined in a way that exploits a gap in traditional naval defences. Harbours and ships alongside are well protected against aircraft, missiles, and submarines, but far less so against cheap, low-signature drones approaching sub-surface and striking beneath the waterline. In that sense, the incident represents a genuine first in modern naval warfare, and a warning that even major warships can be vulnerable when stationary in port.

Professor Clive Williams MG, Australian Naval Institute
19 December 2025

SHIP OPERATIONS

Cruise ship *Celebrity Edge* berths Newcastle

306m *Celebrity Edge* enters Newcastle port
(Photo courtesy Port of Newcastle)

CRUISE ship *Celebrity Edge* made its maiden voyage to Newcastle on the weekend, with more than 4000 eager passengers on board.

According to the New South Wales Port Authority, the 306-metre vessel was the longest cruise ship to visit this season.

PANSW chief executive John McKenna said the arrival of *Celebrity Edge* meant more tourists could experience the region's offerings.

Posted by Caroline Tung, DCN *15 December, 2025*

Refloating of the grounded Australian expedition cruise ship *Coral Adventurer.*

The general manager of Port Moresby-based Pacific Towing has paid tribute to his own team as well as other stakeholders involved in the successful refloating of the grounded Australian expedition cruise ship *Coral Adventurer.*

Gerard Kasnari said PacTow—which is part of the Steamships Group and thus under the John Swire & Sons umbrella—was very pleased with the result of the salvage operation.

On a 12-day Coral Expeditions' cruise from Cairns (18 December) *Coral Adventurer* (IMO 9838644) struck a reef off the Finschaffen Coast at around 0525 local time on 27

*Coral Adventure*r refloated
(Photo courtesy DCN)

December in the waters of Morobe Province during passage between Lae and Wewak, with 120 people aboard.

Following the vessel's grounding, PacTow was engaged to lead the salvage and recovery efforts. An early salvage attempt by Lae-based *Macedon* faltered when the tug's engine overheated.

The more powerful *Langila* was subsequently deployed and the refloating took place on the afternoon of 30 December, after the 80 passengers aboard were safely evacuated to the chartered Lutheran Shipping small ro-pax *Ialibo,* which took them the 30km to Lae to board a repatriation flight to Cairns.

There were no injuries among passengers or the 43 crew, and no pollution has been reported with the hull said to be intact. As of 8 January, AIS shows *Coral Adventurer* remains at anchor near the grounding site, having been detained by AMSA while also the subject of an ATSB investigation.

Mr Kasnari said the successful outcome was made possible through the prompt and professional coordination between the crew onboard *Coral Adventurer* and supporting shore staff from Coral Expeditions, the National Maritime Safety Authority and PacTow, whose diving and salvage experts coordinated the refloat. "Our speed to respond and the teamwork demonstrated across all parties ensured a safe and efficient refloat, and at all times keeping safety, the integrity of the vessel and the protection of the marine environment at the forefront of our decision making."

Dale Crisp DCN *10 January 2026*

USN CoastGuard Icebreaker rescues Australian Cruise Ship *Scenic Eclipse II*

The U.S. Coast Guard dispatched its most powerful ship and heaviest icebreaker to help set free an Australian-owned cruise ship that was wedged in ice in Antarctica on Jan. 17. The *Polar Star*, which boasts up to 75,000 horsepower, sliced through thick sheets of ice to wrestle free the *Scenic Eclipse II* from its immovable position, the U.S. Coast Guard said in a release 23 January. The incident took place eight nautical miles from McMurdo Sound.

USCG Polar Star frees Scenic Eclipse II
Photo Courtesy US Coast Guard

The Australian-owned cruise ship *Scenic Eclipse II* contacted *Polar Star* at approximately 11 p.m., local time Friday after becoming beset in pack ice roughly eight nautical miles from McMurdo Sound. *Polar Star*'s crew conducted two close passes to break the vessel free, then escorted it approximately four nautical miles to open water.

But the day was noteworthy for another reason, too: It was the cutter's 50th birthday, having been commissioned 17 January 1976. *Polar Star* is the US's only active heavy icebreaker and has served as a cornerstone of U.S. presence in the polar regions. For five decades, the cutter has executed missions ranging from Antarctic resupply and search and rescue to environmental protection and national defense.

US Coast Guard Media Release *23 January 2026*

(Although the above article indicates Scenic Eclipse II to be an Australian ship, it does not appear on the Australian Register of Ships and may be registered in Croatia– Ed)

AMC (UTas)

Australian Maritime College (AMC) Annual Prizegiving Ceremony 2025

The 2025 AMC Prizegiving Ceremony was held on 11 December 2025 in the AMC Auditorium. The RINA Tasmanian Section Chair Martin Renilson, presented the RINA Australian Division Prize for Best Research Project by a final-year student in the Bachelor of Maritime Engineering degree to Jake Rehrmann. The title of Jake's research project is "Motion characteristics of a novel entrapment hull in head seas at low to moderate speeds".

Martin Renilson presenting the RINA Australian Division Prize for Best Final-Year Research Project to Jake Rehrmann
(Photo courtesy: AMC)

Jake Rehrmann was also the recipient of the prestigious Connell Medal as the Most Outstanding AMC Graduate at Bachelor Level across the entire College. The AMC Principal Mal Wise AM presented this award to Jake.

AMC Principal Mal Wise AM Presenting the Connel Medal 2025 to Jake Rehrmann
(Photo courtesy: AMC)

Naval architecture and ocean engineering students received the following awards:

- OMC International Innovative Honours Project Award 2025 for an Innovative Project in the JEE418/419 Research Project Unit, awarded to Jack Batley, James Curr and Terence Gawthorn
- Captain Thomas Swanson Medal 2025 for Outstanding Graduate in the Degree Programme in the Centre for Maritime Engineering and Hydrodynamics, awarded to Terence Gawthorn

Nipuna Rajapaksha, RINA Tasmania Secretary

OMC International Innovative Honours Project Award winners (from left to right) Jack Batley, James Curr and Terence Gawthorn with AMC Principal
(Photo courtesy: AMC)

Chair of the AMC Board, Teresa Lloyd, presenting the Captain Thomas Swanson Medal 2025 to Terence Gawthorn
(Photo courtesy: AMC)

Saudi Arabian Students to Commence Maritime Studies at AMC in 2026

The Australian Maritime College (AMC), University of Tasmania, is pleased to announce that 40 students from the Kingdom of Saudi Arabia (KSA) will commence their Undergraduate Maritime Engineering programs at the Centre for Maritime Engineering and Hydrodynamics (CMEH) in February 2026. This cohort has successfully completed their Foundation Year in Hobart during 2025 as part of a formal educational partnership between AMC, the University of Tasmania, and the Kingdom of Saudi Arabia. The initiative forms part of KSA's broader Vision 2030 strategy to strengthen international collaboration and develop future capability in key technical sectors, including maritime engineering.

In addition to the engineering cohort, 17 KSA students will also commence their Undergraduate program in Maritime and Logistics Management at AMC in February 2026. These students, who likewise completed their Foundation Year in Hobart, will join AMC's growing community of logistics and maritime business students, contributing to a diverse and internationally engaged learning environment.

Their transition to the Launceston campus marks the beginning of a multi-year academic and professional

Kingdom of Saudi Arabia maritime engineering students 2026
Photo courtesy Hossein (Behrooz) Enshaei

Kingdom of Saudi Arabia maritime engineering lecture
Photo courtesy Hossein (Behrooz) Enshaei

journey in Australia's leading maritime education and research institution. AMC looks forward to welcoming these students into its world-class facilities and supporting their development as the next generation of maritime professionals.

Hossein (Behrooz) Enshaei, Director CMEH, AMC (UTas)

UNSW Canberra

Since the last issue in November 2025, our class of 2025 has graduated, and they are each moving on in their careers where:

- Sasha Apelt, is working at UNSW Canberra on an "IGNITE" project led by Sean McCracken;
- SBLTs Archer Gumley, Aaron Kearns and Rian Klinger have posted to HMAS Cerberus before joining a ship in the marine engineering officer ranks (MEO); and
- SBLT Kelvin Hepburn is in further training as a maritime warfare officer (MWO).

In celebrating academic achievement beyond the award of degrees in 2025:

- The RINA Australian Division Prize for the best thesis in naval architecture was awarded to SBLT Kelvin Hepburn for his thesis "Evaluating a Representative High-Performance Very Slender Vessel Against a Planing V-Bottom Hull Form Control".
- The David Carment Memorial Prize for the best overall performance in the final year of the Bachelor of Engineering degree in Naval Architecture was presented to SBLT Rian Klinger.

Three Graduating Students with their Degrees
L-R, SBLTs Aaron Kearns, Archer Gumley, Kelvin Hepburn
(Photo courtesy Warren Smith)

- The Inaugural "Phil Helmore Prize" for the best performance in third year of the BE(Hon) degree in Naval Architecture was awarded to MIDN Luke Michael Reidy.

Looking positively forward, the 2026 academic year began on 23 February. It is always exciting when a new year starts with new projects and opportunities. We remain small in numbers but the enthusiasm of our students to learn is infectious and stimulating. We also have a couple of announcements to make.

Firstly, I would like to announce that with the support of Navy, and in particular our sponsor HNE, RADM Rachel Durbin, our program will continue under a new significant agreement between the Commonwealth and the University. This now allows us to look for new academic staff to take our enterprise forward with confidence while implementing a succession plan. If you or someone you know might be interested, please do not hesitate in contacting me. We are looking for candidates, keen to contribute with expertise and experience in ship hydrodynamics, ship structures and/or warship and submarine design and a motivation to grow within a strategically significant discipline.

Secondly, while referenced earlier, Sean McCracken, the Marine Engineer on our team, has led a successful application under Australia's Economic Accelerator (AEA) Ignite program IG250200388, "Low-Cost Rapid Prototypes Driving Fast Boat Hull Innovation" (Defence capability Advanced Manufacturing $483,661).

This project along with dozens of others across the country under this scheme, should strengthen industry partnerships, accelerate commercial outcomes, and help build the sovereign capabilities Australia needs for the decades ahead. It is the first major grant received into the naval architecture discipline at UNSW Canberra and will be a mechanism for building industry connection.

In closing this relatively brief report, I again invite all stakeholders to engage with us as we attempt to make a difference in meeting national objectives in things maritime. There is much to be done.

Associate Professor Warren Smith
Naval Architecture Program Coordinator

Spirit of Mulgumpin Enters Service Setting a New Standard for Tour Vessels in Australia

Spirit of Mulgumpin, a highly customised 22-metre tour vessel Incat Crowther has designed for The Tour Collective's See Moreton business has entered service supporting See Moreton's award-winning operations in the Moreton Bay Marine Park in Queensland, Australia. Named in honour of the local Indigenous name for Moreton Island – 'Mulgumpin' – *Spirit of Mulgumpin* has been designed to support the unique schedule and operational requirements of See Moreton while providing a world class tourism experience for customers.

Spirit of Mulgumpin
(Photo courtesy Incat Crowther)

The new vessel incorporates Incat Crowther's proven stern swimming platform design which offers an unparalleled passenger experience for vessel-based snorkelling and recreation. The low-draft vessel is also fitted with a bespoke bow gangway to allow for beach landings. The main deck features comfortable seating for 105 passengers, a large central bar, two large refreshment refrigeration units, three bathrooms and large windows to ensure every passenger can enjoy the iconic views while on board. The mid deck features lounge-based seating for 28 passengers with the layout tailored to ensure passengers can enjoy the views whether standing or seated. The mid deck also boasts a second bar, two additional bathrooms, outdoor front-of-vessel seating for 40 passengers, the wheelhouse and a multifunctional platform that can act as a lifeguard station during snorkelling tours, as well as a DJ booth on dinner cruises. The open-air roof deck, which can be accessed via dual stairways, offers spacious and secure outdoor seating for 32 passengers in addition to standing room.

Anthony Ardern, General Manager of The Tour Collective, said:

> We couldn't be happier with *Spirit of Mulgumpin* and believe the vessel sets a new standard for on-water tourism in Australia. Incat Crowther's design process meant their team of naval architects worked closely with our See Moreton team to design a vessel that is uniquely tailored to our service offering and the conditions we experience in the Moreton Bay Marine Park. *Spirit of Mulgumpin* is also operationally flexible and provides our guests with a safe, reliable, comfortable and memorable tourism experience.

Incat Crowther's Technical Manager Dan Mace said:

> The Tour Collective have delivered on their vision to provide a world-class tourism experience offering open spaces and modern features throughout.

The Tour Collective chose to work with Incat Crowther on the design of *Spirit of Mulgumpin* following the success of *Spirit of Migaloo II,* an Incat Crowther designed catamaran that has been in operation for The Tour Collective's Seaworld Cruises brand since 2019.

Specifications – Incat Crowther 22

Length Measured	72' 2" / 21.99m
Length Waterline	72' 2" / 21.99m
Beam Overall	29' 6" / 9.0m
Draft (hull)	3' 11" / 1.2m
Depth	9' 3" / 2.75m
Construction	Marine grade aluminium
Fuel Oil	1 849 gallons / 7 000 litres
Fresh Water	792 gallons / 3 000 litres
Black water	528 gallons / 2 000 litres
Passengers	190
Crew	5
Speed (Service)	25 knots
Speed (Max)	28 knots
Main Engines	2 x MAN D2862 LE425
Power	2 x 749kW @ 2100rpm
Propulsion	2 x Propellers
Generators	2 x Zenith Isuzu
Flag	Australia
Class / Survey	NSCV 1C

Australia's Engage Marine places multi-role harbour tug into service

Western Australia-based towage operator Engage Marine recently welcomed a new azimuthing stern drive (ASD) harbour tug to its fleet. *Engage Maverick* will be operated primarily in Sydney Harbour, where she will be available for escort, ship assist, and emergency response duties in port as well as offshore waters.

The new tug, built by Damen Song Cam shipyard in Vietnam, has a steel hull, an LOA of 27.59 metres (90.52 feet), a beam of 12.93 metres (42.42 feet), a draught of 3.8 metres (12 feet), a depth of 5.15 metres (16.9 feet), a gross tonnage of 388, and accommodation for 10 crew members. Two Caterpillar 3512C TA HD/D IMO Tier III main diesel engines that each produce 1,902 kW (2,550 hp) drive Kongsberg Maritime US 255 fixed-pitch propellers to deliver a speed of 12.8 knots and bollard pulls of 81 tonnes and 74.5 tonnes ahead and astern, respectively. Because of the ASD configuration, the tug is highly manoeuvrable, making her suitable for operation in busy port waters.

Engage Maverick demonstrating her fire fighting capability
(Photo courtesy Engage Marine)

The electronics include a radar, an echosounder and a speedlog from Furuno, a MaxSea plotter, a Simrad autopilot, two Sailor VHF radios, Cassens and Plath and JRC compasses, a Gill Instruments anemometer, and an EPIRB and a SART from Jotron. These and the onboard systems draw power from two Caterpillar C4.4 TA 86kW diesel generator sets.

The wheelhouse has all-round visibility as well as upward-facing windows to aid the helm operator while assisting larger vessels.

The deck machinery includes a hydraulically driven, two-speed double drum forward winch and two anchors. The fendering consists of D type fenders at the sides, cylindrical fenders at the transom corners, as well as cylindrical and W type block fenders at the bow to provide all-round protection from impact damage during ship handling operations. The tug is also fitted with two Fire Fighting Systems monitors, each capable of discharging up to 1,200 cubic metres (260,000 gallons) per hour.

Azcue supplied the tug's two general service pumps, the oily-bilge water stripping pump, the clean lubrication oil pump and the fuel transfer pump while C.C. Jensen provided two fuel oil purifiers. Box and keel coolers are also installed.

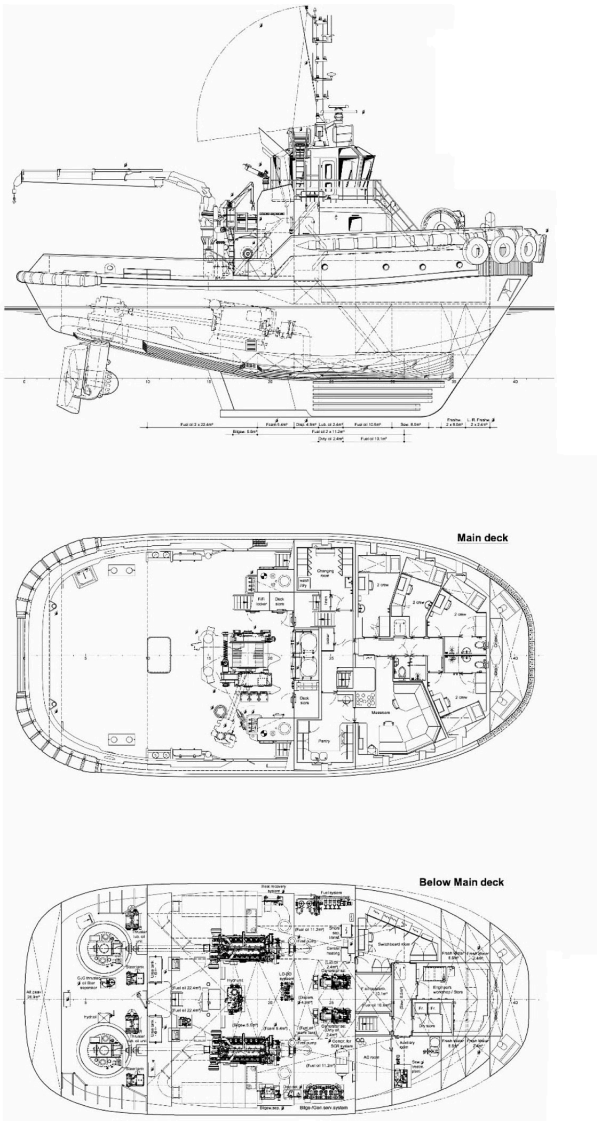
The accommodation spaces are laid out in compliance with MLC 2006 standards and are fully insulated and air-conditioned. There are single cabins for the captain and the chief engineer and four double cabins for the remainder of the crew. The other facilities include a galley, a mess/dayroom, a dry stores area, a ship's office, and sanitary facilities.

Engage Maverick was built in compliance with Bureau Veritas class requirements including the escort tug, unrestricted navigation, COMF-NOISE 3, and COMF-VIB 3 notations.

Baird Maritime *5 January 2026*

Bagwan commissions latest 38m vessel

Bhagwan Marine have proudly christened their newest vessel, the *Bhagwan Micah* at their Brisbane operation. This latest addition to their fleet marks another milestone in the Company's strategic growth as Australia's leading provider



Layout drawings
(Photo courtesy Engage Marine)

of integrated marine solutions across Offshore Energy, Subsea, Ports & Inshore logistics and Defence sectors.

With a fleet now of over 100 vessels, Bhagwan Marine continues to position itself as the partner of choice for operators who demand proven reliability, technical excellence and low-risk project execution in complex marine environments.

The *Bhagwan Micah* (formerly 'the Phoenix') is a 38m state-of-the-art Stern Landing Vessel (SLV), designed from the ground up for the exacting requirements of modern offshore energy and subsea operations – particularly oil & gas decommissioning with the ability to work in shallow water environments, subsea IMR and defence logistics projects.

Unlike a traditional landing craft that loads and discharges over a forward ramp, a SLV operates from the stern. This design provides:

- Safer, more efficient sea going capabilities and cargo deliveries
- Improved manoeuvrability in shallow, remote or constrained areas
- Greater efficiency and turnaround times
- Low carbon intensity

The vessel is secured under a five-year bareboat charter from BM Fleet, providing Bhagwan Marine with long-term control of a scarce, high-spec asset while maintaining capital flexibility for further fleet renewal. We look forward to Bhagwan Micah joining our operations and supporting the safe, reliable and efficient marine services our clients depend on.

The vessel proudly carries the name *Bhagwan Micah* in honour of the late Micah Kirk, a much-loved and former member of our Melbourne team. In maritime tradition, naming a vessel in honour of an individual carries enduring significance – it is said the name accompanies the vessel on every voyage and watches over those who sail aboard her. Through this tradition, Micah's name, contribution and legacy will continue with the *Bhagwan Micah* throughout her service life. The *Bhagwan Micah* is not just another vessel – it is a strategic asset that reinforces Bhagwan Marine's leadership in complex, high-consequence marine operations where safety, technical performance and environmental responsibility cannot be compromised.

Bhagwan Micah
(Photo courtesy Bhagwan Marine)

Vessel overview:

Classification:	DCV 2B, Offshore Support Vessel; Supply; SLV
IMO No:	864231
Trading Area:	2B
Total Berths:	19 (3 x single berth, 8 x double berths)
Length Overall:	38.62m
Breadth Moulded:	12.80m
Draft (Design):	1.90m
GRT/NRT:	456.5GT / 137NT
Main Engines:	4 x Cummins QSM11 @ 300 kW
Performance Speed:	10 knots

***Ibis III* – Versatile amphibious boat for Western Australia-based rescue organisation**

A new rigid inflatable boat (RIB) was recently delivered to the Broome rescue station of Volunteer Marine Rescue Western Australia. Custom-built by Western Australia-based Westerberg Marine, the 9.5-metre (31-foot) Ibis III boasts amphibious capability, allowing her to operate on water and on land. Her area of operations is Broome on the southwest side of the Kimberley region of Western Australia, approximately 2,400 kilometres (1,500 miles) north of Perth. Westerberg told Baird Maritime:

> The vessel takes our existing 8.5-metre (28-foot) RIB and integrates the amphibious capability that suits the needs of the operators in the challenging Kimberley Environment. The hull performs just as well off the water as it does on it.

Ibis III demonstrating her amphibious capability
(Photo courtesy Westerberg Marine)

The builder said Broome Sea Rescue's operational area extends from 80 Mile Beach in the South to Cape Leveque in the North. The coverage area is between Cape Leveque to the North and 80 Mile Beach to the South of Broome. The volunteer sea rescue group is responsible for assisting people and vessels in distress covering an area of over 300 kilometres (190 miles) of coastline.

Because massive tidal fluctuations in the area of service present significant problems launching vessels at times of low water, an amphibious capability was deemed essential in the vessel's design. Westerberg said:

> With the tidal movement in Broome reaching as high as 10 metres (30 feet), the local marine rescue group must be able to get on the water in any tide. The amphibious system from Anura has allowed Ibis III to do this. The brief also includes simplicity of operation and maintenance. This led to opting for electric over hydraulic (EOH) power over the traditional internal combustion system. This quiet and simple to operate system has exceeded the operators' expectations on usability.

The Anura S45 EOH amphibious system delivers high traction, excellent ground clearance, and robust load capacity for rapid deployment in challenging coastal conditions.

Power is provided by two Mercury Seapro Verado 300hp (200kW) outboards when the boat is on the water. On land, the hydraulic drive system for the boat's three wheels relies on a 48V lithium battery bank.

Baird Maritime *26 January 2026*

Construction underway on fleet of 42m DP2 fast crew boats for Caspian Sea operator

Global digital shipbuilder Incat Crowther has been commissioned by Baku Shipyard to design three new bespoke crew boats for an offshore energy services operator in Azerbaijan. The new 42-metre DP2 fast crew boats will

support offshore energy support operations in the Caspian Sea, with construction now under way at Baku Shipyard.

Capable of speeds of up to 22 knots, the new vessels are designed specifically for fast deployment across multiple offshore sites in the Caspian Sea. Each vessel is tailored to pre-existing offshore infrastructure to allow for the efficient and safe transfer of crew.

Incat Crowther designed the propulsion system specifically for robustness, high-displacement capability and low fuel burn by utilising a drivetrain of four newly developed MAN D3872 workboat engines paired with Hamilton HT810 waterjets. The vessels are designed to accommodate a Walk2Work gangway which allows the fleet to dock and begin transferring crew to offshore energy infrastructure in less than one minute.

The next-generation fleet features a range of design improvements the current fleet of crew boats including quad propulsion engines, dynamic positioning control and a revised hull form to allow for

easier access to docking infrastructure. Capable of transporting up to 50 service personnel in safety and comfort, the multi-functional vessels also boast a large 120m2 aft deck that can transport up to 20 tonnes of deck cargo. The vessels' air- conditioned passenger cabin includes a large luggage area, two bathrooms and a medical room. Eight crew are accommodated in comfort on the lower deck, which also features a crew mess and galley. The vessels' large wheelhouse provides the captain a 360-degree operational view, while a rescue boat is also housed on the vessels' upper deck.

Incat Crowther Technical Manager, Dan Mace said: "Our team of naval architects worked closely with the customer on the design of this new fleet of vessels to ensure it builds on the capability and performance of crew boats already in operation. As part of this process, our team listened to the requirements while drawing upon our extensive experience of designing vessels for the Caspian Sea region to ensure these new vessels are tailored to local conditions and infrastructure.

Sea trials for the first vessel in the new fleet are expected in 2026.

Vessel overview:

Length Overall	188' 11" / 42.7m
Length Waterline	176' 10" / 39.0m
Beam	41' 0" / 8.0m
Draft (prop)	7' 2" / 1.8m
Depth	15' 11" / 3.675m
Construction (Hull)	Steel
Construction (Superstructure)	Steel
Fuel Oil	26 417 gallons / 60 500 litres
Fresh Water	7 925 gallons / 6 000 litres
Sewage	1 585 gallons / 5 500 litres
Lube Oil	2 641 gallons / 2 000 litres
Waste Oil	2 641 gallons / 2 000 litres
Crew	8

Încât Crowther 42m Crew Boat
(Photo Courtesy Încât Crowther)

Passengers	50
Aft Deck Area	120m2
Deck Cargo	20 T
Speed (Cruise)	20 knots
Speed (Max)	22 knots
Main Engines	4 X MAN D3872-LE432
Power	4 x 1213kW (1627hp)
Propulsion	4 x Hamilton HT810 Waterjets
Bow thruster	2 x 118kW
Generators	2 x 90kW
Flag	Azerbaijan
Class / Survey	ABS ✠A1, HSC Crewboat, Restricted Service, OE, ✠AMS, ✠DPS-2

Incat Crowther Media Release *4 December 2025*

Hydromover 2.0 enters service in Singapore as Yinson Greentech expands electric vessel fleet into UAE

Hydromover 2.0, an ultra-efficient all-electric light cargo transfer vessel designed by Incat Crowther for Singapore's marinEV, a business of Yinson GreenTech, has officially entered service in Singapore. Building on the success of the prototype Hydromover 1.0, Singapore's first fully electric cargo vessel launched in 2023, the next-generation Hydromover 2.0 is now transporting light cargo to vessels anchored in the Singapore Strait waiting to dock at the Port of Singapore. The launch of Hydromover 2.0 marks a major step forward in Singapore's efforts to decarbonise its harbour craft fleet. The 24-metre Hydromover 2.0 features an ultra-efficient hull form that maximises range and energy efficiency while ensuring smooth navigation in challenging sea conditions. The vessel can carry a 30-tonne payload across its 70m² cargo deck and is powered by a lithium-ion battery. Hydromover 2.0 also integrates advanced digitalisation features, including real-time analytics, route optimisation, collision detection and automated vessel management systems that helps to ensure efficient and safe operations.

Fully charged in under two hours, Hydromover 2.0 delivers high uptime and reliability for daily operations, providing 50 per cent more cargo capacity and a 75 per cent larger deck

Incat Crowther Hydromover 2.0
(Photo Courtesy Incat Crowther)

space than the prototype vessel. This supports greater cargo consolidation, efficiency and flexibility in port operations. Hydromover 2.0 also boasts an increased energy storage capacity and a redesigned electrical architecture to reduce power loss. These improvements translate into a threefold increase in the vessel's operational range.

Unveiling the vessel, Yinson GreenTech also announced a bareboat charter agreement with Yacht International UAE with delivery of Hydromover 2.0 vessels to the United Arab Emirates (UAE) expected to occur by mid-2026. A memorandum of understanding (MoU) has also been signed between YinsonGreenTech, Yacht International UAE, and Wilhelmsen Port Services to advance the deployment of electric vessels throughout UAE ports.

Jan-Viggo Johansen, Managing Director of marinEV, said:

> The all-new Hydromover 2.0 sets unprecedented standards for the modern maritime industry. At the same time, the signing of new agreements in the UAE marks a pivotal step forward for marinEV and Yinson GreenTech. Together, these milestones demonstrate our ability to move beyond innovation and into real-world deployment - taking proven electric vessel technology, connected IoT systems, and integrated digital platforms from Singapore to new markets. They reinforce our commitment to transforming port operations through the combined power of electrification and digitalisation, and to shaping a smarter, cleaner, and more connected maritime future.

Sam Mackay, Technical Manager at Incat Crowther, said:

> Seeing the Hydromover 2.0 enter service is a clear demonstration of how smart design and collaboration can accelerate the global transition to low and zero-emission shipping. The commissioning of new vessels for operation in the UAE underlines the proven performance and scalability of the Hydromover platform.

Incat Crowther Media Release *20 January 2026*

Bespoke luxury catamaran allows Kauai Sea Tours to expand Services in iconic Hawaiian tourism hotspot

Lady Kailani, a new 20-metre (65 foot) luxury catamaran designed by global digital shipbuilder Incat Crowther for Kauai Sea Tours in Hawaii, is now in service offering tours along Kauai's iconic Nā Pali Coast. The successful delivery of *Lady Kailani* by south Louisiana shipyard Breaux Brothers Enterprises has allowed the award-winning tourism operator to expand to year-round tourism experiences in Kauai, Hawaii.

The multifunctional and highly capable vessel has been designed to provide a luxurious and immersive tourism experience. *Lady Kailani* boasts a custom hydraulic swim platform providing effortless snorkelling and ocean access. Two water slides and two freshwater showers are also located on either side of the vessel's swim platform.

Combining cutting edge design with guest-focused amenities, the vessel is designed to carry a maximum of 149 guests across three spacious decks, each offering 360° ocean views. Seating options include protected outdoor seating areas on the vessel's main and upper decks, an upper deck VIP dining area, and a shaded helm lounge allowing guests to ride alongside *Lady Kailani'*s captain. The vessel's expansive bow also offers a safe, open-air viewing area for guests. The customer experience is enhanced further via the inclusion of a large interior galley providing an elevated on-board dining experience. The vessel also features a walk-up bar and two accessible bathrooms on the vessel's main deck, as well as a state-of-the-art sound system for narration and music.

Darren Paskal, Co-Owner of Kauai Sea Tours recently said:

> *Lady Kailani* is the first luxury catamaran of its kind on Kauai. Our tours are often described as 'lifechanging.' The Nā Pali Coast is truly magical to behold, with towering sea cliffs, waterfalls, hidden valleys, and abundant wildlife – all made even more special by the deep local knowledge and fun personalities of our captains and crew. Lady Kailani gives us an incredible new way to help our guests create treasured memories, whether it's a romantic escape, a family adventure or milestone celebration.

Grant Pecoraro, Incat Crowther's Managing Director for North America said:

> *Lady Kailani* has been designed to not only provide a world-class tourism experience, but to be a robust, safe and operationally capable vessel. Our US-based team of naval architects worked closely with Breaux Brothers and Kauai Sea Tours throughout the design process to turn the operator's vision into a reality. The result is a truly unique vessel that is tailored specifically to Kauai Sea Tours' operations and enables them to expand their award-winning services further.

Powered by dual X15 Cummins engines, *Lady Kailani* has the ability to reach speeds of up to 24 knots.

Vessel overview:

Length Overall	65' 0" / 19.80m
Length Waterline	65' 0" / 19.80m
Beam Overall	27' 0" / 8.23m
Draft	3' 6" / 1.10m
Depth	9' 2" / 2.80m
Construction	Marine grade aluminium

Lady Kailani off Kauai Island
(Photo Courtesy Încât Crowther)

Fuel Oil	740 gallons / 2 800 litres
Fresh Water	185 gallons / 700 litres
Sullage	185 gallons / 700 litres
Passengers	149
Crew	4
Speed (Service)	22 knots
Speed (Max)	24 knots
Main engines	2 x Cummins X15
Installed power	2 x 469 kW @ 2,100rpm
Propulsion	2 x Propellers
Flag	United States of America
Class	Survey Subchapter T

Incat Crowther Media release *28 January 2026*

Auckland's first plug-in hybrid electric fast ferry performs exceptionally on sea trials and set to enter service

In a major milestone for Auckland's public transport network, the city's first plug-in hybrid electric fast ferry has performed exceptionally on sea trials and will soon enter service on the busy Auckland to Devonport commuter route. The vessel achieved a top speed of 36 knots on all-electric mode, with the performance of the electric propulsion and onboard systems consistently meeting and surpassing expectations.

Designed by digital shipbuilder Incat Crowther, built by Q-West Boat Builders with systems integration by Hamilton Jet, the operationally flexible 32-metre vessel is the first in a fleet of two new electric hybrid fast ferries that will be operated by Fullers360 for Auckland Transport.

Capable of transporting up to 299 passengers and 20 bicycles at speeds of up to 28 knots, the new vessel has been designed for safe, comfortable, and highly reliable commercial rapid transit ferry services. The passenger experience has been enhanced via the inclusion of a range of seating options – including tables and USB ports for those that need to work on their commute, fold-up luggage compartments and floor-to-ceiling windows.

The vessel's drivetrain includes four Danfoss EM-PMI540-T4000 electric motors, Hamilton HTX42 water jets, and state-of-the-art hybrid electric systems. Incat Crowther has utilised cutting-edge digital shipbuilding technology in designing the support systems for the electric propulsion system. This includes liquid cooling systems featuring pumps and heat exchangers for e-motors, converters, inverters and switchboards, and chillers for batteries. The design also features electrical equipment and cable route arrangement to minimise electromagnetic interference, the selection and integration of fire suppression systems, and battery room ventilation systems. Weight control for such expansive systems has been critical, with each item weighed and tracked throughout construction.

The vessel's drivetrain features the ability to employ a pair of range-extending generators that can be used in conjunction with the battery bank. This technology supports electrification and the reduction of emissions whilst delivering on timetable and range requirements. The new vessels are also future- proofed and can be refitted to operate on hydrogen fuel for increased range in the future. The new vessel will contribute to Auckland Transport's mission to modernise and decarbonise the city's ferry fleet. The vessel is expected to reduce carbon emissions by 750,000kg per year.

Liam Dowling, Head of Innovations and Asset Development at Fullers360 who have acted as client representative and project managers on the build said:

> Incat Crowther has been great to work with throughout this project, from the inception phase through to rollout. The flexibility, adaptability and spirit of partnership that's gone through this project has been key to making Auckland's first plug-in electric-hybrid ferry a reality.

Incat Crowther's Technical Manager Dan Mace said:

> This new vessel will offer Aucklanders a world-class, low-emission travel experience. Incat Crowther's expertise in conceptualising the vessel design to ensure it is tailored for Auckland Transport's operational requirements, combined with the application of the latest digital shipbuilding technology, was critical to the successful delivery of this project. This tailored design approach also ensured the vessel's electric drive system was accurately and reliably integrated from the outset. Embedding digital shipbuilding processes throughout the project will also provide a range of benefits to Auckland Transport and Fullers360 over the long term – including lower maintenance costs and improved operational outcomes through streamlined training for staff.

Specifications:

Length Overall	113' 7" / 34.6m
Length Waterline	105' 8" / 32.2m
Beam Overall	31' 3" / 9.5m
Draft (hull)	5' 1" / 1.5m
Depth	10' 5" / 3.15m
Construction	Marine grade aluminium
Batteries	2204 kWh
Fuel Oil	358 gallons / 5 140 litres
Fresh Water	264 gallons / 1 000 litres
Sullage	264 gallons / 1 000 litres

Passengers	299
Crew	3
Speed (Service)	28 knots
Speed (Max)	36 knots
Propulsion motors	4 x Danfoss EM-PMI540-T4000
Propulsion	4 x Hamilton HTX42 water jets
Generators	2 x Danfoss EM-PMI540-T3000
Flag:	New Zealand

Incat Crowther Media Release *5 February 2026*

Switch Marine and Incat Crowther Hydrogen fuel cell-electric fast ferry for New York and Beyond

Global digital shipbuilder Incat Crowther has begun detailed development and naval architecture on ahydrogen fuel cell-electric fast ferry design, with initial deployment targeted for New York waters. Incat Crowther is working on the design and regulatory approval process for the new 28-metre vessel in partnership with zero-emission vessel developer SWITCH Maritime (SWITCH). The project includes a global team with expertise spanning ferry operations, electric propulsion, and hydrogen system safety. From their office in New York City, SWITCH is actively advancing project development activities beyond vessel design. The project team is planning to deploy a ZEF-150 demonstration based at the Brooklyn Navy Yard.

The new vessel is designed to align with local operational requirements and pre-existing infrastructure. The vessel's world-leading hydrogen fuel cell-electric propulsion and hydrogen storage systems ensure the new ferry can maintain an operational profile similar to that of a diesel vessel. This means parallel service speeds, a daily bunkering schedule, no need to increase dwell time or alter service to account for vessel charging, and no investment in costly shoreside charging infrastructure and power grid upgrades. The drop-in nature of the technology ensures the new hydrogen fuel cell-electric ferry will seamlessly integrate into current operations, rather than requiring schedule changes or a system-wide reorientation.

In this project, vessel modernisation and emission reduction will be achieved through the deployment of hydrogen fuel over other low and zero emission technologies proving there is no one-size-fits-all approach to achieving these outcomes. The use of hydrogen fuel in this case offers considerable flexibility and presents a zero emission transport solution for fleets with longer range requirements and those operating in areas where shoreside charging for battery-electric propulsion may not be technically or economically feasible.

The new 28-metre hydrogen fuel cell-electric ferry will be capable of transporting 150 passengers at a cruising speed of 25 knots. The operationally flexible vessel will have 720 kilograms of stored, compressed hydrogen capacity giving it the ability to operate on a range of routes across New York ferry networks with a full day of operational range. Although the New York market will be its first deployment, the vessel is well equipped to perform on longer, high-frequency commuter routes in both the United States and around the world.

In addition to operational flexibility, the new vessel's design will also prioritise the passenger experience. The vessel's spacious main deck will feature comfortable seating for 150 passengers, ample luggage storage, a kiosk, three bathrooms including a wheelchair accessible bathroom, and large windows to allow passengers to enjoy the iconic views on New York's waterways.

Incat Crowther Hydrogen Fuel Cell -Electric Ferry
(Photo Courtesy Încât Crowther)

The development of New York's first hydrogen fuel cell electric ferry, which is supported by a $US2 million grant from the New York State Energy Research and Development Authority (NYSERDA), builds on the successful partnership between Incat Crowther and SWITCH. The two companies have recently partnered on the design, delivery and regulatory approval for Sea Change – the world's first zero-emissions hydrogen fuel cell-powered electric-drive high speed passenger ferry. Sea Change, developed and managed by SWITCH, now operates in the California Bay Area.

SWITCH Maritime's Co-founder and CEO Elias Van Sickle said:

> SWITCH aims to provide operators with commercially viable vessels that future-proof ferry fleets. Our objective is to meet existing performance standards with drop-in solutions that don't require overhauling systems or schedules. And if it can be done in New York, it can be done anywhere.

Incat Crowther's Technical Manager Dan Mace said:

> The design of this vessel showcases a feasible solution for mass transit operators looking to begin the fleet decarbonisation process, while maintaining existing operational profiles. The vessel's ability to drop in to existing New York fleets is a real positive step to reduce emissions, and ensures the vessel can be deployed quickly without the need for constructing additional shoreside infrastructure.

NYSERDA's support, through its Innovation and Research Advanced Fuels and Thermal Energy Research program, builds ecosystems for clean hydrogen and other low-carbon alternative fuels. NYSERDA President and CEO Doreen M. Harris said:

> NYSERDA's partnership with SWITCH Maritime and Incat Crowther on the first hydrogen fuel cell-electric ferry is a catalyst for the future of zero-emission transportation in New York State. This demonstration is an impressive showcase for clean

hydrogen asan emerging and innovative technology that is on the cusp of transforming how people move from place to place.

Specifications – Încât Crowther 28

Length Measured	93’ 6” / 28.5m
Length Waterline	93’ 6” / 28.5m
Beam Overall	29’ 6” / 9.0m
Draft (hull)	3’ 10” / 1.18m
Draft (propellor)	6’ 8” / 2.03m
Depth	9’ 6” / 2.9m
Construction	Marine grade aluminium
Compressed Hydrogen	4 x CH2 Tanks, Total 720kg
Fresh Water	528 gallons / 1 000 litres
Sullage	528 gallons / 1 000 litres
Passengers	150
Crew	6
Speed (Service)	25 knots
Speed (Max)	27.5 knots
Propulsion e-motors	4 x 588 kW
Fuel cells	6 x 225 kW
Batteries	1576 kWh
Propulsion	4 x Propeller
Flag	USA
Class / Survey	USCG Subchapter T

Incat Crowther Media Release *19 February 2026*

MEMBERSHIP NEWS

Australian Division Council

The Council of the Australian Division of RINA met on the afternoon of Monday 15th December 2025 by zoom-conference under the chairmanship of our President, Prof Jonathan Binns in Melbourne with links to Gold Coast, Sydney, Canberra, Melbourne, Hobart, Adelaide and Perth.

Among the items discussed were:

Warship 2026 Conference

Council noted that the Warship conference would be held on 30 September and 1 October2026 at Optus Stadium in Perth with the theme “Delivering Added Mass with Affordable Minor Warships”.

The Australian Naval Architect

Council was advised that the proposed change to a digital magazine had not progressed pending responses from RINA HQ. Members expressed concern that the magazine had been made accessible to members only without reference to the Division. Further considered the future of our magazine following the devastating loss of its editorial team at the start of the year. The current ANA editorial group had met in a workshop during August and reached the conclusion that the *ANA* was not sustainable and that it would need to be turned into a digital publication if it is to continue. It needed to be made more responsive to the needs and opinions of members. Council agreed in-principle with the proposal of a three-tier structure which would provide for not only the timely dissemination of news but also improve provisions for feedback and comment. The transition to and implementation of such an arrangement would be subject to negotiation with RINA HQ as host for the digital magazine.

AMSA Domestic Commercial Vessel Issues

Council noted the correspondence with AMSA on the issue of safety risks arising from false declarations of unchanged lightship particulars.

Succession Planning

While no progress had been made on the urgent recruitment of a new Secretary and Treasurer, Council agreed that prospective candidates should note that the duties of these positions were set in the Divisions bylaws and any extra duties would be divided among members.

Joint Board for Naval Architecture

Council agreed that, for continuity purposes, our Vice President Sammar Abbas should attend the next meeting of the Joint Board (in February or March) as an observer and thereafter become a RINA representative in place of either Jim Black or Rob Gehling.

Bob Campbell Prize

As part of a brief report on the highly successful Indo-Pacific2025 International Maritime Conference, Council was informed that the Prize for the best paper and presentation at the conference had been awarded to Dr Michael Candon of RMIT University for “Unsteady Hydrodynamic and Hydroelastic Reduced Order Models for Propellers”.

Registration of Engineers

Noting that Engineers Australia had an ongoing campaign for a national registration system for professional engineers, Council agreed that the views of Section should be sought on the matter bearing in mind that registration of naval architects was currently only in place in Queensland and arguably in Victoria and the ACT.

Council Members Nominated by Sections

Sections had been invited to make their nominations of Council members for coming two-year term commencing following the 2026 Division AGM. The terms of current elected Council members would expire in 2027.

The draft minutes of the meeting have been circulated to Council members and are available to other members by request. Next meeting was tentatively scheduled for Tuesday 17th March 2026 to be followed by the Division AGM one week later.

Rob Gehling AO

Secretary

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P: 0403 221 631

Mentoring

Senior naval architects can contribute to the development of Graduate naval architects by becoming their mentors. New graduates are often seeking professional guidance both in the technical area and on their career development path. Some companies employing naval architects have a well established graduate training program where senior engineers can readily contribute. In other companies the development of graduate talent can be less structured. Managers may pair graduates with a senior naval architect on a project basis or more simply for set time periods. In other situations, graduates may be seeking advice from senior naval architects outside of their employment.

For the senior naval architect, mentoring is recognized by RINA as contributing to their continuing professional development. The contribution may be limited to a short number of meetings or extend over a longer agreed period. As remote meeting proficiency has developed in the last few years, the contact would not be limited to people in the same location.


THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

Sample Only

This is to certify that

Name of AMS

is a current member of
The Royal Institution of Naval Architects holding

Member - Status

Membership is valid until

Jan 1, 2027

Signed on behalf of The Royal Institution of Naval Architects
8-9 Northumberland Street, London, WC2N 5DA.

Paul Jobson
Chief Executive Officer
The Royal Institution of Naval Architects

If you are thinking about providing mentoring or seeking a mentor, RINA Australian Division is considering establishing a data base to connect RINA members for this purpose. RINA Australian members will be invited to send a brief description of what you might be able to offer or what you are seeking if you are interested in being connected. Details of this will be published in a future edition.

AMSA Marine Surveyor Accreditation

The process of renewing AMSA Marine Surveyor Accreditation has been updated. In addition to a continuing professional development record reaching back five years, documentation is now required to establish membership status including level and currency of membership of a relevant professional body.

For RINA members, RINA UK can provide a confirmation statement similar to the image on request to membership@rina.org.uk .

AMS Update – DCV Electrical Wiring Requirements

In December 2025 AMSA published an update to the Electrical Wiring requirement for Domestic Commercial Vessels following their identification of several instances where electrical installations on DCVs have been carried out using cable that did not comply with the prescribed marine electrical standards. Non-compliant wiring poses significant safety risks, not only to vessel operators and passengers, but also to the broader marine environment. Electrical systems on DCVs are subject to demanding conditions that are unlike those found in domestic or automotive settings.

Constant vibration, saltwater exposure, high humidity, UV radiation, and fluctuating temperatures all place additional stress on cabling and insulation. Using wiring that is not designed or certified for these marine environments can lead to serious hazards, including overheating, insulation breakdown, short circuits, and electrical fires.

To promote safety, Chapters 7 (Low Voltage) and 8 (Extra Low Voltage) of NSCV Part C5B require that a vessel's electrical system comply with AS/NZS 3004.2 Electrical installations – Marinas and boats, Part 2: Boat installations. For a copy of the updated DCV electrical wiring requirements please contact dcvsurvey@amsa.or.au

Jennifer Knox, FRINA

NAVAL ARCHITECTS ON THE MOVE

The moves that we are aware of are as follows:

Tony Armstrong has retired from Teekay Shipping Australia

Nick Barratt has moved to Technical Manager at WaveX:Wave Powered Generators in Perth.

Tom Benham has started a new position as Development Manager for Renewable Energy Partners.

Christopher Carl has been at ASC for 8 years and has recently taken on a new role as Engineering Manager

Louise Chan has been promoted within Ocean Installer to be Senior Engineer in Stavanger, Norway.

Sebastien Dessevres has joined the Naval Architecture team at Austal.

Lochlan Finch has started as Business Development Manager for Birdon Group in Perth

Lucas Foong has been promoted to Senior Operations Engineer for DOF in Perth

Chris Hawtone has been promoted to Project Manager, In his third year with DOF.

Zi Hsiang Heng, having finished graduate engineer position.

Harry Hubbert has been promoted to Chief Operations Officer at Greenroom Robotics

Yaseen Iqbal, after finishing his Master of Maritime Engineering in Naval Architecture, has landed a new job at TasPorts as Port Engineer.

Ashley Jones, in his 15th year at Technip, has taken on a new role as Installation Engineering Manager.

Joji Kiniuwai has started a new position as site engineer at Brady Marine & Civil after 2 years at McConnell Dowell.

Zack Lindenberg has started a new job as Senior Project Manager Coastal Engineering for the City of Wanneroo, WA.

Kate Linley has been promoted to Principal Regional Port Marine Surveyor at AMSA.

Hamed Majidian has started as Postdoc Research Fellow at the Australian Maritime College

Stuart McDonnell has moved on from Australian Terminal Operations Management to be Senior Project Manager at Bowen Wharf for North Queensland Bulk Ports Corporation

Mostafa Mohseni has been at Bhagwan Marine since he graduated and has recently taken on the role as Project Engineer.

Tim Murfet has recently been promoted to Senior Maritime Engineer, after starting with Arup 7 years ago as a graduate.

Jaikob Norman has started as Principal Consultant - Naval Architect at Bastion Defence, after 4 years with Sea Transport Pty Ltd.

Casey O'Connor has move back to DOF as a Project Engineer in Perth.

Louis Osantana has now taken up the roles of Naval Architect at Austal in Perth

Alex Ruskin has left Santos to join KBR as Regulatory Compliance Manager.

Peter Samarzia has been promoted to Chief Engineer at BMT Defence and Security

Ben Slater has recently been promoted from Grad Nav Arch to Naval Architect for Marine Industrial Design Ltd in Devonport NZ

Zach Sutherland has started as Project Manager for Point Hope Maritime Ltd, after gaining valuable experience at BAE Systems Australia.

Zay Zin has started a new role as Coastal Engineer at Mofffatt & Nichol, after 5 years at Hatch, and whilst providing leadership for the QLD/NT branch of PIANC.

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 including LinkedIn postings that come to our attention. Please advise the editors when you up-anchor and move on to bigger, better or brighter things, or if you know of a move anyone else has made in the last three months. It would also help if you would advise Rob Gehling when your mailing address changes to keep Division records updated and reduce the number of hard copies of *The Australian Naval Architect* emulating boomerangs.

Trev Ruting with all notifications provided by Jonathon Binns and Rob Gehling

THE AUSTRALIAN NAVAL ARCHITECT

IS YOUR JOURNAL – CONTRIBUTIONS WELCOMED

Contributions from RINA members for *The Australian Naval Architect* are most welcome Material can be sent by email and should preferably be in MS Word format. But please use a minimum of formatting — it has to be removed or simplified before layout. Illustrations should not be incorporated in the document but submitted as separate files.

Photographs and figures should be sent as separate files with a minimum resolution of 150 dpi. A resolution of 200–300 dpi is preferred.

Naming Ceremony for catamaran *Norman Selfe*

The construction and delivery of catamarans of the Parramatta River class operated by Transdev for Sydney Ferries has already been reported in previous issues of *The ANA*. The last pair of these seven ferries built by Richardson Devine Marine in Hobart to a design by Incat Crowther have recently entered service from Circular Quay to Parramatta. Like others in the class, these have been named after notable Australians. *Norman Selfe* entered service on 5 December 2025 while *Jack Mundey* followed about a fortnight later on 17 December completing the fleet.

John Bernard "Jack" Mundey will be well known to older Sydneysiders as an influential trade unionist and environmental activist. But most would wonder who was Norman Selfe? He was an Australian engineer, naval architect, inventor, urban planner and advocate for technical education.

Given the naval architecture connection with not only the catamaran, but its namesake, RINA Australian Division was invited to attend the naming ceremony for *Norman Selfe* in Sydney on 4 December 2025. Adrian Broadbent attended on behalf of RINA.

Officiating at the naming was Howard Collins, Coordinator-General of Transport for NSW and Jane Spring AM, who is the great, great, great niece of Norman Selfe. Also attending were Minister for Transport John Graham, Briseida Tran on behalf of Engineers Australia alongside additional members of the Selfe family and others.

As Briseida Tran notes, it is rare to see an engineer recognised in such a significant way, with both a ferry and a suburb (Normanhurst) bearing his name.

Gathering for the naming ceremony for the catamaran *Norman Selfe* in Sydney on 4 December 2025
(Photo via Briseida Tran)

Norman Selfe (9 December 1839 – 15 October 1911)

In 1855, ages 15, Norman Selfe emigrating to Sydney with his family from Kingston upon Thames in London, England. One of the reasons the family emigrated to the colony of New South Wales was to enable Norman and his brother Harry to undertake engineering apprenticeships without having to pay the heavy premium required by large firms in London.

Norman's ability in mathematics and draughtsmanship was apparent from a young age. The brothers earned a reputation for innovation during their youth, and were reportedly the first

Jane Spring AM (in wheelchair), descendant of Norman Selfe, with Howard Collins, Transport for NSW, on board the new catamaran
(Photo via Adrian Broadbent)

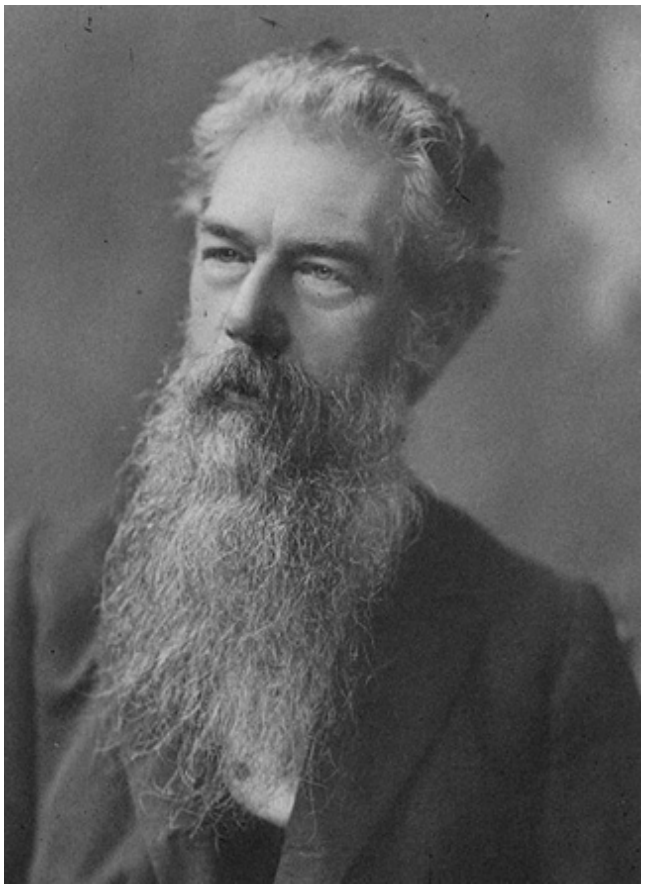
Briseida Tran (Engineers Australia) with Adrian Broadbent (RINA) on board *Norman Selfe* alongside the description of Norman Selfe
(Photo via Briseida Tran)

to construct a velocipede (early form of bicycle) in the country.

Selfe very quickly began his career as an engineer, taking articles of apprenticeship to the ironmaster Peter Nicol Russell, at whose firm he worked in several departments and eventually became its chief draughtsman, remain there until 1864. In 1859, when PN Russell & Co expanded to Darling Harbour, Selfe drew up plans for the new works and the wharf, and oversaw their construction.

While at Russell's, Selfe made several innovations in the design and construction of dredges for "deeping our harbours and rivers".

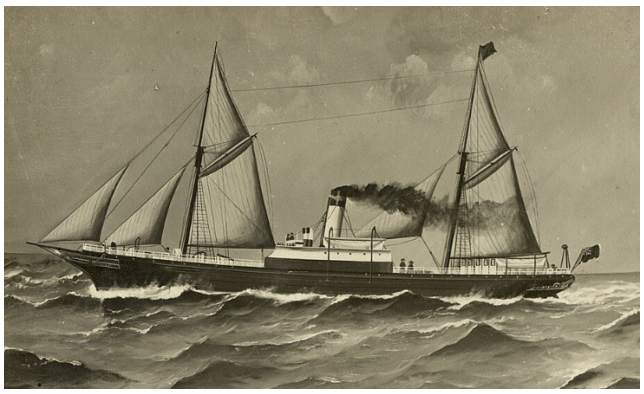
Selfe achieved international recognition in 1861 when leading British journal *The Engineer* published illustrations of his designs for one of the first refrigerating machines. One such machine was installed behind the Royal Hotel in George Street in Sydney's ice-works – one of the world's earliest commercial



Portrait of Norman Selfe
(Image via Wikipedia)

refrigeration plants. Selfe was closely involved with the evolution of refrigeration technology. The introduction of refrigeration to the colony revolutionised farming and made possible the export of meat and dairy products. Selfe became an international authority on refrigeration engineering; he wrote articles and eventually a definitive textbook on the subject, published in the US in 1900.

After leaving Russell's, Selfe went into partnership with his former employer James Dunlop. They designed and built major installations for the Australasian Mineral Oil Company, the Western Kerosene Oil Company and the Australian Gas Light Company. In 1869 Selfe was appointed to the senior post of "chief draftsman and scientific engineer" at Mort's Dock & Engineering Company in Balmain. In this role he oversaw the design and construction of the mail ship SS Governor Blackall, commissioned for the Queensland government in 1869.



Painting of SS Governor Blackall
(Image via Wikipedia)

In 1872 Selfe married Emily Ann Booth, the daughter of John Booth, a well-known shipbuilder and Balmain's first mayor. They lived for many years in Balmain then Ashfield and Hornsby. In 1884 their first daughter Rhoda Jane was born followed by Norma Catherine in 1888.

Selfe left Mort's in 1877 to practise as a consulting engineer gaining a reputation for versatility and originality. Upon his return from an overseas trip through America, Britain and continental Europe in 1884–85, where he visited engineering works and technical education facilities in search of new ideas to take back to Sydney, Selfe set up a new office in George Street.

Selfe designed the hulls or the machinery for numerous steam vessels, including two torpedo boats for the New South Wales government, which he claimed were the fastest boats on the harbour for 20 years, and the *SS Wallaby*, Sydney Harbour's first double-ended screw ferry. He designed the first concrete quay wall in Sydney Harbour, along with wharves for deep-sea vessels. He also introduced the first lifts, patented an improved system of baling wool which increased capacity fourfold, and oversaw hydraulic and electric light installations in the city and the carriages on its railway network. He planned mills, waterworks and pumping stations. He made major electric light installations at the Anthony Hordern & Sons department store and the Hotel Australia, and provided a hot-water system for the hotel. He designed machinery for factories, dairies and railways, including, in 1878, the incline of what is now the Scenic Railway attraction at Katoomba in the Blue Mountains.

During his lifetime Selfe received both local and international recognition for his engineering skill. He had been active in Australian mechanical engineering institutes. He was also elected a full member of the English Institution of Civil Engineers and, by virtue of his writings also being published in Chicago, also an honorary member of an American engineering association.

Selfe was also an energetic civic and urban reformer. From the mid 1880's, he campaigned for improvements to the city of Sydney. These included proposals for a city railway loop, the redevelopment of the Rocks, and a bridge to the North Shore. He published plans and proposals elaborating on his ideas, and produced major articles with titles like "Sydney: past, present and possible" and "Sydney and its institutions, as they are, and might be from an engineer's point of view".

In 1887 Selfe published proposals for a city underground railway, with stations at Wynyard, the Rocks and Circular Quay, and a loop to Woolloomooloo and the eastern suburbs. The proposal included a bridge across Sydney Harbour for trains, vehicles and pedestrians. He presented these schemes to the Royal Commission on City and Suburban Railways in 1890; but nothing was to come of it, largely because the 1890s depression brought public works initiatives to a standstill.

By the late 1890s a harbour crossing and a city railway extension were again on the agenda with a commitment to a new Central Railway Station and a worldwide competition for the design and construction of a Harbour Bridge. Selfe submitted a design for a suspension bridge and won second prize. After the outcome of the initial competition had become mired in controversy, in 1902 Selfe won a second competition outright, with a design for a steel cantilever bridge stretching from Dawes Point to McMahons Point.

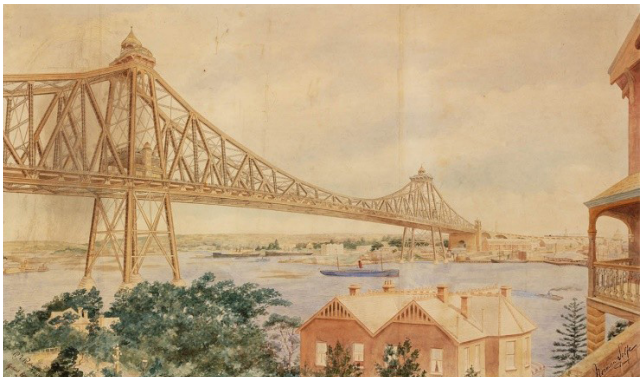


Illustration of Norman Selfe's winning design for a proposed Harbour Bridge circa 1903

(Image via Wikipedia)

Construction of Selfe's version of the Sydney harbour bridge never eventuated due to an economic slowdown and a change of government. Over the following decades, versions of what Selfe had much earlier articulated for a city circle railway link and a bridge to the north shore were realised, however Selfe's contribution received little public or formal recognition.

In May 1906, four years after the death of his first wife, Selfe married Marion Bolton.

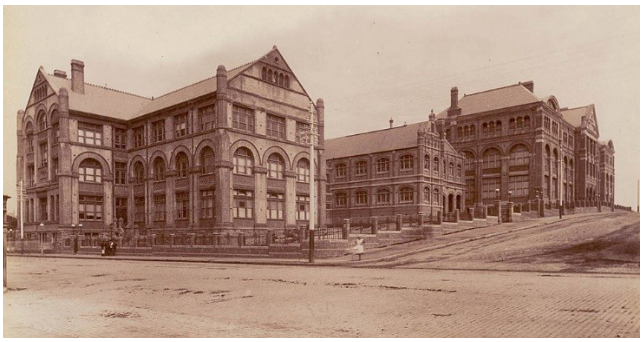
In 1908–09 he served on the Royal Commission for the Improvement of the City of Sydney and its Suburbs. Selfe's proposals included an overhead railway station at Circular Quay and major landscaping works at Belmore Park opposite Central Railway Station. Both of these visions were also later realised, but not in his lifetime.

Selfe was a key figure in the history of technical education in New South Wales. He advocated a more utilitarian and less literary education system, to produce a skilled workforce that could realise Australia's potential as an efficient industrial state.

Selfe believed an overhaul of education was needed, from kindergarten to tertiary study. His concept of technical education encompassed Friedrich Fröbel's kindergarten activities based around play and occupations; the teaching of drawing, manual work and science in schools; and specialised practical training of workmen and professionals in technical colleges. He argued for the establishment of a new kind of university – an "industrial university", less theory-oriented and more concerned with practical application. He saw technical education as a distinct sphere of education to be administered and delivered by people with practical industry experience, not government officials or traditional teachers.

As early as 1865 Selfe gave regular classes in mechanical drawing to tradesmen at the Sydney Mechanics' School of Arts. Selfe's class in mechanical drawing was the first technical, vocational offering at the School of Arts, and its popularity led to the introduction of other practical subjects.

Due to the demand for skilled labour, there were increasing calls in the 1870s for a formal system of technical education. In 1870, Selfe helped found the Engineering Association of New South Wales which amalgamated into Institution of Engineers, Australia in 1919. He was its president from 1877 to 1879 and for a number of years Engineers Australia annually awarded the "Norman Selfe Medal" to a student at the Australian Maritime College. In 1878, the association joined forces with the New South Wales Trades and Labour Council and the Sydney Mechanics' School of Arts to form the Technical and Working Men's College. The college initially operated as an agency of the Sydney Mechanics' School of Arts. The college occupied premises in the city before it moved to Ultimo in 1889.



Sydney Technical College in Ultimo circa 1890

(Image via Wikipedia)

The college later became the Sydney Technical College out of which grew the University of New South Wales, the University of Technology, Sydney, and the National Art School. The Ultimo buildings still serve their original purpose, now as the main campus of the Sydney Institute of TAFE.

In 1880, Selfe became vice president of the School of Arts. He supported the school's Working Men's College, but felt a more thorough focus on practical skills was needed. He rejected the non-technical, non-practical approach of the school's model and campaigned instead for the establishment of a proper institute of technical education, where instructors would be skilled tradesmen with practical industrial experience. He also pushed for the expansion of technical education facilities into the suburban and regional districts.

In 1883 the New South Wales government made a proclamation which transferred control of the Technical and Working Men's College to an independent Board of Technical Education, to which Selfe was appointed, and assumed financial responsibility directly. The government also provided funds to fit out workshops in Kent Street that opened in 1886. This was an initiative driven by Selfe. It represented a major innovation in technical education in New South Wales. Selfe was president of the Board from January 1887 until it was disbanded in 1889 when the NSW government assumed direct operational control placing the college within the Technical Education Branch of the Department of Public Instruction (now the New South Wales Department of Education).

Selfe died of heart failure on 15 October 1911 with his funeral held at St Paul's Church, Wahroonga. He was buried in Gore Hill cemetery.

Wikipedia provides further details of the new catamaran class including links to descriptions of the other notable namesakes for these ferries:

https://en.wikipedia.org/wiki/Parramatta_River-class_ferry

Based on information provided by Adrian Broadbent and Briseida Tran and condensed from the more extensive Wikipedia description, with references, at:

https://en.wikipedia.org/wiki/Norman_Selfe

Martin Grimm

Len Randell, 'Grandfather of WA naval architects' declares job done after cutting the cake at his 100th birthday celebration at South of Perth Yacht Club

(Photo courtesy Rick Steuart)

Back Cover Photo:

HMA Ships *Bathurst, Albany* and *Childers,* the last three Armidale class patrol boats, sail into Darwin

(Courtesy Defence Images)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